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AUTOMOTIVE INDUSTRIES
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INDEX TO VOLUME XLVI

ISSUES OF JANUARY 5, 1922,
TO JUNE 29, 1922, INCLUSIVE

HERE is an accurate guide to the authoritative articles and reference data which have appeared in AUTOMOTIVE INDUSTRIES during the last six months.

The publication of this index is in line with our constant efforts to make this publication of maximum service to the entire automotive industry.

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Foreign Models Predominate at Belgian Show

The 12 Belgian makers, however, show evidence of coming back into production after the period of war depression. Little attempt has been made to get into cheap production. All-weather bodies and four-wheel brakes have been given increased attention.

By W. F. Bradley

THE last of the European series of automobile shows for this season was opened when Burgomaster Adolphe Max inaugurated the Belgian fifteenth motor exhibition in the Palais du Cinquantenaire in Brussels on Dec. 4. The show was open to all but ex-enemy countries, but unlike all other exhibitions united more foreigners than natives. Belgium has only 12 makers of passenger cars, while the French industry was represented by 41, Italy by 7, America by 4 and England by 3, thus making a total of 67 in the car class. In addition to these there were 40 truck or tractor exhibitors, 20 body builders and nearly 200 accessory dealers, the total occupying 112,000 sq. ft. of exhibition space.

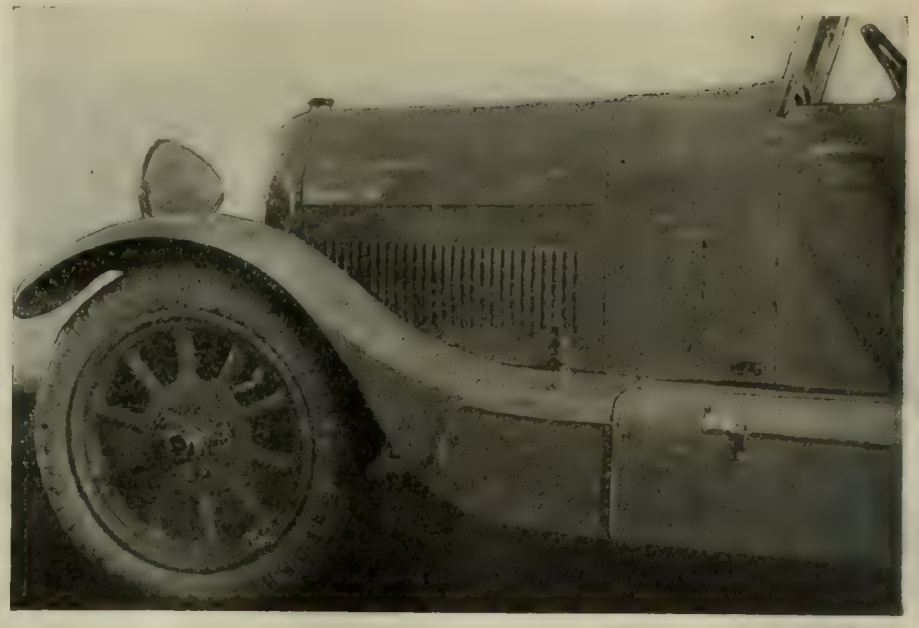
The Belgian show was open to all branches of the automobile industry, the main hall being filled with chassis and complete cars, the galleries with accessories and an annex with trucks, tractors and motorcycles. American passenger cars on exhibition were Case, Overland, Studebaker and Willys, with Cletrac, Fordson, Rainier, Titan in the tractor section and Harley-Davidson and Ace in the motorcycle class. American tire makers were well represented.

Although Belgium now has the lowest import duties in the world, namely 20 per cent ad valorem, compared with 45 per cent in France and 33 1/3 per cent in England, it has become very difficult for American dealers to do business in that country during the past year, owing to the high value of the dollar. The greatest volume of business is being transacted by French and Italian makers. For the former the rate of exchange is at par, for the latter there is a decided advantage. During the first nine months of the present year France shipped 1653 automobiles to Belgium, compared with 561 coming from the United States and 548 from Italy. During the same period Belgium sent 82 automobiles into France and 13 to America.

The low import duty is not the only reason for the invasion of the Belgian market by foreign firms. Before the war the Belgian makers were only interested in high-grade powerful or medium powered cars, and exported about 75 per cent of their production. After rebuilding and refitting her wrecked factories, she got into production again a little more than a year ago, on the same general lines. Since then the only change has been the introduction of smaller cars to meet the demand for economy, but there has been no attempt to get into really cheap production. This state of affairs left the Belgian market open in 1919 to American firms with cheap cars, and since then France and Italy have stepped in, for America is



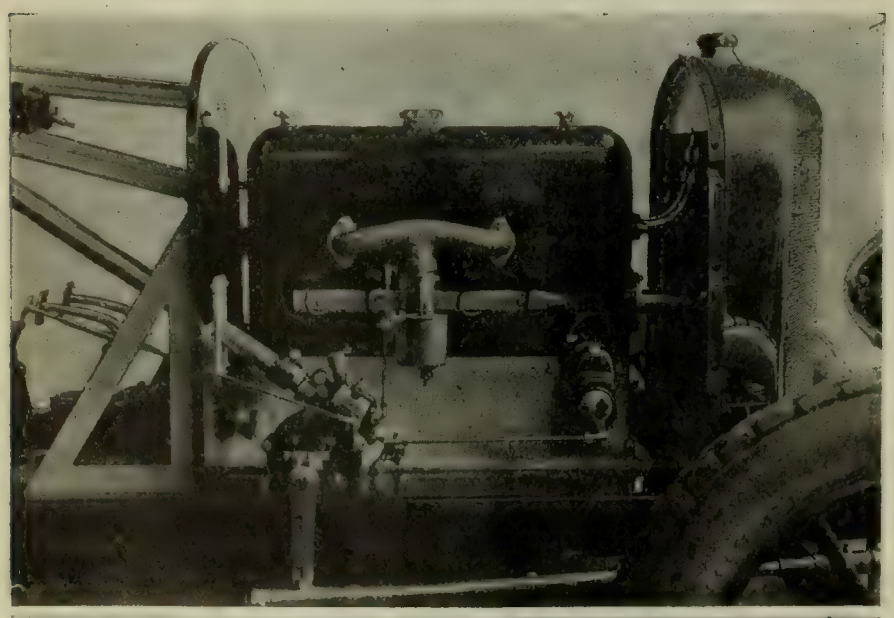
Rear end of Fiat passenger car, showing how spare wheels are carried

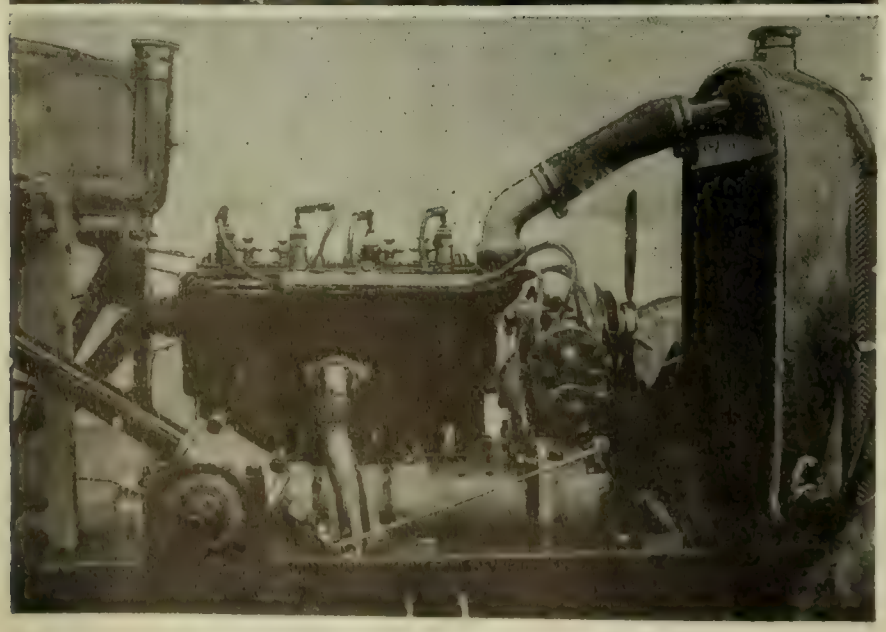


Tool and battery box in running board and fender of Fiat touring car

handicapped by exchange rates, and also to a slight extent by higher shipping costs. One explanation of the decreased American business is the excessive gas consumption of her automobiles, but this is a minor matter compared with exchange rates.

Although there is depression at the present time, statistics show that a big volume of business has been done in Belgium since that country was freed from the war. In 1914 there were 16,000 automobiles in use in Belgium; this year the number has reached 33,200, of which 12 per cent are trucks or tractors. Motorcycles have increased from 11,000 to 20,000.

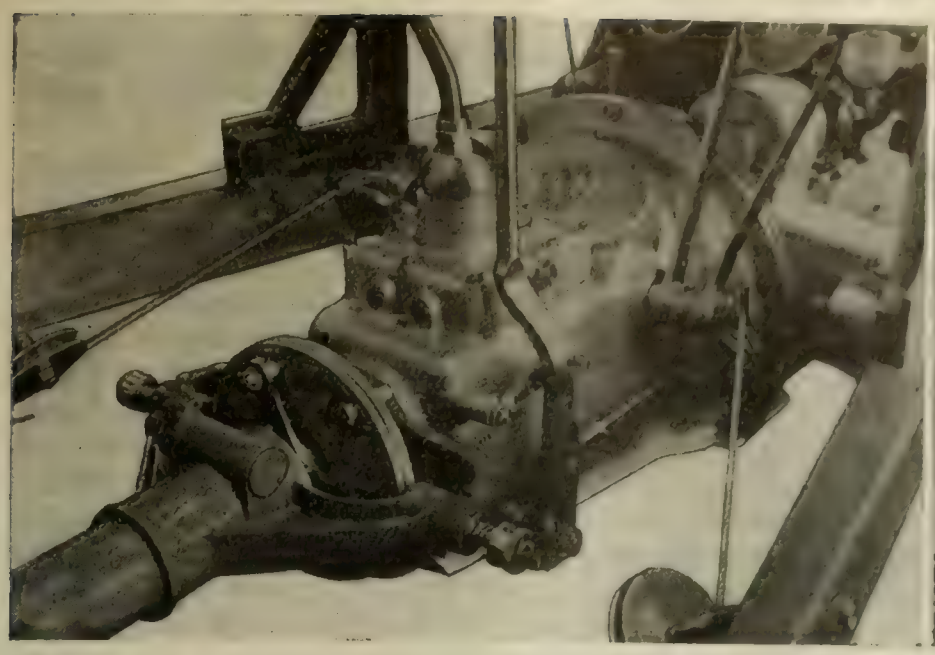




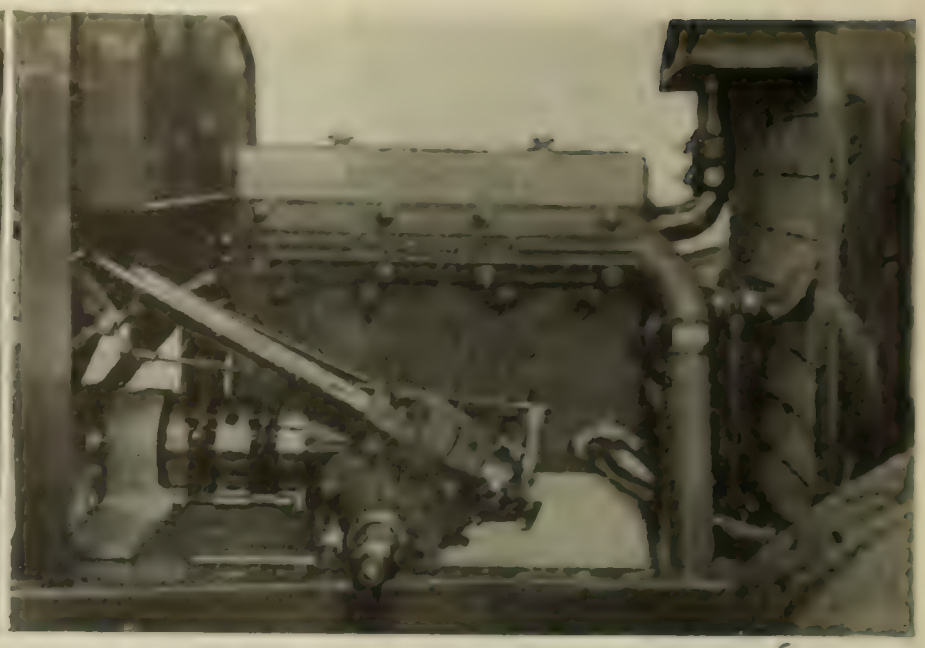
(Above)—Dasse overhead valve engine
(Below)—Auto-Mecanique P. M., one of the few Belgian small light cars

As it is the practice for European makers to prepare one set of show models which are sent to Paris, London and Brussels, the last show of the season contains few technical novelties. In this instance the new types are confined to a limited number of Belgian makes which were not ready for the earlier shows. Following the general tendency toward 122 cu. in. touring models, the Nagant Company has brought out a new chassis of this class. It is a four-cylinder of 72 x 120 mm., with detachable head, overhead valves and concealed pushrods. The power plant is unit construction, with four speeds, the two levers mounted on the top of the box, but with right-hand steering. An inclosed type propeller shaft is used, with forked front end connected up to the two extremities of a forged steel member mounted on the rear end of the gearbox. The universal is a fabric type placed within the fork. One of the features of this car is the use of four-wheel brakes applied under Adex license. Under this system of braking the camshaft is mounted in the axle and control is by means of flexible steel cables used diagonally. This mounting is not only exceedingly neat, but it has the advantage of adding very little to the production costs of the car. Control is normally by pedal, this applying all four brakes simultaneously. The lever, however, gives the same control, and is only used for holding the car in a standing position. This arrangement is acceptable with diagonal control of the brakes, for if for any reason one set failed, two wheels on opposite sides would be braked and the car could be pulled up normally. Nagant expects to get into production on this job by early March.

Metallurgique has also taken up the Adex system of front-wheel braking, and is applying it to one model only, a high class four-cylinder of 30 hp. The Adex patents are held by Engineer De Coninck, of the Belgian Excelsior Company, and these brakes are naturally applied to his firm's cars. One model only is produced, this being a high grade and expensive six. Imperial-Abadal of Liege, has an eight-ahead overhead valve job fitted with the Perrot system of front-wheel brakes. Miesse shows a front-wheel brake, of his own design, but has not yet applied it to his standard cars, and it appears that the brake has yet to go through its tests. Miesse uses an open jaw front axle and mounts the whole of the brake operating mechanism on the top of the jaw. This consists of a short, vertical castellated shaft, in the same axis as the king bolt, with a mushroom headed disk mounted on it. There is a cam under the disk and by its rotation the mushroom head is raised or lowered, thus opening or closing the brake shoes, the



Gearbox, universal joint and center control on Nagant 12 hp. chassis. Note four wheel brake cables



New Nagant 12 hp., 2-litre overhead valve engine

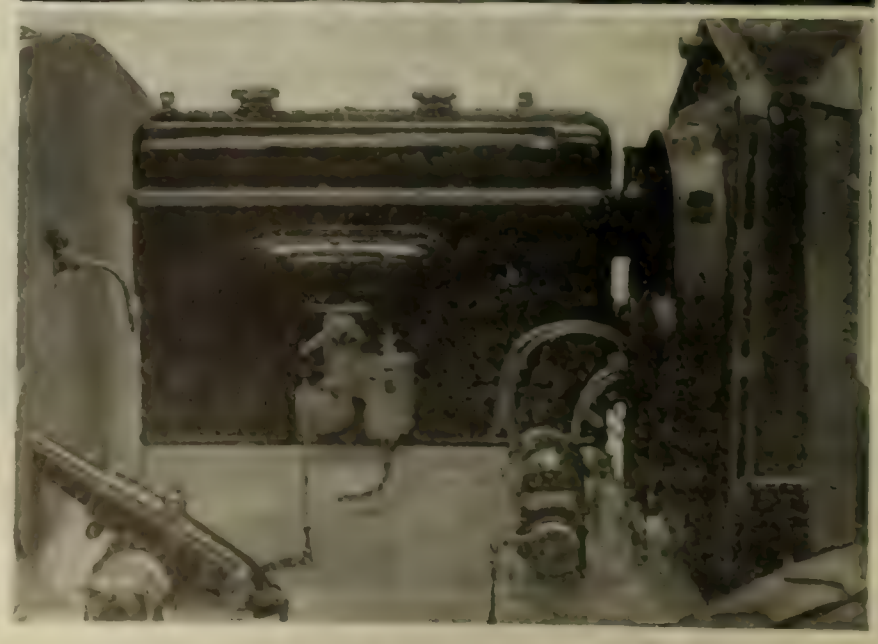
ends of which are fitted with rollers. The claims made for this design are that it avoids all flexible connections between frame and brake drum, and does not necessitate carrying the brake camshaft in the axle. All that is necessary to fit it is sufficient area on the head of the axle jaw.

A fine example of Belgian designed 2-litre engine, on a four-passenger car with a wheelbase of 118 in., is the new Somea. This has a unit powerplant, the four-cylinder engine measuring 69 by 133 mm. The head is detachable, and the overhead camshaft, carried in three plain bearings, is operated by a vertical shaft in the cylinder block, with the use of spiral bevel gears. A cross shaft in front drives magneto and fan. This is an exceptionally good example of modern, clean design, the cleanliness being obtained by the use of concealed cylinder holding down bolts, the extension of the aluminum crankcase webs right up to the frame members and the use of an aluminum dash with a close fit to the top of the crankcase. All air is thus expelled laterally, through the sides of the hood. The only openings under the hood are for the passage of the steering column and for the fan belt, which is driven off a pulley on the crankshaft. The gasoline tank is on the rear face of the aluminum dash, with the filler under the hood, the union for the gasoline feed pipe being brought through the dash, and the lever type shut-off cock placed just above it. The engine runs up to 3000 revolutions, at which speed it develops 36 hp.

The electric generator and starting motor are placed respectively to left and right of the four-speed gearbox. This mounting of the generator is rather unusual on European cars. Brake and change speed levers are not mounted on the top of the box itself, but on the cast steel end-plate which closes the box and receives the ball head of the propeller shaft housing. The practice of using center control with right-hand steering appears to be a growing one in Belgium. A detail of this car is the use of the space usually occupied by the rear gasoline tank for a tool box. This is fitted in flush with the top of the frame members, and would at first sight be mistaken for a gasoline tank. The arrangement is acceptable with a light car running 25 miles to the gallon and capable of carrying a good supply of gasoline on the dash. Although of high class the Somea is a fairly cheap production job and is being marketed at 25,000 francs (at present exchange $1,600) with five-passenger body.

Miesse has got into production with two models, a four and an eight-ahead, each of 69 by 130 mm., with overhead camshaft. Another new overhead camshaft job is the Dasse 30 hp. four-cylinder of 90 by 140 mm. This is a detachable head engine with vertical shaft inside the cylinder casting, and spiral-bevel gears. The fan is driven off the shaft and a cross shaft operates pump and magneto from its ends. The Dasse has an air-tight dash, but, contrary to the usual practice, the





(Above)—2-litre Somea engine with overhead valve. Note aluminum dash with air-tight joint in base-chamber

(Below)—Exceptionally neat Somea 2-litre. Gasoline tank is on rear of aluminum dash. Note gasoline feed pipe and cock just above it

dash is wood instead of aluminum. A smaller model has a four-cylinder L-head engine of 75 by 130 mm.

There are no cycle cars produced in Belgium and very few cars of less than 122 cu. in. piston displacement. The smallest on the market appears to be the Auto-Mecanique P. M., an L-head four-cylinder of 69.5 by 120 mm. This is laid out for cheap production and is one of the lowest priced cars on the Belgian market. Another cheap car is the Belga, the feature of which is a friction transmission which gives direct drive through a cone clutch on top and only a frictional point contact when running on a lower ratio.

The Pipe Company of Brussels has been one of the slowest to get into production, having just come out with its new lines. The biggest model is a four-cylinder L-head engine with inclined valve stems, of 120 by 200 mm. This is one of the biggest engines on the European market, and the practice of adopting a bore of nearly 5 in. for a four-cylinder engine is quite contrary to the general European tendency. There are two other Pipe models, with four cylinders of respectively 100 by 180 and 80 by 150 mm.

Renault showed his new models with some modifications in design, among these being changes in the radiator, which is no longer right across the frame, behind the engine, but forming a bridge over the engine, with the rear cylinder under the header tank. Wind scoops are fitted on the radiator core in order to direct the current of air into the tubes. Renault announces that on all but his smallest model he will fit diagonal cantilever springs, the forward ends of which are shackled up to a point near the center of a heavy cross frame member. There is now no insweep on the frame members, these being uniform in width throughout, with a false frame built out to carry the running boards to the full width of the chassis.

Belgian makers have not taken up motor truck construction, consequently this part of the exhibition is almost entirely foreign. Among the new features is a Berliet 5-ton truck with worm-driven rear axle.

Among the newcomers is the Auto-Traction semi-trailer, the tractor of which has a Minerva Knight engine of 90 by 140 mm. The feature of this job is the provision made for automatically loading the trailer on the rear end of the tractor. There is a pronounced upsweep of the front end of the trailer, and under this a pivoted two-wheel fore-carriage which only carries the load when the trailer is stationary. The tractor is designed to back under the front end of the trailer, rollers on the front end of the latter fitting into grooves on the top of the tractor frame members. When in position the trailer fore-carriage is automatically tilted upward and backward so that its wheels are quite clear of the ground, and are tucked between the rear end of the tractor frame members. A load of 7 tons is carried on the trailer.

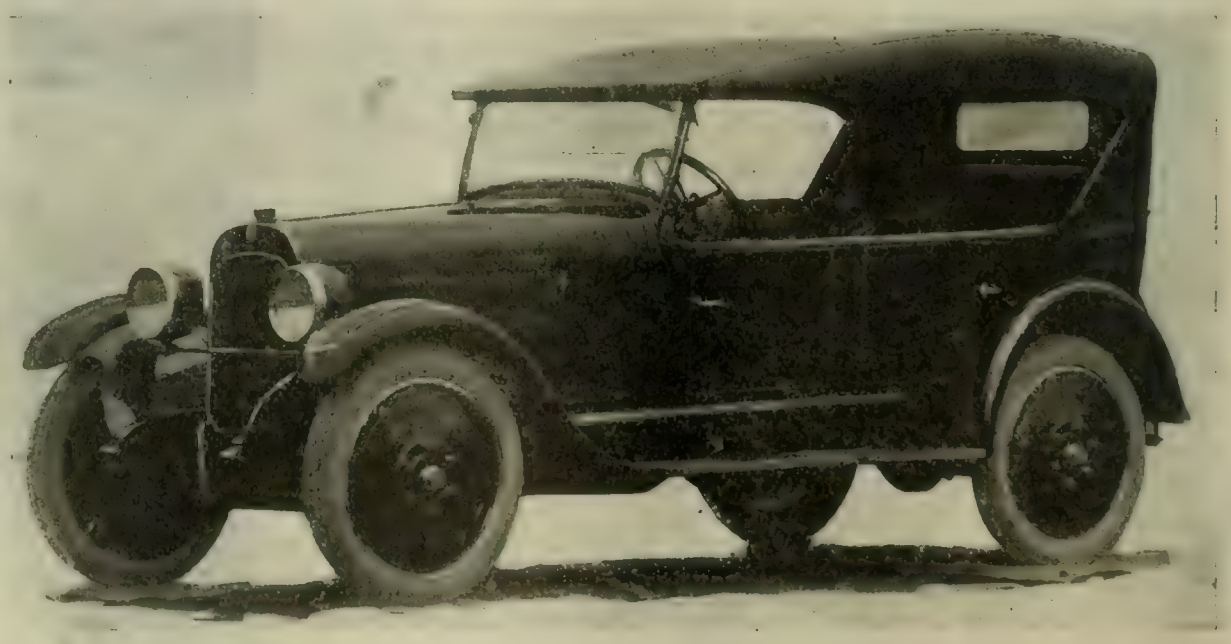
In the body section the feature was the attention given to all-weather bodies. These have been particularly developed by d'Ieteren, one of the leading Belgian builders. The Minerva company, now having its own body department, is also making a specialty of all-weather bodies built under the Gwynne patents. The demand for a body of this type, which gives an open car in summer and a completely closed car in winter, the change from one to the other being made in less than a minute, is becoming strong.

New Chalmers Body Models

A NUMBER of refinements in the body finish and appearance have been made in the Chalmers cars for 1922. The chassis remains unchanged. A new type of fender has been adopted which has a deeper crown and which is made from heavier gage stock. The new fender follows the contour of the wheel closer than the former style, giving a materially altered appearance. Drum type headlamps have been adopted and, on enclosed cars, cowl lamps of the same pattern are also fitted.

Another material factor in altering the appearance of the car is the adoption of a new radiator shell with an aluminum bead. This bead surrounds the core and gives the front end of the car a distinctive appearance. Disk wheels are now fitted as standard equipment, and these, in connection with a lower top, accentuate the long lines of the car. Carrying out the low effect, there is now a one-piece windshield in place of the two-piece type formerly employed. In the construction of the top, all of the seams have been made water tight and there are no exposed bows, one bow having been eliminated in the new model. The tool kit is now in the left front door on all models and the side curtains are carried in flat pockets outside of the regular door pocket.

One of the refinements in the finish of the body is the addition of a dull finish molding strip around the top edge. Kick pads and foot pads are placed on the apron and running boards, and on the roadster there is a trap door in the deck. For more accessible control, the starter has been placed between the clutch and brake pedal, and the dash layout has been rearranged to secure greater accessibility of the instruments. The body hardware has been entirely revamped, even to the hub caps, which are now of new design carrying the initials of the Chalmers Motor Co., and the door handles which are of the exposed type.



New series Chalmers Six five-passenger touring car, showing standard equipment

Prices of the car are for the Model C roadster, $1,245; C, five-passenger touring car, $1,295; C, coupe, $1,995; C, sedan, $2,295, and B, seven-passenger touring, $1,395. The sport model has been discontinued, as it is practically duplicated in the present five-passenger model.

New Four-Cylinder Car Has Brakes on All Wheels

Frontenac is designed along racing car lines with 197 cu. in. engine and foot operated four-wheel brakes. Chain-driven overhead camshaft and location of electrical units alongside the gearset gives a clean appearing powerplant. Open cars are expected to sell for less than $2.500.

By J. Edward Schipper

THE new Frontenac, which incorporates a great many unique features of design, is now being made ready for production. The car was designed by Louis Chevrolet and C. W. Van Ranst, who has been associated with Chevrolet on the racing cars. It is of original design throughout, incorporating an overhead camshaft engine, four-wheel brakes and many other departures from usual practice. In spite of this, the designers claim that the car will be in the $2,000 class when it is put on a production basis, which, they state, will be early in the spring of 1922.

The engine is a 3⅜ by 5½-in., four-cylinder, block cast. The cylinder head is cast separately from the block and the crankcase is also a separate aluminum casting with a pressed steel bottom pan. The clutch and gearset are mounted on the engine, forming a unit powerplant.

The piston material has not as yet been decided upon, but it will probably be an aluminum alloy. The piston length is 4¼ in., and the design incorporates the Nelson patent features, having an expander in the form of a double ended bolt which determines the piston clearance in a plane at right angles to the piston pin. The piston is turned round to .008 in. clearance in the cylinder wall and then expanded .0025 in. by the expander. When heated, the piston is said to expand only in the plane of the piston pin and to return to the normal round shape.

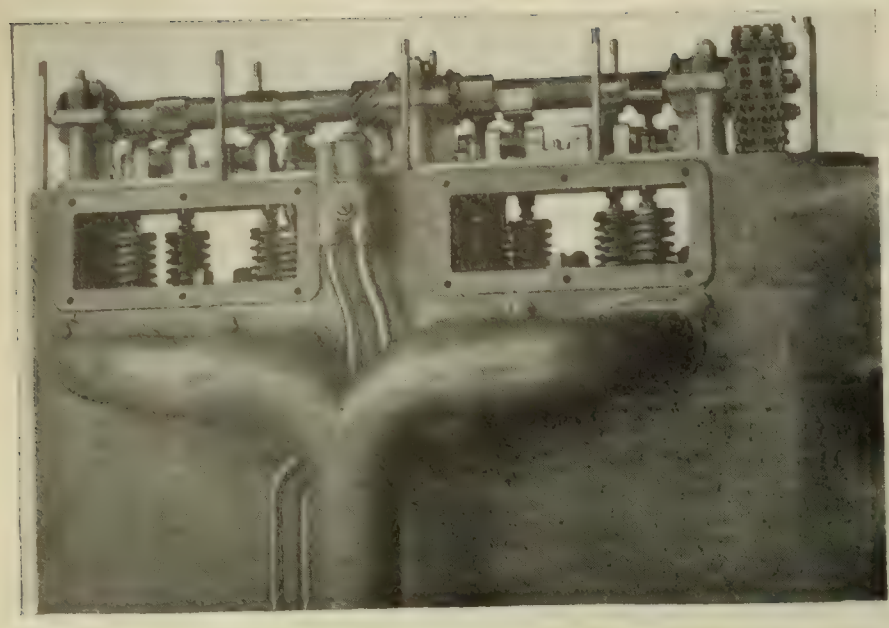
I-beam connecting rods with 11 in. center distance are employed. The crankshaft has three bearings with 2⅛, 2 3/16 and 2¼ in. diameter at front, center and rear, respectively. The lengths of the bearings are, respectively, 3, 2½ and 3⅞ in., front to rear. The crankshaft is a plain disk type, the end thrust being taken by the center bearing; .005 in. end play is allowed in the crankshaft.

One of the interesting features of the Frontenac engine is the method of driving the camshaft. This is by means of two chains through a relay idler, permitting the reduction to be stepped up and, consequently, reducing the sprocket size. The chain employed is the Link-Belt, unit type, with a spring idler take-up. The overhead camshaft is hollow and mounted in three bearings. The cams are pierced with oil holes at the point of commencement of the lift. The camshaft chamber is oil tight and separated from the valve chamber. The valve action is by rocker arm to an adjustable tappet which operates through an oil tight bushing. The rocker arm is a very light forging, hardened and ground on the bearing surface. The bushing guide is of cast iron. The tappets are hollow steel and the valves seat directly in the head. Both the inlet and exhaust valves are of the same size, although the materials differ, high tungsten being used for exhaust and low tungsten for inlet. The valves are 1⅞ in. clear diameter and have a lift of ⅜ in. from a 30 deg. seat. The stem diameter is ⅜ in. The valves are so timed that the exhaust opens 45 deg. before lower dead center, closes at 10 deg. after upper center and the intake opens 10 deg. past upper center and closes at 40 deg. past lower center.

Lubrication is by high pressure system, normal pressure being 50 lb. Leads are carried to the three main bearings



1—Right side of engine used in the Frontenac car showing exhaust manifold. End of cone is shown at bottom of manifold. 2—Carbureter and intake side of new Frontenac engine



3—Camshaft and valve chamber on new Frontenac. The overhead camshaft mounting structure is of diecast aluminum

and from these to the connecting rod bearings. The oil is led under reduced pressure to the camshaft, the leads passing to the center camshaft bearing, where the oil flows through a small hole, which has the effect of reducing the pressure. There is a regulating valve equipped with a check to keep the oil pump full of oil, and a by-pass for oil pumped in excess of requirements.

Cooling water is circulated by thermo-syphon action. A four-blade fan is mounted on the shaft which carries the relay sprocket for the camshaft drive chain. The water passages are large, none being less than 3/8 in. in the coring at any point. The spark plugs are mounted in the side of the cylinder block and are completely surrounded by water.

Ignition is by the Delco system and both automatic and manual advance are furnished. The generator drive is on the rear end of the gearset, the chain being driven from the rear end of the main shaft, thus it only is in operation when the car is under way. This allows the engine to accelerate suddenly without danger of stripping the generator drive gears. The starting motor balances the generator on the other side of the transmission gearset, leaving the engine clear and also giving a distribution of weight toward the center of the car. Bendix drive and shift is employed on the starter. Another advantage resulting from this location of the generator and starting motor is a decreased length of wiring.

An interesting point in connection with the engine assembly is that the studs for the crankcase and head are screwed into the block, thus eliminating the necessity for solid bosses through the block to take care of continuous stud mountings. Eight 9/16 in. nickel steel studs are employed for the case. There are thirteen head studs 7/16 in. in dameter. The cover of the valve mechanism is of aluminum and is held in place by ten cap screws.

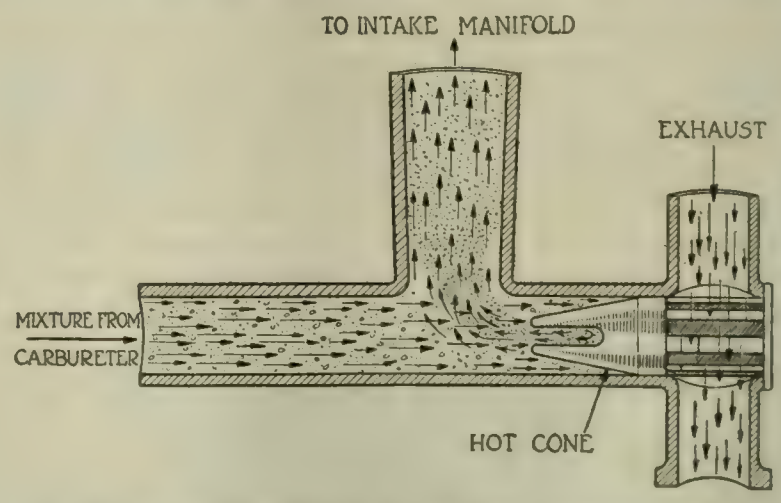
Gasoline is fed by vacuum to the carbureter from a 20 gal. tank at the rear of the chassis. The make and size of the carbureter has not as yet been determined, but it will be either 1½ or 1¾ in., taking in all cold air. The carbureter is a horizontal type with vertical flange and the mixture is led through a transverse pipe directly across the block between the two middle cylinders to the opposite side where the heavier fuel particles come into contact with a heated cone which is in contact with the exhaust. The vaporized portions of fuel pass upwards into the intake. The hot cone vaporizes the heavier particles of fuel, allowing them to join the in-going gases which flow up the vertical intake passage. The cone being on the right side of the engine is in the path of any liquid fuel which drains to that side, due to traveling with the left wheel on the crown of the road. The cone is shown diagrammatically in the sketch herewith.

The clutch is a single, dry plate type which will be bought outside, and the gearset is a three-speed type with a double bearing on the rear end of the main shaft to take the generator drive stresses. The halves of the double bearing are placed about 3 in. apart. One of the features of the transmission gearset is the large oil filler which is located in the front valve cover.

Propulsion is by means of a hollow shaft with two universals. The rear axle is of Frontenac design with spiral bevel gear. It is a ¾ floating type with a ratio which will probably be about 4½ to 1. The pinion shaft has a bearing on each side of the pinion and the axle construction is very similar to those used on the Frontenac racing cars. The front axle is an I-beam section and is of the inverted Elliot type. The wheels are equipped with 32 by 4-in. tires.

Four-wheel brakes are employed for the service layout and a brake on the rear end of the transmission is employed for the emergency. The four service brakes are all internal expanding shoe type operated by cams. As is usual with four-wheel brakes, the king pins in the front axle are inclined so that if produced they would intersect the ground at the point of contact of tire and road. The four-wheel brake cams are mechanically operated. The hand brake is a metal-to-metal internal expanding type. The emergency brake ratchet is cast in the cover of the transmission and is so arranged that when the brake is applied it cannot be jammed on so hard as to make it very difficult to release. The lever has direct action to the brake cam piece without exposed parts.

The frame is of deep section pressed steel with the front springs outside of the frame, as in the Frontenac racer. The springs are semi-elliptic, front and rear. A full line of bodies will be provided, the open cars to sell for less than $2500. The cars are replete with detail features of interest, such, for instance, as the location of



4—Diagrammatic sketch of hot cone system used to assist vaporization on Frontenac engine

the breather, which is in the front inspection cover over the valve mechanism. The front end timing chain cover carries a funnel-shaped guide to assist in the easy engagement of the starting crank. A number of details are unsettled at this writing and the final design will probably not be complete until ready for production.

THE Bureau of Standards has been invited to take an active part in organizing and executing a comprehensive series of investigations relating to the properties, testing, and standardization of molding sands. The Bureau has done considerable work on this subject in the past, and it is to be expected that with the active cooperation of the American Foundrymen's Association, the National Research Council, and others, considerable progress will be made in this important subject.

Continental Manufacturers Turn to Light Cars

High taxes and high cost of fuel causing French makers to build machines of from 10 to 12 hp. Some jobs may be strong competitors of light built American cars in foreign markets. Prices range from 8,500 francs for two-seater to 95,000 francs for car de luxe. Four wheel brakes a feature.

By W. F. Bradley

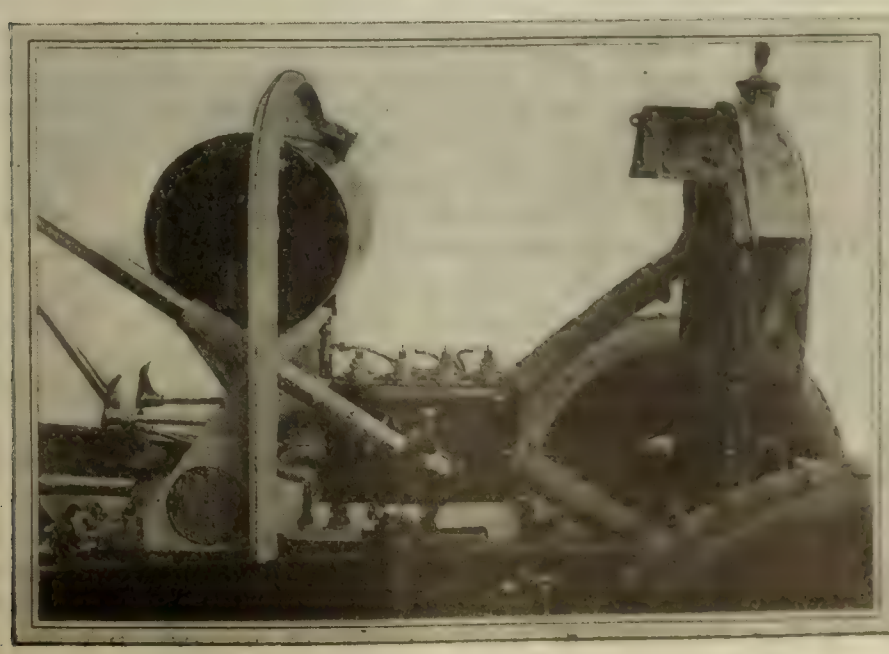
THROUGHOUT Europe generally the public is calling for cars which are cheaper to purchase and maintain. As a consequence all manufacturers have put on the market a four-passenger car of nominally 10 to 12 hp. These have four-cylinder engines varying in bore from 60 to 75 mm. (2.3 to 2.9 in.) and generally have a wheelbase from 100 to 120 in., with a 48 to 54 in. track. The only counterparts of the American type cheap production car with comparatively big engine are the Berliet, with a cheap four-cylinder of 3.5 to 5.1 in. bore and stroke; the Lorraine-Dietrich, with an overhead valve six, and the Bellanger, which is assembled in France with parts imported from Detroit.

All the other makers offer cars with smaller engines, 120 cu. in. generally being the maximum piston displacement. They are all four-passenger types, for some of them have a narrower track than the standard 56 in. These 10 to 12 hp. cars are more economical to maintain in Europe than the American types, for they pay less in taxation and have a lower gas consumption. Their makers claim to be able to meet American competition on foreign markets by reason of a higher quality of finish and a lower cost of maintenance, which will offset the greater initial cost.

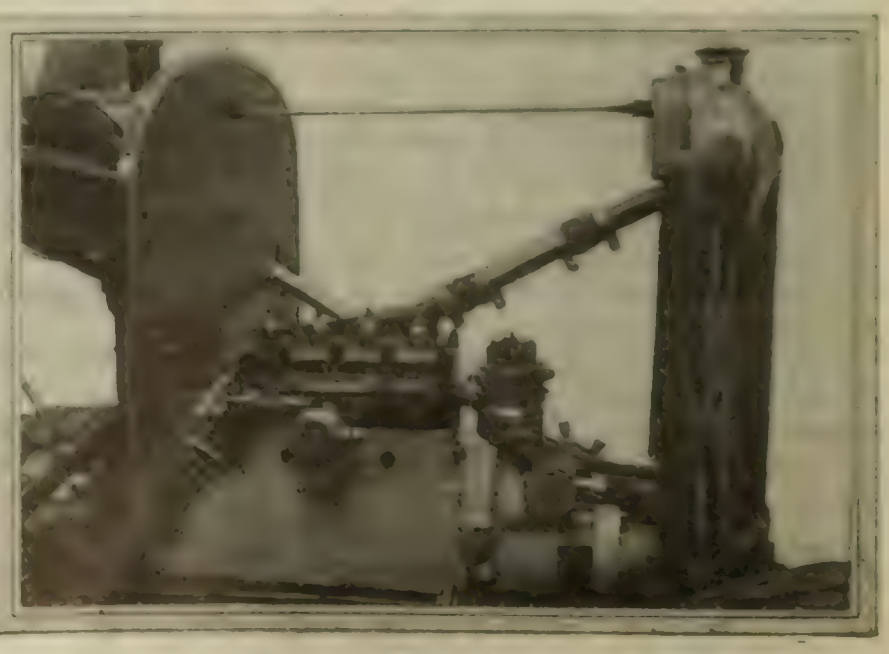
While there is uniformity in piston displacement there is a wide diversity in design and in production and selling costs. Citroen still markets the cheapest four-passenger car on the French market, his latest cut having brought the price down to 13,900 francs (this amount includes the state 10 per cent luxury tax), or at present exchange $993. A car of this type kills all American competition on the French market, where, however, conditions are artificial by reason of exchange rates and a high import duty. Even in other countries, where exchange rates are more normal, and import duties do not play the same importance, this and other cheap French cars offer real competition to the cheaper American types. Renault is listing his cheap production four-passenger four-cylinder 10 hp. car at 19,000 francs.

Fiat has a car of similar size and power, but of higher finish, which has just been reduced on the French market to 21,500 francs. Talbot-Darracq has come into this class with a cheap production 10 hp. overhead engine, four or five-passenger body, 48 in. track, 118 in. wheelbase, which is being marketed at 22,000 francs, complete. In the bigger class comes Lorraine-Dietrich with a six-cylinder six-passenger selling at 28,750 francs, complete. These few examples are cars not only of local importance, but which will figure on international markets.

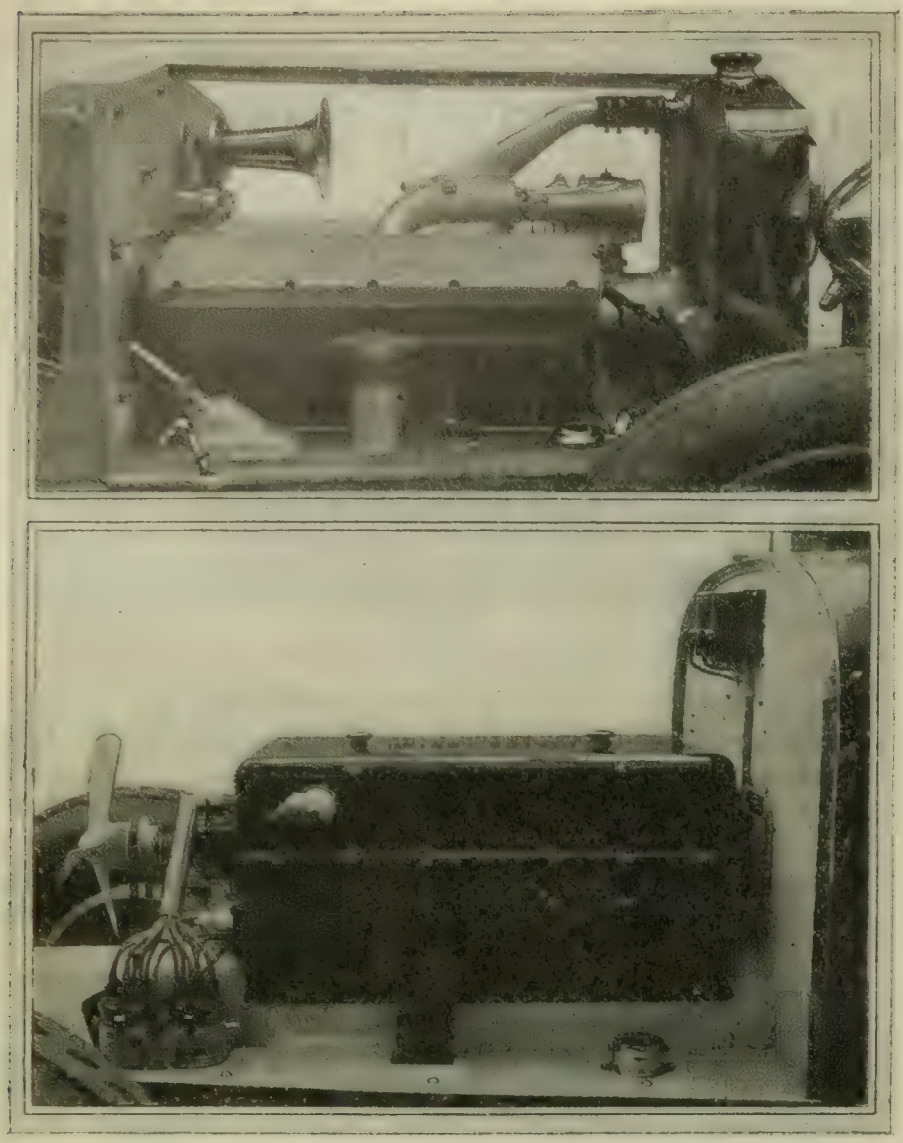
Apart from these cheap production models, there is a big series of 10 to 12 hp. cars not comparable with anything produced in America, for they have a finish and a quality which in the United States is nearly always associated with costly cars. Delage, whose original program was a high grade six, has put forth an 11 hp. four-cylinder with front wheel brakes which, while of high quality, has been closely studied with a view to low production costs and is selling at 26,900 francs with six-passenger open body. Delaunay-Belleville, a firm formerly associated with big, costly cars only, now has a modern 10 hp. chassis with a four-cylinder engine of 72 by 120 mm. bore and stroke. Panhard-Levassor has stepped into a smaller car



Mathis cyclecar



Citroen big production light 2-seater with 5-hp. engine and Delco ignition



(Above)—Fiat 12-cylinder overhead valve engine
(Below) Voisin all aluminum Knight type 12-cylinder

class with a four-cylinder Knight of only 60 by 105 mm. bore and stroke. Voisin, another firm having established a reputation with big, high-grade cars, has come into the cheaper car class with a four-cylinder sleeve valve engine on the Knight principle, although not built under Knight patents, of 60 by 110 mm. bore and stroke. These cars primarily meet French requirements; they are also very suitable for most other European countries, and it remains to be seen if they can compete with American types on more distant markets. To prove that these small engined cars can be used satisfactorily for long distance touring, Delage carried out a series of long-distance daily demonstration runs during the last half of September with the following results:

Paris-Cherbourg and back, 540 miles, 33 m.p.h.; 23 m.p.gal.

Paris-Brussels and back, 450 miles, 21 m.p.h.; 23.8 m.p.gal.

Paris-Strasbourg, 289 miles, 34 m.p.h.; 22 m.p.gal.

Strasbourg-Geneva, 248 miles, 31 m.p.h.; 21.4 m.p.gal.

Geneva-Paris, 333 miles, 34 m.p.h.; 23 m.p.gal.

These runs were undertaken with a stock model under normal touring conditions, and they give a general indication of what can be expected of this class of French economical light car.

Below the light two-seater is the cycle car. Under the French Government tax regulations a cyclecar is an automobile of not over 67 cu. in. piston displacement and 770 lb. weight. There are no mechanical restrictions, with the consequence that many of these machines are only standard automobiles in miniature, with nothing in common with the original type of cyclecar developed from the motorcycle.

Citroen has not officially entered the cyclecar field, for his 5 hp. two-seater, with a four-cylinder 55 by 90 mm. engine, fits the piston displacement rule, but its weight lifts it out of the cyclecar into the light car class. Citroen is marketing this car at 8500 francs, complete, with lighting and starting, spare wheel and spare tire, and two-seater open body. In order not to interfere with the production of his 10 hp. car, the Bayard-Clement factory has been purchased for the construction of this new model. The importance of this move is that Citroen has got down to a price which is comparable with that of the cyclecars built by comparatively unknown firms and he possesses a commercial organization second to none in Europe. Production on a big scale will not begin for several months, but it is understood that as soon as the car is ready a big advertising campaign will be undertaken and for the first time in France sales will be made on the installment plan.

The Salmson Aviation Motor Co., one of the biggest firms of its kind in France, has put into production a light two-seater which complies with the official definition of a cyclecar, and which, like the new Citroen, has all the standard features of a full sized automobile, the selling price of which is 8,900 francs. There is thus the anomaly of a car which is not officially accepted as a cyclecar selling at a lower price than an officially accepted cyclecar. Mathis has also put on the market a little two-seater fitting the cyclecar definition, which is sold at 8,900 francs. These three types have water cooled four-cylinder engines, three-speed transmission, and shaft drive.

In contradistinction to the small and cheap cars, a number of very high-class and costly models are being produced. In not a single case are these luxury types intended to replace a cheaper model, for while no firms have abandoned a cheap model in favor of an expensive one, there are numerous examples of costly cars being dropped in favor of cheap ones. The idea seems to have been to round off a well-proportioned series by a limited production of a high grade model.

Fiat has produced a Super-Fiat which, with a chassis price of 95,000 francs, is probably the most expensive automobile manufactured on the Continent. Fiat, however, has been on the market for two years with three types of cars calculated to meet general requirements, and it is stated that the Super-Fiat will be produced in very limited quantities. It is a twelve-cylinder of 85 by 100 mm. bore and stroke, rated at 40 to 60 hp., but really developing more than twice the higher figure.

Gabriel Voisin has also produced a high-grade twelve-cylinder, intended to be a limited production job, but at the same time the firm has put out a 10 hp. light car selling at 23,000 francs. Panhard has a new 60,000 franc chassis with an eight-ahead Knight engine, which will come in direct competition with the six-cylinder Hispano-Suiza, but here again the firm has added a 10 hp. car selling complete at 23,800 francs. Delaunay-Belleville, after undergoing a complete technical and commercial transformation, has put an expensive six-cylinder chassis on the market, but has paired it with a comparatively cheap 10 hp. model. Hotchkiss appears with a new, high-grade six, but the medium class car is retained. Bugatti has a high-grade three-litre eight-ahead on original lines. Business necessity appears to have pushed these firms into cheap car construction, while love for the mechanically perfect has caused them to build a luxury type. Considered as a whole, the program of the French industry is very much more healthy than in 1919; not only are there fewer "irrespective of price" cars, but no maker is attempting to operate exclusively on this class of car.

Undoubtedly the outstanding mechanical development of recent years is the use of front wheel brakes. Thirty-seven makers have taken up braking on all four wheels either for some of their models, or in certain cases for all of them.

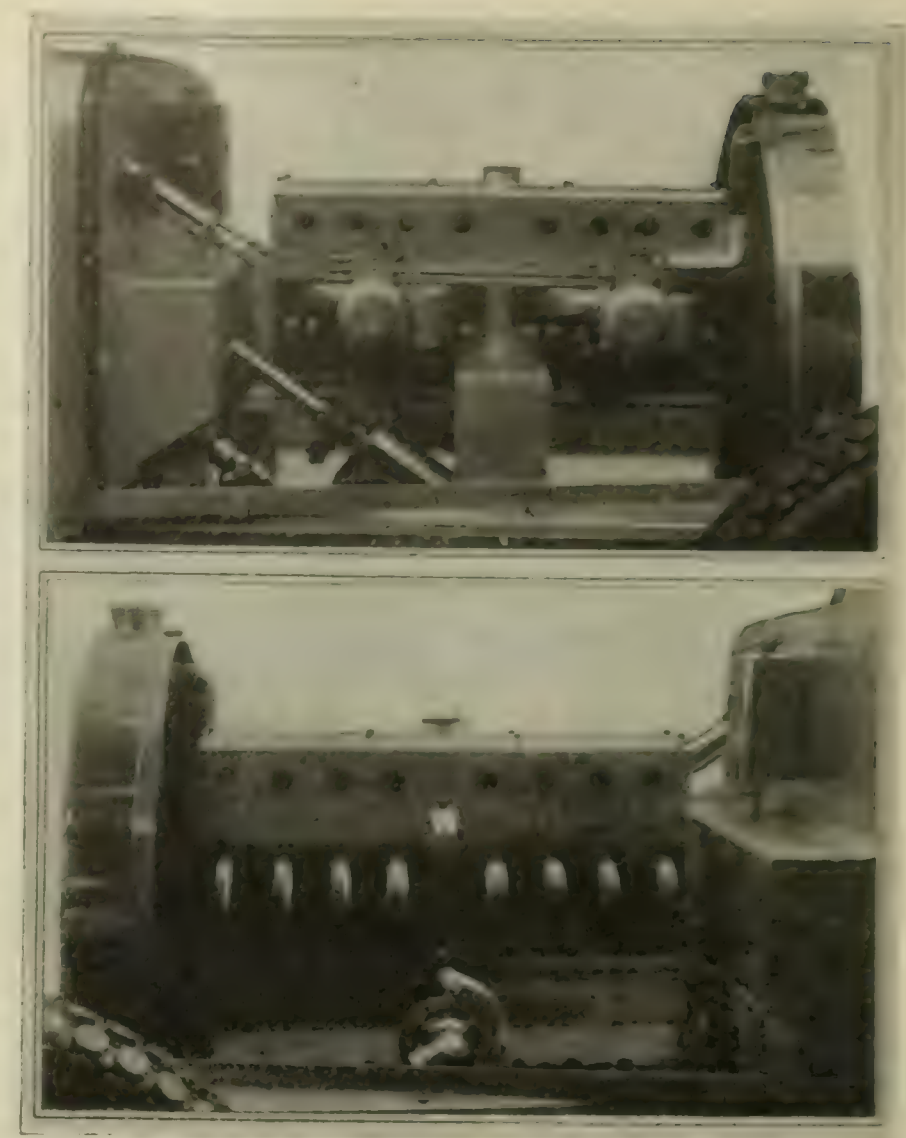
Front wheel brakes have gained the confidence of the

French public by the way in which they have been introduced. Used first of all on racing cars, they gave entire satisfaction, and the public was given conclusive demonstrations of their ability to stop a car rapidly and safely. Later they were used on a few very high-grade cars, such as Delage and Hispano-Suiza and, having been built with extreme care, the public was further convinced of their safety. Experimental work has been long and often costly, but no inefficient or unsatisfactory type of brake ever having been put on the market, users never have been able to raise any objections against this system of braking, and the general impression now is so good that the public is asking for front wheel brakes whatever the price of the car.

The latest development in this connection is the use of the servo-brake by which the momentum of the car is employed to bring it to a standstill. Hispano-Suiza was the first to use a servo-brake on a stock car; Ballot has used one on his racing models. Panhard is now fitting a servo-brake on the recently produced eight cylinder-in-line. The Hallot servo-brake has been taken up under license by Chenard-Walcker, Bignan and others.

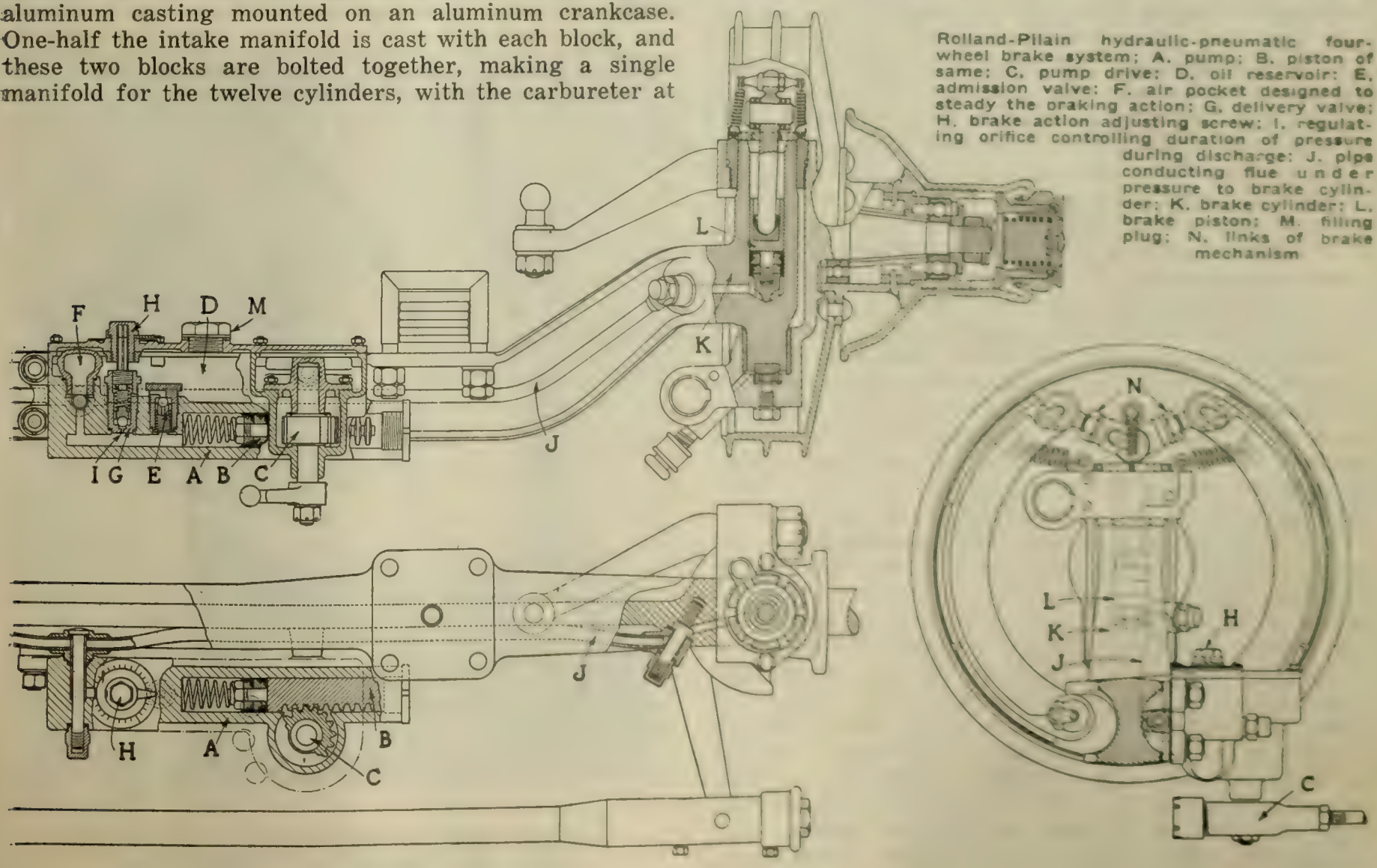
Rolland-Pilain has a very original type of hydraulic-pneumatic brake, claimed to be protected by master patents. This firm maintained that the braking system used on the Duesenberg racing cars in the French Grand Prix was an infringement of their patents and consequently obtained an official injunction against them. One of the features of the Rolland-Pilain system is the combination of the pneumatic with the hydraulic system, thus avoiding the shocks of the hydraulic brake, and allowing of an adjustment which prevents the blocking of the road wheels. The details of this braking system are shown in the drawing below.

The new high-grade cars are all distinctive in design and execution. The twelve-cylinder Voisin is a Knight type, but not built under Knight license; its cylinders measure 80 by 120 mm. and each block of six is an aluminum casting mounted on an aluminum crankcase. One-half the intake manifold is cast with each block, and these two blocks are bolted together, making a single manifold for the twelve cylinders, with the carbureter at

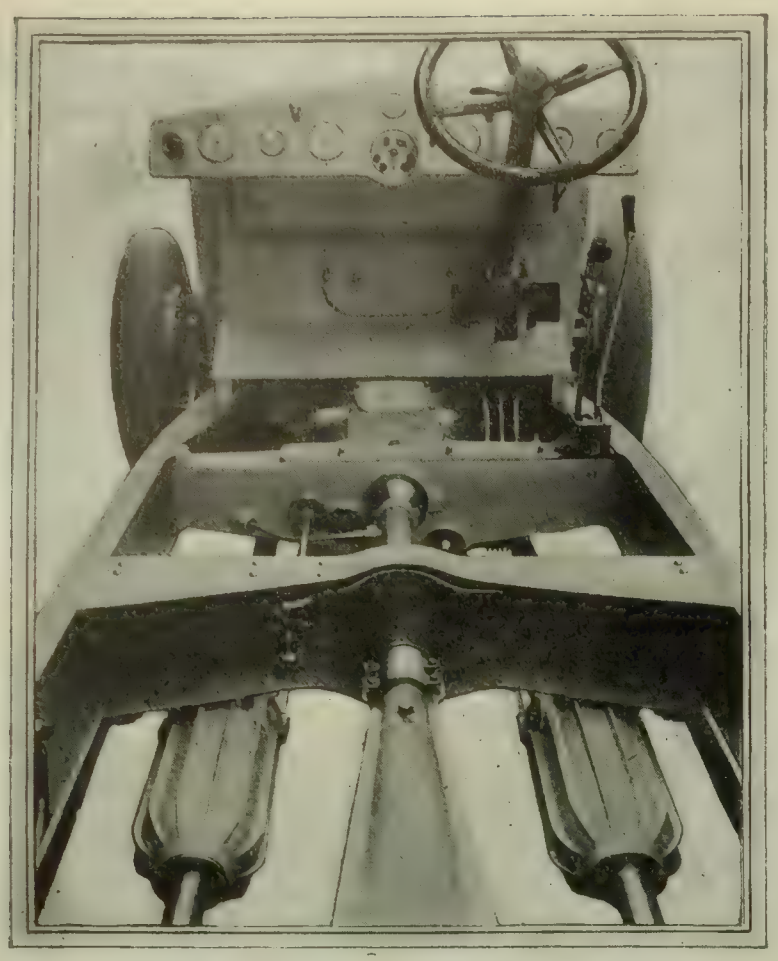


(Above) Bugatti 183 cu. in. straight eight. Magneto is in square box
(Below) Bugatti 183 cu. in. straight eight

the rear projecting through the aluminum dash. This gives accessibility to the carbureter, which is at the



Rolland-Pilain hydraulic-pneumatic four-wheel brake system; A. pump; B. piston of same; C. pump drive; D. oil reservoir; E. admission valve; F. air pocket designed to steady the braking action; G. delivery valve; H. brake action adjusting screw; I. regulating orifice controlling duration of pressure during discharge; J. pipe conducting flue under pressure to brake cylinder; K. brake cylinder; L. brake piston; M. filling plug; N. links of brake mechanism



Chassis of the new 12-cylinder Super-Fiat

driver's feet, but hidden by a quick detachable aluminum plate. To overcome any porosity in the aluminum cylinder block, the inside of the water jacket is enamelled under pressure and baked. The intake manifold is treated in the same way to assure a perfectly smooth surface.

The crankshaft, which has a minimum diameter of 2.16 in., is in two parts, keyed and bolted together, and is carried in three roller bearings, with a ball thrust bearing at the rear. Auxiliary connecting rods are dispensed with, for the sleeves each have a couple of lugs cast on their base, with their inner faces turned cylindrically and mounted directly on the eccentric shaft with split bronze bushings. The timing gear consists of a helical pinion on the crankshaft driving a cross shaft at the front of the engine, this cross shaft operating the two eccentric shafts by means of helical gearing and driving the water pump from one end and the Delco high-tension distributor from the other. The pinions on the eccentric shaft are mounted on a fixed hub, with a slot and a bolt. When the correct engagement of the two gears has been obtained, two holes are drilled through pinion and hub, and the two are secured together by a couple of bolts.

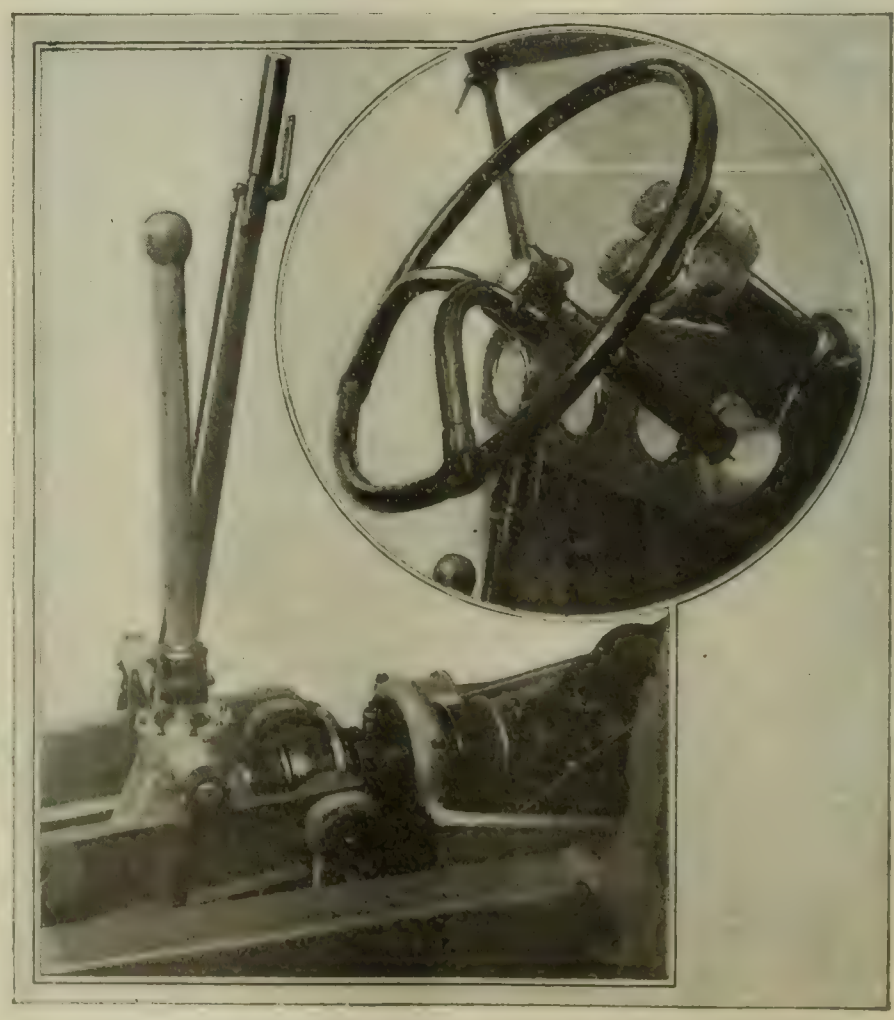
Voisin has pushed the all-enclosed idea on this car to extremes. Externally the cylinders are a slab-sided block with a squared exhaust manifold dropping from each side. There is no opening between base chamber and frame members, nor between engine base and dash, and back of the dash everything is covered in flush with the top of frame members by means of detachable aluminum plates.

Four wheel brakes with hydraulic operation are a feature of this chassis. The car is being shown with a forged front axle, but the production job has a tubular axle. A feature of the springing is the use of semi-elliptics at the rear, with a considerable offset of the axle. To compensate for the short length of spring behind the axle, the rear end is shackled with a long coil spring in a metal housing.

The new Super-Fiat twelve-cylinder model has its cylinders in two blocks, at an angle of 60 deg. A detachable head is used, with a single camshaft in the base chamber and operation of the valves by hollow push rods, going through the cylinder casting, and rocker arms. Exceptionally clean lines have been secured; there are no external rods or wires, and the only visible moving part is the gear driven fan. The exhausts are on the outside of the cylinder blocks, the lead being dropped down from the center and surrounded by an aluminum casing. In the Vee the engineers have lodged the electric generator and the water pump, and hidden them from view by a close fitting aluminum plate. The intake manifold arrangement is original, for it is cast with the aluminum water outlet pipe from the two blocks of cylinders, and the single carbureter is bolted up to the water outlet, with the main air intake just to the rear of the radiator. A cross shaft at the front of the engine drives the two high-tension distributors, for this car is fitted with generator battery ignition of Fiat's own design.

Gasoline is under pressure in a rear tank, the initial supply being obtained by an air pump automatically put into operation when the starting motor begins to turn. A thermostat is fitted on the cooling system, and the aluminum fan is direct driven through a flexible coupling. No electric wiring is visible, for aluminum covers have been used everywhere. An unusual position for the storage battery is in an aluminum box on the dash.

Three forward speeds and reverse are used on this car. It is claimed that it is impossible for any person to tell, by sound, whether the car is running on its direct or its first indirect gear. Rear axle construction is the same as on other Fiat models, but with the drive transmitted through a heavy central cross frame member. Rear springing is distinctive: A very long cantilever is mounted directly under the frame members, the main leaf of each spring being shackled to an oscillating spring pad on the axle housing, this being automatically lubricated from the interior of the housing. The second leaf of the spring is nearly twice the length of the main leaf, and is extended rearwards and attached by means of rollers to the extremity of the frame member. This leaf has two different cambers, and thus tends to eliminate rebound, while also giving lateral stability to the rear end of the chassis. Brakes are fitted on all the wheels.



Bugatti 8-cylinder, showing torque members each side of propeller shaft, with compressed fabric links. (Upper corner) Bugatti 2-spoke steering wheel

Bugatti's 183 cu. in. eight ahead is another original job. The cylinders, measuring 69 by 100 mm., are in two castings, but having a common water jacket and a one piece overhead valve gear cover, the appearance is that of a block casting. There are three vertical valves in the head, with overhead camshaft, having centrally placed vertical shaft drive. From its base this shaft drives the water pump on one side and the magneto on the opposite side. There is a plain bearing between each pair of adjacent cylinders, and an additional bearing outside the clutch shaft. This is obtained by the use of an open clutch housing bolted to the rear face of the engine base chamber. The engine develops 90 hp. at 3400 r.p.m.

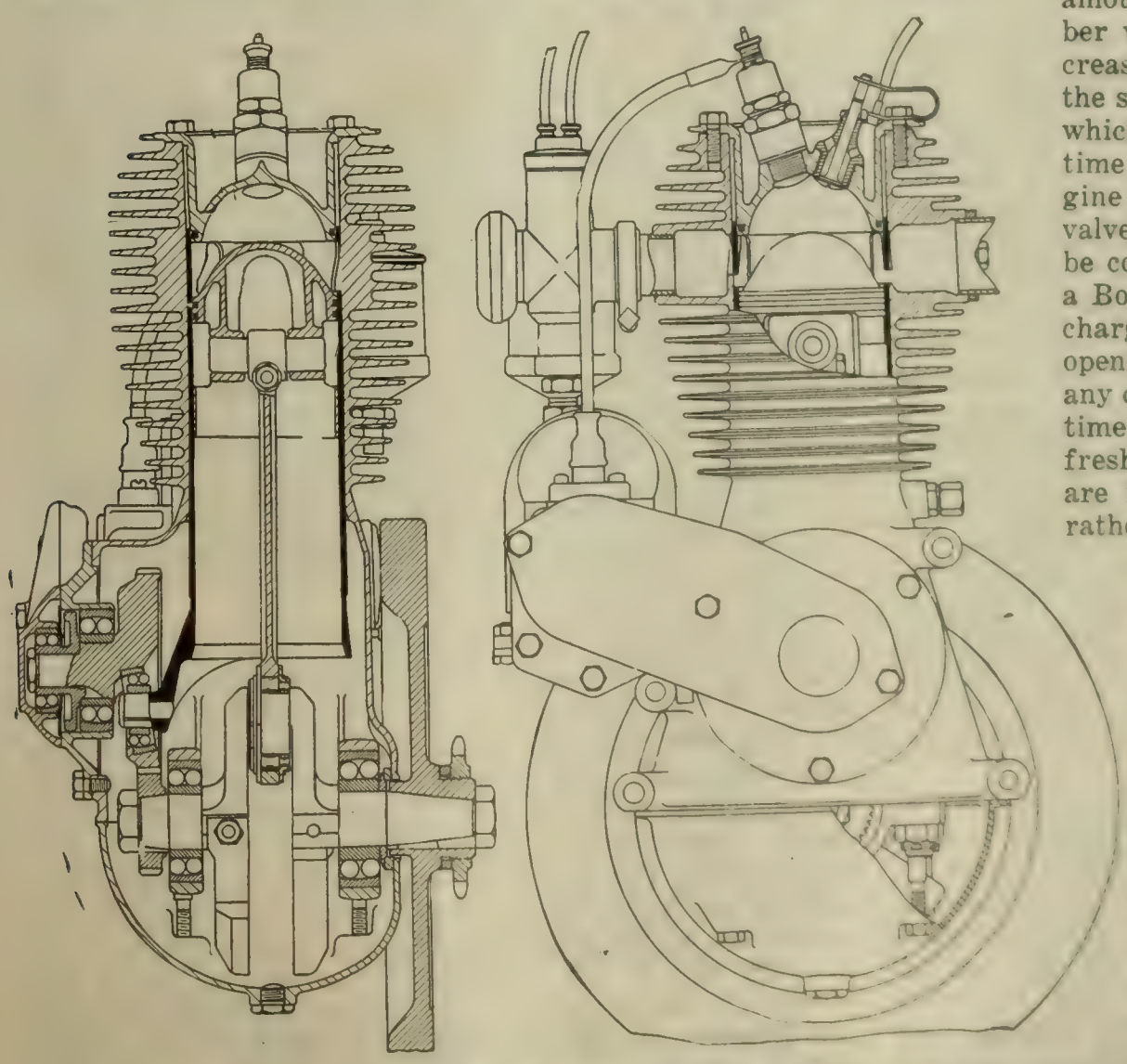
Bugatti uses only two speeds and reverse, it being claimed that this is quite sufficient with an engine of this power in an exceptionally low-weight chassis. The indirect and the reverse gears are contained in the combined differential and gearbox housing on the rear axle. Axle tubes are machined from the solid steel billets and the central housing is of aluminum. On each side of the propeller shaft there is a channel section torque member, with hardwood filling bolted to the differential housing at the rear and attached at the front to the extended engine base chamber by compressed fabric links. The change speed and the brake levers are mounted on one of these members. Bugatti's distinctive type of quarter elliptic spring with the thick end rearwards is used on this chassis in conjunction with a shock absorber, the friction drum of which is inside the brake drum. Hydraulic brakes are fitted to all four wheels, and are supplemented by a hand control.

There is a very unusual use of compressed fabric in the steering gear connections. At the base of the steering column there is a fabric coupling of the type commonly employed on drive shafts. The transverse steering tie bar is formed of two steel tubes, with oval shaped ends formed of compressed fabric about ½ in. in thickness, held between steel plates. The pivots operate direct in this fabric. The fore and aft steering rod is also made of two steel tubes, connection from this rod to the steering knuckle being by a universal with compressed leather bushings. The steering wheel has only two spokes, to allow the hand to be passed through in order to reach the carbureter controls which are on a separate column, secured to the aluminum dash. These steering connections assure flexibility with rigidity, absorb vibration and road shocks and require no lubrication.

Sleeve Valve Type of Motorcycle Engine

A MOTORCYCLE engine having a single-sleeve valve of the Burt-McCullum type is now being used on a British make of motorcycle, and it is understood that it is being subjected to tests by a well-known American motorcycle firm. Double-row, self-aligning ball bearings are used throughout, except on the crankpin, which is fitted with roller bearings. The crankshaft is a single-piece forging provided with bolted-on counterweights. The valve sleeve is given a combined reciprocating and rocking motion by means of a ball bearing of the self-aligning type mounted eccentrically in a half-speed gear. Evidently the inner race of this bearing is mounted so it can slide on its stud, and the axes of the two races are angularly movable relative to each other.

In an engine of this design the ports require a considerable depth of combustion chamber side wall, and in order to obtain this without getting the compression space too large the piston head is crowned, as shown. This is a rather unfortunate requirement, for it can easily be seen that if the piston were cupped the same amount as it is crowned, the combustion chamber would be nearly doubled without any increase in the cooling area; that is, figuring on the same compression, the total cooling area to which the burning gases are exposed at the time of ignition need be no greater in an engine nearly twice the size. There is a small air valve in the cylinder head which can evidently be controlled from the handlebar by means of a Bowden wire. This permits of diluting the charge at will and, by closing the throttle and opening the air valve, to coast without drawing any charge through the engine and at the same time cool the engine by scavenging it with fresh air. Cylinder and top half of crankcase are in one casting, and the whole design is rather neat and compact.



Motorcycle engine with Burt-McCullum single sleeve valve

TESTS of fuel tanks entered for the Air Ministry competition for safety tanks for aircraft commenced at the Royal Aircraft Establishment on Dec. 5. The object of the competition, for which prizes amounting to £2,000 are being offered, is to obtain a tank that will withstand the shock to which it may be subjected in an airplane crash without either bursting or leaking, and thus eliminate almost entirely the possibility of fire in such circumstances, and will also withstand the effects of enemy action by machine gun and shell fire. The competition brought in 26 entries.

Features of Recent Development in Truck Parts Design

Trend in truck design is well illustrated by changes and innovations developed by parts makers. In this article, Mr. Heldt has analyzed recent trends in engine, clutch, transmission, universal joint, rear axle and wheel design and has described a few of the more striking features developed.

By P. M. Heldt

NOTWITHSTANDING the general stagnation in the motor truck industry during the past year—or possibly because of it—there has been considerable development in the design of motor truck components. As has been the case for years past, most of this development has been in connection with the engines. This is partly due to the fact that the change in the characteristics of motor fuels has compelled certain changes in design. On the other hand, there seems to be a tendency to increase the speed of truck engines, which necessitates the use of lighter reciprocating parts, heavier crankshafts and heavier crankcases. Finally, the opening up of new fields of applications, such as to motor bus service and high speed transport work, has created a demand for engines of new characteristics. The following article is based upon the results of an inquiry among manufacturers of motor truck components as to the improvements made and new models brought out by them during the year.

One of the most interesting developments in the design of truck engines is the adoption of removable cylinder barrels. This construction has been used for some time in the truck engines manufactured by the Minneapolis Steel and Machinery Co. and the Wallis Tractor Co. These two concerns are manufacturers of farm tractors, and their use of removable sleeve engines might be ascribed to the fact that they are using in their trucks the same engines as in their tractors; the Wisconsin Motor Mfg. Co., however, which has recently come out with an engine with removable cylinder barrels, seems to have designed this engine specially for truck work.

The valve-in-head type of engine has made further gains and bids fair to become the standard type for commercial vehicles at least, where noiseless operation is not so important as in the case of passenger engines. In connection with this type there have been further developments in lubrication. Pressure feed is gaining ground constantly, and the practice of regulating the pressure in accordance with the load on the engine, which is now quite extensively used on passenger car engines, is also being applied in connection with truck engines.

The other branch of the truck components industry in which there has been considerable development is that of rear axles. The adoption of a speed truck model by so many truck manufacturers naturally has created a strong demand for units for such models, and it is found that a good many of the new components brought out the past year are for this type of vehicle. Rear axles for speed trucks of up to 1-ton capacity, are generally of the spiral bevel drive type. For trucks of larger capacity the tendency in rear axle design seems to be toward the use of double reduction or bevel and spur gear drive axles. It will be remembered that the International Motor Co. came out with an axle of this type the past year, and now the Wisconsin Parts Co. has brought out a line of such axles, so that in future they will be found also on assembled trucks.

It should be pointed out that this article does not contain descriptions of all new truck parts that have been brought out in the course of the year, but only of such new parts as are of special interest in indicating trends in design and which have not already been described in AUTOMOTIVE INDUSTRIES.

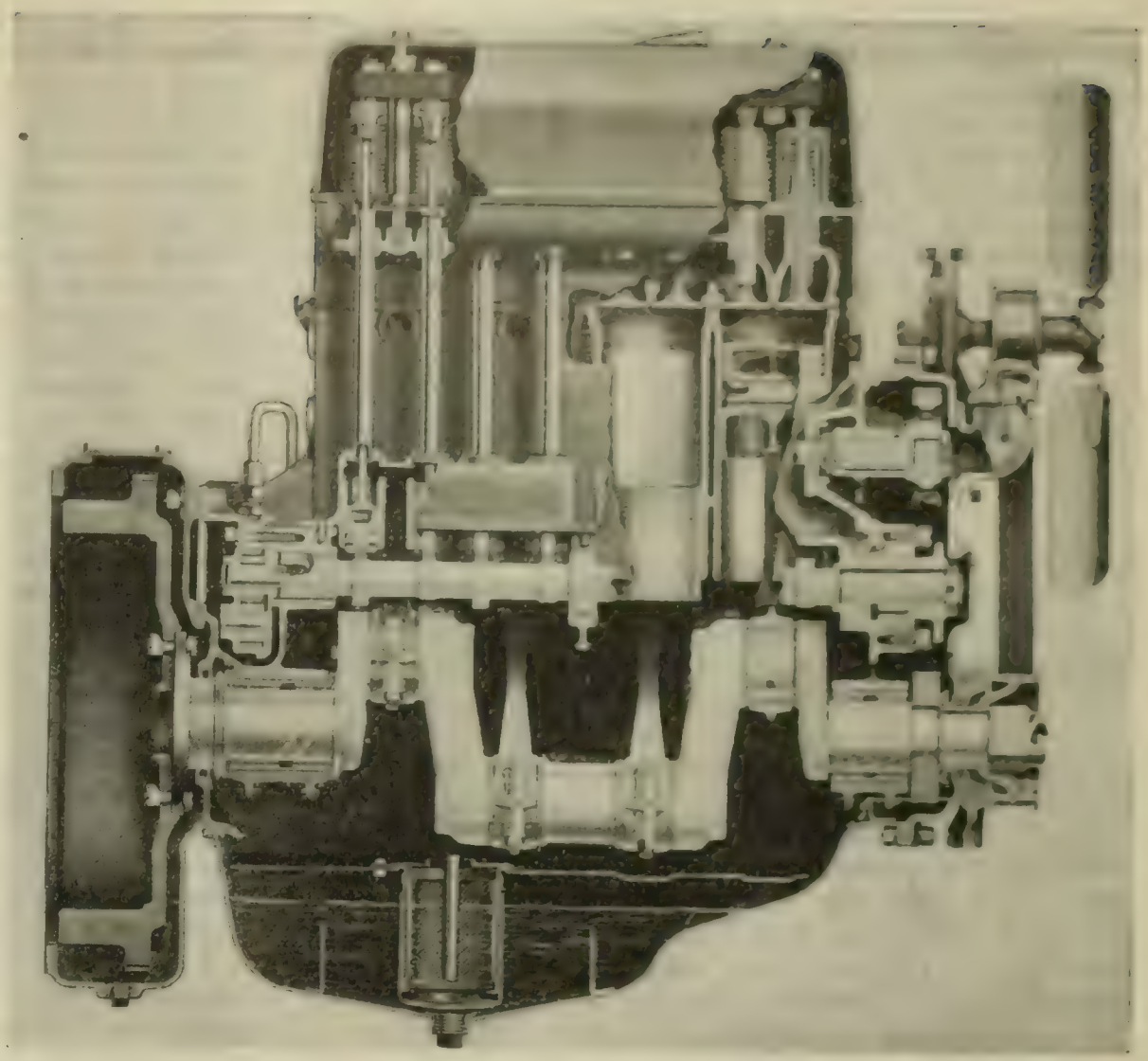
New Midwest Line

The Midwest Engine Co. has brought out a line of truck and tractor engines comprising three four-cylinder models of the following cylinder dimensions: 3⅝ x 5 in.; 4⅛ x 5¼ in. and 4½ x 6 in. All three models are designed on the same lines. The horsepower outputs, according to the manufacturers, are 39 hp. at 1800 r.p.m., 47.5 hp. at 1600 r.p.m. and 61 hp. at 1500 r.p.m. for the three models respectively. Perhaps the most interesting feature of these engines is the use of a two-bearing counter-balanced crankshaft, which is uncommon for such large engines as 4½ x 6 in. The company has also developed a smaller high-speed heavy-duty engine for trucks, tractors, taxicabs and motor buses. This is a four-cylinder engine of 3¼-in. bore and 4½-in. stroke, and the maximum output is given as 33.8 hp. at 2400 r.p.m. The general design of this engine is quite similar to that of the other three models, except that no counterweights are used on the crankshaft and the engine is designed for thermo-syphon cooling instead of pump cooling. A sectional view of the smaller engine is shown herewith, and the chief features of construction are as follows:

An exceedingly heavy crankshaft is used to prevent whipping, the diameters of all bearings being 2¼ in. Large oil passages are drilled through the crankshaft and part way through the camshaft, force feed lubrication being used. The rate of feed of the oil is controlled in accordance with the load on the engine and not by the speed. This prevents excess oiling at low speeds and light loads. The oil is delivered to all crankshaft, connecting rod and camshaft bearings under pressure generated by a self-priming, gear-type pump driven from the rear end of the camshaft. The feed of oil is controlled by the vacuum in the intake manifold, reducing the pressure on the oil relief valve when the throttle is nearly closed and the suction therefore strong. The

position of the oil leads in the crankshaft forces the oil out on the bottom side of the connecting rod bearings. No oil grooves or shims are used. There is no direct lead for the oil to pass out of the connecting rod bearings, which is said to insure an unbroken film from the point of entrance of the oil to the outer edges of the bearing. As a result comparatively loose bearings can be used and thus the bearing friction reduced.

There is no breather on the crankcase, but instead the crankcase is placed in communication with the valve chamber on top of the engine through eight tubes surrounding the valve tappets, and a breather of special design is placed on the valve cover. This arrangement causes a circulation of air carrying a mist of oil through the valve chamber, which insures effective lubrication of the valve mechanism, and at the same time it tends to keep dust out of the engine. The weight of this engine with bell housing is approximately 425 lb. and with open flywheel, 390 lb. The cylinders and upper half of the crankcase are a single casting, while the cylinder head, containing the valve, is cast separately, and the oil pan is a steel pressing. The connecting rod bearings are 2¼ in. in diameter by 1⅝ in. in length; the front main bearing measures 2¼ by 2⅜ in. and the rear main bearing 2¼ by 2⅞ in. Roller type cam followers are used. The valves have a clear diameter of 1½ in. and a lift of ⅜ in. The bell housing is a No. 4 S. A. E. standard.



Sectioned view of Midwest high speed, heavy duty engine

Wisconsin Has Valve-in-Head Engine

The Wisconsin Motor Mfg. Co. is coming out with two new models of truck engine, the SU, which is a four-cylinder 3¾ x 5 in., intended for 1 and 1½-ton trucks, and the Model NU, a four-cylinder 4¼ x 5 in., intended for 2 and 2½-ton trucks. In the larger of these two engines, the established practice of the Wisconsin company has been closely followed, but the Model SU differs in many important particulars. This engine is of the valve-in-head type, the cylinder heads naturally being removable. A feature that is as yet rarely met with in truck practice is the removable cylinder barrels. Three-point suspension is employed and the crankcase and cylinder-block with the exception of the removable cylinder barrels—are one integral iron casting. The entire valve mechanism is enclosed, and for easy mounting and dismounting the valve tappets are assembled on removable plates on the right-hand side. The crankshaft is a chrome nickel steel forging and is supported in three bronze-back, babbitt-lined bearings of the following dimensions (front to rear): 1 15/16 x 2½ in.; 2 x 2½ in.; 2 1/16 x 3 in. It will thus be seen that the bearing sizes are tapering from one end to the other, a feature which facilitates the manufacturing operations. The connecting rod bearings are 2 x 2 in.; the diameter of the wristpin is 1 1/16 in. and the diameter of the valves 1 11/16 in. This engine is provided with an S. A. E. standard bell housing No. 3 and the S. A. E. standard supporting arms No. 2.

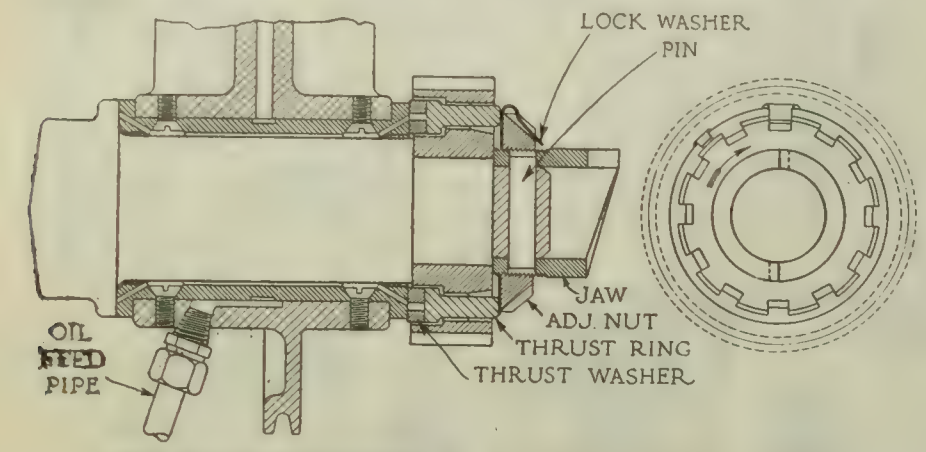
The NU model is of the block type with L-head cylinders and an aluminum crankcase. The cylinder head is removable. Crankshaft and bearings are of the same type as in the SU model. A separate steel supporting arm bolts to the bell housing. Lubrication is by force feed, pressure on the lubricating oil being produced by a gear pump. Water is circulated by a centrifugal pump. Generator, starter, inlet and exhaust manifold and carbureter are mounted on the right-hand side; water pump, magneto, oil filler, breather and oil gage on the left. A governor drive can be furnished. The main bearings of this engine have the following dimensions (front to rear); 2⅛ x 2½ in.; 2 3/16 x 2½ in.; 2¼ x 3½ in. The connecting rod bearings are 2⅛ x 2¼ in. and the wristpin is 1 3/16 in. in diameter. The valves have a diameter of 1 31/32 in. The standard supporting arm is 21 x 5 in., but other arms can be furnished.

Herschell-Spillman Improvements

The Herschell-Spillman Motor Co. manufactures one size of engine suitable for motor truck purposes, a four-cylinder 3½ x 5 in., which is recommended for trucks up to 1½ tons capacity, and especially for speed wagons. A number of changes in the design of this engine have been made during the course of the year, as follows: The cylinder head studs and nuts have been increased from 7/16 to ½ in. An open slot is now provided in the fan bracket so that the fan can be easily removed when desired. The valve adjusting nuts are now provided with oval heads to insure proper contact with the valve stems and allow positive adjustment. Fiber thrust washers are provided to take care of any play in the fan driveshaft. The connecting rod bearings are riveted in place to prevent movement of the bearings detrimental to the operation of the engine. All main bearings are now secured in place by screws so that there can be no movement of the bearings tending to cause wear and noise. End play of the camshaft is adjusted by means of a hardened disk inserted in the hub of the camshaft gear against which bears the end of a hardened adjust-

ing screw. The crankshaft is recessed at the rear end to take care of inaccuracies in the splined shaft of the transmission.

Piston fits are held to tolerances of 0.0025 and 0.003 in. The piston pins are secured in position by a lock screw provided with a lock nut and cotter pin. The distributor lock screw boss has been strengthened. An end play adjusting mechanism has been provided on the crankshaft, and permits of taking up the end play by



End thrust adjustment on Herschell-Spillman engine

simply removing the oil pan. In order to insure greater accuracy, the transmission circle of the bell housing is now drilled after the bell housing has been secured to the engine. The inside of the engine is given a coat of paint to prevent grit from adhering to the walls and causing trouble in service. The fan pulley is now flanged.

Hercules Speed Truck Engine

An improvement in the lubricating system of its models, CU, MU and T, has been made by the Hercules Motor Mfg. Co. This consists in the provision of an oil pressure regulator located at the forward end of the engine close to the oil pump. Adjustment of the relief pressure can be made by merely removing a cap and adjusting a screw. This oil regulator is of the conventional spring-pressed ball valve type. On the Series NU the main bearing studs have been increased in size from ½ to 9/16 in.

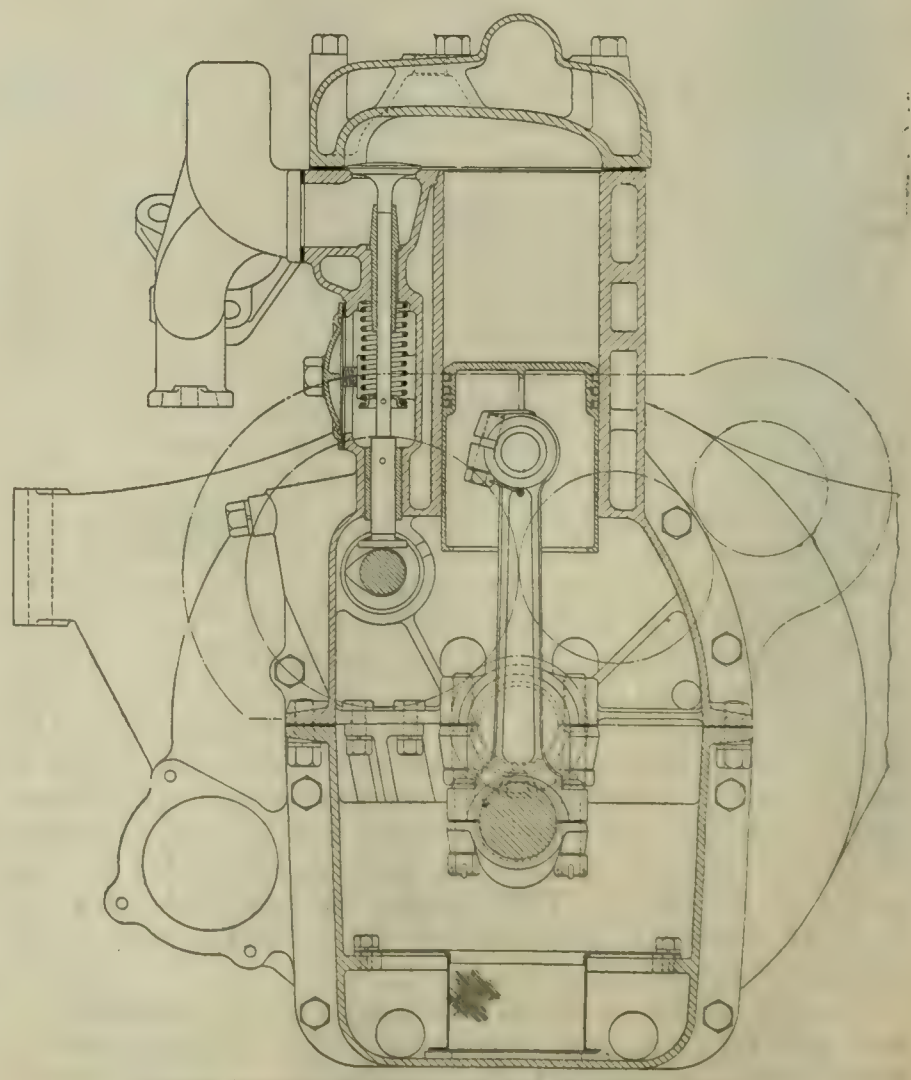
The company has just developed a new engine intended for ¾ and 1-ton speed trucks which has been adopted as standard equipment for the new light truck of the Ruggles Motor Truck Co. This engine is a four-cylinder 4 x 5-in. and weighs slightly less than 600 lb. Cylinder block and crankcase are cast integral, while the oil pan is made of aluminum. The engine has a three-bearing crankshaft, with force-feed lubrication to the main bearings. An output of 42 hp. at 2000 r.p.m. is claimed, and the engine is said to run without perceptible vibration at all speeds. The waterjacket runs the full length of the cylinder block, which is said to be exceptionally strong on account of the rigid supports for the three bearings. The caps of the main bearings are babbitted without the use of a supporting shell for the babbitt. Shells are used for the upper half of the bearing, however. There are no shells in the bearings of the connecting rods, which latter are first tinned and then have the babbitt poured into them. Cylinders and pistons are ground, the tolerances on the cylinder bore being plus and minus 0.001 in. The piston pin bearing is in the piston bosses, the pin being rigidly clamped in the upper end of the connecting rod.

The engine is designed for three-point support, having two arms cast integral with the bell housing and a third supporting point in the form of a trunnion integral with the front cover. The fan is driven from the water pump driveshaft. This shaft is 1 15/16 in. in diameter and is carried in a sleeve, with the drive gear on one end and the pump coupling on the other, the entire unit being removable from the cylinder block after three screws have been taken out. The shaft is made of No. 1040 carbon steel and runs in a phosphor bronze housing. The engine is built for either thermo-syphon or pump cooling, and a "through-shaft" generator can be used with the magneto at the end when the engine is equipped for thermo-syphon cooling, or with a generator or distributor drive. If pump circulation is used, provision is made for a generator with distributor drive attached, or for a magneto. This engine is fitted with a separate bell housing, which permits of using either the No. 2 or No. 3 S. A. E. standard.

Developments With Other Concerns

The Waukesha Motor Co. has made a change in its smallest motor, the Model BUX (which is a 3¾ x 5¼-in. four-cylinder) with the object of improving the operation of the motor under light loads. This consists in the incorporation of a vaporizing device in the intake manifold which vaporizes the heavier particles of fuel that might otherwise get into the cylinders in an unvaporized state when operating at small loads and low speed. When bringing out their new line of engines, of which this particular model is one member, the Waukesha company greatly increased the depth of the crankcase and the diameter of the crankshaft to overcome objectionable vibration in truck work.

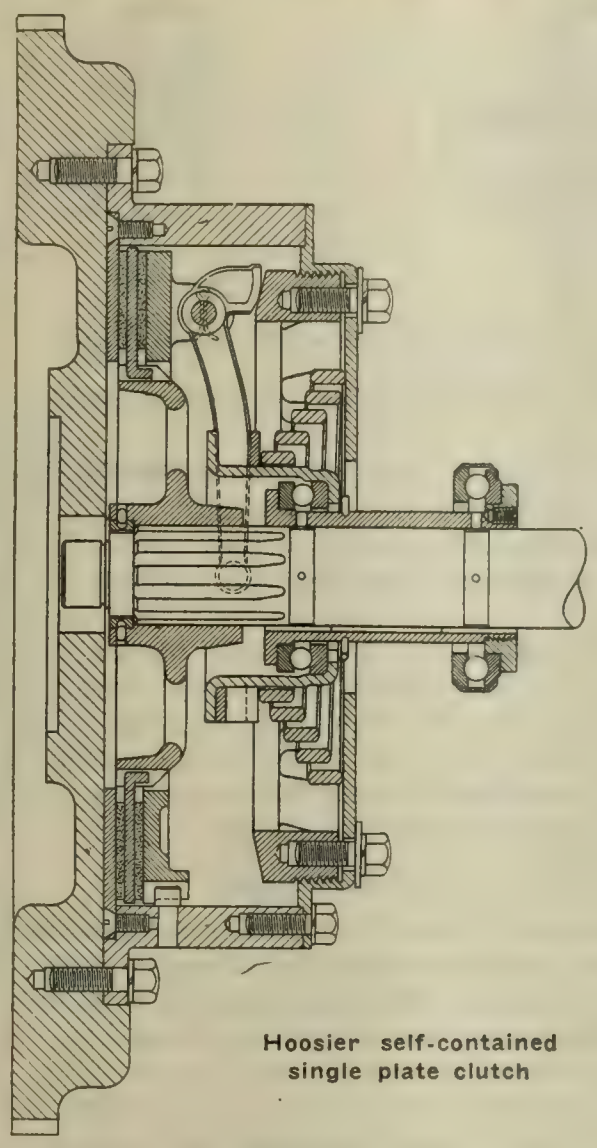
A new engine model for use on motor buses, to be known as Model 4-L, has been developed by the Continental Motors Corp. This engine is adapted for vehicles of 4½ to 5½ tons total weight and is especially designed to facilitate lubrication and to meet high speed requirements. Several changes intended to insure more efficient operation has been made by the Lycoming Motors Corp. Light pistons and connecting rods are being used, and bronze-back, babbitt-lined bearings have replaced the plain die-cast bushings in the main bearings and connecting rods.



Cross section of Hercules speed truck engine

In clutches the tendency seems to be toward the dry-disk type, either single or multiple disk, and a good many of the manufacturers specializing in this line have made minor improvements or added new models in the course of the year. Thus the A. J. Detlaff Co. is now using radial thrust bearings on all of its clutches instead of the straight thrust bearings formerly used. It has also adopted woven asbestos linings.

The Hoosier Clutch Co. has brought out a new model



Hoosier self-contained single plate clutch

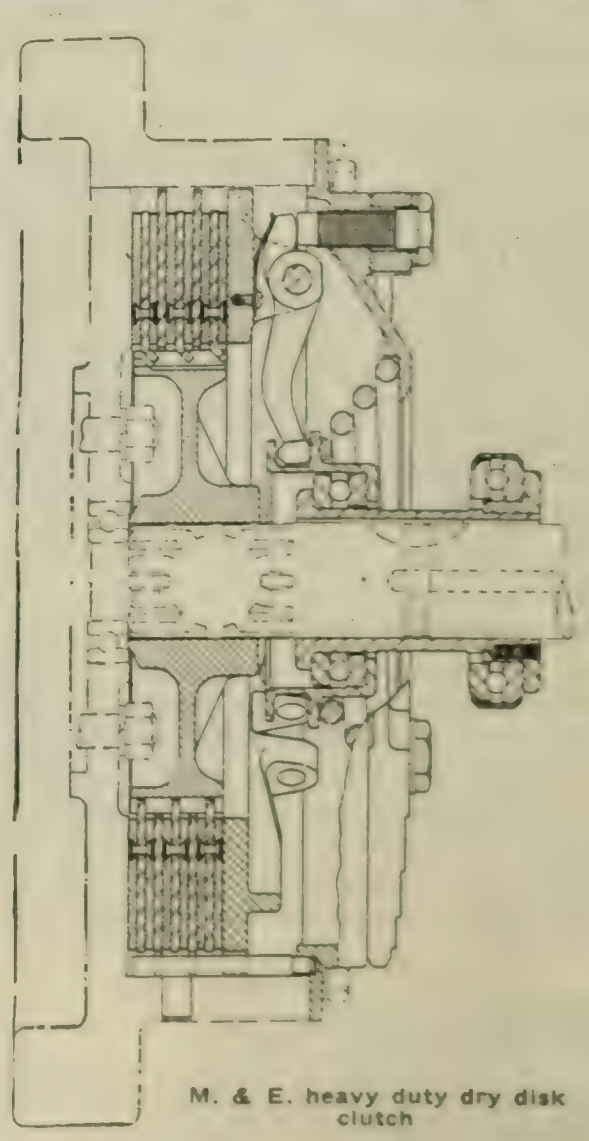
of single-plate clutch which, however, can be built also as a duplex type, being so designed that practically all of the parts are interchangeable, the 10-in. duplex size replacing the 12-in. single plate. This makes it possible for the truck manufacturer to service the clutches by carrying only one size of clutch parts. By enclosing both the single plate and the duplex clutch in a housing, making these clutches self-contained, it is claimed that the assembling of the clutch on the chassis is facilitated, the cost of the flywheel reduced and alignment within the clutch itself is assured. The single plate clutch is made in 8, 10 and 12-in. sizes and the duplex clutch in 8 and 10-in. sizes. All models are made either with or without the inside bearing on the sleeve, on both the amidships and the unit-power plant types.

Fuller & Sons Mfg. Co., in its unit type of transmission, which combines a transmission and clutch, now provides automatic oiling for the clutch throwout bearing. All models are now also provided with an oil-level filler hole. Oil is poured into the transmission until it reaches the filler hole. This latter improvement was made primarily to prevent the operator from putting an excessive amount of oil in the transmission case, with the idea of obviating the need for frequent renewal of the supply. An excess of oil in the case is undesirable because it will work out through the bearings and joints, and also because it tends to lower the efficiency of the transmission.

Merchant & Evans Co. has added a heavy-duty dry-disk type of clutch, as shown in the accompanying illustration. It will be seen that although this is a multiple-disk type, the pressure of the clutch spring is multiplied by radial levers, of which there are three to each clutch. A handy adjusting device is provided. The thrust of the clutch spring is taken up on the ball thrust bearing and the clutch throwout collar also is in the form of a ball thrust bearing. The clutch drum is mounted on the clutch shaft with a splined fit.

Transmissions

Manufacturers of truck transmissions with one or two exceptions do not seem to have introduced any additional models during the past year. One of the exceptions is the Fuller & Sons Mfg. Co., which has brought out two new models. Its model SU-1, which is for speed trucks up to 1¼-tons capacity, has a low gear ratio of 4 to 1, while its model J, which is limited to trucks of ¾-ton capacity, has a low gear ratio of 3½ to 1. This firm strongly advocates the detachable power take-off and the selling of the transmission with a power take-off opening, so that a power take-off may be mounted at any time after the truck is sold. These transmissions are provided with the S. A. E. short-length mounting for power take-off, and the power take-off are designed accordingly; they are placed over the constant-mesh



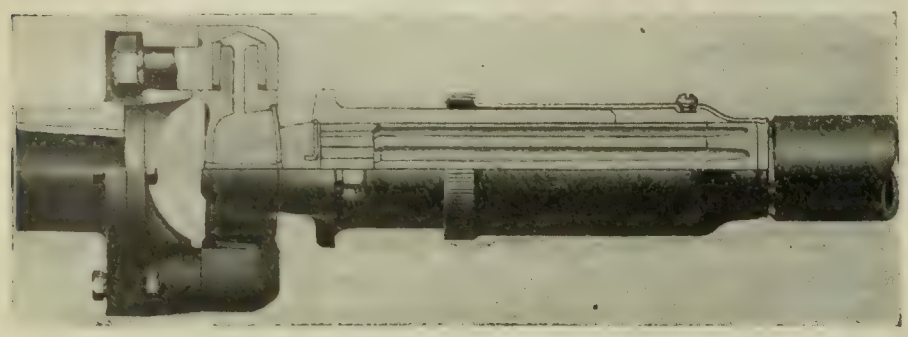
M. & E. heavy duty dry disk clutch

set, the power take-off gear meshing with the large gear on the countershaft. All models of transmission of this company are also provided with openings for tire pumps according to the S. A. E. standard. In some cases the tire pump opening is over the reverse idler gear and in other cases over the large countershaft gear of the constant-mesh set.

Universal Joints

Considerable development work has been done in the line of universal joints and several of the manufactur-

ers have brought out entirely new designs. The Peters Machine & Mfg. Co. have developed adapters which are claimed to make the front and rear universal joints complete units and allow of the rapid assembly to companion flanges on the transmission and on the axle. The cross pins are now subjected to a special heat-treatment to increase the life of their wearing surfaces. A spline sleeve covers the entire splined portion of the shaft and



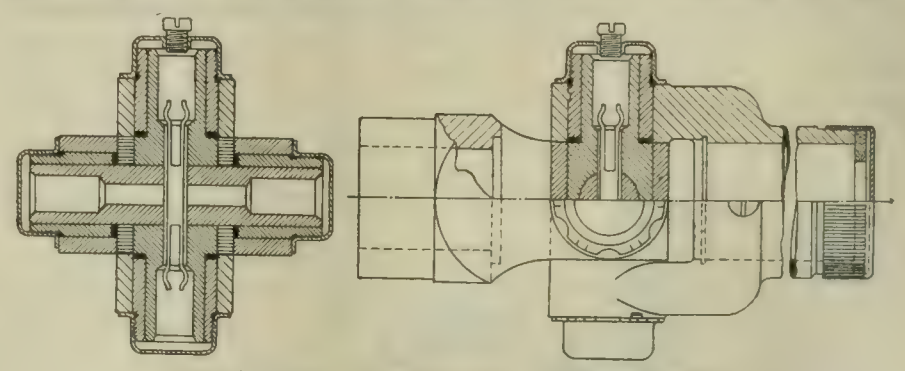
Peters universal and sliding joint with spline-protecting sleeve

serves as a lubricant retainer, thus insuring proper lubrication of the splined sliding joint. A patent on this feature has been applied for. The sleeve at the same time protects the splined shaft from mud and dust, thus increasing its life. The splined shaft is now made from a heat-treated steel and is hobbed and ground to close limits. This company manufactures six sizes of universal joint assemblies, four of which are for truck use.

Blood Bros. Machine Co. has made a refinement in its joints whereby the lubrication of the bearings is facilitated. This improvement is illustrated by the drawing herewith. The new joint is known as the Model B, and it is claimed to possess the advantages of improved lubrication, lighter weight and reduced number of parts. Referring to the accompanying drawing, the lubricant (heavy oil or soft cup grease) is forced to all of the bearings under pressure, and lubrication of the bearings is maintained by centrifugal force. Section BB shows the knurled bushing developed as a safeguard against the turning of the bushing in the yoke ear. The same section also shows how the cap is permanently locked in place.

Tendency to Reduce Weight

Snead & Co. state that the general tendency in universal joint design during the past year has been to reduce the weight of propeller shafts and universal joints to a minimum, to eliminate as far as possible all vibration or whip at high operating speeds. This feature is especially important at the present time because of the tendency of automotive engineers to utilize high-speed engines for trucks as well as for passenger car work. This, in most cases, means a much higher propeller shaft speed, and universal joint manufacturers are compelled to make changes to meet these conditions. Snead & Co. produce ten different sizes of universal joint and propeller shaft units, all of the same general design. They specialize on four or five sizes. The feature of the Snead unit is the use of nickel alloy steel, electrically heat-treated tubing which permits of the



Blood Bros. oil-lubricated universal joint

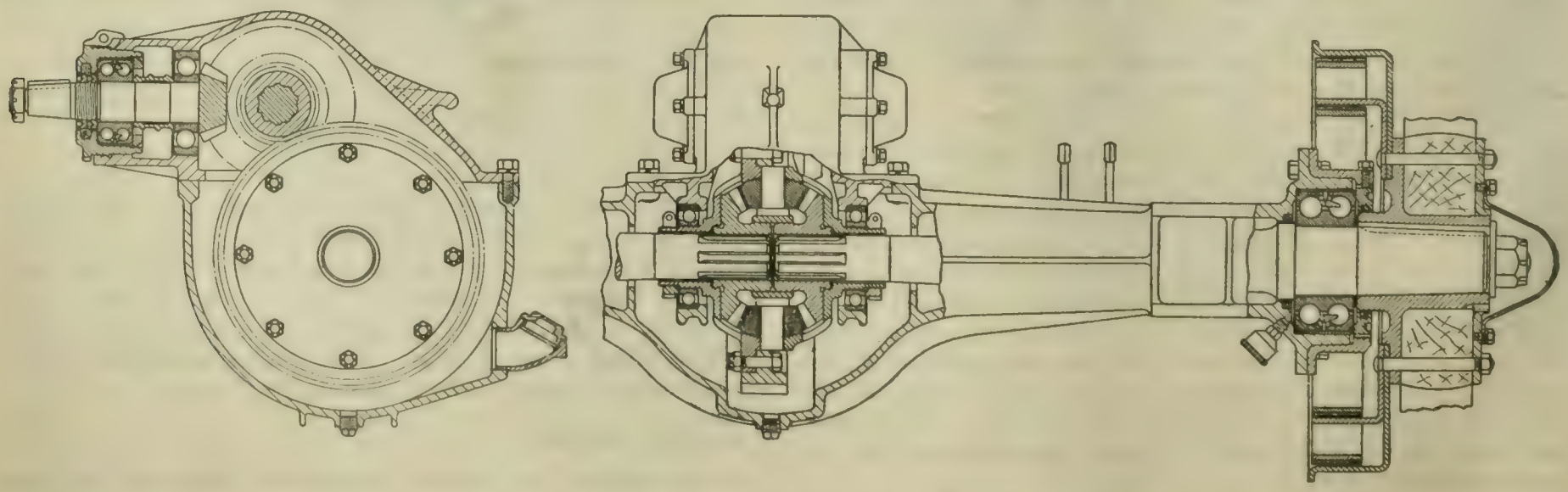
use of light wall thicknesses and consequently low weight.

The Carl Pick Co. has brought out a small universal joint primarily for power take-off purposes in connection with dump body hoist equipment. This joint is provided with a positive means of lubrication and lubricant retention.

One of the parts of motor trucks in which there continues to be intensive development is the rear axle. This probably is due to the fact that there are a number of different forms of final drive in the field, and the rivalry between these different methods of drive stimulates advancement in design.

Wisconsin Double Reduction Axles

The Wisconsin Parts Co., which has been manufacturing a line of worm-driven axles, is continuing that line, but in the course of the year has brought out in addition a double-reduction type of rear axle and is now in production on six models of uniform design. The advantages claimed for this axle may be briefly summarized as follows: The whole reduction takes place at the center of the axle, where all gears and bearings can be securely supported and held in alignment, in which respect the double-reduction axle is similar to the worm-drive axle. The power of the engine is transmitted first through a pair of spiral-bevel gears and then through a pair of spur gears to the differential and driveshafts. The differential is combined with the second reduction set and therefore rotates more slowly than it would if it were placed in the first reduction set. The axles are of the semi-floating or fixed-hub type, as shown in the sectional view herewith.



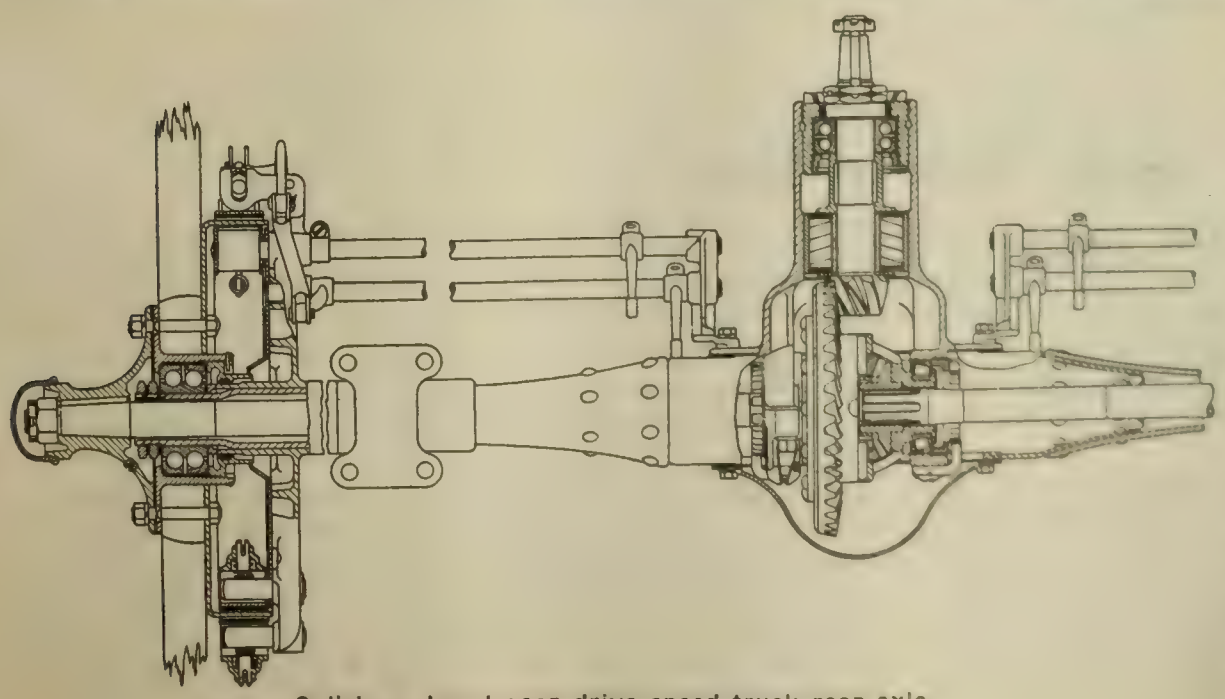
Wisconsin double reduction axle

All gears are forged of 3½ per cent nickel steel. The spiral bevel gears are cut with long addendum teeth, while the spur gears are cut with stub teeth. The differential gear is of Brown-Lipe-Chapin make and of the four-pinion type. All of the gears of the differential are of the stub-tooth form and forged from alloy steel. The axle driveshafts are forged from chrome nickel-steel, while the housing is a malleable casting of suitable section and well ribbed, for stiffness. The bowl at the center of the axle constitutes a reservoir for lubricant, which latter is elevated and distributed by the ring gear. There are grease cups on the wheel bearings.

Bus and Trackless Trolley Axle

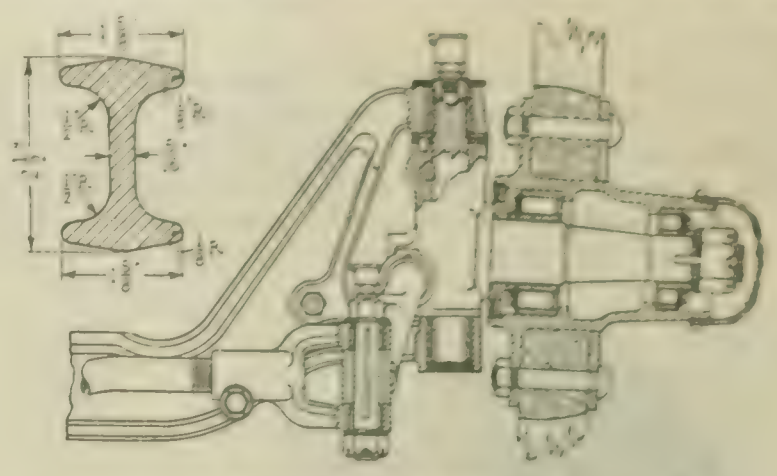
In addition to the standard line of double-reduction axles, the Wisconsin Parts Co. is now at work on a special type of double-reduction axle particularly applicable to motor buses and trackless trolleys. One of the factors of importance in a motor bus is a low center of gravity permitting of low floorboards, which results in convenience to passengers and in increased stability and safety of the bus. Accessibility of parts that require periodical repair is also essential. The Wisconsin company has designed an axle known as Model 120-K, which, it claims, successfully meets these requirements. This axle has a wide tread. The pinion shaft center is in the same horizontal plane as the axle proper. This permits of a greater top clearance and provides for a straight-line drive with low floorboards.

The same brake system is employed on the double-reduction axles as on the worm-drive line. Service and emergency brakes operate in separate drums arranged concentrically on the rear wheels. Three decided advantages are claimed for this form of brake construction, as follows: The heat generated at one drum is not transferred to the other; hence when it is necessary to have long-continued brake action, as in driving in hilly country, the service brakes may be applied alternately with the emergency brakes, the efficiency of one brake not being impaired by the application of the other. Another advantage is that the brake camshafts are separated, and there is therefore no danger of the two shafts binding and freezing, as often occurs when the two shafts are concentric. The third advantage resides in the fact that because of the concentric arrangement of the brake drums it is practically impossible for lubricant to get onto the service brakes. If any oil or grease should work its way through the double felt retainers on the driveshaft, it is caught by the inner drum, thus leaving the drums of the service brake dry.



Salisbury bevel gear drive speed truck rear axle

New front and rear axles for speed trucks have been brought out by the Salisbury Axle Co. The rear axle is of the spiral bevel-driven type, the differential and driving gears being of Brown-Lipe make and designed with coarse teeth to insure maximum strength and life. The pinion and pinion shaft are an integral part, made of alloy steel and heat-treated. The drive-shafts are made of chrome-nickel steel, of tapering section and heat-



Salisbury front axle end

treated. Each shaft is given a Brinell test. The axle is of the three-quarter floating type, which is claimed to combine the chief advantages of both the full-floating (easy removal of shafts) and the semi-floating type (reduction of loads on bearings and tubes when rounding curves).

The brakes are 16 in. in diameter and are provided with adjustments for taking up wear on the lining. The axle tubes are made of heavy seamless steel tubing and are pressed into the housing center and riveted in place under pressure. The driveshafts are rendered accessible after the removal of eight hexagon nuts on the driving flange, after which the driveshaft and flange can be withdrawn together without jacking up the wheel, as the full load is carried on roller bearings in the hub. The brake shafts are mounted in oilless bushings, thus eliminating the necessity for oiling inaccessible bearings. The differential gear carrier can be removed after unscrewing the cap screws which hold it to the housing.

The axle center and steering arms of the front axle are made of 1040 S. A. E. carbon steel, which is heat-treated and is required to show a Brinell test of from 380 to 425. The steering knuckles are made of chrome nickel steel and are heat-treated to show a Brinell hardness of 325 to 360. The knuckle pins, tie-rod pins, knuckle pin bushings, tie-rod bushings and spindle thrust washers are made of carbon steel, carbonized and hardened to show a scleroscope hardness of between 75 and 85, the parts being ground after hardening.

The National Axle Co., which is manufacturing a line of worm-driven axles, has added a new type A which is suitable for speed trucks of ¼-ton capacity, as well as for taxicabs. In addition the company is manufacturing a type 100 worm-driven axle for speed trucks of 1-ton capacity.

A number of improvements in design have been made by the Torbensen Axle Co. in its line of internal gear-driven axles. The pinion shaft mountings have been changed and S. A. E. standard tapers have been incorporated in the two smaller

models. The object of the change in the pinion shaft mounting is two-fold, namely, to increase the bearing capacity so as to extend the periods between adjustments and also to permit of gear adjustments without the necessity of disturbing the bearing adjustment. The changes referred to were made in axles intended more particularly for speed wagons and pneumatic tired trucks.

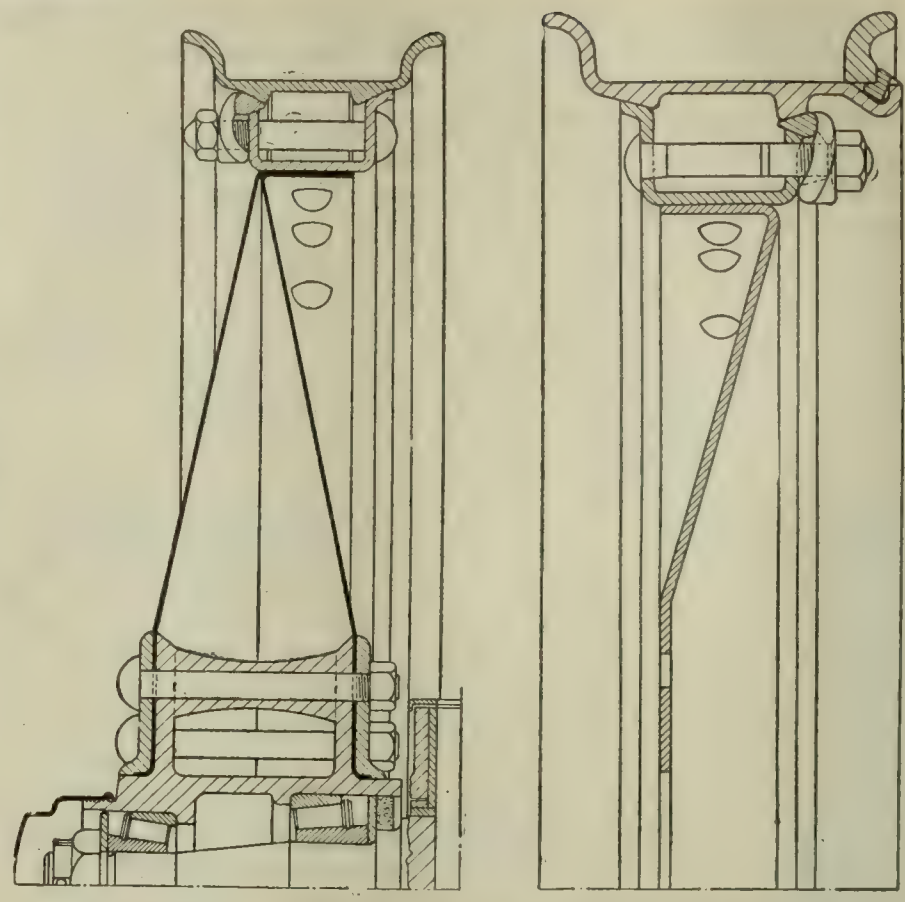
Wheels

The Dayton Steel Foundry Co., manufacturers of cast-steel truck wheels, during the past year has considerably lightened its wheels. A demand for lighter truck wheels arose in connection with the propaganda in several states to place limits on the permissible weight of trucks. The five-spoke wheel was originally developed



Sectioned view of Smith cushion wheel

by the Dayton company some years ago, but at that time it did not meet with much favor, on account of the rather radical departure from principles that had been applied to wheel design for centuries. The weight of a set of four wheels for a 2-ton truck is now approximately 100 lb. less than it was a year ago. The weight reduction is even more radical in the case of a set for 5-ton trucks, amounting to about 250 lb. This lightening of the wheels is the more important because the weight eliminated is unsprung weight.



Sections of Indestructible Wheel Co.'s double disk and single disk wheels

In order to produce smoother castings the company has installed metal patterns and equipment for handling them. This is said to have resulted not only in smoother castings but in fewer shifts and a minimum percentage of scrap.

The double disk pressed steel wheel for motor trucks of the Indestructible Wheel Co. has been improved by a new bracing center, on which a patent has been applied for. The company has recently brought out a single-disk wheel for speed trucks. This comprises a coned disk to be secured to a hub flange by bolts, which is provided with a wide lateral flange at the circumference to which a steel rim or felloe is secured. The center hole of the wheel disk can be either drawn or bored straight to fit the hub, and the number and diameter of the holes and the diameter of the bolt circle made to fit the design of the hub flange. The wheel is designed to take a Firestone demountable rim.

"Ask 'Em to Buy"

WHEN the Automotive Equipment Association adopted the slogan "Ask 'em to buy," it said something. It said something that manufacturers can well take the trouble to pass on to their dealers. The more this simple selling necessity can be emphasized, the more money will there be in the automobile business next year.

One of the machine tool makers has recently started a sales campaign embodying an idea that manufacturers should be interested in from a sales promotion standpoint. The Van Norman Machine Tool Co. has recently brought out a small "Relio" grinder, which it is marketing to garages and service stations. This machine has been rigged up on the back of a Ford car, in such a way that it is self-contained. It can be plugged in on the lighting circuit, thereby making it possible for the salesman to actually show the prospect the machine, as well as the type and kind of work that it can do. The idea is a novel one so far as machine tool selling methods are concerned. It embodies the "Ask 'em to buy" idea in a practical way.

The specific application of the idea is not adapted to any of the selling problems confronting the manufacturer or his dealer organization. The fundamental behind the idea, however, does apply. The instance is cited here simply to show how one company has worked out a new sales idea, suitable for their product and for the selling period in which it now is. "Ask 'em to buy."

Committee Recommends Standards for Tests of Welds

American Bureau of Welding committee finds that three standards, shop, commercial and research, are desirable. Different tests are required for each of these standards. The different methods are fully described.

A COMMITTEE on welding research and standardization of the American Bureau of Welding, which is a joint advisory board of the American Welding Society and the Engineering Division of the National Research Council, has recently made a report on the subject of standards for tests of welds. Following is a review of the recommendations made in this report.

The basis for measuring the effectiveness of a joint between two pieces of metal is the base metal without a joint. Therefore, the quality of a joint is best determined by comparing the characteristics of a section of the structure which includes the joint with those of a similar section which has no joint.

Three standards are desirable as follows:

(a) *Shop Standard.* In the shop a standard test is required for such purposes as checking the work of a welder from time to time, testing a new lot of electrodes in electric welding or of welding wire in gas welding, testing the effect of some change in conditions which may have taken place, etc. Such a standard must necessarily be as simple as possible and preferably a single test. The procedure must be of a simple character.

(b) *Commercial Standard.* There are many cases

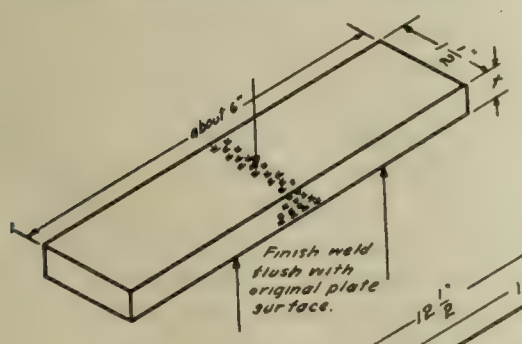


Fig. 1

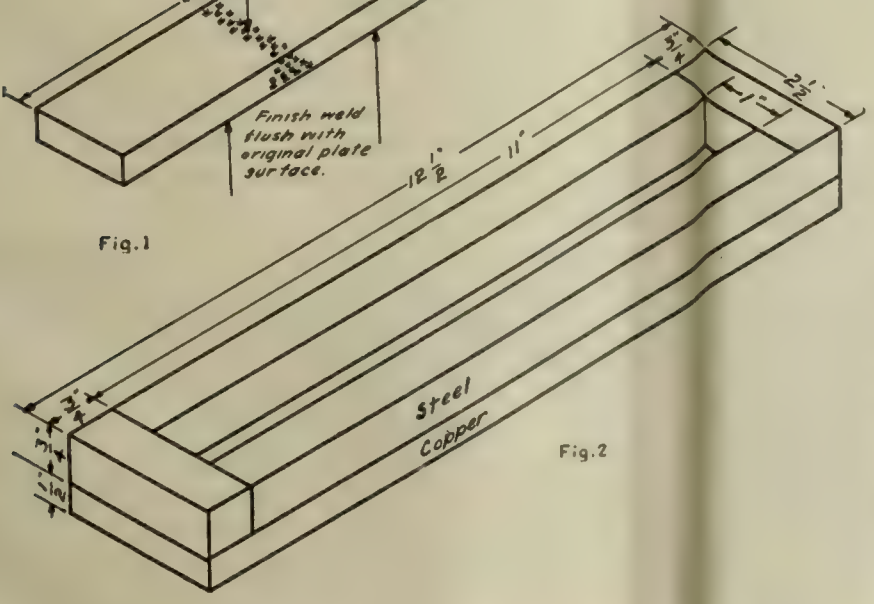


Fig. 2

where more than one kind of test should be made, but where the circumstances do not justify a complete investigation. There is, therefore, a need for what might be termed a commercial standard for making, for example, comparisons between different commercial welding processes or between different kinds of electrodes in electric metal-arc welding or different wires in gas welding.

(c) *Research Standard.* When a complete investigation of a weld is to be made for research or other purposes, all tests and examinations are made which will contribute any information in regard to the characteristics of the weld. It may be necessary to make tests of a special character in special kinds of welds or where application under unusual conditions is contemplated, but there should be a standard list of tests which will give information which is complete as far as all ordinary requirements are concerned.

Definitions.

(a) A weld is a solid union of metallic pieces formed by uniting or consolidating by hammering or compressing with or without previous softening by heat.

(b) A fusion weld is a weld formed by heating to a fluid state the edges of the pieces to be joined and allowing the metals to flow together (with or without additional molten metal being supplied) without any pressure being applied. The heat may be supplied by a gas flame, an electric arc, thermit or otherwise.

(c) In a fusion weld, the *base metal* is the material composing the pieces to be united by the weld. Unless otherwise expressly stated, it is understood that a weld joins two pieces of identical material.

(d) In a fusion weld, the *weld metal* is the material which has been used in forming the weld. It may consist entirely of the base metal adjacent to the weld or of the material added to the fused base metal from a welding rod or electrode, or other material.

(e) *Filling metal* is the metal added during the welding process to form part of the weld. In gas welding it is supplied by means of a *welding rod*, in carbon arc by a *filling* rod and in metal arc welding by the *electrode.*

(f) A *test weld* refers to a sample of welding which has been performed under known conditions and upon which mechanical tests are to be made.

(g) A *test specimen* is a prepared piece on which a mechanical test is to be made.

For the shop standard a bending test only is recommended; for the commercial standard, both a bending and a tensile test, and for the research standard, tests of the base or parent metal, of the weld and of the filled-in metal, the various tests of each metal being enumerated. Wherever possible the standard procedure of the American Society for Testing Material is to be followed, as given in the A. S. T. M. Report for 1918. Three duplicate specimens are to be tested in each test and the average taken as the value of the property determined by the test.

The most interesting of the proposed tests is the bending test, as this is to be the shop standard. Shape and dimensions of the specimen for this test are given in Fig. 1. In the case of welds in flat rolled material the surface of the weld is to be machined substantially flush with the surface of the specimen, unless the specimen is bent or offset, in which case it is to be machined all over. Cast and other irregular-shaped specimens are to be

machined all over. It is essential that the edges of all specimens be machined to remove material in a condition likely to cause premature failure. The thickness of a weld specimen is to be as nearly as possible that of the base metal.

In the case of the weld metal, a specimen may be prepared from a bar of weld metal prepared the same as for tensile tests. The box, Fig. 2, is to have a width of

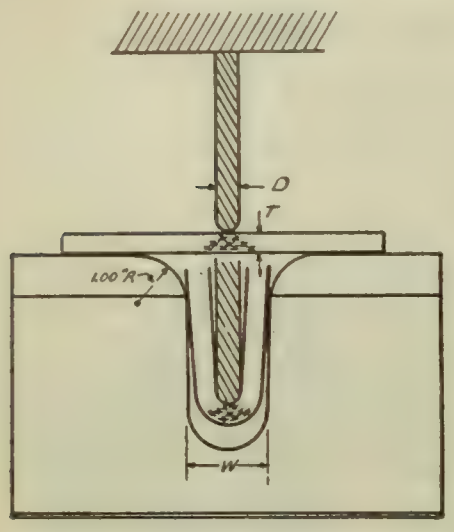


Fig.3

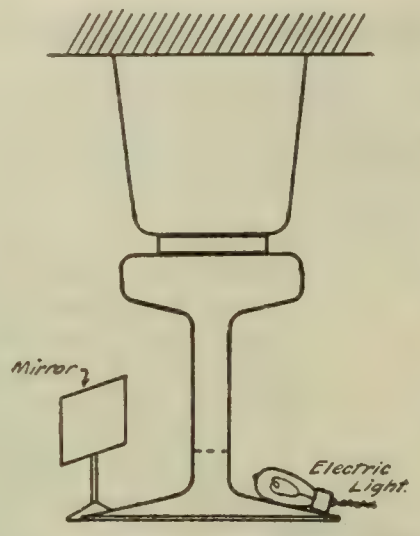


Fig.4

1.75 in. and the thickness of the specimen is to be that of the test weld. These specimens are to be machined all over.

In order to load the specimens so that as large a part of the bend as possible occurs in the weld metal, the special fixture illustrated in Figs. 3 and 4 is to be used. It can be conveniently used with any standard testing machine. The cylindrical surface D, Fig. 3, about which the specimen is bent, conforms to the requirements of the American Society for Testing Materials for bending tests of the base metal. This piece is attached to the underside of the moving head of the testing machine. Upon the platform are to be fastened two blocks having machined top surfaces and polished corners of a radius of 1 in. These blocks are to be separated a distance

$$W = D + 2T + \tfrac{1}{8} \text{ in.}$$

A lubricant of lard oil and graphite or similar compound is to be used on these surfaces.

Two specimens are to be tested. The load is to be applied at the center of the weld—in one specimen to the open side of the Vee and in the other to the closed side. The rate of application of the load is not to exceed that at which the beam can be kept balanced at all times, or a maximum of 2 in. per minute. The angle through which the specimen is bent may be measured by any convenient method. The following method is described as a matter of information:

A piece of paper is held firmly against the edge of the specimen when it is in place on the testing fixture and a line drawn on the paper along a corner of the specimen, thus outlining the shape of the specimen so far as bending is concerned. A line is drawn before loading and after failure occurs. The change in the angle in the two lines as determined with a draftsman's protractor is the angle through which the specimen had been bent at failure.

The test results to be recorded are the total angle through which the specimen has been bent when the first crack appears upon the convex surface (that is, the sum of the angles through which the two halves are bent), and is to be measured without removing the load. An electric light and mirror will assist in observing this surface, as indicated in Fig. 4; also, the load on the specimen at which the first crack occurs.

The tensile test specimen for sheet materials is shown in Fig. 5. The thickness of the specimen may be anything desired, but a thickness exceeding ¾ in. would require a testing machine in excess of 100,000 lb. capacity. If the specimen is cut from standard sheet material, it is usually not necessary to machine the 1.5-in. faces of the specimen. The tensile test specimen for cast or brittle material is indicated in Fig. 6. It is particularly important to use swivel specimen holders when testing such specimens, in order to eliminate undesirable stresses.

The test results to be recorded include the ultimate strength, calculated from the area of the original section, the yield point, the contraction of area and the appearance of the fracture. The proportionality limit, the modulus of elasticity and the total elongation may be recorded if desired.

The shape and dimensions of the test specimen for tensile tests of the weld metal are shown in Fig. 6. It is to be prepared from a bar of weld metal ¾ x 1 x 11 in. This bar is to be formed entirely by depositing filling metal in an open box of the shape shown in Fig. 2, employing exactly the same method as used in making the corresponding test weld. For metal electrodes this box is to consist of copper plate ½ in. thick, upon which is secured a frame of steel bars ¾ in. square. The parts of the box are secured in any convenient manner. During this operation the copper plate is to rest on a steel plate. After the bar is formed the copper plate and the frame may be removed by machining. For gas welding the copper plate is to be replaced by a steel plate. For thermit, a box of suitable refractory material should be used. The test results to be recorded are the same as those for the tensile test of the base metal.

Shape and dimensions of the test specimen for tensile tests of the weld are given in Fig. 5, with the weld at the center. If the material is cast or brittle the specimen shown in Fig. 6 is to be used, with the weld located at the center. It is especially necessary that the 1.5-in. sides of the specimen be machined, particularly if the two pieces of base metal are offset or if they form an angle at the weld. Tests made in the latter case, where the specimens are not machined, are not reliable. Furthermore, care must be taken that specimens having the latter defect are not "straightened" before being machined, because such treatment is likely to materially decrease the strength of the weld. A roughing cut in the planer or shaper which will just clean up the surfaces of the specimen is sufficient. The test results to be recorded are the same as for the tensile test of the base metal.

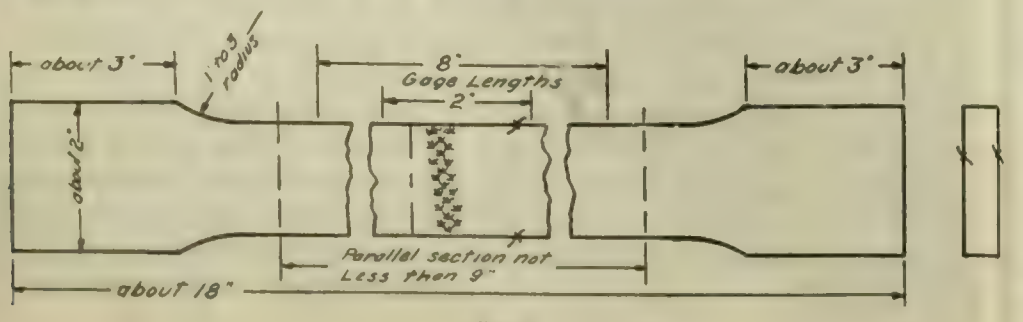


Fig.5

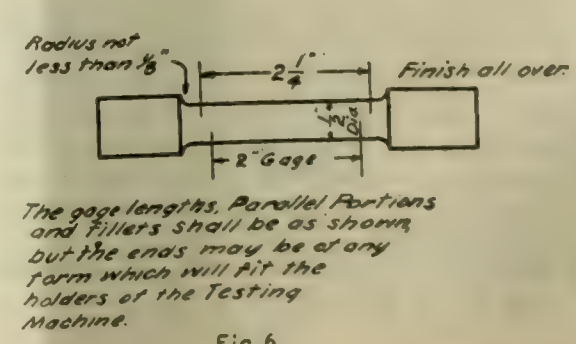


Fig.6

How Diecastings Are Produced

A description, not only of the methods followed, but of various types of diecasting machines employed. Considerations to be borne in mind in the design of parts to be diecast and the characteristics of various alloys used are outlined. Diecastings of gearboxes, etc., now possible.

By Herbert Chase

DIECASTING owes its rapid growth in large part to the automotive industry, but that industry is none too well acquainted with methods used in diecasting and partly for this reason has failed to visualize the possibilities of diecasting or make full use of existing facilities.

One purpose of this article is to convey to the automotive industry certain information which, though more or less elementary in character, is quite necessary to an appreciation of the subject. Most of the information here given was secured as a result of a recent visit which the writer made to the plant of the Stewart Mfg. Co.

The primary reason for diecastings is, of course, the fact that as they come from the mold, they require little if any finishing, since the surface is smooth and the dimensions can be held to close limits. Furthermore dies are sufficiently durable to enable the rapid manufacture of several thousand castings with practically no variation in size as between the first and last piece. A great majority of the castings made to-day are of relatively small size, but zinc-base castings weighing as much as 11 lbs. each have been successfully produced in large quantities (one such casting is shown in an accompanying cut) and the concern mentioned considers it possible to diecast pieces as large as the gearcase used on some of the smaller passenger cars to-day. Thin section curtain light frames measuring 8 x 28 in. are readily made in aluminum alloy by this company to-day and it is considered but a short step to the production of castings of similar or larger major dimensions, with the third dimension much greater than that of the frame mentioned. These instances are cited simply as a means of indicating that the near future may well see some interesting developments in quantity production of much larger diecastings than have heretofore been thought feasible.

For best results in diecasting, as in most other casting, alloys produced from virgin metals are used, but a small percentage of scrapped castings or material cut from castings in trimming them can be used without detriment. In the Stewart Mfg. Company's plant the virgin metal is unloaded direct from the railway cars, weighed and delivered to the raw material stockroom, adjacent to the alloying furnaces. The latter are gas-fired and the temperature is thermostatically controlled and recorded to prevent overheating.

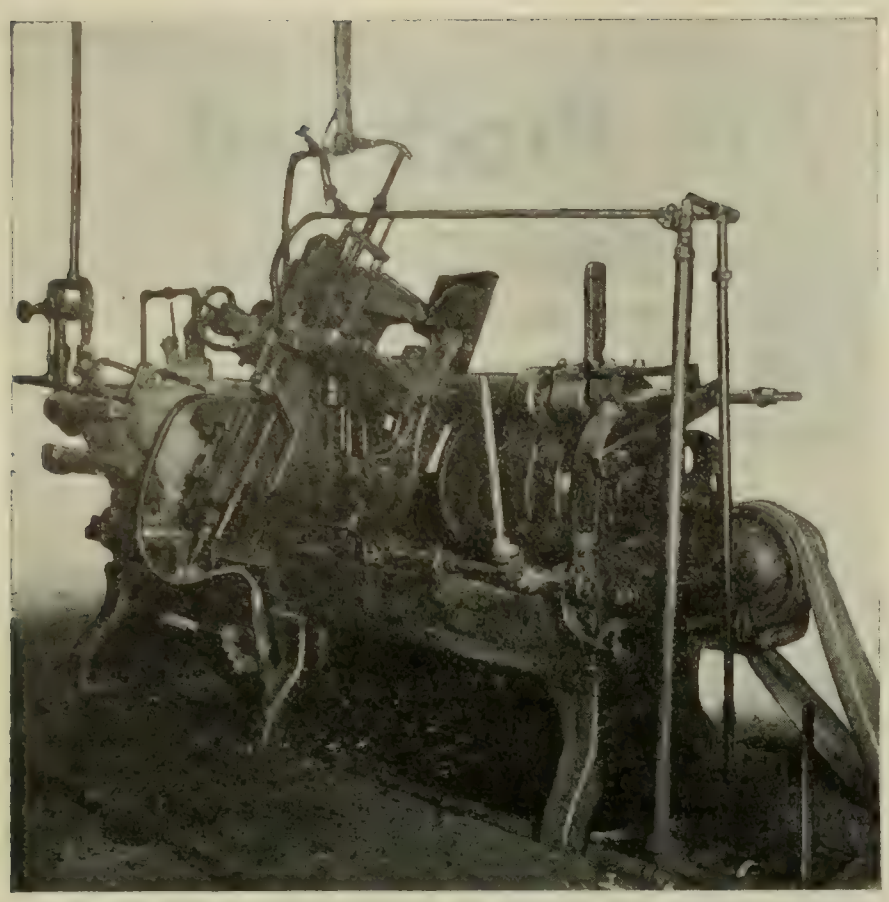
The furnaces used for alloying zinc and tin base alloys are provided with mechanical stirring devices and are arranged to pour directly into metal ingot molds carried on an endless chain conveyor, which, as shown in an accompanying cut, moves slowly over a long table. By the time the molds reach the end of this table the metal has solidified and the ingots are discharged onto trucks. They are stacked and the ends painted a distinctive color to enable proper identification of various alloys and are then delivered either to the diecasting machines or to temporary storage.

Largely because of the higher temperatures required to melt aluminum alloys, these are not cast into ingots, but are delivered direct in molten form in ladles to the diecasting machines. Separate furnaces are used for preparing the aluminum base alloys. These are in the same room with the other alloying furnaces, and closer to the diecasting machines in an adjacent room.

Three general types of diecasting machines are employed: a horizontal type used chiefly for the smaller castings made in other than aluminum base alloys, a ver-



Alloying room in Stewart Mfg. Corp. plant, showing chain conveyor carrying the molds in which ingots are cast



Horizontal type of diecasting machine used chiefly for the smaller white brass and lead and tin base alloys

tical type used for larger castings of the same character, and an aluminum machine used entirely for aluminum-base castings. The three types operate on the same general principle, but are quite different in appearance as will be noted by reference to the cuts. All types have the following essential parts: two members for carrying the two halves of the die, so arranged that the dies can be held closed under considerable pressure during the casting operation and then quickly opened to eject the casting, two core-carriers, usually arranged to move at right angles to the direction of motion of the dies, and a metal pot arranged to be moved up to the die, or the die up to it. Each type has somewhat differently arranged means for controlling the motion of the various parts.

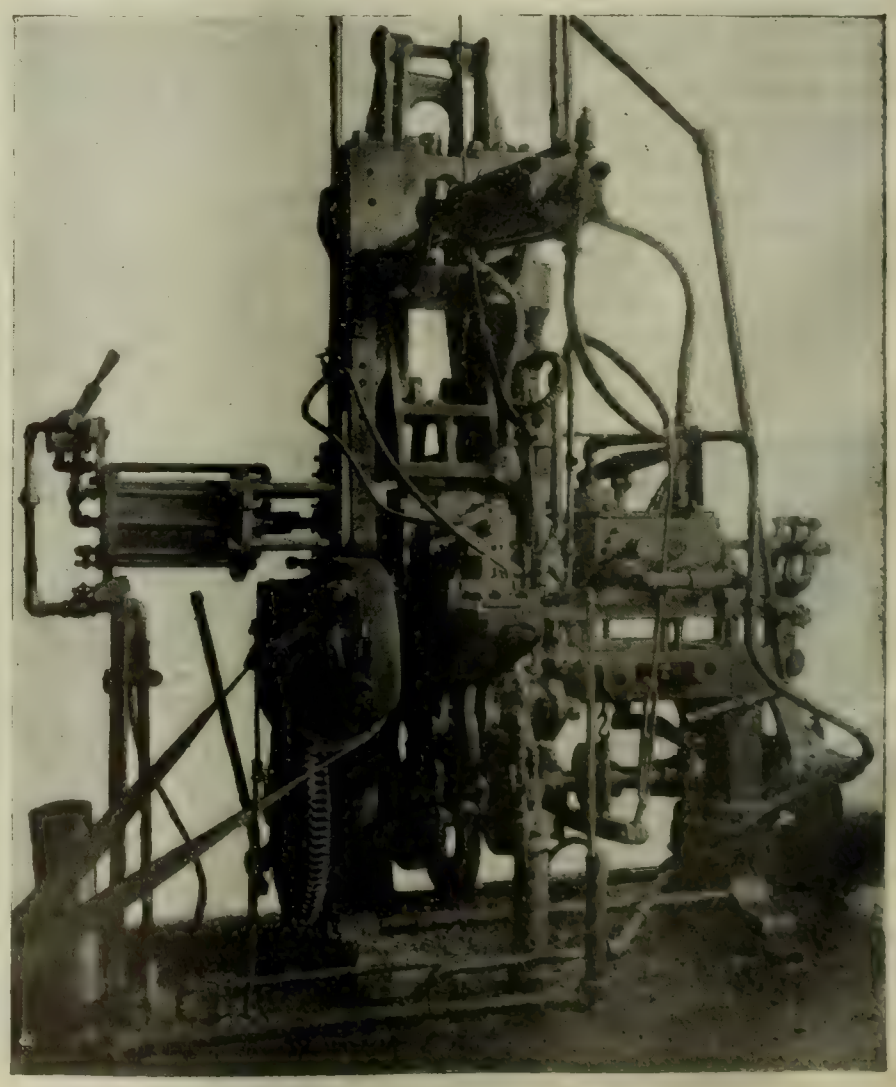
The largest and latest type of machine for other than aluminum alloys is pictured in one of the photographs and the essential elements are shown diagrammatically in Fig. 1. In this machine the lower half B of the die is stationary and is rigidly attached to the frame A of the machine. The upper half C of the die is attached to the sliding head E which is actuated in suitable guides in the frame by the toggle linkage F and piston of the air cylinder D. When the dies close (they are held together under very heavy pressure) the cores G and H move transversely on the carriages I and J, and assume their proper position in the die. At the same time the metal pot K is moved transversely into such position that nozzle L registers with the gate in the die parting and presses tight against the die. The valve M is then opened, a sufficient length of time is given to allow enough molten metal (contained in metal pot K) for a single casting to enter the chamber N. Valve M is then closed and air under about 300 lbs. per sq. in. pressure is applied to the opening O. This forces the metal in N out through the nozzle L and into the die under high pressure. The die is vented to permit the air contained in it to escape so that the metal entirely fills the open space in the die. The die is watercooled and consequently the metal freezes almost instantly. The machine is then reversed, the metal pot moved back, the cores moved outward, and the dies opened. Into the latter are fitted ejector pins which conform to the shape of the die when the latter is closed but which automatically move inward as the die opens and force the casting free from the die after which it is removed by hand. The dies are occasionally lubricated to prevent the metal from sticking. The first casting made after lubrication is usually imperfect and is therefore rejected. In some machines a pneumatic vibratory hammer is used to actuate the ejector pins.

The dies must, of course, separate a sufficient distance to clear the casting and permit of its removal. The type of machine described above is given a rather long stroke for this reason and is used for the deep castings. It will of course be understood that the metal pot must be kept sufficiently hot to keep the metal in the fluid state and at such temperature as to make the best casting. A pyrometer is therefore used in the metal and a gas fire is so regulated as to maintain the desired temperature, and at the same time melt new metal as it is added. The fire keeps the whole metal pot, including the nozzle, hot so that the metal will not freeze and fill the passages through which it enters the chamber N.

It will be noted that the position of the core carriages I and J and the metal pot K is controlled by levers. The position of the latter is in turn controlled by cams (some of which are not shown) while the dies are opened and closed by pneumatic means. The cams are attached to a shaft or shafts which are in turn driven by belts from shafting under the floor. In most cases the entire machine is operated by one man, but in some of the older types of aluminum machines two men are required.

The horizontal type of machine shown in one of the photographs differs but little in principle from the vertical machine. The two halves of the die are, however, cam-operated on slides inclined about 30 deg. from the vertical position. It will be noted in the photograph that the upper half of the die is connected to a bell crank the near end of which is guided by a pin operating in a slotted cam. Cores carried by cross slides can also be employed in this machine, which is often used for die casting bearings.

In case it is desirable to have the metal in the casting



Large vertical type of diecasting machine used primarily for making large white brass castings

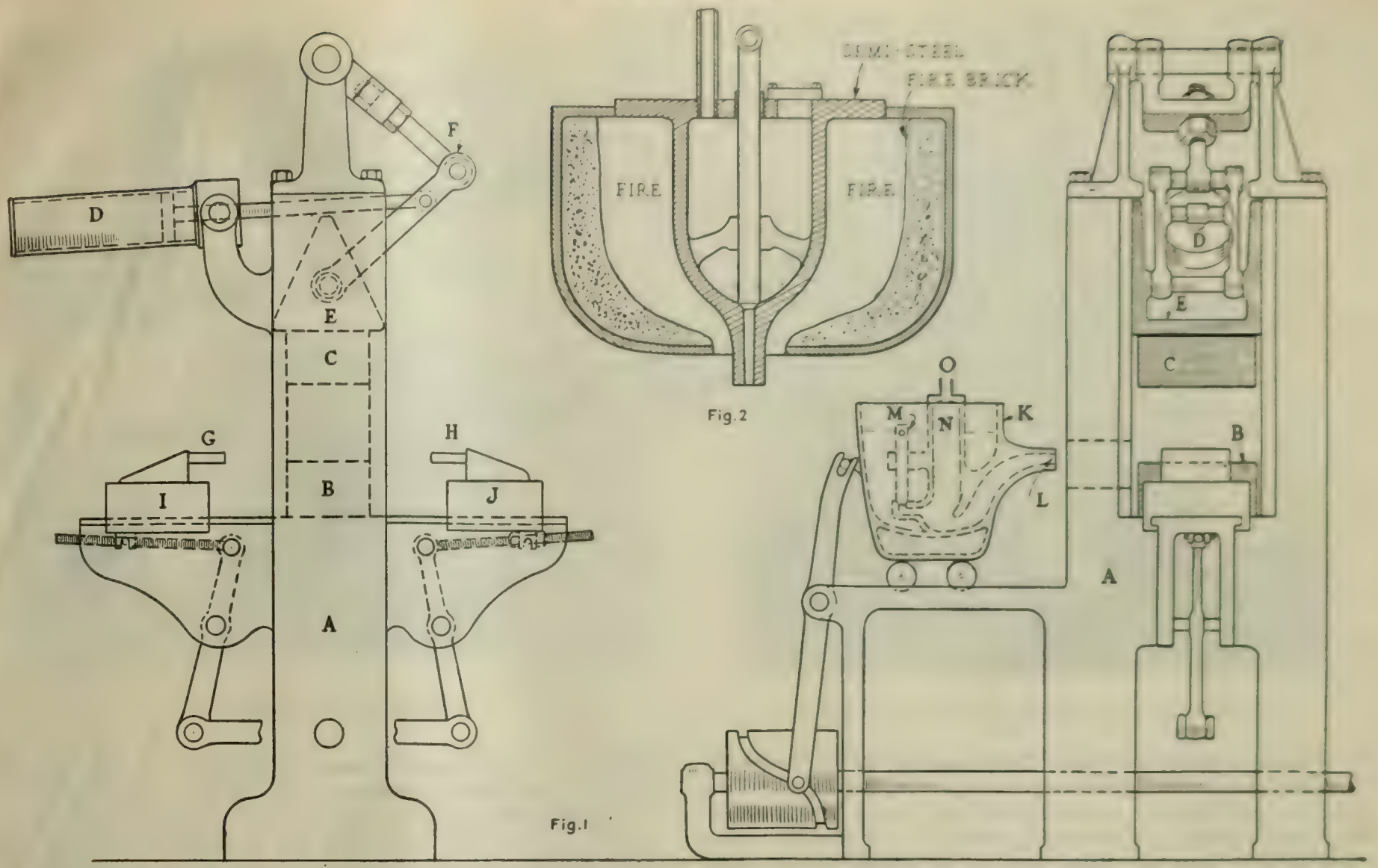


Fig. 1—Diagrammatic sketch of the vertical type of diecasting machine. Fig. 2—Diagram showing type of closed metal pot used on the machines for diecasting aluminum

extremely dense as in the case of a bearing, the pressure on the metal entering the bearing is increased. In this case a piston is employed in the metal cylinder within the metal pot, and this piston is actuated by a second piston of larger diameter on which air pressure is applied. A pressure of about 1,000 to 1,500 lbs. per sq. in. is used in casting bearings.

Casting Aluminum Alloys

The machine for casting aluminum alloys, as shown in the photograph (page 24), is quite different in appearance to the other machines shown but is substantially identical in principle. The halves of the die are pneumatically operated in this case, but instead of moving the metal pot up to a stationary die, the entire head of the machine containing both the die and its operating mechanism, is moved up to a stationary metal pot. The metal pot on this machine is closed and sealed and has but a single chamber, which contains the molten aluminum at a temperature of about 1150 deg. Fahr. A diagrammatic sketch of the metal pot used for the aluminum machine is shown in Fig. 2. It will be noted that the valve is centrally located and seats directly in the outlet of the casting. An air pressure of 300 lbs. is maintained on top of the molten metal, but the latter can flow out only when the valve is open. The walls of the metal pot are surrounded by a fire box lined with fire brick. By keeping the aluminum in a closed container oxidation is reduced to a minimum. The metal pot is filled with molten aluminum by removing the covered plate which is bolted in place.

It sometimes happens that metal intended to be discharged into the die escapes through an opening between the joint made by the nozzle of the metal pot or the die. Since it is under high pressure it may fly in almost any direction, and cause serious injury. Screens are therefore employed to shield operators of adjacent machines and the operating levers are so placed that the operator will be out of range.

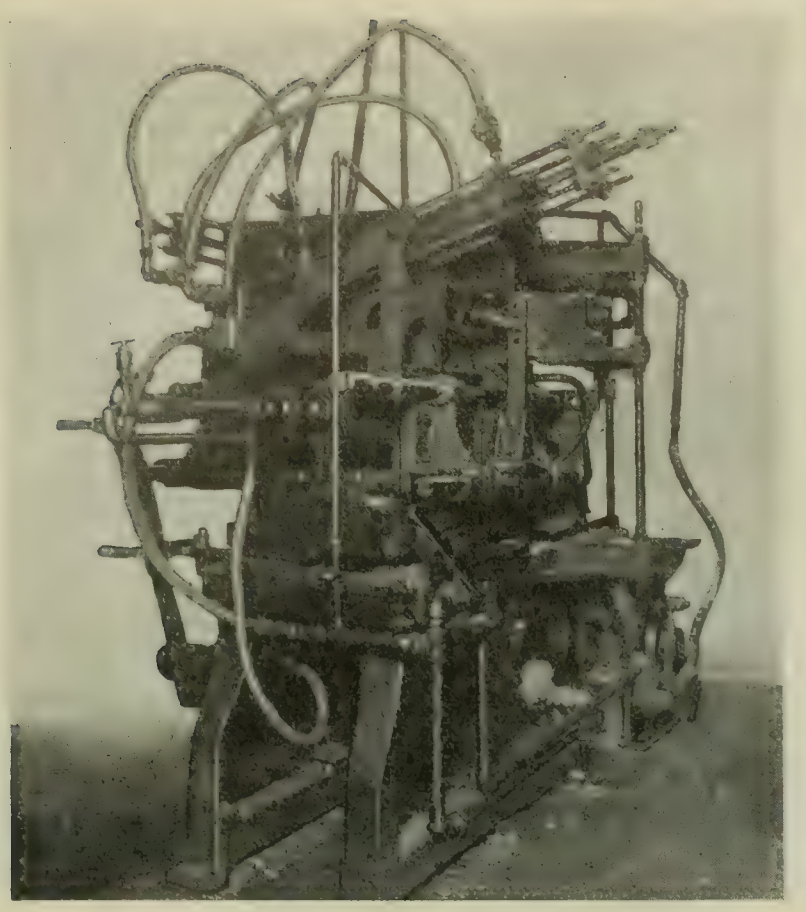
How Dies Are Constructed

A good idea as to the type of die construction employed is given by one of the photographs showing the two halves of a die used in casting the body of a carbureter. It will be noted that there are two large diameter cores operating in a plane parallel to the face between the two halves of the die. A third movable core containing two pins for making holes in the casting is operated in the same plane as the other two but at right angles to them by means of the slotted plate and linkage shown. Opposite to the last mentioned core is the gate through which the molten metal enters the die when it is closed. One of the castings made with this die is shown between the two halves of the die. The piping shown is for conducting water to and from the jacket of the die.

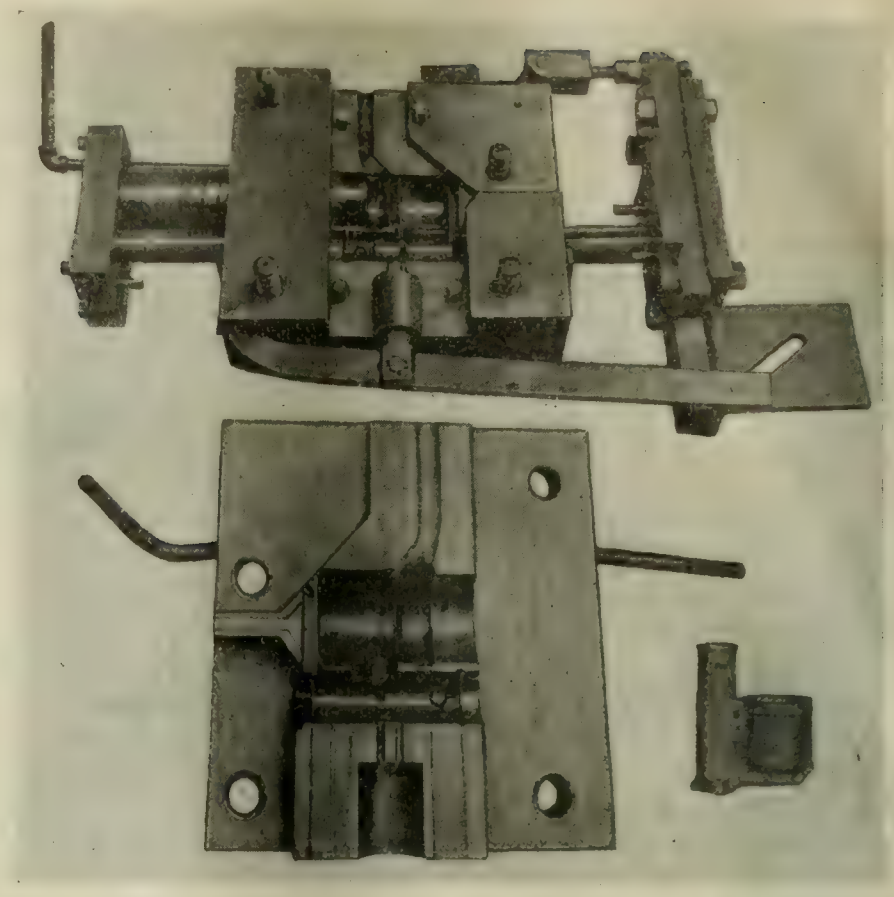
In some dies employed the projected area subjected to a pressure of 300 lbs. per sq. in. is in excess of 70 sq. in. This means that the total pressure tending to separate the two halves of the die is in some cases in excess of 10 tons. For this reason the dies must be held securely in the machine, especially since any springing will not only allow the metal to issue from the die, but will change the dimensions of the casting. This is one reason for employing the heavy type of machine used.

Inspecting and Finishing Castings

From the casting machines the castings are taken to a first inspection department where they are gaged and inspected for cracks or porosity. Some castings are here purposely broken with a hammer to determine first whether any weaknesses due to hidden flaws have developed and second to enable the inspector by observing the character of the fracture to determine whether any weaknesses exist.



Machine used for making aluminum diecastings



Photograph of die used for casting the entire body portion of a carbureter

If defects are discovered in several castings it is usually possible to determine the cause and correct it at the casting machine before any considerable portion of the product has been ruined. In this department any individual castings which have not filled out or are defective in other ways are thrown out.

In the first inspection department it is not necessary to break any of the aluminum castings since any flaws which may exist in these are large enough to be seen readily by the inspector.

Castings which pass the first inspection go to the cleaning stock room from which they are issued to workmen who operate the various types of cleaning tools employed. In these operations fins and runners are removed together with any die marks which may remain. In some cases the piece is simply pressed through a finishing die which removes fins and runner, but in some cases a lathe operation, a slotting machine or a band saw is used to good advantage. In one portion of the cleaning department a number of grinding and buffing wheels are employed.

From the cleaning rooms the castings go to a final inspection department where they are finally gaged or given in some cases simply a visual examination. The castings are then sent to the packing room where they are counted by hand and boxed for shipment.

Laboratory Checks

A laboratory in which many chemical and physical tests are conducted is in charge of a metallurgist. It makes not only routine tests on sample castings, alloys and metals used in making the castings, but conducts research work and issues to the factory instruction regarding the alloy to be used and the temperature in which it is to be cast. It is quite largely through the efforts of this department that it has become possible to make many castings which heretofore were considered impracticable. Die materials have also been investigated and many improvements in die materials have resulted. The selection of a proper steel and the correct heat treatment is of course most important. The life of the dies has in some cases been increased from 10,000 castings to 100,000 or more. By so designing the die that parts which wear can be easily renewed it is possible to make dies which will last almost indefinitely. Chrome vanadium steels have been found to resist heat and wear and make excellent material for many dies.

The zinc base alloys called white brass are extensively used in die casting work and are among the cheapest in cost. These alloys contain as a rule from 84 to 92 per cent zinc, 2.5 to 4 per cent copper, 5.5 to 12 per cent tin and 0.3 per cent aluminum. One standard alloy much used by the Stewart Mfg. Co. contains 91.4 per cent zinc, 2.6 per cent copper, 5.7 per cent tin, 0.3 per cent aluminum.

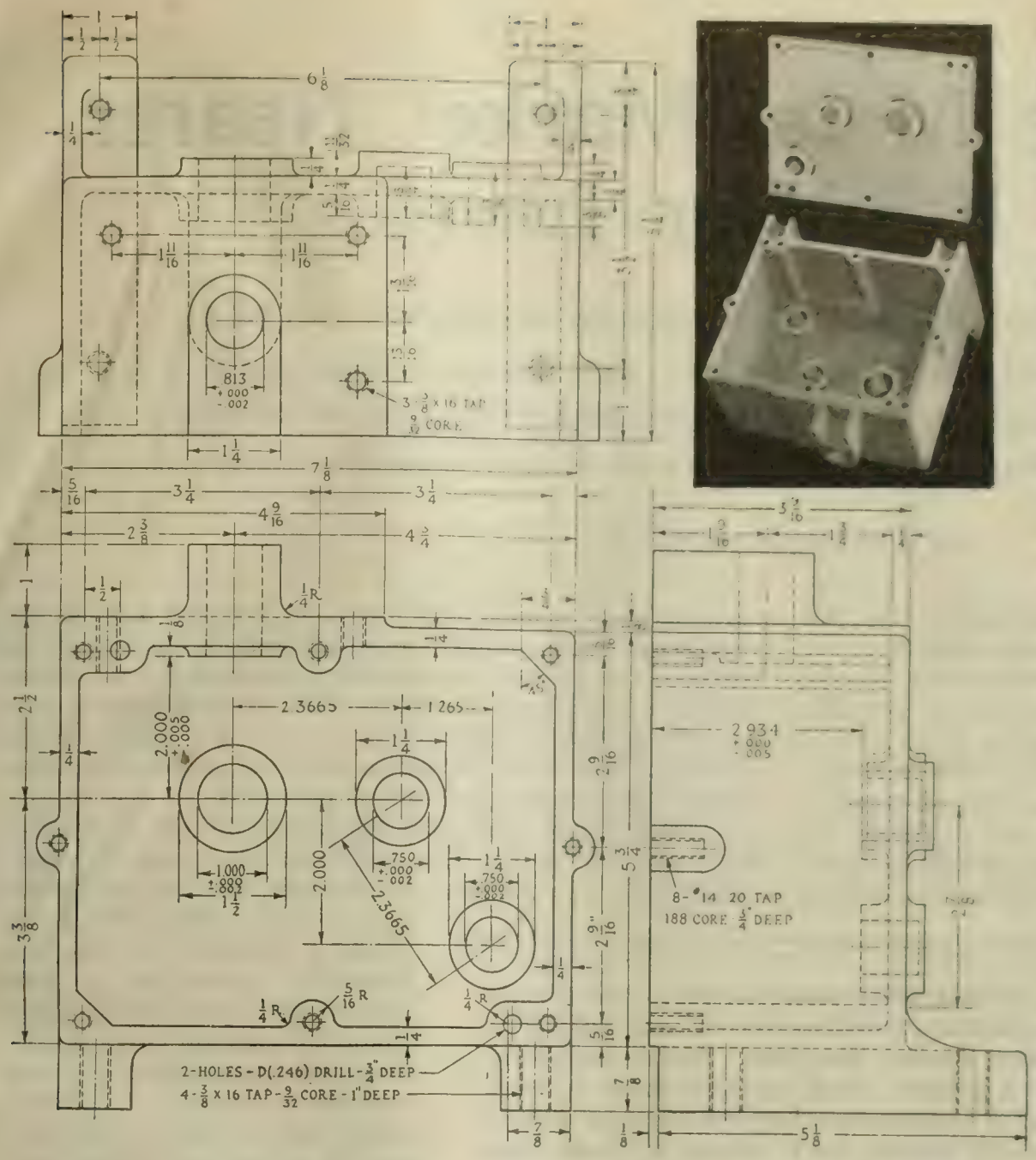
The physical properties of zinc base alloys vary considerably with the section of the casting and temperature at which it is made, as well as with the chemical composition. In general the tensile strength of these alloys runs from 20,000 to 24,000 lbs. per sq. in. They have but slight elongation and are comparatively brittle. The brittleness increases with the age of casting. The scleroscope hardness varies from 16 to 22. The zinc base alloys are not affected by gasoline, but corrode to some extent when exposed to the weather, and especially to moisture. Corrosion is lessened by polishing, and can of course be prevented entirely by nickel plating or lacquering.

Tin and lead base alloys are used chiefly for bearings or in places where ability to resist corrosion is more important than strength. They are usually made in accordance with S.A.E. standard specifications which call for the composition given herewith but can, of course, be made to other specifications when desired.

No. 12 Babbitt	Per cent
Antimony	9.50 to 11.50
Copper	2.25 to 3.75
Lead	24.00 to 26.00
Iron (max.)	0.08
Bismuth (max.)	0.08
Zinc	None
Aluminum	None
Tin	Remainder

No. 11 Hard Babbitt	Per cent
Tin	86.00 to 89.00
Copper	5.00 to 6.50
Antimony	6.00 to 7.50
Lead (max.)	0.35
Iron (max.)	0.08
Arsenic (max.)	0.10
Bismuth (max.)	0.08
Zinc	None
Aluminum	None

The tensile strength of tin and lead base alloys is in the neighborhood of 12,000 lbs per sq. in. but is usually unimportant. Some of these castings are fairly malleable and some much more brittle. Scleroscope hardness varies from 7 to 18 depending largely upon the antimony and copper content. Lead and tin base alloys are usually more



Photograph and drawing of an eleven-pound diecast gearbox, one of the heaviest diecastings made to date. The drawing gives a good idea of the type of construction and the limits which it is possible to maintain

expensive than a zinc base especially when the tin content is high.

The aluminum base alloys usually referred to simply as aluminum are made with a number of different compositions, but the No. 12 alloy which contains 92 per cent aluminum and 8 per cent copper is the standard alloy which is most used. It has a tensile strength of 22,000 to 24,000 lbs. per sq. in., 2½ to 3 per cent elongation. The elongation increases and the strength slightly decreases when the copper content is lowered. This alloy stands shock well, that is it is not brittle if the copper is kept below 12 per cent. The scleroscope hardness varies from 16 to 22. The usual aluminum alloys are medium in price, and are used extensively by the Stewart Co. for casting curtain light frames. They stand weathering well, that is, are not easily corroded, unless exposed to alkalies or salt solutions.

A great many other alloys can be used to advantage for special purposes, but the alloys referred to are those used in a large percentage of cases.

In connection with the design of parts to be die cast the following points should be borne in mind:

1. Avoid undercuts on inside surfaces so far as possible.

2. Allow, in the case of aluminum, for a draft of 0.005 in. per in. of length and diameter on cores. On white brass cores allow a draft of 0.002 to 0.003 in. per in.

3. Uniformity in section tends to prevent cracking. When thick and thin sections are necessary the transition from one to the other should be as gradual as possible.

4. Allow fillets whenever possible. Even a very slight fillet is better than none at all.

5. The minimum thickness of section practicable varies considerably with the area of the section. One-sixteenth in. is usually the practical minimum in the case of aluminum and 1/32 in. in white brass, but thinner sections have been cast in some cases.

6. The minimum size of hole which it is practicable to cast in aluminum is about 1-16 in. when the hole is not more than ¼ in. deep or 3-32 in. for hole ½ in. deep. In the case of white brass a 1-16 in. hole is practicable if the length does not exceed ½ in., while a 3/32 in. hole of almost any length can be cast readily.

7. The use of knife edges should be avoided.

8. In the case of aluminum some dimensions can be held to ± 0.0015 in. On thickness the limits are usually about ± 0.0015 in. The corresponding tolerances for white brass are ± 0.0005 and ± 0.001 in. Both internal and external threads can be cast, but for close work these must usually be chased. In the case of a female tread the core is withdrawn by unscrewing.

Inserts can often be used to advantage. Their surface should be groved, knurled or roughened in case it is desired to anchor them permanently in the casting. Iron, bronze, graphite and other inserts have been successfully used. Bushings can be die-cast in place or pressed in after the casting is completed, but in some cases a bearing directly in the metal without bushing is employed.

Frame Standardization Under Way

REPRESENTATIVES of passenger car frame manufacturers recently got together and determined to undertake the standardization of passenger car frames, as it is felt that such standardization would be of material assistance to passenger car designers and to frame manufacturers. Information in reference to present frame practice is to be obtained as a basis for the standardization involved, a questionnaire requesting this information having been sent out to all passenger car manufacturers.

The standardization of frames will be of special assistance to many frame manufacturers because passenger car manufacturers are often willing to use a frame for which the frame manufacturer has the necessary tool equipment in case the design conforms reasonably well to their requirements. The adoption of definite frame standards will result in an increase in the number of such orders to the mutual advantage of both frame and passenger car manufacturers. This work is being undertaken by the S. A. E. Standards Committee.

Automotive Metal Market Nearer the Pre-War Level

Price reductions that featured the 1921 market can be furthered only by increased production and lower freight rates. Automotive Industries were instrumental many times in keeping the steel market out of the rut of idleness. Review shows that future conditions will depend upon the buyers.

By Wm. Crawford Hirsch*

THE year 1921 was a necessary evil. This is the verdict which reflects the majority sentiment of buyers, as well as sellers, of automotive steels, pig iron and non-ferrous metals. The former are disappointed because the year failed to bring forth downward revisions to the extent of restoring pre-war levels, which at the outset of 1921 was the dream of many a keen purchasing agent. The sellers are shedding no tears at the passing of a year in which periods of utter stagnation of demand recurred all too frequently; a year in which freight rates and taxes, from the oppressive burden of which relief had been promised time and again, remained at practically war levels.

And yet much was accomplished in 1921. That the expectations of neither producers nor consumers were fulfilled merely emphasizes the fact that 1921 was a link in the chain of readjustment which is by no means completed. Last year's record of the iron, steel and non-ferrous metal markets, however, furnishes ample proof that 1921 was a much stronger link in this chain than was 1920, and that readjustment gained such headway as to bring within sight the end of the period of subnormal activity and the dawn of that phase of the cycle in which re-establishment of the equilibrium between demand and supply will bring about natural stability of values. Conceding, therefore, that 1921 was a necessary evil, it was so rather in the sense of a thunder shower that clears the atmosphere than of a havoc-wreaking upheaval in the ferrous and non-ferrous metal markets.

The year opened on a pig iron market in which values still suffered to a great extent from the adipose of war prices, No. 2 foundry being quoted at $32, which, although low when compared with the $50 price at which sales had been made four months previously, was, nevertheless, looked upon with more or less suspicion by consumers. Automotive foundries were all the more reluctant to commit themselves for any representative tonnages at quoted prices, as it was an open secret in the trade that a Michigan automotive interest, owning and operating his own blast furnace, frequently supplied parts makers holding contracts from him with pig iron at considerably lower prices than those quoted in the open market. Amid the distrust of melters and, as the year grew older, under the sledgehammer blows of the falling away of the demand, prices weakened from month to month, until by midsummer blast furnaces would have been delighted to book orders for No. 2 foundry at $20 and less. Scores of furnaces went out of blast in mute protest against the market's vicissitudes.

In September, 1920, 319 furnaces had been pouring forth pig iron at the rate of 100,000 tons a day, buyers falling over one another to secure as much of the output as possible at $45 to $50 a ton. What a different picture the industry presented a year later! Only 69 furnaces had survived and, of their output of 30,000 tons a day, the bulk had to be stored in furnace yards until buyers would consent to come forth from their hiding place.

AUTOMOTIVE manufacturers can greatly further stabilization of markets by a rational buying program. Never has there been a greater need for this than in 1922. Chronic bargain hunting in a pig iron market in which buyers have things to themselves is bound to react to their detriment when the tables are turned.

The weekly market letters of the leading pig iron sellers read like funeral sermons, frequently so lugubrious that they even withheld all hope of the market's resurrection. As is usually the case, when matters looked darkest the turn for the better came. Buyers still proceeded cautiously. They did not order large tonnages. In fact, most of them continued to buy from hand to mouth, but in the aggregate this hand-to-mouth buying yielded orders that enabled those blast furnaces which had continued in operation to cut down their accumulations and to maintain production at a satisfactory rate. In fact, by November pressure on the available supply and the facilities of the furnaces in blast had become such that idle plants began to lay plans for a resumption of productive activity.

The end of the year found the price situation in somewhat plastic shape. Automotive foundries were offered No. 2 foundry at $19.50, Buffalo or Chicago, and malleable at the same price level, Chicago, or $20, valley basis. In other words, pig iron prices at the close of 1921 ruled about 40 per cent lower than at the year's opening. Considering that there has been only a modest reduction in the freight rates on the raw materials which enter into the making of pig iron, a factor that makes up more than one-third of prevailing market levels, the pig iron market's course in 1921 has been truly expressive of the trend toward readjustment. Of paramount influence on a further downward readjustment of prices would be, of course, a drastic pruning down of freight rates in 1922. Next in the importance of its effect on

*Editor Raw Materials.

market conditions will be the attitude of producers and marketers. Demand has not yet assumed such proportions as to bring sellers face to face with the temptation of forcing the market higher by manipulative tactics, such as have often been employed in years gone by, 1921 having formed a notable exception in that respect. Perhaps last year's lessons have not been lost. Pig iron producers may at last have learned that a stable market is preferable to one of such wide fluctuations as those which were noted between September, 1920, and December, 1921.

Automotive foundries can greatly further stabilization of the market by a rational buying program. Never has there been greater need for this than there will be in 1922. Chronic bargain hunting in a pig iron market in which buyers have things to themselves is bound to react to their detriment when the tables are turned. Price stabilization results largely from an equable distribution of the demand over the longest possible period. Although this ideal is not possible of complete attainment in the automotive foundry industry, much can be done to eliminate the frequent spurts of intensive rush demand which invariably furnish an incentive to runaway market conditions. Now, it would seem, is the time when automotive pig iron consumers could profitably ponder this problem, because the market just now is free from artificial conditions and consumers are still its masters instead of its slaves, as they were in the summer and fall of 1920.

How much of the country's steel production was consumed by the automotive industries in 1921 is a question no more to be answered by an estimate of the tonnage it represented than in preceding years. Those who would minimize the importance of the automotive industries in the steel market will always trot out in answer to this problem the hoary opinion that in the manufacture of an annual output of, say, 2,000,000 automotive units, only between 3 and 4 per cent of the country's aggregate output of rolled, finished steel is consumed. This sort of calculation comes within the category of the famed trinity of falsification: "Lies, d—— lies, and statistics." It is utterly unfair to take automotive sheets which sell at $80 to $90 a ton and bunch them with rolled, finished products on the order of plates and beams which sell at $30 a ton. The only half-way fair estimate would be to figure the percentage of gross revenue derived by the steel industry from automotive manufacturers, and, inasmuch as none of the steel producers reports the value of his output, properly segregated as to the industries into which it enters, this is a statistical feat which cannot be accomplished.

Time and again, however, during the last year automotive buying lifted the steel market out of the rut of utter idleness. In fact, the improvement in the demand that began to make itself felt during the end of the third quarter was solely due to the placing of more liberal orders by automotive interests.

There is no gainsaying the fact that of all the steel products none was more frequently in the limelight than were sheets. Even those who make light of the automotive industry's importance as a steel consumer admit that it absorbs more than one-quarter of the country's total sheet production, and there were at least two periods in 1921 when sheet mills were working almost exclusively on orders from the automotive industries. If accurate records were available, it would probably be found that what sustained sheet mill operations in the fall of the year was the support emanating from the automotive industries, which frequently figured to an extent exceeding 50 per cent of all classes of consumers in the sheet market.

It may be put down as an axiom based upon the experience of the last three years that the automotive industries are the bell-wethers of nearly all buying movements in the steel market, especially of those which follow protracted periods of idleness. Curves showing the uptrend of automotive operations are invariably matched by curves showing a like quickening of steel buying, the latter preceding the former by the brief interval necessary to set steel shipments moving from mill to automotive consumers. As a rule, buying by automotive plants acts as an incentive to consumers in other branches of manufacturing to cover their steel requirements.

Moreover, it will be well to bear in mind the inadequacy of the methods used by steel statisticians in computing automotive consumption. They proceed on the basis of the country's passenger car and motor truck output, losing altogether sight of the thousands of tons of steel that go into garage construction, into gasoline and oil containers, pipe, etc., and the many implements and replacement parts the steel entering into which is never credited to the automotive industries. A buying flurry, such as recently took place in tubular goods, is always considered without the slightest reflection as to the share which the automotive industries had in causing it.

STEEL prices are approximately 33 1/3 per cent nearer pre-war levels than they were at the beginning of 1921, and on January 2, 1922, the price was only 25 per cent higher than the ten year pre-war average. The conclusion must be drawn that the year 1921 was a truly remarkable one in the reconstruction of the steel market on a sane and healthy basis.

One of last year's outstanding conditions in the steel market was the frequent change in its leadership. At numerous stages the chief interest assumed a passive attitude when it came to dealing with a drifting market, permitting the independents to set the pace in price reductions as well as advances, and refraining from changes in its official prices until after the situation had sufficiently cleared to reveal the reaction of market changes on consumers. It was, however, an open secret in the trade that during those periods, when independents were disposed to slash prices so as to enhance their rate of operations, the corporation extended the utmost protection to its regular customers and permitted no desirable orders to get away from it.

During the worst of the midsummer slump the steel market had at one time the appearance of thorough demoralization, even some of the larger independents admitting that they were ready to book orders at any price the buyer might name, but adding woefully that there were no buyers at any price. Expectations of a downright price war came to naught, however, as the result of the diplomatic handling of the situation by the steel industry's leaders. There is an entirely false conception abroad that a price war benefits consumers. As a matter of record it may be stated that buying is always at a low ebb while prices go tumbling. A declining steel market resulting from lessened costs of production is one thing, while a market devoid of all semblance of soundness, in which producers cut prices for no other purpose than to injure their competitors, is quite another.

A stable market is, after all, the one most conducive to healthy activity. Downward price adjustments announced by the chief steel interest in tubular goods and

wire products shortly before the year's end were apparently for the purpose of enhanced stability, and liquidation of war prices, while by no means finished, appears at the outset of 1922 to have reached a pass where stability is possible, subject, of course, to such further downward price adjustment as a lowering of freight rates, taxes, overhead and further economies in production costs will make possible.

Let us see now how far the automotive steel market traveled last year along the road to normal conditions. Take, for instance, cold-finished steel bars or screw stock. Late in December this product was quoted at 2 cents base, compared with 3.60 cents at the beginning of the year. In the same period hot-rolled bars (which are the raw material from which screw stock is made) declined from 2.35 cents to 1.50 cents. The decline of $32 a net ton in the price of screw stock denotes, therefore, in addition to the $17 drop in the cost of the raw material, a $15 decline per net ton in conversion cost. Hot-rolled strip steel opened the year at 3.30 cents and cold-rolled at 6.25 cents, Pittsburgh. At the year's close hot-rolled was quoted at 2 cents and cold-rolled at 3.75 cents, the change implying a saving of 40 per cent to the consumer.

The Sheet Market

Of more than passing interest to the automotive industry is the record rolled up by the sheet market during the year. Sheet bars, the semi-finished form of steel from which sheets are rolled, wavered early in January somewhere between $42 and $47 a ton. At the year's close they could be bought at $29. Assuming that in January sheet bars were obtainable at $42 and at the close of the year at $29, there was a decline of 25 per cent.

Let us see now what the course of prices for sheets was. No. 28 black opened the year at 4.35 cents, Pittsburgh, and closed the year at 3 cents, a decline of 31 per cent. No. 10 blue annealed descended from 3.55 cents early in January to 2.25 cents late in December, a recession of approximately 37 per cent. The average decline in sheets for the year may be put down at 35 per cent, as against a decline of only 25 per cent in sheet bars, the difference of 10 per cent representing the proportionately greater reduction in conversion costs than in the cost of the raw material. This would tend to show that the non-integrated sheet mills, most of which cater to the automotive industries, have set their house in better order than have the semi-finished steel producers.

A fair idea of the changes that have come over the alloy steel market may be gained from a brief consideration of the course of values in the nickel, chrome and vanadium markets, the three alloys that enter chiefly into automotive steels. Nominally the price of nickel has not undergone very sharp revision. The quotation early in January was 43 cents and in December 41 cents, taking ingots as a basis. Unfortunately, the outlet for nickel has been considerably curtailed.

Aside from the effect of the general slump in the demand for non-ferrous metals and the heavy offerings of resale nickel-steel, mostly war legacies, the naval disarmament program affected the immediate future of nickel more adversely than that of any other metal. Diminished consuming avenues may, for a time at least, render sharp price reductions impossible. The overhead on the impaired sales quota will be the same as it was when the industry was in its heyday, and it will have to be borne by the curtailed output.

In the course of time nickel will find its way into new uses, and, as consumption increases, there may be a possibility of economies which will come the buyer in good stead. For the time being the market may be expected to continue a nominal affair, with desirable orders, as a rule, coming in for concessions from quoted prices. Late in December there were still weighing on the market a number of resale tonnages of nickel steel, one of these (S.A.E. 2330) being offered at 2 cents, f.o.b. Chicago warehouse, far below the market for very new material.

Ferrochrome, which throughout 1920 sold at 18 and 19 cents for 60 to 70 per cent chromium and 6 to 8 per cent carbon of domestic origin, was offered at the end of 1921 at 14 cents. Imported alloy, containing 6 to 8 per cent carbon, held at the beginning of 1921 at 16 cents, ex store, could be had at the year's close at 10 to 11 cents. Chrome ore, 50 per cent chromic oxide guaranteed, sold at the end of 1921 at 40 to 45 cents a unit, as compared with 55 to 60 cents per unit at the beginning of the year.

Ferrovanadium, 30 to 40 per cent, declined from $7 a pound, obtained at the year's beginning, to $4.25 to $4.75 at its close.

While on the subject of alloy steels, it may not be amiss to record the fact that, from the point of view of metallurgical progress, the year just closed has been a keen disappointment. If there was one hope which automotive steel consumers had a right to entertain, as the result of the sacrifices they made during the war, it was that the impetus which the great conflict had given to the development of alloy steels would lead to uninterrupted research and progress along the line of developing steels that would steadily diminish in weight and increase in tensile strength and in their ability to withstand shocks and stresses. The alloy steel industry has passed through a trying year, and the heavy draft made on the ingenuity of producers to overcome the difficulties of financing their enterprises and keeping them afloat apparently sapped their strength, leaving them little zest for expensive research work in their laboratories. In this respect 1922 should bring a decided change. After all, the automotive industries want better rather than cheaper steel.

There is a gratifying sentiment in evidence in the steel industry that 1922 will exact from every man engaged in it the very best that is in him. The metallurgical laboratory should be the first department of the mill for translating this worthy resolution into still more worthy action.

Nearer the Pre-War Price Level

To return to consideration of the year's price record in the steel market, there are bound to be those who, as they behold the year's closing levels, will declare that we are still far from their ideal of pre-war values. This argument may be answered by stating that we are approximately 33 1/3 per cent nearer to pre-war steel levels than we were at the beginning of 1921, and that price levels obtaining on Jan. 2, 1922, were approximately only 25 per cent higher than their 10-year pre-war average. When one bears in mind that, as the result of savings in freight, taxes and the general cost of doing business, further reductions are not precluded and, moreover, that there are still scores of basic commodities which rule in price considerably higher than 25 per cent above their 10-year pre-war level, the conclusion must be reached that 1921 has been truly a remarkable year in the reconstruction of the steel market on a sane and healthy basis.

At the beginning of last year tremendous tonnages of non-ferrous metal scrap resulting from the manufacture of munitions remained to be absorbed. In fact, ever since the signing of the armistice, which was followed shortly afterward by publication of an inventory of

surplus metal and scrap held by the Government, there has been coming into the market at periodical intervals tonnages of non-ferrous scrap which somehow or other had eluded the eyes of those who were supposed to have made a complete inventory of the supply. These surprises are not yet over, and at the beginning of 1922 the Government is arranging further sales of such scrap material.

In addition to the domestic scrap accumulations, the American market had to absorb part of Great Britain's war scrap, although most of this material is supposed to have been shipped here solely for the purpose of refining. With this millstone hanging around their neck, in addition to the long-continued absence of domestic consuming demand for virgin metals of all kinds resulting from the general business slump during midsummer, American producers, with the possible exception of lead refiners, had a hard road to hoe last year.

The large copper producers took the bull by the horn and early in the year decided on a shutdown of their mines and many of their smelters. The aluminum industry also practically suspended production for a time, European competition flooding the American market with heavy tonnages of aluminum at the first sign of a slight recovery in the demand.

Zinc producers recognized early in the year that their sole salvation would lie in a curtailment of output and cooperation to the end of preventing selling pressure. Tin prices declined to record-breaking low levels as the result of the glut of supplies in the East and demoralized exchange conditions. With the sole exception of aluminum, however, all of the metals recovered during the closing months of the year and, having safely weathered the worst year in the non-ferrous metal markets, producers have mapped out a program of gradual resumption of mining activities and smelting operations in 1922.

Aluminum.—Although the sole domestic producer's quotation at the end of January, 1921, stood blithely at 28c. for virgin ingots, 98 to 99 per cent, it was manifest from the year's outset that the American producer's official quotation was a strictly nominal affair. In fact, the price schedule of the Aluminum Company of America was quoted from the beginning of the year subject to revision according to daily conditions. On Feb. 7 the company's quotation was reported to be 28.20c., an advance of 1/5c., the reflection of a temporary rise in the "outside" market fed from the year's start on imported metal which was offered 3c. below the American producer's quotation and, when sellers could not realize 25c. they pruned their price down to 24c. This paring of prices by sellers of foreign aluminum continued to be a progressive affair becoming the more pronounced as the decline in demand made itself felt. Fraction by fraction prices were hammered down by the flood of German, French and other European metal that poured into the United States until 17c. was considered a good price and sales at below this level were reported. Meanwhile the domestic producer had reduced his quotation to 24.50c. and late in November, after it had been definitely understood that the American interest was no longer permitting foreign competitors to get away with desirable business, the official schedule was revised downward to 19c. for 98 to 99 per cent pure virgin ingots. The quotation for sheets was put at 35c. for 18 gage and heavier flats and at 30c. for coils, while No. 12 alloy (aluminum-copper) was quoted at the same price as virgin ingots, 98 to 99 per cent pure. These quotations, however, continued their nominal character as imported metal was offered up to the end of the year to 1 to 2c. lower, according to country of origin.

Aluminum prices closed the year at not far from one-half of what they were during the war and one-third lower than they stood at the year's beginning. At the close of the year there seemed to be somewhat of a slowing up in the enthusiasm with which the Germans had for many months dumped aluminum onto the American market. Not that they had lost their eagerness to continue as factors in the American aluminum market but they seemed to recognize the folly of slashing prices merely for the sake of slashing them. A policy of permitting the American producer and those of other countries to set the pace and then to cut just sufficiently under their quotations to permit of the sale of what tonnages happen to be available for export to the United States, seems to have been adopted by the German aluminum exporters during the closing months of last year.

FURTHER reductions in steel prices can be brought about in but two ways; a material decrease in freight rates and an increase in production. Increased steel consumption in 1922, therefore, portends lower prices. This increase, however, should be spread out over as long a period of time as possible, as sudden increases would have a demoralizing effect.

After all, the aluminum market's future is wrapped up in whatever tariff legislation is enacted in 1922. The Fordney bill provided a 5c. per lb. duty on ingots and alloys and 9c. per lb. on plates, sheets, bars, rods, circles, disks, blanks, strips, rectangles and squares. The existing rates of duty are 2c. and 3½c., respectively. Whatever tariff law is finally adopted, the rate of duty on aluminum may be expected to be somewhere between the existing one and that proposed in the Fordney bill. If it is wisely adjusted it will prevent dumping, which would be disastrous to the American industry, and at the same time afford to American consumers, among which the automotive industry is the most prominent, the benefit of a continuance of healthy competition by the foreign producers in the American market.

Copper.—It was a decidedly sick condition in which the copper market found itself at the beginning of 1921. What little artificial support had been extended to it in the preceding year vanished over night and the quotation noted in January for electrolytic, 12.85c., failed to express adequately the disheartening position of the red metal, save when compared with the opening price of the preceding year, which was 19c. Domestic demand was negligible from the very beginning of the year, brass rolling mills and foundries being loaded down with surplus accumulations of both primary and second metal. Exports were difficult to finance until the Copper Export Association succeeded in hypothecating 400,000,000 lb., obtaining thereon (its notes being part of the collateral), a loan of $40,000,000 from a syndicate headed by the National City Company and Guaranty Company.

But the securing of this loan failed to help matters materially. Domestic demand kept going from bad to worse and England was not in the least interested in offerings while business with Germany, hungry as that country was for copper, became more and more difficult as the result of the falling mark. In March 18 large and small producers decided to shut down all operations at mines and smelting plants and curtailment of the output began in April, by which time the market for electrolytic had declined to 12.50c. After a short-lived and very modest recovery, the business depression of

August caused the market to break to the lowest level since 1914, electrolytic being offered at close to 11.50c. The turning point had now come and improvement went on apace until 13c. was chalked up early in November, the market being subsequently lifted to very close to 14c., which price level was actually the producers' end-of-the-year quotation for deferred deliveries.

At the beginning of the year it was estimated that there were 1,000,000,000 lb. of undigested copper in the United States. This "billion-pound copper surplus" has been worked down during the year to approximately 600,000,000 lb., of which 300,000,000 lb. are held by the Copper Export Association. About one-half of the 300,000,000 lb. which remain to be absorbed in the home market is available in the refined state, the other half being blister copper awaiting treatment.

When the copper market's firmament looked gloomiest the industry busied itself with plans for broadening copper consumption by promoting the use of the metal in many different products heretofore made of other metals. There were reports that the New Cornelia Copper Co. of Ajo, Arizona, was working on the direct production of automotive radiators and gaskets from the electrolytic copper solution. Other producers carried on experiments with a view to producing other automotive parts from copper sulphate solutions, but all of these are either still in an embryonic stage or else have been abandoned.

The fact of the matter is that when the copper market was prostrate on its back many in the industry turned in their despair to countless projects, some practical and others utterly visionary, all, however, centering in the aim to force an increase in the consumption of copper.

Among the large producers, the sentiment that the time had arrived when they must have more close control over their product in its progress from the mine into the finished copper or brass product crystallized into action in at least one noteworthy instance, the Anaconda Copper Mining Co. having announced in December its intention of absorbing the American Brass Co. If the final financial preliminaries to this merger succeed, the world's largest copper producer will also be the world's largest producer of finished copper and brass products, a transformation in metal market conditions which deeply concerns the automotive industry, this all the more so as late in the year rumors of further mergers between Connecticut valley brass interests and other copper producers were in circulation. Combinations of this kind can be made of the greatest economic benefit to the consumer. A plant which is self-contained in its supply of raw material can always work to greater advantage than one dependent upon the vagaries of the open market. It is quite possible that the change which is now coming over the copper industry, making of it, as the steel industry is to-day, a producer of finished material instead of merely the purveyor of raw material, will eventually lead to the greater use of brass and copper parts in the automotive industries. Certain it is that, once these powerful interests get their full stride as sellers of finished copper and brass products, which may take a few years, they will permit nothing to stand in the way of developing the consumption of their products in automotive construction. Automotive consumption of copper and brass in 1921 made up a far greater percentage of the industry's total output than in former years. This was, perhaps, not so much due to greater requirements by automotive consumers as to the diminished needs of many other copper and brass consuming industries which were practically absent from the market throughout the year.

Tin.—The Straits tin market ruled at around 38c. during the first month of the year and by March had declined to 27.50c. Following a short-lived upward spurt, the market declined gradually until in September Straits tin could be bought at 25.50c., the lowest price level recorded in a score of years. This was followed by a gradual recovery in values due in part to the metal's improved statistical position and speculative support in London and Singapore and in part to the improvement in the market for sterling exchange. When the pound sterling crossed $4, the rise in tin prices became accentuated and the year's last week found the market fluctuating between 33c. and 33¼c. The market was jumpy throughout the year as the result of the frequent seesaw course of the exchange market. At the close of the year the tin market showed the same evidences of having left the worst behind as did the copper market. In spite of the fact, however, that most of the professional tin traders are bullish in their sentiments, consumers are proceeding with caution which is always becoming in so highly speculative a market as that for this metal.

Lead.—No metal displayed greater price steadiness in 1921 than did lead. Opening the year at 4.87½c., East St. Louis, the metal never went below 4c., closing the year at 4.40c. Storage battery manufacturers were consistent buyers throughout the year, but the real prosperity which lead frequently enjoyed while other metals were in the doldrums was due to the demand from pigment makers. At the end of the year output and consumption appear to balance nicely.

Antimony.—For the greater part of the year the antimony market was lifeless. The price for Chinese metal, duty paid, declined from 5.25c. in January to 4.45c. in September, 4.50c. being the year's closing quotation.

The Outlook for 1922

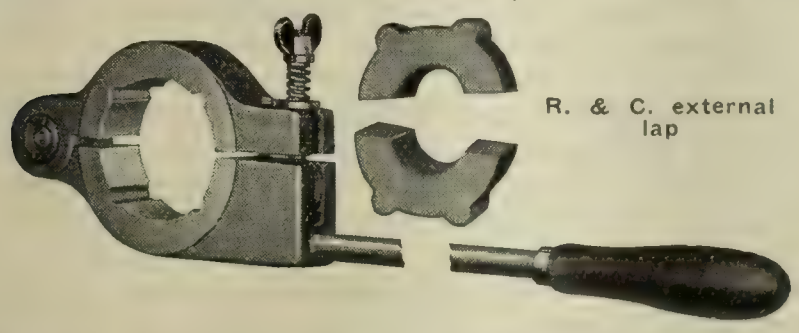
Market prophecies are not only useless but impossible. It is permissible, however, to point out certain guide posts that may help in the framing of a correct buying policy. Both in the steel and copper industries the trend is toward further consolidations for the purpose of more economic production. The question uppermost in the consumer's mind, especially with reference to the various mergers in the steel industry, that were the subject of more or less trustworthy reports in the closing weeks of last year, is whether their consummation would result in a lessening of competition in the steel market. Confining consideration of this problem solely to its effect upon market conditions in 1922, all indications point to healthy competition regardless of whether these mergers materialize or not. The success of whatever consolidations there are will be measured by the increase in the business done by them over what was the aggregate amount of business done by the individual constituent companies before they were unified. To accomplish such increases in sales will necessitate the contesting on every foot of ground with the competition. This activity may not find expression in a wide disparity between quotations of the competing interests, but it will nevertheless exert an indelible influence upon the formation of market values. A market may be competitive and yet far from ragged. The all important benefit accruing to the buyer from competitive conditions is their acting as a preventative against unwarranted advances when demand turns brisk.

The last few years brought in quick succession steel markets in which buyers, especially those in the automotive industries, drove prices up on themselves by bidding against one another, followed by a "buyers' strike" in which consumers spontaneously turned their

backs on the market. The buyer's true interest in 1922 lies in quite a different direction. The steel industry has reached a point where, save for a reduction in freight rates, it can cut prevailing market levels perceptibly on one condition only—a marked increase in operations. If the rate of operations can be enlarged so as to approach capacity more nearly than it did in 1921, numerous economies can be effected and the pro rata share of overhead per ton of finished steel will be proportionately lowered. It is the consumer who has it in his power to make possible this condition. Increased steel consumption in 1922, therefore, portends lower prices. Of course, if this enlargement in the demand should materialize by fits and starts, there is danger of its creating the impression that it exceeds capacity production with the result that prices would temporarily reflect this situation. If the increased demand, however, is spread as much as possible over the entire year, thereby enabling the mills to operate at a fairly satisfactory rate all the year around, the effect on market values will assuredly be in the buyers' favor. The astute steel buyer will constantly bear in mind that every increase of mill operations from their present fractional rate to capacity lowers production costs and if the trend of values does not reflect this condition it is either due to abnormally large shipments being exacted in any one month, causing producers to fear that the rate of operations will decline perceptibly following the satisfying of this demand, or else that artificial influences are at work. At the outset of the new year it looks as though there would be less danger of the latter condition in 1922 than in years gone by.

Lapping Outfits for Cylinder Bores and Crankshaft Bearings

THE call for precision work in quantity production during the recent war was responsible for important strides in manufacturing processes. Particularly did it bring to the front the lapping process, which for years had been used in finishing precision gages. In a few instances lapping had been used for finishing the working surfaces of internal combustion engines, but most people



R. & C. external lap

regarded it as impractical for this purpose, because of the crudeness of the tools made for lapping, and the meager knowledge existing regarding the correct abrasive.

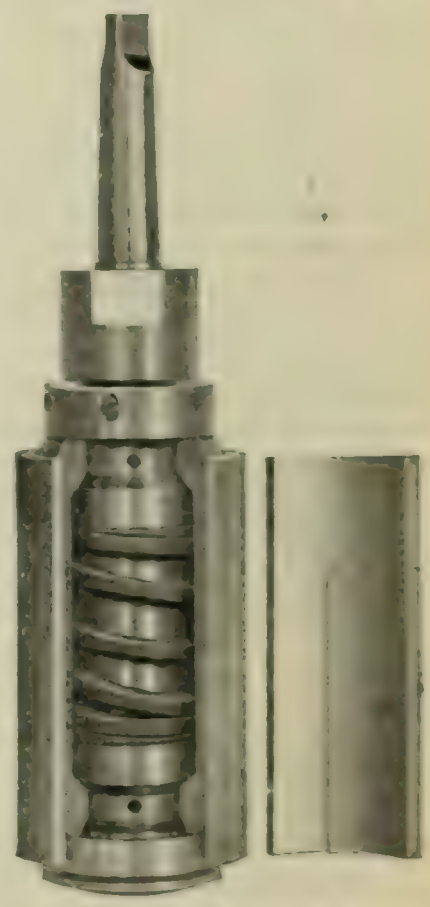
The R. & C. Lap Co. has developed a line of standardized laps with interchangeable and replaceable shells. The laps are made for both external and internal use, in sizes from ¼ in. up. It is claimed that the design of the lap and the use of a standardized abrasive render highly skilled labor and lengthy experience unnecessary. The replaceable shells are supplied in two grades, the use of which depends on the speed of cutting desired and the type of work.

As illustrated, one section of the shell of the internal lap has been removed to show the construction. The lap consists of a floating shank and an expanding device for adjusting the size, as well as for taking up the wear of the soft metal shell which is charged with abrasive. It is claimed that while the lap is being expanded the diameter is kept constant over the whole length, assuring a true bore, free from bell-mouthing and taper.

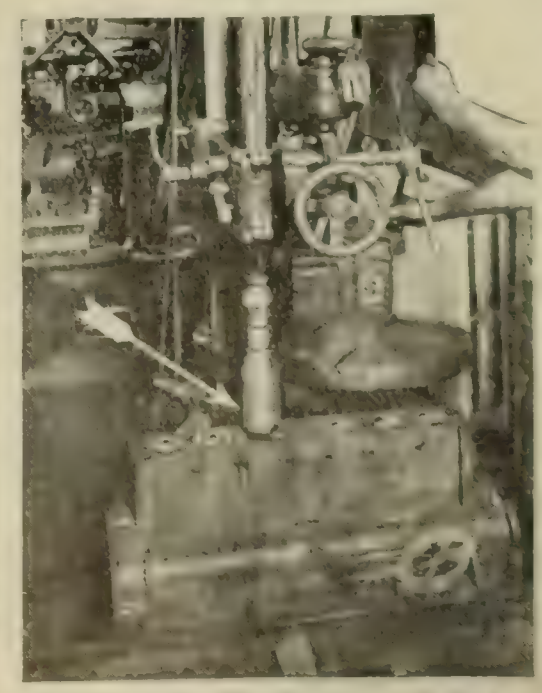
Among engineers the impression has gained ground that in every lapping operation some of the abrasive remains embedded in the surface being lapped. We are informed by the manufacturers of this device that conclusive tests have shown it to be impossible to charge the surface being lapped if the lap is made of softer material. The R. & C. lap shells are made of metals which are softer than the surface to be lapped, thus overcoming the objections of the split-piston and similar laps. The abrasive becomes embedded in the softer lap shell, rather than in the surface being lapped.

Another advantage claimed for lapping—which, by the way, is used for finishing the cylinder bores of some of the highest grade cars—is that it renders unnecessary the "running in" of new engines or engines to which new pistons have been fitted. Purchasers of cars are ordinarily cautioned to drive slowly the first 500 or 1000 miles to prevent seizing of the pistons or bearings while they are still imperfectly "worked in." This precaution is rendered unnecessary by lapping.

In crankshaft manufacture a tolerance of plus and minus 0.0005 in. is generally allowed on the crankpin and main bearings. Frequently, however, inspection departments find crankshafts that measure an additional 0.0005 in. above or below the limits given. One way of avoiding scrapping such oversize parts is the adoption of selective assembly.



The R. & C. cylinder lap



Manner of lapping cylinders with R. & C. lap

This, however, impedes production, and if any of the specially fitted parts become separated or mislaid, still more time is lost. The R. & C. external lap was designed for use in lapping crankshaft bearings. The crankshaft bearings are left 0.0001 in. oversize, and are lapped to size within 0.0001 or 0.0002 in. The connecting rod bearings are finished by means of hardened and lapped plugs and are then absolutely interchangeable, it is claimed.

Leadership Necessary in Executive Supervision

Proper distribution of authority and development of understanding in individuals constitute major problems in modern industrial organization. The supervisor must develop leaders beneath him; he cannot rely merely upon centralized orders. Subordinates must be given responsibility.

By Harry Tipper

NOT very long ago, in a conversation with an executive of the largest company in a certain line of business, this executive admitted that it was impossible for this company to compete, quantity and quality considered, with a company of medium size in the same field. Further questioned, and asked for the reason of it, he stated that in his opinion it was due to the difficulty of getting a decision, the difficulty of moving in any direction, and the difficulty of instituting improvements to the organization with any celerity.

These are all human difficulties and arise from the lack of leadership and the incapability of coordinating all human differences and human necessities in so large an organization. One of the younger executives of the company having ten or twelve subsidiary companies, stated that there had been a change of policy in the organization, so that the tendency to build up a central system for all the companies was being discarded and instead the present policy was to allow a greater latitude and individuality of the separate subsidiaries. Asked why this was the case, he remarked that it was possible to get in a single factory a compact group working together under a local and compact idea of progress, whereas the development of the spirit was almost impossible when the control was centralized for this factory in common with a number of other factories.

This again is a human matter and arises out of the same necessity—the necessity for a group spirit in a small group and the difficulty of securing a group spirit through the centralized operations of control in connection with a large group.

This is particularly true in the supervision work upon which depends the development of the subordinates and the increased efficiency of those subordinates. How much may be done in this direction is illustrated by the case of one factory which had failed to make money in the good years of 1918, 1919 and 1920, but which, under different management, with the same equipment, the same products, a much poorer market and a large and high-priced inventory, succeeded in returning a very decent dividend to its stockholders in 1921.

The whole details of this case are the painstaking details of the development of a group spirit, a thorough understanding, a pride, loyalty and consideration which found its expression in the increased efficiency and the increased profits. It is something of a feat to take an organization that lost money in 1920, and enable it to make money under those conditions in 1921. The character of the work becomes more impressive when the details of the job are understood. No elaborate systems were installed, no great changes were made in the organization, the man at the head of affairs simply tackled each problem as it came up, with the knowledge that he needed the initiative, the ideas, the support and the good feeling of his subordinate officials, supervisors and workers, and the results were beyond his expectation and certainly far beyond anything expected or even contemplated by the finacial powers in control of the situation.

The most difficult element in the organization of any industrial group is the proper distribution of authority and the proper development of understanding so that the judgment of the individual supervisors is required to exercise itself and co-operation in progress is secured by the loyalty engendered through the understanding.

It is comparatively easy to lay out a plan and require all members of the organization to adhere to that plan; secure its development on a centralized basis, and get a fair degree of production. It takes less time to do it this way. The officials who operate this way are on safer ground because they can refer to methods that have been used in the past and that are being used in other establishments, to prove the wisdom of their own actions. It is the safer way, but it is capable of less advancement and is responsible for a large amount of the waste present in almost all of the industrial concerns of to-day. No man can logically apply the term "leader" to himself or to any official who depends upon this centralized system of organization to turn out the work.

It is the business of the supervisor to develop the subordinates, to see that they have opportunities for exercising their judgment and their thought upon the work in proportion to their skill, and to develop a sufficient degree of understanding to maintain their loyalty. This cannot be done successfully where the organization reaches a great size under the usual methods of organization. It is not possible to put to work thousands of supervisors and secure any decent percentage of those supervisors who are capable of leading in this way.

It is not possible to secure executives in the numbers necessary and find them capable of organizing by the distribution of functional responsibility. Consequently, the larger the organization the greater the tendency toward highly centralized systems and all the difficulties which come from that condition. Hobson, in his book, "Evolution of Modern Capitalism," points out that the more efficient concerns tend to grow more rapidly than the general growth of the business and less efficient concerns grow more slowly. Institutions became of great size because of the rapid development of this country. The efficiency and leadership in the small group encouraged this rapidity of growth into a large group.

These factors of growth, however, do not justify the present size of such organizations, and in many lines of

business, they are not to-day growing as rapidly as the smaller organization in the same field. These smaller organizations, in many cases, are more efficient than the larger, and in the course of their growth they will tend to overtake these huge concerns and displace them from their dominating positions.

The increased efficiency will come more and more from an understanding of group organization in itself, and not from the character of the mechanical equipment, control of the raw supply, or the physical advantages merely. The difficulties of the large organization are increased and they must be met by the growth of leaders more profoundly informed upon the structure of business, the relation of this machine or industrial development in its different parts, one to the other, the things which govern human action and make for an increase of human efficiency. Economic conditions in an individual concern are the result of the human organization conditions, and they will be changed in accordance with the changes in this way.

An institution containing 25,000 men in various factories is as complicated in its governmental requirements as a city with its outlying communities, inside organization, differences of opinion, politics, individual grievances and all the other troubles inherent in community life which exist and, in many cases, flourish. The government of such an institution so that it can maintain itself against the competition of smaller and more flexible establishments requires a very broad knowledge, a very fundamental understanding, and a patient, painstaking movement, step by step, toward a more ideal condition.

The past success of the big organization does not indicate its future position. Success continues for some time after the methods that contributed to the success have been replaced or lost their usefulness. The continued success depends upon the agreement between the methods and the necessities, and this agreement has not yet been secured in the conduct of large organizations of business from the human standpoint.

Proposed Bearing Standardization

Metric Roller Bearings

AT a recent meeting of the Ball and Roller Bearings Division of the Standards Committee of the Society of Automotive Engineers, it was voted to request the Subdivision on Roller Bearings to continue consideration of the following revisions of the present S. A. E. Standards for Roller Bearings, proposed by the Subdivision on Nov. 20, 1918, as it was felt by those present that the demand for standard metric roller bearing sizes that are interchangeable with the wide or double row type ball bearings is becoming greater. It was stated at the meeting that the present dimensions of the standard metric roller bearings are generally considered very satisfactory, although possibly a few changes in tolerances, overall widths and corner radii should be made. All members present were of the opinion that these standards should be put into the best form possible.

Bearing Numbers—Bearings of the light series shall be designated by prefixing the letter L, the numbers ranging from L04 to L22 consecutively, and bearings of the medium series by prefixing the letter M, the numbers ranging from M04 to M22 consecutively.

Inside and Outside Diameters—The inside and outside diameters shall be given in integral millimeters and shall correspond to the inside and outside diameters for the same sizes of the annular ball bearing of the light and medium series, pages C26 and C28, S. A. E. Handbook.

Widths—The widths shall be given in inches and shall be in accord with the widths of the annular ball bearings of the wide type, page C31, S. A. E. Handbook.

New Sizes—The medium series shall be extended to specify dimensions for bearings Nos. M21 and M22; the inside diameter for bearing No. M21 to be 105 mm., the outside diameter 225 mm., and the width 3 7/16 in.; and the inside diameter for bearing No. M22 to be 110 mm., the outside diameter 240 mm. and the width 3⅝ in.

Chamfers—The chamfer or radius on the inner and outer races of bearings of the light and medium series with inside diameters from 20 to 25 mm. shall be 1 to 1½ mm.; for inside diameters from 30 to 50 mm., the chamfer shall be from 2 to 4 mm.; and for inside diameters from 55 to 110 mm., the chamfers shall be from 3 to 5 mm. The headings of the columns in the tables giving the chamfers shall read "Radius or Chamfer C" and the limits shall be shown as maximum and minimum.

Clearances—The maximum clearances required for the bearing cage, when used, shall be given for each size of bearing. These clearances shall not be considered as standard, but as general information only.

Eccentricity Tolerances—Further consideration shall be given to the question of whether the eccentricity tolerances given in the present S. A. E. Standards refer to the error in running true actually measured or to the true eccentricity of the center of the inner and outer races.

Diameter Tolerances—Further consideration shall be given to the tolerances for the diameter, as these depend upon the type of bearing and its application.

Inch-Type Thrust Ball Bearings

Criticisms and suggestions in connection with the present thrust bearing standards that had been submitted to the Society were discussed. It was the consensus of opinion that the present standard should remain as published in the S. A. E. Handbook, it being stated by several members that they are in satisfactory form and use.

Advances in Acetylene Welding

RECENT advances in acetylene welding and some of the problems confronting the welding industry are considered in a report of the Oxy-Acetylene Welding Committee of the International Acetylene Association. It is stated that metals of almost any desired composition can be deposited by the oxy-acetylene torch, but that many important problems like preheating, heat treatment and annealing require consideration. Duriron, a high silicon cast iron, is being successfully welded, but must be most carefully preheated. Manganese steel is difficult to work, but good results are being obtained on simple castings. All of the regular alloy steels, such as nickel chromium and vanadium, can be welded without difficulty, but inasmuch as the welds are usually wanted where great strength is required, the process does not hold out much promise, unless the metal can be poured and heat-treated. Monel metal, which is being used for valves and similar purposes, has been welded successfully, and further studies are being made in this direction.

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Developing Future Markets

THE production capacity of American automobile manufacturers is in excess of the immediate demand for cars in this country. As a result of this situation, brought about by the war and its aftermath of business depression, many factories are producing only a small percentage of what they could produce if there was an available market for their goods. Such a condition, naturally, is one to be overcome as rapidly as possible, and by the surest and most economical means possible. To overcome this situation means that the American manufacturer must find and develop new markets.

It is not a new thought that a study of the needs of foreign countries and preparation to supply those needs is, perhaps, the best way out of the difficulty. The conditions affecting international business have, in the recent past, been most unfavorable. In many instances they are not much better at present. The last few months of the past year, however, did much toward restoring the world's economic stability and the year 1922 will do more. Foreign exchange values are becoming stabilized in certain instances, and the purchasing power of many countries will increase. There is a need for automobiles in many parts of the world and the United States is looked to to supply that need. It is no less true that American manufacturers need the rest of the world as a market.

While the year 1922 may not be a "big year" from the exporter's standpoint, it offers a chance to pave the way for future business. The manufacturer who has representatives in the various foreign fields talking the merits of his product in times of business depression will be the one to secure orders when that depression is over. If the desire is created before those countries have the money to buy, they will buy as soon as they get the money.

Power Gear Shifting

THE shifting of the gears is admittedly the most unpleasant operation in running a car. Few people learn to shift the gears deftly, so as to make a speed change without a grating noise under all conditions. The clashing of gear teeth, if often repeated, shortens the life of the gears.

Attempts have not been wanting to make the shifting of the gears automatic, with a view to lessening the physical exertion required of the driver and to remove the cause for disinclination on the part of some drivers to change gears. At one time the magnetic system of gear shifting had a certain vogue, being fitted particularly to high-priced cars. Gradually, however, the car makers who once supplied this system as standard equipment have either given it up or decided to supply it only as an extra. Such a gear shifting mechanism naturally involves considerable expense, and when competition in any particular class of cars becomes keen the manufacturers are always inclined to omit equipment and thus move into a lower price class if possible. Besides, the magnetic gear shift draws a very heavy current from the battery and, when much used, undoubtedly adds considerably to the wear and tear on the battery.

Most inventors have sought the solution of the problem in the provision of some mechanical device whereby the depression of the clutch pedal stores up the necessary amount of energy for shifting the gears. In this case, of course, the energy used for shifting is muscular energy, and the expenditure of physical energy in driving is not really lessened, but the driver does not shift the gears directly and does not feel the grating of the teeth against each other, at least not so distinctly. The operation of gear changing is somewhat simplified in that the approaching need for a change in the gear can usually be discerned some time in advance and the selector set for the speed which is to be engaged next; then when the change must be made, only a single operative movement—depression of the clutch pedal—needs to be made, instead of two separate and properly timed movements, as in an ordinary car.

Clashing of gear teeth is usually due to a great difference in pitch line velocity of the two gears at the time of meshing, and the art of changing gears quietly consists in first bringing the two gears to be

meshed to the same pitch line velocity. This applies as well to cases where mechanical power is used for shifting the gears as where they are shifted by the direct application of muscular power. Of course, it is possible that with an automatic shift, where the operator needs to merely depress the clutch pedal, his mind is not so much occupied, and he is more likely to bring the two gears to corresponding pitch line velocities by appropriate use of the throttle.

Whether the mechanical gear shift will prove more successful than the magnetic remains to be seen. One of the objections to the latter, that it throws additional load on the storage battery and shortens the life of same, is eliminated. In its simplest form it can undoubtedly be made considerably cheaper than the magnetic, which is another thing in its favor. On the other hand, there is much less novelty in automatic gear shifts now than there was when the magnetic made its appearance.

Concerning Design Changes

THERE are some who think that the next ten years of motor car development will see fewer and less extensive change in design than have been seen during the past decade; in short, that there will be an increasing tendency toward a more staple product. Most manufacturers are loath to make changes, as, indeed, they should be if the matter is viewed chiefly from the standpoint of economy in manufacture. But sooner or later the manufacturer who fails to keep his product abreast of the times finds that he is suffering in competition with more progressive organizations.

Engineers who are given to making forecasts regarding the future or ultimate type of car usually indicate, if they predict that variation from present type will be slight, that changes in respect to available fuel supplies may completely upset calculations and make necessary some far-reaching changes in design, at least so far as the engine is concerned. This is simply another way of saying that engineers who are wise are keeping a weather eye on the fuel situation—as there is good reason that they should. Those who have read the survey of the fuel situation contained in last week's AUTOMOTIVE INDUSTRIES and have followed other developments in this field will readily agree to this.

Fuel has, indeed, played an important part in respect to all automotive design and is destined to play a still more important part in the near future. This does not necessarily mean that radical changes in design are at hand, but it does mean that no time should be lost in efforts to meet the coming fuel situation, either with or without "radical" changes, as may prove most expedient. If, as seems quite possible, motor fuel becomes almost as expensive here as it is in England, for example (the difference is less to-day, quality considered, than many think), there may be some tendency toward smaller engines and lighter cars, as there has been in England, but this appears to us quite unlikely. What seems far more probable is a fairly close adherence to present size and general type, but certain changes in the functioning of engines, and in detail of design which will enable our present general type and size of car to travel as far or farther per gallon of fuel than even the small British car of to-day. In fact, we seem to be just around the corner from developments which will leave us with cars as efficient in respect to fuel utilization as any now in common use anywhere, but just as powerful and flexible as the average American-built car of to-day.

While this is not a commercial reality, it is by no means an idle speculation. The thing has been done in an experimental way, and by several different methods. Some of these involve little or no more complication than we find in many cars which handle present fuels comparatively well, measured by present standards. In the past fuel prices have been such as not to encourage developments of this kind, but this condition is now passing. Furthermore, the modern car user is becoming more and more interested in anything which decreases operating costs.

So we must not and cannot remain contented with cars as they are. They must be made more dependable, more efficient and generally less expensive.

Discussing Bus Design

AUTOMOTIVE engineers will have an excellent opportunity to discuss the problems of motor bus design and the economics of bus transportation next week at the motor truck transportation session of the S. A. E. winter meeting. Truck transportation in general is included in the topic, but the discussion of buses should bring forth specially interesting material, since this will be the most important open forum that has been held on this subject to date.

It is to be hoped that considerable emphasis will be placed upon that phase of the subject dealing with the adaptation of ordinary truck chassis to bus work. It is strongly felt in many quarters that the regular truck chassis is not at all suitable for bus use and that radical changes in design are necessary if satisfactory operation is to be attained. The motor truck industry as a whole does not seem to have taken the interest in studying this problem of bus design that the possibilities of the field appear to warrant.

In a few instances definite progress has been made in modifying standard truck chassis so that they are more suitable for bus work, but there is really only one case in which the problem has been approached from the standpoint of pure bus design—and that case is not strictly within the motor truck industry.

A general survey of transportation possibilities in this country leads very definitely to the conclusion that there is a real need for the motor bus and that its ultimate development will be great. Every truck chassis used for bus work, however, which fails to fulfil its function properly and adequately acts as a deterrent to that development.

The task of suitable bus design properly rests with the engineers of the motor truck industry and the development of the motor bus with the motor truck firms. There is a future market which is worth cultivating. It is to be hoped that next week's S. A. E. meeting will bring forth some sound and pertinent discussion of this interesting matter of bus design.

General Revision of Prices Expected

New Models Also to Feature New York Show—Greater Value, Aim

By James Dalton

NEW YORK, Jan. 5—Several of the price cuts predicted for the turn of the year already have been made but more will follow, coincident with the opening of the New York show Saturday. Some of these reductions have been discounted but others will be more or less unexpected. It now seems probable that the revision will be more general than had been anticipated and that companies which had intended to stand pat will be forced into line to meet competition. As a consequence predictions are unsafe. New prices are a closely guarded secret until executives think the psychological moment has arrived to spring them.

New prices will be one of the sensations of the show. Another will be new models or old lines revamped to give purchasers improvements or comforts they have not had hitherto. The two combined will present motor car values not duplicated since the war and in some cases never equalled. Because of changes and improvements in equipment it is practically impossible to compare present values with those of pre-war days in individual makes.

More Business Forecast

Confidence of manufacturers that the new values will result in orders is evidenced by the fact that most of them have been assembling parts for complete units since current sales began to decline a month ago. This has been reflected in the unexpectedly large volume of business given parts and accessory makers in December. It is expected their sales for the last month of the year will exceed those for November.

A remarkable evidence of the stability of the industry in the past year is found in the fact that sales by members of the Motor and Accessory Manufacturers' Association for the last ten months have been in virtually the same volume each month. Sales in March jumped to $20,000,000 from half that amount in February. They rose to $26,000,000 in April and May. They fell to $22,000,000 in June, while in July, August and September they were $23,000,000. In October they dropped to $22,000,000 and in November to $19,000,000. They probably reached the $20,000,000 mark again in December.

With December estimated, this would make a total for the year of approximately $243,000,000. When the year began, however, all the vehicle manufacturers were loaded up with enormous inventories, so that only a part of their requirements for the year came from releases or new orders.

While the lower prices and the higher values which will be offered at the New York show will usher in an era of keener competition, it is generally believed prices will have been stabilized for a considerable period. This would hearten the dealers who would be able for the first time in a year to give prospective purchasers the whole-hearted assurance that no further cuts were in prospect.

The final estimate of production of passenger cars and trucks by American manufacturers in 1921 has been reduced from 1,700,000 to 1,680,000.

Small Property Sold to Bank for $175,000

INDIANAPOLIS, Jan. 3—The William Small Co., maker of the Monroe, which has been in the hands of a receiver since August, 1920, was sold in a receiver's sale to the Fletcher American National Bank, a local creditor, for $175,000 cash. It is understood that a reorganization of the company will be consummated soon, and that pending such action production will be continued.

According to James W. Fesler, receiver, there are approximately 450 creditors representing $900,000 of undisputed claims and $200,000 of disputed claims. He states that it will be impossible at this time to estimate on what percentage on the dollar the sale will permit the company to pay its obligations for the reason that certain expenses must be deducted from the purchase price before the creditors' accounts can be satisfied.

Service Truck Company Adds Rail Car Division

WABASH, IND., Jan. 3—A railroad car division, with a complete staff of its own, has been announced by the Service Motor Truck Co., following a demand created by demonstrations to railroad companies of the 30-passenger railroad coach mounted on a Service truck chassis. Charles Guernsey, for several years chief engineer of the company, has been made manager of the division; William Petty succeeds him as engineer, while William E. Marvel will be manager of sales of the railroad division.

Fifty railroad officials are expected here late in January to witness a test and demonstration of a new 55-passenger railway coach mounted on a Service truck. The new design is now under way and will be completed by the time of their visit.

Cooperation Halted by Court Decision

Some Associations Hesitate to Submit Statistical Data to Secretary Hoover

WASHINGTON, Jan. 3—The majority opinion of the Supreme Court in the hardwood case has had the expected result of disturbing co-operation between trade associations and the Department of Commerce. One association has given notice that it will not submit further statistical data to the Department of Commerce for use in the *Monthly Survey of Current Business*, issued under the direction of the Bureau of the Census.

Other associations have indicated that they are uncertain as to whether they will co-operate further, being apprehensive of the effect of the decision of the Supreme Court. The chief difficulty disturbing this co-operation, which has been carefully urged and built up on the initiative of Secretary of Commerce Hoover, has been the doubt left as to the actual effect of the decision.

Few Associations Affected

It is evident that careful analysis of the opinion has left the general impression that it affects the activities of only a small portion of trade associations of the country, but many associations which feel that they are not affected are at the same time left in doubt pending the clear interpretation of the decision by the Government.

For this reason, it is believed some of them at least will hesitate to co-operate with the Department of Commerce until Attorney General Daugherty presents an official statement expressing his views in the matter. Even this, however, will not satisfy representatives of certain associations who think that the only remedy assuring their legality lies in the enactment of legislation, though passage of such legislation, if undertaken, probably would require a long time.

Hoover Reiterates Views

Secretary Hoover has reiterated his view that the decision will have a bearing on only a small number of trade associations, estimating that it will not involve over 10 per cent of the total. This calculation is based on the survey made some time ago by the Department of Commerce as to the activities of the 1700 or 1800 trade associations of the country.

Nathan B. Williams, associate counsel of the National Association of Manufacturers, takes the same view that Mr. Hoover expressed and thinks that trade associations should continue their legitimate statistical activities and supply data to the Department of Commerce for public use.

Daugherty said he would confer in a day or two with Secretary Hoover on

(*Continued on next page*)

Paige-Detroit Cut; No Jewett Statement

Reductions Made Possible by Condition of Company, President Says

DETROIT, Jan. 3—Price reductions announced by the Paige-Detroit Motor Car Co. on all its models range from $170 to $680. The prices on the 6-44 line are:

	Old Price	New Price
2 passenger Touring..	$1,635	$1,465
5 passenger Touring..	1,635	1,465
Coupe	2,450	1,995
Sedan	2,570	2,245

The prices on the 6-66 models are:

	Old Price	New Price
4 passenger Touring..	$2,975	$2,245
3 passenger Touring..	3,295	2,495
7 passenger Touring..	2,875	2,195
Coupe	3,755	3,100
Sedan	3,830	3,155

President Harry M. Jewett stated the reductions were made possible by the financial strength and manufacturing facilities of the company which permit a large production schedule for 1922. The prices of the new Jewett car, the light six line which will be produced as a companion to the Paige, will not be announced until a meeting of Paige dealers at the New York show.

Apperson Adds New Body Models and Changes Prices

KOKOMO, IND., Jan. 3—Sharp reductions in prices will be announced at the New York show by the Apperson Bros. Automobile Co. The prices are:

	Old Price	New Price
4 passenger Sportster (open)	$3,000	$2,620
4 passenger Tourister	2,248	2,395
7 passenger Touring..	3,250	2,645
4 passenger Tourister (open)	3,500	2,995
4 passenger Sedanette	4,500	3,895
Sedan	4,500	3,995
Limousine (sedan)....	4,700	4,195

The Apperson line will be unchanged mechanically but two new body models will be added. They will be known as the "tourequip," listed at $2,995, and a four passenger "tourister," with special equipment, listed at $3,245.

STUTZ MAKES REVISION

INDIANAPOLIS, Jan. 3—Lower prices on its models will be announced at the New York show by the Stutz Motor Car Co. The prices will be:

	Old Price	New Price
4 passenger Touring..	$3,350	$2,990
6 passenger Touring..	3,350	2,990
Roadster	3,250	2,950
Coupe	4,800	3,990

NASH SIX CYLINDER DROPS

KENOSHA, WIS., Jan. 3—Price reductions ranging from $155 to $305 are announced by the Nash Motors Co. on all models in its new six cylinder line. No price changes are made on the four cylinder line. The prices are

	Old Price	New Price
5 passenger Touring..	$1,545	$1,390
7 passenger Touring..	1,695	1,540
7 passenger Sedan....	2,695	2,390
Coupe	2,395	2,090
Roadster	1,525	1,360
4 passenger Sport.....	1,695	1,545

The price on the new four cylinder taxicab has been reduced to $1,395.

HAYNES LOWERS PRICES

KOKOMO, IND., Jan. 3—Price reductions on several of its models will be announced at the New York show by the Haynes Automobile Co. The prices follow:

Model 55	Old Price	New Price
5 passenger Touring..	$1,785	$1,595
Roadster	1,835	1,645
Coupe (new line).....		2,295
Sedan	2,835	2,595
Model 75		
7 passenger Touring..	2,485	2,395
4 passenger Tourister	2,485	2,395
Speedster	2,685	2,595
Brougham		3,095
Sedan	3,485	3,395
Suburban		3,395

Additional Reductions on Page 43

Cooperation Halted by Court Decision

(*Continued from preceding page*)

the question of publication by the Commerce Department of trade statistics gathered by the various associations. The attorney general declared that procuring information was not in violation of the law, the only question being whether the associations use the trade information when collected for illegal purposes, such as fixing prices, dividing territory or limiting production.

Distribution of Goodspeed Limited to Eight Centers

CHICAGO, Jan. 3—Distribution of the new Goodspeed car, which will be shown by the Commonwealth Motors Co. for the first time at the New York and Chicago shows, will be strictly limited.

A statement by Leland F. Goodspeed, vice-president and chief engineer, says that there will be distribution only in eight Metropolitan centers and that production will be so limited that only a few of the cars will be available in each of these cities. Goodspeed spent nine years perfecting his new motor.

M.A.M.A. COMMITTEE TO ORGANIZE

NEW YORK, Jan. 3—The foreign trade committee of the Motor & Accessory Manufacturers Association, headed by W. O. Rutherford, vice-president of the B. F. Goodrich Co., will be organized some time during show week in New York. The additional members of the committee will be announced at that time.

Ford Changes Parts Distributing Policy

Dealers May Solicit Wholesale Business at 33 1/3 Per Cent Discount

DETROIT, Jan. 3—Genuine Ford parts will be available for sale in all stores conducting a general accessory or parts business under a change in the service plan of the Ford Motor Co. which will permit its authorized dealers to solicit wholesale business from stores of this character at discounts of 33⅓ per cent f.o.b. Hitherto the selling plan by dealers permitted only a 25 per cent discount to garages and accessory stores on sales in any quantity that the dealer could supply.

Under the new policy the dealers may solicit the wholesale business in certified quantity lots, these to be shipped from the branch plant in the territory. Through this plan all stores engaging in the supplying of automobile parts, and this includes stores maintaining automobile accessory departments, will be able to handle genuine parts for the first time on a basis competitive with parts supplied by outside manufacturers.

Big Stocks Unnecessary

Stores and garages unable to buy in the quantities certified for the bigger discount will continue to be sold at the former 25 per cent rate. The Ford dealer may go after the new business without the necessity of carrying a heavy stock of parts on hand, though a sufficient stock will be carried in the dealer stations to supply, as formerly, the garage and small accessory trade. Stocks in the branch plants will be augmented to meet the increased demand.

Through the sale of genuine parts more generally, the factory is undertaking to obtain much of the business which has been going to outside manufacturers, and feels that owners will derive added satisfaction and additional service from their vehicles.

HEARS TEMPLAR MOTION

COLUMBUS, Jan. 3—Judge Charles Warner in the Franklin County Court heard the application of N. P. Clyburn of Washington Court House for a receiver for the Templar Motors Co., a Delaware corporation, and also the Templar Motor Co., an Ohio corporation. The action is resisted on the technical grounds that the corporation was not legally served to appear in Franklin County.

LABOR SEEKS ROAD WORK

NEW YORK, Jan. 3—The executive council of the New York State Federation of Labor has addressed a letter to Governor Miller, urging him to use his influence to have highway building undertaken by the state as a means of alleviating unemployment.

Owen Tire Receiver Sues Former Officers

Seeks Recovery of Commissions and Title to Property in Bedford

CLEVELAND, Jan. 3—W. M. Scott, receiver for the Owen Tire and Rubber Co., organized in 1917, and owner of a large plant for the making of tires and tubes at Bedford, a suburb of this city, has made charges of fraudulent actions and misconduct against former officers of the corporation, in a series of suits filed in common pleas court here.

In one action, Scott sues for the recovery of $160,803.56, which he says was paid illegally as commissions on sales of stock of the Owen company. In his petition he states that the Rubber Securities Co. was organized to sell stock of the tire company, and that W. C. Owen, former president and general manager of the tire company, owned 8 shares of stock in the securities company; W. J. Owen, an Owen director, 2 shares, and E. M. Blatz, director and vice-president of the Owen company, 2 shares.

High Commission Alleged

Scott charges that at a meeting of directors of the tire company, at which were present, W. C. Owen, W. J. Owen, E. M. Blatz and Charles I. Reese, it was voted on behalf of the tire company to give the securities company a contract for selling stock of the tire company and to pay 15 per cent commission on all stock sold. Scott charges the resolution was illegally adopted and was for the purpose of enabling the officers of the tire company mentioned to obtain illegal commissions on sales of stock.

He further alleges that the securities company maintained no offices of its own, but conducted its activities in quarters provided in the plant of the tire company. W. D. Areese and O. M. Dickison of the securities company, also are defendants in this suit.

Architect's Fees Involved

In another action, Scott charges that W. C. Owen, who became general manager and president of the tire company, on Sept. 2, 1918, secured from its directors a contract in the name of the W. C. Owen Co., for services as an architect in drawing plans for a rubber manufacturing plant in Bedford and for supervising its construction. Under this contract Owen was to receive an architect's fee of 16 per cent of the total cost of the building. On this contract, which, it is charged, was entered into at the time Owen was a director and stockholder of the tire company, it is alleged $80 538.28 has been paid to Owen. The petitioner asks for the recovery of this sum.

In another suit Scott asks the court to turn back title to six lots in Bedford, which it is alleged, were purchased with tire company funds and to which, it is charged, Owen took title in his own name, and for the recovery of title to other property which he says should rest in the Owen company.

Owen has not made a statement and his answers are not on file.

CONNECTICUT CLASSES HEARSES AS TRUCKS

BRIDGEPORT, CONN., Jan. 3—Motor hearses used in Connecticut are, under the revised State motor vehicle statutes, classified as trucks and, being available for hire, must be registered as public service motor vehicles. Because of the former classification, they must bear plates indicating their rated capacity.

Funeral directors of the State express indignation over interpretations of the statute in question and have appealed. Motor Vehicle Commissioner Robbins B. Stoeckel, following a conference with Attorney General Frank E. Healy, has notified the Connecticut Undertakers Association that he is powerless to change this classification and suggests that an amendment be proposed at the next legislative session, if a change is desired.

Agricultural Engineers Come to Aid of Society

CHICAGO, Jan. 3—At the business session of the fifteenth annual meeting of the American Society of Agricultural Engineers held in this city it was reported to the members that the society is somewhat in debt and that either financial relief must be found at once or some of its activities eliminated. Two direct economy proposals were offered: First, the suspension of the journal of the society; second, withdrawal from the Federated Engineering Society of America.

Immediately, members from the floor objected to the elimination of any of the present activities from the society and expressed the opinion that both the Journal and the membership in the Federated Societies were necessary to bring agricultural engineering into the position it deserved. The members supported this position by voluntarily offering to pay the higher dues to be levied this month and several of the members present offered additional financial assistance.

N. A. C. C. TO HEAR MACDONALD

NEW YORK, Jan. 3—Thomas H. MacDonald, chief of the Federal Bureau of Public Roads, will address the National Automobile Chamber of Commerce export managers' convention next Tuesday on "How the United States Government and Automotive Exporters Can Stimulate Good Road Movements Abroad." Another speaker not previously announced will be Charles S. Wall, executive secretary of the National City Co.

1,535,000 Automobiles Produced in 1921

Truck Output Aggregated 145,000 —Total Production 24 Per Cent Below 1920

NEW YORK, Jan. 3—Careful estimates made by the statistical department of the National Automobile Chamber of Commerce show that the production of cars and trucks in the United States in 1920 was 1,680,000, a decrease of 24 per cent from the 1920 production. The passenger cars built numbered approximately 1,535,000 and the trucks 145,000.

The wholesale value of cars and trucks produced is estimated at $1,222,350,000, a decrease of 45 per cent from the 1920 wholesale value. The average wholesale price of the motor cars sold in 1921 was $702 as compared with $897 in 1920 and $968 in 1919.

The National Automobile Chamber of Commerce estimates that there are registered in the United States approximately 10,000,000 motor vehicles, of which 1,000,000 are trucks. Farmers own 2,850,000 motor cars and 150,000 trucks. It is estimated that farm products hauled by motor transport for the year totaled 134,400,000 tons.

There are now in operation about 20,000 motor buses and 1500 public motor express lines. It is figured that 6,000,000,000 passengers are carried annually by motor car and 1,200,000,000 tons of freight by motor truck. The number of street railway lines now using motor buses is 35 and the number of steam railroads using motor trucks with flange wheels is 12.

Gasoline production in the United States in 1921 was 5,360,014,000, an increase of 9.8 per cent over 1920. Gasoline consumption increased 5.9 per cent.

Tire casings produced last year numbered 19,379,000 and inner tubes 24,157,000.

The value of motor vehicles and parts exported in 1921, including engines and tires, was $102,945,610. Motor cars exported numbered 30,639.

FORD 100,000 AHEAD OF 1920

DETROIT, Jan. 3—The Ford Motor Co. states that its sales for 1921 will run about 100,000 ahead of 1920. This figure was reached by Dec. 1 and the total for the year is not expected to show much deviation. Production in 1920 was 1,023,553. There will be no heavy inventory of complete cars carried over the winter as was the case last year.

FEDERAL ROAD AID FOR KANSAS

LAWRENCE, KAN., Jan. 3—Announcement was made to-day by the State Highway Commission of the receipt of the Federal road appropriation of $2,102,281 for Kansas roads. Of this fund $700,000 is immediately available.

Arbiters Classify Fekete Invention

Not Entitled to Place in "Class B" in Cross Licensing Agreement

NEW YORK, Jan. 3—An arbitration board appointed to consider the Hudson crankshaft case has decided that the invention of Stephen I. Fekete, chief engineer of the Hudson Motor Car Co., is not entitled to classification as a "Class B" invention under the patent cross licensing agreement existing among the members of the National Automobile Chamber of Commerce.

Some years ago Fekete obtained a patent on a crankshaft design for a six-cylinder engine and assigned that patent to the Hudson company. Since then this design has been embodied in the engines with which the Hudson Super-Six is fitted. The Hudson Motor Car Co. being a member of the N. A. C. C., there arose the problem of properly classifying the invention.

Three Classes Recognized

In the cross-licensing agreement three different classes of inventions are recognized, namely, Class A or basic inventions; Class B, inventions of a striking character, involving a radical change from existing practice, and Class C, inventions which include all mere improvements, variations or modifications.

It was the contention of the Hudson company that the Fekete invention came under classification B, but this was denied by the experts of the N. A. C. C. A demonstration to prove the effect of the Fekete method of counterbalancing a six-cylinder crankshaft was made as long ago as 1917, when horsepower tests of a Hudson Super-Six engine both with and without the Fekete counterweights were made at the Hudson plant in Detroit, in the presence of a number of patent experts and technical press representatives.

Arbitration Necessary

No agreement was reached between the Hudson Motor Car Co. and the N. A. C. C. as the result of this demonstration, and the matter was finally put in the hands of an arbitration board consisting of Walter C. Noyes, Michael I. Pupin and Rolla E. Carpenter. Carpenter was later replaced by Charles E. Lucke.

The specific definition of Class B inventions in the agreement is an invention of a striking character involving a radical departure or radical change in from what is known; it must result from an inventive effort of a high order, and must not be a mere improvement, variation, modification or natural development of the existing art resulting from an ordinary effort of the inventive faculty.

The crankshaft covered by the Fekete invention, which is protected by a reissue patent, No. 14,292, issued on April 24, 1917, is of the type in which there are four main bearings. Hence there are two crankpins between each pair of adjacent main bearings. Each short crankarm is provided with a counterweight having a moment equal to the crankarm, to which it is secured, plus the moment of one-half the adjacent crankpin. There are also long crankarms which extend straight across from one crankpin to another spaced 120 deg., and these crankarms are provided with a counterweight secured to the side of it and providing an unbalanced moment equal to the moment of the long crank arm plus that of one-half of each of the two crankpins adjacent to the arm.

SCHEDULE OF EVENTS FOR AUTOMOBILE SHOW WEEK IN NEW YORK

NEW YORK, Jan. 4—Following is a schedule of events for automobile show week.

MONDAY, JAN. 9.

Annual meeting Rubber Association of America, Waldorf-Astoria, 2:30 P. M.
Meeting of Traffic Committee, National Automobile Chamber of Commerce, 2:30 P. M.
Divisional meetings Rubber Association, Yale Club.
Opening Body Builders show, Twelfth Regiment Armory, Columbus Avenue and 62nd Street.
Opening automotive accessories show of National Retail Merchants and Buyers Association, Hotel Imperial.
Dinner of Rubber Association, Waldorf-Astoria, 7 P. M.
Dinner of Aero Club of America, Commodore, 7:30 P. M.
Dinner of Old Timers Association, Flotilla restaurant, Sixth Avenue and 56th Street, 7 P. M.
Meeting National Highway Traffic Association, Automobile Club of America, 8 P. M.

TUESDAY, JAN. 10.

Annual convention export managers National Automobile Chamber of Commerce at N. A. C. C. headquarters, 10 A. M.
Meeting of Truck Committee of N. A. C. C., 2:30 P. M.
Meeting of Patents Committee of N. A. C. C., 2:30 P. M.
Annual meeting, Society of Automotive Engineers, Engineering Building.
Dinner of N. A. C. C., Commodore, 7 P. M.

WEDNESDAY, JAN. 11.

Annual meeting of Motor and Accessory Manufacturers Association, Commodore 2:30 P. M.
Monthly meeting directors of N. A. C. C. at 10:30 A. M.
Meeting of Executive Board of American Automobile Association, 501 Fifth Avenue, 10 A. M.
Luncheon of National Association of Show Managers at Woodstock hotel at noon.
Meeting of Legislative Committee of N. A. C. C., 3 P. M.
Dinner of M. A. M. A. at Commodore, 7 P. M.

THURSDAY, JAN. 12.

Annual dinner of S. A. E. at Hotel Astor, 7 P. M.
Paige-Detroit Motor Car Co. dinner at Commodore, 7:30 P. M., to unveil new Jewett car.

FRIDAY, JAN. 13.

Dinner and convention of Automobile Service Association at Automobile Dealers Club, 6:30 P. M.

Willys Inventory Reduced $27,000,000 in 6 Months

TOLEDO, Jan. 3—Branch managers of the Wilys-Overland Co. have been informed by John N. Willys that the inventory of the corporation now is in the neighborhood of $19,000,000 as compared with about $46,000,000 six months ago.

"This inventory is not out of line with the requirements for our 1922 program and we look for the purchase of at least $11,000,000 worth of materials before the end of March," Willys said.

Michigan Protects Truck Lines from Competition

DETROIT, Jan. 3—The Michigan Public Utilities Commission through its chairman, Sherman T. Handy, has outlined its policy toward controlling motor truck lines. The commission will endeavor to prevent dissipation of utility property by unfair and unnecessary competition. Bus routes are already under state control in Ohio.

"When the Legislature seeks the cooperation of this commission in drafting legislation for the regulation of motor truck transportation, we will recommend such legislation as will protect the pioneer, stable and serviceable interests then engaged in it from unfair and unnecessary competition to the end that a fair return may be received on the investment and a fair grade of service rendered to the public," Handy says, in speaking of the situation.

Handy believes manufacturers operating their own truck lines could not be designated as common carriers. Authorization of motor truck lines parallel to existing serviceable transportation routes is regarded as unlikely. "Loss to the public inevitably follows unreasonable and unnecessary utility competition," says Handy.

Sheridan Features Few in New Durant

Six-Cylinder Successor Will Have Four Models—Has Ansted Engine

NEW YORK, Jan. 3—Production of a six-cylinder car has been undertaken by the Durant Motors Corp., which some time ago took over the business of the Sheridan, manufactured by the General Motors Corp. in Muncie, Ind. The name was changed to the Durant Six and the car was completely redesigned so that few of the features of the Sheridan remain.

Four models will be produced which will sell as follows: Roadster, $1,600; touring car, $1,650; coupé, $2,250, and sedan, $2,400.

Equipped with Ansted

The Durant Six is equipped with the Ansted overhead valve high speed engine with an N. A. C. C. rating of 25.4 hp. The engine, however, is said to develop 70 hp. at 3000 r.p.m. on the block. The carbureter is the Rayfield horizontal type and is fed by the Stewart vacuum system. Engine lubrication is by the pressure system, the pressure being automatically controlled in accordance with the load. Chassis lubrication is by the Alemite high pressure grease system.

Ignition is by the battery system, the combined interrupter and distributor being mounted on a vertical shaft at the left hand side directly back of the camshaft gear housing. Auto-Lite starting and lighting systems are employed. A storage battery of U. S. L. make is carried in an accessible position to the driver's seat.

The radiator is the cellular type, the water being circulated by a centrifugal pump mounted forward at the right hand side of the engine. Should this pump fail, the water can be circulated by gravity or thermo-siphon action.

Transmission Separate

An unusual feature of design lies in the fact that the transmission or gearset of the Durant Six is not built in a unit with the engine, but is mounted separately amidships. One advantage claimed for this form of construction is that the clutch can be more easily removed when necessary. The clutch is of the multiple disk type and is provided with means of adjustment. The transmission is of the sliding gear type affording three forward speeds and reverse. Provision is made in the design of the transmission housing for the mounting of a tire pump.

The rear axle is a Timken semi-floating type with third member, and the front is a Timken one section axle of nickel steel. The wheels are mounted on Timken roller bearings. There are both internal and external brakes on the rear wheels.

The frame consists of channel section pressed steel members made from 5/32-in. carbon steel stock. The springs are semi-elliptic all around with the leaves polished and graphited. Wheels are of the wood artillery type and tire equipment consists of 32 by 4½ in. Fisk cord tires, nonskids at the rear.

The bodies are of the streamline reinforced type, upholstered over curled hair and long springs.

Fully equipped the car weighs 3350 lb. It can be turned around in a 42 ft. 8 in. radius.

Franklin Adds Coupe to Closed Car Line

SYRACUSE, Jan. 3—A coupé has been added to the Franklin line of closed cars, which previously consisted of a sedan and a brougham. The new coupé seats four passengers and has been brought out particularly to meet the needs of doctors and women drivers. A good sized parcel box is located to the left of the rear seat, and there is room for luggage in the boot, which is provided with a water-tight lid.

The windshield is of the straight front type, the lower section being fixed and the top section hinged, ventilation being effected through side cowl ventilators. An inside adjustable eye shade takes the place of the usual outside vizor, the object being to avoid the need for getting out of the car for adjusting the vizor. The left door locks from the inside, the right from the outside, with a Yale lock and key. The roof construction is slatted and padded, which has a tendency to deaden noise.

Two New Case Models To Appear This Season

RACINE, WIS., Jan. 3—Two new Case models are to make their appearance for the 1922 season, these being models X and W. Model X will be priced $1,890 for the touring car and $2,790 for the sedan. It has a wheelbase of 122 inches. Continental 7-R engine, bore 3¼ in. and stroke 4½ in. A Rayfield thermostat controls the cooling water. The starting and lighting system is Bijur.

The other model, W, is to sell at $2,380 for the touring car and $3,375 for the sedan.

HAYNES PRODUCING COUPELET

KOKOMO, IND., Jan. 3—The new Haynes, model 55, three passenger coupelet is to be shown for the first time at the New York show. The three passengers ride side by side and there is no staggered seat. The chassis is the standard 55 model, mounted on a 121 in. wheelbase. The body is finished in coach blue and the car is fitted with 33 x 4 in. cord tires.

VELIE HAS OWN ENGINE

MOLINE, ILL., Jan. 3—The Velie Motors Corp. is now in production on the new model 58 which has a 115-in. wheelbase and is equipped with Velie built 6-cylinder engine with overhead valves.

Ryan Heads Company Producing Frontenac

Chevrolet Corporation Reorganized—No Connection With Stutz Motors

NEW YORK, Jan. 3—The new Frontenac car designed by Louis Chevrolet, which will be shown for the first time at the Hotel Commodore next week, will be built by a new company backed by Allan A. Ryan and a syndicate of capitalists. Beyond the fact that Ryan is the dominating figure in the Stutz Motor Car Co. there will be no connection between the two corporations, it is asserted.

Detailed plans for the new company have not yet been worked out but it will be a reorganization of the old Frontenac Motors Co. incorporated some time ago by Chevrolet. Negotiations have been completed for the purchase of a plant in Indianapolis large enough to permit quantity production of the new car, which is described elsewhere in this issue of AUTOMOTIVE INDUSTRIES.

It is understood that the president of the company will be a man widely known in the automotive industry but his identity has not been disclosed. Chevrolet personally will have a prominent place in the organization.

The Frontenac organization will be entirely distinct from that of Stutz but it is possible many of the Stutz dealers may take on a new line in addition to the old. It is planned to begin production in the near future.

The Frontenac car will sell for from $2,000 to $2,200.

Seiberling Cord Tire to Be Exhibited at Show

AKRON, Jan. 3—The new Seiberling cord automobile tire, invented by F. A. Seiberling, will be exhibited at the New York show. The tire is said to be a radical departure from cord tire practice and will be featured by a treadstock running from bead to bead and replacing the old fabric side wall.

Seiberling states this semi-flat tread construction with treadstock side walls will prevent rut wear on the tires and will prevent damage to tires on machines which stand with the tires pressed against a curb. The Seiberling cord will have no mileage guarantee but will sell for only a little above the standard list price.

The tire will be manufactured at the Portage plant at Barberton, recently purchased by Seiberling. Shipments will be started by March 1.

GRAY TO BE AT COMMODORE

DETROIT, Jan. 3—The Gray Motor Corp. will exhibit its new car in the lobby of the Hotel Commodore during the New York automobile show. The car, which has been produced by Frank L. Klingensmith and F. F. Beall, will sell for less than $500.

Opposes Higher Duty on Oils and Asphalt

Senate Committee Told Industry Would Suffer—Tariff Action Urged

WASHINGTON, Jan. 3—Protesting the proposal to increase the duties on oils and asphalt because of its effect on automobile owners, M. O. Eldrege, of the American Automobile Association, told the Senate Finance Committee that higher tariffs would prove costly to American industry.

He estimated that a higher duty on Mexican oil would increase the price of gasoline from 3½ cents to 7 cents per gallon and tax automobile users about $140,000,000 annually in addition to the present heavy internal revenue assessment. It was his contention that a tariff on oil would have a tendency to encourage monopolies in petroleum.

A partial view of the entanglements surrounding the tariff are sufficiently significant to show that its enactment will be delayed indefinitely. This is proving disappointing to manufacturing interests of the country and is assigned as one reason for the calling of the special convention to be held in Washington on Jan. 30-31 by the National Association of Manufacturers.

Immediate Tariff Needed

The association is of the opinion that immediate passage of a tariff of one form or another is more urgent to relieve the nation's manufacturers of their present anxiety and to bring about a stabilization of world business. The manufacturers express the belief that Congressional delay over the tariff is retarding business in many lines.

The Senate Finance Committee has undertaken to revise the House tariff bill after extended hearings. They are cognizant of the need for serious consideration of a marked departure in tariff making as proposed by the President in his annual message.

The first and greatest task of the committee will be to reach a decision as to the plan to be adopted, a question that is the source of heated discussion and much propaganda on the part of proponents and opponents of the American valuation plan. If the plan is not adopted in toto, the flexible system as suggested by the President is expected to be with sentiment favoring the latter, judging from indications.

ASKS INSURANCE RECEIVER

CHICAGO, Jan. 3—Insurance Commissioner Hands of Michigan has asked for the appointment of a receiver for the United States Mutual Automobile of Saginaw on the ground of insolvency. The Mutual has liabilities of $105,000, largely in unpaid loss claims. A 50 per cent assessment was levied in October, but a large part of the membership refused to pay and the unpaid losses kept mounting.

It is also charged that the company wrote business at cut rates and paid extravagant salaries to its officers. These were also officers of the Peninsular Fire of Grand Rapids, which is having trouble with the Michigan department.

Springfield Body Works Planning for Expansion

SPRINGFIELD, MASS., Jan. 3—Production of automobile bodies has entered upon a period of expansion in this district. The Auto Metal Body Corp., building Hupmobile bodies, plans an early enlargement of its plant. The All-Metals Co. is negotiating for a building in which to engage in the systematic manufacture of bodies. Springfield Coach Works has bought the land and buildings on which its factory is located, and in the near future will erect a structure specially adapted to its needs. Smith-Springfield Body Corp. is being operated at its full capacity of 250 employees. This concern is getting an increased number of orders for bodies for foreign cars, a trade lately revived after being interrupted by the war.

New Campbell Foundry Will Double Production

DETROIT, Jan. 3—Campbell, Wyant & Cannon Foundry Co., Muskegon, will open its new plant unit soon after Jan. 1, doubling the production capacity of the present plant and bringing the number of employees to 3000 men. Facilities will be available for the production of 1,250,000 lb. of castings daily.

Arrangements are such that all material coming in raw at one end leave the other as finished castings. All material and product will be handled mechanically.

ALLEN FUTURE IN ABEYANCE

COLUMBUS, Jan. 3—The future of the Allen Motor Co., now in the hands of George A. Archer and William C. Willard as receivers, will be determined at a meeting of creditors to be held in the near future. The receivers have received an offer of $570,000 for the assets of the company, not including cash, accounts receivable and notes receivable. This is the best offer so far received and it is probable that the court will be asked to accept it. If the offer is not accepted the property will be advertised and sold under a judicial order.

STEVENS-DURYEA ADDS BODIES

CHICOPEE FALLS, MASS., Jan. 3—Stevens-Duryea, Inc., is bringing out three new body models, a roadster, a 4-passenger sedan and a 6-passenger sedan. The 4-passenger sedan is semi-collapsible, the rear part being of leather, with a beam ceiling effect inside, and of owner's drive design. The 6-passenger sedan resembles the vestibule limousine, but is built on more compact lines. It is hoped to bring these cars to the production stage this month.

Oregon Places Bus as Public Utility

New Law Regulating Operations Has Support of Legitimate Lines

PORTLAND, Dec. 31—Operation of motor buses and trucks engaged as common carriers in Oregon is placed under the strict direction of the Oregon public service commission, according to a law passed at a special session of the legislature this week. While the law is aimed to protect the public roads and to guard the welfare of the traveling public, it has the support of the legitimate bus lines.

Under the new law the state public service commission will grant franchises for operation of bus lines under the rule of necessity and convenience to the public, holding the power to revoke these franchises in cases in which the bus operators maintain regular service and charge satisfactory rates. The law virtually places the bus lines under the same general restrictions as the railroads.

To Enforce Weight Law

The public service commission has the authority to regulate rates charged by the bus lines, to fix rules and regulations governing their operation and to exercise other general regulatory authority. Among the requirements that probably will be made by the commission will be the filing by the bus lines of tariffs showing their rates, and schedules and annual reports covering finances and data regarding operations. The law will prevent the operation of the fly-by-night bus operator, as bus operation which is other than permanent and continuous will not be allowed, except to care for special emergencies.

In regard to operation of trucks on the public roads the state legislature reached the conclusion that the present scale of weights and speeds as applied to trucks is ample, and that stricter enforcement of the law is necessary. To cover this phase a measure was passed forming a state motor police under the state highway department. This state police will in time replace county speed officers and city motor policemen in the small towns, it is aimed.

A third measure passed by the legislature provides for increasing the tax on retail sales of gasoline from two to three cents, in order to raise $3,000,000 to aid in conducting a world's fair in Portland in 1925.

PACKARD MAY BUILD IN POLAND

BERLIN, Dec. 21 (*By Mail*)—It is reported here that the Packard Motor Car Co. of Detroit intends to erect an automobile factory in the town of Torun, Poland. It is stated a site has been purchased and preliminary work begun. The capital of the Polish company will be $1,000,000.

Road Association Urges Higher Taxes

Also Requests Government to Distribute More Tractors for Highway Work

WASHINGTON, Jan. 3—Further distribution of surplus motor vehicles, especially 5 and 10-ton caterpillar tractors has been requested by the American Association of State Highway Officials, as a result of resolutions passed at their annual meeting at Omaha.

Assurances were given the President and Congress that materials and equipment received from the War Department have been of incalculable service to the States in the prosecution of their programs of highway construction and maintenance and that they have been used for these purposes and for no other, with a resultant saving of untold millions of dollars to the American people. This expression was made as a result of criticism from certain business interests that the materials thus made available for the public use have been generally mismanaged and illegally disposed of by the States.

Owner Willing to Pay

The association also went on record in favor of higher taxes on motor vehicles. It was resolved that the association "urge upon all States the fairness and the necessity of collecting an adequate portion of the cost of highway programs from the users of motor vehicles. This fair share is not only the cost of maintenance of modern highways, but includes also a fair proportion of the cost of new construction, because much of this latter cost is due to the necessity of adequately providing for motor traffic. It was recommended that appeals be made to the individual motorist for his support of a policy of providing for a fair distribution of the cost of highway improvement."

It was stated that in most of the States the owners of motor vehicles are paying an insufficient portion of the cost of the State's highway program, as compared to the portion of the cost raised by taxation on general property, despite the fact that the individual owner is always willing to pay his fair share of such cost.

Suspends Bonus Plan Pending Further Study

NEW YORK, Jan. 2—Pierre S. du Pont, president of General Motors Corp., has issued the following statement regarding the corporation's bonus plan:

In order to reduce the labor turnover and to induce employees of exceptional merit to remain with the corporation for a period of years, a bonus plan was adopted in 1918. The corporation each year proposed to deduct a certain percentage from its net earnings and this amount of money was to be placed in a bonus fund to be invested in stocks of the corporation.

At the end of each year employees of merit were to be awarded stock of the corporation out of this bonus fund. The stock was to be held in trust for a period of five years when it was to be delivered to the employees free and clear. In the interim the employees were to receive the dividends.

The experience gained during the actual operation of the plan indicates that it is desirable to make certain changes. A committee has been appointed to make an exhaustive study thereof but because of the large number of employees affected and the many problems involved, it will not be possible to complete the study for several months.

The operation of the present bonus plan has, therefore, been suspended pending the completion of the study, which will likely result in an amended plan to be adopted during the current year. This amended plan will not affect awards heretofore made to employees under the provisions of the old plan and the rights of these employees will in no way be affected through the suspension thereof.

New World's Record Made for Non- Stop Air Flight

NEW YORK, Jan. 3—A new world's record for a continuous non-stop flight in a heavier than air machine was established at Roosevelt Field near Mineola when Edward Stinson and Lloyd Bertaud remained in the air 26 hours, 19 minutes and 35 seconds in a Larsen all metal monoplane. The flight was made in gales, snow, and a zero temperature. The distance covered was at least 2200 miles. The previous record, made in France, was 24 hours, 19 minutes and two seconds. It was made on a clear day in June after a careful preparation.

J. L. Larsen, owner and designer of the monoplane, stated that it was made in America by American workmen and of American material.

British to Offer Prize for Helicopter Airplane

NEW YORK, Jan. 3—A dispatch from London says that the British Air Ministry proposes to offer a prize of £50,000 for a practical helicopter designed airplane capable of rising vertically and soaring over a given spot.

The machines must be capable of rising to a height of 2,000 feet under their own power, carrying one man and one hour's fuel supply; be able to remain stationary over a ground object for half an hour in any wind up to 20 miles an hour as well as land safely in any wind up to 20 miles an hour without horizontal motion and with the engine shut off.

TERNSTEDT HOLDS DINNER

DETROIT, Jan. 3—Ternstedt Mfg. Co. celebrated its third anniversary by tendering a dinner to its executives and department heads. As emblematic of the growth of the company in the four years of its existence it was pointed out that the number of men participating in the anniversary dinner has increased from fifteen in the first year to 115 this year.

President Paul W. Seiler ascribed the growth of the company to the co-operative spirit actuating the men in authority.

Common Dividend Passed by G. M. C.

Company in Strong Position Despite Losses Written Off, du Pont Says

NEW YORK, Jan. 4—The directors of the General Motors Corp. at their meeting here to-day omitted the dividend upon the common stock due to be declared at this time. The regular quarterly dividends upon the other classes of stock were declared as follows: Six per cent preferred, $1.50 a share; 6 per cent debenture, $1.50 a share; 7 per cent debenture, $1.75. These dividends are all payable on Feb. 1 to stockholders of record at the close of business Jan. 14.

Pierre S. du Pont, president of the corporation, issued a statement following the meeting in which he said:

This action, taken after full discussion and most careful consideration, is believed to be in the best interests of the corporation and is designed not only to strengthen the position of the corporation itself but also to maintain the investment character of its debenture and preferred stocks.

Losses Accepted

The past year demonstrated satisfactorily the large earning capacity of many of the more important divisions of the corporation, the aggregate profits of which even under the adverse conditions that have obtained in the automobile industry, are estimated to have been in excess of the amount required for dividends on the debenture, preferred and common stocks.

On the other hand, substantial losses were made by other divisions due mainly to large inventories carried at high prices in the face of a constantly declining range of prices for the finished product and also to extensive commitments entered into in the earlier part of 1920 for parts and supplies at the high prices then prevailing. Moreover, in closing the books as of Dec. 31, 1921, further charges will be made against surplus to write down inventories to market prices and set up reserves to provide for losses properly chargeable to prior years.

Liabilities Reduced

The corporation is in a strong position financially. Inventories have been greatly reduced, and bills payable which amounted to about $72,000,000 on Dec. 31, 1920, have been reduced to about $49,000,000 as of Dec. 31, 1921, cash on hand in banks amounting to approximately $41,000,000. Accounts payable and other quick liabilities have likewise been reduced, viz from about $42,000,000 to $30,000,000. After writing off all determinable losses and writing down inventories, the ratio of current assets to current liabilities as of Dec. 31, 1921 will be approximately two for one.

The corporation's plants have been maintained in a high state of efficiency. Substantial economies have been effected in many directions and others are in contemplation, and most satisfactory progress has been made in improving the character and raising the standard of the corporation's product to the end that it will be enabled effectively to meet competitive conditions and maintain its position in the trade.

Marmon Makes New Price Reduction

Total Revisions Effective During Year Range from $1,300 to $1,500

INDIANAPOLIS, Jan. 5—Another revision of prices is announced by the Nordyke & Marmon Co., on the entire line of Marmon cars. The prices, effective Jan. 3, are:

	Old Price	New Price
4 passenger Roadster...	$3,985	$3,700
4 passenger Touring car	3,985	3,700
7 passenger Touring car	3,985	3,700
7 passenger Sedan.....	5,425	5,150
4 passenger Coupe.....	4,875	4,700
Speedster	4,185	3,900
Suburban	5,425	5,300

The new reductions represent total cuts ranging from $1,300 to $1,500 within a year.

Hanson Announces Cut on Open and Closed Cars

ATLANTA, GA., Jan. 3—Price reductions of $200 on all open cars and $300 on all closed cars, effective Jan. 1, are announced by the Hanson Motor Co. The prices are:

	Old Price	New Price
2 passenger touring.....	$1,795	$1,595
5 passenger touring.....	1,795	1,595
7 passenger touring.....	1,995	1,795
4 passenger coupe.....	2,775	2,475
Sedan	2,885	2,585

Models of the Hanson "little six" which will be displayed at the New York and Chicago shows has been completed. The price will be $995.

STEWART PRICES DROP

BUFFALO, Jan. 3—The Stewart Motor Corp. has reduced the prices of its various models. The schedule follows:

Model	Old Price	New Price
¾ ton.....	$1,395	$1,195
1 ton.....	1,875	1,395
1½ ton.....	2,200	1,790
2 ton.....	2,800	2,090
2½ ton.....	2,950	2,290
3½ ton.....	3,850	3,090

HANDLEY-KNIGHT REDUCED

KALAMAZOO, Jan. 3—Price reductions are announced by the Handley-Knight Co. They are:

	Old Price	New Price
Touring car.....	$2,850	$2,450
Coupe	4,150	3,750
Sedan	4,150	3,750

Two new models have been added to the line. They are a sedan-coupé selling at $3,750 and a five-passenger touring car selling at $2,250.

DENBY MAKES CHANGES

DETROIT, Jan. 3—Effective Jan. 1, another reduction in prices was made by the Denby Motor Truck Co. The prices follow:

Model	Old Price	New Price
¾-1¼ ton.....	$1,625	$1,485
1½-2 ton.....	2,300	2,145
2 ton.....	2,600	2,395
2½-3 ton.....		2,795
4 ton.....	4,200	3,895
5 ton.....	4,850	4,295
7 ton.....	5,500	4,945

These reductions, together with those made July 1 last, bring Denby trucks back to pre-war prices.

MAXWELL TRUCK DOWN $400

DETROIT, Jan. 4—The Maxwell Motor Corp. has reduced the price of its 1½-ton truck by $400 on all models. The range now is from $932 on the chassis to $1,385.50 on fully equipped models.

SAXON LISTS REVISED

DETROIT, Jan. 4—The Saxon Motor Car Co. announces that it has reduced prices on its open and closed models. They are:

	Old Price	New Price
Runabout	$1,295	$1,195
Touring car.....	1,295	1,195
Coupe	1,995	1,795
Sedan	1,995	1,795

DAVIS INCREASES $100

RICHMOND, IND., Jan. 4—The George W. Davis Motor Car Co. has increased the price of its touring car from $1,695 to $1,795.

ELGIN REVISES PRICES

ARGO, ILL., Jan. 5—The Elgin Motor Car Co. announces new prices effective immediately. They are as follows:

	Old Price	New Price
5 passenger touring car..	$1,495	$1,295
4 passenger scout.....	1,595	1,345
2 passenger roadster.....	1,595	1,345
5 passenger sedan.....	2,395	2,195
4 passenger coupe.....	2,395	2,195

R. & V. REDUCES 20 PER CENT

EAST MOLINE, ILL., Jan. 5—Reductions approximating 20 per cent are announced by the R. & V. Knights Motors Co. on its six-cylinder line. The prices are:

Roadster, 5-passenger and 7-passenger touring car, from $3,350 to $2,750.
Four passenger coupe, from $4,000 to $3,350.
Seven passenger sedan, from $4,200 to $3,450.

BIG LAFAYETTE CUT

INDIANAPOLIS, Jan. 5—Sweeping reductions of $760 on the open models and $1,350 on the enclosed models are announced by the R. & V. Knight Motors The open models will now sell at $4,090 as compared with $4,850, and the enclosed at $5,175 as compared with $6,250.

BELGIUM REVISES TARIFF

LONDON, Dec. 24 (*By Mail*)—Belgium, to combat German dumping of automotive products in the country following the recent slump of the mark, has revised her tariff so that motor imports from Germany must pay from 24 to 40 per cent ad valorem. Exporters from other countries wishing to secure the benefit of normal rates of duty must send certificates of origin, duly legalized by the resident Belgian consul.

Akron Enters Year on Firm Footing

Tire Manufacturers in Instances Are Approaching Peak of Production

AKRON, Jan. 3—The rubber tire industry has emerged from the year's slump, has re-established itself upon a reasonably firm footing in the opinion of rubber manufacturers and has started the new year with production on a basis which, if remaining constant throughout the year, will mean the manufacture of close to forty millions of automobile and motor truck tires in 1922.

Tire production in Akron alone, according to an authentic check, now is averaging more than 100,000 tire units a day. This is the highest production point reached by the tire industry in 18 months, and compares favorably with the peak production obtained in the early months of 1920. If normal can be considered 75 per cent of the peak of 1920, then Akron's tire factories are back to normal and in most instances are above normal, with some even approaching the old peak which it had been predicted never again would be reached.

Spring Orders Received

The advent of the new year has brought with it a rush of spring orders from tire dealers and automobile manufacturers which, it is figured, will keep Akron's tire plants running at full blast for at least five months.

There is always a seasonal recession in production to be anticipated after the first spring rush is over, but basing predictions upon present conditions, a tire production for Akron alone in 1922 of at least 30,000 000 tires seems almost assured.

An official check in Akron shows that Akron factories alone turned out between 15,000,000 and 16 000,000 of the total production in the United States of 19,-000,000 for 1921. Akron tire manufacturers report sales for 1921 aggregating more than $3,000,000,000.

Surplus Absorbed

In addition to the manufacture of more than 15,000 000 tires here in 1921, the huge surplus of tires which existed a year ago, has been completely absorbed. Absorption of this surplus has meant the reduction of finished goods inventories in Akron alone to the extent of more than 2,000,000 tires and this in turn has released between $40,000,000 and $50,000-000, hitherto tied up in finished goods with no potential market therefore, to be re-applied to working capital.

Improved transportation facilities have been to some degree responsible for the heavy inventory reductions made. In some instances, finished goods inventories of Akron factories to-day are smaller than the actual number of tires these same companies were forced to keep in transit a year and two years ago.

Lincoln Taxes Due to Federal Blunder

Plant Was Assessed at Full War Cost Despite Law Covering Situation

WASHINGTON, Jan. 3—An unusual instance of blundering by the Government in the realm of taxation is revealed to-day in the decision Wednesday of the collector of internal revenue reducing taxes assessed against the Lincoln Motor Co. from $4,500,000 to less than $500,000.

It was the action of the Government on Nov. 4 last in assessing this tax which forced the Lincoln company into the hands of a receiver. The collapse of several smaller accessory corporations in Michigan and elsewhere, which were creditors of the Lincoln, and of a number of the distributing concerns, formed in other cities to handle the new car, followed immediately. In all it is estimated that business institutions of a total capital value of $12,000,000 were involved.

Plant Built with Government Funds

Now, only a little more than a month later, the Government has decided it was a mistake, and that the major portion of the tax should not have been assessed.

The action of the Government in pressing the tax assessment in November is all the more startling in light of the history of the Lincoln company. The plant was built almost entirely with money advanced by the Government for the purpose of manufacturing Liberty airplane motors. It produced 6500 of these motors before the armistice, when it was just beginning to reach its maximum of production. When the Government no longer needed the plant for its war purpose it was sold to the Lincoln Motor Co., a Delaware corporation.

The sale price represented approximately 55 per cent of cost. The reduced price, of course, was due to the abnormal construction costs prevailing during the war period and the recognized necessity of the material transformation of the property by its purchasers to adapt it to automobile construction.

In effect, the Government came along some time thereafter and assessed the plant for purposes of taxation at its full war cost. It denominated as profit the difference between the original cost and the subsequent 55 per cent sale price and assessed a tax on this profit at the maximum rate of 80 per cent.

Law Covered Case

The 1918 tax law plainly intended to provide for this specific situation. It declared in effect that a manufacturer producing materials exclusively for war purposes was allowed to deduct from his income within three years after the war the loss represented by depreciation from the abnormal war cost of his plant.

At the moment when the tax was levied, in November, officials of the Lincoln company were in New York, where they had about closed negotiations for a loan sufficient to carry the company through until spring, when it was believed that reviving business would enable it to carry itself. The immediate effect of the assessment was to destroy the credit of the company. In the face of it no one would make a loan.

SHOW TO DISCLOSE TWELVE NEW MAKES

NEW YORK, Jan. 3 — Twelve cars never before seen at the New York Automobile Show will be shown this year. Ten of them are home products and two are made abroad. The new American cars are the Ambassador, Bournonville, Durant, Earl, Goodspeed, Handley-Knight, Kelsey, Leach - Biltwell, Rickenbacker and Wills Sainte Claire. The foreign cars are the Itala, an Italian product, and the Vauxhall, which was made in Canada.

Shipments by Rail Show Loss in Third Quarter

WASHINGTON, Jan. 3—Comparison of freight commodity statistics of railroads having an annual operating revenue above $1,000,000 shows a decline of 6,773 carloads and 13,814 net tons of automobiles and motor trucks classified as revenue freight during the third quarter of 1921, ended Sept. 30, as against a similar period of last year.

These figures do not clearly reflect the effect of freight rate increases which became effective Aug. 26, 1920, as the figures for the third quarter of 1920 included only one month of high freight rates. It indicates, however, a tendency to ship motor vehicles on their own power because of the excessive freight charges.

The statistics for the third quarter of 1921 show that 108,942 carloads and 879,771 net tons of automobiles and motor trucks were carried as revenue freight, originating on various roads. Agricultural implements and vehicles other than automotive showed a total loading of 26,129 carloads for the third quarter of 1921, as against 63,657 carloads for the same period last year.

STOCK SENT INVESTORS

MILWAUKEE, Jan. 2—Following issuance of warrants charging larceny as bailee against Orson A. Towle, known as vice-president of the Holmes Air-Cooled Motor Car Corp., Canton, Ohio, the district attorney of Milwaukee County has received telegrams from the company explaining that the stock purchased by the complainants in the cases and other purchasers in Milwaukee has been sent from the corporation's offices. The delay also is explained. Up to this time there has been no service of the warrants for Towle, who left Milwaukee several months ago.

$8,000,000 Offered for Lincoln Plant

If Accepted, Lelands Will Continue in Charge and Receivership Be Lifted

DETROIT, Jan. 3—Lincoln cars will continue to be "Leland built" under the plans of the group which offered $8,000,000 for the Lincoln Motor Co. property in Federal Court here this week. The offer was made by Harold H. Emmons, attorney for the company, who said he was acting for "persons interested in getting the company back on its feet."

The first offer of the group was of $5,000,000 for the unencumbered property of the company and this was increased to $8,000,000 following the fixing of this figure by the court as the upset price. Date of sale was set for Feb. 4. The appraised value of the company is $11,000,000 and its liabilities approximate $10,000,000.

Original Offer $5,000,000

The original offer of $5,000,000 caused such a storm among attorneys representing different classes of shareholders and creditors that Judge Tuttle decided to raise the upset price to $8,000,000.

One attorney asserted the $5,000,000 would pay only half the debt and wipe out the shareholders of the "A" and "B" classes. Another contended that $5,000,000 would pay only about 22 cents on the dollar to creditors. He estimated the liabilities at $9,000,000 and said that when preferred creditors were paid there would remain only about $2,000,000 for the remainder.

If the group, represented by himself, is successful in acquiring the property, Emmons said, the Lelands will be continued in the active management of the company. Speedy lifting of the receivership and the continuance of manufacturing by the company is important to keep the sales organization intact, he said. With the company again in control, the impression is that an early revision in prices may be expected which would place the Lincoln in a much more active selling class.

The slash in assets made by the appraisers has had the highly desirable effect of placing the company on a strictly present day valuation basis.

Officials of the Treasury Department at Washington will be asked by the receiver to consider the writing off of the $500,000 balance remaining on the original $4,500,000 claimed for unpaid taxes. This will not be a formal appeal from the decision reducing the claim to $500,000 but the writing off will be presented as greatly facilitating the recovery of the company. Stockholders and creditors considered the offer of $8,000,000 for the company made by Emmons at an informal meeting to-day, with a view to determining their attitude on the proposed purchase. There is a likelihood of another bid being entered from this quarter.

Factories Operate on a Sales Basis

With Most Plants Production Was at Standstill During December

DETROIT, Jan. 4.—Production in December, except for a few factories, was practically at a standstill, though a number of factories kept on a sales basis in the early part of the month. This activity gradually dwindled as the holidays approached, so that from the 20th on there was almost a complete cessation of production in all plants.

Ford Motor Co., prior to closing for inventory, on the 21st, had been running along replenishing parts stocks with minor activity in assembling. Sales for the month will approximate 50,000 cars.

Maxwell has continued steadily in the manufacture of its new model, turning out about from 100 to 150 daily throughout the month except for a few days of inventory taking. Preparations were made to get into production early in January on the new Chalmers, models of which will be shown for the first time at New York.

Dodge Brothers, while assembling and shipping 100 to 150 cars a day, was making parts for about 450 vehicles daily in anticipation of a strong early spring demand. Dealer stocks are low, shipments having been held by the company to a sales basis. The fact that stocking has not been done has been responsible in large part for the report that an early cut of Dodge Brothers prices may be expected.

Buick, working on about a half time basis throughout the month, has been the most active of General Motors units.

Cadillac production and shipments fell off early in the month.

Chevrolet has maintained an active front, and **Oakland** and **Oldsmobile** have been moving along slowly.

Studebaker, after closing for inventory early in the month, has been gradually working back to a production point which is expected to reach early in 1922 the record breaking proportions of 1921.

Hudson and **Essex** have been working along on about a half time basis for the month and with new prices on all lines now effective are tuning up for heavy production following the shows.

Reo has been operating on a sales basis throughout the latter part of the year, December operations being on about a 50 per cent basis, speed-wagon business has shown consistent gains and with the addition of the special taxicab model to its line, the company looks for another stable business producer.

Earl Motors, Inc., under the impetus of its new models and widely strengthened dealer organization, maintained a steady production schedule throughout the month and will increase this during January.

Hupp, Paige, Liberty, Dort, Columbia and **Saxon** have been operating on part time on a sales basis only, but steadily strengthening their dealer organizations in anticipation of early 1922 business.

Packard reports both car and truck business in December as in excess of November and considerably in excess of business in December, 1920.

Wills Sainte Claire, Handley Knight and **Roamer**, in the higher price class, have moved along slowly during the month, but report a share in the general business consistent with the time of the year.

1922 *PREDICTED YEAR OF GROWTH*

By Charles Clifton, President, National Automobile Chamber of Commerce

NEW YORK, Jan. 4—Nineteen hundred and twenty-two will be a year of growth. The production of 1921 probably will not be exceeded in 1922; but this is only one particular in the scope of motor transportation.

More attention will be paid to the needs of the individual owner. The repair parts business of the factories will be better organized. Governmental and other agencies will carry on studies of transportation costs which will affect owner economies. Road development will give the motorist more value per vehicle. The export market will be better. In fact, if the allied debt is refunded, foreign trade will be measurably improved as the exchange rate will then readjust differences in currencies on a basis of comparative purchasing power

Many companies are giving and have given splendid service to their owners, but for the industry as a whole there is great opportunity for growth. It is a complex situation to deal with, because good service to the owner is a matter of personal contact with the local man in the field. Fortunately, time is gradually eliminating those local shops which have not served the customer well. Time also is giving the local man a chance to know what the motorist wants. Nineteen hundred and twenty-two will give many factories an opportunity to study their service situations throughout the country and to aid their local dealers in giving satisfaction to the car owner.

NASH GIVES ENGINE FOR STUDY

MILWAUKEE, Jan. 2—The Nash Motors Co., four-cylinder car division, has presented the college of engineering of Marquette University in this city with a Nash four-cylinder engine and transmission for installation in its laboratory of mechanical devices for practical use and study.

Clarence A. Pfeffer Resigns from Saxon

Affairs of Company Will Be in Charge of Vice-President Temporarily

DETROIT, Jan. 4—The resignation of Clarence A. Pfeffer as president of the Saxon Motor Car Co. has been accepted by the board of directors. Until a successor is chosen the affairs of the company will be in charge of Harry L. Bill, vice-president and general manager. It is understood that the directors have practically decided upon the man who will take over the destinies of the company and he is said to be thoroughly experienced in financial affairs. The company will undergo several constructive changes under the new administration, it is declared.

The resignation of Pfeffer brings to an end three years of service for the reorganized Saxon company. For the present he will act as a business consultant, specializing in the automotive industry.

It has been understood that the Saxon company would be one of about 20 corporations taken over by the Associated Motor Industries, a Delaware corporation, which has acquired the assets of the Jackson Motors Corp.

Japan Manifesting Greater Interest in Small Tractors

LOS ANGELES, Jan. 4—The tractor is beginning to attract greater attention in Japan, although the market is by no means an attractive one. The increasing interest was manifested at the recent tractor demonstration conducted by the Department of Agriculture and Commerce of Japan at the government experiment station at Takinogawa, on the outskirts of Tokio.

All importers and dealers holding foreign tractor agencies in Japan competed at the demonstration. Each tractor was required to turn up a specified amount of ground. No results were announced, as is usual in the Japanese government tests, but it is known that the government officials showed more interest in the performance of the smaller tractors and cultivators than in the larger sizes of either.

EARL MOTORS NOT AFFECTED

JACKSON, MICH., Jan. 3—Clarence A. Earl, declared to-day that Earl Motors, Inc., is not affected in any way by the difficulties of the Fort Dearborn banks in Chicago. He stated the company is free from all entanglements and declared that the resignation of John Fletcher, vice-president of the Fort Dearborn bank, as treasurer of Earl Motors, effective Dec. 31, was only incidental to the troubles of the bank as Fletcher desires to devote his entire attention to his banking interests.

Program Completed for S. A. E. Meeting

Twenty-two Papers Will Be Presented at Three Days' Session

NEW YORK, Jan. 3—Twenty-two papers will be presented at the technical sessions of the Society of Automotive Engineers incident to its annual meeting in the Engineering Societies Building Jan. 10 to 13.

The session Wednesday morning, Jan. 11 promises to be one of the most interesting and important of the meeting, H. C. Dickinson delivering a short talk on automotive research in 1922. His remarks will be followed by several brief papers by engineers prominent in aviation, automobile, tractor, motor boat and stationary engine fields. These speakers will endeavor to predict the progress in 1922 in their respective fields. President David Beecroft will terminate the session with a talk bearing on the status of the automotive engineer in the economics of his industry.

To Discuss Air-Cooled Engines

Charles Lawrence will present a paper at the aeronautic session Tuesday evening when discussion will be devoted entirely to the development of air-cooled engines for aircraft.

Harmony in upholstery will be covered in a paper by R. S. Quaintance at the session the following afternoon; George E. Goddard will present a paper containing recommendations for body seating dimensions, and L. V. Pulsifer will treat of the application of body paints and varnishes. The California top will be discussed by P. W. Steinbeck.

On the same afternoon the motor truck transportation session will be held when consideration of the possibilities of the motor bus will take up a major part of the time. Walter Jackson will lead the discussion on this subject. The economics of motor truck transport will be treated by M. C. Horine. At the lubricating session, to be held simultaneously, W. H. Herschel of the Bureau of Standards will speak on viscosity and friction; Neil MacCoull of the Texas Co. will take up the relation between fluid friction and transmission efficiency, and Prof. Robert Wilson of the Massachusetts Institute of Technology, and Daniel P. Barnard will present a joint paper on the mechanism of lubrication, as the result of extensive research.

Harry Ricardo to Speak

The paper of Harry Ricardo of Great Britain, to be given at the Thursday morning session will cover many phases of automotive engineering, most of them confined to the power plant. At the fuel and engine session in the afternoon, Thomas Midgley, Jr., and T. A. Boyd will compare the past methods of measuring detonation. O. C. Berry and C. S. Kegerreis will outline the results of tests made at Purdue University on the vaporization of petroleum fuels and factors affecting exhaust temperatures. Midgley and W. K. Gilkie will supplement the material contained in the preprint of their paper on spectroscopy with actual data which have been collected by them from recent tests.

G. R. Norton will describe a new forging process at the materials session on Thursday afternoon. The steady improvement in the uniformity and reliability of malleable iron castings will be the topic of a paper by Enrique Touceda. C. N. Dawe will speak on the application of chrome molybdenum steel to automotive construction from the consumers' standpoint, and J. H. Nelson will make recommendations regarding practice in drop forgings.

J. E. Schipper and S. von Ammon will present papers at the passenger car session to be held Friday, which will be devoted to the treatment of motor car brakes. At the same session Prof. Augustus Trowbridge of Princeton University will describe an indicating device and its applications in engine testing.

NOVEMBER OUTPUT AGGREGATED 106,043

NEW YORK, Jan. 4—Production of passenger automobiles in the United States for November was 106,043. Truck production was approximately 10,000. The month's total of 116,043 showed a decline of 30,893 from October.

Morris Syndicate Buys Harley Co. for $1,100,000

SPRINGFIELD, MASS., Jan. 4—Transfer of the Harley Co. from the Hendee Mfg. Co. to a syndicate headed by A. W. Morris, formerly production manager of the Harley Co., has been completed. The sum of $1,100,000 was involved. Associated with Morris are R. E. Northway of Boston, who recently retired as vice-president and director of Northway Motors Corp., Charles H. Burr of Philadelphia and J. A. Young of Fredonia, N. Y.

Morris has accepted the presidency of the new company and will install his high pressure die casting process used successfully during the war for casting all metals. In addition to casting work, the company will handle a variety of drop forgings up to medium size crank and camshafts. In addition to its own plant it has a close connection with a company in Bridgeport, Conn., which has a large machine shop and will be in a position to finish automotive parts or complete assemblies.

The new company will have headquarters at the Commodore Hotel during show week and will be represented there by Morris, Northway and J. A. Young, formerly eastern representative of the Sheldon Axle Co.

November Exports of Tires Increased

Foreign Shipments for 11 Months of Year Totaled $14,562,890 —United Kingdom Led

WASHINGTON, Jan 3—A material improvement was shown during the month of November in the foreign sales of American made automobile tires, the total for the month having reached $1,677,678, as compared with $1,447,268 in October, according to a statement of Bureau of Foreign and Domestic Commerce.

The leading countries figuring in the November totals were the United Kingdom, Mexico, New Zealand, Cuba, Philippine Islands, Argentina, Sweden, South Africa, British West Indies, Spain, Denmark and Panama, in the order that they are named.

The total was divided as follows: Casings, $1,474,065; inner tubes, $115,411 and solid tires, $88,211. Details of the shipments are as follows:

Belgium	574
Denmark	24,694
France	13,940
Italy	.....
Netherlands	17,781
Norway	8,694
Spain	25,484
Sweden	52,493
Switzerland	6,737
United Kingdom	710,899
Canada	15,379
Panama	18,531
Mexico	172,898
British West Indies	31,666
Cuba	62,097
Argentina	53,024
Brazil	5,472
Chile	6,827
Peru	12,383
Uruguay	12,295
Venezuela	11,323
China	7,027
British India	17,839
Straits Settlements	8,061
Dutch East Indies	3,300
Japan	28,466
Australia	16,388
New Zealand	78,459
Philippine Islands	55,099
British West Africa	12,702
British South Africa	39,313
Other countries	147,833

Tire exports for the eleven months of 1921, ending Nov. 30, totaled $14,562,890.

CALIFORNIA SALES INCREASE

LOS ANGELES, Jan. 4—New automobiles sold in the eleven counties of southern California from Jan. 1 to Nov. 30, 1921, totaled 51,226 as compared with 43,148 in the same period of 1920. Los Angeles County absorbed 35,850 of the total. Sales of motor trucks in the same territory for the same period totaled 5646, of which 2794 were sold in Los Angeles County. Ford sales of passenger cars in southern California totaled 22,911. The other sales leaders in order were Chevrolet, Studebaker, Dodge, Buick, Overland and Oldsmobile.

FINANCIAL NOTES

General Tire & Rubber Co. during the past year, according to its annual statement, wiped out a bank indebtedness of $1,400,000 and at the close of the year reported current assets of $1,846,969, including $182,015 in cash and an inventory appraised at $465,191. Fixed assets of the company total $566,864. Total assets are $2,460,189. The company lists $329,686 in notes and $868,569 in accounts receivable and accounts payable of $94,000. Production has been increased to 1500 tires a day, its general sales for 1921 exceeding $6,000,000 in money value, while in tire units they exceeded those of 1920 by more than 50 per cent.

Moline Plow Co. reorganization committee states in a letter to creditors and security holders that $3,612,000 of the $4,000,000 serial notes outstanding have been deposited under the plan and others are coming daily. All bank creditors have accepted the plan and the assent of the merchandise creditors is expected at an early date. Of the 75,000 shares of old first preferred stock 67,463 shares have been deposited, also 14,901 shares of the 15,000 shares of second preferred stock and 13,818 shares of the 18,000 common stock. Common stock deposited does not include that held by Willys-Overland interests.

Spicer Mfg. Co. for the twelve months ended Dec. 31, 1921, will show a slight profit after interest charges, but before depreciation. For the year ended Dec. 31, 1920, earnings were $646,022 on the $3,000,000 8 per cent preferred and $7,375,000 common. Inventory position is better than for some time past. All raw materials and supplies are carried at cost or market, whichever is lower, and the policy is to purchase as current needs present themselves. The company expects to be operating at 80 per cent by March of this year.

Earl Motors, Inc., and subsidiary companies consolidated balance sheet giving effect as of Aug. 31, 1921, to the proceeds of the recent sale of $2,500,000 7½ per cent debentures and 200,000 shares of common stock shows inventories, $2,390,683; notes and account receivable, $343,997; cash, $834,166, and deferred charges, $356,877, among the assets. The liabilities include notes payable, $377,191; accounts payable, $566,578; dealers' deposits, $41,001, and provision for price adjustment, $50,000.

Pierce-Arrow Motor Car Co. earned a small profit in October and November this year after operating at a loss since September, 1920. Business fell off somewhat this month, but probably not sufficiently to wipe out earnings in the two preceding months, indicating a slight profit for the current quarter. In the three months ended Sept. 30, 1921, a deficit of $2,110,000 was reported. With the loss of $1,890,000 in the first half deficit for nine months aggregated $4,000,000.

Kelly-Springfield Tire Co. directors have decided to pass the regular quarterly dividend of 3 per cent, payable in stock. The last cash quarterly dividend paid on the common issue was $1 in February, 1921. The unsatisfactory earnings of the year are the result of the cost of starting the new plant at Cumberland, Md., and the adjustments of tire prices. It is understood that sales last week were the largest in the history of the company.

Republic Rubber Corp., through Receiver Booth, has been authorized by the Federal court to issue $1,000,000 of receiver's certificates. It is understood banks have agreed to take the issue. The financing is for the purpose of continuing operations and creditors have concurred in the action.

Kalamazoo Motors Corp. has issued $250,000 7 per cent gold bonds to mature in five years and salable at any interest bearing date at 103 and accrued interest. The First National Bank of Kalamazoo is trustee of the issue.

American Bosch Magneto Corp. shows current liabilities Oct. 31, 1921, of $475,000 and cash and receivables $1,400,000.

Kelsey Wheel Co. has declared a regular quarterly dividend of $1.75 on the preferred stock payable Feb. 1.

Greater Output and Sales Seen by Cleveland Industry

CLEVELAND, Jan. 3—Cleveland automobile manufacturers, with no exception, look to 1922 to bring an increase both in production and sales.

Bankers here take the same view, also predicting that general business conditions will improve during the year.

Local automobile manufacturers enter the year on foundations that all admit are much stronger than those on which they started 1921.

In the first place, the makers are down to a strict economy basis. All have made big savings on labor and shop overhead. Arrangements have been re-arranged to lower the cost of handling materials and to reduce factory distribution costs. Moreover, the manufacturers have planned new models, price reductions and improved cars as mediums for attracting more business.

Omits Liability Release in New Bill of Lading

NEW YORK, Jan. 4—The new form of domestic bill of lading prescribed by the Interstate Commerce Commission omits the paragraph in the present bill of lading which tends to release carriers from liability for loss or damage to shipments on open cars. This is a point for which the National Automobile Chamber of Commerce contended in the bill of lading proceedings by giving testimony of the extent of open car shipments of motor vehicles and the inability of carriers to furnish automobile cars.

The traffic committee of the N. A. C. C. has filed with the Interstate Commerce Commission a request to be heard on the subject of freight rate revision.

WILL DISCUSS SHORT HAUL

NEW YORK, Jan. 3—A. J. Brosseau, president of the International Motor Truck Co., will be the principal speaker at a meeting of the Shipping Conference of Greater New York at the headquarters of the Merchants Association at 2:30 p. m., Jan. 10. His subject will be "The Short Haul," and he will outline some of the advantages of the motor truck in this connection. Traffic managers of all the large shipping companies in New York will be present and W. J. L. Banham, general traffic manager of the Otis Elevator Co., will be chairman of the meeting.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During the past week the money market was characterized by a small volume of transactions and general quietness in trading. The rate quoted for call money was 4½ per cent to 6 per cent as compared with 5 per cent to 6 per cent in the previous week. The quotations for fixed-date maturities from 60 days to 6 months remained unchanged at 5 per cent to 5¼ per cent, while prime commercial paper also remained unchanged at 5 per cent to 5¼ per cent.

Two notable features of development in the Federal Reserve banking field during the past year have been the large increase of gold reserves, over $810,000,000, since Dec. 30, 1920, and the reduction by over 25 per cent in the volume of Federal Reserve note circulation. The Federal Reserve statement as of Dec. 28, 1921, showed a decrease of $1,394,000 in gold reserves from the figure of the previous week, and an increase of $534,000 in other cash reserves.

As a net result of these changes the total reserves decreased $860,000. Total earning assets decreased $27,422,000 as a result of the following changes: A decrease of $57,155,000 in total bills on hand; an increase of $8,388,000 in United States bonds and notes, and an increase of $21,345,000 in all other notes except Pittman one-year certificates. The total amount of Federal Reserve notes in circulation decreased $4,063,000, and total deposits decreased $20,226,000. The reserve ratio increased from 70.7 per cent to 71.1 per cent.

The total reserves of the New York institution increased $9,925,000, while total bills on hand showed a reduction of $37,827,000. Total earning assets declined $18,849,000, and total deposits $6,881,000. Federal Reserve notes in circulation decreased $3,242,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 79.5 per cent to 80.8 per cent, while the ratio of gold reserves to Federal Reserve notes in circulation, after setting aside 35 per cent against deposit liabilities, increased from 127.7 per cent to 130.2 per cent.

CLIMBER TO INCREASE OUTPUT

LITTLE ROCK, Jan. 3—H. F. Buhler, president of the Climber Motor Corp., states that plans are being perfected to increase production at the factory, and that possibly a branch or two will be established for the manufacture of cars. He says that the prospects for 1922 are very encouraging, with indications of a fairly good export business.

The factory was in operation throughout 1921, but the output was limited because of the depression. However, the year resulted in earnings being made, due to the cutting down of forces, the practicing of economy in every department and the reduction of overhead expense in every way possible.

INDUSTRIAL NOTES

Velie Motors Corp., Moline, Ill., opened the year with 500 men employed and a production schedule of 500 cars monthly, this to be increased to 800 in the spring. General manager F. E. Bradfield states that the orders on hand call for 1,600 cars. During the fall the company added enamel, windshield and clutch departments. With the recent addition of a motor factory at Marion, Ind., the company is able to produce cars entirely within its own plant, or affiliated plants in Moline, this keeping overhead to the minimum and saving time and labor.

Century-Plainfield Tire Co. and Rubber Insulated Metals Co., Plainfield, N. J., have been disposed of at public sale to Mrs. Agnes Dana of Bernardsville, a creditor and large stockholder, for $100,000. The Chancery Court decree under which the sale was held was $536,000, representing mortgages and other claims against land and buildings. The companies were formed during the war and at one time employed 1,000 men. This year a receiver was named and an attempt at reorganization was made.

Westmore Mechanical Laboratory Co., Milwaukee, organized in 1915 by Charles P. Wetmore, president and P. B. Rogers, secretary, is again actively engaged in engineering and manufacturing work, devoting its efforts to the developing of mechanical devices and in the perfecting of manufacturing methods, including jigs, fixtures and tool work. The company is manufacturing several articles for companies in which it has also become a stockholder.

C. G. Spring Co., Kalamazoo, has been closed down for the last ten days to allow facilities for a greatly increased production schedule. A large force is completely rearranging the bumper unit, providing for the most economical handling of production. Resumption of operations will be made at the earliest possible date. It is reported that the company has sufficient orders to keep it operating steadily until April.

Chandler Motor Co. during the past year shipped approximately 5,000 cars compared with 23,832 in 1920 and 18,476 in 1919. It is stated that retail sales to the public, however, have reached about 65 per cent of the record years of 1919 and 1920. At the beginning of 1921 dealers had in the neighborhood of 6,000 cars on hand whereas today, it is reported, the same dealers have hardly one car apiece on hand.

International Harvester Co. has gradually added machinists to the forces at its Akron plant and has advertised for former employees to communicate with it, with the purpose of making ready for increased business. It is believed that the daily output will be close to 50 tractors a day early in the year. During the latter part of 1921 the company made every effort to work down completed inventory.

Goodyear Tire & Rubber Co., in a New Year message to its dealers, states that despite difficulties during the past year it would be apparent when the books were closed on Dec. 31 that it would have sold more goods through dealers than in any previous year.

Cole Motor Co. reports that October shipments for 1921 exceeded those for the same period in 1920 by 100 per cent; November, the same period in 1920, 200 per cent; December, 500 per cent and that 1920 was the second biggest year in the history of the company.

Gall Auto Specialty Co., Denver, has been appointed distributor of the Timken-Detroit Axle Co. It is also distributor for Continental motors and parts, Borg & Beck clutches, Spicer universal joints, Bosch magnetos and Zenith carbureters.

Fulto Auto Body Co., Atlanta, has opened its new plant manufacturing custom made bodies and sport bodies for the Ford chassis. The company is headed by Charles Drager and sells mainly through dealers in the southeastern territory.

Double Fabric Tire Co., Auburn, Ind., is operating on full time, increasing its working schedule from two eight-hour shifts a day to a ten-hour day shift and a ten-hour night shift.

Frank Held Tractor Co., which has been in active operation in Columbus, Ohio, for a year, has acquired additional plant facilities for the manufacture of a tractor which is especially designed for the truck gardener.

Sundby Battery Co. of Milwaukee has been incorporated with an authorized capital stock of $500,000 to manufacture storage batteries and similiar automotive specialties.

MacDonald Steam Automotor Car Co., Garfield, Ohio, is planning additions to its plant to permit of a production of 1,000 cars this year.

Car Registration Gain 43,662 in Wisconsin

MILWAUKEE, Jan. 3—Passenger car registrations in Wisconsin in 1921 showed a net gain of 43,662 over those in 1920, while motor trucks gained 5100 and there was a loss of 1567 in motorcycles. There were 176 more dealers licensed in 1921 than in the previous year. At the close of business, the Secretary of State at Madison showed a total registration of 320,755 passenger cars; 21,305 trucks; 6435 motorcycles and 2122 dealers. All Wisconsin licenses are annual and expire Dec. 31 each year, regardless of the time of year issued.

The 1921 increase of 43,662 in the number of passenger cars registered was exceeded twice before. In 1920 there were registered exactly 53,000 more passenger cars than in 1919. In 1917, a gain of 48,886 cars over 1916 was established.

Pennsylvania Shatters Registration Records

HARRISBURG, Jan. 3—Registration of motor vehicles in the State during 1921 broke all records. During the year 110,706 more passenger cars were registered than in 1920 and the total revenue was almost $1,400,000 greater.

A comparison of automobile license registration figures follows: In 1921—Passenger cars, 632,541; motor trucks, 57,048; motorcycles, 21,111. In 1920—Passenger cars, 521,835; motor trucks, 48,329; motorcycles, 23,981.

FAVOR ROAD REFERENDUM

TRENTON, Jan 3—Republican members of the New Jersey legislature have decided to recommend the passage of the bill which would place before the people of the state next fall a referendum on a bond issue for $50,000,000 for an improved system of state highways.

Cooperative Move Opens Bus Terminal

Portland System Covers 21 Cities —Operated Under Regular Schedule

PORTLAND, Jan. 3—Portland's new automobile bus depot, in the heart of the city and one of the busiest and most complete depots of the kind in the country, was opened for use last week, and now is running full swing. The depot is owned by a corporation formed by bus line owners, and represents the fruits of a co-operative movement on the part of the operators.

Although the present schedule of operations from the bus depot is declared to be merely a beginning, there are already over 100 different buses leaving the terminal daily, many of them making two or three trips. Under the schedule bus lines are operating to every city of any importance within a radius of 100 miles from Portland.

The terminal resembles a railroad depot, with waiting rooms, ticket office, announcer, etc. At the rear of the building is a covered platform with drive-in from the street, where the buses load or unload. Under the arrangement the patrons remain in the waiting room until the bus drives up to the platform. The bus is then announced and the patrons pass through the door and take their seats, just as they would in a train. Regular time tables are maintained.

There will be no such thing as making patrons wait for a later scheduled stage in case the car which they hoped to take is filled before they secure seats, it is announced. Several stages will be kept in reserve at all times, and in case the regular stage is not sufficient to carry all who have secured tickets a reserve stage or stages will be brought up.

Under the present schedule, which will probably be enlarged as the terminal expands, 150 departures in 21 different directions are provided. This gives many of the closer towns hourly bus service, while the more distant points are served by two buses a day.

Two Races Scheduled for French Grand Prix

PARIS, Dec. 23 (*By Mail*)—Strasbourg has been selected as the scene of the French Grand Prix races on July 15 and 16. There will be two distinct events, the first one being for racing cars of not more than 122 cubic inch piston displacement, with a minimum weight of 1433 pounds, and the second one for fast touring cars with a minimum weight of 3086 pounds, which will be given a supply of gasoline and oil equivalent to 13.7 miles per gallon.

German cars will be seen for the first time in a big European road race next September, when the European 183 cubic inch Grand Prix will be run over a short course near Milan, Italy.

MEN OF THE INDUSTRY

Captain Robert W. A. Brewer, consulting engineer, of New York, who previous to the war resided in London and who during the war was an inspector of motor apparatus in New York for Great Britain, has been awarded the Bessemer premium of the Society of Engineers, one of the oldest engineering societies. This award is in recognition of his engineering work in America during the war, some of which was described in a paper which he read in London in March, 1921. The paper dealt principally with the manufacture of thermionic valves for radio telephones for airplanes, which were constructed in large numbers under his supervision. Ten years ago he received similar recognition for his work on "two stroke cycle engines" and in 1907 was awarded the gold medal of the society for his work in connection with the use of "liquid fuel for internal combustion engines."

Roy McNamara, widely known as a road engineer and automotive expert, has joined the staff of the Rickenbacker Motor Co. as experimental engineer. For several years McNamara acted as experimental engineer for the Maxwell and Chalmers companies. He is credited with having crossed the continent thirteen times in a motor vehicle and is said to have a total road mileage of nearly 1,000,000 miles. Although he never sought racing honors, he has taken part in many endurance contests.

N. W. Cummins, who entered the service of the Miller Lock Co. Sept. 1, 1921, as head of the automotive department, has been made a vice-president of the company in charge of automotive equipment. He received his early training with the E. J. Manville Machine Co., and until he joined the Burns & Bassick Co. to develop a line of automotive products was associated with the Scoville Mfg. Co., the Keystone Watch Case Co., and the Bowen Products Corp. He was a vice-president and director of the Bassick company.

Frank L. Campbell has been appointed sales manager of the United States Chain & Forging Co. of Pittsburgh, succeeding C. M. Power, resigned. He was formerly associated with the Beaver board companies of Buffalo and prior to that was connected with the Cambria Steel Co. and John Lucas & Co., Inc., Philadelphia.

J. J. Kennedy, for the past five years with the Champion Spark Plug Co., in charge of New England sales, has resigned to accept the position as sales manager of Bell Manufacturing Co., Boston, which will market a high grade timer for Ford cars. Kennedy has been associated with the automotive industry since 1907.

L. E. Averill has resigned as safety engineer of the Saginaw Products Co. to take charge of safety work for the Oakland Motor Car Co. **E. F. Vogt,** personnel director of the Saginaw company, has been named his successor.

Ray C. Chidester has resigned as manager of the Milwaukee branch of the Packard Motor Car Co. to assume management of Chidester-Frint, Inc., that city, distributer of the Durant in Wisconsin and upper Michigar

William C. Young, assistant manager of aeronautical sales of the Goodyear Tire & Rubber Co., has been appointed manager, succeeding Willard P. Seiberling, who has resigned to join the new Seiberling Rubber Co.

Claude Sauzedde has joined the Maxwell-Chalmers staff as designing engineer. He was formerly a designer with Dodge Brothers and previously was connected with the first general staff of General Motors Corp.

H. W. Scholl has been appointed sales manager of the Philbrin Corp., Kennett Square, Pa. He was formerly connected with the Splitdorf Magneto Co. as salesman, export sales manager and sales manager.

F. C. Allen of the export department of the Firestone Tire & Rubber Co. is contemplating an extensive trip abroad, visiting the principal markets outside of Europe and South America.

W. C. Starkey has resigned as chief engineer of the Ohio Brass Co., Mansfield, to become vice-president and directing engineer of the Stevenson Gear Co., Indianapolis.

Roland Rohlfs, American pilot and holder of several aeronautic world's records, has joined the Aeromarine Airways, commercial aviation organization.

CANADIAN PRODUCTS REOPENS AFTER TAKING OF INVENTORY

DETROIT, Jan. 5—The Canadian products division of General Motors of Canada, Ltd., has resumed operations in its plant at Walkerville on an increased scale after being closed one week for inventory. It has been operated continuously for the past year, employing from 600 to 1000 men manufacturing motors and axles for Buick, Oldsmobile and Chevrolet cars. The expansion of operations is due to the new policy of General Motors to manufacture in Canada all cars of these lines which are sold in the export trade.

FORD SITE FOR WATER POWER

DETROIT, Jan. 5—Ford Motor Car Co. will begin in the spring the development of water power on the Menominee River, south of Iron Mountain. The site owned by Ford is said to be one of the best on the river.

CHAMPION PLANS SPEEDOMETER

DETROIT, Jan. 5—The Champion Ignition Co. soon will begin the manufacture of a speedometer which will require a large addition to the present plant at Flint.

MOTOR TRANSPORT TRAINS

LONDON, Dec. 24 (*By Mail*)—The proximity of the Manchester manufacturing center to the great seaport of Liverpool has led to such a rapid development of motor transport in Lancashire it has been suggested that an existing railroad should be converted into a motor road. At present three separate lines connect the two cities.

CORRECTION

NEW YORK, Jan. 4—It was stated in AUTOMOTIVE INDUSTRIES of Dec. 22 that the Lexington Motor Co. would display at the New York show a "light six" model which would sell in the neighborhood of $1,300. Emery Huston, vice-president of the company, states that while a new model of the Lexington will be announced at the show, the price will be considerably more than $1,300.

METAL MARKETS

WHILE the quota of tentative inquiries for automotive steels is fairly large, producers are not indulging in false hopes. They realize that buyers are combing the market extraordinarily fine for the most advantageous prices and that when orders are finally placed they will call for conservatively modest tonnages. They argue perfectly correctly, however, that eventually the aggregate force of this sort of buying will lead to more liberal commitments on the part of consumers. An important automotive interest has been canvassing the market for fine finished sheets for several weeks and sheet producers assert that this consumer has been unable to shade the 4.35c. base quotation.

They admit, however, that the specifications of this buyer are so exacting that, if the mills which can handle this business take it at the regular market quotation, they are making a concession. There is no denying the outward steadiness of the sheet market generally. That producers are averse to cutting under the regular market quotations at a time when they can confidently look forward to a certain quota of orders, even though they turn a deaf ear to buyers' entreaties for concessions, is only natural. At the same time there are some sheet rollers who seem more anxious than others for orders that will give them a comfortable operating rate from the year's outset.

It remains to be seen whether the present steadiness of the market will survive the eager competition for orders that may be expected to develop between individual mills. Plate mills will seek to obtain as large a share of the business in blue annealed sheets as possible and their production schedules are being laid out with this program in mind. Quite a few of the sheet mills are still obligated on contracts calling for black sheets at 2.75c. and blue annealed sheets at below the prevailing 2.25c. base quotation.

Stocks of cold-finished steel bars carried by automotive manufacturers are said to be adequate for first quarter requirements and a leading producer is quoted as having given up hope of representative business in that specialty materializing until next April.

Pig Iron.—The character of business coming into the pig iron market during the year's opening week continues to be unchanged from that of the closing weeks of 1921, buying being of decidedly retail proportions.

Steel.—Makers of cold-rolled strip steel are figuring on several fair-sized inquiries from automotive sources. Although a 300-ton order is said to have been placed recently at 3.75c., base Pittsburgh, it is understood that when contracts involve 500 tons monthly deliveries, 3.5[illegible]c., base Pittsburgh, is the price named. Demand for hot-rolled is light. Philadelphia reports state that there is an inquiry for 10,000 tons of automobile sheets in the market, deliveries extending over the first half of the year. There has been so prolonged a lull in automotive demand for nuts and bolts that producers expect the placing of orders for liberal tonnages within the next few weeks.

Aluminum.—It is stated in brokerage circles that during the closing days of December some buying of virgin ingots, 98 to 99 per cent pure, took place at around 18c., deliveries covering the year's first half.

Copper.—Reports of an early resumption of mining activities by leading producers were followed on the heels by denials.

Calendar

SHOWS

Jan. 7-13—New York, National Automobile Show, Grand Central Palace. Auspices of N.A.C.C.

Jan. 9-14—New York, Motor Car Body Exposition, Automobile Body Builders Association. Twelfth Regiment Armory.

Jan. 28-Feb. 4—Chicago, Automobile Salon, Hotel Drake.

Jan. 28-Feb. 4 — Chicago, National Automobile Show, Coliseum, Auspices of N.A.C.C.

Feb. 6 to 11 — Seventh National Tractor Show and Educational Exposition, Minnesota State Fair Grounds, Minneapolis.

Feb. 6 to 11 — Winnipeg, Can., Automotive Equipment Show, Western Canadian Automotive Association.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

CONVENTIONS

Jan. 17-20, 1922—Chicago, American Road Builders Association.

Jan. 30-31—Chicago, Fifth Annual Convention, N. A. D. A., La Salle Hotel.

Jan. 30-Feb. 2—Boston, Sixth Annual Conference of the International Delivery Association, Copley Plaza Hotel.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Feb. 24, Mar. 24, April 28, May 26.

New York, Jan. 10-13, 1922—Annual Meeting.

New York, Jan. 16, First Annual Meeting of Advisory Board on Highway Research, Engineering Societies Building.

Chicago, Feb. 1

Minneapolis, Feb. 8-9—Annual Tractor Meeting.

French and Italian Conditions Surveyed

Reports Show Need of Careful Study by American Manufacturers

WASHINGTON, Jan. 4—A survey of automotive production capacity in France and Italy as reported to the automotive division of the Department of Commerce this week shows that there is need for American manufacturers to give careful study to manufacturing conditions in these countries.

According to a report from Commercial Attaché Huntington at Paris:

Prices of motor cars in the French market have dropped but are now well stabilized. However, the prices of French cars are high. Even those of the newly developed 10 hp. vehicles run from $1,000 to $2,000 at the present rate of exchange, which is at least twice the cost of a car of equal utility in America. The demand for motor trucks is still low owing to army stocks which glutted the market.

The number of individual manufacturers has increased from 48 before the war to 60 after the armistice. At the present moment they are working only at 20 per cent of their capacity and thus turn out 53,000 cars per annum, which compares with a capacity production of 250,000. The eight hour law now in effect in France, necessitates an average of one year's working time of one man for the production of a chassis, which is evidenced by the fact that for 53,000 cars per annum 55,000 men are employed in the manufacture of chassis and parts, 15,000 on body work and 10,000 on accessories or a total of 80,000 men.

The American consul at Turin, Italy, reports:

Thirteen of the most important Italian automobile manufacturers are located in Turin. Their production is approximately 43 per cent of the normal output, which is accounted for not only by the present economic condition of the home market, but more particularly because of conditions affecting the foreign markets.

Italian automotive manufacturers, when operating their plants at normal, were required to export from 65 per cent to 70 per cent of their annual output as their home market cannot absorb the total production. The reduced demand abroad, together with high protective tariffs, is chiefly responsible for the curtailment in export shipments. Spain is one of the best markets that has been lost to Italian manufacturers owing to high tariffs.

Perfect-Lite Lighting Set Placed On Market

TWO RIVERS, WIS., Jan. 4—An isolated lighting plant consisting of a single cylinder vertical engine direct-connected to a 1½ kw. generator has been placed on the market by the Perfection Hoist & Engine Co. The engine has cylinder dimensions of 3¾ x 4 in., the same as the Ford engine, and the piston rings, connecting rods, valves, springs and tappets are duplicates of Ford parts. Either gasoline or kerosene can be used as fuel. The fuel tank is located in the base and is raised by suction.

The generator armature is mounted on ball bearings and turns at 1150 r.p.m. The slate base switchboard, on top of the generator, has mounted upon it a zero center ammeter, a fuse and the switches. The ignition coil and automatic stop relay are mounted on the back of the board. The generator is wound for either 32 or 110 volts and the set is furnished with storage batteries of several different capacities. The 32-volt outfit with 110 ampere-hour battery sells at $545.

WICHITA CHANGES NAME

WICHITA FALLS, TEX., Jan. 4—The Wichita Motors Co., manufacturer of the Wichita truck, and the Price-Campbell Cotton Picking Corp. have merged under the name of the Mechanico Agricultural Co., manufacturer of trucks and mechanical cotton pickers.

DODGE HAS FIELD DIRECTOR

DETROIT, Jan. 4—John Nichols, former eastern district representative for Dodge Brothers, has been appointed to the new office of director of field operations. He is studying the used car question as his first job.

Japan May Produce Cars on Large Scale

Plans Depend on Outcome of Washington Conference—Would Use Shipyards

LOS ANGELES, Jan. 3—That the manufacture of automobiles in Japan will be attempted on a large scale along with a number of other lines at present not produced in appreciable quantities, if the proposal to restrict construction of warships is agreed to at the Washington Conference, is the report received from Nipponese industrial centers.

It is declared that plans are already being organized by one of the leading shipbuilding organizations in Japan to convert part of its plant for the production of motor cars, spinning machinery, motors for electric cars, railings for building purposes and telephonic and telegraphic apparatus.

Plans Road Building

With an ambitious road building program being undertaken throughout Japan, the future is believed to hold bright prospects for automobiles in the Empire, and while attempts heretofore made by Japanese companies to manufacture cars and place them on the market have been unsuccessful, the large shipbuilding companies are confident that they can succeed. While the proposed manufacture of motor cars in Japan in the present shipbuilding plants is in merely a discussion stage, it is believed that American automotive experts will be imported to supervise the technical work, if it is undertaken.

E. Matsukata, president of the Kawasaki Dockyard Co., in Kobe, perhaps the greatest shipbuilding plant outside of the naval dockyards in Japan, has been making a tour of inspection of American industries to determine the course to pursue in transforming his big shipbuilding plant into one of an industrial nature, in case the American proposals are adopted.

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Price Reductions Feature New York Show Opening

Sales influence of price drops uncertain. New models numerous. Noticeable trend toward utility closed cars. Marked trends in chassis and engine design. Attendance compares favorably with last year.

NEW YORK CITY, Jan. 7—The twenty-second National Automobile Show, conducted by the National Automobile Chamber of Commerce, has opened its doors. A view of the crowds at the opening gives no indication of a business depression. The afternoon crowd on the opening day has not been quite so large as last year, but the evening has brought out as many as any previous year. The number of exhibitors is as large as usual. A spirit of optimism, tempered with a sane view of facts, is found at nearly every booth.

The great number of price reductions comprise the chief commercial feature of the show. It is difficult to determine at this time just what the sales effect of these latest reductions will be. This phase of the show is discussed more fully in later pages.

There was considerable color in many of the exhibits, although the brightness was conservative in most cases. There were only a few bizarre body colorings this year. A majority of the exhibits were so arranged as to emphasize the utility, rather than the luxury, phase of the automobile. Few ribbons over hoods acted as silent "hands off" signs. Curious customers were encouraged to look under the hood; sedan doors were cordially thrown open to those who appeared to be interested; there was a definite effort at selling that has not characterized shows of other years. There is still a noticeable lack of training on the part of salesmen, but the spirit behind the merchandizing effort is much better than in previous years.

The increasing desire of the general public for facts and information concerning the working parts of the cars has been recognized in most exhibits. A factory man has been provided in most cases to explain the details of the car. The need for this sort of service is typified by an incident which occurred about the middle of the afternoon on the opening day. A local salesman at one first-floor booth came running back to the manager exclaiming, "For goodness sake, get somebody out here to talk the technical end of this car. These fellows are catching us up right and left." The requested service was provided immediately in this case, as in most others throughout the show.

There are certain interesting and definite trends in body designs. There is an atmosphere of increased utility and less display. A greater diversity of models and styles has been provided to better meet the diversity of industry and social needs. The entering wedge of the smaller closed type car is very apparent. No longer is cubical capacity a measure of the appreciation of the buyer. In sedans there is an unmistakable trend to the smaller sizes, and the greatly increased sale of some makes during the past year has perhaps served to draw the attention of other manufacturers to this demand. The big sedan and the big limousine seem to be on the wane. History repeats itself and if we take a leaf from carriage history we recall that the value of the fashionable brougham or

victoria was not measured by wheelbase, but rather by its effectiveness as a vehicle best suited to the needs of those who owned it.

The greater numbers of coupes are another evidence of this. Some of these have a commercial aspect which will make them well suited for use by professional and business men. Bringing the price of the closed type down so as to be closer to the open car is certain to stimulate the sale of the closed vehicle and manufacturers will have to arrange for increased production where they have some of these increasingly popular models. There has been a long and consistent request for a reduction in the price of closed types and the answer seems to be pretty nearly at hand.

A second unmistakable trend, and one which has scope for development, is improving the personal conveniences of the car, of which many examples are seen at the show. The American automobile has been described as the greatest utility automobile in the world, but it should also be the easiest and most convenient to operate. This year some manufacturers have confined most of their improvements to a better arrangement of the body for appearance and use. Some have consulted artists of note to assist in this work, and the more comfortable tilt to seat cushions, a general improvement in steering wheels, added style by individuality in lamp design, more comfortable springs, lighter operation for pedal controls, easier brake application, more convenient lighting control and many other details of this character reflect a commendable effort.

There is a very definite indication, on the engineering side, that manufacturers have attempted to give their dealers a better product to sell. While there are many cars which have changed but slightly from last year, there is an unusually large number which embody numerous refinements of chassis and engine design. There are several entirely new cars and several entirely new models of old cars.

The new Chandler, Velie and Elgin models were shown for the first time, while the Rickenbacker made its initial public bow as well. The Hanson light six, which will sell for less than $1,000, is displayed. The hotel exhibits include the new Fox air-cooled car; a Frontenac engine and racing car exhibit; Gearless Motors steam car, Bay State car, an assembled job; the Ace, the Neracar, an interesting new type motorcycle; the Driggs, and others. The new Gray car is, perhaps, the most important of the hotel exhibits from a possible quantity production standpoint. This is priced "under" $500.

The recently announced Jewett is not in the show, but is being unveiled before a select group on Thursday evening.

The new Franklin four-cylinder air-cooled job is the most interesting show development in the way of a new model, but is not being exhibited publicly. It will sell for about $1,000. This car is also to be unveiled before a select group later in the week. Experimental work on it has been completed, but the Franklin company is not yet ready to begin production. This new car is designed to make from 28 to 30 miles per gallon and will develop a speed of 60 m.p.h. The touring car price will be about $1,000 and the sedan $1,500. It will have a wheelbase of 103 in. and will generally follow the lines of the 6-cylinder Franklin. Improvements have been made in the induction jacket and the regular Franklin vaporizing system will be used. It will have semi-elliptic springs, front and rear. It is understood that John Wilkinson, the Franklin engineer, had this car well toward completion of design when the war changed all manufacturing plans. It is expected that a new factory will be erected for the production of this vehicle, although this will not be started immediately.

The verdict as regards the immediate merchandizing value of the show cannot yet be given, but there is every indication that a stabilization of prices on the basis of accurate cost and selling data will be necessary to the stimulation of sales in the immediate future.

The show does bring out these three points, however. First: automobile manufacturers as a whole have taken advantage of the period of depression to have their engineering departments design better cars; definite progress has been made along this line, although there is some ways to go yet. Second, the demand for a utility closed body, with a low price differential between it and the open job has been recognized and several attempts are being made to meet it. Third, lasting qualities and second-hand value are going to be more important factors in car selling than ever before.

Influence of Price Reductions at Show Uncertain

By David Beecroft

AN analysis of the public's attitude during the two opening days of the New York Show is that very many do not believe all prices to be at bottom, notwithstanding the fact that the show opening was heralded by a great number of price reductions.

It yet remains to be seen what will be the influence of the heavy advertising campaign that is being carried on in the metropolitan press to advise the public in large black figures what the new prices are, how all previous prices have been shattered, how the highest point in car values has been reached, etc. These messages of new prices and new models fill the pages of the press. The buyer cannot escape them.

The New York City buyer cannot be taken as a representative of the average buyer of the country, and the exact effect of price reductions from a national viewpoint has yet to be determined. There is a sentiment prevalent that, among buyers having used cars to trade in, the price reductions are not stimulating purchases as might have been expected. Some of the prospects are reasoning this way: John Smith has a 1920 X car that he wants to trade for a 1922 X model. Two months ago he was offered $1,000 for his old car in trade for the new, but Smith decided to wait until the show, strong in his belief that the 1922 X car would be reduced perhaps $400 by show time. This reduction has been made, but now Smith has learned that the value of his own car has been reduced the same amount. He does not see himself any better off under the new prices. He is not much closer to buying to-day than two months ago. As one manufacturer expressed it, "The prospect with a used car to trade in is largely influenced by what he can get for his old car. That price means as much to him as the price of the new car, and he sees that if you cut $400 off the price of the new car and take as

much off the estimated value of the old car he is no further ahead. He has to pay out the same amount of money, plus his old car, just as if he had purchased at the higher prices before the cut was made."

Estimates by dealers indicate that at least 50 per cent of the buyers with old cars to trade in are influenced primarily by what they get for their old car. It makes no difference to them whether the new car is priced at $1,200 or $1,500 if in either case they pay for it $1,000 cash, plus their old car. The cash remains the same in either transaction.

The new prices have a different appeal for that small minority of the first-time buyers. This group, however, is a small minority. To them price reductions represent savings in dollars of the actual reduction. Price reductions stimulate them to purchase, and where they have confidence that prices are at the bottom they are certain to buy according to their needs, with due regard to the season.

There is a distinct increase, evidenced at the show, in that school of manufacturers who believe that the initial selling price of a car is not the dominant issue in a sale to-day, but rather that the second sales price, or what the owner can realize on his used car, is the more essential consideration in the selection of a new car. Transportation value is becoming more and more a cardinal, if not a primary, consideration. The present wide range of price reductions is impressing this fact on the buyer as never before. Every day during the last few weeks he has seen the value of his used car drop. He has counted his losses as he has been advised of them through the advertisements in the press. The present show, with its bumper crop of price reductions, is driving this thought home.

Is not this buyer concerning himself with this question, "What is going to be the value in eight months or one year of the car I am thinking of purchasing at this show—what can I sell it for then?

The manufacturers have brought him to this turn of mind. The advertisements in the past twelve months of so-called final prices have created a feeling akin to uncertainty, which is perhaps resisting sales to-day. The all-too-general concentration of so many makers on prices is the apparent major reason for purchasing any particular make of car, and often prompts this question, "Are present prices the bottom, or is there to be another of these final reductions?"

Would not car-merit advertising talk, and making the price secondary to this merit argument, be more convincing to-day than staking so much on the price? The enthroning of the dollar mark as the panacea for selling ills is interpreted as a reflection of that still too prevalent bugbear of great production. The spectre of war-expanded factories, overhead difficult to reduce, and big production programs of past years, are perhaps hanging over too many manufacturers. These manufacturers see low prices as synonomous with big production. It might be better business to think lower production and better quality. The Armageddon of some manufacturers is still ahead. Some are resigned to be content with limited production and proportionate profits.

The condition of the times demands that the manufacturers should carefully weigh all selling factors and the remaining days of the show will undoubtedly serve to drive home this thought. The present thunderstorm of liquidation prices will pass, but time will be required for the public to crystallize its buying program.

Many New Cars at Show

By J. Edward Schipper

THERE is more novelty at this New York Show than in any other for five years. This does not mean in the way of novelty accessories and mechanical devices alone, but in new cars and in real engineering features which have been developed during the last few years and which are now finding their way to cars for the first time. In addition to refinements in the older models, there are several new cars which are making their debut at this show—more of these which are important, in fact, than for several years.

True, some of these cars have been on the market for a large part of the year which has intervened since the show of 1921. The Wills Sainte Claire is a newcomer during the year, but is already reckoned as a stable member of the industry, although exhibiting its product at a national show for the first time. The Rickenbacker is showing its first cars off the production line, although almost simultaneously with the opening of the show the factory in Detroit has reached a steady production, in the engine department at least, of ten per day. The Durant organization has its product at the show, this being another of the strongly recognized concerns practically born during the year and now submitting its product to the scrutiny of trade and public.

There are a great many cars at the hotels which may next year be seen on the floor of the Palace. The Gray, Jewett, Fox air-cooled, Ace, Bay State, Ogren, Frontenac, Ferris, Sun and others are to be found at the hotels.

Rivaling in interest the new cars are those which have so many changes that they may be properly classified as really new models for 1922. The Chandler, a new series car with a radically revised rear end, is of particular interest in that it marks the entry of this important concern into the ranks of those who are using Hotchkiss drive. Other refined models which are being shown for the first time are Studebaker, Case, Elgin, Velie, Oakland, Nash, Hanson, Premier, Lexington and Cleveland.

There are certain well-defined tendencies to be noted in the changes made in these cars which are of prime importance. One outstanding feature which is to be noted on more cars than any other during the year is the tendency toward the use of stiffer frames. The adding of frame cross members and in some cases the use of channel members of not only greater depth but of wider flange has been particularly widespread. Some cars have an entirely redesigned frame. One of these is the Jordan, which has greatly increased the strength of the structural members. Studebaker, Earl, Chandler and Mitchell are particularly good examples among the new models of the improvement made in this respect, though there are a number of others.

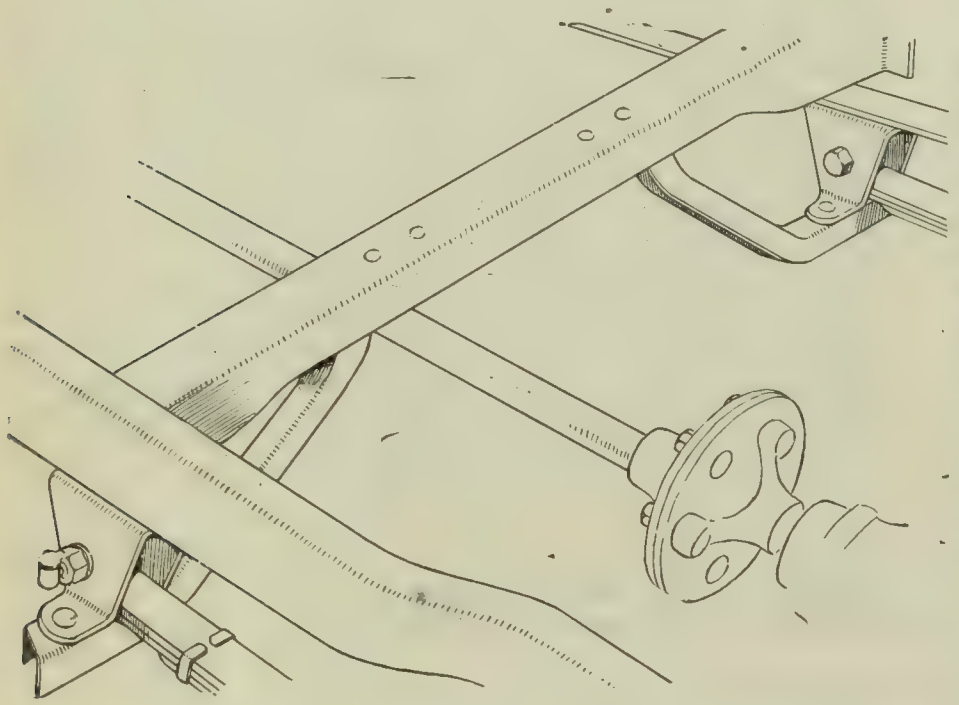
There are practically no examples of larger engines in the same chassis, which is distinctly different than a few years ago, when show-time was usually the occasion for the announcement of chassis containing power plants with "more power." The Earl car upon succeeding the Briscoe increased the engine dimensions slightly, but is one of the few exceptions in this respect. The care taken to make cars easier to drive, by means of

lighter clutch and brake pedal pressures and more accessible instruments, deserves mention.

Chandler Makes Changes

Extensive changes have been made in the Chandler chassis, resulting in a quieter car, of which longer life and more satisfactory performance may be expected. What has been accomplished is well brought out by the fact that, in revising the rear end drive and suspension, 42 lb. have been added to the frame and axle members for the sake of greater strength and rigidity, but through other refinements which have deducted considerable weight the chassis is but 2 lb. heavier than previously.

The changes are chiefly in the rear end of the chassis and are due to the adoption of Hotchkiss drive, stronger rear axle, heavier frame, hand brake on the rear of the transmission gearset and consequently an entirely new layout of brake actuating linkage. At the same time



Part of new Chandler chassis which now has Hotchkiss drive and an entirely revised rear end

there have been a few other changes at miscellaneous points throughout the entire car, although the power plant has been but little affected. The bodies are so extensively refined that they may be classed as entirely new.

In the adoption of Hotchkiss drive the torque member has been abandoned and longer semi-elliptic rear springs are now used. These are 58½ in. in place of 56 in. The spring width has also been increased ¼ in. and is now 2¼ in. The front rear spring hanger has been strongly reinforced to take the drive of the car, and there is now a bracketed cross member at this point to provide additional support and give a high factor of safety.

There is also another tubular cross member on the rear end of the frame which not only increases the rigidity of the frame but also acts as an additional support to the rear tire carrier brackets. The changes which have been made in the rear axle are claimed to have increased the strength of that unit by 27 per cent. The pinion and shaft are now a one-piece forging, eliminating the usual key, nut and cotter pin mounting. The pinion bearings are now Timken tapered roller in place of annular ball, and the mesh between the pinion and the ring gear is now adjustable from the exterior of the housing. The differential is now mounted on Timken bearings instead of ball. Annular ball bearings are now used in the rear wheels and in transmission bearings and Timken bearings are continued in the front wheels.

New flexible couplings of the fabric type are employed instead of the metal universals formerly used. These are special Chandler design which, the experimental department states, they have had under observation on test cars for 18 months. The elimination of the metal universals is a point in line with the policy in redesigning the chassis of reducing the labor incidental to chassis lubrication. In the revised chassis there is but one grease cup and that is on the steering gear housing and, consequently, readily accessible upon lifting the hood.

The change in the engine consists solely in the remodeling of the fan drive. This has resulted in better alignment and the elimination of any tendency for the belt to jump the pulley at high speeds. The change is both one of design and of manufacture. The more accurate machining of the fan bracket is quite as essential in the satisfactory results which are now said to be obtained as the change in the design and material of the pulleys themselves.

Located in the transmission gearset housing, the speedometer drive gear is assured of lubrication and quietness. This is typical of other changes which have been made for the same purpose. A statement has been made that in the rear part of the chassis the new construction eliminates twelve points where backlash, due to wear, may occur and eventually develop rattle. Five of the points are in the propeller shaft and universals, one in the clutch and six in the torque members. The point mentioned in the clutch is due to the adoption of a steel center friction disk which insures longer service.

There is an anti-rattle and alignment feature in the rear brake construction consisting of a flat spring which passes through an eye on the brake band. This makes it certain that the band will always center itself on the drum and will also tend to eliminate sideslap in the band.

The bodies are entirely new and are of interest particularly because they are about the first production from the new $10,000,000 Cleveland plant of the Fisher Body Co. There are eight cars in the line, including five-passenger touring, four-passenger dispatch, four-passenger roadster, two-passenger roadster, seven-passenger sedan, seven-passenger limousine, four-passenger coupe and seven-passenger touring.

There are some interesting features on the bodies which represent new departures, at least for stock bodies. The cowl ventilator is of the flush type and does not project above the cowl deck. In the floor board in front of the driver's seat there is a trapdoor which gives ready access to the battery.

Refinements in Nash

Refinements have been made throughout the Nash line, both the six- and four-cylinder models. A new line of bodies has been mounted on both. The six-cylinder power plant has not been altered fundamentally, but there have been a number of changes which affect the handling of the fuel and the auxiliary units, such as the fan and electrical equipment.

Delco three-unit electrical equipment takes the place of the system formerly employed. The generator drive pulley is now drop-forged and machined all over. The fan, which is on the front end of the generator shaft, is now a die casting, in place of the sand casting formerly employed, and more satisfactory performance and longer life is secured by putting the fan and generator in strict running balance in assembling the engine.

A change which has been made in the interest of service accessibility is the making of the crankshaft drive pulley in two parts, permitting of the replacement of the belt without taking off the radiator. The belt can now be

slipped off over the fan by disassembling the crankshaft sprocket and, in reassembling the belt, can be fitted over the fan and the other half of the crankshaft sprocket fitted into place.

A new hot air stove has been adopted. This has a venturi-shaped opening which points toward the rear. It has been adopted in view of a desire to reduce the amount of road dust which finds its way through the carbureter and into the combustion chamber. As the dust passes through the radiator the inertia of the larger particles will carry them past the venturi-shaped horn of the hot air stove so that in this way a part of the usual accumulation will be eliminated. It is also claimed that when the other particles strike the heated exhaust they will drop and consequently be eliminated from the incoming air stream. The carbureter air spring has now been inclosed to give it longer life.

There is a new oil filler on the engine and a plate on the cover over the valve mechanism which is inscribed with the firing order and with the clearances which should be left in the valve adjustment. It is possible to drain the crankcase now without getting beneath the car. There is an opening cut in the pan and a special tool provided with the car fits over the handle of the draincock and permits it to be turned from above.

A refinement has been made in the clutchshaft. This is still a splined type, but is now ground on all sides. The splines are now individually hand fitted, resulting in a claim for easier shifting and longer life. The propeller shaft, which is hollow, has now been provided with oil plugs at each end to permit of the lubrication of the universals from these points. An oil gun is provided in the tool kit to take care of this.

Heavier Front Axle

A heavier I-beam front axle has been adopted, and in mounting the oilers for the steering knuckle the lower oiler has been placed on a sort of standpipe which brings the level of the oil over the thrust bearing. Closer limits of manufacture have been adopted in certain parts of the rear axle to increase the quietness of this unit.

An entirely new spring suspension is a characteristic of the new model. The springs consist of an increased number of thinner leaves and a rebound plate. The theory of this type of springs is that when small bumps are encountered only the flexible ends of the spring are affected. When a larger depression is struck the entire spring is depressed and then the rebound plate comes into play. Its arc is opposite that of the other leaves, so that it has the action of softening the recoil. It is also claimed that this type of spring is instrumental in reducing side sway.

The changes on the Nash Four are very much along the lines of those made in the Six. The Delco three-unit system has been adopted, and the front axle, transmission gears and shafts, wheel and axle bearings are the same for the Four as for the Six. A new carbureter has, however, been adopted on this model; this is the double-adjustment Schebler which replaces the previous type Schebler. The bore of the Nash Four was altered during the year from 3¼ in. to 3⅜ in. Another change in the Four has been the addition of a gussetted cross member to the frame to increase its stiffness.

The bodies and equipment on both Nash models have been improved materially. A gasoline gage has been placed on the dash of the Six. A new two-passenger inclosed body is now provided on the four-cylinder chassis. It has a permanent leather-covered top and is virtually an inclosed roadster. It has a large luggage compartment under the rear deck and there is a compartment also for small parcels at the back of the seat.

The New Jewett

The Jewett will be built and marketed by the Jewett Motors, subsidiary of the Paige-Detroit Motor Car Co., in the Paige shops. It will be sponsored by E. M. Jewett, president of the Paige organization, after whom it is named.

The new car is a Six with 112-in. wheelbase. It is equipped with a $3\frac{1}{4} \times 5$, L-head motor, with an S. A. E. rating of 25.35 hp., but actually claimed to develop 49 brake horsepower on the block. The motor will be built in the Paige power plant. It is a three-bearing crankshaft unit. Lubrication is by pressure to the main bearings and also by splash. Cooling is by centrifugal pump. The four-bladed fan is driven by a flat belt from the pumpshaft.

The clutch is a four-plate, dry construction, departing from usual practice by using six helical springs for compression set out toward the periphery of the clutch plates in place of one. These are claimed to give a more even clutch engagement, regardless of clutch alignment, and to eliminate the grab or chatter and also to make adjustment unnecessary.

A conventional type transmission is used with three forward speeds and reverse. A transmission lock built into the cover of the gearbox and controlled by a Yale cylinder positively locks the gearshift lever in neutral. A tubular driveshaft with two universals transmits power from the gearbox to the rear axle. An all-metal universal joint of very clean design is used. It consists of a hollow ring through which the torque is transmitted and which incloses all the working joints. This ring forms a container for the necessary lubricant, as well as a dust cover, making care of the joint, it is claimed, a simple matter of renewing the oil every 20,000 miles.

Final drive is through a Timken rear axle fitted with spiral bevel gears. The pinion is supported between two roller bearings, one on either side. Torque is absorbed through long, semi-elliptic rear springs.

The foot brake is of the conventional type, contracting around 12-in. steel drums bolted to the rear wheel hubs. The hand brake contracts around a 10-in. steel drum attached to the propeller shaft between the gearbox and the forward universal joint.

The chassis side members are channel sections tied together by four cross members. The two center cross members are channel sections riveted back to back and gussetted at the ends to resist diagonal stresses. The cross member at the rear forms a shield, protecting the 17-gal. fuel tank.

Studebaker Changes

Studebaker is showing refined models with both chassis and body changes. None of the principal chassis dimensions have been altered, but in the two larger models a rather radical change has been made in the incorporation of the disk in place of the cone type of clutch. This has been adopted not because the former clutch proved unsatisfactory as a clutch, but to facilitate gear changing. The stiffness of the frame has been increased on both the larger models, the Special Six and Big Six, and the bodies have been entirely redesigned, although along very similar lines to those of last year.

The Big Six is now fitted with a newly designed seven-passenger touring body with a heavy beaded edge and a larger and higher hood. There is also a new one-piece windshield, permitting greater vision; a windshield wiper fitted as standard equipment and cowl parking lights, which are miniature headlights in the corners of the windshield. There is now also a cowl ventilator, operating from the dash, and a courtesy light on the

driver's left. The tool kit has now been placed in a pocket on the left side of the driver and is locked with the same key that fits the transmission lock and ignition switch. The instruments have been rearranged on the dash and grouped to give better visibility.

About the same changes have been incorporated on the Special Six as on the Big Six, including the disk clutch, cowl ventilator, new windshield, etc. The Little Six, which is the newest of the three models, has been provided with a cowl ventilator and the windshield wiper, although the chassis and body have not been otherwise altered in any material detail.

Oakland Models New

Five Oakland models are shown for the first time. The engines have been improved in detail. Improved pistons and piston rings have been added and the cylinders are specially honed to insure a more perfect individual fit. A Morse silent chain drive has been made a standard at the front of the motor.

Distinctly new body lines are used, including a higher radiator, hood and cowl. Drum-type, non-glare headlights with exterior means for focusing are now standard. Nickel-plating is used on the radiator and other parts of the car where it will add most to the appearance. Rear windows and windshields are of plate glass, and in the closed models there is plate glass throughout. Heater, rear view mirror, visor, windshield wiper and snubbers are furnished in coupe and sedan.

All doors are now full square, with wide openings and handles inside and out. Locks are provided on all door handles in closed models. The door frames are metal covered to insure smoothness, and all hinges are concealed. The instrument boards are now walnut, with the instruments all faced with silver and all under glass. A new and convenient grouping is made this year. Corrugated walnut steering wheels are standard, with walnut spider in the closed models and polished aluminum spider in the open types. Another innovation in Oakland equipment on the 6-44 is that 32 x 4-in. non-skid cord tires are furnished all around.

Goodspeed

The Goodspeed is a car designed along sport lines and is replete with refinements. It is named after its designer, who was formerly associated with the Roma company and who recently established several world's records for stock cars at Daytona, Fla. It is mounted on 124-in. wheelbase.

The engine is unusual in that it employs piston valves, producing a silent running mechanism, free from the clatter often resulting from the use of poppet valves and strong valve springs. The valves occupy about the same relative position as those in a T-head engine and are actuated by eccentrics. Large water spaces around the valves insure good cooling, and the cylinder head is so designed that it makes a good foundry and production job. Lubrication is by pressure and splash, the latter being used also for the valves. There are two spark plugs per cylinder, ignition being of the dual type. The engine is of the four-cylinder type, 3⅝ x 5⅛-in. bore and stroke.

Other units comprise a Munsey clutch, Brown-Lipe gearset, fabric universal joints and Columbia rear axle. The front axle is an American ball bearing. Tires are 32 x 4½ in., with wire wheels as stock equipment. The radiator is protected from strains by mounting it on two ball joints instead of on the frame side members or front cross member. A feature in connection with the frame is the incorporation on the front and rear horns integral brackets for mounting bumpers. This makes a very rigid construction and eliminates the loosening of bumpers, quite common with conventional installation types.

Elgin

The Elgin 700 is one of the entirely new chassis models at the show. The engine has been made considerably more powerful, the increase in brake horsepower being raised from 37 to 46. The improved layout of the frame presents some striking characteristics, the most noticeable of which is the heavy box structure and the layout of the torque arm, which has its forward support on the engine base, and the abandonment of the cantilever spring in favor of the cross type.

The engine bore and stroke are the same as in previous Elgin models, being 3⅛ by 4¼. The valve-in-head design has been retained, but the lubrication system has been entirely redesigned, embodying circulating pressure feed. The oil enters the hollow crankshaft at the rear end and is carried direct to the bearing. The oil pressure is regulated and controlled by the vacuum in the intake. Oil is also forced by pressure to the hollow rocker arm shafts, through the drilled rocker arms and over to small cups on the upper end of the pushrod.

The valve guides have been redesigned so that they can be easily removed and replaced in case of wear. The entire valve operating mechanism is then closed, using a top cover and side cover plates of aluminum.

The cooling system, which is of the thermo-syphon type, has been improved in several respects. The water jacket around the cylinders has been greatly enlarged, as have also the water inlet and water outlet passages. The radiator is considerably larger and the cooling fan has been improved. This is driven by V-belt and has a plain bearing, instead of a cup and cone as in the old model. The fan hub is a hollow casting which is filled with oil that floods the bearing.

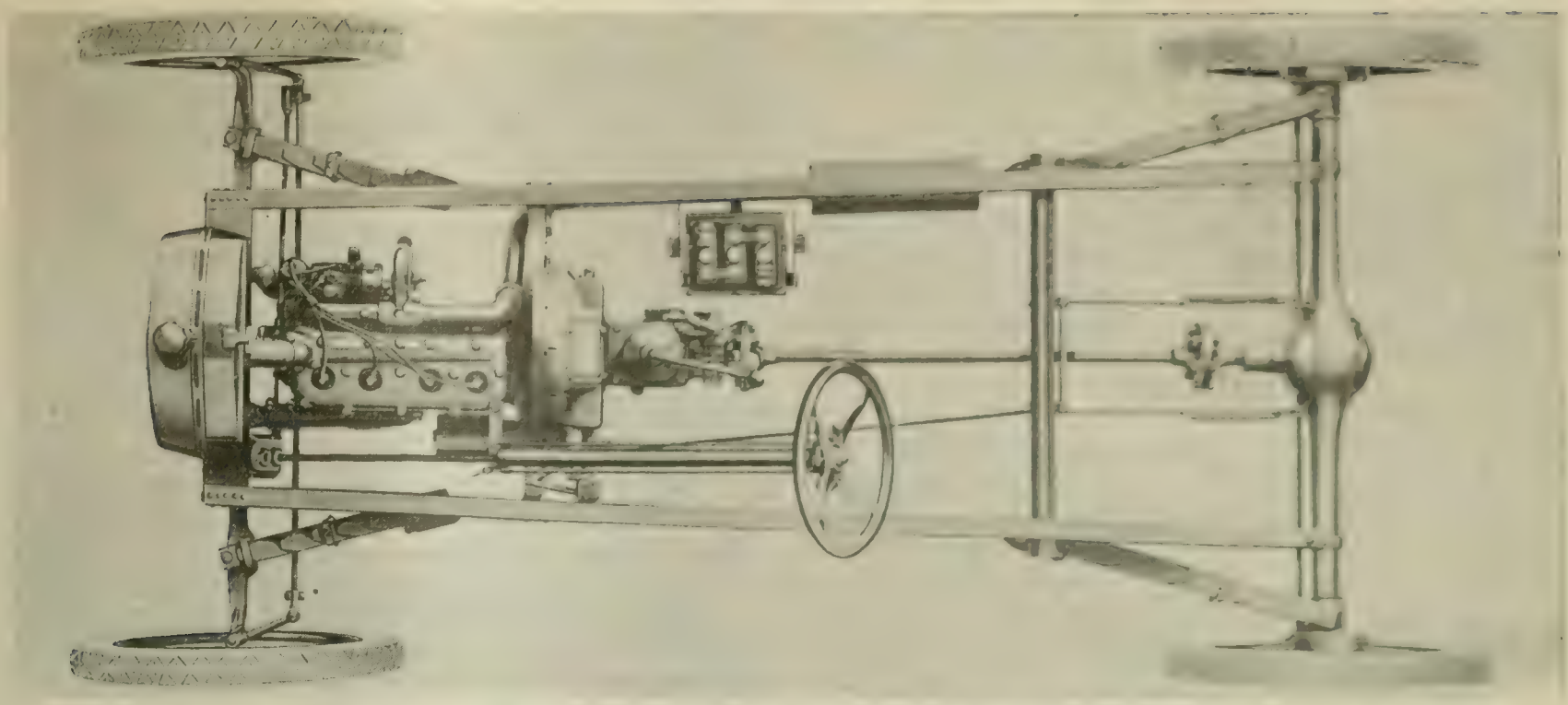
Fox

An air-cooled engine of interesting design is the feature of the exhibit of the Fox Motor Co. at the Commodore. The display consists of a chassis, a touring car and a sedan. The touring car is priced at $3,900 and the sedan at $4,900. The coach work is good and the general appearance of the cars, from the standpoint of body-work, is pleasing.

The pressure system of cooling is used. The cooling fan is mounted on the forward end of the crankshaft. It draws in air through a dummy radiator and forces it under pressure up the front of the engine through a duct which carries it over the cylinder heads. It then passes down past the cylinder walls which are provided with vertical cooling fins. These fins are integral with the cylinder walls.

The engine has six individually cast cylinders, with 3¼-in. bore and 5-in. stroke. The valves are located in the head and are actuated by push rods and rocker arms. The clutch is a Borg & Beck, single dry plate and the gearset, which is provided with a lock, furnishes three speeds. Ignition is by Bosch magneto and the starting-lighting system comprises Westinghouse generator and motor and Exide battery. The carbureter is a Zenith and is fed by a Stewart vacuum system.

The axles are of Fox design. Semi-elliptic springs are used front and rear. The service brake operates on the transmission and the emergency internally on drums on the rear wheels. The steering gear is a Ross and the wheel equipment is optional. The tires are 32 x 4½ cord and the wheelbase 132 in. Equipment includes Moto-Meter, Watson stabilitors, power tire pump, rear view mirror and windshield cleaner.



Selling for less than $500 the Gray chassis which is on exhibition at the Commodore hotel, presents a study in design primarily arranged for manufacture on a quantity basis

Durant Six

Durant is showing its new six-cylinder chassis. This has been completely designed from the old Sheridan car. it incorporates the Ansted engine, which is a 3½ x 4½-in. unit, said to develop 70 brake horsepower at 3000 r.p.m. The engine is provided with Auto-Lite electrical system, Rayfield carbureter and Stewart vacuum system. Other units include a dry disk clutch and Timken axles and 32 x 4½-in. Fisk cord tires are used. There are some notable accessibility features on the car, particularly in the brake adjustments.

Case Model X

The Case Model X is one of the new chassis. It has a Continental model 7-R engine. The previous Case model used a Continental 9-M. The new model is a six-cylinder of 3¼-in. bore by 4½-in. stroke. The Model 7-R is a high-speed engine and at 2600 r.p.m. develops 55 hp. The new car has a wheelbase of 102 in., as compared with 126 in. for the last year's model, and with open touring body weighs 3050 lb. The chassis is also furnished with a sedan body and then weighs 3350 lb.

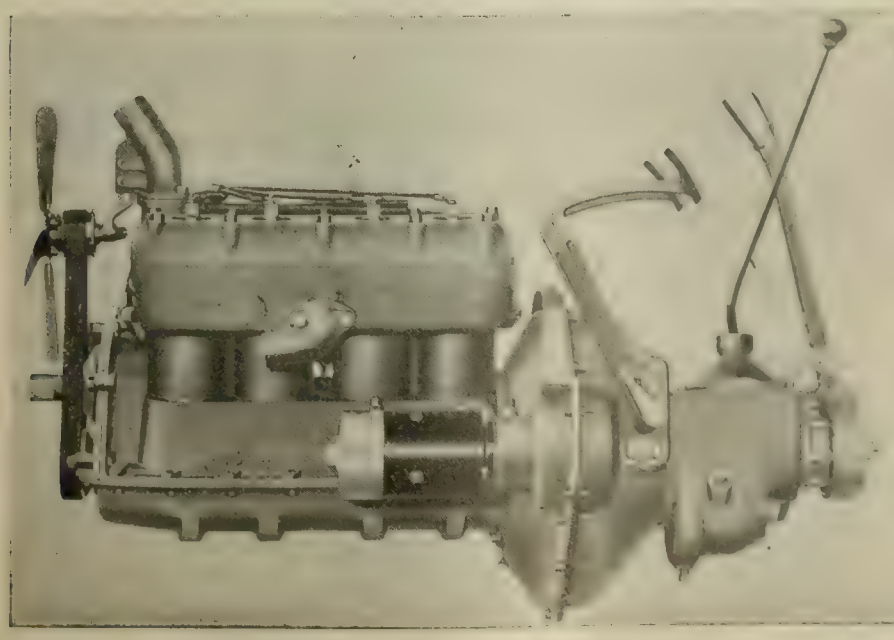
Last year's model was equipped with a clutch and gearset made by parts makers, but these parts in the present model are made in the Case factory. Clutch is the multiple dry disk type, similar to that used on earlier Case cars.

Gray

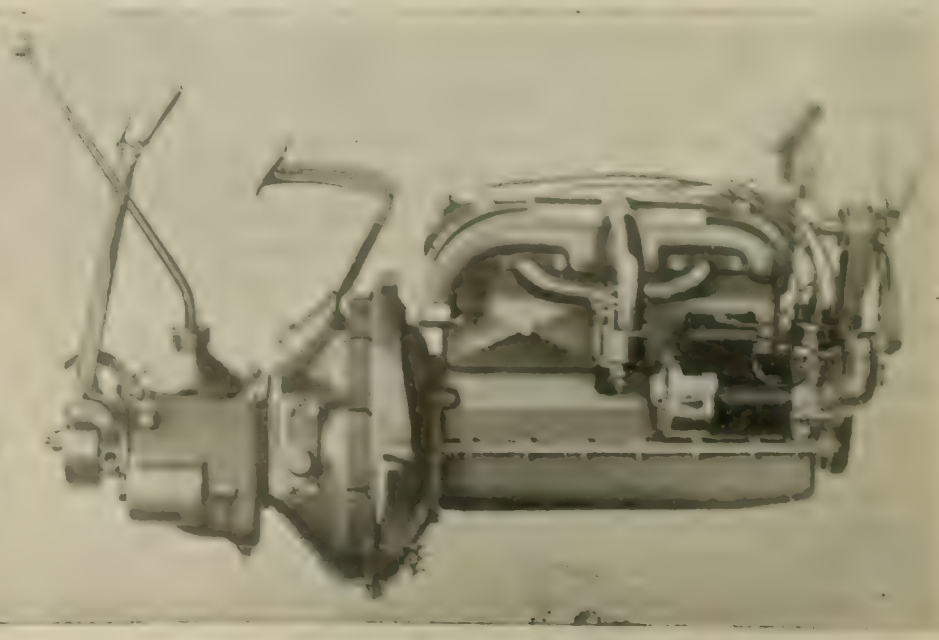
The new Gray is priced under $500. It is the product of the Gray Motor Corp. of Detroit, of which Frank L. Klingensmith, formerly of the Ford Motor Co., is president. It is powered by a four-cylinder, 3⅝ x 4-in., L-head engine. The exhaust and intake manifolds are located on the right side of the engine, as are the combined generator and ignition unit. The starting motor is located on the left side. Lubrication is by splash. Gasoline is supplied by gravity from the main tank, which is located under the cowl. Cooling is by thermo-syphon.

The clutch and gearset are a unit with the engine. The former is of the single-disk type and the latter provides three speeds forward. The rear axle is a semi-floating Timken with spiral gears. The drive pinion is integral with the driveshaft. The service brake is of the internal type on the rear wheels and the emergency operates on the transmission. The springs are quarter elliptic front and double quarter elliptic rear. The tires are 30 x 3½ in. on demountable rims. The steering gear is of the spur gear type with 16-in. wheel. The controls consist of gas and spark levers on the wheel and foot accelerator pedal. The wheelbase is 100 in.

Standard equipment includes electric horn, tools and spare rim mounted at the rear. The cushions are 5 in. deep and the doors 21 in. wide. The door handles are



Mounting of starting motor on the new Gray four-cylinder engine



Intake side of new Gray engine showing the hot-spot manifold

located on the inside. Other features are crowned fenders, ventilating windshield and one-man top with side curtains.

Westcott

The Westcott Model A-44 is shown for the first time and incorporates a transmission brake of exclusive Westcott design. The Model C-48 designation has been changed to D-48. The new Model A has a Continental engine, six-cylinder, 3¼ x 4½, 120-in. wheelbase, and is fitted with 32 x 4-in. tires.

Bournonville Rotary Six

The Rotary Six, another newcomer at the show, is a 130-in. wheelbase car fitted with an engine having an overhead rotary distributor valve. This distributor valve essentially is a shaft about 3 in. in diameter, having depressions cut into it to form the passages for the entrance and exit of the gases. The engine, owing to the overhead valve layout, is necessarily quite high and the hood on this car gives evidence of this fact. The car is to sell for $6,000. Other features include Columbia axles, Brown-Lipe transmission, Borg & Beck clutch and metal universal joints. Only a seven-passenger touring car is shown, this being fitted with wire wheels which come as regular equipment.

Hanson Light Six

A new light six-cylinder car is being shown by the Hanson Motor Co. In many respects the car uses the same units as the larger Hanson model. The Little Six is a 112-in. wheelbase job, seating five passengers. Upholstery is of long grain leather. The frame is quite deep for so small a car, having a 6-in. depth. Both axles are Timkens, the brake drums being 14 in. in diameter. A feature which makes for easy riding is the use of 54-in. rear springs, which are underslung from the axle. Disk wheels are regular equipment on the new model. The car at the show has a special Hansen engine, but at this writing it is uncertain as to whether it or the Continental will be used. The car sells for $995 f.o.b. Atlanta, Ga.

Trends in Chassis Design at the New York Show

By P. M. Heldt

AN impression of substantial and healthy progress in design is carried away from the show after an inspection of details of transmission, running gear and controls. Naturally, the improvements are very unevenly distributed; that is to say, there is a very considerable number of cars at the show that are exactly the same in all important particulars as they were last year, while others are materially, if not radically, changed. Moreover, there are a goodly number of entirely new models and some new makes on view. On the whole the most progress in design seems to have been made where it was most needed, which is a matter for satisfaction.

In judging the trend of design one must not lose sight of the economic conditions which have prevailed during the past year. We have passed through a period of deflation, and what demand for cars we have had has been mainly for vehicles of greater utility at decreased cost. The price trend has been constantly downward. In view of these conditions it is easy to realize that many of the well established firms have found it inexpedient to change their designs. In cases where the same model has been manufactured continuously for a number of years, the "bugs" or obvious defects that so often characterize first year models have been completely eliminated, and while it would not be difficult to suggest improvements in design, these would generally occasion material increases in manufacturing cost and would not be warranted under present conditions. Most of such improvements would probably be better classified as luxuries than as utilities. Of course, there is to-day a demand for high class as well as cheap cars, as there always has been, but in view of the general price trend in the industry we can hardly expect features of luxury to multiply just now.

Unfortunately not all cars are in that advanced state of development where they have been entirely ridded of weaknesses of design which cause annoyance and expense to owners, and efforts made during the year to eradicate such features of weakness have been most praiseworthy.

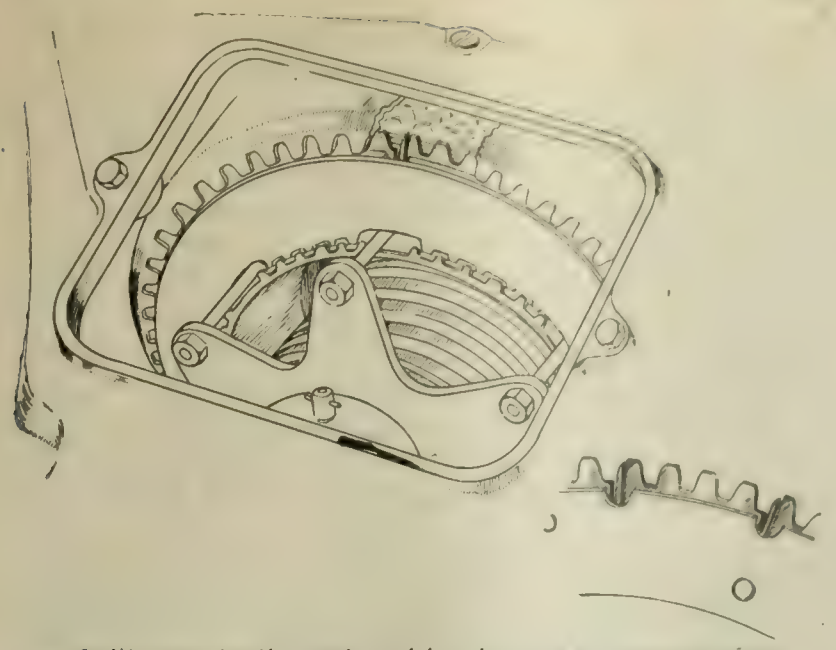
Following is a synopsis of the outstanding trends in chassis design as revealed by an inspection on the opening day of cars at the show proper and in the various hotel exhibits:

1. Increased use of the single plate, multiplying lever type of clutch, particularly on low priced cars.
2. Widespread adoption of involute keyed or "gear-toothed" spiders and drums for multiple disk clutches.
3. Endeavors to overcome chattering or noise and a tendency to failure to disengage in such clutches.
4. Increased use of transmission locks.
5. Provisions for making gear cases oil-tight.
6. Relocation of gear cases or redesign of shifting levers for more comfortable operation.
7. Further increase in the use of fabric universal joints.
8. Oil lubrication for metal universal joints.
9. Increased use of transmission brakes, particularly on low-priced cars.
10. Almost complete disappearance of the straight bevel gear drive.
11. Cleaning up of chassis layout by placing brake rods inside frame.
12. Strengthening of frames by use of heavier stock or deeper sections, or by the provision of additional cross members, particularly tubular members.
13. Almost complete elimination of grease cups.
14. Provision of improved steering hand wheels.
15. Almost universal use of die-cast, friction held controls.
16. Wider adoption of anti-friction bearings in steering gears and steering knuckles for easier steering.

These various improvements, together with some other features, are worth discussing in some detail.

Clutch Changes

The single plate clutch with multiplying levers, which came into prominence some four or five years ago, first found a wider field of application in the commercial vehicle line. It is an excellent type of clutch, particularly for use on cars of low or moderate power, because of its small inertia, permitting gear changing without destructive clashing, and also because it is simple and therefore cheap to manufacture. This type has recently been taken up by additional parts makers, and it is now also manufactured by car makers for their own use. An improvement recently introduced in one design consists in means



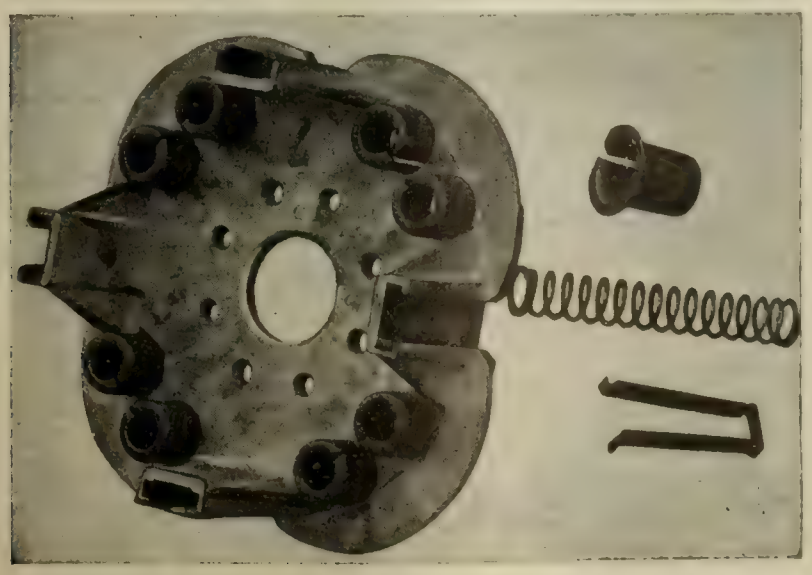
Split gear-tooth used on Lincoln cars to prevent rattle when clutch is disengaged

for equalizing the pressure on all three levers. With the ordinary arrangement, where these levers must be separately adjusted, one can by no means be sure that the pressure of all levers is alike.

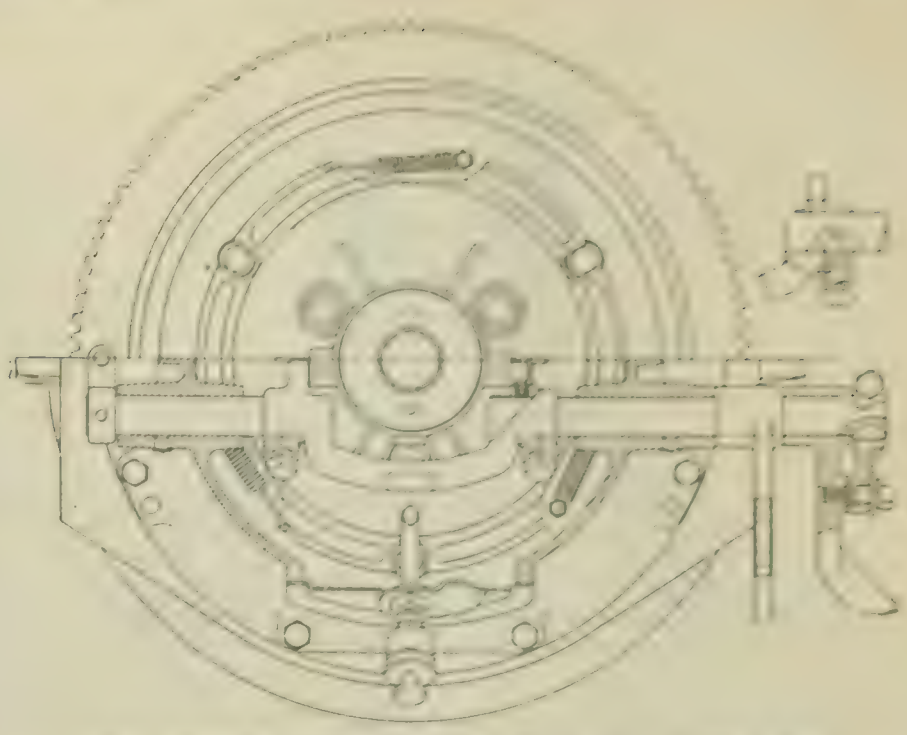
For the large cars the multiple dry disk type of clutch is in most extensive use. In the earlier designs of this type, and in some present ones, the disks are driven by a relatively small number of keys or studs, and this often causes trouble on account of rapid wear of the key slots or holes in the disks. To overcome this, the practice of cutting keyways in the form of involute gear tooth spaces all around the circumference of the clutch disks (outer circumference of driving, inner of the driven disks) and providing the flywheel drum and clutch spider with corresponding keys or teeth, has gained vogue. This obviates the trouble from rapid wear, but it introduces another difficulty. The involute splines much be given a certain degree of freedom or else the clutch will not release properly when the pedal is depressed, but will drag. If the splines are made sufficiently free so the disks will separate readily when the spring pressure is removed, the disks are apt to chatter or cause an unpleasant noise. During the past year a number of manufacturers have set themselves the task of eliminating this chatter, and the results of their efforts may be seen at the show.

In the Lincoln clutch three or four teeth of one disk are saw-slotted and the teeth are then slightly spread so they fit in their tooth spaces with a slight pressure (see sketch). This is said to completely overcome the disagreeable chattering action.

In the Detlaff clutch used on the Dort car, as shown by the sectional views herewith, coiled tension springs are



Diecast clutch spider with hardened steel inserts, used on Hudson cars



New Detlaff clutch used on Dort cars has springs to prevent rattle on disengagement

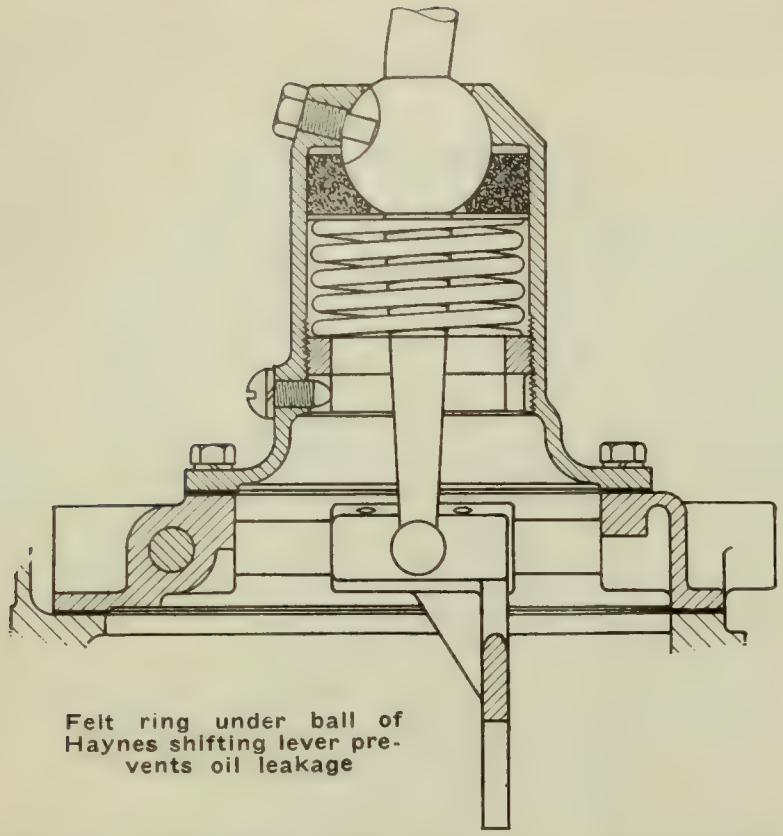
used to prevent rattling of the plates when the clutch is disengaged. The driving disks are provided with three cutouts in their periphery in which these springs are located. One end of the spring hooks over a post secured into the web of the flywheel, while the other end engages into a hole in the disk near the circumference thereof. The effect of the springs is to constantly pull the disks sideways against the driving studs.

Improvements with substantially the same object in view were made in the Hudson clutch, which is of the cork insert multiple disk type. In this the cork inserts were formerly carried in the driven disks, and as the disks containing the corks must be made of considerable thickness, these were the heavier of the two sets of disks. Recognizing the fact that the driven member of a clutch should be the lighter one if at all possible, in order to reduce the clashing effect in gear shifting to a minimum, the Hudson engineers made the driving disks of heavier material and put the cork inserts in them, making the driven disks in the form of thin steel plates. The drum or spider of this clutch is now made in the form of a die casting, which offers advantages from the production point of view, but as materials suitable for die casting are never very hard, and therefore do not possess good wearing qualities under heavy pressures, it was necessary to provide wearing surfaces of other material in the form of inserts of strip steel on which the keys of the disks bear. The driven member is formed with four T slots like a planer bed into which these inserts snap. There are also eight thimble-shaped inserts in the driven member which receive the clutch springs. On the driving studs between lugs on the driving disks are inserted coiled springs which effect positive separation of the disks when the clutch is disengaged. There are also shear springs which coil around the driving studs once and whose ends hook over the edges of the driving plates, which tend to prevent rattle of the plates when the clutch is disengaged.

Transmission Locks

Locks on the transmission cover, of which there were only two examples two years ago, are now seen on a great many cars. Of course, the great number of car thefts during the past few years has brought the subject of theft retardants prominently to the fore, and there is no doubt that a substantial, non-pickable lock by which the gear shift lever can be locked in neutral has considerable merit.

There seems to be a tendency toward the increased use



Felt ring under ball of Haynes shifting lever prevents oil leakage

of oil lubrication for transmissions. Oil lubrication, however, calls for oil-tight gear cases. Even with grease lubrication a fairly tight case is an advantage, because in extreme summer heat or when the car is being driven on one of the lower gears for long periods of time, the grease becomes quite fluid and the pressure of the heated air in the case then tends to force it out through any openings there may be. The easiest exit is usually through the shifter rod guides, if these are not provided with covers or thimbles, as they often are in the more expensive cars.

Convenience in Gear Shifting

Those whose memory goes back to the time when center control first came into use will remember that in the early applications the control levers were often in very awkward positions; sometimes part of the seat was even cut away to give free range to the gear shifting lever. Even in present models gear shifting is by no means uniformly convenient, the gear shifting levers being sometimes of unsuitable design and in other cases located in positions where they are hard to reach from the driver's seat, at least in some of the gear positions. In talking with exhibitors, several mentioned having redesigned their shifting levers and in at least one case the gearcase was moved in order to bring the shifting lever, which is located on the cover thereof, into a more convenient position for the driver.

Directly back of the transmission comes the transmission brake, if one is used, and any visitor to the show can readily convince himself of the fact that the transmission brake is gaining in favor with American designers. In Europe transmission brakes are almost universal, while in this country they were a rarity ten years ago. The reason for the prevalence of the practice here of fitting both brakes to the rear wheels is believed to be as follows: About 1904 the Packard Motor Car Co. came out with its Voiture Legere, the racing counterpart of which was known as the Gray Wolf. This car marked a big step in advance in American design and became more or less of a model after which engineers patterned their designs. This early Packard had its transmission on the rear axle, a construction with which it is obviously impossible to use a transmission brake, as the brake would be ineffective if the gear were disengaged. Evidently some of those who accepted the Packard as a model failed to realize that the double brake on the rear wheels was a feature to which there was no alternative in that car, and adopted it for cars in which there was no need for this construction.

Among present users of transmission brakes may be mentioned Franklin, Cleveland, Chandler, Westcott, Liberty, Holmes, Earl, Nash, Elgin, Ford, Fox and Gray. It will be noticed that quite a few of the lower-priced cars embody this feature, and the consideration that one brake close to the control device (thus requiring short, simple connections, costs less than two brakes on the rear wheels with long rods and more complicated connections and possibly equalizing gear) may have been determining in some cases. This remark is not made in any carping spirit, because as long as equally good service is derived, the simpler and cheaper the means of attaining the desired end the better.

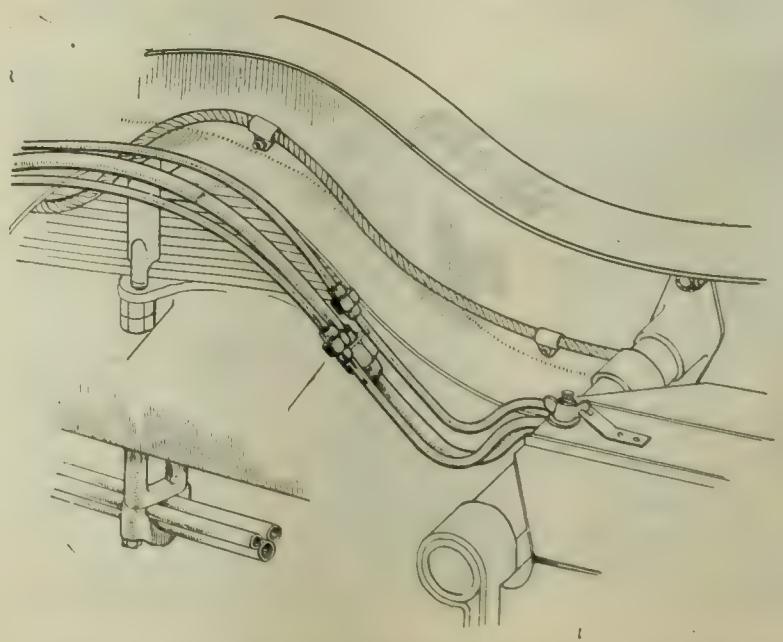
Unfortunately, as compared with the substantial transmission brakes found on most European cars of the better makes, sometimes fully inclosed, some of the transmission brakes on American cars are of rather flimsy appearance. With the limited diameter of the brake drum for the transmission brake, it must be made comparatively wide to get enough surface, and this calls for a considerable overhang of the brake support and the support for the operating lever. These supports must therefore be made exceptionally rigid to stand up to their work. A good design in this respect may be seen on the Fox car.

Further gains are shown by the fabric type of universal joint, and it would now seem that the only thing that could possibly stop its continued conquest of the field would be the popularization of the third member type of rear axle, that is, an axle having a propeller shaft housing built integral with it. With this type of axle a spherical joint is generally used at the forward end, and the dimensions of this ball joint are insufficient to take a fabric type of universal.

Recently several manufacturers of metal universal joints have brought out joints designed for oil lubrication, and these are now beginning to make their appearance on cars. In one car at the show the hollow propeller shaft serves as an oil reservoir for lubricating the universal joints.

This year the low-priced contingent at the show, including Chevrolet, Oakland and Dort, has given up the final drive by straight bevel gears, and, making an exception of the Ford, which is not at the show, the spiral bevel gear now reigns supreme and undisputed in the passenger car field.

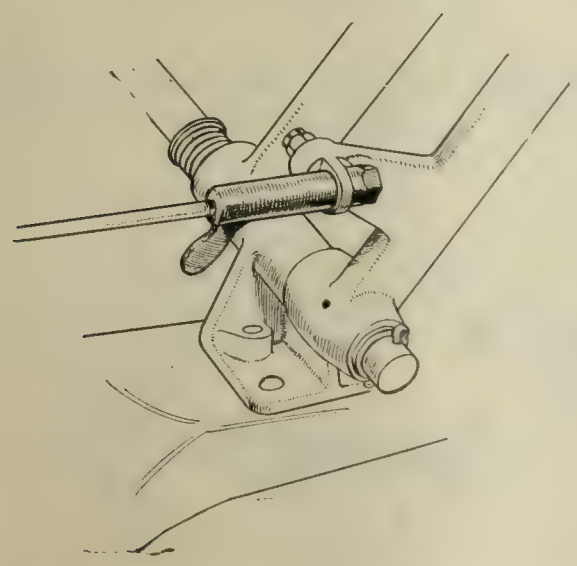
There are a good many cars at the show in which the frames have been made more rigid during the past year. In some cases the side bars are actually stronger than in



Fuel pipes on Locomobile are supported under chassis frame by special brackets and are easily removed

the preceding models, being either made of heavier stock of sheet steel or else having a deeper section or wider flanges. But in the majority of cases one or more cross members are added or existing cross members are made of deeper or stronger section. Tubular cross members at the front or rear or both are constantly gaining in favor. Such members are particularly serviceable in preventing weaving of the frame. A good example of the use of a tubular cross member is found in the new Gray low-priced car which has only a single cross member to the frame back of the engine; that cross member is a tube of considerable diameter and heavy wall thickness. Among makes of cars with stiffened or heavier frames may be mentioned Nash, Studebaker, Auburn, Lexington, Cole, Stearns, Liberty, Westcott and Gardner. On the Stearns a very deep central cross member has been substituted for one of less strength in the vertical plane. This cross member has a large opening stamped in it through which pass the propeller shaft and torque arm. The object of this cross member is not only to add to the rigidity of the frame but also to serve as a guard for the propeller shaft and torque arm, preventing these from falling to the ground and causing a serious accident in case they should become disconnected at the forward end. On the Chandler a simple brace for the spring bracket at the forward end of the rear spring was observed. The spring bracket is in the form of a U directly below the frame channel, as shown in the sketch, and a diagonal brace from a cross member runs to the bottom of the bracket.

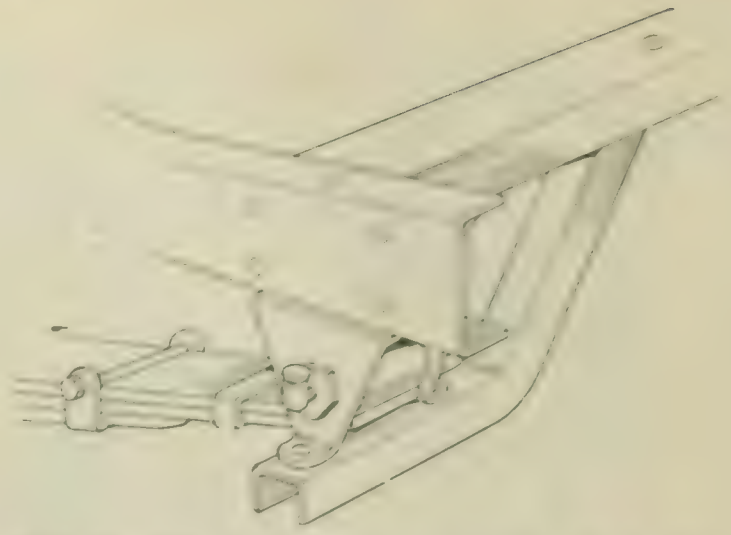
Aside from the tendency to increased use of transmission brakes there does not appear to be much new in brake design. On the Templar a ring is swaged to the edge of the brake drum on the outside to reinforce it. On several models the brake rods have been removed from the outside of the frame and put inside where they are less conspicuous when the car is assembled. Laudable attention has been given to the problem of making the adjustment of the brake easier. The Gemmer device, brought out about a year ago, by which the brake rods can be taken up without taking the pin out of a yoke connector, was seen on two or three cars at the show, and a similar device is found on the new Durant car. The Durant brake rod adjuster is shown herewith. An internally threaded sleeve is screwed over the end of the brake rod. This sleeve is reduced in diameter over part of its length and the reduced portion passes through the eye of an eye bolt



Brake adjusting device used on the Durant

whose shank passes through a hole in an arm on the brake pedal. An annular washer and a ring nut hold the sleeve in the eye of the eye bolt.

In connection with brake design is has been a wonder to the writer that apparently more makers than formerly put out their cars without brake equalizers. His own experience is that this is a serious defect, as it is quite impossible to so adjust brake rods that the two brakes



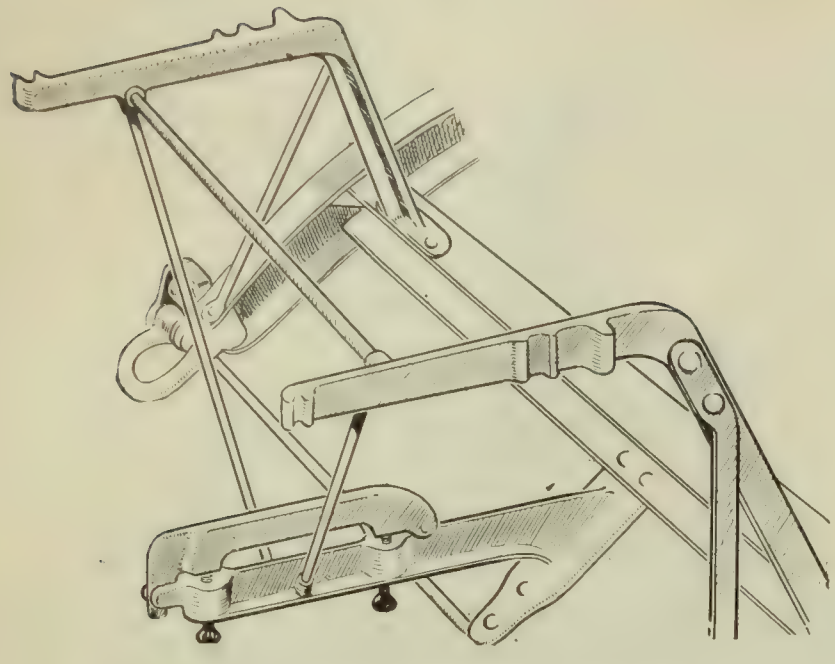
Brace for spring bracket used on forward end of rear spring on Chandler chassis

will grip equally if no equalizer is provided. Usually the brake on one wheel will exert much more retarding effect, with the result that that wheel will slip on the slightest provocation and its tire will show rapid wear. An acquaintance spoken to at the show, who is also "blessed" with a car without brake equalizers fully confirmed these observations. It may be that designers reason that the brake linkage is hidden on the car and the average purchaser never asks about it, so why assume this additional expense? It is safe to say, however, that users who have once been annoyed by seeing one of their rear tires wear out in short order, because of constant slipping under brake action, will look out for this matter when in the market for a new car. Of course, it is conceivable that in certain brake linkages incorporating rather flexible cross shafts, the brakes could be applied with nearly equal pressure even though they were not adjusted absolutely equally, but such flexible linkages are objectionable for another reason, in that they give the driver a feeling of insecurity. In the writer's opinion there are few parts that are not absolutely essential to the operation of a car that warrant so well the expense of their installation as does a simple effective rattle proof brake equalizer. Oakland has adopted brake equalizers this year.

Steering Wheel Changes

Coming now to steering gear, it is of interest to observe that a good many manufacturers during the past year have changed their steering wheels. Some that were formerly 17 in. in diameter have been increased to 18 in. (Gardner, for instance); others have changed to the composition, non-wearing rim with scallops on both the inside and the outside; still others use walnut rims with walnut spokes extending in either all the way to the metal hub or to metal spokes extending a short distance from the hub, and the Gardner has adopted an aluminum steering wheel spider instead of a malleable iron one. The new Standard car is an example of the use of a walnut rim and walnut spokes in the steering wheel, and the same car also has a walnut instrument board.

In several instances ball thrust bearings have been put into steering gears where plain thrust washers were formerly used, and the Studebaker among others is now fitting roller bearings on its steering knuckle pins, the object of both of these improvements being to render the car easier to steer. Looking over the steering gears and their connections, the writer was somewhat surprised at the crooks in some of the drag links. The reason why these links are given these awkward shapes is fairly obvious; it is desired to make the turning radius as short as possible, and to prevent limitation of the steering deflection by the drag link it is bent to such form that it is out of the way of the wheel when the latter is swung



New tire carrier used on Dorris cars

around till it is practically up to the frame. Bending the drag links to the extent seen on some cars greatly weakens them. It might be argued that the links in any case are strong enough for their work, and while this may be so, the fact remains that if they were made straight the same strength could be obtained with much less weight. There are many cars on which the links are absolutely straight, while in others there is only a slight offset. In the Studebaker, in which the frame tapers from end to end, the front springs are arranged parallel with the axis of the car, so that their rear ends are inside the frame, which seems to obviate the need of greatly bending the drag link in order to obtain a large limiting steering angle. Drag links with such crooks in them that they look as though they had been in a wreck do not appeal to the mechanical sense.

Frames tapering from end to end, with their side rails absolutely straight, have become very common. In a few instances either the rear end as far forward as the rear springs extend, is made parallel with the axis of the car, and in some cases the front end is also parallel with the frame axis. But the bottle-necked type of frame has passed definitely out of use.

Grease cups in chassis lubrication have come to be a rarity. Numerous makers again have adopted the high pressure grease gun method of lubrication, while others have adopted the method of lubrication by oil fed in the same way as the ordinary oilers.

The Dorris car is provided with a new tire carrier which holds two tires and rims securely locked in position as shown in the accompanying sketch.

A good deal of interest centers in the Gray car exhibited at the Commodore, which is to sell at less than $500, according to announcement. Among the officials of the company which plans to put this car on the market is Klingensmith, formerly executive vice-president of the Ford Motor Co. It is significant that while other former lieutenants of Henry Ford who dissociated themselves from the Ford enterprises and started out "on their own hook," like the Dodges and Harold Wills, carefully avoided the field in which direct Ford competition might be expected, Klingensmith is preparing to put out a car that seems to have exactly the same range of appeal as the Ford. To engineers the design of the new Gray is of much interest as indicative of what a car of cheap production possibilities should be. It has a frame with only a single cross member back of the unit power plant, and that tubular. The rear axle is of the pressed steel type with spiral bevel gear drive. In connection with this feature it would appear that the spiral bevel gear is as cheap as the straight bevel gear, or at least very nearly so, if you do not have to scrap an expensive installation for cutting straight bevel gears. The springs are quarter elliptic, those in the rear being double, superposed. The steering gear seems to comprise a double set of spur gears or what is known as a compound gear, at the bottom of the steering post, and from it connection is made to the steering knuckle on the opposite (right hand) side. Both axles are of Timken make. The wheelbase is 100 in. and the wheels are 30 x 3½ in.

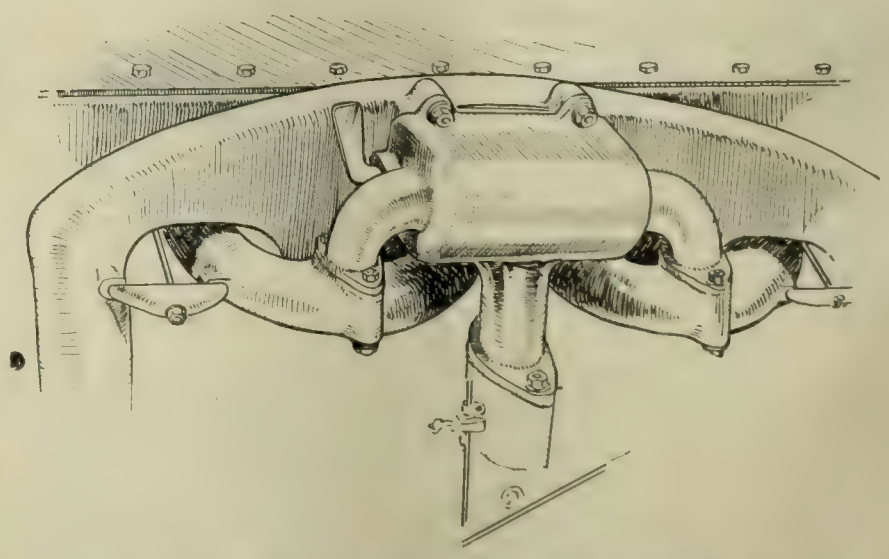
Powerplant Trends as Seen at the Show

By Herbert Chase

THOSE who were looking for radical departures in means for better handling of fuels were able to discover but little of this nature in the cars on view this week at the National Automobile Show and in various hotels in New York.

There is, however, an encouraging tendency to provide devices for better vaporization of the fuel, most of these being in the nature of hot spots or some form of exhaust jacket around a portion of the inlet manifold. In some cases means are provided for manually varying the quantity of heat applied to the manifold. Examples of this are the new Studebaker Special Six which, as shown in the accompanying cut, is provided with a shutter for controlling flow of exhaust gas into jacket around inlet manifold, and the Buick Six in which a shutter in the exhaust pipe is interconnected with the throttle in such a way that the amount of exhaust deflected through the exhaust jacket of the inlet manifold is varied with change in the position of the throttle.

Among the engines employing hot spots are some of the Continental jobs fitted in several cars including, for example, the Columbia. The special engine built for Jordan by Continental also has a hot spot. Others of the newer cars which have hot spots in various forms are



Manifold layout on the new Studebaker Special Six, showing the lever connected to the shutter which controls flow of exhaust into jacket around inlet manifold

the Goodspeed, Gray, Leach, Mitchell and the Elgin fitted with a Falls engine. The H.C.S. and the new Walker engine used in the Grant car are among the engines fitted with combination inlet and exhaust manifolds cast in a single piece, the latter having a small hot dome to aid in vaporization of the fuel. In the new Rickenbacker and some other cars a ram's horn type of manifold is used in combination with the hot spot, the arrangement being such that fuel deposited on the walls of the ram's horn portion drains toward the cylinder and is vaporized by contact with hot walls in the cylinder head. A variation of the hot spot idea is seen in the new Frontenac in the form of a slotted aluminum cone which is heated by the exhaust at one end and is in contact with inlet gases to which it conducts heat at the other end.

In the Premier engine and the Ansted, which is used in the new Durant Six and in Lexington cars, provision is made whereby fuel thrown out of the air stream is vaporized by contact with exhaust heated ribs on the interior surface of the inlet manifold. The latter is so disposed as to add a minimum of heat to the air, while still providing sufficient heat for vaporization of liquid fuel.

The Dorris engine is equipped with a device called a "distillator," which is intended to go a step further than some of the other vaporizing systems. In this device exhaust heated wells are provided adjacent to the inlet ports. These are so arranged as to trap liquid fuel and vaporize it. Any fuel which is not quickly vaporized runs by gravity from the wells to an exhaust heated compartment called a still, adjacent to the carbureter. The still is so arranged that the heat can be cut off from it in warm weather if desired, but it has been found desirable to use it the year 'round in most cases, and it is said to have resulted in a very marked decrease in the quantity of fuel which passes the pistons and dilutes the lubricating oil.

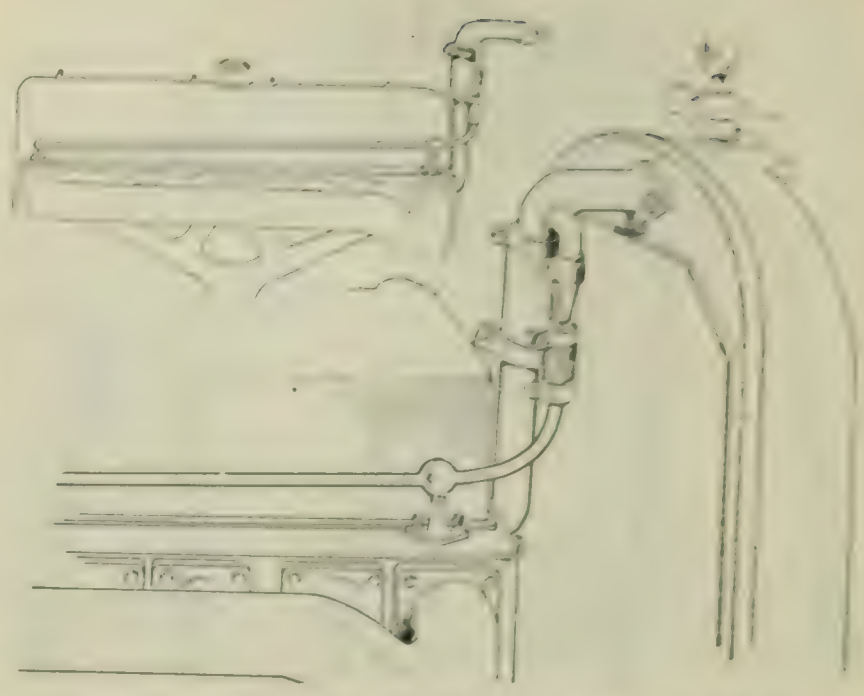
In several of the eight-cylinder engines the inlet manifold is cast integral with a passage connected to the exhaust manifold of the respective blocks at each end. The exhaust gases surge back and forth through this passage and are said to provide ample heat for vaporizing the fuel.

In some cases a water jacketed inlet is still depended upon for providing the heat for vaporization of the fuel, and one new car, the Wills Ste. Claire, has this arrangement. In the Stevens-Duryea, heat is furnished both by a water jacket and by the exhaust.

In the new model Cadillac the carbureter is provided with two thermostats, one of which is arranged to control the mixture proportions so that the charge is somewhat richer when the engine is cold than when it is warm. The second thermostat controls a vent on the float chamber, opening this vent as the temperature increases. A plunger operated by the accelerator pedal is so arranged as to momentarily increase the pressure in the float chamber when the accelerator is opened quickly, thereby giving a richer mixture for acceleration. When the vent to the chamber is opened by the thermostat, however, the enriching action is decreased or eliminated.

Cooling Systems

Turning now to other phases of powerplant construction it is apparent that more attention is being given to the cooling system. Thermostats for control of the circulating water are now used in more cars, having been fitted to the Case, Cole, Haynes and Goodspeed among others of the newer cars or models. Heretofore the thermostat has usually been so arranged as to permit circulation through the engine jacket only and not through the radiator during the warming up period. In



Extra water outlet pipe used on Marmon engine to prevent steam pockets in corners of jackets

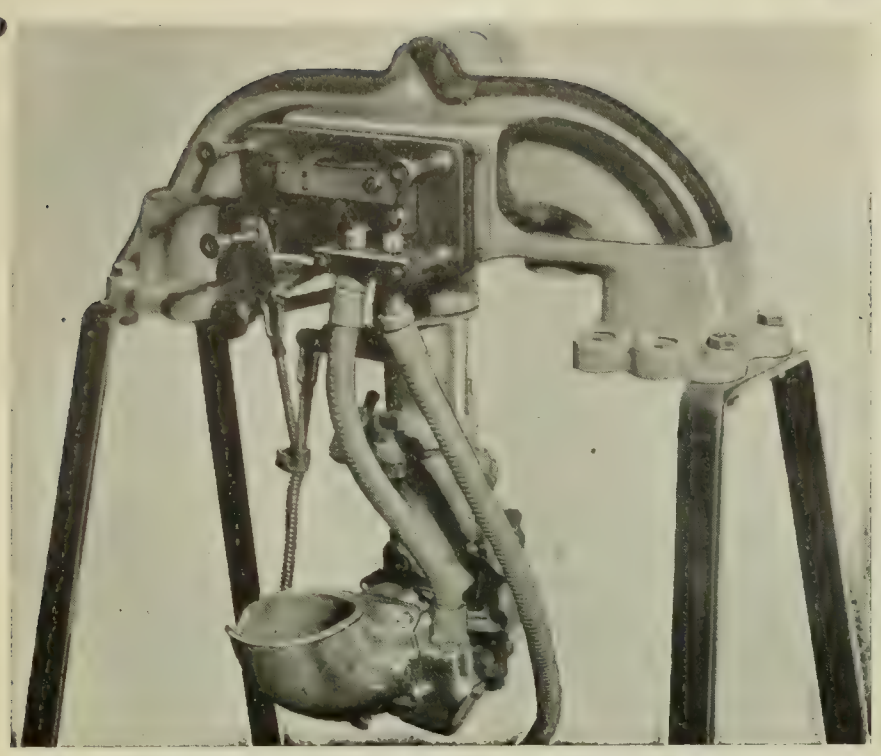
the new Haynes model the thermostat is so installed that the pump circulates the water through the radiator only during the warming period, and opens when the temperature in the jacket has risen to a predetermined point. By this arrangement freezing of the radiator is less likely.

Wider fan belts are seen on some cars, including the Driggs, Dorris and Studebaker. In the Apperson and Olds eights an unusually wide belt is used for driving both the fan and the lighting generator, the fan being mounted on the end of the generator shaft. More convenient means are provided in some cases for adjustment of the tension on the fan belt. In the case of the Elgin this can be done without the use of tools, by simply turning a wing nut. A spring with wing nut adjustment is also provided on the Buick Six, while the new Durant Six, among others, is provided with a convenient eccentric adjustment. On the new Leach Six the fan is positively driven by a bevel gear off the vertical shaft which connects the crankshaft with the overhead camshaft. The fan on the Wills Ste. Claire is provided with a clutch arranged to release automatically when the speed of the engine exceeds a predetermined r.p.m. The Elgin, Dorris and Studebaker cars are provided with larger fans than formerly, while the Dorris has also a larger radiator.

In the latest model Marmon an extra water outlet pipe is connected to the cylinder head at points just above the exhaust ports on cylinders 1 and 6. This we understand has been added to avoid air or steam pockets in the vicinity of the exhaust valves of the cylinders mentioned. The arrangement is shown in an accompanying cut.

Aids to Starting

Lincoln cars are now provided with a special electrical heating device designed to facilitate starting in cold weather. The heating element is made of Chromel wire and is located at the lowest point of the carbureter near the air inlet. When the strangler handle located on the instrument board is pulled out an electric circuit is closed through the heating element, which carries about 100 amperes for eight of ten seconds. The current which passes through the heating element also passes through two sheet metal contact switches shown in the accompanying cut. One leaf of this double switch is composed of Invar and brass, which form a thermostat. This thermostat automatically opens the circuit through the heating



Switch and connections used on the new Lincoln "electrofog," an electrically heated device to assist in starting the engine

element at the end of the period mentioned, thus conserving energy taken from the battery and also preventing the possibility of fire or burning out of the heating element.

The action of the heat upon the liquid gasoline results in the formation of a fog and some permanent gas in the inlet pipe, and this mixture is then quickly drawn into the engine by cranking with the starter. The mixture is very easily ignited and makes it possible to start almost immediately upon cranking the engine.

In tests made prior to the development of the "electrofog" it was found by Lincoln engineers that cranking the engine for thirty seconds at low temperature with the choke closed would cause as much as one-half pint of liquid fuel to pass into the cylinders and by the pistons into the crankcase of the engine. Since cranking for this length of time is not infrequent on any engine which is extremely cold, the utility of such a device as the "electrofog" intending to prevent dilution of lubricant by raw fuel used in priming is apparent.

The new Case and the Franklin are among other cars regularly equipped with primer-heating devices.

Lubrication and Piston Design

A number of efforts to improve the lubrication of engine parts are in evidence. In practically all new cars some system of pressure lubrication is employed. Pressure lubrication to the main and connecting rod bearings, for example, is provided in the Wills Ste. Claire, Duesenberg, Frontenac, Goodspeed, Grant-Walker, Durant Six and Elgin, among others, the last two mentioned having a vacuum control arranged to increase the oil pressure as the load increases. The Velie is provided with a full pressure system in which oil is carried to the main bearings, connecting rod bearings and thence to the wristpins under pressure. In the Grant-Walker engine oil from the valve rocker shaft passes through the rocker arms and into cups on the upper ends of the push rods. Oil which overflows these cups runs down the push rod and lubricates the cam followers and cams. In the Wills Ste. Claire the cam face is drilled and receives oil from a hollow camshaft.

The Cleveland and Nash, among others, are now provided with oil drain cocks which are readily opened from a position above the frame without getting under the engine, while Cleveland, Jordan and Locomobile are among those provided with more accessible or larger oil fillers. The Locomobile now has two oil pumps, one of which draws oil from the front end of the engine and returns it to the sump. New splash pans which give practically a constant level of oil regardless of how much the car is tilted from side to side, are also provided.

A number of the newer cars and models are fitted with constant clearance pistons. The Frontenac and Premier employ the Nelson expanded type, which is elliptical when cold. The Cole and Stevens-Duryea, among others, employ slotted types. In most cases some provision is made for wiping the oil from the piston skirts or draining it through holes back into the crankcase. A sharp-edged skirt and rings are used on the new Rickenbacker, while the Cleveland, Lincoln and Wills Ste. Claire employ a sharp-edged lower ring to serve as an oil scraper. The new Mitchell engine is provided with pistons in which the heads are polished, and the same is true of the Wills Ste. Claire, in which the pistons are also somewhat longer than formerly. Dort, Lincoln and others are using lighter pistons than heretofore, and a number of concerns are now using aluminum pistons, difficulties formerly encountered with this type having been overcome by improvements in design and manufacture. In the new Duesenberg car Magnalite pistons are regularly furnished, but cast iron pistons are optional.

Valves and Valve Actuation

Aside from the piston valve used in the Goodspeed engine and the rotary valve in the Bournonville Rotary, there is little departure from conventional practice in valve construction, although a number of refinements in design have been incorporated in many engines. Quite a percentage of the newer cars and models are equipped with overhead valves, among these being the Duesenberg, Frontenac, Leach and Wills Ste. Claire. In some cases in which the L-head construction is employed the valves are slightly inclined from the vertical in order to give a shallower pocket in the L and, consequently, a better shaped combustion chamber. The Haynes is one example of this type of construction. Many cars are using alloy steel valves, among these being the Frontenac, which has high tungsten exhaust and low tungsten inlet valves, and the Wills Ste. Claire, which uses valves with stems made of Invar, which has a low coefficient of expansion and therefore requires less clearance allowance. Valves of tulip shape are occasionally seen, as on the Haynes, while other types are frequently made with larger fillets than were formerly used. In the new Frontenac the overhead valves are located in a chamber separate from that in which the camshaft is placed.

The rocking chair type of rocker is seen on Ansted engine, which, in common with Dorris and Cleveland, among others, now uses double valve springs. Haynes, Mitchell and Velie are now among the users of a unit construction or block for accommodating several valve tappets. These are sub-assemblies which facilitate production, and are also readily removable for repair or adjustment. They are apt to be seen in more cars in the future.

Distribution Gearing and Crankshafts

Some engines which formerly used gears are now using chain drive for cam and accessory shaft drives, while several of the new cars also use chain. Among these may be mentioned the new Jordan-Continental, the Frontenac with two chains and the Rickenbacker with a triangular chain drive. In some cases provision is made for tightening the chain by moving the accessory driveshaft sprocket, while in others the new Link Belt spring-adjusted idler is employed.

Where gears are still used for distribution a composition material, such as Fabroil, is generally used, as in the Earl, or spiral bevels, as in the shaft drives on the Duesenberg and Wills Sainte Claire. The last-mentioned make uses a special frictional steadying device on the camshafts as an aid to quietness.

There is a tendency toward the use of heavier and more rigid crankshafts than were formerly employed. Haynes, Locomobile and Jordan are examples of this, while several of the new cars, including the Buick Four and the new Velie Six, have crankshafts of unusually large dimensions as compared to former practice. Shafts designed with a view to better balancing are also in evidence. Frontenac, for example, employs the disk type, while Rickenbacker has the curved-cheek type.

The Duesenberg has connecting rods in which the big end bearing is provided with circumferential ribs to assist in cooling. The Durant and the Wills Sainte Claire are among newer cars laid out in such a way that no shims are required in the bearings.

Cylinders and Mounting

In several of the newer engines the cylinders and upper half of the crankcase are cast in a single piece, but in some instances the bell housing formerly cast also in one piece with the crankcase is now made separately to facilitate certain machining operations. In quite a number of instances the combustion chamber is now machined all over and polished with a view to giving uniform compression pressure in all cylinders and helping to minimize carbon deposits.

While the use of three-point suspension for the engine is becoming rather general, there are still some advocates of four-point rigid mountings. In the Durant Six car the engine is supported by short lugs attached to cross members, instead of to the main frame. Wills Sainte Claire, among others, uses a spring-mounted engine. In this case the springs are placed under each of the forward engine supports and are of the helical type, the flat springs formerly used having been given up.

Electrical Equipment

In some of the newer cars and models the starting motor and lighting generator are being placed adjacent to the gearset, and in one or two instances are driven off the transmission. This gives a cleaner engine compartment and in some cases renders the units rather more accessible. It also distributes the weight to better advantage. Good examples of this type of construction are seen in the Stevens-Duryea and the new Frontenac. Flange mountings are quite generally employed, but there are a number of instances of sleeve-type mounting, and others in which the generator or starting motor are mounted on a separate base, some of the latter being held in place by a substantial strap so arranged as to facilitate removal when this is necessary. The starting motor is provided with a Bendix drive in the great majority of cases, and the pinion meshes gear with teeth cut in the flywheel rim. In a few cases a roller chain and sprocket with over-running clutch is employed for the starter drive.

The tendency to mount the ignition distributor higher up, where it is readily accessible and less apt to become dirty, is worthy of note. Vertical shafts with the distributor mounted high up are now used on the Packard, Essex, Leach and Rickenbacker among others, while on the Frontenac the distributor is horizontal but located near the top of the engine.

General Observations

There are but few novelties in evidence at the show, but there are, as usual, a number of refinements and slight departures from conventional practice. The Rickenbacker, for example, has two flywheels, one at the front and one at the rear of the engine.

There is a general improvement in external appearance, with less complication in control devices for the engine accessories. The Velie, H. C. S., Leach and Frontenac, among others, present an unusually clean external appearance and are good examples of the general tendency toward a more finished design.

Trend Toward Utility Bodies at Show

By George J. Mercer

BODY designs exhibited at the show, as a whole, are good. There are many high spots as regards new designs, refinement in detail on old models as well as the addition of new features and quality of workmanship. All go to make the show rank with the best of its predecessors.

One noticeable feature is that several things that were new on bodies at the Salon are exhibited on bodies at this show. As a rule the Salon has designs that are never considered from the quantity manufacturer's point of view. As an example of this many cars had the trunk or trunk rack at the rear, and this was new even for the Salon. Other points include the extensive use of nickel for the radiators, wire wheels all nickel finished, disk wheels with nickel flanges, more extensive use of dash or cowl lamps and nickel windshield as well as having the lower part of the shield stationary and the use of ventilators on the shroud and at times in the roof.

One other feature that makes this show closely resemble the Salon is that the new body designs shown there are presented here by more than one manufacturer and, in some instances, in the remodeled form that manufacturing in quantities necessitates. One particular instance in this respect is the showing of bodies in which fabric or leather is used for the body covering in place of metal.

The inside drive cabriolets exhibited by Lincoln, Stevens Duryea and McFarland are the equal of the same designs exhibited at the Salon. At that time the writer predicted that the impetus given the use of fabric for the outer covering by this new model, the enclosed cabriolet, would surely be felt in the industry, and that there would be a number of new models making use of the fabric to get cheaper manufacturing costs. This prediction has been verified, as shown by the illustrations of the Hupmobile, Dodge, Dort and Essex.

These models represent the first efforts of manufacturers to get reduced costs along this line. There is no unified effort, however, as shown by these illustrations, for each has apparently taken advantage of their individual opportunities to use part of their regular equipment. The primary idea in each case has been to get maximum results with minimum costs. Only time can tell what permanent results will follow.

One thing is certain—the use of fabric for panel covering will continue in increased quantity, because designers will not admit that its disadvantages cannot be overcome.

Those who give it serious attention, however, are surprised to find that it has not the inherent low cost that would be supposed. On a sample body, or for special designs, this form of manufacture will be cheap in comparison, but it does not lend itself to quantity production, as does an all metal body, and still give the same uniform results. The method of attaching at the belt is a serious problem. On the inside driven cabriolets this has been well done, but on the bodies made for a cost it has in no instance been well performed. In all previous departures from established custom, however, the initial efforts have been disappointing and we may yet see good results obtained in fastening the fabric on built-for-the-price bodies.

One other new model was the close coupled, four-passenger inside drive body that is really a miniature sedan. This design has not been stabilized as yet. It was shown by the LaFayette, as illustrated, and the rear had a built-in trunk or suitcase carrier. Most of the types at the show have two doors at the front, the same as the regulation coupe. The rear seats are straight across and the front seats are divided with an aisle between. Time is also the factor that will bring uniformity as to the number of doors best suited for this body. It would seem from the writer's observation that the four door body has more advantages than the two. The cost of the additional two doors would be approximately $10 and it remains to be seen if this is not well worth the expense.

The point is that in this new model the cost problem is being attacked from more than one angle. The fabric covered body represents one end, the close coupled body another. Those who are bringing forward the latter body are saving in weight, using a short wheelbase car, and trusting to a smaller sales resistance by continuing to produce a car that is somewhat similar to an established model and thereby gain increased production.

Many Attempts at Reduced Cost

The question of reduced costs has almost as many angles as there are manufacturers. Those building a medium priced car can make a reduction and yet have a body that will be superior to the low priced car. All makers of this type of body use the straight front, in fact this applies to the large percentage of all the bodies. This makes for economy as does the use of the fabric visor which is almost general. This again is less in cost than the third glass to the windshield.

The close coupled body necessitates the use of something at the rear to cover the space on the chassis. This is provided for by the trunk or suitcase holder. In a few instances the extra tire is carried beyond the trunk, but with others the tire is placed at the side and forward. However, it is quite general to have the bumper form the extreme end of the trunk rack.

The various bodies exhibited, in proportion to models, are about the same as in previous years. The sedan and five passenger phaeton predominate and the regular proportion of coupes and roadsters with a few limousines, broughams, cabriolets and berlines are in evidence.

Of exterior features, the most noticeable include the more extensive use of nickel for the radiators and the use of large circular headlights. These also are quite often nickel or have nickel rims. The windshields on some of the open bodies are nickeled and the use of dash or cowl lamps is quite general. These are more often placed directly on top of the shroud panel and not attached to the windshield post as in former years. The nickel extends to the wire wheels also and the disk wheels have nickel rims or bands.

Of the use of wire, disk and artillery wheels the proportions are fairly divided, sometimes all three being seen in one exhibit.

Ventilators are used on the top of the shroud in connection with the stationary windshield and at times they are also used on the sides and on the roofs of the closed bodies. It is logical to assume that the use of the roof ventilator will increase. The tendency is to make bodies, especially those that are produced for the price, with the rear quarter window stationary or leave this window out entirely. Some means must be provided for ventilation in the rear of these bodies, as they are sold for all season cars.

The use of steps is not confined to sport roadsters, but they are used in certain instances in connection with all body models. There are many more in use than last year. Step lights are used quite often and some have the light incorporated within the step casing.

Mudguards are conventional, the full crown predominating, and when made to use with steps usually come further down or rather follow the wheel contour further down.

The soft roof does not show the proportionate gain that it did at the Salon nor is it so well covered by moulding. Use of a moulding on the top to cover the joint has a tendency to make a pocket to hold the water and in time causes leakage. A large number of the bodies use a built up material forming a solid roof panel.

The inside drive cabriolets exhibited are all good examples of this body type. Some have outside joints giving the top the appearance of having the falling feature, although they are not made to drop. The roofs on these bodies have good lines.

Round lines are the predominating feature on radiators, hoods and shrouds as well as for the rear of the bodies. There are fewer severe or angular surfaces than at previous shows. Most of the closed bodies use one wide belt moulding from 1 in. to 1½ in. wide and not raised much at the back.

Doors are made flush, with mouldings and with the overlap, the latter predominating. Both outside and concealed hinges are used and the handles are uniformly the straight pattern. Both nickeled and black are used.

The painting combination on the closed bodies combines with the usual display of dark colors a large proportion of cars with bright colors, of which blues and greens, bronze greens and browns in two tones have their share. There are more maroon and black painted cars than at previous shows. Maroon combines remarkably well with the nickel finish and makes the most happy combination at the show, especially on the cars having disk wheels with nickel rims and hub flanges.

Interior Trimmings

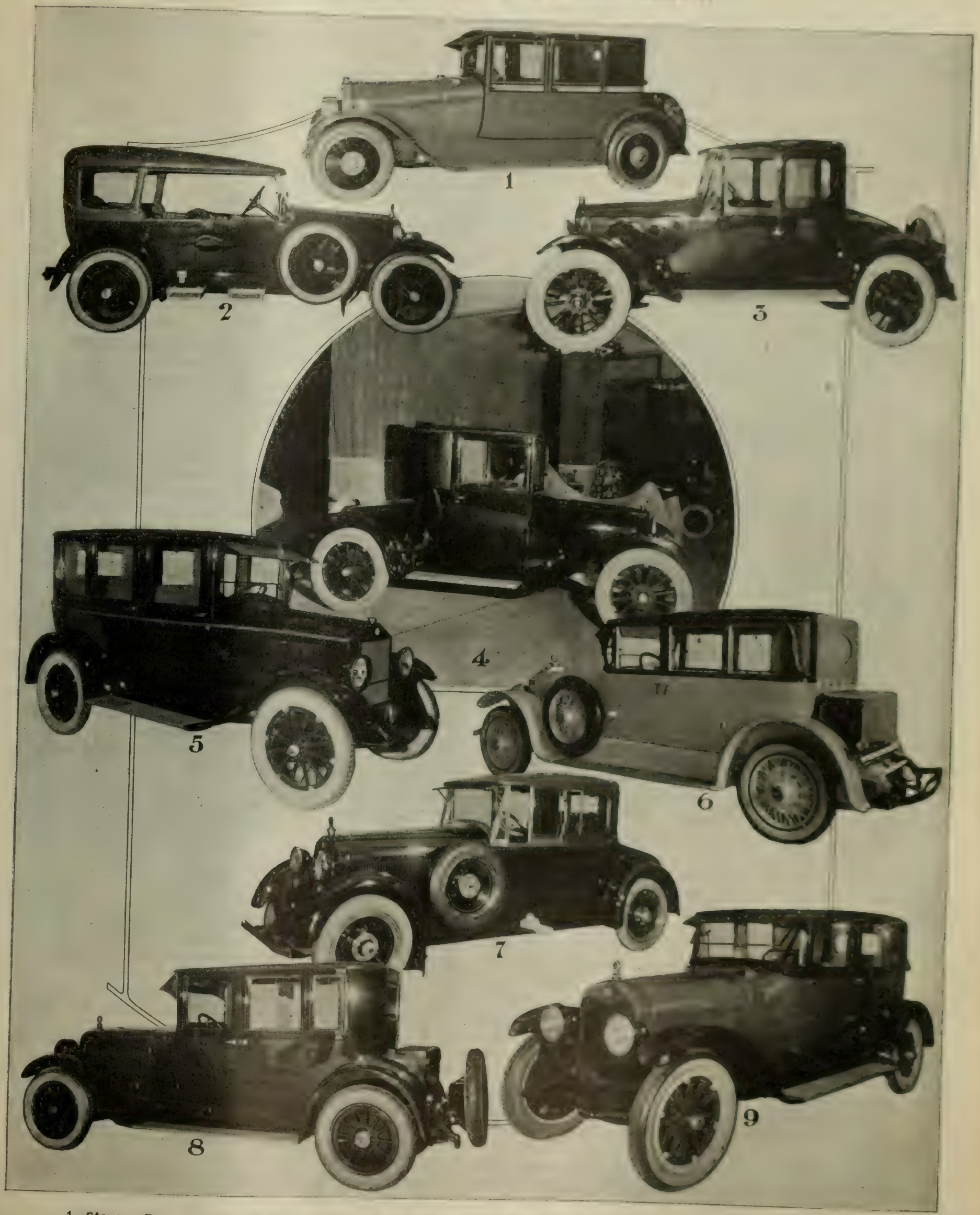
The interior trimmings combine about all that is offered in modest colors. Velours and wool fabrics share about half and a few use worsted. This latter trims in a clear cut manner when well done, but on account of its springy nature is a more expensive material in labor cost than softer fabrics.

Nearly all the fabrics are of a double pattern, having the seat and cushion of a pin stripe and the upper plain. Greys and browns predominate as does the straight pleat. In some instances buttons or the pipe and point, and in rare cases, a plain design are used.

From indications at this show and the Salon there is a tendency to allow the wood interior finish to come back in a limited way. Several bodies use Circassian walnut trim on top of the driving seat and the inside of the pillar that separates the doors. One body has the roof entirely wood finish and there are a few using the wood trim on the doors similar to that in use some years ago.

Interior appointments have not decreased but rather there is a slight tendency to add to their number. A few cars have visible vanity cases and some have concealed

Body Features at the Show



1—Stevens-Duryea inside driven cabriolet. 2—A semi-California top on the H. C. S. 3 and 4—Service models with fabric covered upper structure on Hupmobile and Dodge. 5—A larger service model body on the Dort. 6—McFarlan inside driven cabriolet. 7—The California top as used on the Leach. 8—Lafayette close coupled sedan. 9—Lincoln inside driven cabriolet

cases. Toggle grips are used to a limited extent. One car has arm holders and several have flower holders. One car has a large pocket at the rear of the front seat and there are more cars with pockets on the doors than last year. Otherwise the doors are plain trimmed and the curtains are confined to the rear quarter and the back window. The interior wood finish is either circassian walnut or mahogany.

The interior metal parts are mostly of dull silver finish with design patterns. Regulators are used on the doors and in a few instances on the quarters, but straps predominate. A few of the windows are of the jump fence type, but the majority run in straight grooves.

More cars use the combination dome light and corner lamps than the single dome light. Other metal appointments include the regulation equipment, and in addition all cars have robe rails, some having them on the doors. Some have cushion pillows and foot pillows or rests. On the close coupled bodies the front seat rear panel is pocketed for additional leg room.

The phaeton models (formerly called touring cars) are uniformly the five and seven passenger sizes. The extra seat on the latter models is made both to be concealed and to be exposed in its pocket. These bodies, in some instances, are made with steps instead of runboards, but nothing like a general tendency can be said to be under way in this respect. This could not even be claimed for the roadsters.

The general lines of the bodies are round. The bevel edge or angular surfaces are non-existent.

The use of the outside door handle is general, but the need of having some means of protecting the top edge of the door from deterioration is evidenced by the larger number of bodies that use a non-deteriorating trim. Some use dull finish metal, formed as a moulding and well rounded. The use of wood has made some gain and there are two using a white metal or aluminum, one in the form of a flat strip and the other as a channel that fits over the top of the door. Generally the top edges of the bodies are flat or slightly rounded and only a few carry the body line through the hood to the front.

Seat Backs Low

The average height of the body side on about 20 cars is 23 inches, and the height of the rear seat cushion at the front above the floor is 14 inches. The seating arrangements, so far as the thickness of cushions is concerned, are uniformly good, but the rear seat backs average below 19 inches above the cushion, which is too low for comfort. There is a slight effort to make these bodies close coupled as with the closed models, and the use of trunk racks at the back and guard rail on the rear panel has increased, both on the close coupled and regulation length bodies.

To provide foot rests, the triangular box with luggage space has come into use on the short bodies. In some cases this compartment has been used to carry the curtains.

Curtain compartments in the rear of the front seat are increasing in number. This is provided for in several ways. Some use a bellows pocket that is the cover for an opening; others have doors. On high priced cars it would seem that there is a tendency to use natural wood finish at the rear of the front seat and have lockers and curtain pockets in same. Tonneau lights at this place are not often used.

Metal instrument boards are the rule on all cars, and the narrow straight louvres on the hoods seem to have become more general.

The exteriors of these bodies are plain and without mouldings on the doors, overlap panels being most in use.

The tops are the conventional one man design, but there are more using a khaki colored fabric with wood bows and nickel metal parts than is customary at this show.

The color combinations have the usual number of light shades and there is a more general use of the stripe.

The larger bodies on roadsters, that have come into use during the last few years, are in evidence. The seating and carrying space has been increased in even the sport type. The tops on these bodies are now made to close the sides up to the door and the body as a whole is more luxurious and attractive. The roadster has developed from humming bird size to be the dandy of body types.

A summary of the tendency in the design of bodies as exemplified by those at the show can be gauged only from what is new. There are always at this show bodies that represent a style that has been in use for a period of time, due to the custom of manufacturers to exhibit only what they can deliver from stock and if they have a large number that will have to be moved before being replaced by newer designs.

Enclosed Bodies Arouse Interest

Enclosed bodies to-day interest more people, both buyers and manufacturers, than at any previous time in the history of the trade. The desire of manufacturers to market an enclosed body at a price only a few hundred dollars above that of the open car is bringing about the keenest interest in any design that will fulfill this demand and at the same time not sacrifice too much in appearance.

No one effort in this respect, so far introduced, either the close coupled body of minimum size or the fabric covered panel body, will meet all requirements, however. Both represent an effort with different objects in view, because two classes of purchasers must be considered. These are divided into those who want simply a business car and those who want one for family use and yet cannot afford to pay the price that an enclosed body of regulation pattern sells for. It would seem that these two divisions will tend to be even more distinct as time sifts out the design that will survive. We may expect a business car that is made for the price and in which appearance is sacrificed to get cost of manufacturing at the lowest possible figure and we may also look for a slightly better appearing body of the close coupled size, in which manufacturing costs, selling price and appearance are medium. This body will fulfill the requirements of the sedan and the coupe as they are to-day. The probability is that it will be made with both two and four doors. This latter body has the advantage that it can always be added to in the way of accessories, such as trunk racks, etc., and be quickly converted into the near special built body class.

These two body types will in the future be the total enclosed models of many medium priced car manufacturers.

The high priced bodies will in the future, as at present, be divided into the two divisions of enclosed and outside chauffeur driven cars. The latter are not subject to revision, but the former, as indicated at the salon, tend to be made in the Berline or two compartment size.

Details of the show will be presented in the next issue of AUTOMOTIVE INDUSTRIES.

THE outstanding feature of the alterations embodied in the new customs tariff schedules since adopted by the New Zealand Parliament is increased preference for British goods.

Included in a schedule of more than 100 pages are the following items:

Motor vehicles, former rates 10 per cent, British, and 20 per cent, foreign, now pay 15 per cent and 25 per cent, respectively; rubber tires were formerly free, even though attached to motor cars, now pay 15 per cent, British, and 25 per cent, foreign.

10,449,785 Cars and Trucks Were Registered in 1921

Figures for the past year show an actual gain equal or greater than that of 1920. Increase amounts to about 14.52 per cent. exceeding all estimates. One car for every 10.10 persons. Fees collected will amount to approximately $110,000,000, an increase of about $19,000,000.

DURING 1921 a total of 10,449,785 passenger cars and trucks were registered in the United States. This represents a gain of 1,517,327 over the 1920 registration figures, or a gain of 14.52 per cent.

About 250,000 of this gain, however, is a "statistical" gain and an explanation should be made at the outset. There are two reasons for this situation, one in Minnesota and the other in the District of Columbia. In Minnesota, registrations were formerly on a three-year basis and in order to get yearly registration figures it was necessary to take only the number of cars registered during the year, which really represented the gain for that year. Thus in 1920 the figures given for Minnesota were 65,517, while this year the figure is given as 328,700, representing an apparent gain of 263,183. This figure is obviously wrong, although the total registration is correct. It is quite logical to assume that about 250,000 cars should be deducted from the actual gain made in 1921 on this account, although this would not affect the total registration figures. Minnesota is now on a yearly registration basis, and there should be no trouble there in the future.

In the District of Columbia, also, confusion has existed and accurate registration figures were exceedingly hard to obtain. The figures presented in the registration tables, however, are accurate for 1921 and there should be no statistical difficulties.

Taking these two points into consideration, however, the actual gain in 1921, which will about equal the gain of 1,335,955 in 1920, exceeds the predictions of some of the most optimistic estimators.

On the basis of these figures there are about 10.10 persons per car in the United States. It is impossible to determine exactly how many of the 10,449,785 vehicles are passenger cars and how many trucks, for there are several States in which they are not segregated in the registration figures. In those States that do make such distinction, however, the totals show that about 11 per cent of the vehicles are trucks. This could probably be taken as an average for the entire country, although there are, of course, exceptions.

Fees Will Exceed $110,000,000

In the matter of fees collected from motor vehicle registration incomplete figures show that a total of $98,449,925.66 have been paid into the various State treasuries so far. There are, however, fourteen States from which the amount was not obtainable. The total thus far, however, represents a gain of $7,474,527.66 over the amount collected in 1920. When complete returns are in for 1921 the amount will probably exceed $110,000,000. This vast amount of money released for road maintenance purposes should do considerable in the way of increasing the automotive market.

As previously stated, these gains exceed nearly all estimates. Some optimists predicted that there would be a million more cars registered in 1921 than in 1920 but few dared to place their estimates above that figure. While it is quite possible that dealers sold many cars that were on their floors at the beginning of last year, the figures indicate that there is not an enormous amount of unsold cars in the country to-day. The approximate production in 1921 of American automobile factories was $1,500,000. With a gain in registration almost equal to the number of cars produced it stands to reason that there are at least no more cars in the hands of dealers than at the beginning of 1921.

Sales Have Progressed

Hence, the figures show one thing clearly and that is that despite the period of business depression that has swept over the country, the sale of automobiles has progressed. Sales have gone on to as great an extent as they did when times were normal. It is quite true that not as many cars are produced as American factories are capable of producing, but such a situation may be accounted for in several ways. In the first place production capacity expanded during the war. Since the war exports have fallen off to a considerable extent, due to unfavorable rates of exchange. The export business, however, was not at a complete standstill in 1921 and when the number of cars that were sent abroad is taken into consideration the domestic registration figures assume still larger proportions. And the statistics presented in this article concern that domestic market. They show that the American public has been buying cars. If, despite the period of business depression, the automotive industry has managed to increase the use of its product to the same extent that it did in normal times, it seems logical to assume that the future holds even better prospects. The opinion of automotive manufacturers, expressed at the show, is that business has reached its lowest level and is now on the road to recovery. The year 1922 should see an even greater increase in registration than did 1921.

Numerous changes have taken place in the past year as regards leadership of States in the matters of number of persons per car, greatest number of cars, and greatest increases. California has come to the front as having one car for every 5.19 persons. Last year her ratio was 6.02. South Dakota, while still holding second place, now has one car for every 5.33 persons instead of one for every 5.24. Iowa, formerly one of the banner States in all respects, has dropped back a bit for the present, her registration decreasing by 7297 in 1921, and instead of the ratio of 5.5 persons per car there is now a ratio of 7.31. This situation, however, is one that will be overcome as agricultural conditions are bettered.

In the way of actual gains made during the year Ohio still heads the list of States as having the greatest increase. There were 127,316 more cars registered in Ohio in 1921 than in 1920, and 104,366 more registered in 1920 than in 1919. New York, formerly in second place with a gain in 1920 of 97,628 over 1919, has not only dropped to fifth place in this list, but also showed a decrease in gain, the number this year being but 84,795 higher than in 1920. New York, however, still has more cars registered within her boundaries than any other State. There is little change in the order of these States so far as the ones having the greatest numbers are concerned, although some changes have taken place in those States having fewer cars. Iowa has dropped from sixth to eighth place, and Michigan has gone above Texas.

Sectionally, the cars and trucks are divided about as they have always been, the greatest number being in the manufacturing centers, agricultural States following closely behind. So far as the number of persons per car is concerned, however, agricultural States are in the lead.

It is also of interest to compare these two groups as to the increases made in each. The statistics show that in eleven States forming the agricultural group there was a total gain of 147,343, while in ten States forming the manufacturing group there was a total gain of 510,388, or nearly half the total gain of the country.

The ten manufacturing States, however, show fewer cars in proportion to population than other sections of the country. The ten States considered in this group, together with their gains actually made and the number of persons per car in each are as follows:

State	Gain	No. persons per car
Massachusetts	58,401	10.11
New York	84,795	13.77
Pennsylvania	119,425	12.64
Michigan	64,320	7.69
Delaware	3,200	10.37
Connecticut	16,326	10.19
Rhode Island	3,346	11.25
New Jersey	43,868	11.69
Indiana	67,635	7.31
Wisconsin	48,672	7.69

Registration of Motor Vehicles

STATE	Total Net Registration	Non-Resident and Re-Registration	Passenger Cars	Commercial Cars	Motorcycles	Total Fees
Alabama	82,343	.....	73,233	9,110	805	$935,872.19
Arizona	35,220	1,576	30,312	4,908	.....	195,981.75
*Arkansas	67,413	509	66,477	936	171	.....
California	674,830	.....	638,922	35,908	17,603	6,990,981.04
*Colorado	145,370	.....	136,000	9,370	2,860	905,000.00
*Connecticut	135,460	.....	109,160	26,300	.....	.....
*Delaware	21,500	.....	.....	.....	.....	.....
District of Columbia	61,745	.....	54,147	6,976	2,487	383,289.00
Florida	97,837	.....	82,992	14,845	1,296	.....
Georgia	131,942	2,511	.....	.....	1,338	1,770,724.02
Idaho	51,300	.....	.....	.....	.....	.....
Illinois	670,452	.....	590,564	79,906	7,104	6,803,456.22
Indiana	400,342	.....	357,025	43,317	7,524	2,422,171.00
Iowa	430,003	112,994	399,478	30,525	3,897	7,718,926.19
Kansas	291,309	4,205	269,661	21,648	2,271	*3,000,000.00
Kentucky	125,627	8,759	110,602	15,025	1,175	1,771,887.02
*Louisiana	80,000	.....	72,000	8,000	.....	.....
Maine	77,530	7,240	67,593	9,937	1,525	1,004,653.00
*Maryland	140,000	.....	.....	.....	.....	.....
Massachusetts	363,032	.....	307,471	55,561	12,060	4,716,890.00
Michigan	477,037	42,996	426,984	50,053	6,195	6,526,387.01
Minnesota	328,700	.....	301,900	26,800	3,500	5,600,000.00
Mississippi	65,120	.....	58,420	6,700	375	798,306.07
*Missouri	343,386	.....	.....	.....	.....	.....
Montana	54,175	.....	.....	.....	.....	.....
Nebraska	242,557	.....	223,457	19,100	1,765	.....
Nevada	10,819	.....	.....	.....	130	102,800.00
*New Hampshire	42,500	.....	37,030	5,440	.....	.....
New Jersey	271,605	50,039	.....	.....	9,706	3,960,122.71
New Mexico	28,780	.....	23,780	5,000	200	.....
New York	754,085	.....	581,915	172,170	25,024	9,686,561.49
North Carolina	148,684	.....	134,884	13,800	1,276	2,250,000.00
North Dakota	92,643	6,261	90,300	2,343	810	683,052.45
*Ohio	742,713	32,452	647,774	94,939	21,938	6,795,522.99
Oklahoma	221,300	.....	.....	.....	1,013	2,619,713.49
Oregon	118,615	19,103	103,855	14,760	3,164	2,334,782.25
Pennsylvania	689,589	.....	632,541	57,048	21,111	9,443,640.77
Rhode Island	53,721	.....	43,824	9,897	1,683	.....
South Carolina	90,546	1,394	83,349	7,197	756	733,820.01
South Dakota	119,262	.....	110,998	8,264	682	720,587.00
Tennessee	117,025	6,500	102,795	14,230	1,043	1,325,000.00
Texas	467,788	.....	.....	.....	3,902	2,146,873.00
Utah	47,485	.....	40,562	6,923	1,003	441,283.88
Vermont	37,265	4,195	33,778	3,487	965	668,288.50
Virginia	141,000	.....	125,000	16,000	2,200	2,100,000.00
Washington (See Copy)	186,170	.....	157,504	28,666	3,878	2,925,730.74
West Virginia	105,000	.....	90,000	15,000	.....	2,000,000.00
Wisconsin	342,060	.....	320,755	21,305	6,435	3,648,465.00
*Wyoming	26,900	100	24,000	2,900	324	288,083.08
TOTALS	10,449,785	300,834	7,628,949	958,295	181,194	$98,499,925.66

*Estimated.

NUMBER OF PERSONS PER CAR, December 31, 1921

State	Population	Car and Truck Registrations	No. Persons Per Car
California ...	3,426,861	674,830	5.19
So. Dakota...	636,547	119,262	5.33
Nebraska	1,296,372	242,557	5.34
Kansas	1,769,257	291,309	6.07
Colorado	939,629	145,370	6.46
Oregon	783,389	118,615	6.60
No. Dakota..	646,872	92,643	6.98
Dist. of Col..	437,451	61,745	7.14
Nevada	77,407	10,819	7.15
Wyoming ...	194,402	26,900	7.22
Minnesota ...	2,387,125	328,700	7.26
Washington..	1,356,621	186,170	7.28
Iowa	2,404,021	430,003	7.31
Indiana	2,930,390	400,342	7.31
Michigan	3,668,412	477,037	7.69
Wisconsin ...	2,632,067	342,060	7.69
Ohio	5,759,394	742,713	7.75
Idaho	431,866	51,300	8.41
Oklahoma ...	2,028,283	221,300	9.16
Vermont	352,428	37,265	9.45
Utah	449,396	47,485	9.48
Arizona	334,162	35,220	9.48
Illinois	6,485,280	670,452	9.77
Florida	698,470	97,837	9.88
Maine	768,014	77,530	9.90
Missouri	3,404,055	343,386	9.91
Texas	4,663,228	467,788	9.97
Massachusetts	3,852,356	363,032	10.11
Montana	548,889	54,175	10.13
New Hamp..	433,083	42,500	10.19
Connecticut..	1,380,631	135,460	10.19
Maryland ...	1,449,661	140,000	10.35
Delaware ...	223,003	21,500	10.37
Rhode Island.	604,397	53,721	11.25
New Jersey..	3,155,900	271,605	11.69
N. Mexico....	360,350	28,780	12.52
Pennsylvania.	8,720,017	689,589	12.64
W. Virginia..	1,463,701	105,000	13.08
New York...	10,385,227	754,085	13.77
Virginia	2,309,187	141,000	15.92
N. Carolina..	2,559,123	148,684	17.25
S. Carolina...	1,683,724	90,546	18.59
Kentucky ...	2,416,630	125,627	19.24
Tennessee ..	2,337,885	117,025	19.97
Alabama	2,348,174	82,343	20.84
Georgia	2,895,832	131,942	21.94
Louisiana ...	1,798,509	80,000	22.48
Arkansas ...	1,752,204	67,413	25.99
Mississippi ..	1,790,618	65,120	27.50
Totals.....	105,710,620	10,449,785	10.10

GAINS MADE IN CAR AND TRUCK REGISTRATION

Ohio	127,316
Pennsylvania	119,425
California	105,938
Illinois	101,693
New York	84,795
Indiana	67,635
Michigan	64,320
Massachusetts	58,401
Wisconsin	48,762
Missouri	46,467
New Jersey	43,868
Texas	40,095
West Virginia	26,138
Kansas	25,913
Florida	23,923
Maryland	23,659
Nebraska	19,557
Oklahoma	17,000
Colorado	16,419
Connecticut	16,326
Tennessee	15,173
Oregon	14,825
Maine	14,623
Louisiana	14,000
Kentucky	12,942
Washington	12,250
Arkansas	8,331
North Carolina	7,824
New Hampshire	7,820
Alabama	7,706
Virginia	7,000
New Mexico	6,671
Vermont	5,640
Utah	4,907
Rhode Island	3,346
Delaware	3,200
Wyoming	2,974
North Dakota	1,803
Mississippi	1,636
Arizona	661
Idaho	427
Nevada	355
*District of Columbia	52,033
*Minnesota	263,183
	1,546,980

DECREASES IN CAR AND TRUCK REGISTRATION

Georgia	12,480
Iowa	7,297
Montana	6,471
South Carolina	2,272
South Dakota	1,133
	29,653
Total gain	1,517,327

CARS AND TRUCKS IN THE UNITED STATES

New York	754,085
Ohio	742,713
Pennsylvania	689,589
California	674,830
Illinois	670,452
Michigan	477,037
Texas	467,788
Iowa	430,003
Indiana	400,342
Massachusetts	363,032
Missouri	343,386
Wisconsin	342,060
Minnesota	328,700
Kansas	291,309
New Jersey	271,605
Nebraska	242,557
Oklahoma	221,300
Washington	186,170
North Carolina	148,684
Colorado	145,370
Virginia	141,000
Maryland	140,000
Connecticut	135,460
Georgia	131,942
Kentucky	125,672
South Dakota	119,262
Oregon	118,615
Tennessee	117,025
West Virginia	105,000
Florida	97,837
North Dakota	92,643
South Carolina	90,546
Alabama	82,343
Louisiana	80,000
Maine	77,530
Arkansas	67,413
Mississippi	65,120
District of Columbia	
Montana	54,175
Rhode Island	53,721
Idaho	51,300
Utah	47,500
New Hampshire	42,500
Vermont	37,265
Arizona	35,220
New Mexico	28,780
Wyoming	26,900
Delaware	21,500
Nevada	10,819
Total	10,449,785

*See text for information.

In the agricultural States the number of persons per car is somewhat larger, although the gains were smaller. It is worthy of note that while South Dakota registrations decreased by 1133 the State stands second on the list so far as the number of persons per car is concerned. The same statistics for nine agricultural States are as follows:

State	Gain	Number of persons per car
North Dakota	1,803	6.98
South Dakota	1,133	5.33
Kansas	25,913	6.07
Nebraska	19,557	5.34
Oregon	4,825	6.60
Oklahoma	17,000	9.16
Texas	40,095	9.97
Washington	12,250	7.28
Iowa	7,297	7.31

In the mining states of the West the amount of gains must be studied in connection with the population. While Colorado only increased the number of cars registered by 16,419, the State is well toward the top of the list, showing the number of persons per car. Her ratio in that respect is 6.46. New Mexico is the lowest of this group in this respect, having 12.52 persons per car. New Mexico, however, has a large foreign population, and all these facts must be considered in attempting to analyze markets on the basis of registration figures. In those states that have the best educational advantages and the more modern methods in all respects will be found the lowest ratios of persons per car.

The same situation holds true in the Southern States. A large negro population, as well as a poorer element of whites, lack of good roads and modern educational facilities has caused the number of persons per car to be particularly high in that group.

The greatest percentage gain was made in West Virginia, where registrations increased 33.14 per cent. New Mexico also increased by 30.07 per cent.

The ten states having the highest percentage gains are as follows:

	Per cent		Per cent
West Virginia	33.14	Pennsylvania	26.69
Florida	32.39	New Hampshire	22.54
New Mexico	30.07	Louisiana	21.21
Ohio	26.05	Massachusetts	20.33
Maine	23.08	Indiana	20.32

Motorcycle registration figures are as yet incomplete. The figures thus far received do not bring the total up as high as last year, but when complete returns are received it is believed that there will be a small gain for the entire country.

Trailers and tractor registrations, particularly the latter, are not segregated in all States. In some few instances the trailers are included in the truck registration, and consequently become a part of the whole figure for passenger cars and trucks. This is true in only a few cases, however, and in States where there are probably few

Motor Vehicle Registration 1912 to 1921

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Alabama	3,385	5,435	8,078	11,925	21,636	32,873	46,171	58,898	74,637	82,343
Arizona	1,624	3,098	5,040	7,318	12,124	19,890	23,905	28,979	34,559	35,220
Arkansas	2,250	3,000	5,642	8,021	15,000	28,693	41,458	49,450	59,082	67,413
California	88,699	60,000	123,516	163,795	232,440	306,916	364,800	477,450	568,892	674,830
Colorado	8,950	13,135	17,756	27,568	43,296	66,850	83,630	104,865	128,951	145,370
Connecticut ..	24,101	27,189	33,009	43,985	61,855	85,724	92,605	109,651	119,134	135,460
Delaware	1,732	2,350	3,050	4.657	7,102	10,700	12,955	16,152	18,300	21,500
Dist. of Col. ..	1,732	2,373	4,833	8,009	13,118	15,493	30,490	35,400	9,712	61,745
Florida	1,749	2,372	3,368	10,850	20,718	27,000	54,186	55,400	*73,914	97,837
Georgia	19,120	18,500	20,916	25,671	47,579	70,357	99,800	127,326	144,422	131,942
Idaho	2,500	2,173	3,346	7,071	12,999	24,731	32,289	42,220	50,873	51,300
Illinois	68,073	94,656	131,140	180,832	248,429	340,292	389,620	478,438	568,759	670,452
Indiana	54,334	47,000	66,400	96,915	139,317	192,192	227,160	277,255	332,707	400,342
Iowa	47,188	75,088	112,134	152,134	198,602	254,317	278,313	363,857	437,300	430,003
Kansas	22,000	34,366	49,374	72,520	112,122	159,343	189,163	227,752	265,396	291,309
Kentucky	5,147	7,210	11,746	19,500	31,700	47,416	65,870	90,641	112,685	125,627
Louisiana	7,000	7,200	12,000	11,380	17,000	28,394	40,000	51,000	66,000	80,000
Maine	7,743	10,570	15,700	21,545	30,972	41,499	40,372	53,425	62,907	77,530
Maryland	10,487	14,254	20,213	31,047	44,245	60,943	74,666	95,634	*116,341	140,000
Massachusetts.	50,132	62,660	77,246	102,633	136,809	174,274	193,497	247,183	304,631	363,032
Michigan	39,579	54,366	76,389	114,845	160,052	247,006	262,125	325,813	412,717	477,037
Minnesota ...	29,000	37,800	67,862	93,269	46,000	54,009	204,458	259,743	65,517	328,700
Mississippi ...	2,895	3,000	5,964	9,669	25,000	36,600	48,400	45,030	63,484	65,120
Missouri	24,379	38,140	54,468	76,462	103,587	147,528	188,040	244,363	296,919	343,386
Montana	2,000	5,686	10,172	14,499	24,440	42,696	51,037	59,325	60,646	54,175
Nebraska	33,861	25,617	40,929	59,140	100,534	148,101	175,409	192,000	223,000	242,557
Nevada	900	1,131	1,487	2,009	4,919	7,160	8,159	9,305	10,464	10,819
New Hampshire	5,764	7,420	9,571	13,449	17,508	22,267	24,817	31,625	34,680	42,500
New Jersey..	43,056	48,892	60.247	78,232	104,341	134,964	155,519	190,873	227,737	271,605
New Mexico..	911	1,721	2,945	5,100	8,228	8,457	15,000	18,077	22,109	28,780
New York....	107,262	134,405	169,966	234,032	317,866	411,567	463,758	571,662	669,290	754,085
North Carolina	6,178	10,000	14,677	21,000	33,904	55,950	72,313	109,017	140,860	148,684
North Dakota	8,997	13,075	15,701	24,908	40,446	62,993	71,627	82,885	90,840	92,643
Ohio	63,066	86,054	122,504	181,332	252,431	346,772	412,775	511,031	615,397	742,713
Oklahoma	6,524	7,934	13,500	25,032	52,718	100,199	121,500	144,500	204,300	221,300
Oregon	10,165	13,957	16,447	23,585	33,917	48,632	63,324	83,332	103,790	118,615
Pennsylvania .	59,357	76,178	112,854	160,137	230,578	325,153	394,186	482,117	570,164	689,589
Rhode Island.	8,565	10,294	12,331	16,362	21,406	37,046	36,218	44,833	50,375	53,721
South Carolina	10,000	11,500	14,500	15,000	19,000	39,527	55,492	70,143	92,819	90,546
South Dakota.	14,481	14,578	20,929	28,784	44,271	67,158	90,521	104,628	120,395	119,262
Tennessee ...	35,187	54,362	19,769	7,618	30,000	48,000	63,000	80,422	101,852	117,025
Texas	35,187	54,362	64,732	90,000	197,687	213,334	251,118	331,310	427,693	467,788
Utah	2,576	4,021	2.253	9,177	13,507	24,076	32,273	35,236	42,578	47,485
Vermont	4.283	5,918	8,256	11,499	15.671	20,369	22,655	26,807	31,625	37,265
Virginia	5,760	9,022	14,002	21,357	35,426	55,000	72,228	94,120	134,000	141,000
Washington ..	13,990	24,178	30,253	38,823	60,734	91,337	117,278	148,775	*173,920	186,170
W. Virginia...	5,349	5,088	6,159	13,279	20,571	31,300	38,750	50,203	78,862	105,000
Wisconsin ...	24,578	34,646	53,161	79,791	115,637	164,531	196,844	236,981	293,298	342,060
Wyoming	1,300	1,584	2,428	3,976	7,125	12,523	16,200	21,371	23,926	26,900
Totals.....	1,033,096	1,287,558	1,768,720	2,479,742	3,584,567	4,992,152	6,105,974	7,596,503	8,932,458	10,449,785

*Estimated.

trailers in use, so the total would not be materially changed were they deducted In other places the trailers are not registered. A table showing the number of trailers in all States where they are segregated is in preparation, and will be presented when revised registration figures are shown in the Statistical Issue of AUTOMOTIVE INDUSTRIES in February.

The figures presented in this article are accurate and final in most cases, but slight revisions will be necessary in certain instances. In some states complete returns from various counties have not yet been received and in others there has been a delay in tabulation, so that final figures are not available. A final revised table will appear on Feb. 16, however, in the Statistical Number of AUTOMOTIVE INDUSTRIES.

High Taxes Decreased Italy's Production

THAT high taxes restrict the development of the motor movement and are less profitable to the state than moderate taxes is the lesson learned by the Italian Government. A couple of years ago, by making use of the argument that automobiles were purely luxuries, considerable increases were made in the annual state taxes; cars of 50 hp. and over, notably, had to pay 15,000 liras annually to the state. As the Italian Government formula for calculating horsepower is very disadvantageous, several high-grade Italian cars came into this class.

The effect on the industry has been so pernicious that the promoters of the high-taxation policy have been among the first to claim a revision. Commandatore Agnelli, president of the Fiat company, predicted when the new taxes went into effect that in his factory alone it would cause 5000 men to be laid off. Under the new law, which goes into effect Jan. 1, 1922, the taxes are reduced 56 per cent on 10-hp. cars, 44.5 per cent for 20-hp. cars, 41.5 per cent for 25-hp., 35 per cent for 30-hp., 29 per cent for 35-hp., 38.5 per cent for a 40-hp., 37.5 per cent for 45-hp., 28 per cent for 50-hp. and over.

For motor buses and trucks the taxes have been slightly increased, but these vehicles were always reasonably treated compared with passenger cars. When fitted with pneumatic tires, buses and trucks pay 30 per cent less than when solids are used. This measure has been taken in order to protect the roads against the destructive effect of heavy trucks with solid tires. In Italy very few trucks of more than 1½-ton load capacity are run on pneumatics. Taxicabs are to pay the same taxes as private cars, with a refund of 25 per cent. Under the horsepower formula two-stroke engines are given an advantage in order to encourage the development of this type. The mere announcement of the reduction in automobile taxes has been sufficient to cause a considerable increase in local sales.

Spain Considering Reduction of Duties on Automobiles

DESPITE the fact that Spain will probably increase import duties on many products after January 1, it is quite likely that the tariff on automobiles will be lowered, says a dispatch to the Department of Commerce at Washington from Commercial Attaché Cunningham at Madrid. This is encouraging news to the American automobile manufacturer, although there remains the menace that the tariff on other articles, coupled with considerable labor unrest, is adversely affecting the normal recovery of trade and industry. Then, too, petroleum is one of the products upon which a higher import duty will probably be placed.

The cable dispatch said the cost of living is continuing to rise in Spain, although lower prices are predicted. Increased taxes to meet the budget estimates for the year 1922 are probable.

Transportation difficulties are encountered, partly on account of seasonal shipment of grains, fertilizer and coal causing congestion and because repairs and maintenance continue to be inadequate.

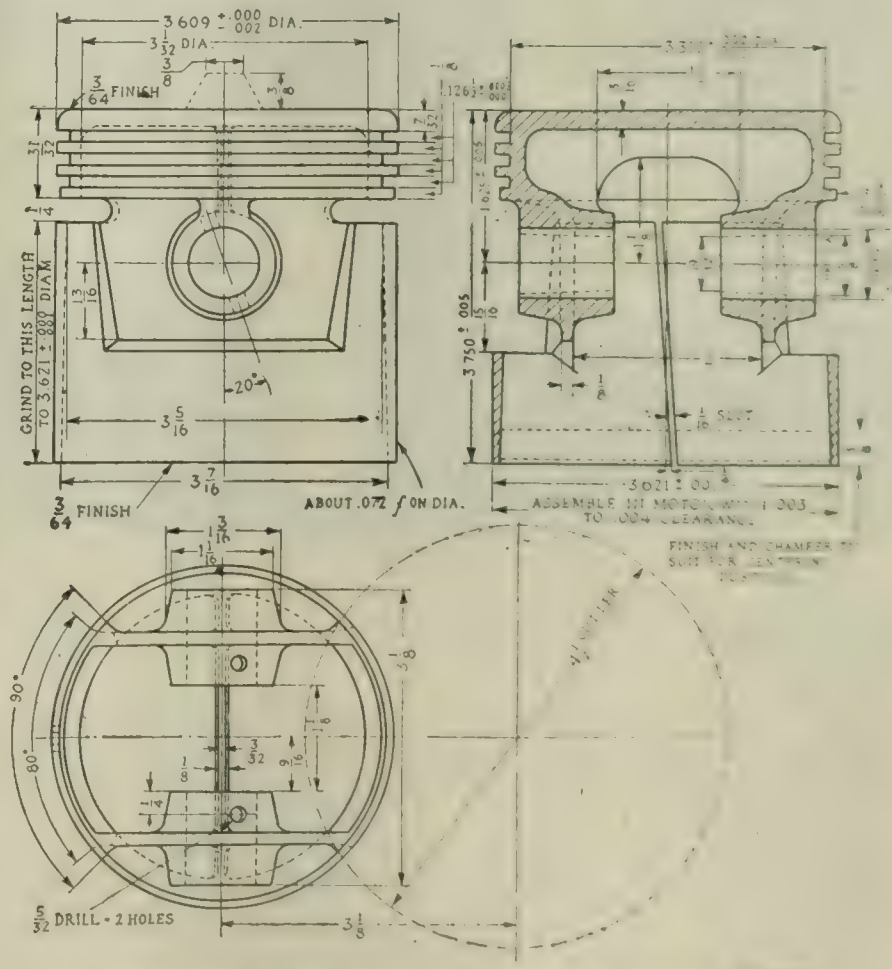
Modern Facilities for Quantity Production of Pistons

How aluminum pistons used in Maxwell car are manufactured. The various operations employed are described in sequence, the type and make of machine employed being given in each case. Special precautions are taken in machining and gaging to insure maintenance of close limits.

By J. Edward Schipper

THE manufacture of the slotted type of "constant clearance" piston offers an exceptional opportunity for ingenuity in the layout of machinery. The pistons are of very thin section aluminum and consequently require careful handling in order to maintain the desired amount of accuracy. The operations are of such nature that the most up-to-date types of machinery can be employed to advantage in reducing the unit cost of these parts. For the Maxwell pistons the raw Lynite castings weigh 1.39 lb. and the finished pistons weigh .94 lb., hence a little less than ½ lb. of aluminum is machined off each casting in the manufacture of the finished piston, which is shown in the drawing Fig. 1. As will be noted, it is of a modified slipper type with three rings above the wrist pin. There is a horizontal slot cut around the piston below the lower ring land and a relief formed in the casting adjacent to each of the piston pin bosses. There is also a vertical slot which takes up the expansion of the piston under heat.

The entire layout of the piston department at the Maxwell plant is designed to give a minimum of manual handling to the pistons, and the equipment is such that the machining operations are done with maximum rapidity and in the most concentrated manufacturing space.



1—Maxwell slotted type of constant clearance piston whose manufacture is herewith described

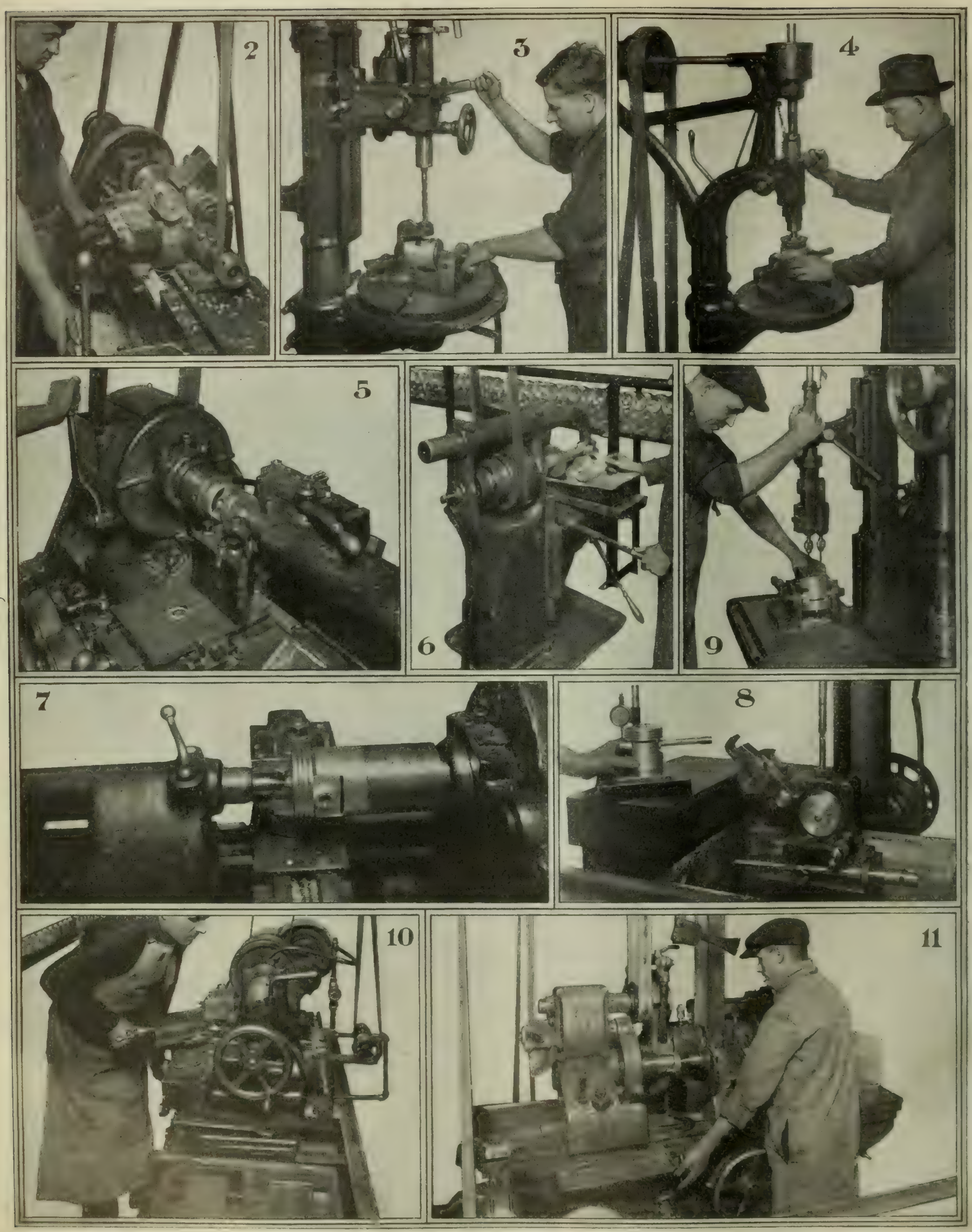
A sample of each shipment of castings is sent to the laboratory for a material examination and after satisfactorily passing the laboratory test, the castings are released to the manufacturing department. The pistons are then loaded on a track carrier immediately adjacent to the machine which performs the first operation and from then on they are slid along this carrier from machine to machine until they are completed. The machines are arranged in two rows on each side of this carrier, which is a sort of double track and visible in several of the views of individual operations shown herewith.

The first machining operation is performed on a special Bardons & Oliver lathe. The operation is to bore the open end of the piston, chamfer it and cut it to length. There is also a centering operation on the head end. The piston is chucked on a quick-acting, self-centering adapter, which holds the piston from within. It is an air expanding type of chuck. The operation is located from the under side of the piston head and from the interior walls of the casting. Bearing against the interior walls of the casting there are seven plunger points on the adapter. This operation is shown in Fig. 2.

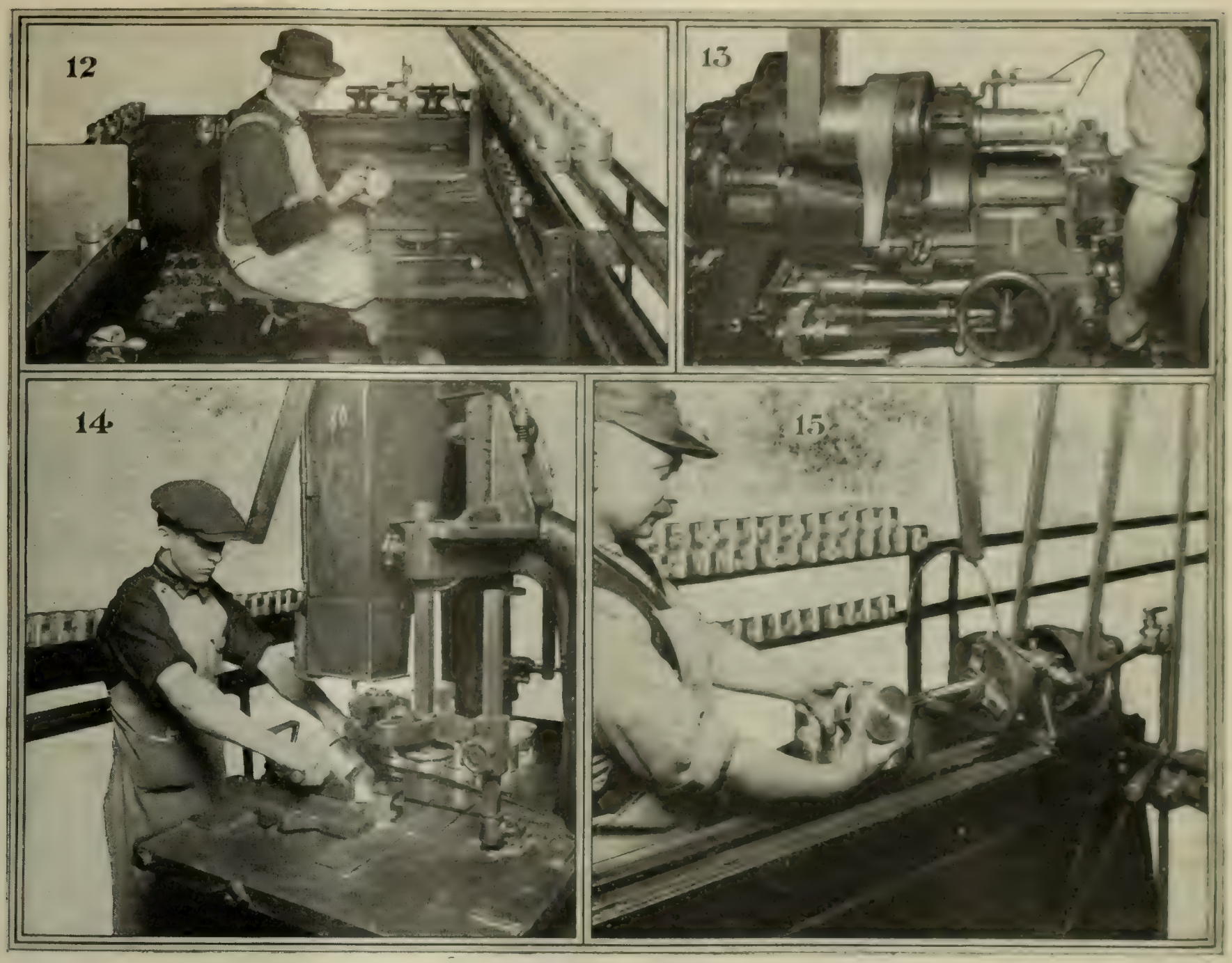
Location for the second operation, which is the rough drilling of the wrist pin holes is from the open end of the piston bore and from the bottom face. This operation is shown in Fig. 3 and is performed upon a Cincinnati drill press capable of 91 pistons per hr. There is an equalizing clamp against the piston head which holds the piston firmly in position for the operation.

Squareness of the piston's cylindrical surface with the wrist pin bore is secured by the next two operations, which are really locating operations, although the cuts taken are required in the piston itself. In finish chamfering the open end of the piston, which operation is shown in Fig. 4, the piston is located from a plug through the wrist pin hole and by the self-centering action of the chamfering tool itself. By permitting the piston to float on the plug through the wrist pin, the chamfer is automatically made square.

With the chamfering operation completed in this way, the chamfered surface can be used for locating practically all other operations. The work of chamfering is done on a Barnes drill press. It is a very quick operation



2—Boring open end, centering, chamfering and cutting piston castings to length. 3—Rough drilling piston pin holes. 4—Finish chamfering the open end. Note the self-centering operation of this tool, most of the subsequent operations are located from the chamfer. 5—Machine which displaces four others for rough turning outside diameter, rough turning ring grooves, rough facing the head end of the piston and finish forming the radius on the piston head. 6—Milling horizontal slots of both sides of piston below bottom land. 7—Finish turning the outside diameter and finish turning the piston ring grooves on a Reed lathe. 8—Drilling and reaming wrist pin holes. This is a semi-finish operation on a Kern drill press. 9—Drilling two oil holes in the piston pin bosses. 10—Finish turning grooves. This work is done on diamond point tools and held to a limit of .0005 in. 11—Grinding outside diameter. This work is performed on either a Norton or Landis grinder with a Crystolon wheel, using lard, oil and kerosene for lubrication



12—Inspection given after grinding showing the gages employed and also giving an idea of the rack or track along which the pistons are pushed. 13—Facing head end of piston, cleaning burrs, and cutting off the centering boss. There are two tools on this machine, one cuts off the boss and the other faces the head. 14—Sawing the vertical clearance slot in the piston. 15—Reaming the piston pin holes. The pistons are pushed by hand to the reamer bar which incorporates cylindrical centering or piloting parts on each side of the cutting portion of the reamer bar

making a 30 deg. cut 1/16 in. in depth at the rate of 250 pistons per hr.

Given the chamfered end of the piston to work from, the turning of the piston skirt and other operations on the wall and head can be accurately performed. The operations shown in Fig. 5 are all performed on a semi-automatic LeBlond Multi-Cut lathe. This is a special machine for piston purposes. The operation is the rough turning of the outside diameter, the rough turning of the piston ring grooves, rough facing of the head end of the piston and the finish forming of a radius on the piston head. The latter radius is simply to remove the sharp edge from the top of the piston, which projects for a slight distance into the combustion chamber at the top of the stroke. There are two machines on this work each capable of turning out 65 pistons per hr., and each of these machines, due to the compounding of the operations, replaces four others, so that in this department, these two LeBlond machines are performing the work of eight ordinary piston turning machines. As will be noted in Fig. 5, the piston is clamped against the chamfered face and centered, the work being driven by a lug which projects between the piston pin bosses in the center of the piston.

Horizontal slots are milled on each side of the piston below the bottom ring land. These relief slots are what makes the piston a modified slipper type, as they separate the head portions which carry the ring from the skirt. The piston in the fixture fits over a dowel through the piston pin hole and rests in a V block. The cut is made on a Toledo hand mill, which is capable of 150 pistons per hr. The same operator who handles the chamfering operation shown in Fig. 4 also handles this milling operation which is shown in Fig. 6, both of them being very fast operations and capable of keeping ahead of production on the other machines.

The outside diameter and the tops of the ring grooves are finish turned on a Reed lathe shown in Fig. 7 which is equipped with a special tool block with two cutters for this work. One cutter first comes into operation and turns the piston down to the proper outside diameter and after this tool has passed by, another cutter comes into operation for the top of the ring groove. The two cutters are so spaced that the cutter which finish turns the outside diameter, completes its work as the cutter which turns the tops of the ring grooves passes by the bottom groove. Location for the work is from the chamfer on the bottom and the piston is centered as in the previous operations in the center which has been established in the centering boss on the head. As each of these machines is only capable of 69 per hr., the equipment for the department consists of two similar machines.

Drilling and reaming of the piston pin hole to a semi-finished condition is accomplished on a Kern drill press. The operation is illustrated in Fig. 8. A plug is first put

through the piston pin hole for centering and the fixture locates against the outside of the piston body, thus assuring squareness of the piston pin hole to the body. The piston is clamped against a stop, as shown in the illustration, the clamp being shown lifted in order to be better seen. The first operation is with a core drill, which is then removed from the quick, detachable chuck and the reamer, which is shown lying on the table of the machine in the illustration, is inserted in its place. The operator gages the piston for the distance from the bottom of the piston face to the center of the piston pin hole on the amplifying gage also shown in the illustration.

Two 5/32 in. oil holes are driller simultaneously in each piston pin boss by means of a Cincinnati drill with a special fixture, which sets the piston at a proper angle for these oil holes. The machine is capable of 150 pistons per hr., and the location is by means of plugs which enter the piston pin holes for a short distance on each side of the piston, and against a V block which allows the piston to rest at the proper angle. The locating plugs which enter the piston pin hole enter only for a short distance, so that the drills cannot come into contact with them. This operation is shown in Fig. 9.

Finishing the Piston

With all centers accurately established and with the rings, walls, etc., in a semi-finished condition squared to the center of the piston pin hole, the piston is ready for finish turning. The finish turning of the groove, Fig. 10, is held to very close limits. There are four tools on the machine, three of which are for the grooves and the fourth for the recess, which is turned below the bottom ring, at which point the piston is smaller in diameter than at the top of the ring grooves. A tolerance of but .0005 is allowed on the width of the groove. A rolling gage is employed to check this and the gage must roll all around the grooves without play or bind. This is to insure free working of the piston ring after installation and this rolling gage check prevents any possibility of a narrow point somewhere in the groove. Diamond point tools are employed in order to secure a good finish. In the inspection on this particular operation, the pistons are thrown out for the least discernible roughness. The recess on the bottom land is .0005 under size. A three-sided gage is employed to check these grooves for squareness and depth. The gage must fit into the groove on two opposite sides of the piston in order to establish squareness. The operation is located on the chamfer at the bottom of the piston and is centered in the usual way in the centering boss on the head.

Grinding of the piston is accomplished on either a Norton or Landis grinder. This is a finish grinding operation, location being from the chamfer at the bottom of the piston, and the piston is centered in the centering boss on the head. A Crystolon wheel is employed and a lubricant consisting of lard, oil and kerosene designed to keep the grinding wheel from loading, is employed. This grinding operation is in accordance with standard practice and is illustrated in Fig. 11. Following the finish grind, the pistons are given a 100 per cent inspection. The outside diameter is inspected by micrometer and a limit of plus or minus .0005 in. is allowed. The ring grooves are inspected by a rolling gage, a limit of plus or minus .0025 in. being allowed here. They are also tested for eccentricity on a Brown & Sharpe gage, the piston being located on the chamfer and centered in exactly the same way as in the manufacturing machine. These operations are shown clearly in Fig. 12, the Brown & Sharpe gage being in the background with a piston in place. A good idea of the track or rail type of rack along which the pistons are passed is also secured from this illustration.

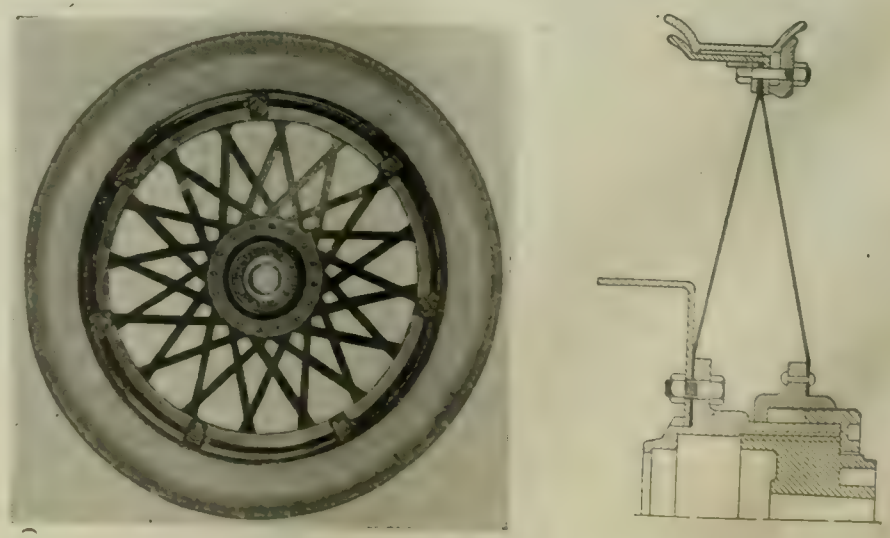
The inspector also stamps a serial number inside of the piston and indicates the size for selective assembly at the same time. A hand operation follows for removing all burrs, following which the piston head is finish faced and the centering boss removed in the operation shown in Fig. 13. There are two tools in this operation, one which faces the piston and the other which cuts off the boss. These are both visible in the illustration. The operator gages the piston for length after this operation and also for squareness of the head with the piston pin hole. Both of these gaging operations are performed on go and no-go gages. The machine employed is a Cincinnati lathe capable of 50 per hr. There are three of these.

The vertical clearing slot in the piston is sawed on a Wright steel band saw capable of handling 150 pistons per hr. The piston for this operation is located from a plug in the piston pin hole and against a V block. The work is pushed against the saw up against a stop which is placed at a point such that the correct depth of the saw slot is automatically assured. An interesting feature of the saw which is shown in Fig. 14, is that it is adjustable for squareness of cut, the knurled screw shown just above the piston being for this purpose.

An unusual reaming operation is used for semi-finishing and finish reaming the wrist pin holes. An expansion reamer with six flutes is employed, there being a locating or pilot part on each side of the reamer. The piston is pushed by hand up over the end of the reamer and as it is passed along, it pilots on a cylindrical portion of the reamer bar, so arranged that the piston pin hole is piloted throughout the entire reaming operation, the length of the reamer being such that the piston is centered on the cylindrical part of the reamer while it is cutting. Kerosene only is used for a lubricant and the finish reaming cut is only a very light one, as the semi-finish reamer leaves only .001 to .005 in. for the finish ream. See Fig. 15.

After the wrist pin holes are finished, the pistons are gone over thoroughly and all burrs removed, after which they are washed in gasoline and blown out with air. They are placed on a skid which takes them to the inspection department and they are there given a thorough going over for squareness of head with the piston pin hole, alignment of the piston pin hole in each boss, they are gaged for length, depth of ring grooves, squareness in all directions and, also, attention is given the finish and care taken to guard against cracks or blow holes. They are stamped by the inspector and passed on to finished stock. The weighing of the pistons is taken care of in conjunction with connecting rods at time of assembly in the engine.

Lattice Tension Wheel



The above photograph and drawing illustrates the Thompson lattice wheel which was described in Automotive Industries of Dec. 29, page 1283

A Crank Arm Turning Machine

Device simultaneously turns the non-circular contours of all of the arms of an engine crankshaft. This gives a better balance than is likely to be obtained with unfinished crank arms. Development of airplane production. Circular tool used and tool block rocked to maintain cutting angle.

By P. M. Heldt

AIRCRAFT engine crankshafts are usually turned or finished all over, partly because in this way it is possible to make the parts more accurately to dimensions, thereby saving weight, and partly because it tends to give a better balance than can be obtained in any other way. Recently, automobile manufacturers have begun to finish the crank arms, chiefly, it appears, with a view to securing the advantages of improved balance which are gained thereby.

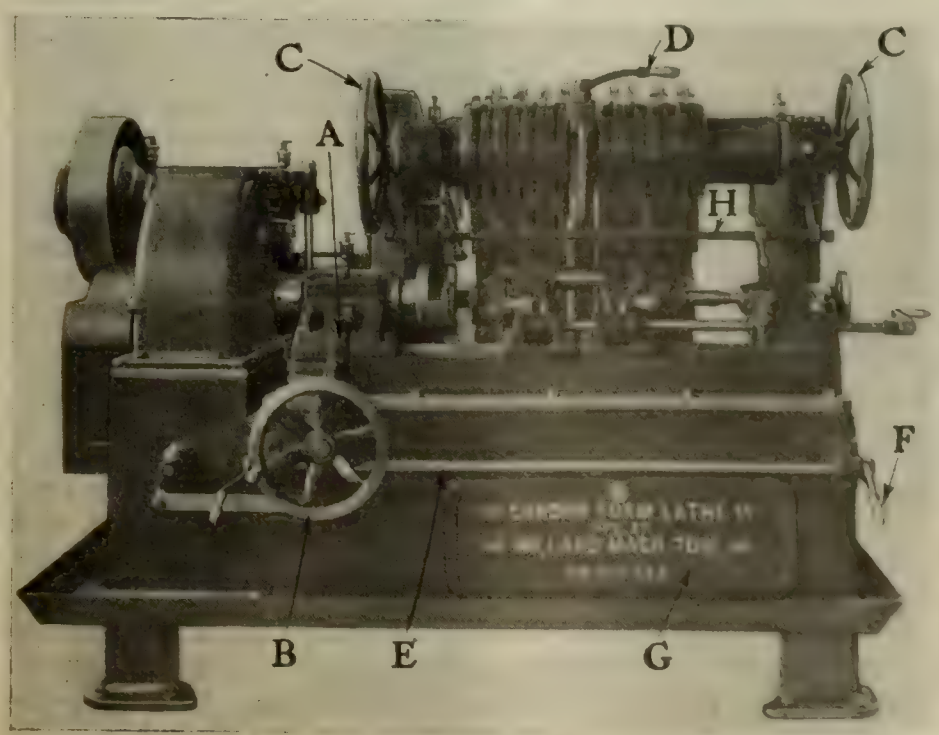
The Gordon Form Lathe Co. has developed a crank arm turning lathe which turns all the arms of a crankshaft in one operation. This lathe turns the crankshaft arms the same as a regular engine lathe would turn a round piece of work, from which conclusions may be drawn as to the time required for the operation.

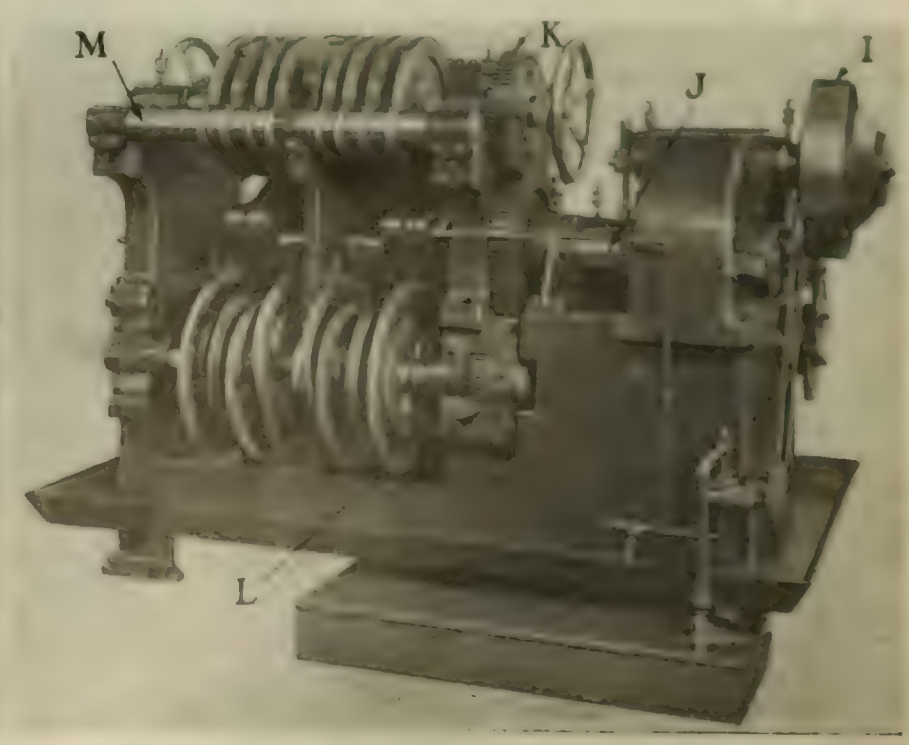
The machine has been designed to permit of heavy cuts and feeds, being of very rigid construction. The accompanying cuts are of a crank arm turning lathe used by the Studebaker Corp. From Fig. 1, which is a front view, it will be seen that there are eight rocker arms—the same number as there are arms on the crankshaft to be turned.

This crank arm turning lathe differs from a standard engine lathe in the following respects: The cutting tools are held in a tool block which rotates in the rocker arm. They are placed in the back of the work and swing from a 6-in. diameter overarm shaft, to and from the crankshaft, as the contour of the crank surface requires. The rocker arms are held in a fixed plane. The spacing of the rocker arms to coincide with the spacing of the different crank arms is taken care of by spacing collars on the overarm, and by guide plates fixed to the main frame of the machine which are inserted in the rocker arm below the tool block. In this manner the rocker arm is guided at both top and bottom.

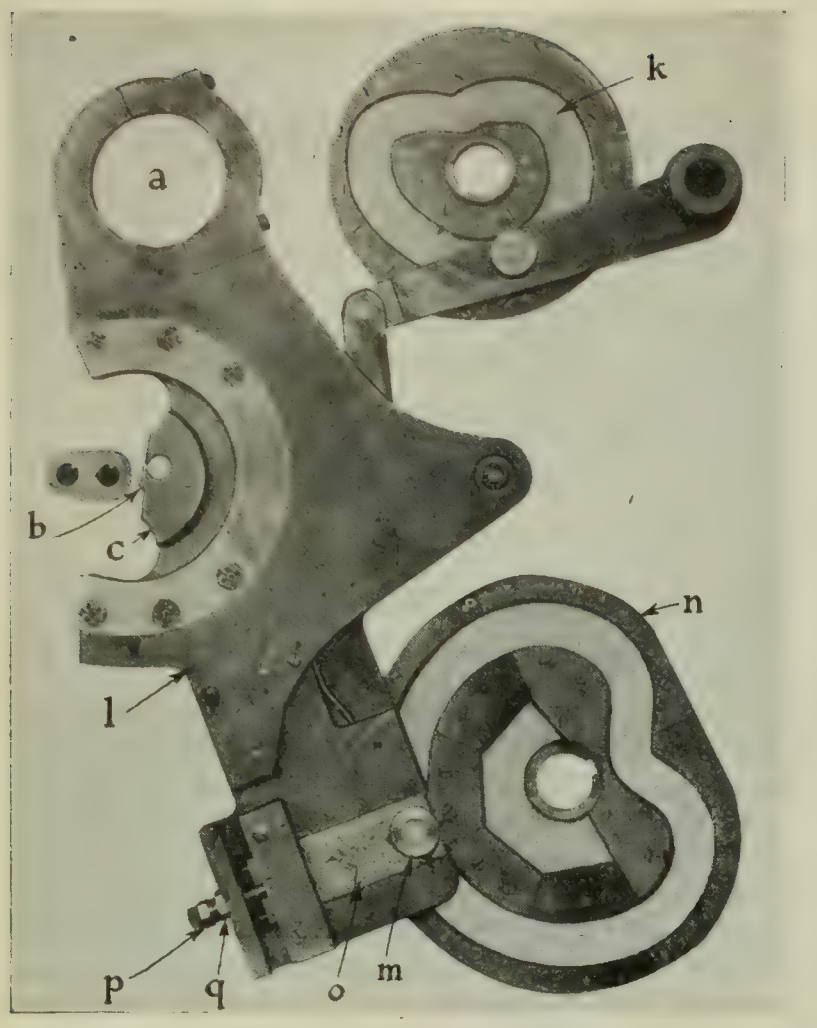
The feed of the work is obtained by a longitudinal travel of the platen, which slides in the frame of the main bed. The platen is driven by screw feed, and carries the work across the point of the cutting tool. There is a feed gear quadrant connected to the feed screw at the front end of the machine which has a large range to take care of, both fine and coarse feeds. An automatic trip is provided which throws out the feed at lever A at the conclusion of the cut across the crank arm. After finishing each cut the platen is returned to its starting position by a handwheel B.

Headstock, tailstock and steady rests are bolted to the platen of the machine, making them one unit which travels with the work. The machine has been arranged for a roughing and a finishing cut. This is controlled by two eccentric bushings which are located in the outer bearings of the overarm shafts, the change-over being effected by means of a large capstan wheel C. After the overarm shaft has been thrown in either the roughing or the finishing position it is locked by lever D. This overarm shaft is locked at the central overarm support, which is a housing bolted to the main frame of the machine. Starting and stopping of the machine is accomplished by means of a shaft E in front, with a handle F on each end. With this arrangement the machine can be quickly started and stopped for unloading and loading. Ample chip clearance has been allowed between the bottom of the rocker arm and platen, the chips falling directly into the chip pan and





Figs. 1 and 2—Front and rear views of Gordon crank arm turning machine



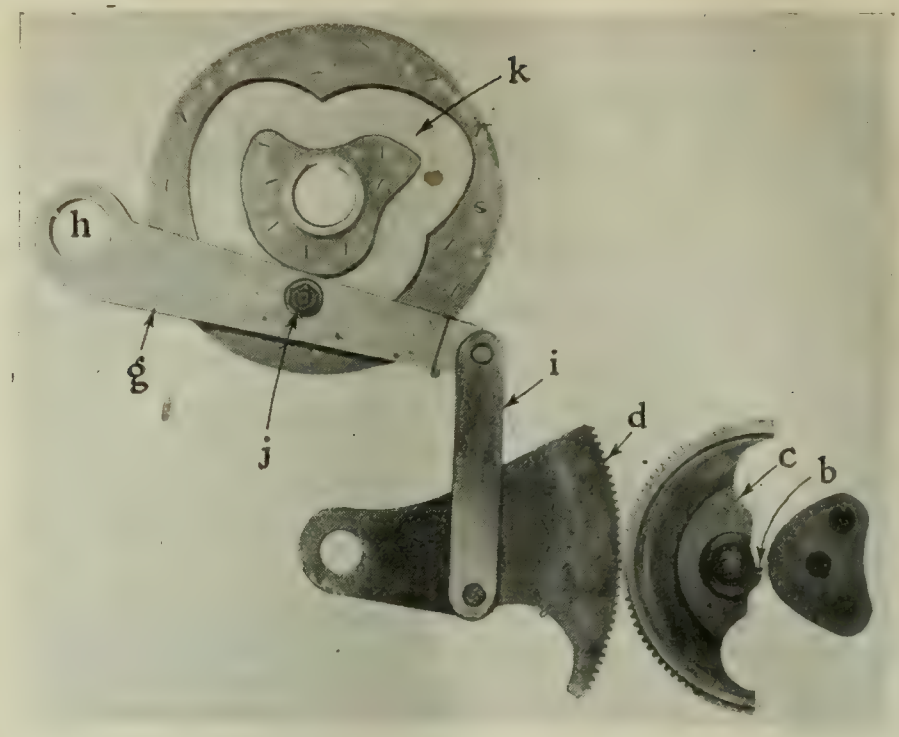


Fig. 3 (on left)—Rocker arms, tool block, cutting tool, upper and lower master camshafts, gear sector and levers. Fig. 4 (above)—Showing mechanism for tilting tool so as to maintain the same angularity relative to the surface being cut

being removed through the door G. Cutting fluid is applied to each cutting tool through pipe H, which travels the full length of the rocker arms and has lead tubes to each cutting tool.

The cutting fluid is circulated by a Brown & Sharpe pump, which is driven by belt from the clutch pulley (see Fig. 2). The main drive of the machine is through a friction clutch I, which connects directly to the main intermediate shaft, J, by two intermediate gears. The main spindle, as well as the upper and lower master-camshafts, is directly geared to the main intermediate shaft J by gear K on the upper master-camshaft and gear L on the lower master-camshaft. The gear driving the main spindle is inside the gear box. The main spindle and the upper and lower master-camshafts operate in unison. The gear box is of heavy construction, the spindle bearing and gears are of liberal proportions and the gears are constantly running in oil.

Fig. 3 shows the complete unit, consisting of rocker arms, tool block, cutting tool, upper and lower master-camshafts, gear sector and levers, in the relation which they bear to each other in the machine. The cut also shows the relative position of the cutting tool to the crankcheek being turned.

The center of the 6-in. overarm shafts on which the rocker arm swings is denoted by a, while b is the point of the cutting tool at the center of the tool block. As the tool block is rotated to bring the tool to the proper cutting angle relative to the crankarm, the cutting tool point remains stationary. In Fig. 4 it will be seen that the tool block has gear teeth cut around the outer flange which mesh with gear sector d fulcrumed at e, thus bringing b and e into the same horizontal line. The purpose of this construction is to maintain the cutting tool at the proper cutting angle. This is done through the upper cam k, which is the cutting tool rotating or tool tilting cam, and is connected to the gear sector by lever g and link i fulcrumed on shaft h. The cutting tool is rotated through the fixed roller j on lever g which is raised and lowered as it travels in the track of the rotating cam k.

The form of the crank is obtained by swinging the rocker arm l, Fig. 3, which is controlled by roller m traveling in the track of the master cam n, which latter is generated from the form of the crankarm to be turned. Adjustments of the cutting tool for different diameters are obtained through a slide, o, at the bottom of the rocker arm to which roller m is attached. These adjustments are made by a screw, p, and locked by nut q. In Fig. 4 it will be noted that the tool block c carries a circular cutting tool b which is 3 in. in diameter and is held in position by a $\frac{7}{8}$ in. stud and nut. The adjustments of the cutting tool are obtained through a worm which is locked in the tool block and travels in the hobbed teeth in the cutting tool. A circular tool is used, because of its long life.

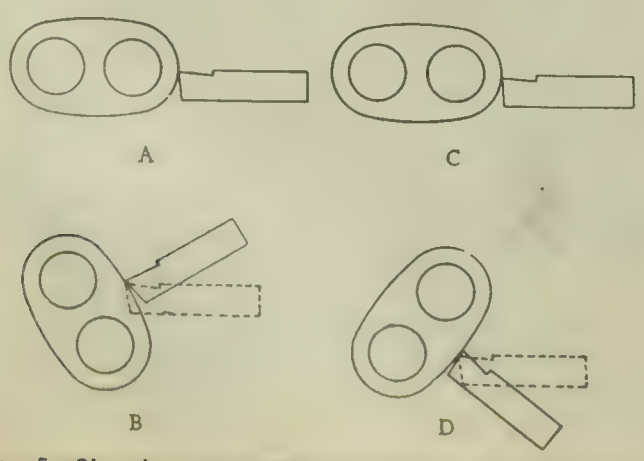


Fig. 5—Showing successive positions of cutting tool

A History of Vehicles

"THE WORLD ON WHEELS" is the title of a new book to be published soon by H. O. Duncan, the author, who has reviewed the progress of vehicles since the days of chariots to the present modern motor car.

Mr. Duncan has avoided technicalities in discussing the evolution of vehicular transportation, and has spent eight years in preparation of the volume. The automobile industry from its pioneer stages in all countries to its present position is reviewed.



Compression Temperatures

Editor, AUTOMOTIVE INDUSTRIES:

I would like to know about the rise in temperature of the combustible charge in a gasoline engine. Could you give me the formulæ for calculating the rise in temperature of the charge, commencing with the start of the compression stroke when it is about atmospheric temperature, through to the end of the compression stroke when it is about to be ignited—compression pressures of 60, 70 and 80 lb. per sq. in.? I want to familiarize myself with the comparison of rise of compression temperature with rise of compression pressure. H. T. C.

The temperature of the gases during compression is given by the equation

$$T\,V^{x-1} = \text{constant},$$

where $x = 1.41$ for adiabatic compression, in which all the heat due to the compression is retained by the gases. Under the actual conditions of compression there is a loss of heat to the cylinder walls (which are cooled by water at less than 200 deg. Fahr.) especially during the latter part of the compression stroke, and x then has the value of 1.3, as determined by measurements on actual indicator diagrams. Hence, if we denote the absolute temperature at the beginning of the compression stroke by T_0 and that at any portion of the stroke by T_1; the volume of the compression space plus piston displacement by V_0 and that of the combustion chamber at the particular point of the stroke by V_1, we have

$$T_0 V_0^{x-1} = T_1 V_1^{x-1}$$
$$T_0 V_0^{0.3} = T_1 V_1^{0.3}$$

As we can use any measures of volume we desire we will denote the volume of the compression space plus piston displacement (the cylinder volume at the beginning of compression) by unity, and the volume at the end of the stroke for a compression ratio of 4 to 1 is then ¼. Consequently we have

$$T_0 1^{0.3} = T_1 (\tfrac{1}{4})^{0.3}$$

The temperature at the beginning of the compression stroke should be about equal to the dew point of a correctly proportioned fuel mixture at atmospheric pressure, which is about 95 deg. Fahr. for gasoline. That is, a 15 to 1 mixture of gasoline vapor and air is stable at all temperatures down to 95 deg. and no fuel will condense out as long as this or a higher temperature is maintained.

95 deg. Fahrenheit = 556 deg. abs.

Inserting this value in the above equation we get

$$556 \times 1^{0.3} = T_1 \times (\tfrac{1}{4})^{0.3}$$
$$\log 556 + (0.3 \log 1) = \log T_1 + (0.3 \log \tfrac{1}{4})$$
$$2.74507 + 0 = \log T_1 + [0.3\ (9.39794 - 10)]$$
$$2.74507 = \log T_1 - 0.18062$$
$$\log T_1 = 2.92569$$

$T_1 = 846$ deg. absolute $= 846 - 461 = 385$ deg. Fahr.

The temperature at any stage in the compression is directly proportional to the initial temperature of the charge at the beginning of the compression, in absolute degrees.

It may seem that the figure of 95 deg. Fahr. for the initial temperature has been chosen too low, as thermometers inserted in the manifolds of modern engines usually show from 160 to 175 deg. Fahr. However, it is known that some fuel always enters the cylinders in the liquid state, and if the heat of vaporization of this fuel were subtracted from that of the gaseous portion of the charge, the temperature would be in the neighborhood of 100 degrees.—EDITOR.

Some Results of Careless Inspection

Editor, AUTOMOTIVE INDUSTRIES:

I have read with interest articles and letters in AUTOMOTIVE INDUSTRIES regarding the lack of finish and attention to details found on modern medium-priced cars, as now sent out by the manufacturers. My experience in this connection may be of interest. I have owned a number of cars since 1911 and since I always care for them myself, can make good comparisons. The faults found in the car referred to below came as a surprise on account of the good reputation and financial status of the maker.

This summer I purchased a new light six. This model now in the first year of production, is being accepted eagerly by the public due to the excellent results obtained during the past two or three years with other models of that make. The following faults developed during the first few hundred miles of running:

(a) Defective head light wiring. This wire, though armored, has not enough insulation between conductor and armor. Broken during installation. Grounds hard to locate.

(b) Generator trouble. New thermostat had to be installed before any good results could be obtained. At 3500 miles am again having trouble to get proper charging rate.

(c) Unsightly leakage of grease out of front wheel bearing. Had to put in hard grease to stop it.

(d) Both shackle pins on all four springs very loose sidewise, causing bad rattles. Not suspecting this in a new car was some time in locating the noises.

(e) About 1/32-in. fore and aft play in engine crankshaft. The longitudinal movement of this heavy weight at low speeds caused very annoying pounding noise.

(f) Faulty adjustment and installation of clutch throw-out fork and mechanism necessitating considerable attention on my part to eliminate noise.

(g) Leaky radiator shell.

(h) At 3500 miles, city driving, the upholstery is commencing to get out of shape at the driver's seat.

Practically all of the above can be laid to the lack of, or poor, inspection. I feel that, aside from the wiring, the material in the car is good throughout. Careless assembly and testing rather spoils the good impression which would otherwise go with a well-designed car. I. H. HOOVER.

Export Combine Is Proposed

Central company would handle all foreign trade of N. A. C. C. members, but keen competition would result from forming of subsidiary companies or groups. Plan would relieve export managers of considerable detail.

ONE central export company, with thirty-three subsidiary groups comprising all manufacturers of passenger cars and motor trucks who are members of the National Automobile Chamber of Commerce, would be formed under the Webb-Pomerene law to handle all the foreign trade of these companies, according to the plan submitted to the N. A. C. C. export managers on Jan. 10 at their annual New York meeting. The central company or combine would perform all non-competitive functions, including the financing of shipments, whereas the subsidiary groups would be highly competitive in sales promotion work, each handling a low, medium and high priced line of passenger cars and a line of motor trucks.

This proposal was presented by George F. Bauer, chairman of the foreign trade committee of the Chamber, who has devoted much effort to finding a means by which the member companies might combine their efforts to foster and develop the use of automobiles outside of the United States. The plan, with its groups of manufacturers, was the outcome of his studies, which have shown him that co-operative effort, particularly so far as the financing of orders is concerned, is desirable if the automotive upbuilding of many territories is to be increased in a manner commensurate with the world-wide need for motor car and truck transportation and the intrinsic worth of the American made equipment.

Briefly, all of the 132 manufacturing companies of the N. A. C. C. are considered for membership in the combine. The main company, whose functions are entirely non-competitive, will be capitalized at $500,000 of common stock and $500,000 of the preferred stock, the latter of which, with interest at eight per cent, is to be offered to the public. The common stock will be held by the member companies, each of which must subscribe to it to the amount of $2,000 (twenty shares) plus one additional share (valued at $100) for each million dollar valuation of output in 1920.

The combine will finance all shipments. In addition, it will carry out such work as documentation, research, shipping, packing, stenographic and translation work, foreign educational campaigns, etc. Also, it will maintain representatives abroad, all of its work being commensurate with its strength as a representative of the majority of the American automobile producers.

The subsidiary groups will be engaged entirely in sales promotion work, competing, of course, with every other subsidiary group, each of which has one truck and three car lines. The manager or chief official of each subsidiary will have no work other than sales promotion in connection with his lines, as the routine duties of documentation, translation, etc., will be handled by the parent company. In this manner, Bauer believes that each export manager will be relieved of a vast amount of detail that now hampers him from sales development work.

The chief value of the plan is in the financing of shipments, a problem that now outweighs practically all others in building up foreign trade. Buyers in other countries are demanding satisfactory credit terms and the manufacturers, harassed as they are by the domestic situation, are unable to grant these.

The Bauer proposal plans the use of bank acceptances in its efforts to overcome this condition. The financing possible under such an arrangement multiplies many times the capitalization, thus giving the combine ability to handle a large volume of business. The financing would be executed as follows:

The manufacturer, on shipment in response to orders, draws at 90 days sight upon the combine for the value of the equipment. Shipment goes forward, with documents and drafts, title passing to the combine, when the draft is accepted by the combine's bank. This draft, of course, may be discounted at current rates and the manufactory then has no more financial interest in the shipment, as the payment has passed to his account.

The transaction as it relates to the foreign buyer is most valuable. The buyer's home bank opens an "acceptance credit" covering the value of the shipment in the United States, in favor of the export combine. This credit should not be confused with a confirmed letter of credit which requires the foreign buyer to post his payment in advance in the United States. This is the method that has financed most automotive shipments in recent years and it is one that has occasioned much serious criticism from abroad. An acceptance credit does not require the advance posting of any money. The credit opened, the export combine, upon presentation of documents, draws a 60 day draft covering the shipment. This draft may be discontinued, if desired by the combine, but in any event the dealer has had two months credit after the time of shipment. Presuming that shipment requires 30 days, which is sufficient for most territories, he yet has another month in which to dispose of the cars or trucks before he is called upon to pay his local bank.

These points cover the main features of the proposed company and its subsidiary. The subsidiary, it is explained, is in no way curtailed by the combination in fostering sales abroad but it is given the added strength of backing by an export company sufficiently strong to carry it through all storms. The Webb-Pomerene law, it will be recalled, allows combination to competing firms in foreign trade which is denied to them in domestic business. The Bauer plan has taken full advantage of this provision but still retains the sales competition so necessary in selling automotive equipment.

Bauer has many automotive executives and export managers behind him in presenting the plan, the chief of whom is Walter E. Drake, of the Hupmobile company, chairman of the N. A. C. C. foreign trade committee and whose company has been one of the pioneers in the export field. Following its presentation to the export managers, the proposal will go before the chief executives of the industry. Several months must elapse before any definite action may be taken and the plan thus comes before the industry for discussion.

"The Webb-Pomerene law permits of concerted efforts in combinations for export trade, that, if attempted

domestically, would probably be considered illegal." Bauer stated. "It is comparatively new for the United States but in England, France, Belgium and Germany, such combinations have been effectively used in industrial combines for a large number of years.

"Since the law is fairly recent here, its usefulness to the automotive industry is not fully known as yet. A necessary purpose may be served in presenting a plan that is designed merely to aid in pointing the way for such application. Its object is to show how N. A. C. C. members may, through combined efforts, obtain greater and better results in the development of foreign markets. Consolidation, whether the functions are included in the class of competitive or non-competitive, is possible and if carried out, will prevent considerable lost motion by manufacturers individually."

The proposal is such that any number of subsidiary companies may be formed.

A Headlamp Without Beam Modifying Lens

TO eliminate glare and comply with legislation enacted to this end, most motorists at the present time provide their headlamps with lenses in front of the reflectors, which either diffuse or else deflect the beam in a generally downward direction. Similar results can, of course, be obtained by using reflectors of special shape in place of the paraboloidal reflectors.

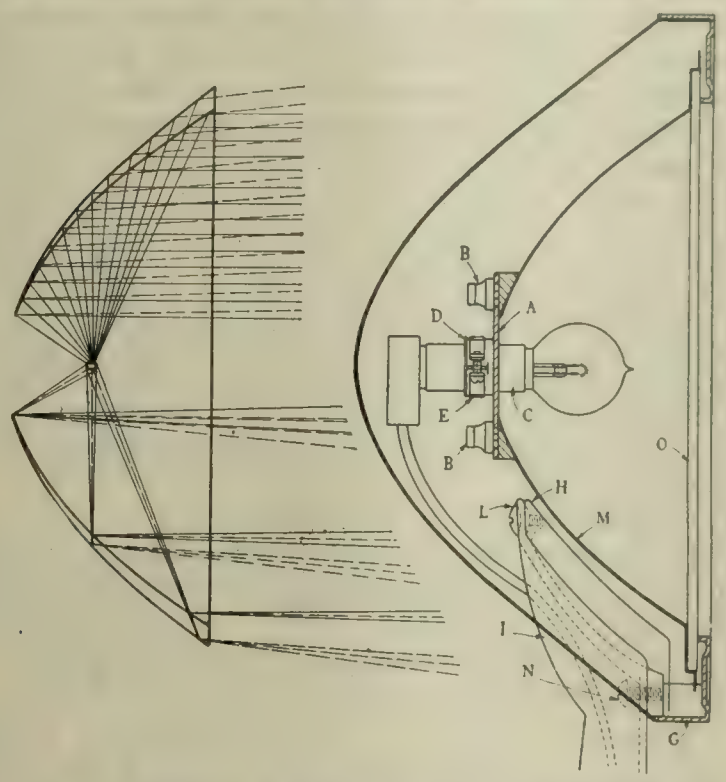


Fig. 1—Reflection of light rays from paraboloidal and hyperboloidal surfaces when emanating from a point source (above) and from a lamp filament. Fig. 2—(right) Focusing and aiming devices of Nolenz lamp

A new lamp placed on the market under the trade name of Nolenz by the Automotive Utilities Mfg. Corp. embodies the principle referred to above. The reflector is divided into six sectors which are arranged in pairs. Two of the reflector segments supply the strong road illumination—often referred to as the pick-up light—which is required directly in front of the car, striking the road at a distance ahead of 150 to 250 ft.; two supply illumination for the sides of the road where the light need not be so intense, and the other two illuminate the ditches still further out to the sides.

The "pick-up" light is obtained from the top and bottom sectors, which are of paraboloidal form and tend to confine the rays to a fairly narrow, conical beam of great intensity. The direction of this beam is accurately adjusted by means of a special aiming device with which the lamp is provided and which will be described further on. The two pairs of sectors on the sides are made of hyperboloidal form. The two paraboloidal sectors of the Nolenz reflector produce a conical beam of light of about 3 deg. diameter, while the two pairs of hyperboloidal sectors distribute the light evenly in bands about 8 deg. wide, extending from the central height point downwardly and outwardly at 60 deg. to the vertical.

The light distribution from the two parts of the reflector is illustrated in Fig. 1. The upper portion of the figure shows the rays as they would be distributed from a point source. The broken diverging lines show how the rays would diverge, and the solid lines show how the rays would be projected in parallel lines. The lower portion of the drawing shows the light rays as they are projected from the two surfaces with the lamp filament as a source.

An important feature in connection with any headlight is the means of aligning the source or bringing the filament center into the axis of the reflector. This is accomplished in the Nolenz, as shown in Fig. 2. The circular plate A may be moved both vertically and horizontally until the lamp filament is brought into the reflector axis, where it is locked by two thumbscrews B. The socket C may then be rotated or moved back and forth in the collar D until the center of the lamp filament is at the reflector focus, when it can be locked in position by the locking band E.

The aiming adjustment is made by means of a three-point bracket. The triangular shell F is rigidly secured to the reflector rim G. The socket joint H engages the upper end of the supporting member I where the two pivot. The set screws K are threaded into the triangular shell F with small spiral springs between the supporting member I and the triangular shell F. To aim the reflector, therefore, the set screws are manipulated until the beam is projected in the desired direction. The headlamp is then locked by tightening the set screw L, which is threaded into the supporting member. The reflector M is secured to the reflector rim G with set screws N, which also hold the glass O in place. The rear housing is removable for relamping, so that the focal adjustment may be easily accessible.

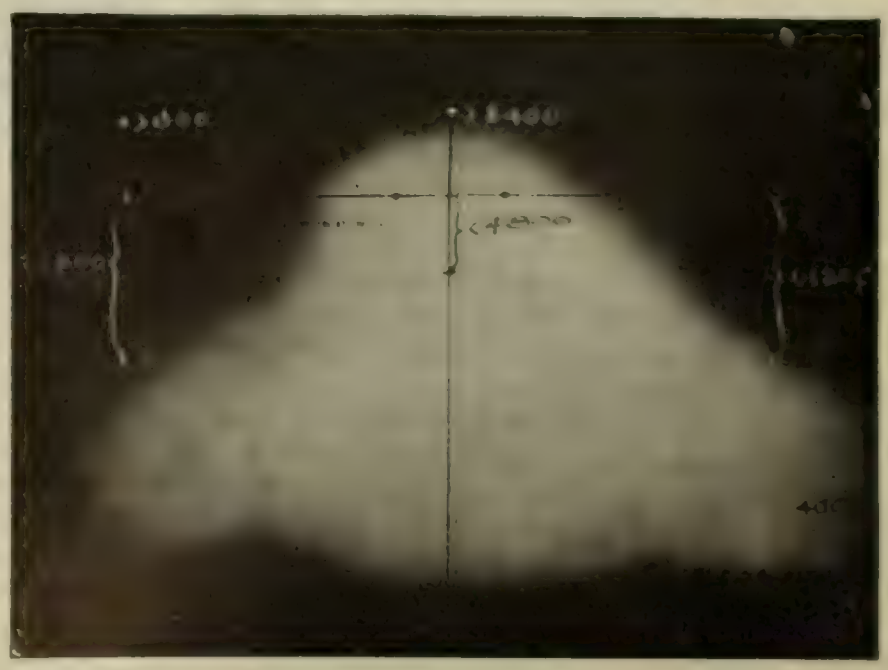


Fig. 3—Distribution of light from Nolenz lamp

Manufacturers Are Largely Responsible for Labor Troubles

Executive of International Harvester Co. recommends for industry the motto: "Physician, heal thyself." The views expressed here are specially interesting as coming from a man who has studied labor problems carefully from the management standpoint.

By H. F. Perkins*

I AM one of those men who firmly believe that conditions modify the approach to the question of industrial relations. There is no cut and dried panacea, no general plan that I have or would like to talk about. I recognize that the kinds and qualities of your industry must determine the kinds and qualities of your relation to your labor. Therefore, a general approach along the lines of principles seemed to me to be the more appropriate.

The relationship of management and men is, to my mind, the proper statement, and not the relation of capital and labor. Capital has no relation, as I see it, to men; it is the management that we are interested in discussing. Methods and policies are those of management.

What is the purpose of this subject we are discussing? Industrial relations is a common term to-day; it is in everybody's mouth. I take it that what we are after is peace in industry, and that—coupled with one other thing, efficiency in industry—is what we are aiming to accomplish. It seems to me that the two must go hand in hand. Peace in industry means simply lack of conflict that is destructive. It has nothing to do with the meeting of minds in the discussion of the problems. Those are essential and stimulating and valuable. Peace presupposes mutual understanding.

There can be no peace, as I see the history of things, except through mutual understanding or absolute domination. The period of absolute domination in management of countries and in the management of men, to my mind, has passed. Therefore, we must get back to the proposition of a mutual understanding and arriving at a mutuality of purpose and interest that will bind you together to a degree that will accomplish the purposes of efficient production.

As I study the history of industrial relations, or the lack of industrial relations, in our country and in other countries, I am very thoroughly persuaded that we might as well, as the heads of industry, as manufacturers or producers, admit that we are largely responsible for the troubles in which we find ourselves. I think it will help us, in approaching the subject, not to try to find the fault with our workmen or the fault with the attitude of the country—those men who express themselves, the public, those who create publicity—but to consider what we are responsible for, and how much the obligation lies upon us to correct that trouble.

It is to me beyond peradventure of discussion that the control which the labor unions have secured in this country in many lines of industry is not the fault of labor, is not the fault of the public, but is the fault of the manufacturers and the business men themselves.

The rapid and entrancing, captivating growth of industrial work in this country following the Civil War, and the great development that followed in Europe after the Napoleonic Wars have led to an absorption of business men in their money-making enterprises. The game has been so exciting, the proposition so great and captivating mentally and physically, that they went after it and forgot that they were dealing with men. We are now awake to the fact that a genuine problem is confronting us.

The trouble in industrial management in the past, as I see it, has been ignorant or domineering management. I want to stop just long enough to emphasize one matter that seems to me vital—that in our factories, in our workshops and in our mining and field enterprises we instill in the men a better quality of leadership.

I believe that much of the trouble that we find in our factories to-day is growing out of the fact that the foremen who have been in charge, until recently, have been men who were elevated to their positions from the ranks because they were good technical men or good "bosses" or compellers of output, rather than because they were leaders of men and intelligent students of the subject. Out of that unfortunate contact between men not properly introduced to the question of labor and management has come much of the bad feeling that has arisen on the part of the working men toward the control; no matter how splendid a character may be the head of your institution, no matter how kindly may be the spirit which controls the man in charge of your manufacturing operations or your producing operations, he cannot transmit that state of mind, he cannot transmit that spirit of friendly interest in his men through a crooked glass.

"Physician, heal thyself" is a good motto for industry to-day, and I am very anxious to leave that one thought if no more, that if we are going to approach the question of industrial relations intelligently and successfully, it will be after each one has taken himself and his organization in hand and figured out what he can do to make his relation to his men right and begin to study the problem from that angle rather than from the angle of complaint against the less educated, the less opportune, the less fortunately situated laboring man.

*Vice-president International Harvester Co. Excerpts from a paper read before the annual meeting of the American Petroleum Institute.

The growth of interest of the public is also a general principle which I think we must consider in this subject.

I understand that many of your concerns have done wonderful things in the way of labor regulations, but all of us are but touching the surface. What we want to do is to get the combination of forces which will in proper time and with proper study, slowly bring about the successful conclusion.

Investigation is essential and only organized investigation will get the goods.

In regard to the workmen themselves, I feel that we should always bear in mind this proposition: first, that they are men. They are very much like we are. Most of us started in that field—at least that is true in our industry—at the bottom. Most of the men at the top began in the shops or in the small work in the sales office and have worked their way through. I believe that is true of all industries. You would think on that very account that there would be a sympathetic understanding, but it does not follow.

Many people say that they believe the workmen want wages alone. I doubt that very much. The easy solution of this industrial relations problem of paying a man a good wage and letting him go is a very appealing one, because it is dead easy if you can afford to pay the wage. To my mind, however, it is unscientific, unintelligent and in the end will win nothing.

All men desire personal consideration; I believe that they desire to have an opportunity to express themselves, whether their expression finds itself responsible in the policy pursued or not; just as you with some of your growing young men will ask them a question on a matter of importance and see them respond with interest and give you their opinion and then perhaps you make a decision contrawise; you know that you have excited their interest, you know you have their thought turned in the direction in which you are working and that is equally true in the relation between management and men.

There has recently been in our midst a representative of manufacturing interests in England, Mr. Rountree, and the other day he made this remark: "Capital and labor must co-operate before either can become effective, but I look upon it as unreasonable that in matters affecting my daily life and the conditions under which I work, capital shall always be master and I the unquestioning servant. I acknowledge that in industrial enterprise there must be some one in supreme control and there must be true discipline, but this does not preclude an arrangement under which working conditions are mutually agreed upon instead of being dictated by the representative of capital alone."

I believe there is a principle which we must consider. How to apply it you must work out. First, remember that any man likes to have a chance to find an expression of his thought through himself or some representative, and second, that every man will respond to fair play to such a degree that you can dismiss the other element that does not.

If they do not get an opportunity in the years that are following to express themselves through representation or individually, I am sure they are going to call for professional help, because the size of our organization is making it more and more necessary that there shall be a new point of contact either through hired professional assistants or through direct representation of the men themselves in contact with their management.

In my judgment the average working man would much prefer to deal with his own master rather than with an outside man. I cannot see any indications that the average workman likes to work through a union delegate. It seems to me as an easy preliminary to the question of approach to this matter, that we may assume that, with proper attitude expressed in an organized way between management and men, the men will prefer to work along that line rather than with the methods which are now their only resource.

I want to leave just the final thought that for each of you it is an independent proposition. I am not one of those who believe that any successful concern working in industrial relations for two or three years can tell any other concern that they should go and do likewise. I am sure each enterprise will work out its own problem in its own way.

Official Report on Bournonville Double Transcontinental Trip

ON October 14, last, Eugene Bournonville and his son, Rene, started from Columbus Circle, New York City, in a car fitted with a Bournonville rotary valve engine for a trip to Los Angeles and return, under observation of the valve mechanism by the American Automobile Association. No representative of the A. A. A. accompanied the car, but previous to the start of the tour seals were applied to the front and rear cover plates of the valve chest, a special form of wire seal being used which made it impossible to remove the valves from the cylinder head without breaking at least one of the seals.

The car returned to New York on November 15, where it was met by A. A. A. representatives. An inspection of the motor was made at the Bournonville plant the following day. Both seals were found to be intact, which proved to the A. A. A. officials that no access had been had to the rotary valve throughout the trip of 6000 miles. After the seals had been broken the two sections of the valves were removed from the engine and micrometered as before. The results of the measurements before and after the trip are given in the following table, from which it can be figured that the clearance of the valve in its sleeve is only 0.0017 to 0.0019 in. The figures show that the wear of the valve was exceedingly small, the report concludes.

Valve Measurements—Bournonville Rotary Valve Engine

(Valves Cold)

	Before Start of Trip, Oct. 13, 1921	*After Trip, Nov. 16, 1921*
Front Valve		
Front	3.7510 in.	3.7507 in.
Center	3.7511 in.	3.7510 in.
Rear	3.7511 in.	3.7509 in.
Rear Valve		
Front	3.7498 in.	3.7498 in.
Center	3.7499 in.	3.7498 in.
Rear	3.7498 in.	3.7497 in.
Valve Sleeve		
Front	3.7527 in.	
Center	3.7528 in.	
Rear	3.7517 in.	

EXPERIMENTS were made in England recently with an amphibious tank, which, however, ended in an accident. In the course of the trial a crossing of the Thames was attempted. Leaving the Charlton Tank Experimental station in the morning the tank arrived at Cross Ness and was driven into the water when the tide was at a favorable height. She had traveled about 300 yd. from shore when, from some cause unknown, she sank. The tank is to be raised for examination.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE
Reg. U. S. Pat. Off.

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A. B. Swetland, General Manager
David Beecroft, Directing Editor
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Effective Car Advertising

NO class of advertising has been more replete with exaggerations and superlatives than has that which pertains to automobiles. The unsoundness of such publicity effort from the standpoint of sales is becoming more generally recognized throughout the industry, but a lack of definite facts still characterizes much car advertising. The buying public is becoming more familiar with automobiles each year, and as a result there is an increasing necessity for facts and really informative data in publicity designed to promote sales.

It would be an excellent thing for the industry if every automobile advertisement could have the same honor which was recently accorded to one put out by a prominent car maker. The ad "Over 600,000 Owners," which has become rather familiar during recent months, was used by a Chicago pastor as a text for a sermon a few weeks ago. Standing out prominently on one side of the platform was the full-page advertisement bearing the simple fact message just given. On the opposite side of the pulpit, on another placard, stood a color advertisement brilliantly illustrated and splendidly worded.

The sermon was a special one to children and the pastor emphasized that "we should be known by our deeds even more than by our words." The two advertisements served to illustrate the text. Would that more automobile advertising might be suitable as texts for similar sermons.

Over-specialization in Production

SPECIALIZATION in production processes has been carried to a point where it may make for inefficiency rather than for efficiency, thus defeating its own end. A failure to utilize all of the productive qualities in each worker is just as much inefficiency as to cut up material so that a maximum of waste results.

Efficiency engineers have propagated so thoroughly the idea that maximum efficiency lies in maximum specialization that modern industry is in grave danger of going too far in that direction. The manager may say "So long as that worker puts more pieces per hour through the machine than anyone else, I don't care what else he knows or thinks." Such management is not sound from an economic viewpoint.

To begin with, the period over which that worker will be able to do that single thing at the maximum rate in this particular place will be governed to some extent by his mental attitude toward his work, his employer and his environment. Even from the limited viewpoint of quantity production, it is not sound management to consider the production volume of the worker as the only contact with the employer.

In a wider sense, however, the loss to management is greater. If a man has the ability to think or to make constructive suggestions, it is poor economy to permit him to exercise only his capacity for pushing metal into a machine. Even though his mental capacity be limited, the employer is not getting maximum efficiency from the worker until that mental capacity, whatever it may be, is given the opportunity to function to the fullest possible extent.

It is not enough that the management simply be willing to listen to suggestions: it is necessary that constructive thinking on the part of employees be definitely encouraged. This must be done, not only by encouraging the men to make suggestions concerning the plant operations, but also by a definite attempt to make the conditions of the job such as to permit and encourage mental development of themselves. Complete specialization tends to remove responsibility from the individual and, consequently, to discourage mental development. It is only through the development of individual responsibility, however, and through the development of individual intelligence that management can hope ultimately to make definite progress. The necessary direction of growth is clear; the exact path must be found. Some plants have already started on the right road and are reaping the benefits which grow by the wayside.

Selling the Price Cuts

THE expected number of price cuts in all classes have taken place during the New York show. It may be assumed that the purpose of these additional cuts is to stimulate sales. In a general economic sense it is true, of course, that a lower price automatically widens the potential market, but it does not necessarily follow that every unit of a series of close-following reductions will result in immediately increased sales.

Many automobile salesmanagers stated emphatically and published broadcast that "rock-bottom" prices had been reached when the first flurry of price cuts came over a year ago. This statement has been reiterated with each succeeding reduction since that time. Conditions in the material and labor market have justified certain reductions since that first cut, but, particularly in recent months, there has been no decided change in basic economic conditions that would necessarily be reflected in another cut.

Consequently the public may assume that previous cuts were not particularly scientific reductions based upon costs plus a certain profit; that present statements concerning "rock bottom" may not be true because previous statements to that effect proved subject to considerable modification. The time has come when price reductions themselves must be sold to the dealer and to the prospective owner.

The dealer is beginning to ask merchandising reasons for cuts. It is difficult for him to get much selling value out of the "rock-bottom" argument. He knows that that price is only one consideration among many in buying and selling an automobile, but constant price cuts serve to emphasize this single factor in the minds of buyers. Thus the dealer is called upon to sell very largely upon that basis at the present time. In many cases he is at a loss to know just what the real basis of reductions has been.

The dealer who must present the car to the public must be sold on the reasons for the latest reduction, the basis upon which it was made, and its relation to a proper stabilization of values in the automotive industry. Car prices must fluctuate to a certain extent in conformity with economic and business conditions, but such fluctuation does not call for a constant readjustment every few months.

Recent price cuts have had comparatively little effect upon the cash value of a car sale. A large proportion of prospective new car customers are already car owners. While the first-time buyer benefits by price reductions, the man with a car to trade does so to a very limited extent, if at all. As the new car price is lowered, used car values depreciate in proportion. Thus the actual cash payment for new cars tends to become uniform, regardless of the price of the new car.

The replacement market is constantly becoming a larger proportion of the total car market, and used car owners are rapidly coming to recognize that price reductions have little effect upon the cost of a new car to them. Commenting on the numerous price drops at the show, a man who now owns a car and desires to get a new one was even heard to remark, "These price cuts are all right, but they don't mean anything to the man who wants to trade."

A fair price, based upon costs and service value, is always necessary, but given that as a basis, price is only one of many other important factors in selling an automobile. Nothing could be more demoralizing to the industry than a price war. Even the strongest are weakened by such a process, and the industry as a whole cannot benefit.

The present price cuts must be "sold" if they are to accomplish their purpose of stimulating sales. There is an urgent necessity for an immediate stabilization of car prices on the basis of the most accurate cost and selling data available.

Display Clears Air for Industry

Price Uncertainty Is Met by Makers

New Era of Keenest Competition in Same Typed Cars Forecast

By James Dalton

NEW YORK, Jan. 11—Atmospheric conditions in the automotive industry have been materially cleared by the New York show. The uncertainty in regard to prices which has existed for the past few weeks has been dissipated. Reductions have been more general than was expected in the lower priced lines and less general than was expected in the higher priced cars.

The result will be tremendously keen competition by manufacturers of the same type of cars which are on practically the same price level. This fight will be keenest among the largest producers. Business rivalry will be all the sharper because of the general expectation that sales in the coming year will be little larger than in 1921. It is felt that just as many cars will be sold but that they will be made by a smaller number of manufacturers.

Buyers Given New Values

Values given purchasers at the show never have been greater than this year. Refinements in models have been made and better materials used. This has been made possible by the reduction of inventories and the writing off of losses which have permitted makers to go into the market for materials and buy them at current prices.

Scarcely a manufacturer can be found who will not be in the market in the near future for supplies of various kinds, although they will not buy in large quantities. This will result in better business for parts and accessory manufacturers. The inventory situation is so much better than it was at the beginning of 1921 that there is no comparison. Few companies have any serious worries on this score.

One of the striking trends of the show is toward lighter models and another is toward lower prices for enclosed models. One company announced a slash of $700 on its coupe and sedan. Other price cuts show the same general tendency.

No especially sensational mechanical announcements have been made at the show. Probably the most interesting is the Franklin four-cylinder, which will sell for less than half the present model. There is added interest in this car because the General Motors Corp. will bring out four and six-cylinder air-cooled models in the early fall.

The competition for capable dealers who are good merchandisers is becoming very sharp, and this is one of the subjects which is occupying the minds of the many manufacturers attending the show. Most of them are disposed to back up their dealers to a greater extent than ever before. Few are offering increased discounts, but many are making changes in their contracts designed to please dealers and distributors.

Opens as Buying Show

Early indications are that the exposition will be a "buying show." It is certain that more retail sales will be made than was the case last year. It is significant, however, that prospective purchasers are "shopping" carefully and are determined to get the best value for their money.

The big, outstanding fact of the show, however, is that prices probably have been stabilized for months to come on the more popular lines.

Coincident with the opening of the show comes the completion by AUTOMOTIVE INDUSTRIES of its annual tabulation of the registration of motor vehicles in the United States. The total for 1921 was 10,449,785, an increase of 1,517,327 over 1920. This increase was larger than the gain for 1920 over 1919, which was 1,335,995. The difference probably is accounted for by the fact that nearly all manufacturers entered 1921 with large stocks on hand.

REVEL OF PESSIMIST OVER, FRANKLIN SAYS

SYRACUSE, Jan. 9—Commenting on the outlook for 1922, H. H Franklin, president of the Franklin Automobile Co., says:

The business outlook for the coming year is encouraging.

One feels like getting into the fight.

All business signs point ahead.

Each month should see a gain in general conditions. The entire world will move forward slowly.

The revel of the pessimist is about over.

No False Optimism Manifested at Show

Majority of Manufacturers Expect Production to Be on 1921 Basis

NEW YORK, Jan. 9—No evidence of false optimism is to be found among automobile manufacturers who are here for the New York show. They have no illusions about what the coming year has in store for them. A few expect sales of passenger cars in 1922 to exceed those of 1921 by about 25 per cent, but the majority believe production this year will be on about the same basis as last year.

See Centralization of Output

While it is the consensus of opinion that there will be no falling off from the production of 1,535,000 passenger cars in 1921, there are many factory executives who believe this output will be centralized in a few factories to a greater extent than it was last year. There is no disposition to wink at the fact that competition will be keener than it ever has been, especially in lines which are in practically the same price class. It is felt that if there are further price concessions it will be by rival companies fighting for sales of cars.

Those companies which have developed an export trade report a somewhat larger volume of actual sales and many more inquiries than have been apparent for several months. They are confident that as the year advances their foreign trade will steadily increase.

Generally speaking, manufacturers feel that there can be no marked revival of buying until the position of the farmer is materially improved. They point out that a large part of the sales of 1921 were made in a comparatively few cities and that it will be necessary to carry on intensive sales campaigns not only in those cities but in a new territory in the coming year if the sales mark of 1921 is to be equalled.

Schedules Purely Tentative

Production schedules for 1922 thus far are purely tentative and all estimates merely are guesses. All manufacturers as a whole will build cars strictly on a sales basis and will permit no large accumulation of unsold vehicles. They will be able to tell more definitely in a few weeks what their output for the year is likely to be.

While there is still some hesitancy on the part of bankers in financing sales, manufacturers sense an easing up in the situation.

Show Sees Wave of Price Reductions

48 Manufacturers Announce Changes

Automobiles in Medium Cost Class Bear Brunt of Revisions

NEW YORK, Jan. 9 — Price readjustments are of paramount importance in the merchandising plans of the car manufacturers and the belief of the public that the exhibition would be ushered in with a wave of price revisions was well founded. The opening days of the show are bringing with them announcements that embrace many lines.

Manufacturers whose prices were lowered at the show are Reo, Lexington, Studebaker, Velie, Milburn electric, Peerless on its open models, Cleveland, Gardner on its sedan, Chandler on its new line, Paterson, Noma, Sayers, Standard, Grant, Maibohm, Crow-Elkhart, duPont, Kissel, Earl, Premier, Elcar, Stephens, Auburn and Detroit Electric. Oakland announced a slight revision upward on three of its models, the touring and sport remaining unchanged.

Other Changes Made Earlier

These price changes follow many others during the last few weeks, all of which were announced sufficiently early so that the public had ample time to become acquainted with them before the doors of the annual show swung open. These early changes were on the Cadillac, Hudson, Buick, Essex, Stearns, Oldsmobile, Saxon, R & V Knight, Paige, Apperson, Stutz, Nash, Haynes, Marmon, Hanson, Handley-Knight, Elgin, Stephens and Lafayette lines and an increase on the Davis.

Dodge Brothers, whose line has been the subject of persistent rumors, announced that it would reduce its prices on Feb. 1, effective Jan. 1, though what the reductions would be was not stated. Advertising Manager G. H. Phelps formally denied the report current at the show that Dodge would set a new figure of $775 or $785 and the Dodge salesmen are continuing to quote a factory price of $985 on the touring car.

Meets Buick Prices

Studebaker, Cleveland and Chandler were also the subject of much speculation as the show opened, as these lines are among those offering stiffest competition to the Buick, which is entering the new year with its second decline from the top price of 1920. Studebaker met the Buick price by naming $1,045 on its redesigned light six, $1,475 on the special six and $1,785 on the big six, these representing reductions of $105, $160 and $200 respectively. Cleveland dropped $100 on the touring car, bringing it to $1,195 and Chandler, showing for the first time a five passenger touring car, set a price on it of $1,595, which compares with $1,785 as the old price on the two and seven passenger touring models. Cleveland made its best bid for prominence in price cutting by bringing its sedan down $700 to a new price of $1,595.

CARS ON WHICH PRICE REVISIONS ARE MADE

Apperson	Gardner	Oldsmobile
Auburn	Grant	Paige
Buick	Handley-Knight	Paterson
Cadillac	Hanson	Peerless
Chandler	Haynes	Premier
Cleveland	Hudson	R. & V. Knight
Crow-Elkhart	Hupmobile	Reo
Davis	Kissel	Sayers
Detroit Electric	Lafayette	Saxon
Dodge	Lexington	Standard
Dupont	Liberty	Stearns
Earl	Maibohm	Stephens
Elcar	Marmon	Stutz
Elgin	Milburn	Studebaker
Essex	Nash	Velie
Ferris	Noma	Wills Ste. Claire
	Oakland	

Medium Price Class Affected

The medium price class bore the brunt of the changes and the lines selling in the neighborhood of $1,500 show the results of the competition that has set in. Velie dropped from $1,585 to $1,395, thus coinciding to a penny with Buick. Reo brought its touring car down to $1,595 and several others in the same class show by their revisions that they are fully awake to the merchandising situation created by the present tendency to get rock bottom prices.

The new Rickenbacker car, on which production already has started and which perhaps is destined to play its part in the automotive world, came out with a list that fixes its touring car at $1,485, its sedan at $1,985 and its coupé at $1,885. The first announcements of the Rickenbacker stated that its touring car

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ELGIN INCREASES OUTPUT

ARGO, ILL., Jan. 7—Elgin factory sales for the first six days in January show an increase of 22 per cent over the sales for the entire month of December. C. L. Alexander, sales promotion manager for the Elgin Motor Car Corp., says that his entire distributor and dealer organization shows a more optimistic spirit than at any time during the past six months. January, he says, will show more business than any similar period during the past four months.

Inventory Situation Is Vastly Improved

Bears No Comparison With Year Ago—Responsible for Price Revisions

NEW YORK, Jan. 9.—The position of passenger car manufacturing companies in relation to inventories at the opening of the show this year is so much improved over the serious plight they were in at the beginning of 1921 that there is no comparison. Almost without exception factory executives assert that inventories have been liquidated and losses taken. These assertions should be discounted to a certain extent but it unquestionably is true that most companies have little to worry about so far as inventories are concerned at this time.

There is scarcely a company in the field which is not in the market for small supplies, at least, of parts and materials. These orders will increase as production is enlarged. After a review of the situation at the show it can be stated safely that the improved position of manufacturers will be reflected from now on in the business of parts and accessory makers.

Revisions Due to Inventories

Many of the factory executives seen at the show declared that price revisions had been made possible by the fact that old and high priced inventories had been cleaned out. Ability to purchase materials at the market has resulted in a scaling down of prices.

When the show opened last year manufacturers were hopeful that they would be able to work off their high cost inventories without material loss to themselves, but after sales had been at a standstill for three months they changed their minds and began taking their losses. This process of liquidation now has been virtually completed.

Must Replenish Stocks

The inventory taking period is practically over and nearly all companies now know exactly where they are at in respect to stocks of supplies. They will take steps immediately to replenish those parts of which they are short. Except in the cases of the larger production concerns buying will continue to be on a hand to mouth basis but it will be for current needs.

There is evident determination on all sides to avoid loading up with large inventories which has proved so disastrous in the past year and a half.

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Makers Competing for Ablest Dealers

Not Enough to Go Around in Building Strong Sales Force

NEW YORK, Jan. 9.—There have been few shows in the history of automobile expositions in which the manufacturers are more keenly interested in dealers than at the one now in progress at the Grand Central Palace. Competition for successful dealers is almost as keen as for sales. It is realized that the one question is closely related to the other and that the company with a strong sales organization will be the one which will get the business.

Factory sales managers at the show are greeting cordially all the dealers with whom they come in contact and inviting them to pay visits to hotel headquarters where contracts are scanned and the general merits of the factory proposition are considered.

Merchandising Being Developed

Almost without exception manufacturers admit that they are anxious to make large additions to their dealer organizations. They state frankly there are not enough good dealers to go 'round and that real automotive merchandisers must be developed to meet the demand.

Factories generally are giving greater consideration than ever to the need for teaching modern merchandising. The most popular method of doing this is by sending factory representatives into the field as district men. Hundreds of these salesmen have been added in the past few weeks and many more are in prospect.

Representatives of a few companies admit that they propose gradually to eliminate distributors but the preponderance of sentiment seems to be for the retention of the automobile middleman. The manufacturers who are sold on the distributor, as a general rule, are not those with the largest production but it has become evident that there will be automobile distributors in the business for a long time to come.

Dealer Financing Easier

Most companies are having their distributors call frequent luncheon or dinner meetings of their dealers which are addressed by factory men. These meetings are used to preach the gospel of "buying them right," in relation to used cars. It now is conceded that there is no panacea for the used car evil and that the only way in which it can be solved is by eliminating losses on trade-ins.

The question of dealer financing is not nearly so serious as it was a year ago but many companies are arranging for the accommodation of their dealers through financing companies. Most of the manufacturers who are sold on the distributor contend that a large proportion of the dealers are unable to finance themselves except for purchase of two or three cars at a time through distributors.

There is apparently a disposition to adopt in dealer contracts the suggestions made by the directors of the National Automobile Chamber of Commerce after a series of conferences with a committee representing the National Automobile Dealers' Association.

Hupp, which now has 1250 dealers and 90 distributors, expects to increase its dealer organization to 1400, but does not believe it could add profitably more than ten distributors. Marmon is making an effort to materially enlarge its dealer organization.

Some Branches to Be Established

The new Fox air-cooled car will be handled entirely through distributors. The Frontenac sales policy has not been definitely determined. The Gray has selected distributors in Boston, New York, Philadelphia, St. Louis and several other large cities.

Rotary (Bournonville), a quality job, plans to sell only directly from the factory and will place no dealers or distributors. This car, however, is made largely to introduce the Bournonville Rotary Valve and Bournonville admitted that he expected to build very few cars. Kelsey, just going into production, will place no distributors, but will deal through branch houses. Sayers looks with favor upon the establishment of branch houses but is taking no definite steps along this line as yet. Anderson also plans taking a step of some sort in this connection, but would make no definite announcement. It was said, however, that some distributors would probably be eliminated to make room for branch houses.

Trend Is Toward Distributors

The strongest sentiment, however, was expressed in the opposite direction. Dupont will probably do away with some of its branch houses and place its car in the hands of distributors. The Stanley Steamer will probably do the same thing. Rickenbacker will have no branch houses but will deal through distributors. Norma is looking for new distributors and dealers, as are Hanson and Hatfield. Itala, a foreign car, may also add new distributors in this country. Leach Biltwell, a California firm, plans an invasion of middle western and eastern territory, but has not yet decided whether it will deal through distributors or establish branches in New York and Chicago. The latter course will probably be followed if satisfactory men can be found.

While Dorris has opened a factory branch in Philadelphia it is not an indication that the company is adopting a policy of distributorship elimination. To the contrary it is building up a strong distributor organization.

Pilot is leaning toward the factory branch policy with six branches already opened and four more, at Pittsburgh, Philadelphia, Boston and Cleveland, under contemplation. Under the company's policy a few distributors will be retained but they will be those that have proved strongest in the organization.

See Greater Output from Export Trade

Manufacturers Expect Foreign Business to Surpass That of Last Year

NEW YORK, Jan. 9.—Export activities by many of the exhibiting companies were a marked feature of their merchandising plans for the show. Foreign sales managers of many of the companies, or representatives of that department, were on hand at the displays, with the expectancy that 1922 would show a much larger volume of overseas shipments than 1921. In fact, many makers are counting upon such business to aid them in increasing their schedules and it was apparent that many companies had awakened to the possibilities in such trading.

Unsold Stocks Cleaned Up

Officials reported generally that recent weeks had brought about a change in the stagnant condition of foreign trade and that inquiries and orders were being received in a manner that warranted greater optimism for the coming months. Stocks of unsold cars in the hands of distributors in other countries or in the customs warehouses have practically been cleared up, thus assuring an entirely different situation than confronted the trade at the last show. Then, large numbers of cars were unsold in the hands of dealers but, in the meantime, these have been worked off and new buying to meet the current demand has set in.

The recent improvement of the exchange situation, which now affects many countries, has greatly heartened the export managers, who obtained prospective purchasers on the first day of the show. Several commission houses at New York are reported to be seeking automotive connections but a number of sales officials declared that they intended to keep the lines in their own control. The opening of export offices or the appointment of export officials will be announced by several companies during the show and it is reported that a number of dealers and distributors from other countries have come to New York to take on new lines.

Delay Action on Senate Reimportation Measure

WASHINGTON, Jan. 9.—On request of Senator Curtis of Kansas, the Joint Resolution imposing a duty of 90 per cent on all goods exported from the United States for the use of the American Expeditionary Forces and its allied forces which have been sold to any foreign government or person when reimported to this country, was passed over in the Senate to-day.

This bill is known as the Graham resolution and was prepared in response to protests from American automobile dealers and manufacturers.

Hupp Has 30,000 Output Schedule

Will Double Production of 1921 —Changes in Price of Closed Cars Only

NEW YORK, Jan. 9—The Hupp Motor Car Corp. has entered 1922 with a tentative production schedule of 30,000 cars, which would be double the production of last year. The price of the coupé has been reduced from $2,100 to $1,835 and on the sedan from $2,150 to $1,935. Open model prices remained unchanged. The main factory of the company in Detroit has been enlarged and many improvements have been made in the branch plants which include the Detroit Auto Specialty Co., the American Gear & Mfg. Co. at Jackson, and the H. & M. Body Co. at Racine.

To Increase Dealers

A. C. Hutchinson, general sales manager, who is here for the New York show, announces that the dealer organization, which now numbers 1250 and 90 distributors, will be increased to 1400 dealers. A scientific analysis of automobile registration in every county in the United States compared with Hupp sales in each county, has been made by Hutchinson and the allotments to dealers are based on this analysis. This has inspired a feeling of confidence within the dealer organization that no favorites will be played and that every man will be treated with absolute fairness. This spirit was reflected in a resolution adopted by the dealers at their recent convention in which appreciation of the company's policy was expressed.

Domestic sales of the Hupp company in 1921 are said by Hutchinson to have been 92½ per cent of the domestic sales for 1920, which was the biggest year the company ever had. There was a sharp falling off in export sales last year, however, and they reached only 5 per cent of the 1920 total. The tone of the export market is steadily improving and a large increase in foreign sales is expected this year. Hupp has sixty-five foreign distributors.

Heavy Program Planned by Cleveland Factories

CLEVELAND, Jan. 9—The thirteen automobile factories here have scheduled for the present production figures that will run the total thousands of cars in excess of the number turned out in the year just ended. Practically all of the companies plan to augment their working forces, while some in recent weeks have taken on employees.

Grant will build approximately 7000 cars in the new year, says George C. Hubbs, vice-president and general manager. This organization by Feb. 1 will have more than 100 direct sales connections.

Templar did not allow the recent fire to halt production and it plans to build 5000 cars. M. F. Bramley, president, says that 500 additional workmen will be employed during the early spring months. J. H. Bramley, son of the president, is acting factory manager, succeeding D. L. Britton, resigned.

Winton is busy on plans for a larger year than 1921, H. J. C. Miller, sales chief, says. The factory organization has been changed, the overhead has been cut down and new materials and supplies are now arriving at the plant.

Chandler plans include an intensive development campaign in all directions. The company expects to employ its full quota of workmen early this year.

Plans are under way to lift the receivership of the **Ferris** car, which has been in effect since summer.

The Kurtz Automatic is to turn out 600 cars in 1922. This is the city's newest automobile plant. The factory has been operating during 1921 on a car a day basis. The new **Marsh** factory that has been in course of construction is expected to get into production on a light four early this year.

Gray Expects to Produce 23,000 Cars During Year

NEW YORK, Jan. 9.—Gray Motor Corp. will build 23,000 of its new light four-cylinder cars in 1922 and has already contracted with dealers to take over this number. These for the most part will be built and assembled in the Detroit factory. With the establishment of its assembly branches throughout the country the company will go into production on a basis of 200,000 cars a year.

This statement was made at the Gray Motor exhibit in the Hotel Commodore by Frank L. Klingensmith, president of the company, and former executive vice-president of the Ford Motor Co. Twelve assembly stations will be located this year, the cities thus far tentatively settled upon being New York, Philadelphia, Boston, Detroit, Chicago, Minneapolis, San Francisco, Kansas City, Dallas, Atlanta, Columbus and Portland, Ore.

Production Is Resumed on Milburn Electric Truck

NEW YORK, Jan. 9 — The Milburn Wagon Co. has resumed production of electric trucks which was suspended in 1917. It is producing the chassis for ½-ton and 1-ton models.

A complete line of bodies will be provided and purchasers will be given their option on a complete line of batteries. Persons to whom the trucks are sold will be supplied with the battery best fitted to their needs. In order to study these questions and give expert advice to fleet owners and individual purchasers the company has engaged the services of W. L. Lindsell of Detroit, a transportation engineer.

Sales of the delivery wagons will be handled by the Milburn passenger car dealers and others who will be added to the organization from time to time.

Ford Reopens Plant With 40,000 Workers

If Car Demand Falls, Company Will Keep Busy Making Parts

DETROIT, Jan. 9—Ford Motor Co. resumed operations to-day on a basis approximating full capacity of the Highland Park plant, 40,000 men being employed working in shifts under which 32,000 are employed at one time. This compares closely to the number employed by the company through 1921.

Though a statement has been issued by Edsel Ford, president of the company, that the company looks for a volume of business aggregating that of 1921, it is considered likely that the company is prepared to keep its factory busy in the manufacture of parts for cars already in the hands of owners, as manifested by its recent change in parts sales policy, if sales of cars fall off.

Officials have declared that if the company were to get but a small fraction of the parts replacement business now going to independent manufacturers, it would mean a very large addition to the output of the plant. Fortified with a heavy demand for parts, the company would not have to depend so largely upon the sale of new cars to keep the plant in 100 per cent operation.

Hanson Detroit Factory Depends on Show Results

NEW YORK, Jan. 9—Location by the Hanson Motor Car Co. of a plant in Detroit for the manufacture of its new light six line and the former Hanson line is held in abeyance pending the results obtained from the New York and Chicago shows. Until such time as the capacity of the Atlanta plant is exceeded, all manufacturing will continue to be carried on there.

Much dealer attention was given the light six, which at $995 is the only car in its class below $1,000, at the opening day of the show. With this vehicle the company hopes to open the channels of national distribution to Hanson products. When the company is ready to go into production on this model, officials declare, it will be equipped with the new light six Continental engine.

Factories in Syracuse Operate at Full Blast

SYRACUSE, Jan. 9—Automotive manufacturing, which suffered keenly here during the readjustment period, is now coming rapidly into its own again. Plants like the Brown-Lipe-Chapin Co. and the New Process Gear Corp., in particular, are running full blast filling large orders for complete vehicle manufacturers.

The stimulation of the automotive and other industrial plants in the city is rebuilding the retail market here.

48 Manufacturers Make Price Change

Automobiles in Medium Price Class Bear Brunt of Revisions

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would fall below $1,500 and its sedan under $2,000. These figures are barely shaded.

Two other cars concerning which there had been speculation were the Gray, which F. L. Klingensmith, former Ford official is to build in the Gray plant at Detroit, and the new Hanson six, which had been advertised to be the lowest-priced six made in America. The Gray was exhibited in one of the hotels, with a price announcement reading that it would list below $500. It was said, however that the touring model would sell for $475.

Only two models of the car will be built this year, touring and sedan. Next year it will include a complete line. The work of dealer organization is progressing rapidly but in no case yet has the company permitted any contracts to be signed.

Much Speculation Rife

The opening day of the show was surcharged with speculation about prices. Manufacturers and their representatives seemed to realize that a great part of their hopes for a successful year were tied up in the necessity of reaching a price stability that would prove to the public that further cuts were not in the offing. The public has grown weary with its rumors that tomorrow or the day after would see such and such a car brought down materially and consequently it was interpreted as watching the present exposition with a great deal of expectancy. From a merchandising standpoint, the public demand for lower figures had to be met and, fortunately in many cases, a cut was justified by the better position in regard to inventories, parts, labor, etc.

Aim at Minimum Figure

Factory executives, generally, seem to be thoroughly awake to this situation and, although many of them stated that they are making cuts now in advance of lowered production costs, they nevertheless are keen to prove that they had come down to a minimum figure. Some executives expressed themselves as being so thoroughly sold on the fact that the minimum had been reached that they speculated as to what the buyers would do on a rising market, provided manufacturers should raise prices in the spring or early summer. But this sort of talk was not frequent; officials rather took the standpoint that they had announced the 1922 prices and that they expected the present figure to carry them through the year. The doctrine that prices must be stabilized has been well understood and, while there are too many complexities in the merchandising and manufacturing fields to assure that the lowest prices have been announced, there was everywhere the feeling that the 1922 models represent 100 per cent value.

The opening days of the show are too early, perhaps, to set at rest all of the price problem. Every manufacturer is scouting to find out just what his competitors are doing and the utmost secrecy surrounded many of the price changes until the last moment before they were announced. Some cars opened the first day with their old prices and were dropped before evening. Others held off their price decisions until yesterday or to-day and there is yet a tendency to see what the other makers plan to do. This situation, however, should be ironed out before the close of the week and the meetings of factory officials, distributors and dealers should see the last of the cuts that can be attributed to the show.

Reductions Absorbed

Of course, some lines have absorbed any possible price reduction by improving quality, fittings, etc. There were several such cases and these manufacturers are meeting the price threat by more careful merchandising of their products. This becomes an individual problem but manufacturers and dealers must accept it as a big factor in their 1922 merchandising plans. It was significant that the price guarantee was absent, only McFarlan, so far as could be learned, guaranteeing that the present prices would hold until 1923. Also, there was no unanimity in regard to the readjustment of parts prices to the dealers. Some manufacturers have recently revised their parts lists or have new lists just coming out. Producers, however, who have not reduced car prices are not making any revision or contemplating any change, as a general rule, in their parts list.

Stutz Head Mentioned As Frontenac President

NEW YORK, Jan. 9.—William M. Thompson, president of the Stutz Motor Car Co., has been mentioned as the possible president of the Frontenac Motor Car Co., incorporated under the laws of Delaware for $1,000,000, to produce the new Frontenac. Thompson is the latest acquisition to the forces backing the production of the car, chief of which is Allan A. Ryan, the dominating figure in the Stutz organization.

Both Detroit and Indianapolis have been mentioned as likely sites for the factory, denial being made, however, that the car will be produced at the Stutz plant. Other than the association of Thompson and Ryan in the new company it is stated that there is no connection between the two organizations.

NAPIER SHOWS PROFIT

LONDON, Dec. 20 (*By Mail*)—Napier's annual meeting shows that last year's working loss of $250,000 was this year turned into a profit of $320,000.

Ford May Advance Lelands $8,000,000

Property Will Be Sold in February for That Upset Price

NEW YORK, Jan. 10 — Automobile executives attending the New York show are discussing with interest the report from Detroit that Henry Ford is backing the Lelands in their efforts to regain control of the Lincoln Motor Co. The property will be sold by the Detroit Trust Co. as receiver, early next month. The bid of $8,000,000 for the assets made in behalf of the Lelands is the largest thus far recorded. According to the reports current here this fund will be provided by Ford, although when the bid was filed it was understood stockholders of the company would provide the funds.

Officials Reticent

Both Henry M. Leland and Henry Ford are exceedingly reticent on the subject but it is known they are close friends. Before the receivership petition was filed, it was understood, Ford was asked by Leland to come to the rescue but refused. If he is financing the new plan it is evident he is anxious to have the Lelands retain control of the enterprise. It is not believed that Ford has any idea of linking up his present plant in any way with that of Leland, but that the money would be in the form of a loan.

Taxes May Be Cut Further

A further reduction of $200,000 in back taxes of Lincoln Motor Co. is in prospect, according to Government agents working on the case. If effected, the final Lincoln tax, originally $4,500,000, will be slightly more than $400,000.

Lincoln Motor Co. will continue under the direction of the Detroit Trust Co., receivers, during the New York and Chicago national shows. A plan was considered for a time whereby the company would have been turned back to Leland control under a $2,000,000 bond, so that they could have carried out special show plans, but after consideration it was thought best that the receiver continue to act until the date of sale.

New Jersey Court Sustains Foster Patent No. 108,731

NEW YORK, Jan. 9—In a patent infringement suit brought by the Westinghouse Electric & Mfg. Co. against the Sims Magneto Co., based on the Foster patent No. 108,731, the Federal District Court for New Jersey has held that the patent is valid and infringed. The patent covers a device for starting a motor in which the gear on the motor is meshed with the flywheel.

The Sims Magneto Co. was charged with contributory infringement, inasmuch as it was making the equipment for the Maxwell Motor Corp.

PRICE CHANGES ANNOUNCED AT SHOW

Auburn

	Old Price	New Price
5 passenger touring	$1,695	$1,575
Roadster	1,670	1,575
7 passenger touring	1,760	1,615
Coupe	2,475	2,275
Sedan	2,495	2,395

The four-passenger sport model is priced at $2,195.

Chandler Prices

	Old Price	New Price
5-passenger		$1,595
2-passenger	$1,785	1,595
4-passenger		1,595
7-passenger	1,785	1,695
4-passenger Sport		1,695
Coupe	2,785	2,295
Sedan	2,885	2,395
Limousine		2,995

Chandler shows for the first time a five-passenger touring car which is priced at $1,595. The old price on the two and seven-passenger touring cars was $1,785.

Cleveland

Model	New Price	Old Price
Roadster	$1,175	$1,295
Touring car	1,195	1,295
Coupe	1,550	2,195
Sedan	1,595	2,295

Crow-Elkhart

	New Price	Old Price
Four-cylinder touring car	$1,095	$1,295
Six-cylinder touring car	1,345	1,545
Six-cylinder sedan	2,095	2,395

Detroit Electric

	New Price	Old Price
Model 90	$2,800	$2,985
Model 93	3,500	3,985

Dodge

Dodge Brothers announces that it will reduce prices on Feb. 1, effective Jan. 1, and no announcement will be made until the first mentioned date.

Dupont

	New Price	Old Price
Roadster	$3,000	$3,400
Touring	3,200	3,400
Sedan	4,000	4,900
Coupe	3,800	(new model)

Earl

	New Price	Old Price
Touring	$1,185	$1,285
Sedan	1,895	1,995

Elcar

	New Price	Old Price
Four cylinder models		
Open	$1,095	$1,145
Coupe	1,345	1,645
Six-cylinder models		
Open	1,395	1,595
Coupe	2,065	2,495
Suburban	2,115	2,395
Sedan	2,165	2,495

Ferris 60

	New Price	Old Price
Roadster	$2,575	2,695
Touring	2,475	2,595
Sedan	3,475	3,695

OTHER CAR COMPANIES MAY CUT AT CHICAGO

NEW YORK, Jan. 11—While an extraordinary number of price reductions have been announced in connection with the New York show, it is generally believed that several manufacturing companies which have not made price concessions at this time will announce them at the Chicago show.

There has been some talk that a second cut would be announced by companies which already have made reductions this year, but the industry does not believe that such will be the case.

It is the consensus of opinion that whatever price changes are in prospect will be cleaned up at the Chicago show, and everyone sincerely hopes that such will be the case because it is felt that unless prices are stabilized by that time the entire industry will be discouraged.

Fox

The open models of the Fox are priced at $3,900. The prices on the coupé and sedan are $4,900.

Frontenac

Frontenac announced that the touring car would list at about $2,000 and the sedan at $2,800 or $2,900.

Gardner

The Gardner sedan has been reduced $100 from $1,695 to $1,595.

Gearless

Prices of the Gearless (steam) are $2,650 for the roadster and $2,600 for the touring.

Grant

Both open and enclosed models are provided with extra equipment under the new prices.

	New Price	Old Price
Touring and roadster	$1,385	$1,285
Coupe	1,895	1,950
Sedan	1,945	1,950

Kelsey

Kelsey announced that the prices on its new model are as follows: Six-cylinder touring, $1,800 coupé and sedan, $2,700; sport roadster, $2,000; four-cylinder touring, $985.

Kissel

	New Price	Old Price
Standard Touring	$2,175	$2,475
De Luxe Touring	2,675	2,975
De Luxe Coupe	3,275	3,775
De Luxe Sedan	3,475	3,775

Lexington

	New Price	Old Price
5-passenger touring	$1,985	$2,100
7-passenger sedan	2,285	2,785
Thorobred	2,100	

Liberty

	New Price	Old Price
5-passenger touring	$1,295	$1,595
Sport	1,495	2,400
Sedan	2,245	2,495

Maibohm

	New Price	Old Price
4-passenger sport	$1,495	$1,595
Sedan and coupe	2,165	2,295

Milburn

The five-passenger Milburn electric brougham was cut to $2,585 from $2,685.

Noma

	New Price	Old Price
1-D Speedster	$3,000	$3,250
1-D Foursome	3,100	3,350
1-D Six	3,200	3,450

Oakland

	New Price	Old Price
Roadster	$1,095	$1,120
Touring	1,145	1,145
Sport	1,265	1,265
Coupe	1,625	1,685
Sedan	1,725	1,785

Paterson

	New Price	Old Price
3-passenger	$1,550	$1,595
7-passenger	1,585	1,625
Sedan and Brougham	2,595	2,695

Peerless

Prices on open Peerless models have been reduced $90 from $2,880 to $2,790.

Premier

	New Price	Old Price
5-passenger touring	$3,100	$3,690
Roadster	3,150	3,790
7-passenger touring	3,250	3,890
5-passenger sedan	5,000	6,000
7-passenger sedan	5,100	6,100
5-passenger brougham	4,300	(new)

Reo

	New Price	Old Price
Roadster	$1,595	$1,650
Touring	1,595	1,650
Business coupe	1,895	
Coupe	2,355	2,700
Sedan	2,435	2,750

Sayers

	New Price	Old Price
Touring car	$1,695	$1,795
Sedan	2,795	2,995

Standard

	New Price	Old Price
Open models (2-4-7-passenger)	$2,500	$3,400
Sedan	3,600	4,800
Vestibule Sedan	3,750	5,000
Sedanette	3,500	4,500
Coupe	3,250	4,500

Stephens

	Old Price	New Price
Roadster	$1,800	$1,675
4 and 6 passenger touring	1,850	1,745
4 and 7 passenger sedan	2,850	2,650
4 and 6 passenger sport	1,950	1,795

More Price Cuts on Page 95

Parts Service Plan Inaugurated

Country Covered Under New System

Five Companies Included — 40 Central and Many Branch Stations Provided

NEW YORK, Jan. 9—The opening of the New York show has seen the official inauguration of the direct service plan by leading units parts manufacturers. Under the arrangement 40 central parts stations and more than 300 branch stations will begin immediately the furnishing of parts for units direct to owners of cars in which these units are standard equipment.

Included in the plan at the outset are Continental Motors Corp., Timken-Detroit Axle Co., Brown-Lipe Gear Co., Borg & Beck Co. and Spicer Mfg. Co. Each of these represents a separate unit entering into the manufacture of a car. Other manufacturers will be embraced in the plan until it includes at least one manufacturer of each important unit.

Several of the most important results which the unit manufacturers claim for this plan are set forth by the committee in charge of the plan as follows:

Doing away with "pirate" parts—It will make it unnecessary for the dealer to nullify the guarantee on his vehicle by selling his customer inferior parts made by other than the manufacturers of the original unit. This action on the dealer's part has been necessary in the past as he was not able to obtain genuine parts immediately. The stations carry only genuine parts designed, produced and inspected by the specialists of the unit manufacturers organization.

Lowering of parts prices—Direct assistance to manufacturers, dealers, small and large fleet owners and users.

Protection for car and truck manufacturers service when territories are without representation.

Elimination of investment by dealer allowing him to use his working capital in the promotion of sales.

Guarantees genuine parts so that the dealer and owner of specialized vehicles can depend upon purchasing genuine material—All parts are to be trade marked by the unit manufacturer producing them. This will provide a universal means of identification and a guarantee of protection and value.

As one member of the unit manufacturers' committee has put it—"the extent to which the plan succeeds will be directly proportioned to the extent to which it serves the automotive industry in general. It is a great step forward. Its basic ideal of unselfishness is alone sufficiently meritorious to warrant enthusiastic support. The plan is unique in that it is the first undertaking of its kind in the automotive industry."

The policies under which the stations will operate are in the hands of a committee made up of one representative from each of the companies that are working under this plan.

The station managers are to represent the customers of the unit manufacturers in their respective territories, in promoting the sale of specialized vehicles. Through the stations will be held sales conferences eligible to all dealers and salesmen selling vehicles equipped with units represented by the stations. There will also be conferences held in each station territory for instruction to the dealers' mechanics.

Careful inspection of each major station and each sub-station will be made regularly by a factory representative, so that high ideals and standard set for the stations will be maintained.

Continuous national, trade-paper, newspaper and direct advertising will be run by both unit manufacturers and stations directly promoting the sale of the specialized vehicle.

Service Importance Recognized

For a long time there has been much discussion among the truck and car manufacturers as to whether the parts distributing plan started by some of the leading unit manufacturers would prove satisfactory to all concerned. It now develops that the parts distribution is only one of the many plans of action which is developing for the promotion of specialized vehicle sales. The phrase "Specialized Vehicle" means the cars and trucks that are built of high-grade units produced by unit manufacturers who are specialists in their respective lines.

As one member of this committee expressed it, "service is the cornerstone of the automotive industry and adequate parts service is the mortar which holds this stone in place. A passenger car or motor truck without national parts service is like a battleship without guns, a fine target for a competitor but with nothing to fight back."

One of the greatest drawbacks to the automotive industry in the past has been the inability of the car and truck owner to enjoy uninterrupted service because the dealer was unable to obtain genuine parts immediately. Two of the most important reasons for this is the financial situation of the average dealer and the ever-increasing rate of dealer mortality.

This plan, then, of the leading unit manufacturers is built from the ground up. Acknowledging the importance of service they have started at the beginning by putting parts distribution on a firm permanent foundation, where it will bring the greatest good to the greatest number.

The parts service end of the plan assures the owner and buyer that they can keep

(*Continued on page 96*)

CLIMBER ELECTS OFFICERS

LITTLE ROCK, ARK., Jan. 10—H. F. Buhler of this city was re-elected president of the Climber Motor Corp. by the board of directors. Other officers elected were G. A. Edmundson, Salem, Ark., vice-president, and J. S. M. Cannon, Little Rock, secretary.

Recommend Cycle Show for New York

Matter of Change Taken Up at M. & A. T. A. Annual Meeting

NEW YORK, Jan. 10—The Motorcycle and Allied Trades Association at its meeting here to-day recommended to the Cycle Trades of America, a parent body including cycle dealers, jobbers, etc., as well as the motorcycle organization, that the next motorcycle and bicycle show be held in New York City during the first or second week of February, 1923. For many years past the show has been held in Chicago, but there is a definite feeling, on the part of the motorcycle group especially, that there should be a change next year.

The M. and A. T. A. also decided that it would not participate hereafter in the summer meeting of the Cycle Trades of America, which is usually held during August in Atlantic City. The feeling that this meeting was unproductive of any constructive work was unanimous among the motorcycle manufacturers.

May Hold Separate Meeting

It is probable, however, that the M. and A. T. A. will hold a separate midsummer meeting, possibly at the time of the Gypsy Tours in June, which will be a real motorcycle gathering.

Gordon Lee, chief of the Automotive Division of the Bureau of Foreign and Domestic Commerce, addressed the meeting and outlined the service which the automotive division can render to the motorcycle manufacturer. Lee announced that a separate motorcycle section of the automotive division would be installed July 1, 1922.

New Directors Chosen

The following were elected to the board of directors of the association for the ensuing year: Frank Weschler, Hendee Manufacturing Co.; Arthur Davidson, Harley-Davidson Motor Co.; G. E. Atkin, Reading Standard Co.; A. C. Rice, Cyclemotor Corp.; Ignaz Schwinn, Excelsior Motor Mfg. & Supply Co.; E. Wetzel; Max M. Sladkin, Ace Motor Corp.; D. R. Walls, Splitdorf; George Briggs, Wheeler-Schebler; and Dave Kunney of Goodyear Tire & Rubber Co.

G. M. TRUCK PLANT REOPENS

DETROIT, Jan. 9—The General Motors Corp. truck plant at Pontiac has resumed production after the holiday inventory period. The schedule calls for an output of 25 trucks a day, most of which will be of the lighter models.

Reports Approved at S. A. E. Meeting

Standards Committee and Aeronautical Sessions Held—Bachman and Beecroft Speak

NEW YORK, Jan. 11—The annual meeting of the Society of Automotive Engineers, which opened here yesterday with meetings of the standards committee and an evening aeronautics session, is proceeding with a schedule which will be completed with the holding of the passenger car session on Jan. 13.

Stamping Recommendations Approved

At the standards committee meeting a majority of the reports of divisions (a summary of which was recently published in AUTOMOTIVE INDUSTRIES) were approved with but little discussion, although the reports of the chain division and the engine division were the occasion for considerable comment, pro and con. Some objections were raised to the proposed specifications of minimum breaking strength of roller chains, but it was pointed out that wearing qualities rather than ultimate strength is the controlling factor in most chain applications, and that the former quality is dependent largely upon the case hardening which is best accomplished on low carbon steel which has a relatively low tensile and shearing strength, as compared to higher carbon steels. This view prevailed and the proposed specification was approved.

The proposed system of engine numbering resulted in much discussion, but was finally approved as recommended practice. Action upon the report prepared by the tire and rim division was postponed as a result of overtures made by the Rubber Association of America, which has now promised co-operation heretofore given more in name than in reality.

With this exception all the reports as published were approved, although slight changes of a minor character were made in certain items, and one item, that relating to generator flange mountings in the report of the electrical equipment division, was referred back for further consideration.

Airplane Engine Session

Charles L. Lawrance presented the only paper at the airplane engine session. His subject was Air-Cooled Engine Development. The meeting was attended by about 150 members. Lawrance traced the history of air-cooled cylinder development and predicted that it would not be long before larger air-cooled cylinders would be developed with performance ability equal to that obtained with water-cooled engines.

Considerable discussion of the subject was developed among the members present. Henry M. Crane took the stand that the air-cooled cylinder is still on trial and has not by any means proved itself even though it had an early start.

In the early days, he said, air-cooled jobs outnumbered the water-cooled types. The discussions brought out the fact that in the last year there have been some very notable developments particularly at McCook Field. The discussion made it clear that one of the difficult points to overcome with the air-cooled engine as used in air crafts, is its greater head resistance, whereas, with proper radiator design, it is possible to secure highly efficient water cooling with relatively low head resistance.

Annual Meeting Held

At the annual business meeting there were presented reports on automotive research, progress in aviation, international affiliation of engineers, finances, membership, meetings and section activities, among other subjects. The report of the standards committee was approved in the form submitted. President David

New President of S. A. E.



B. B. Bachman

Beecroft spoke on the Status of the Engineer in Automotive Economics, and President-elect B. B. Bachman spoke briefly on current problems of the automotive engineer.

The tellers of election announced that canvass of the ballots cast by mail vote had resulted in a practically unanimous election of the following officers: President, B. B. Bachman; first vice-president, J. V. Whitbeck; second vice-presidents, F. E. Watts, H. E. Morton, O. W. Young, V. E. Clark and C. B. Segner; treasurer, C. B. Whittelsey; councilors, Lon R. Smith, C. F. Scott, H. M. Crane and W. R. Strickland.

President-elect Bachman, who has for many years held the position of chief engineer of the Autocar Co., has served as chairman of the standards committee, and has been actively interested in the work of the society almost from its inception. He has been an officer of the society and as such a member of the council for several years past, and was at one time chairman of the Pennsylvania section of the society.

New Franklin Car Shown to Dealers

Greeted With Unbounded Enthusiasm—Will Sell for Less Than $1000

NEW YORK, Jan. 11—The new Franklin 4-cylinder model was shown to dealers at a luncheon at the Commodore hotel to-day and was greeted by them with unbounded enthusiasm.

No definite price has been set but assurance was given the dealers that it will sell for less than $1,000. It is stated that production will get under way in the near future.

John Wilkinson, the veteran Franklin chief engineer, has spent several years in the development of the new model. It was almost ready for production when the war began and its introduction was delayed. Models have been thoroughly tested in the vicinity of Syracuse.

It is understood the car will be manufactured by a new company and that another plant ultimately will be erected for its production.

Engine Is Air-Cooled

The chassis follows in many respects the line of construction used in the 6-cylinder car. With the exception of there being two less cylinders the engine of the small car is the same as the six. Cylinder dimensions are the same —3¼ by 4 in.—and parts are interchangeable with the six. This also holds true of parts like the clutch, etc.

One departure from the big car is the use of semi-elliptic springs on the 4-cylinder. These are overslung on the rear axle and underslung on the front axle. The frame is of laminated wood construction, carrying at each corner suitable brackets for mounting springs. The wheelbase is 102 in. Wood wheels are fitted, carrying 30 by 3½ in. Goodyear cord tires.

The rear springs have been mounted very close to the wheels and this has made possible the use of a light rear axle. The service brake is on the transmission and the emergency on the rear wheels. The latter are operated by a single cable. The propeller shaft carries two fabric universal joints. Steering is by worm and wheel, operating the tie rod by a transverse drag link.

The engine, which is cooled by a blower fan mounted on the front end of the camshaft, is mounted in an accessible way and is itself accessible. An unusual feature in connection with the carburetion system is the carrying of all the exhaust gases through an aluminum jacket surrounding a hot-spot on the intake manifold. By this layout the forward end of the exhaust pipe is brought around the front cylinder to the carbureter side and thereby escapes the ignition, starting and lighting units on the right side of the engine. The electrical equipment consists of the Atwater Kent system.

Secretary of Navy Addresses N. A. C. C.

Irvin S. Cobb Also Speaks at Annual Dinner—"Decorations" Bestowed

NEW YORK, Jan. 11—More men prominent in the automotive industry attended the annual dinner of the National Automobile Chamber of Commerce in the grand ballroom of the Commodore last night than ever were present at a similar event. A list of the names of the manufacturing executives at the tables would read like a roster of the industry.

Not only was the dinner a complete success in point of attendance but in every other respect as well. The speakers were Edwin Denby, Secretary of the Navy, formerly an officer of the Denby Motor Truck Co. and the Hupp Motor Car Corp., and Irvin S. Cobb. Colonel Charles Clifton, president of the N. A. C. C., presided as toastmaster. Among those seated at the table of honor were:

Among Those Present

J. K. Robinson, president, Manufacturers' Aircraft Association; C. W. Nash; William E. Metzger; George C. Diehl, president, American Automobile Association; A. R. Erskine; Alvan Macauley; E. H. Broadwell, president, Motor and Accessory Manufacturers' Association; J. Walter Drake; H. H. Rice, treasurer, National Automobile Chamber of Commerce; Gordon Lee, United States Department of Commerce; Windsor T. White; Roy D. Chapin; Charles Clifton, president. National Automobile Chamber of Commerce; C. C. Hanch; Captain Carl T. Vogelgesang, U. S. N., Commandant Brooklyn Navy Yard; A. J. Brousseau; Pierre S. duPont; W. L. Hughson, vice-president, National Automobile Dealers Association; Fred J. Haynes; H. F. Dunn, president, Rubber Association of America; H. M. Jewett; Thomas H. MacDonald, director, United States Bureau of Public Roads; John N. Willys; David Beecroft, president, Society of Automotive Engineers; R. E. Olds; W. A. Woods, New York Automobile Dealers Association and Harry Ricardo.

Denby Cheered

It was evident that Denby has lost none of his popularity within the industry and that automobile men regard his selection for the Cabinet as a reflected honor. He was given a rousing reception when he rose to speak. At that instant the Stars and Stripes were run out on a flagstaff extending from the balcony, naval signal flags reading "Welcome" fluttered up over the speaker's table and the orchestra swung into the Star Spangled Banner.

The Secretary of the Navy paid tribute to the automotive industry for the courage it has displayed during the period of depression and congratulated it upon the fact that it has come through safely. Most of his address was devoted to his experiences as a private and a petty officer in the Marine Corps. He made no reference to the conference at Washington on the limitation of armament but declared:

"Our navy ought always to be the equal of any in the world. It is now and I think it will so remain. I earnestly hope so."

He added that no man would take the fire insurance off his building and declared this would be comparable to lowering the navy below its proper limits.

Cobb made a characteristic after-dinner speech but asserted seriously that general acceptance throughout the world of good roads and the use of motor vehicles would do much to break down racial animosities.

"Decorations" Given

A feature of the dinner was the awarding of the annual "decorations." They were given to David S. Ludlum, president of the Autocar Co., C. Harold Wills, Walter C. Marmon, George M. Graham, Edward S. Jordan and A. R. Erskine.

Wills was told he might some day succeed in getting into the automobile business. Marmon was informed that "only a genius could have taken the scraps from an ancient milling machine business and built an automobile." He was complimented also on the fact that he "had risen above every obstacle, including Fred Moskovics."

Jordan was dubbed "an ambidextrous ambassador of automobile advertising." The head of the Studebaker Corp. was given the title of "Baron Erskine, doctor of financial difficulties."

BANKERS EVINCE THEIR INTEREST

NEW YORK, Jan. 11—The interest of big bankers in the automotive industry was evidenced at the annual dinner of the National Automobile Chamber of Commerce last night. Among those who attended were:

E. R. Stettinius of J. P. Morgan & Co.; Seward Prosser, president of the Bankers Trust Co.; Percy Johnson, president of the Chemical National Bank; Percy Rockefeller, and Joseph A. Bower, vice-president of the Liberty National Bank.

Other New York banks which had representatives at the dinner were the Chatham & Phenix, the Guaranty Trust Co., the Chase National, the Mechanics & Metals National, the Equitable Trust and the Gotham National.

SPAIN RULES ON ACCESSORIES.

WASHINGTON, Jan. 10—An authorization permitting the purchase during 1922 of automobile accessories in Spain was provided in a Spanish decree dated Jan. 6.

"Best Buying Show", Is General Verdict

Paid Attendance Largest on Record—Practically All Exhibitors Report Sales

NEW YORK, Jan. 12—"The best buying show ever held in New York," is the verdict of veteran automobile men in reference to the annual automobile exposition at the Grand Central Palace. Not only are more retail sales being made but the paid attendance is the largest on record and more western dealers are here for the show than ever before.

Practically every exhibitor reports retail sales and some of them run to substantial proportions.

Dealer interest is one of the striking features of the show and while few distributors are placing large orders they have been much encouraged by the public interest and are confident that sales for the next three months will be much larger than for the same period last year.

No Waning Public Interest

As the show has progressed this feeling of confidence has pervaded the representatives of the entire industry that are assembled here this week. It has demonstrated that there has been no waning of public interest in motor cars. While no exaggerated predictions are being made of sales for the coming year it is the general belief that they will exceed those made in 1921.

The public is keenly interested in the new and improved models displayed at the show, but it is also keenly interested in the question of prices. Except in the highest priced class, prospective motor car purchasers are shopping carefully and they are determined to get the greatest possible value for their money.

Especial interest is being shown in closed models and gratification is expressed by visitors to the show over the fact that a movement is well under way to cut sharply the difference in price which heretofore has existed between open and closed models.

MAKES FREIGHT ALLOWANCE

BALTIMORE, Jan. 9—Black & Decker Mfg. Co. announces that effective immediately it will make a freight allowance on shipments of 100 lb. or over to points in the United States and Canada, thus making it possible for jobbers to sell its goods in the two countries without adding anything to the price to cover freight.

In the past the majority of jobbers have worked under a handicap of having to pay the freight or charge the customer extra to include the freight. This is equalized in the present move, which is one strongly recommended by the Automotive Equipment Association in behalf of its jobber members.

Cuts Small Factor, N. A. D. A. Head Says

Cars Will Be Purchased on Strength of Past Performances

NEW YORK, Jan. 10—Price cuts are not going to sell automobiles this season, according to Harry G. Moock, general manager of the National Automobile Dealers Association, who reached New York to-day from St. Louis to attend the automobile show. Moock says:

Price cuts, new models, hot spots, gear boxes and any other so-called features, are not the things that will bring buyers into the market this year. Mechanical features served their turn when it was a rising market, but the public is not coming back this year for any of those things. Something more is demanded this year.

As I view it, the market this year is going to consist of about 150,000 new buyers; that is, persons to whom owning an automobile will be a new thing, and the balance will be replacements.

Public to Buy on Car Performance

The replacement market is going to be dominated by people who have a pretty definite idea, gained by actual experience, with a certain make of car. Some of the replacement buyers are going right back to the dealers who supplied them with a car in the first place. They will go back to the dealer who supplied them a meritorious automobile and who gave them sufficient and reasonably priced service. The car that has not stood the test, the dealer who hasn't stood the test, the factory that hasn't stood the test, will not be given another chance in 1922. The public in 1922 will not buy on a promise.

The public has bought for four or five years back on promises, but the public of 1922 is going to buy motor cars that have made actual performance records during those five years. There is going to be a good business for those dealers and manufacturers who kept the promises they made in that five year period. Those dealers and manufacturers who did not keep their promises during that period are going to have a tough battle for business.

Expects Consignment Deliveries

I do not look for any such business in 1922 as was done by the dealers in 1920. 1922 probably will be as good a year as 1921 for those dealers and factories that are producing meritorious automobiles.

By that I do not mean necessarily the automobiles that have a great production and are distributed nationally, but I mean those automobiles that have been built right, priced right, and maintained right. Probably some of the smaller factories will have to give up their idea of national distribution and be satisfied to distribute their cars within a limited radius of their factory which they can do profitably because of the freight rates on automobiles from their factory to various parts of the country. They will avoid this extra charge in handling their products close to the factory.

Before the year is over, I expect that a great many factories will be sending automobiles to dealers on consignment and abandoning the idea that they can sell their product sight-draft-bill-of-lading-attached as they have done in the past. When this is done by the factory, there is going to be a great deal more attention paid by the manufacturer to the personal character of the dealer he selects to represent him in a territory.

There is going to be plenty of money for the dealer who has character, who is honest, who is a business man, and who is handling a proved automobile. I have had enough conferences with bankers to know that there are half a dozen or a dozen men in every city handling automobiles who have almost an unlimited credit at the bank, but likewise there are scores of dealers in each city who have not such credit facilities and who will be greatly handicapped in the 1922 battle for business.

Used cars proved a tremendous problem to the entire trade last year. There is no solution for the used car problem for the trade as a whole. The solution lies in the hands of the individual dealer coupled up with the necessary co-operation on the part of his manufacturer.

Many Price Reductions Made at New York Show

(*Continued from page* 91)

Studebaker

Series 22 Special Six	New Price	Old Price
Chassis	$2,200	$1,350
Touring	1,475	1,635
Two-passenger roadster	1,425	1,585
Club roadster	1,475	1,635
Coupe (4-passenger)	2,150	2,450
Sedan	2,350	2,650
Series 22 Big Six		
Chassis	1,500	1,650
Touring	1,785	1,985
Coupe	2,500	2,850
Sedan	2,700	2,950
New Light Six		
Chassis	875	975
Touring	1,045	1,150
Two-passenger roadster	1,045	1,125
Coupe roadster	1,375	1,550
Sedan	1,750	1,850

Sun

The price of the Sun has been set at $475.

Velie

	New Price	Old Price
Roadster	$1,395	$1,585
Touring car	1,395	1,585
Coupe	2,085	2,485
Sedan	2,085	2,485

WILLS SAINTE CLAIRE REDUCES

NEW YORK, Jan. 12—After an announcement Tuesday that no price changes would be made at this time, C. H. Wills & Co. announced to-day that prices on its various models would be cut materially, effective Jan. 12. The schedule follows:

	Old Price	New Price
Touring car and Roadster	$2,875	$2,475
Coupé	3,750	3,275
Sedan	4,100	3,475

CHAMPION REDUCES PRICE

PHILADELPHIA, Jan. 9—Champion Motors Corp. has reduced the price of its special passenger car model from $1,195 to $1,095.

Dodge to Announce New Prices Feb. 1

Will Be Effective From First of Year, President Tells Dealers

NEW YORK, Jan. 11—Dodge Brothers cars will be reduced in price dating from Jan. 1 but the new prices will be withheld from the public until Feb. 1. President F. J. Haynes made the announcement at the annual luncheon and meeting tendered to dealers at the Pennsylvania Hotel yesterday. The announcement read:

"Dodge Brothers will announce on Feb. 1, 1922, a substantial reduction in the prices of their cars, effective Jan. 1."

There was much comment among the 1700 dealers attending on the universal price procedure. The report that the touring car will be priced at $775 was generally accepted.

The reason most generally advanced for the unique handling of the reduction is that it will give the factory the use of several millions of dollars for the period ensuing between the time the prices are actually effective and the time rebate is made to the dealer.

The feature of the dinner aside from the price declaration was a playlet written by Montague Glass in which his characters Potash and Perlmutter were depicted as Dodge dealers.

BREWSTER READJUSTS

NEW YORK, Jan. 9—Brewster & Co. has announced the following reductions on the prices of its model No. 91:

	Old Price	New Price
Roadster	$7,000	$6,000
5-passenger touring	7,000	6,000
Sedan	10,500	9,200

NEW SELDEN PRICES

ROCHESTER, N. Y., Jan. 9—New prices on its line of trucks are announced by the Selden Truck Corp. The prices are:

	New Price	Old Price
1½ to 2½ ton	$2,250	$2,360
2½ to 3½ ton	3,250	3,425
3½ to 5 ton	3,750	4,175
5 to 7 ton	4,950	5,600
Motorbus chassis (capacity 18 pass. seated)	3,350	
Motorbus Chassis (capacity 30 passenger seated)	4,350	

OTHER GARDNER CUTS

NEW YORK, Jan. 12—The Gardner Motor Co. has reduced the price of its touring car and roadster from $1,095 to $895. The price a year ago was $1,295.

NERACAR IS SHOWN

NEW YORK, Jan. 10—One of the exhibits at the Hotel Commodore is the Neracar, manufactured by the Ner-A-Car Corp. of Syracuse. It is a motorcycle, rather than an automobile, and the price has been fixed at $225. The company expects to produce 3500 in the first six months of 1922.

Earl Is Arranging Further Financing

Continental Bank Takes Action Looking Toward Constructive Plan for Future

NEW YORK, Jan. 11—Ralph Van Vechten of the Continental & Commercial Bank of Chicago has called a meeting to-day of the larger creditors of Earl Motors, Inc., to discuss the future of that company. It is believed some constructive plan will be decided upon. Clarence A. Earl, president of the company, stated to-day he had been assured the funds needed to carry on the affairs of the company as originally planned would be provided by other banks.

When the Tilden interests invested in Earl Motors they provided $3,000,000 with which bank loans were retired and pledged an additional $1,500,000 for working capital. This promise could not be carried out, however, because of the difficulties in which the Tilden estate and the Fort Dearborn banks found themselves. The interest of the Continental & Commercial Bank in the Earl company arises from the fact that it took over the assets of the Fort Dearborn banks. John Fletcher, who represented the Fort Dearborn banks and the Tilden estate in Earl Motors, has retained his personal interest in the company and is assisting in the raising of the additional funds.

Earl stated that the position of the company is such that operations can be continued without difficulty until the new financing is arranged and that his company will not be seriously affected by the difficulties of the Fort Dearborn banks.

Makes It One-Man Job

CHICAGO, Jan. 11—Ralph Van Vechten apparently has decided to make a one-man job of the rehabilitation of Earl Motors. He said to-day he had called the meeting of creditors to put the situation squarely up to the creditors. If they are willing to make concessions a plan can be worked out whereby the company can be properly financed. Bank loans are of minor importance and merchandise creditors have claims aggregating only about $1,000,000. Van Vechten has engineers going over the Earl models and a report will be made at the meeting to-morrow.

Parts Service Plan Inaugurated at Show

(*Continued from page* 92)

their vehicle in uninterrupted service anywhere in all parts of the world where automotive equipment is used.

Car and truck manufacturers all see the importance of building for the future. To do this every selling force must be brought to bear to produce repeat orders. The greatest selling force is satisfaction through past performance. The greatest satisfaction is through adequate efficient service. Real service is possible only with genuine parts instantly available. Parts service then is a great selling force and one which it has not been possible to utilize in the past.

So reason the leading unit manufacturers responsible for this plan and around this ideal they have built a far reaching organization.

This plan divides the United States into forty territories. The size of each territory has been proportioned in accordance with the population, vehicle registration, buying power and the vehicle sales possibilities for the future. Each of these forty territories is to be serviced by what has been called a major parts depot. This is to serve as a central distributing point for the territory.

Of the forty stations planned, thirty-five are now in operation with the remaining five in process of development.

In each territory and under the jurisdiction of the major station are a series of sub-stations. These sub-stations distribute in a specified local territory. There will be from six to ten sub-stations under each major station. The location of each sub-station is such that immediate parts delivery will be possible in all important localities and a maximum of five-hour service possible in the less populated districts.

Chain Stations Provided

It is estimated that there will be at least 325 sub-stations distributing genuine parts in their respective territories.

A chain of stations suitably located will take care of the important market. Statistics accumulated by the unit manufacturer indicate that no other single cause has done more to limit the sale of specialized cars and trucks in Canada than lack of protection as a result of practically no parts service.

The first stations to be established in Canada, will be at Vancouver, Winnipeg, Toronto, and Montreal, with sub-stations under each major station.

Plans are already under way for the establishing of stations throughout the British Isles, Australia, Hawaii, Cuba, Mexico, Netherlands, Norway, Sweden, India, Japan, and in fact every country where specialized vehicles are used.

This world-wide organization is to be devoted to one fundamental task—to promote the sale of specialized cars and trucks. The policies under which these stations will operate are in the hands of a committee made up of representatives of the leading unit manufacturers.

Overflow Accessory Show Includes 132 Companies

NEW YORK, Jan. 9—The Hotel Imperial is having a dealers' equipment show held under the auspices of the National Retail Merchants and Buyers' Association. There are 132 firms represented and the show is to last from Jan. 9 to 20. A rather unusual method of space allotment is made.

There is no charge for space but the association gets 7½ per cent on all orders taken at the show. Two and one-half per cent of the gross amount is rebated to any firms buying their material or parts at the show. This leaves 5 per cent of the gross amount clear for the association.

The exhibits have been well arranged for display purposes but the first two days at the show were very disappointing in the matter of attendance.

M.A.M.A. Re-elects All Its Directors

Officers to Be Selected Will Be Those Who Are Now Serving

NEW YORK, Jan. 12—Hundreds of members of the Motor & Accessory Manufacturers Association were summoned last night to be present in the High Court of Merriment presided over by Chief Justice Jollity in the person of Sidney S. Myers in the grand ballroom of the Hotel Commodore. Julius Tannen, who was the original Perlmutter in "Potash and Perlmutter," was the clerk of the court and he ably abetted Myers in the production of merriment.

At the close of the "judicial proceedings" the entire Midnight Frolic show from the Ziegfeld roof was given. The annual entertainment of the M. A. M. A. followed the usual dinner. It was the second year the guests had been entertained by a Midnight Frolic show. There were no speeches and the show was in charge of Myers assisted by M. Lincoln Schuster, assistant general manager of the association.

All directors of the association were re-elected at the annual meeting yesterday. The present officers will be re-elected at an organization meeting of the directors to-day. Only routine business was transacted at the annual session.

Electric Service Association

NEW YORK, Jan. 9.—Members of the Automotive Electric Association at its winter meeting in the Hotel Biltmore, referred a resolution to amalgamate with the Motor and Accessory Manufacturers Association as a group, to a special committee headed by G. Brewer Griffin, which will report to its board of governors at a meeting set for April 7.

The convention covered two days, addresses being made on the first day by President G. B. Griffin, M. L. Heminway, general manager of the M. A. M. A., who spoke on the advantages of the group plan of organization, and by W. R. Bassett, industrial engineer. Speeches on the second day were by C. C. Parlin of the Curtis Publishing Co., and Harry Tipper, business manager of AUTOMOTIVE INDUSTRIES.

A. D. Libbey of the Splitdorf Electrical Co., Newark, was elected president of the organization to succeed G. Griffin. Other officers were re-elected as follows: C. O. Miniger, first vice-president; E. C. Wilcox, second vice-president; R. J. Nightengale, third vice-president; M. W. Bartlett, fourth vice-president; George S. Cole, secretary and treasurer.

New York Department

NEW YORK, Jan. 9.—To provide a clearing house for the activities of the various groups of manufacturers engaged in the same lines of activity which have affiliated with the Motor and Accessory Manufacturers Association, a new

(*Continued on page* 101)

Questionnaire Seeks Foreign Information

Government Asks Representatives Abroad for Registration—Data to Be Analyzed

WASHINGTON, Jan. 9—Questionnaires on 1921 registration of motor vehicles in foreign countries have been prepared by the automotive division of the Bureau of Foreign and Domestic Commerce and sent to Government agents abroad in an effort to obtain comprehensive data on foreign automotive markets. It is the intention of the division to compile and analyze this data in as complete form as possible for dissemination through the industry as a guide to the relative importance of foreign markets. It is expected that it will require three or four months to gather and compile data accurately.

Information to Be Complete

Gordon Lee, chief of the division, has arranged classifications so that returns will be of the maximum service to the industry. Consuls have been instructed to make particular effort to obtain official figures in each locality and where figures for the country as a whole are unobtainable it is suggested that figures for all districts or states available be given and estimates as to the registration in the rest of the country.

The questionnaire has seven sub-divisions. Section one covers passenger cars, whether steam propelled, electrically propelled, or gasoline driven; section two, motor trucks, including motor buses, motor delivery wagons, etc., and type of power. Section three relates to tractors, whether caterpillar or tractor laying type or wheel type.

Section four covers trailers, whether for motor cars or tractors; section five, motorcycles; section six, airplanes and seaplanes and information is required as to military, commercial or privately owned planes. Section seven concerns mechanically propelled fire-fighting apparatus with number of pumping engines, hook and ladder, hose carts and other equipment.

M. A. M. A. Receives Copies

On request of the Motor Accessory Manufacturers' Association the division has prepared a tentative questionnaire on foreign trade and submitted it to the association for distribution if desired.

The questionnaire covers such points as the kind of automotive products manufactured (if more than one product, the percentage of value of each product to the value of the total output is requested); percentage of products sold outside the United States, total and by specified products in 1920 and 1921; percentage of products expected to be sold abroad in 1922; special foreign markets giving percentage of each to total exports; markets which members are planning to develop and in what foreign countries products are manufactured for members of the association.

Another question is: "In what countries do foreign firms manufacture your products on a royalty basis and specify products?" The question is also asked as to the percentage of exports handled through the manufacturers' own overseas selling branches through commission houses and through export houses. Several questions are asked relative to distribution and advertising and methods of figuring advertising appropriations abroad and whether an attempt is made to regulate selling prices abroad; the use of catalogs; chief complaints received from abroad regarding export practices or products sold abroad.

This questionnaire may be revised by the association and then distributed to the membership.

Inventory Situation Is Vastly Improved

(*Continued from page* 87)

The new orders will be at prices varying little from the prices to which the inventories have been reduced, and in most cases, if varying at all, will be due principally to market variations in the important commodities.

There are several instances of exhibits at the show where new low price models have been brought out by leading makers with the thought uppermost of making a quick cleanup of heavy inventories not necessarily high priced. This will permit the companies to turn into cash these piled up goods, which probably, with only their former higher priced cars to work with, would have taken a year or more to work up.

Four Former Officials Return to Locomobile

BRIDGEPORT, CONN., Jan. 9.—Revival of prosperity and extensive development of business at the Locomobile Co. plant here is indicated this week, in the return of four former officials of the concern.

B. G. Roos, who was called to the Pierce Arrow factory about a year and a half ago, when he severed his connections with the Locomobile plant, as assistant chief engineer of the passenger and truck designing department under A. L. Riker, becomes chief engineer under the new régime.

Prior to his leaving here, he had been connected with the Locomobile plant for about eight years and is a well-known figure in the automotive world Following the war, he studied abroad to further his ideas along truck design lines, using models of cars that had seen war service, to determine remedies against wear and tear.

Others who have returned to the local corporation and their assignments are E. A. Travis, who was connected with the New York Metropolitan district for about a year, general sales manager; Clinton B. Amorous, lately connected with the Daniels Motor Car Co.

Aero Club Launches New Organization

Will Consolidate Group Activities and Have Headquarters in Washington

NEW YORK, Jan. 10—Establishment of a national aeronautical organization, with headquarters in Washington, for the purpose of consolidating the activities of various groups interested in the promotion of aviation, was announced at a dinner of the Aero Club of America held at the Hotel Commodore last night. A committee with Benedict Crowell, president of the Aero Club of America, as chairman, has been appointed to arrange the formation of the national body.

Similar to A. A. A.

The plan has been under advisement for several months because it was realized that the duplication of work handicapped all parties. The new body, national in scope, will hold a position in aviation similar to that of the American Automobile Association. The National Air Association, the American Flying Clubs and the Aero Club of America will be united under one banner. The new organization will take an active interest in all legislation and other affairs relating to control and operation of aircraft. Like the A. A. A., it will supervise contests and races throughout the country. The exact definition of its function will be given out when the organization work is completed. The personnel of the Crowell committee has not been announced.

It is the intention of the consolidated organizations to lead the fight for the establishment of a bureau of aeronautics in the Department of Commerce, as proposed by the so-called Wadsworth-Hicks bill introduced at the extraordinary session of the present Congress. They will also have the co-operation of the Aeronautical Chamber of Commerce in this work.

Republic Rubber Corp. Sued for $279,959 on Contract

CLEVELAND, Jan. 9—The Republic Rubber Corp. of Youngstown has been made defendant in a suit in Federal Court by the Brighton Mills of New Jersey, which claims damages of $279,959 and asks for the appointment of a receiver. Plaintiff alleges that the Youngstown company is indebted to the extent of $64,959 for tires and fabric and $215,000 for damages for failure to accept deliveries on a contract calling for $376,000 worth of merchandise.

Permission to issue $1,000,000 receivers' certificates was granted C. H. Booth of Youngstown, who was appointed receiver of the company last June. The money will be used to continue the company in operation and prevent the property deteriorating.

Dunn Again Heads Rubber Association

De Lisser and Rutherford Chosen Vice-Presidents at Annual Meeting

NEW YORK, Jan. 9—H. T. Dunn was re-elected president of the Rubber Association of America at the annual meeting to-day in the Waldorf Astoria. Horace De Lisser, chairman of the board of the Ajax Rubber Co., was elected first vice-president, and W. O. Rutherford, vice-president of the B. F. Goodrich Rubber Co., second vice-president.

Seneca G. Lewis of the Pennsylvania Rubber Co., J. N. Gunn of the United States Rubber Co. and John S. Lowman of the Philadelphia Rubber Co. were re-elected directors, and J. W. Thomas, Firestone Tire & Rubber Co., and E. G. Wilmer, Goodyear Tire & Rubber Co., were named new directors to serve three years. A. L. Viles is general manager.

A resolution was adopted abolishing the associate membership class, composed hitherto of executives of companies holding membership in the association.

Many Activities During Year

The past year was filled with activities for the association, as shown in Viles' report. The work accomplished was taken up at approximately 75 meetings of the various committees and divisions or their sub-committees and developed a very gratifying increase in the desire to co-operate.

Chief among the accomplishments was the recommendation of the association that a change be made in the mileage guarantee practices. This movement has been indorsed by practically all the tire manufacturers who have put the new method of handling the adjustment problem into effect.

The association took an active part in legislative matters and enlarged the scope of its work in the publishing of statistics relating to the industry.

It recommended uniform protection of dealers against loss on unsold tire merchandise in the event of a price decline which gives the dealer protection only upon goods invoiced to him within 30 days prior to the date of the decline. It recommended also a uniform practice with respect to the destruction of worn-out pneumatic tire casings in order to prevent unscrupulous rebuilding, retreading and resale.

Secured Freight Rate Changes

Included in its recommendations were a common policy with respect to a service charge against tire merchandise returned to the manufacturers for exchange or credit and standard rules for the inspection of waterproofed automobile fabrics, standard shrinkage allowances and a uniform contract form.

The association also sustained and strengthened the recommendation as to non-participation by tire manufacturers in shows, fairs or exhibitions. It co-operated with the Bureau of Standards in drafting contemplated specifications for pneumatic tires, inner tubes and solid tires and advanced the work of standardizing industrial truck tire sizes.

Through its endeavors important freight rate and classification changes were secured.

Weston Heads Tire Division

NEW YORK, Jan. 11—J. C. Weston of Ajax Rubber Co., Inc., was elected chairman of the tire manufacturers' division of the Rubber Association of America at the annual meeting this week. J. V. Mowe, Kelly-Springfield Tire Co., was chosen vice-chairman. Companies elected to the executive committee are:

Brunswick-Balke-Collender Co., Firestone Tire & Rubber Co., Fisk Rubber Co., General Tire & Rubber Co., B. F. Goodrich Co., Goodyear Tire & Rubber Co., Hewitt Rubber Co., Hood Rubber Products Co., Kelly-Springfield Tire Co., Lee Tire & Rubber Co., Michelin Tire Co., Miller Rubber Co., Norwalk Tire & Rubber Co., Pennsylvania Rubber Co., Swinehart Tire & Rubber Co., United States Tire Co.

Approval was given to proofs of a poster setting forth the new dealer warrantee as fixed recently by the division and these will be sent forward at once to dealers everywhere. Standardized tire and rim sizes upon which the technical committee of the division is working with committees of the National Automobile Chamber of Commerce and the Society of Automotive Engineers were discussed but no action taken.

Experiences of manufacturers with the new service charge on returned goods were discussed but no change was suggested in the present plan.

Fergusson Will Rejoin Pierce-Arrow Company

NEW YORK, Jan. 9—The "old guard" is returning to the organization of the Pierce-Arrow Motor Car Co. The enthusiasm which was a feature of the organization in years gone by is coming back and the outlook for the company is more cheerful than it has been in the past two years. It is understood that David Fergusson will return to the company in the near future as vice-president in charge of engineering.

The announcement by Colonel Charles Clifton, chairman of the board, that M. C. Forbes had been placed in charge of operations was misconstrued. Forbes' title remains that of vice-president and no one will be elected for the present to succeed George W. Mixter as president.

There has been a material increase in the truck branch of the company's business and passenger car sales are increasing slowly. The dealer organization has remained loyal and is doing everything in its power to increase business.

The financial situation of the company is much more comfortable. The last quarter of 1921 will show a small profit and all losses on inventory have been taken. Some of the company's bank loans have been liquidated and the remainder is understood to have been renewed for a year.

Railroad Interests Meet in Washington

Brotherhoods Initiate Call—Conference Held to Forestall Strike Possibility

WASHINGTON, Jan. 10—Much interest and speculation has been developed as a result of a meeting quietly held last Saturday night at the home of the Secretary of Commerce, between himself, railroad executives and the heads of the four railroad brotherhoods. The fact that the meeting was held did not become known generally until yesterday, and no comment was made upon it by any government source until to-day, when at the White House it was stated that it was held at the suggestion of the Administration with a desire to avoid conflicts prevailing and threatened with regard to transportation services.

While the remark was cryptic, it is reported that the discussion related to a national wage agreement and that the brotherhood representatives, who are said to have initiated the conference, are endeavoring to have the Administration act on their behalf and have the national agreements restored.

Further Meetings Contemplated

The suggestion is said to have been made to the president of the Railroad Brotherhood men to call the conference and that as a result he requested Secretary Hoover to bring it about to represent the Administration.

A statement at the White House was to the effect that further conferences will be held.

The railroads, it is claimed, had no part whatever in calling the conference and what their attitude was toward questions discussed is not known. In the absence of definite information shippers have expressed apprehension lest the railroad brotherhoods are trying to compel the adoption of some agreement as to wages, working rules, etc., that would make it impossible for the railroads to reduce rates further, so urgently insisted upon by shippers as a whole.

Cent Tax on Gasoline Proposed in Maryland

BALTIMORE, Jan. 6—In his message to the General Assembly of Maryland, Governor Ritchie recommended the passage of a bill placing a tax of one cent a gallon on gasoline beginning June 22, 1922. Such a tax already has been approved by automobile interests in the city.

The tax would continue, according to the message, until a road deficit is wiped out, probably by January, 1923, when it would be reduced to the nominal figure of $1, provided the two cent tax would yield the necessary amount for road maintenance. If it would not, there would be a proportionate reduction in the registration fee.

FACTORY EXECUTIVES IN ATTENDANCE

NEW YORK, Jan. 9—Factory executives here for the show include:

Ambassador—P. H. Geyser, vice-president and general manager; H. C. Bradfield, director of sales and advertising.

Anderson—J. G. Anderson, president; J. W. Anderson, vice-president; W. A. Anderson, sales manager; W. Clark Little, advertising manager.

Apex—H. T. Hanover, general manager; C. W. Butterfield, sales manager.

Auburn—J. I. Farley, vice-president and general manager.

Bay State—R. F. Long, president; R. H. Long, vice-president and treasurer; Charles B. Eastman, sales manager.

Buick—E. T. Strong, general sales manager; A. B. Batterson, advertising manager.

Chevrolet—J. H. Newmark.

Cleveland—J. V. Whitbeck, president; Sid Black, sales manager; E. Wooler, chief engineer; J. T. Nicholson, service manager.

Columbia—William E. Metzger, vice-president; A. T. O'Connor, secretary-treasurer; W. L. Daly, sales manager; William C. Hunt, advertising manager.

Crow-Elkhart—Henry Schmid, first vice-president.

Davis—George W. Davis, president; Walter C. Davis, general sales manager.

Detroit-Electric—A. C. Downing, vice-president in charge of sales; George M. Bacon, vice-president in charge of engineering.

Dixie Flyer—S. K. Miller, vice-president and sales manager.

Dodge Brothers—Fred J. Haynes, president, G. H. Phelps, advertising manager.

Dorris—G. P. Dorris, president; Webster Coburn, vice-president and general manager; J. T. Rumble, sales manager; B. A. Purcell, city sales manager, St. Louis; R. M. Whitney, eastern representative, Philadelphia.

Dort—J. Dallas Dort, president; J. D. Mansfield, sales manager, H. S. Daniels, advertising manager.

Dupont—E. D. Knowles, sales manager; B. R. Kinsey, service manager.

Earl—C. A. Earl, president; K. R. Jacoby, vice-president in charge of sales; W. M. Zerby, traffic manager; D. M. Shaw, advertising manager; J. C. Baggott, eastern division manager.

Elgin—C. S. Pope, chief engineer; L. F. Johnson, assistant sales manager; A. L. Chambers, advertising manager; A. H. Sackett, service manager; F. M. Goodman, eastern district manager.

Elcar—U. G. Manning, vice-president in charge of sales; W. H. Patterson, vice-president in charge of production; James A. Bell, production.

Ferris—W. E. Ferris; C. Floyd Greene, general sales manager.

Fox—Ansley H. Fox, president.

Frontenac—Louis Chevrolet, president; C. W. Van Ranst, chief engineer.

Gardner—Russell E. Gardner, Jr., vice-president in charge of sales; F. W. Gardner, vice-president in charge of production; W. H. Yeldell, advertising manager.

Gearless—R. R. Starnes, president; W. H. Edmundson, general manager; Frank E. McClintock, secretary; G. W. Myers, assistant engineer.

Grant—D. A. Shaw, president; George C. Hubbs, vice-president and general manager; F. S. Denneen, treasurer; F. S. Stratton, sales manager and George Grant, director.

Gray—F. L. Klingensmith; F. F. Bell, vice-president and general manager.

OLD TIMERS EMBARK ON CRUISE TOGETHER

NEW YORK, Jan. 10—The first annual cruise of the Old Timers' Club took place on the S. S. Flotilla last night. In spite of the fact that the old members of the industry are not on the whole seafaring men, it was voted such a success that future annual banquets will probably also take the form of cruises. The 400 Ancient Mariners of the industry who were present had previously voted that anyone attempting a speech would be "keelhauled," so that there was no effort made in this direction and the evening was given over to good fellowship.

Old members of the industry from all parts of the country, with a very liberal sprinkling of Pacific Coast representatives, were on board. The cruisers were from all branches of the industry, engineers joining in the chanties with dealers, jobbers and manufacturers and all declaring themselves good shipmates regardless of the weather that the good ship will encounter during the coming years.

H. C. S.—H. C. Stutz; G. H. Ford, sales manager; C. C. Merz, assistant to president.

Handley-Knight—J. I. Handley, president; John Yoke, general sales manager; H. D. Little, divisional sales agent.

Hanson—G. E. Hanson, president; O. R. Randall, sales manager.

Hatfield—L. I. Hatfield, president; H. M. Hatfield, secretary.

Holmes—G. H. Paddock, assistant sales manager.

Hudson—Roy Chapin, president Hudson; W. J. McAneeny, president Essex; O. H. McCornack, vice-president in charge of sales.

Hupmobile—Charles D. Hastings, president; DuBois Young, factory manager; R. C. Hutchinson, general sales manager; Fred Dickinson, advertising manager.

Jordan—E. S. Jordan, president; W. B. Reilly, Paul Sens, R. S. Begg, S. R. Thomas, J. H. Kelly.

Kelsey—C. W. Kelsey, president and general manager.

King—A. Weber, president; Wallace C. Hood, director of sales; H. Alperin, sales manager; Benjamin Stevenson, factory manager.

Kissel—George Kissel, president; Will Kissel, vice-president; Ralph Kay, advertising manager.

Kline-Kar—J. A. Kline, vice-president and general manager; W. B. Vaden, sales manager; J. P. Harbold, chief engineer.

LaFayette—E. C. Howard, vice-president and general sales manager; Leo M. Burnett, advertising manager.

Leach-Biltwell—Roy D. Heartz, sales manager.

Lexington—Frank B. Ansted, president; Emory Huston, advertising manager; L. A. Hanson, secretary; G. W. Hoyt, sales manager.

Liberty—Percy Owen, president; Joseph E. Fields, vice-president in charge of sales.

Lincoln—R. C. Getzinger, sales manager.

Locomobile—E. A. Travis, general manager; Delmar G. Roos, chief engineer.

Malbohm—H. C. Malbohm, president; W. J. Corr, general manager; T. W. Cushing, sales manager; W. W. Jeffery, assistant sales manager; C. G. Jerosch, export manager.

Marmon—W. C. Marmon, president; F. E. Moskovics, vice-president.

Maxwell—William R. Wilson, president; A. E. Barker, vice-president in charge of sales; J. J. Plath, director Maxwell sales; E. W. Clarke, director Chalmers sales, and W. J. Mattimore, advertising manager.

McFarlan—A. H. McFarlan, president.

Mercer—T. E. A. Barthel, vice-president and general manager; J. P. Oliveau, chief engineer; J. W. MacMorris, factory manager; W. A. Smith, sales manager.

Milburn—R. E. Woodhull, sales manager; K. A. Ridenour, district sales manager.

Mitchell—W. L. Jacoby, president; John Tainsch, sales manager; D. E. Roche, service manager, George Bliss, assistant sales manager; P. J. Batenburg, chief engineer; E. A. Weiss, assistant chief engineer.

Moon—Stewart McDonald, president; F. H. Rengers, sales manager; E. H. Serrano, export manager; D. G. Halley, eastern sales manager.

Nash—C. W. Nash, president; C. B. Voorhis, vice-president and sales manager; A. R. Travers, advertising manager.

National—George M. Dixon, president; William Guy Wall, vice president and chief engineer; M. E. Elstun, secretary-treasurer; E. W. Hurd, sales manager; G. R. Miller, advertising manager and assistant sales manager.

Ogren—R. S. Wiltrout, general manager; Foster D. Miller, director of sales and advertising; Fred G. Smith, secretary and treasurer.

Packard—H. H. Ills, sales manager.

Peerless—R. H. Collins, A. R. Cunliffe, Wilbur Collins, F. J. Miller, L. D. Sasser.

Pierce-Arrow—Charles Clifton, chairman of the board; M. C. Forbes, vice-president; Charles Sheepy, chief engineer; L. E. Corcoran, passenger car sales manager; R. O. Patton, truck sales manager.

Pilot—George E. Seidel, president; Joseph W. Conner, general sales manager.

Premier—M. A. Whipple, vice-president and general manager; H. E. Doty, general sales manager; A. L. Nelson, chief engineer.

R & V Knight—H. A. Holder, president; J. M. Ryan, eastern representative.

Reo—D. B. McCoy, advertising manager.

Saxon—H. L. Bill, vice-president and general manager; C. H. Becker, sales manager; D. C. Bayne, secretary and treasurer; J. H. Hickey, service manager.

Stanley — Frank J. Prescott, president; Prescott Warren, vice-president; S. C. Crane, sales manager.

Stearns—George L. Booker, general sales manager.

Stephens—R. W. Lea, vice-president; H. J. Leonard, general manager; C. Roy Clough, sales manager; C. Fred Hunter, eastern sales manager.

Stutz—W. N. Thompson, president; Fred Wilson, sales manager; E. T. Klee, purchas-

(*Continued on page* 105)

Government Delays Association Policy

Attorney General Says Announcement Might Affect Suits Now Pending

WASHINGTON, Jan. 10—The Department of Justice will not announce in any form a government policy relating to open price associations. This statement was made this afternoon by Attorney General Daugherty and came as a complete surprise. Previous statements from other government sources had led to the well defined belief that the government would outline and make public such a policy based on the decision of the Supreme Court in the Hardwood Lumber case.

Plainly, the Department of Justice position conflicts with that of the Department of Commerce which had been seeking to have a government policy fixed and announced and the statement was made only this week that conferences to this end were under way. It is now a question as to what the effect may be with regard to further co-operation between the Department of Commerce and trade associations which have been supplying it with information. Already this co-operation was lessened somewhat in consequence of the Hardwood decision.

Hoover Judgment Relied On

The attorney general, however, said that the Hardwood decision is the most far reaching and helpful on the subject involved that ever had been handed down by the Supreme Court. While the government desires to be accommodating to business, it was stated, it will not go to the point of defeating the purposes laid down by the decision. It was pointed out that there are a large number of civil cases pending in the courts and that any "concessions" the government made in attempting to interpret the decision, said to be so clear it cannot be misunderstood, might prejudice many of the cases now under judicial review.

When asked if the plans of Secretary Hoover to co-operate with trade associations will be modified, the attorney general said that if he discussed this matter it would be with Hoover only. He said he was sure, however, that Secretary Hoover would pursue nothing but a legitimate policy.

Not to Weaken Government Position

Referring to what he termed the clearness of the Supreme Court decision in the Hardwood case, Daugherty said: "We are compelled to maintain a position which is so fully justified by the decision of the Supreme Court."

The attorney general said that the Department of Justice would not ordinarily interfere with the proposal of Hoover regarding the announcement of a policy, but that he would not state such a policy as coming from the Department of Justice and it was suggested that any statement coming from any other department might weaken the position of the government.

DECEMBER OUTPUT OF CARS AND TRUCKS REACHED 79,784 TOTAL

NEW YORK, Jan. 11—December production of passenger cars and trucks by all makers is estimated by the National Automobile Chamber of Commerce at 79,784. Reports of December shipments by members of the N. A. C. C. show that they were 105 per cent of shipments for December, 1920, but 19 per cent less than for November. Shipments in November last year declined 14 per cent from the previous month. The shipment figures for the year by months follow:

	Carloads		Driveaways		Boat	
	1920	1921	1920	1921	1920	1921
January	25,057	6,485	29,283	3,185	....	93
February	25,505	9,986	43,719	7,507	....	99
March	29,326	16,287	57,273	9,939	....	75
April	17,147	20,187	64,634	14,197	....	1,619
May	21,977	18,608	74,286	15,193	....	2,381
June	22,516	20,269	60,746	18,834	8,350	3,947
July	23,082	19,470	52,342	15,320	8,702	3,725
August	23.386	20,350	34,060	14,290	7,095	3,565
September	20,804	20,150	24,431	13,550	5,469	3,580
October	17,209	17,323	14,127	11,257	2,519	2,300
November	13.253	14,061	9,497	10,509	659	1,385
December	11,802	12,100	6,469	7,500	89	134

French Tire Manufacturer to Supply Russian Soviet

PARIS, Jan. 1 (By Mail)—The Bergougnan Tire Co. of Clermont-Ferrand, France, has just accepted a contract to supply solid and pneumatic tires to the Russian Soviet government to the value of 793,000 francs. The negotiations were made through a British commercial firm. Terms of payment are cash before delivery.

Three hundred automobile trucks sold by the French Ministry of Reconstruction to a British dealer have been shipped direct to Russia for the use of the Soviet government. The Ministry of Reconstruction, which is now handling practically all that remains of the French army supply of automobiles, had no knowledge that these trucks were intended for resale to Russia. The majority of the trucks were of French construction.

It is reported here, but not confirmed, that the Renault automobile factory in Russia has been sold to a British group.

STANDARDIZING DRY CELLS

WASHINGTON, Jan. 9—Bureau of Standards officials are endeavoring to bring about the standardization of dry cells. Conferences have been held with the manufacturers of batteries and with representatives from the automotive industry, in an effort to determine upon specifications. At the conferences seventeen sizes of the larger dry cells were considered, seven of which were recommended as standard. It is expected that an agreement as to acceptable standards will be reached within a few days.

New York Sales Decline in Last Month of Year

NEW YORK, Jan. 10—A falling off in the registrations of new passenger cars in the metropolitan district for the month of December as compared with the preceding month is shown in the figures compiled by Sherlock & Arnold, publishers for dealers of the Automobile Sales Analysis. These figures, however, do not include registrations from Nassau County after Dec. 14, and there are some omissions of new cars in Kings County. Also, on account of some cars being operated on dealers' plates, such registrations have not been included in the December listing.

The summary of the year to date is as follows:

	Approximately below $2,500	Approximately above $2,500	Total
January	483	145	628
February	1,408	210	1,619
March	3,396	487	3,883
April	4,811	570	5,381
May	5,466	584	6,050
June	6,522	495	7,017
July	5,457	388	5,845
August	4,255	354	4,609
September	4,004	331	4,335
October	3,505	427	3,932
November	2,425	368	2,793
December	785	126	911
Total to date	42,517	4,485	47,003

RECEIVER ASKED FOR SWARTZ

INDIANAPOLIS, Jan. 9—Two petitions asking for the appointment of a receiver for the Swartz Electric Co. of Indianapolis have been filed in superior court here. One suit asking for a receiver and judgment was filed by Eli Maybe who claims the company owes him $1,000. The other, filed by Oliver M. Thornburg, sets out that the company is indebted to him on a $1,250 note.

Wider Use of Truck Plate Recommended

Standards Committee of N. A. C. C. Submits its Report

NEW YORK, Jan. 11—More general use of the standard caution plate adopted by the National Automobile Chamber of Commerce was recommended by the truck standards committee in a report submitted to the Motor Truck Committee at a meeting here yesterday. The report said:

The Motor Truck Standards Committee has decided that the matter of re-rating the capacity of motor trucks to meet the requirements of those states which plan to enforce their law strictly upon the basis of the manufacturers' rated carrying capacity is one that varies with each individual manufacturer in each state, and indeed, with each individual truck, and is in reality a matter of sales policy with each individual manufacturer rather than a question of standard procedure which can be recommended by this committee:

We feel that it is beyond our province to recommend any such procedure and that the manufacturers' rated capacity is still the most practical basis for classifying motor truck chassis; that the standard caution plate of all motor truck chassis adopted by the National Automobile Chamber of Commerce in 1912 is probably more suitable for present requirements than any other form of plate that could be recommended at the present time. We feel that the present plate permits of furnishing all the weights required by manufacturer, user and Motor Vehicle Commissioner.

We wish to recommend a more general use of this standard caution plate, not only that it should be attached to chassis, but that the space provided for weight should be actually filled in at the time that these weights are actually determined, and that the manufacturer should urge his agents and customers wherever possible to fill in these weights; that the manufacturer should recommend to the State Motor Vehicle Commissioner that no license be issued for a motor vehicle unless the weights are properly filled in upon the caution plate at the time application is made.

We recommend that the motor truck members of the National Automobile Chamber of Commerce should adopt these standards and the recommended practice of the Society of Automotive Engineers wherever applicable.

To Open Publicity Campaign

A resolution was adopted placing the committee on record as fearing that general antipathy on the part of the public towards trucks would result from the fact that the post office department has no contingent fund to meet liability claims for personal injuries caused by postal trucks. The only recourse open at present is to sue the government which is a long drawn out procedure.

A publicity campaign directed to truck owners and operators designed to promote courtesy and civility on the highways will be undertaken by the committee. The first step will be the publication of a booklet. It is felt that if greater courtesy is shown in the use of highways there will be less general antagonism toward trucks.

Ford Willing to Bid $11,000,000 for Lincoln

DETROIT, Jan. 12—According to a statement from the executive offices of Henry Ford he will bid as high as $11,000,000 for the assets of the Lincoln Motor Co. if he is forced to do so at the sale on Feb. 4. The fortunes of the company already are brightening because of his interest in it and the stock has risen several points It is understood the Lelands will be in nominal control of the factory and that a substantial reduction in the price of Lincoln cars will be made, but the details of Ford's plans in this respect have not been announced.

(*Additional details on page* 90)

M. A. M. A. Re-elects All Its Directors

(*Continued from page* 96)

branch, to be known as the Group Department, has been established with Hargrave A. Long as manager.

Long has been secretary and treasurer of the Automotive Wood Wheel Manufacturers Association, which will become the Wood Wheel Group of the M. A. M. A. He also has been secretary of the Hickory Products Association, but will sever his connection with that organization. The headquarters of the Wood Wheel Association have been located in Chicago since 1905. During the war Long, who has been admitted to the bar, was secretary of the Wood Wheel Manufacturers War Service Committee.

In his new position Long will be responsible for developing the group plan of organization which has been taken up by the M. A. M. A. It now includes groups of manufacturers making springs, sheet metal and wheels and the Automotive Electric Association probably will affiliate as a group in the near future.

The Automotive Wood Wheel Association will hold its final meeting as a separate organization here this week. Officers of the group will be elected at that time.

ELIMINATES 33 X 4½ IN. RIM

NEW YORK, Jan. 9—At the instigation of the Tire and Rim Association, the tire executive committee of the rubber committee has concluded to eliminate the 33 x 4½ inch rim as original equipment for motor trucks from the schedule of perpetuated sizes. All interested are to be notified to that effect.

SUNBEAM OPENS BRANCH

NEW YORK, Jan. 12—The Sunbeam Motor Co., Ltd., of Wolverhampton, England, has opened a direct factory branch at 25 West 57th Street, this city, with Dario Resta, famous racing car driver, as general manager. The 1922 chassis will sell for $6,500.

Body Builders Stage Their First Exhibition

Seventy Displays by Commercial and Passenger Car Companies Are Shown

NEW YORK, Jan. 9—The Automobile Body Builders Association held its first exhibition at the Twelfth Regiment Armory, beginning to-day and continuing to Jan. 14. There were seventy exhibits, one-third of which were by commercial and passenger car body building concerns and the other two-thirds by manufacturers of material going into the manufacture of bodies such as cloth, springs, body irons, plywood, etc. The exhibit occupied the entire floor of the armory.

Admission was by invitation only and the invitations were sent out to those in the trade who might be interested in bodies or body construction.

Body builders represented included H. H. Babcock Co., Bantam Ball Bearing Co., Bender Body Co., Brewster & Co., J. G. Brill Co., Fitzgibbon & Crisp, Highland Body Mfg. Co., Holbrook Co., Hume Body Corp., Martin-Parry Corp., McGuire Convertible Auto Body Co., Metropolitan Body Co., Milburn Wagon Co., Smith Springfield Body Corp., E. J. Thompson Co., Waterloo Body Co., Willoughby Co.

Trade Counts on Price Stabilization, Reports Show

NEW YORK, Jan. 12—Reports made to the directors of the National Automobile Chamber of Commerce at their monthly meeting yesterday showed that the trade generally is counting upon the stabilization of prices between now and the close of the Chicago show. The directors feel that if any price changes are made after Feb. 1 it will be seriously disturbing to what promises to be a good spring business.

A report on the used car survey which is under way shows a tremendous interest in the subject by dealers and manufacturers throughout the country. The N. A. C. C. will welcome suggestions on the subject from anyone who has ideas. Generally speaking, however, the basic thought is that each dealer must solve the problem for himself by "buying them right."

WHITE HAS NEW BUS

NEW YORK, Jan. 11—White Co. is showing at its Long Island City service station a special type of motor bus having new features of design which are important in passenger transportation. The chassis is listed at $4,400, which includes frame braces and standard equipment. The Model 45 engine, 4½ by 5¾ in., is used. Other specifications include a 198-in. wheelbase, four-speed gearset and metal wheels mounted with solid tires.

NOTES GLEANED AT SHOW

NEW SAXON PRESIDENT REMAINS TO BE NAMED

Harry L. Bill, vice-president and general manager of the Saxon Motor Car Corp., will continue to direct the affairs of the company until a successor is named for Clarence A. Pfeffer, who recently resigned as president. The new president will not be appointed until the Chicago automobile show.

THOUGH there is no exhibition of Scripps-Booth cars at the show, the company is continuing production at the Detroit plant until the last of the stock is disposed of. This will probably be worked up early in 1922 and the plant turned over for the manufacture of Buick bodies. Prices on Scripps-Booth are continued as formerly despite the general revisions in all other General Motors lines. The dealer organization will be held intact.

COLUMBIA MOTORS CO. is rapidly expanding its dealer organization and has sent out fourteen more district men in the last few weeks. It is gradually eliminating distributors in the eastern territory, and will have two retail establishments in New York. One of them will be on Broadway and the other in the Bronx.

SINCE the reorganization of the Mercer Motors Co. its sales activities have increased and the company is hopeful of doubling its production in 1922. No price changes are contemplated at this time. The dealer organization is being whipped into shape and the company proposes to have national distribution. The company has made rapid progress in the last five months in liquidating its inventory and soon will be back in the market. Export sales are being pushed as rapidly as possible.

CHARLES B. McLAUGHLIN has been appointed district sales manager of the Handley-Knight Co. He was for many years sales manager of the Willys-Overland branch at Toledo and subsequently was engaged in the distribution of Lincoln cars through northwestern Ohio. The appointment of McLaughlin is in line with the policy of the company to build up the selling organization as quickly as production permits. In the last thirty days many important distributing points have been arranged.

VELIE MOTORS CORP. has expended $500,000 in the past year in adding to the equipment of its factory at Moline, Ill. Its engine plant at Marion is now in operation. More of this company's dealers than ever before will attend the New York show.

GENERAL Motors Corp. has issued its show brochure, in which it sets forth a series of recommendations governing show procedure. The recommendations are divided under several heads, describing the manner in which exhibits should be presented, demonstration of open chassis and mechanical parts, handling of show visitors, and other details regarded as important in getting the best results from exhibits. General Motors dealers exhibiting in any show throughout the country will be advised to consult the brochure in making their show plans.

AN eastern sales office for the R. & V. Knight line is being opened by J. M. Ryan in the Gotham Bank Building, New York. With larger schedules the company expects to go more actively after sales in the eastern territory. Ryan has been a member of the factory sales force.

REPRESENTATIVES of the Peerless Motor Car Co. at the show assert that no material changes will be made in the design of the car, for the present at least, but that it is expected sales will be largely increased by means of more intensive effort on the part of the dealer organization. No information is obtainable concerning the Collins car, which it is understood will be brought out by R. H. Collins, who now controls the Peerless company.

WORD has just been received from Clarence L. Thurston, export manager of the Earl and Briscoe lines that he has been ill for some three weeks at Barcelona, Spain. Thurston sailed for England to visit the London show in November and has since traveled in England, France, Holland and Belgium. Officials of the Earl company have been advised that Thurston is rapidly recovering.

British Effort to Import Ford Parts Ends in Court

LONDON, Dec. 30 (*By Mail*)—The effort by a British company to import Ford parts from the United States and to assemble them in the neighborhood of London in the Whitehead aircraft factory has ended in the bankruptcy court when a deficiency of £51,155 was disclosed. The official receiver reported that in his opinion the company's failure was due to mismanagement and entering into contracts which it had no reasonable expectation of being able to fill.

The plan was evolved early in 1920 by a number of Ford dealers here. J. A. Whitehead promoted the venture through a private company called Amalgamated Motors, Ltd., and was supported by fifteen persons who were to act as distributors for five years and were to pay a deposit of £1 per car. By the means of this levy a sum of £15,605 was subscribed. Ultimately a new company took over the business and arranged with the Gray-Andrewes Corp., New York, to collect and ship parts for assembling in England. A few hundred cars were then delivered by the corporation.

Bankers to Change in Granting Loans

Coast Financier Says Past Liberality Has Caused Industry to Suffer

SAN FRANCISCO, Jan. 9—Banks, in the future, will grant credit to automobile concerns in the same manner and by the same methods they now follow in granting credits to wholesale grocers or any other lines of stable business, according to Clare Walker Banta, vice-president of the Wells Fargo Nevada National Bank of this city.

Banta delivered this message to the Santa Clara County Automobile Trade Association, at its meeting at San Jose to which he had been called by invitation from Robert Martland, secretary-manager of the California State Automobile Trade Association, who has been getting bankers and automotive industry men together at similar meetings in California for some months, with excellent results. Banta says:

The automotive industry suffered from the fact that banks had been too liberal with it in "flush" times. Loans were made without thorough investigation, such as would be applied to other businesses. In the very nature of bank credits, loans from commercial funds are quite different from loans made from investment funds.

The first cannot be tied up for any long period, while investment funds may be put into real estate, or bonds or other long-term holdings. Automobile men often fail to appreciate the difference in the nature of these loans in their criticism of the banks. Installment contracts, for instance, should be financed from investment funds, and not from commercial funds.

Although installment payments are legitimate, they have been rather overdone in the automobile business. In the future, one of the added services of the automobile dealers will be to help the customer decide on the best method of making his purchase. Overzealous salesmen have harmed the industry in some cases. If the automotive industry has enemies, there must be a cause for their enmity, for people do not become enemies without reason. By more careful financing, and more careful arrangements with customers, the motor trades should escape any serious financial crisis in the future.

Haynes Prepares Special Advertising for Used Cars

KOKOMO, Ind., Jan. 9.—The Haynes Automobile Co. has joined the ranks of manufacturers who are preparing special used car advertising copy for the use of their dealers.

Haynes has prepared a series of 18 advertisements of a confidence building nature, some of which feature the time payment idea. The company offers mats or stereotypes of the advertisements to dealers without charge but dealers are required to assume on their own account the cost of running the advertising in their local newspapers. All the advertisements are built around the legend: "Haynes Rebuilt Cars."

Confidence Shown by Export Managers

Take Up Questions Affecting International Trade at Their Annual Meeting

NEW YORK, Jan. 20—Confidence that the international sale of American made automobiles is again on the increase and that world-wide conditions are shaping themselves for a resumption of such trading, was freely expressed at the annual export managers' meeting held here to-day in the headquarters of the National Chamber of Commerce. In numbers attending, the meeting was described as the largest of its character held by the N. A. C. C. and this was true likewise of the interest displayed and the efforts made to show that the automotive companies of this country are prepared to go ahead with their export business in practically all countries.

Longer Credits Granted

The subjects considered by the speakers and in the discussion give a clue to the problems that the export managers are now seeking to solve. The first of these was finance, with the resultant granting of longer credits to buyers in other countries.

Charles S. Wall, executive secretary of the National City Co. of the National City Bank, of New York, explained to the export workers the manner in which bank acceptances might be used in their trading. Buyers, under this plan, would open letters of credit in this country, on terms up to six months, these accounts being arranged and guaranteed through the proper banking channels. Manufacturers, on making shipments, would draw on the American bank holding the letter, discounting this draft at the prevailing rate whenever they desired to do so.

Great Possibilities Exist

The relations of the manufacturers and exporters with their dealers in other countries were a prevailing theme of the meeting. From the opening talk by Walter S. Drake, the chairman, and Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce, to the closing remarks by L. J. Ollier of Studebaker and R. J. Archer of Willys-Overland, the exporters were warned that they must build up confidence in American products through fair dealing and just treatment of their distributors abroad, many of whom are business men of a high caliber, loyal to the firms they represent.

"No matter what competition we may have and what difficulties may confront us in the world-wide markets, if we build up confidence in our dealings and confidence in the American automotive products, all these problems will take care of themselves," Ollier said. "We haven't begun to scratch the surface of the infinite possibilities for the international sales of automobiles."

The plan for forming an export combine of N. A. C. C. members, under the Webb-Pomerene act, was outlined by George F. Bauer, secretary of the foreign trade committee, and a committee to consider its adoption was decided upon. This committee, it is understood, will be headed by A. S. Moore, president of the Denby Motor Truck Co. Details of the plan are given elsewhere in this issue of AUTOMOTIVE INDUSTRIES.

Lee told of the work that is being done by the new division of the Commerce Bureau, requesting that manufacturers keep more closely in touch with it, and assuring that the division would seek in every way to do whatever was needed to build up export sales. A resolution commending the division was adopted.

The furtherance of road building efforts throughout the world was also a topic for discussion, this being the subject of talks by Thomas H. McDonald, chief of the Bureau of Public Roads, and S. T. Henry of the Allied Machinery Co. They counseled the exporters to get behind all road improvement campaigns.

Budd Wheel Wins Its Suit on Socket Punching Patent

NEW YORK, Jan. 9—The Federal District Court at Richmond, Va., has decided against the Wire Wheel Corp. of America in its suit against the Budd Wheel Co. and also against the defendant on a counterclaim. The suit was based on the Pugh patent No. 1,030,428, which covers the punching of rim sockets in wire wheel rims. In reference to one contention the court held that the defendant was not infringing inasmuch as it had eliminated one step in the operation. On a second claim the court held that if it accepted the plaintiff's view the device would not have been patentable as it was covered in the old Frayer racing cars of 1905 and 1906.

The counterclaim was based on the reissue of the Lindsay patent No. 14,461 covering a demountable wheel with a special type of axle. It was held that this was no invention over the earlier British patent to Pugh.

ORGANIZE TO MAKE "ASH" WHEEL

NEW YORK, Jan. 10—American Car & Foundry Co. has organized an automotive wheel division for the manufacture of disk and wire wheels for passenger cars, and a line of wheels for trucks, in the Russell Avenue plant, Detroit. The wheels are the design of C. S. Ash and will be known as Ash wheels. Ash will be in general charge of manufacturing and merchandising the product.

83,349 CARS IN SOUTH CAROLINA

COLUMBIA, S. C., Jan. 7—During the past year South Carolina had 83,349 automobiles and 7197 motor trucks, as compared with 93,843 automobiles and trucks in 1920, according to L. H. Thomas, secretary of the State Highway Commission.

Dealer Meetings Held During Week

Used Car Situation Taken Up—Company Conditions Discussed by Executives

NEW YORK, Jan. 11—Stern measures to meet the used car situation were urged by C. W. Nash, president of Nash Motors Co., in an address to his dealers at the annual show week meeting to-day. It is far better to be content with lean pickings for a time, he said, than to be out of business when the day of good things returns.

A statement by J. J. Storrow, chairman of the Nash board, showed the company entering 1922 with an inventory of $2,600,000 which he said was susceptible of being turned over six times with fair business. He urged the dealers to get behind the factory organization and predicted that through real intensive effort the company could be brought from seventh to fourth place in the industry.

Velie Organization Meets

F. E. Bradfield, vice-president of Velie, was the principal speaker at the annual dinner to Velie dealers held in the Astor. His talk dealt with the new models which the company has brought out for 1922 and an explanation of the new power plant which was exhibited. Through the new co-operative finance plan which the company has fostered he said the work of selling would be greatly lightened and he predicted the greatest of Velie years.

Paige-Detroit Motor Car Co. will hold its dealer meeting and luncheon at the Commodore Thursday at which the new Jewett car will be first exhibited. The Hupp dinner and meeting, Willys-Overland and Grant will also be held at the Commodore Thursday. Studebaker dealers will meet in the Plaza and Auburn dealers in the Waldorf.

Olds Has Dinner

NEW YORK, Jan. 12—The Olds Motors Works is committed to a policy of continuing to handle its products through distributors and to this end is strengthening its dealer organization throughout the country, particularly in cities having a population of more than 5000, President A. B. A. Hardy told 400 eastern Oldsmobile dealers gathered together at their annual dinner at the Commodore Hotel last night. Pierre S. duPont, president of General Motors Corp., addressed the dealers, urging closer co-operation between them and the factory. Remarks were made by a number of factory executives and distributors.

NEW DIAMOND TIRE

AKRON, Jan. 9—The Diamond Rubber Co., Inc., has added a new cord tire to the Diamond line. The new design tread is said to have special road gripping power against both side, forward and back skidding.

Farmers' Meetings to Consider Trucks

Agricultural Conference Will Take Up Matter of Expediting Product Deliveries

WASHINGTON, Jan. 11—Questions of expediting delivery of farm products through the extension of motor vehicle service from farm-to-market will be one of the topics on the program of the national agricultural conference here beginning Jan. 23. Representatives of the automotive industry probably will be named by the Department of Agriculture within a few days to serve as advisors on highway transport. The entire industry will be vitally affected by the outcome of the meetings as the farmers are the best prospects at the present time.

The conference will consider farm problems in their broadest aspect both from domestic and international viewpoints. It is possible the whole course of congressional action as it relates to agricultural interests will be based upon the findings of the various committees. The deliberations will be based largely on the findings of the Joint Congressional Commission of Agricultural Inquiry which has urged the economic value of motor trucks on the farm. This report is said to be one of the most valuable ever made by a governmental body.

One of the subjects to be given careful consideration is that of transportation in which motor vehicles play so large a part. Inasmuch as the recovery of the automotive industry depends largely upon agricultural markets, it has a vital interest in the conference.

Sale of Severin Stock on Coast Investigated

OAKLAND, CAL., Jan. 9—Erwin C. Easton, acting commissioner of corporations, is investigating the sale of $25,000 worth of stock in the Severin Motor Car Co. of Kansas City by H. T. Severin, president.

Severin came to this city in July proposing to move the Kansas City plant to Oakland and asking permission of the commissioner of corporations to sell stock in the company in order to pay for the transfer of the plant and a number of completed automobiles. Severin was informed that, on the deposit of $45,000 in a national bank, as a guarantee, he would be given a permit to sell the stock. It is asserted that he promised to deposit this guarantee, but failed to do so, and, according to the charges made against him, on Jan. 4 proceeded to sell some $25,000 worth of stock, the sales being made largely among wealthy people residing in Piedmont and Berkeley.

Severin's plan was to incorporate his company under the laws of California. Three local attorneys were made dummy directors, C. R. Morse, L. Elrod and E. E. Keyes, to whom it is asserted blocks of stock were issued by Severin, on the understanding that they were to act as his attorneys and advisers in the incorporation of the company.

In a statement issued by Keyes, some $10,000 worth of Severin automobiles are clear of incumbrance, and these have been attached in an effort to recover the money expended by the attorneys, and to reimburse, in part at least, the purchasers of stock.

Departments Readjusted by Bridgeport Brass Co.

BRIDGEPORT, CONN., Jan. 9.—Important executive changes have been made in the Bridgeport Brass Co., these being largely a readjustment of various heads of departments.

Walter B. Clark, who has been works manager of the mills product division, is made general works manager of the entire plant. This position is similar to the one that has been occupied by William R. Webster, vice-president of the concern.

Arthur Brewer, chief engineer, is made works manager of the mills products division. The plant engineering and maintenance department will be known as the plant engineering department and supervisor of maintenance. E. R. Feicht is in charge. G. E. Oakley, who has been assistant sales manager of the fabricating department, has been made sales manager. Warren D. Blatz is made general sales manager of the entire corporation.

The process engineering department is absorbed by the research engineering department and comes directly under the supervision of vice-president William R. Webster. The cost accounting department is temporarily in charge of Paul Swartz of the R. G. Rankin Co., until the work of installation has been completed.

A. A. A. Takes Action on Highway Problems

NEW YORK, Jan 11—The executive board of the Automobile Association of America at a meeting to-day approved the recommendation of Detroit and Jacksonville conferences for a Federal appropriation of $100,000,000 for national highways, and will urge speedy action by Congress to meet highway needs. The money is to be expended over a period of years. Other recommendations were likewise approved.

Ten delegates will be appointed to the American Good Roads Congress meeting in Chicago next week. Recommendation was made that a delegate be appointed to attend a good roads congress to be held in Seville, Spain, in 1922, to illustrate the development of American highways. The project to erect a tri-state bridge at Cairo, Ill., was approved as important to trans-continental travel. The annual meeting was fixed for the latter part of May in Washington.

City Sales Keep Up Throughout Georgia

Recent Price Reductions Stimulate Trade—Smaller Counties Show Decrease

ATLANTA, Jan. 10—While the state automobile department issued but 134,453 licenses for automobiles and motor trucks during 1921, or more than 20,000 less than were issued in 1920, inspection of the records of the last two months of the year indicates that sales held up fairly well in November and December as compared with most of the other months.

In virtually all counties of the state in which the larger cities are located there was an increase in licenses issued during the year as compared with 1920, and an increase in fees collected. These increases were offset, however, by material decreases in the smaller counties.

Recent reductions in Buick, Cadillac, Hudson and Essex prices have served to stimulate sales of these cars to some extent, the local distributors reporting a number of advance orders for delivery upon the lower prices going into effect. Ford car and truck sales have held up unusually good the last three months.

The outlook for the present year seems to portend a revival of buying by spring in the larger centers, but little or no improvement in the smaller communities before the next crop is gathered.

The tractor outlook over the southeast is fairly good, especially for industrial sales and in the timber tracts where operations are being resumed on a broad scale.

Emerson Motors Crops Up in Pelletier Proceedings

BOSTON, Jan. 9.—Testimony that District Attorney Joseph C. Pelletier dropped threatened criminal prosecution against the Emerson Motors Co. of New York after counsel for that company had paid $20,500 fees to Daniel H. Coakley, a Boston lawyer in an effort to avert prosecution, was offered in Supreme Court at the trial of Pelletier on charges of misconduct.

The Emerson case was investigated by the Boston Bar Association, which afterward presented the matter to the attorney general. The specification contains five counts and alleges that the district attorney conspired with Oakley by threatening the company with prosecution and thus coerced the company into paying the fees to Coakley for "averting the prosecution."

In June, 1918, promoters of Emerson Motors were convicted of using the mails to defraud in connection with the sale of stock and three of them, Nicholas Field Wilson, Robert T. Matches and William Loomis, were given prison sentences.

MEN OF THE INDUSTRY

R. V. Rowan has been appointed supervisor of branches of the Pilot Motor Car Co. with headquarters at Richmond. He acted in a similar capacity with the Buck Co., Studebaker distributer for the Cleveland district and Indianapolis. D. H. Cummins, former president of the Lorraine Car Co., is now Pacific coast representative for the Pilot with headquarters at Los Angeles. T. L. Bayne, who was with Lorraine when Pilot took over the business, is service engineer; William H. Conklin, former Lorraine sales manager, is now manager of the hearse department of the Pilot company.

W. C. Starkey has been made vice-president and director of engineering of the Stevenson Gear Co., Indianapolis, and will take over the works management of the company's plant. Starkey has been identified with the Ohio Brass Co. of Mansfield, Ohio, for sixteen years and resigned his position as chief engineer and works manager of that concern to make the new connection.

Albert J. Roemer, formerly in charge of sales in the upper New York district for the Multibestos Co., has been appointed district manager for Metropolitan New York with offices at 105 West 63rd Street. **G. A. Watson,** formerly sales manager for the Western Motor Supply Co. of Minneapolis, has joined Multibestos as district manager in charge of sales for Iowa and Nebraska.

Harry C. Maley has sold his interest in the Albee Corp. and now is operating an advertising and merchandising business in Chicago under his own name. Maley was identified with the early advertising of the Buick Motor Car Co., the Oakland Motor Car Co., the Champion Ignition Co. and the Sheridan Motor Car Co.

George W. Cushing has resigned as advertising manager of the Hudson Motor Car Co. and Essex Motors to become affiliated with Barton, Durstine and Osborn, Inc., an advertising agency, and will be located in the Buffalo office. Cushing at one time served as advertising manager of the Federal Motor Truck Co.

Charles W. Mears has retired from the Mears-Richardson-Briggs Co., advertising agency, Cleveland, having sold his interests to the other members of the firm on a contract omitting his name from the corporate title. His resignation as president and treasurer became effective Jan. 6.

W. H. Girdlestone, formerly sales manager of the eastern district of the Splitdorf Electrical Co., has joined forces with H. B. Shontz Co. as sales manager in charge of battery and electrical service station equipment. Girdlestone has been connected with the industry for twenty years.

Herbert B. Fitch has been appointed manager of the branch of Willys-Overland, Inc., at Boston, succeeding W. G. Northrup. Fitch has been identified with the Overland organization for many years, being at one time secretary to John N. Willys.

Wallace C. Hood has returned to the King Motor Car Co. as director of sales after an absence of several years. He was associated with King in 1917 and 1918. Benjamin Stevenson, formerly with Winton Co., is now factory manager for King.

Henry T. Myers, New England branch manager of the Studebaker Corp. with headquarters in Boston, has become vice-president and general manager of the A. W. Haile Motor Co., Studebaker distributer in western New York.

F. W. Wyttosk, recently connected with the Nordyke & Marmon Co. and for two years connected with the automotive industry in the engineering field, has become associated with the Checker Taxi Cab Co. of Chicago.

George L. Booker, former president of the F. B. Stearns Co., New York distributer of the Stearns, who has been appointed general sales manager of the F. B. Stearns Co., Cleveland, will assume active duties on Feb. 15.

Frank F. Kolbe, for some time in charge of the New York office of the treasurer's department of General Motors Corp., has been appointed an assistant treasurer of the corporation with headquarters in New York City.

Herbert L. Jandus, formerly with the Standard Parts Co., has joined the engineering staff of the C. G. Spring Co. He will specialize in the production of bumpers and assist in the development of that department.

Ray F. McNamara, experimental engineer with the Maxwell Motors Corp., has reconsidered his decision to join the Rickenbacker Motor Car Co., and will continue his connection with the Maxwell interests.

Thomas J. Litle, Jr., formerly directing experimental and development engineering of the Cadillac Motor Car Co. and the Lincoln Motor Co., has opened consulting engineering offices in Detroit.

Socrates X. Newman, formerly salesman of the Automatic Safety Tire Valve Co., has been appointed director of sales of the Edward V. Hartford, Inc., 35 Warren Street, New York City.

H. D. Little, formerly in the wholesale department of Willys-Overland, Inc., has been appointed divisional sales agent of the Handley-Knight Co., covering the central states.

Many Factory Executives Attend Show in New York

(*Continued from page 99*)

ing agent; Earl Jacks, engineering and service departments.

Sun—A. H. Wyatt, president; M. H. Ayre, factory representative.

Templar—M. F. Bramley, president and general manager; Paul E. Ryan, general sales manager; A. M. Dean, chief engineer; Morris Bleiweis, assistant sales and advertising manager.

Velie—F. E. Bradfield, vice president; W. L. Velie, Jr., secretary; T. G. Gannon, sales manager; H. T. Wheelock, advertising manager.

Westcott—B. J. Westcott, president; H. G. Root, general manager; E. H. Gilcrest, sales manager.

Bank Takes Judgment on Notes for $23,000

TOLEDO, Jan. 9—The Old National Bank of Lima has taken judgment on two notes for approximately $23,000 against B. A. Gramm, vice-president of the Gramm-Bernstein Motor Truck Co., and his wife. The action followed the refusal to post more security for the notes or give a mortgage on their home.

Max Bernstein, president of the company, on Dec. 30, placed a mortgage on his business block located at Lima for $140,000.

Casing Production Decreased 175,000

November Output Totals 1,756,555—Inner Tube Production Shows Decline

NEW YORK, Jan. 6—A decrease in production of pneumatic casings is reported for November by the Rubber Association of America. The decline, however, is only about 175,000 with a total output of 1,756,555. The falling off in shipments was from 1,675,169 in October to 1,342,519 in November and inventories increased from 3,545,030 in October to 3,908,342 in November.

Shipments Lower

Production of inner tubes declined from 2,843,918 in October to 2,126,211 in November. Shipments fell off from 2,016,371 in October to 1,540,299 in November. Inventories increased from 4,732,016 in October to 5,203,568 in November.

Detailed figures as compiled by the association are as follows:

PNEUMATIC CASINGS

	Inventory	Production	Shipments
1920			
Dec.	5,508,380	506,111	1,327,153
1921			
Jan.	5,319,605	703,430	965,417
Feb.	5,193,018	819,892	1,013,756
Mar.	4,597,103	1,163,314	1,614,651
Apr.	4,527,445	1,651,418	1,785,951
May	4,451,568	2,100,917	2,085,882
June	4,154,456	2,313,265	2,643,850
July	3,892,037	2,570,524	2,757,581
Aug.	3,934,852	3,042,187	2,894,442
Sept.	3,340,798	1,929,268	2,047,929
Oct.	3,545,030	1,923,271	1,675,169
Nov.	3,908,342	1,756,555	1,342,519

INNER TUBES

	Inventory	Production	Shipments
1920			
Dec.	5,786,929	508,446	1,481,285
1921			
Jan.	5,586,163	740,824	1,042,617
Feb.	5,415,464	916,627	1,129,881
Mar.	5,044,881	1,246,483	1,643,690
Apr.	4,916,772	1,762,122	1,983,571
May	4,751,880	2,210,040	2,342,567
June	3,665,648	2,332,925	3,332,673
July	3,122,815	3,020,941	2,643,248
Aug.	3,649,319	4,430,152	3,904,080
Sept.	3,827,830	3,274,832	2,645,758
Oct.	4,732,016	2,843,918	2,016,371
Nov.	5,203,568	2,126,211	1,540,299

SOLID TIRES

	Inventory	Production	Shipments
1920			
Dec.	303,473	16,297	40,833
1921			
Jan.	303,753	21,220	39,116
Feb.	304,374	28,365	39,599
Mar.	293,840	28,710	43,926
Apr.	269,985	28,859	42,080
May	264,633	35,156	40,122
June	240,336	28,395	49,867
July	220,003	35,123	55,678
Aug.	216,367	55,694	66,866
Sept.	161,839	37,441	50,276
Oct.	163,299	46,274	45,911
Nov.	173,451	43,537	34,556

Explanatory Notes

"Production" and "Shipments" figures cover the entire month for which each report is made. "Inventory" is reported as of the last day of each month.

"Inventory" includes tires and tubes constituting domestic stock in factory and in transit to, or at, warehouses, branches (if any), or in possession of dealers on consignment basis, and as a total represents all tires and tubes still owned by manufacturers as a domestic stock.

"Shipments" include only stock forwarded to a purchaser and does not include stock forwarded to a warehouse, branch, or on a consignment basis, or abroad.

FINANCIAL NOTES

Goodyear Tire & Rubber Co. had over $25,000,000 cash and cash items on its balance sheet Nov. 30, 1921, according to H. H. Springfield, assistant to the president. There were no bank notes on that date and current assets were valued at $63,986,387, against current liabilities of $5,441,512. The general balance sheet on the above date shows excess current assets over current liabilities of $58,544,875 or more than $1,000,000 in excess of the $57,000,000 aggregate bonds and debentures of the company at present outstanding. The assets include inventories, $30,521,041; accounts and notes receivable, $7,069,487. Included in the liabilities are trade accounts and notes payable, $4,482,864; reserve for possible loss on rubber and fabric, $1,862,041; for contingencies and Federal taxes, $4,726,477 and surplus of $2,862,492.

Kelly-Springfield reports earnings for the year, before taxes of $4,000,000, which will be written off to cover the unusual expenses of getting the new Cumberland plant into production. Cash on hand approximates $2,000,000 and only current liabilities against it. There are no bank loans. Inventories stand on the books at figures well below present replacements for rubber and fabric. There is no considerable accumulation of finished goods. The Cumberland factory is running at the capacity of that part which has been brought into production.

United States Automotive Corp. issue of $1,750,000 first mortgage 8 per cent ten-year bonds has been sold to Harvey Fisk & Sons, Inc., and will be offered within the next few days at 99½ to yield slightly more than 8 per cent. The bonds are part of an authorized issue of $3,000,000 and are redeemable after Sept. 1, 1924, at 107½ and thereafter at 105. They are convertible into Class "A," common stock of the company, at a ratio of one share of stock for each $100 principal amount of bonds.

Maguire Tire & Rubber Co. has been incorporated in Delaware by former interests of the Portage Tire & Rubber Co. with $1,000,000 8 per cent preferred stock, $3,600,000 "A" common (par $10) and $400,000 "B" common (par $10). The preferred stock and "A" common will be publicly offered at par. The president is J. W. Maguire; vice-president and treasurer, James Christy, and secretary, J. A. Elden. It is said that the company will purchase one or two Ohio plants.

The White Co. indicates that its inventories at the beginning of the year have been reduced from $7,200,000 to $3,600,000. Cash on hand is expected to approximate $1,250,000; current receivables, $5,500,000; accounts and sundry payables, $2,400,000, giving a ratio of current assets to current liabilities of about four to one, compared with three to one a year ago Sales aggregated 53 per cent of 1920, with orders approximately 60 per cent of 1920 bookings.

Duplex Truck Co. of Lansing balance sheet for the year ended Oct. 31 shows current assets of $910,522, of which inventories make up $635,876; capital assets, $626,784; deferred charges, $7,428. Current liabilities total $419,636, divided as follows: Accounts payable, $8,085; notes payable, $409,712; accrued payrolls, $1,562; excise taxes, $276. Reserves total $14,711; capital stock, $1,000,000, and surplus, $110,387. In 1920 the company sold 600 trucks, it is stated.

B. F. Goodrich Co. entered the new year with no bank indebtedness. At the beginning of 1921 notes payable aggregated $29,000,000. Inventories, which at the end of 1920 exceeded $72,600,000, were cut nearly in half, to $38,295,000 as of Sept. 30 last.

Phoenix Rubber Co. receiver and creditors have agreed that $200,000 new capital must be raised by the issuance of bonds or liquidation must take place. The assets are estimated at $700,000 and liabilities $350,000.

Allen Motor Co. receivers state that a $670,000 offer has been made for the company's assets. Claims against the company are estimated at $3,000,000, including $1,000,000 contingent.

Kalamazoo Motors Corp. is offering $250,000 of first mortgage 7 per cent bonds maturing in five years, to obtain capital required for an expansion of business.

United States Rubber Co. has declared its regular quarterly dividend of $2 a share on preferred stock, payable Jan. 31 to stock of record Jan. 16.

Moon Motor Car Co. declared its regular quarterly dividend of 1¾ per cent on preferred stock outstanding, payable Jan. 1.

Takes Steps to Hold Up Scripps-Booth Program

DETROIT, Jan. 10 — An appeal to minority stockholders of Scripps-Booth Corp. is being made by A. M. Smith of Chicago. Smith asks stockholders to forward name, address and amount of holdings "so that we can make a program and bring pressure to bear upon officials or cause such investigation and forced action to be taken as will put the company back in its proper position as a profitable investment." General Motors, which is liquidating Scripps-Booth, held 90 per cent of outstanding 60,000 shares of stock at last report.

In Attorneys' Hands

NEW YORK, Jan. 10—Comment on the steps taken by minority stockholders of the Scripps-Booth Corp. to hold up the dissolution program was refused at headquarters of the General Motors Corp. here. It was stated that the subject was in the hands of the corporation's attorneys.

Sales Managers Have Plan for Selling Used Trucks

PHILADELPHIA, Jan. 9—In accordance with the plan outlined at the December meeting of the Motor Truck Association of Philadelphia, a gathering of sales managers of member concerns was held in the quarters of the Philadelphia Automobile Trade Association, to discuss ways and means of solving the problem of the resale prices of used trucks. Charles F. Woltz of the Packard Motor Car Co. of Philadelphia presided as chairman.

The thoughts expressed at this meeting were reported to a session of the board of governors of the association, who were sufficiently impressed with the details of the sales managers' suggestions to call a meeting of the association membership for a date, toward the end of January, yet to be fixed. At this time the ideas offered by the sales managers will be reviewed and action upon them may be taken.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

A much easier tone was noted in the money market of the past week, rates for call money ranging from 3½ per cent to 5½ per cent as against 4½ per cent to 6 per cent in the previous week. On Monday of this week the rate went to 3 per cent, which is the lowest since November, 1919. For fixed date maturities the undertone was also easier, and the quotations for all maturities from 60 days to 6 months were 4¾ per cent to 5 per cent as compared with 5 per cent to 5¼ per cent in the previous week.

The 4¾ per cent rate is the lowest quotation for time loans since Sept. 4, 1917. Prime commercial paper rates were also lowered to 4¾ per cent to 5 per cent, as against 5 per cent to 5¼ per cent. Bankers' acceptances in the open market eligible to rediscount at the Federal Reserve Bank declined from 4⅛ to 4 per cent. A large supply of money and a fair volume of transactions were reported.

During the past week an event of world-wide interest and importance was the call issued for an economic conference to be held in Genoa in March, the results of which it is hoped may be as far-reaching as those of the Washington Conference apparently have been.

The total reserves of the New York institution increased $4,931,000, while total bills on hand declined $3,000,000. Total earning assets showed a decrease of $6,232,000, and total deposits an increase of $31,472,000.

The Federal Reserve statements as of Jan. 4, 1922, showed an increase of $17,602,000 in total reserves, of which gold reserves constituted $5,698,000. Total bills on hand decreased $54,641,000.

Early this week the Dallas and Minneapolis institutions reduced their rediscount rate on all classes of paper from 5½ per cent to 5 per cent.

Late week Canadian exchange touched a new high level at 95.5 per cent as against a low of 84.9 per cent for the year 1921.

New Paige Contract Calls for Special Service Man

DETROIT, Jan. 9.—Under the terms of the new Paige contract, distributors are required to add a special service man whenever the factory may consider it necessary to relieve some particular trouble which dealer service men are unable to meet successfully. Such a man would work with the factory service man in the territory instructing the general service men in the way to meet the difficulty.

Dealers are urged in letters accompanying the contracts to do everything in their power to make pleased owners, even to the extent of offering special services such as monthly inspections, grease and oil service for stated periods.

INDUSTRIAL NOTES

Goodyear Tire & Rubber Co. reports increases in production in its California and Canadian subsidiaries similiar to those being made at Akron. The Los Angeles plant started the new year with a production ticket of 2,500 compared with 2,000 during December. The Canadian plant will probably increase to 2,000 tires a day from 1,500 during the next few weeks. The Canadian plant is largely dependent upon export business and some betterment is noted by officials in the general situation.

L. H. Gilmer Co. has elected the following officers: Vice-president and general manager, John S. Krauss, who has been treasurer; Joseph S. McCulloch, president of the Union National Bank and a director of the company, treasurer to succeed Krauss. Walter Rossmassler, treasurer of Sauquoit Silk Co., and William B. Reed, treasurer of the Budd Manufacturing Co., were named as new members of the board of directors.

Wayne Oil Tank & Pump Co. will erect a $75,000 office building in Fort Wayne and will convert the present office section into an addition to the factory. Experimental and research laboratories will occupy part of the shop space. A portable steel warehouse is included in the company's plans for expansion.

Pioneer Instrument Co., Brooklyn, has taken over the manufacture and sale of the K-L fuel system formerly handled by the K-L Automotive Specialties Co. C. B. Kirkham will continue to supervise the engineering work in connection with the apparatus and its installation.

Lehigh Tire & Rubber Co., New Castle, Pa., has elected the following officers: President and treasurer, H. W. Smith, who is the general manager; vice-president, Norman A. Martin; secretary, J. F. Seiberling. Production of a new patented tire is expected to begin March 1.

Franklin Automobile Co., Syracuse, reports that 8,545 cars were shipped during 1921, which was 81 per cent of the number shipped during 1920. Of the shipments 52 per cent were closed cars. This represents an increase of 7 per cent over the previous year.

American Motors Service, Pittsburgh, has been organized by G. Earle Burroughs, I. V. Conneely and other associates in Cleveland, Toledo and Detroit for the purpose of selling direct automotive equipment for complete private garage outfitting.

Hart-Parr Co. has resumed operations after a partial close down. About 25 expert erectors and mechanics have been called back for work. It is stated at the factory that an order for tractors has just been received from France.

Willys Corp. Fostoria plant, which was closed for ten days for inventory, has reopened and will probably increase its working force within the next few months. Sixty men were placed at work when the plant reopened.

National Mas-Core Motors Corp., Kalamazoo, has received an order from the Checker Taxi Cab Co., Chicago, for 1,800 motors. Production is to start immediately.

Metal Specialties Mfg. Co., Chicago, has added to its line the Jorgensen vapor primer, formerly manufactured and marketed by the Jorgensen Manufacturing Co., Waupaca, Wis.

C. G. Spring Co., Kalamazoo, has rearranged its entire bumper unit and placed its machinery to increase the production greatly without requiring additional help.

Gibbons Bros., Ltd., Dudley, Worcestershire, England, has been appointed British Isles representative for W. S. Rockwell Co.

Hoover Wagon Co. has changed its name to the Hoover Body Works. It is proposed to open a branch plant in Long Island City.

Buick Motor Co. plants at Flint, which were closed for inventory taking on Dec. 23, resumed work in all departments Jan. 9.

New York Capitalists Will Produce Standard

NEW YORK, Jan. 9—The automobile branch of the Standard Steel Car Co. has been taken over by a syndicate of New York capitalists headed by Don C. McCord, who has been vice-president of the Bankers' Commercial Security Co. Associated with him are the New York Trust Co., the Liberty Industrial Corp. and individuals connected with the Standard Steel Car Co.

The Standard car will be manufactured by a new company to be known as the Standard Motor Car Co. of Pittsburgh. The present factory will be used until it is outgrown by production. McCord has resigned from the Bankers' Commercial Security Co. to become vice-president and general manager of the new corporation.

The purchase does not include the Vim motor truck, which was taken over by the Standard Steel Car Co. several months ago. The truck interests have been sold to a group of men headed by a former Vim dealer in Baltimore.

Stockholders Ask Receiver for Burdick Tire Co.

INDIANAPOLIS, Jan. 9.—A receiver for the Burdick Tire & Rubber Co., a Delaware corporation having a branch at Noblesville, Ind., was asked in a complaint filed here in federal court by Calvin C. Miller and Joseph Lowman of Preble County, Ohio, stockholders, on behalf of themselves and other stockholders in the concern. In addition to the company, the defendants named are H. G. Steinbrenner, of Huntington, Ind., president, R. E. Rice and Henry Deck of Noblesville, and Charles R. Haller of Huntington, directors. The complaint charges that the defendants and others have made false and fraudulent representations in the sale of company stock.

The company was incorporated in March, 1917, with a capital stock of $1,000,000, which was increased in 1920 to $5,000,000. There is a large factory and power house at Noblesville which the plaintiffs claim has never been fully operated in the making of tires and tubes, and which under present circumstances, it is claimed, they will be unable to operate. The complaint states that in June, 1921, the officers and directors delivered to the Fort Dearborn Trust and Savings bank of Chicago, a mortgage to secure the issue of $250,000 in bonds of the company.

METAL MARKETS

CHEERFULNESS has full sway in the steel market, and even those producers who were timid lest the first half of January turn out to be another period of "watchful waiting" are pleasantly disappointed. Automotive purchasing agents have anticipated much of the buying which sellers did not look for to materialize until after the automobile show. What orders have been placed are not of the spectacular sort.

In this connection it may be stated that the same statistical source which a year ago placed the consumption of rolled finished steel by the automotive industries at 3.5 per cent in striking a balance for 1921 accords to the automotive industries the distinction of being the second largest domestic consumer, automotive steel purchases in 1921 being placed at approximately 10 per cent of the total steel production. All signs point toward a continuance of the predominant position of automotive demand in the next few weeks.

Aggregate bookings of automotive sheet orders for shipment over the next four weeks have been sufficient to diminish the anxiety of many rolling mills regarding their rate of January and February operations. Full-finished sheets in particular have come in for considerable attention and, as a reflex of the improved situation in the sheet market, that for sheet bars has grown firmer. The chief interest now quotes $30, having booked a very fair tonnage at that price level, although some of the "independents" are reported to be still amenable to bids of $29.

Effective Jan. 1, the leading interest lowered its quotation on cold-rolled strip steel to 3.50c., the 3.75c. quotation having long ago become obsolete. While quite a few routine orders for cold-rolled strip have been placed in the last few days, most buyers are apparently waiting to see if the 3.50c. price level will become bottom or whether "independents" will shade this figure on attractive tonnages.

Pig Iron.—A much broader demand is in evidence, especially for malleable, of which some of the automotive foundries in the Middle West are seeking sufficient tonnages to cover their wants for the first half of the year. Most of the sales, however, are for from 125 to 300 tons, and taking the pig iron market as a whole it may be said that buyers' price views are usually $1 below sellers' asking prices.

Steel.—Orders have been and continue to be placed for modest tonnages of all sorts of steel products, none of the tonnages placed exceeding requirements over the next few weeks. This aversion to commitments beyond the next four weeks is in part due to conservatism and in part to the hearings scheduled for this month before the Interstate Commerce Commission regarding reductions in freight rates on steel commodities.

Aluminum.—The general expectation in the trade is that automotive users will place orders more liberally after this week, when production schedules of builders of higher-grade passenger cars may be expected to be ready. Rumors of odd lots of imported metal being offered at sacrifice prices have been current, but contracts could hardly be placed at below 17.50c. for virgin ingots, 98 to 99 per cent duty paid. Sheets are in fair demand.

Copper.—The stage appears to be all set for a further fractional advance in copper prices when the opportune moment arrives.

Calendar

SHOWS

Jan. 7-13—New York, National Automobile Show, Grand Central Palace. Auspices of N.A.C.C.

Jan. 9-14—New York, Motor Car Body Exposition, Automobile Body Builders Association, Twelfth Regiment Armory.

Jan. 28-Feb. 4—Chicago, Automobile Salon, Hotel Drake.

Jan. 28-Feb. 4 — Chicago, National Automobile Show, Coliseum, Auspices of N.A.C.C.

Feb. 6 to 11 — Seventh National Tractor Show and Educational Exposition, Minnesota State Fair Grounds, Minneapolis.

Feb. 6 to 11 — Winnipeg, Can., Automotive Equipment Show, Western Canadian Automotive Association.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

CONVENTIONS

Jan. 17-20, 1922—Chicago, American Road Builders Association.

Jan. 30-31—Chicago, Fifth Annual Convention, N. A. D. A., La Salle Hotel.

Jan. 30-Feb. 2—Boston, Sixth Annual Conference of the International Delivery Association, Copley Plaza Hotel.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Feb. 24, Mar. 24, April 28, May 26.

New York, Jan. 10-13, 1922—Annual Meeting.

New York, Jan. 16, First Annual Meeting of Advisory Board on Highway Research, Engineering Societies Building.

Chicago, Feb. 1

Minneapolis, Feb. 8-9—Annual Tractor Meeting.

Excise Tax Change Hangs on Bonus Bill

Hanch Confers With Washington Officials on Manufacturers' Sales Levy

WASHINGTON, Jan. 11—Survey of the tax situation shows that the repeal of certain excise taxes depends almost entirely upon the form taken by the proposed soldiers' bonus bill. The automotive industry has directed attention of the Administration to the influence of this so-called "stigma" tax as a sales resistance factor at this time when manufacturers are reducing their prices in an effort to stimulate business.

C. C. Hanch, chairman of the tax committee of the National Automobile Chamber of Commerce, conferred with members of the Senate and House fiscal committees and with the officials in the executive departments Monday. Conferences with representatives of other industries showed that the groups which favored a manufacturers' sales tax were not inclined to favor its use for the payment of the bonus and that they object to a bonus in cash.

The Administration will back the bonus but President Harding has reversed his position. Only a week ago he was in favor of meeting it from interest payments on the debts of the allies but he has abandoned this idea. He contends, however, that whatever measure is passed should stipulate the source of the revenue. It is understood he would not object to some form of sales tax for the purpose but a sales tax in any form will be bitterly opposed by the agricultural "bloc". Representative Bacharach of New Jersey has proposed a gasoline tax but this also will be fought to the end by the powerful agricultural interests.

Soldier bonus legislation and revision of the internal revenue laws will not be reached until late in the session and if a bill is passed providing for payment of a bonus out of interest on foreign debts it probably will be vetoed by the President.

If Congress does not insist upon a cash bonus, the indications now are that with a program of economy it will be possible early in 1924 to repeal some of the remaining excise taxes.

DAVIS WILL PRODUCE NEW CAR

RICHMOND, IND., Jan. 9—The Davis Motor Car Co. will bring out a smaller 6-cylinder model some time in March or April. This will be fitted with a new model Continental engine with bore of 3 in. and stroke of 4¼ in. The wheelbase will be 114 in., axles will be Timken and Delco starting, lighting and ignition will be used. The weight will be around 2400 lb. and the price will be in the neighborhood of $1,250.

FENN TO ADDRESS STUDENTS

NEW YORK, Jan. 11—F. W. Fenn, chairman of the motor truck committee of the National Automobile Chamber of Commerce, will speak before the students in the highway engineering class at the University of Michigan on Jan. 23. His subject will be "Highway Transport Cost and Record Systems." Fenn will lecture at the University of Toronto Feb. 9 and 10 on "Highway Transport and Rural Motor Express Lines."

MOSLER TO BE SOLD

NEW YORK, Jan. 9.—An order has been issued by Federal Judge Hand upon petition of Peter B. Olney, Jr., and Archibald R. Lemieux, co-receivers, directing the creditors of A. R. Mosler & Co., spark plug manufacturers, to show cause why the factory of the company at Mt. Vernon, N. Y., should not be sold to the Noesting Pin Ticket Co., for $65,000. Hearing on the order will be held Jan. 18.

INDUSTRY AT CONFERENCE

WASHINGTON, Jan. 12 — Roy D. Chapin and Windsor T. White have been invited by Secretary of Agriculture Wallace to represent the automotive industry at the agricultural conference which will begin here Jan. 23. Harvey S. Firestone will represent the National Highway Transport Committee.

Erie R. R. Adopts Trucks in System

New Plan of Deliveries More Economical, General Manager Says

NEW YORK, Jan. 9.—Transportation of inbound freight from the cars direct to the consumer by motor trucks has been begun by the Erie as part of the road's new system for bringing the freight from the New Jersey rail terminals into this city without the use of floats.

About 100 trucks supplied by the United States Trucking Corp. are operating under the new plan. Freight arriving at Jersey City in carload lots is loaded in the trucks, the trucks bringing the freight to the Manhattan consignees on the Erie's ferries during the non-rush hours. Other freight is brought to the Independent Warehouses' branches at Laight and Greenwich streets.

J. J. Mantell, general manager of the Erie, said the new plan would be more economical than the old, which meant the transfer of the cars across the river on floats and running the cars upon the piers, whence trucks sent by consignees carted off the freight. The use of much pier space for the trucks was one of the big items of expense.

The new system, Mantell said, would be extended largely in the near future. The intention is to use containers that hold a truck load, which are so constructed that they can be put on the motor truck chassis and, on arrival at destination, be emptied quickly.

VICTOR TO EXCEED 1920.

SPRINGFIELD Ohio, Jan. 10—C. A. Swinehart, salesmanager of the Victor Rubber Co., following a conference with branch managers and representatives here yesterday, announced that the company expected to repeat its record of last year on tire sales when it increased its sales 60 per cent over 1920. Prospects, he said, are that the salesmen would exceed this increase in 1922.

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Engineering Research Problems Discussed by S. A. E.

Fuel research session feature of annual winter meeting. Other research problems discussed. Motor bus development predicted. Engineers view their work from merchandising standpoint. Over 700 attend.

THE nineteenth annual meeting of the Society of Automotive Engineers, held in New York City, January 10 to 13, served to emphasize the importance of the part which the engineer is being called upon to play in the adjustment of the economic problems of the industry. Past-President David Beecroft, speaking at the annual banquet, sounded a fundamental note when he declared a firm belief in the future of the industry and when he stated emphatically, as regards the much-discussed saturation point, that "the saturation point for automobiles and trucks is the saturation point of transportation."

The emphasis on research in current engineering problems was a dominant feature of the meeting. Besides the session entirely devoted to research, there was considerable material of a similar nature running through many of the other sessions. Fuel research, in particular, received considerable attention which served to emphasize again the vital importance of such investigations. All of the sessions tended to promote the construction of better and more efficient motor vehicles.

A survey of all the sessions held during the four-day gathering indicates that the individual members of the organization and the society as a whole are already working along the lines indicated by President Bachman, when he said in his inaugural address, "We are entering a period during which the engineer must view his problems from the commercial as well as the technical side."

Viewed from the standpoint of constructive effort, the meeting was one of the most successful ever held by the society. Over 700 attended the technical sessions, while there were nearly 900 at the annual dinner. About 600 were present at the carnival, which can be briefly but adequately described in the words of the rural weekly, "A good time was had by all."

The chief feature of the technical sessions was the presence of Harry Ricardo, the distinguished British engineer, whose research work concerning the factors affecting combustion has attracted so much attention recently in engineering circles.

The winter meeting began with the meeting of the Standards Committee, at which a large majority of the recommendations previously submitted were adopted. At the general business session the following officers were formally declared elected:

President, B B. Bachman; first vice-president, J. V. Whitbeck; second vice-presidents, F. E. Watts, H. E. Morton, O. W. Young, V. E. Clark and C. B. Segner; treasurer, C. B. Whittelsey; councilors, Lon R. Smith, C. F. Scott, H. M. Crane and W. R. Strickland.

The motor transportation session was well attended and developed some lively discussion.

The other technical sessions were as follows: Airplane engine, body engineering, fuel and engine research, lubrication, materials, and passenger car.

The annual dinner brought forth some interesting comments on the present engineering and economic status of the industry. Past-President Beecroft pointed out the necessity of looking forward rather than backward and emphasized the great privileges and possibilities for development offered to engineers of the present generation.

Particularly emphatic were the assertions of Charles F. Kettering, who served as toastmaster. He parodied the "Grasshopper" song, which was one of those chanted during the dinner, and suggested that the "r" should be eliminated so that a "gashopper" would remain. Then, after mentioning price cuts, he proposed the refrain:

"They are all playing poker.
They are all looking for the joker.
They are all going broker."

"The automotive engineer," said Kettering, "has got to quit looking at the past and face the future—and his company's creditors. Up to this time the engineering profession has been guided by a lot of people specially ordained not to listen to anyone but themselves. Advertising managers have made poor Ananias cry.

"The time has come for engineers to have ideas of their own and tell them to the management. They must tell what a good automobile really is if they, in their peculiar positions, really know.

"I wonder if we know where we are going? The automotive industry is just as predominant as the bread and butter industry. It is a great transportation activity. If everyone everywhere ever had a practical problem it is to find out what is the simplest thing he can do and what it will do. It is true of every industry that competition comes only when progress stops.

"It is up to engineers to set new standards of economic values. The only reason you've got a second-hand problem is because your new cars are no better than your second-hand ones. We're only three years away from the war, and for the Lord's sake blame it on that while you've got a chance."

President Bachman, in his inaugural address, made a striking statement of the fundamentals upon which rests the progress of the automotive industry. He pointed out the basic fact that the Society of Automotive Engineers has progressed because it has served. This, he said, is basic and fundamental. "The task must always mean more than the reward, if we are to succeed," said Bachman. He then stated his belief that there is a strong tendency to over-organization in modern industry, and his feeling that a simple program of service is the one to which the society can best apply itself during the coming year. He left with the members the watchword of service as the basis for the progress which is hoped for under his administration.

Arthur Richmond Marsh, editor of *The Economic World,* spoke on the topic, "How Shall We Know When Business Has Really Turned the Corner?" He outlined for his audience a few elementary economic principles and then showed their application to the present economic situation. He pointed out the fact that money is merely a medium of exchange and that, in the last analysis, only goods can be used to buy goods.

Perhaps the most interesting statement in Marsh's talk, from the standpoint of the immediate practical situation of the industry, was that "competition is always the keenest and conditions the most difficult in an industry when it is operating between 75 and 90 per cent of its total capacity." This is the present condition of the automotive industry. During such a time, Marsh said, every manufacturer is not only worried by the spectre of overhead costs, but is near enough to capacity to think that by price cutting or some other means he may be able to get into 100 per cent production, reduce his overhead and accomplish what his fellow manufacturers have been unable to do.

Not only did the general gatherings at the annual meeting bring out much constructive thought, but the technical sessions, as well, developed considerable interesting discussion. In certain instances, however, there was a noticeable lack of familiarity with the papers on the part of members attending the session, and as a result the discussion in some instances tended to be a rather scattered collection of thoughts on the general subject, rather than a close discussion of the points involved. The efforts of the society's permanent staff to get the papers in the hands of members well in advance of the meeting have done much to offset this difficulty, but further co-operation from the individual members is necessary if discussions are to attain their full measure of value for all concerned.

Research Session

By Herbert Chase

PROBABLY the best attended and in many respects the most important and interesting session of the Annual Meeting was that devoted to the paper entitled "Recent Research Work on the Internal Combustion Engine" by Harry R. Ricardo. This paper supplements earlier reports printed in these columns last year, and gives much new material regarding the progressive and timely work being done in England by this prominent British engineer who came to this country primarily to present this paper, which is printed on other pages of this issue. Mr. Ricardo was given a cordial reception by the members of the Society and was complimented by the chairman, Henry M. Crane, and by many other members for the excellent paper he had prepared. The author was particularly commended for his willingness to permit others to benefit by the results of his research work before this has been completed, especially since in so doing he faces the possibility of having, as a result of later experience, to change views or conclusions reached in the paper. Mr. Ricardo frankly admitted, in fact, that his recent work had revealed facts which made it necessary to alter some previously published views especially regarding the effect of turbulence upon detonation.

In opening the discussion Chairman Crane mentioned the fact that most of the work covered by Mr. Ricardo's paper had been done on a single-cylinder engine, thus avoiding many of the difficulties involved in securing proper distribution, which must be faced by those designing multi-cylinder engines.

C. P. Grimes mentioned recent tests, which he has conducted in which he found that economy was increased by increasing the temperature of the cylinder wall. He also mentioned tests made in this country several years ago in which kerosene had been used successfully in an auto-

mobile engine in which the charge had been diluted by the addition of exhaust gas. This dilution had, however, resulted in considerable decrease in power, which accounted for lack of interest in developments of this character.

Prof. Wilson took exception to the impression conveyed by Mr. Ricardo's paper to the effect that pressure has a relatively small bearing upon combustion phenomena. He stated that the rate of reaction in the case of gases increases approximately as the cube of pressure.

Thomas Midgley, Jr., criticised some of the conclusions reached as not being fully substantiated by the data given. He said he was unable to see how the experiments on the adiabatic compression machine could be considered as comparable to engine conditions, in view of the fact that ignition was spontaneous and not by electrical means as in internal combustion engines. He recalled Prof. Dixon's work in which photographs of the flame were taken and mentioned the value of tests made in such a way as to enable the observer to actually see and photograph the combustion phenomena.

E. R. Hewitt mentioned tests he had made by dropping a bomb filled with a combustible mixture into molten lead heated to various temperatures. In some cases he found that complete combustion occurred without a rise in pressure, the combustion having proceeded at such a slow rate that the heat was dissipated as rapidly as it was liberated.



Harry R. Ricardo

O. C. Berry criticised the British practice of giving results in terms of indicated horsepower, in view of the difficulty of making accurate measurements of this power, but said that he realized certain advantages from the theoretical standpoint if the measurements were sufficiently precise. He said he favored measurement based on b.hp. due to the certainty with which brake power can be determined. R. W. A. Brewer asked whether any of the author's experiments had been conducted with gasolines of the grade used in this country, and L. H. Pomeroy mentioned the frequently noticed effect of carbon deposits upon detonation.

G. A. Green outlined some exhaustive tests made by the Fifth Avenue Coach Co. on the Ricardo slipper-type aluminum piston. These, he said had resulted in considerably less wear, higher mechanical efficiency, lower oil consumption, less carbon deposit and slightly higher economy.

Herbert Chase mentioned the fact that the degree of spark advance had been found in tests made by the Bureau of Standards to have a marked effect upon detonation, and asked whether this factor had been given due consideration in Mr. Ricardo's work. He asked also regarding the means used to determine when detonation took place. He commented favorably upon the work with constant compression stratified charge engines conducted by Mr. Ricardo and stated that he hoped that a number of individuals who have been experimenting recently with this type in this country would be willing to give out data on their work similar to that which Mr. Ricardo has given.

In replying to the discussion Ricardo stated that in his belief the matter of pressure as affecting detonation is important, but that chemists with whom he is collaborating held other views in this regard. He said that he is quite familiar with the experiments conducted by Prof. Dixon on compression and flame movement, but that these experiments had been made without sufficient regard to the effect of cooling losses, a factor which had been given careful consideration in experiments reported in the paper. Regarding the use of i. hp. instead of b. hp. readings, he stated that while the i. hp. readings were not perhaps absolutely correct, they were sufficiently close for comparative purposes. Furthermore they eliminate the friction element which varies with each engine, and therefore render results more nearly comparable.

In the tests made with exhaust gas used as a diluent, the precise amount of exhaust gas used was not measured, but an estimate of the amount used can be had by comparing the m.e.p. figures given, said the author. The distinctive sound or pinking which accompanies detonation was, he said, the means of determining when detonation took place. The author said that he fully recognized the fact that carbon deposits have a material effect upon detonation, and that great care was used to control this factor. In the case of the adiabatic compression machine the combustion chamber was always cleaned after a detonation in which carbon is deposited had occurred, as it was found that unless this was done succeeding tests were erratic.

In concluding his remarks Ricardo stated that he is still enthusiastic regarding the possibilities of the stratified charge type of engine but regards the Diesel engine, for automotive applications, as being very far in the future.

The session was concluded by a rising vote of thanks to the author for his most excellent and stimulating paper

Fuel and Engine Session

By Herbert Chase

THE fuel and engine session was devoted to the presentation and discussion of three papers relating to fuel and the study of combustion phenomena. The first of these was entitled "Manifold Vaporization and Exhaust Gas Temperature" by O. C. Berry and C. S. Kegerreis. In this the authors gave it as their view that the most promising method of handling present-day fuels is by heating the charge or the fuel contained in the charge. Various methods for doing this are discussed and data obtained in experiments made at Purdue University with a view to determining the best temperature for the hot spot are given. The authors conclude that with properly designed manifolds and carbureters fuels considerably heavier than those now in common use can be used if necessary without seriously affecting the power or operation of present-day engines.

Aside from a very excellent discussion prepared by P. S. Tice, but presented only in part, the discussion consisted chiefly of asking questions regarding methods followed in the test. Mr. Berry stated that a spark advance of 31 deg. was carried throughout all tests, and that the temperature measurements were made close to the exhaust valve of one cylinder, the thermocouple employed being so insulated as to prevent false readings which might

result from direct heat conduction to adjacent metal parts.

The paper by Thomas Midgley, Jr., and T. A. Boyd entitled "Methods of Measuring Detonation in Engines" was devoted to a description of four methods which have been employed in work done in the testing laboratories in the General Motors Research Corp.

The listing method, he said, is erratic due to the personal factor of the observer. The indicator method is better because a positive record is obtained. The use of a thermocouple and galvanometer is not suited to accurate work because of a number of variable conditions which it is difficult to segregate and control. The bouncing pin method which has been developed to give a cumulative measurement is quite fully described and possesses certain advantages not secured by other methods.

There was but little discussion of this paper or the paper by Thomas Midgley, Jr., and W. K. Gilkey, entitled "Spectroscopic Investigation of Internal Combustion" which followed, these being more of an educational nature than intended to create discussion. The last mentioned paper described the apparatus and some results obtained by careful work conducted by the authors. It appeared from the paper and such discussion as followed it that investigations of this character present many difficulties, and the results are difficult to evaluate, although they may ultimately result in securing many valuable facts.

Lubrication Session

By P. M. Heldt

THREE papers dealing with topics relating to lubrication were presented at a session held on Wednesday afternoon. Winslow H. Herschel, associate physicist of the Bureau of Standards, presented a paper on Viscosity and Friction. Mr. Herschel said that:

"The study of lubrication is made more difficult by the fact that there are different regimes in which different properties of the lubricant have the controlling influence. At the highest speeds and lowest pressures the friction is nearly constant under widely varying conditions. At lower speeds the viscosity of the lubricant and the kind of material constituting the rubbing surfaces have a marked effect; and at the lowest speeds and highest pressures another property of the lubricant, which can be called oiliness, has the predominant influence. Frequently, only two regimes are considered; that of complete film lubrication where the viscosity has the greatest effect, and that of incomplete film lubrication where the oiliness becomes of major importance. The transition point, where the friction is at a minimum, comes within the former regime. The influence of bearing metals is evident with incomplete film lubrication, and in the greater part of the regime of complete film lubrication.

"In selecting a lubricant the properties that need to be considered can be divided into two classes; properties indicating that it is suitable for the purpose at hand, and those giving assurance that it will be reasonably lasting in use. It is not the purpose of this paper to consider the question of the deterioration of oils, but merely the above-mentioned properties of new oils that indicate suitability at least for short-time use. If all the changes of the lubricant with time, by evaporation, oxidation or otherwise are disregarded, the only remaining properties that determine the friction are viscosity and oiliness."

In the paper the relation of absolute viscosity to the readings of the instruments ordinarily used, the estimation of the viscosity at one temperature from the viscosity measured at another temperature, friction tests of bearing metals, incomplete film lubrication, the oiliness of lubricating oils, service tests, and desirable features of oil friction testing machines were discussed and the following conclusions were arrived at:

(1) In comparing viscosity and friction it is necessary to use a unit of absolute viscosity, preferably the poise or centimeter-gram-second unit
(2) The viscosity in poises can be calculated from times of flow in seconds by suitable equations that are given for the viscosimeters most frequently used
(3) In estimating the change of viscosity with the temperature, it is convenient to make use of the observed fact that, with certain restrictions, the logarithmic viscosity-temperature graphs are straight lines which meet at a point
(4) Friction tests with complete film lubrication can give no information in regard to the quality of a lubricant, and viscosity is measured more readily with a viscosimeter
(5) The only use of a friction-testing machine for determining quality of a lubricant is in measuring oiliness, and this must be done at high pressures, low speeds or other conditions which cause incomplete film lubrication. It can be assumed that the pressure must be over 800 lb. per sq. in. (56.2 kg. per sq. cm.) or the speed less than 40 ft. per min. (0.20 meters per sec.)
(6) Bearing metals also should be tested with incomplete film lubrication
(7) It is impracticable to keep a constant smoothness of rubbing surfaces with a journal bearing, so that changes in friction, commonly supposed to be due to changes in quality of lubricant, are generally due to changes in smoothness
(8) Service tests are even more untrustworthy than friction tests, because there are a multitude of bearings whose temperature cannot be controlled or estimated readily
(9) The best solution of the difficulty appears to be the use of a disc machine. The disc could be kept of constant smoothness by removing an interchangeable veneer and subjecting it to a standardized polishing process after the test of each oil, if necessary. A journal could not be kept polished in this way because the radius of curvature, and consequently the film thickness, would be changed.

In the discussion of this paper the subject of temperature of oil film on cylinder walls was referred to, and one member said that some years ago he had had occasion to determine the temperature of the film in an Hispano-Suiza aircraft engine. This engine had a threaded steel liner screwed into an aluminum cylinder casting, and as it was impossible to get an absolute fit of one threaded portion in another, the heat had to flow through an air gap as it were, which necessarily retarded its flow to the water jacket. It was found that in this engine the oil film temperature was about 220 deg., and in ordinary engines it would be less. The reason given to explain this low temperature of the film was that a film of dead gas existed on the inside of the oil film which protected the oil film, keeping down its temperature.

The question was raised whether there was any connection between the viscosity, the piston clearance and the

piston friction. Mr. Herschel explained that the resistance was inversely proportional to the thickness of the lubricating film. There seemed to be a great deal of haziness in the minds of the audience as to what constituted oiliness. The author explained this by saying that lard oil is known to be a good cutting oil, while mineral oil is less efficient for this purpose. Cutting oils act under very intense pressures. It is possible to have mineral oil and lard oil of the same viscosity and the difference in the action of the two oils is then due to differences in oiliness.

Tension and Friction

The surface tension of all oils is practically the same, but the friction of an oil-lubricated bearing depends upon the interfacial tension and not upon the surface tension. The Bureau of Standards is now investigating the effect of organic acidity on the interfacial tension and hence on the oiliness. It was brought out in the discussion that information on oil films is very meager. The journal is not concentric with the bearing except at very high speeds, and for lower speeds the thickness of the film varies, being least at the line of minimum pressure.

It was stated that Professor Carpenter had found that the bearing metal showing the least friction wore away most rapidly. In this connection Mr. Herschel pointed out that the rate of wear of bearing metals was merely a function of the perfection of fitting.

It was also brought out that oiliness is dependent upon the proportion of the unsaturated constituents in the oil. With an excess of unsaturated compounds there is a tendency to gumming; enough saturated compounds are wanted to give good oiliness, but not enough to cause gumming. According to a report by the Lubricants and Lubrication Inquiry Committee in England it is the unsaturated compounds which are the most valuable constituents of lubricating oil.

Mr. Chilton said that he had made some tests of oil derived from shale oil and it had been found that this was a better lubricant than oil from crude petroleum.

Fluid Friction and Transmission Efficiency

A paper on the Relation between Fluid Friction and Transmission Efficiency was read by Neil MacCoull. In this paper the author, who is connected with the Texas Co., gave an account of some tests made to determine the friction losses in automobile transmissions under different conditions of load, speed, viscosity and quantity of lubricant. The method used for making these tests is of interest. Two four-speed truck transmissions were coupled together with their rear ends and the two cases were joined together by means of stays and supported freely upon the driving shafts, so that they had a tendency to turn around this shaft. The couple with which they tended to turn was measured by providing the cases with a torque arm to which a balancing weight could be applied. This torque, together with the speed of the shafts, gave the power loss in the transmission. The power transmitted was measured directly by a dynamometer to which the transmission farthest from the power source was connected.

It was found that the torque loss was greater the lower the temperature of the oil in the transmission, as would be expected. The no-load loss, for instance, was about five times as great when the oil was at 40 deg. Fahr. as when it was at 120 deg. Fahr. When the transmission was under load the variation of the loss with the oil temperature was materially less. Different oils gave widely different no-load losses at low temperatures, while at temperatures exceeding 150 deg. Fahr. the losses approached very closely to each other.

This series of tests has been begun only recently and is far from completed. No conclusions were drawn, and it is expected that further results will be presented at a later meeting of the Society.

In the introduction to his paper Mr. MacCoull gave an analysis of the power losses due to different causes in automobile propulsion, including the losses due to wind, tires, wheel bearings, rear axle gearing, transmission, engine friction losses and engine pumping losses. It was pointed out that there was very little experimental data available on the losses due to the air resistance at different speeds, and in the discussion of this paper one member stated that tests to determine the air resistance of vehicles were to be made at the Kansas Experiment Station. This Station has constructed a concrete pond on which is to be placed a raft of sufficient size to carry the car on which measurements are to be made. In Kansas there are strong and steady winds during certain seasons of the year; the raft with the car upon it will be oriented so the radiator will point directly into the wind, and the drifting force due to the car will then be measured and compared with the strength or velocity of the wind.

Reference was also made to tests made on Class B trucks on a chassis dynamometer during November. It was found that the reduction of loss due to the heating of the oil was much less in a machine that had had considerable use than in a new machine. It was also found that most of the reduction in frictional loss resulted from the first 10 to 15 deg. temperature rise.

The Mechanism of Lubrication

Robert Wilson and W. P. Barnard 4th presented a paper on The Mechanism of Lubrication. They discussed the general theory of "greasy" and fluid friction, partial and complete lubrication and pointed out that all the customary quantitative tests and specifications for oils are designed mainly to meet conditions of fluid friction where the motion of the bearing carries and maintains a film of liquid between the metal surfaces. For this purpose, the general rule to use the oil of the lowest viscosity that will maintain the fluid film is probably sound. The authors pointed out, however, that while a properly designed bearing might be working under conditions of fluid friction the greater portion of the time, the real advantage of an oil over other fluids did not appear at all under these conditions, as evidenced by the fact that bearings running continuously at reasonably high speeds and low loads could be lubricated with entire satisfaction by glycerine solutions or kerosene, or even by air under certain extreme conditions.

On the other hand, it is indisputable, the authors stated, that neither glycerine solutions nor kerosene are satisfactory lubricants for metals under actual operating conditions. To show up their deficiencies, however, it is necessary to note their behavior under conditions of slow speed or heavy load, as when starting or stopping. Under such conditions of *partial* lubrication the presence of water, glycerine or even kerosene gives friction coefficients nearly as high as for the dry metal surfaces, and seizure or serious abrasion is likely to result, with consequent excessive friction and overheating after the bearing has run for a short time. Under these conditions lubricating oils give much lower friction coefficients, with little tendency for the surfaces to seize or abrade. This behavior is frequently referred to as the property of "oiliness."

To study some of these fundamental aspects of the mechanism of lubrication, the research laboratory of applied chemistry at Massachusetts Institute of Technology has undertaken an extensive research program with the financial support of the General Motors Research Corporation. Certain new methods of studying lubricating

films have been developed and are described in detail, together with a discussion of the preliminary results obtained therewith, which in general appear to support the above-mentioned hypothesis of a plastic solid film composed, it is thought, mainly of certain colloidal constituents in the oil.

Professor Wilson, who presented the paper, said that there were at least six reasons why a study should be made of the property of oiliness. He also emphasized the enormous range in the coefficient of friction, which varies from about 0.3 for dry or unlubricated bearings to 0.00075 for well lubricated bearings operating under the most favorable conditions. By means of lantern slides it was shown that as a bearing is started up, the friction drops very rapidly from the high value for static conditions which is due to the existence of metallic contact when the journal is at rest. A minimum value of the friction is reached at a certain speed, and beyond that speed the friction increases again. It would evidently be best to operate at the speed corresponding to minimum friction, but designers are afraid of the nearness of the regime of high speed, high friction, and operate at a much lower speed, where the friction is higher.

A small amount of some fatty acid in oil makes a big difference in the oiliness. There is something in oil, Professor Wilson said, that builds up the lubricating film by absorption, and he hoped to soon have enough of this constituent to find out what it was. There are a number of commercial oils on the market in which advantage is claimed to have been taken of this property of organic acids to increase the oiliness. Heating mineral oils with sulphur compounds increases the static friction.

Motor Truck Transportation Session

By Floyd E. Williamson

MOTOR bus development and the various phases of truck operation came in for a good share of discussion at the Truck Transportation session of the S.A.E. held Wednesday afternoon. Walter Jackson presented a paper on the Past, Present and Future of the Motor Bus, and Economics of Motor Transport was the subject of a paper by Merrill C. Horine, Engineer, International Motor Company.

Jackson declared that in his opinion street railway companies were the logical operators of motor buses. He decried the use of jitneys and individually operated cars, for in many instances he said they were run upon an uneconomical and irresponsible basis. Street railway companies, however, can operate buses to immense advantage in instances in which additional trolley equipment would otherwise have to be provided. Company ownership would secure a higher class of service and more efficient operation. It was pointed out that in cities having a well defined electric railway transportation system there was small chance of the motor bus destroying that system or even crippling it, but in such cities there is an excellent opportunity to conduct bus lines as subsidiaries to the electric railway, providing fares can be adjusted according to the class of service rendered.

In the discussion of this subject comparative costs of operation and installation formed the basis for considerable argument. So far as the latter item is concerned there was, of course, no dissension of opinion, for the motor bus in that respect has a decided advantage. Figures were presented to show that it costs between $6,000 and $10,000 to install a mile of trolley overhead equipment above in addition to the cost of the rolling stock which was shown to be higher than the cost of motor buses. Operation costs, however, in the opinion of many who entered into the discussion, are to the advantage of the electric railway in some instances, especially those in which the cars can be run full, standing room included. Others contended that with proper attention a motor bus would prove as economical, if not more economical than the trolley, size for size. Those who held to this opinion, however, admitted that the density of traffic would play an important part in determining this point. So far as upkeep is concerned the general opinion seemed to prevail that there should be little difference in the maintenance of motor buses and the rolling stock of a trolley company.

Concerning the trackless trolley as a competitor of the motor bus, it was agreed that these lines have not the flexibility of the motor bus, which, by the way, was shown to be one of the chief advantages of the latter vehicle over any other means of transportation. G. A. Green said that trackless trolleys are heavier, more complicated and probably more expensive than motor buses.

Another great advantage of the motor bus also lies in the fact that it can materially aid in speeding up traffic now congested by street car operation. It is no uncommon sight to see a trolley car stopped at a street crossing to allow passengers to alight or get aboard and thus delay 20 or 30 vehicles which are forced to wait until the passengers have safely reached the sidewalk. Were the minutes lost throughout the country in this manner totalled up they would reach an enormous number of hours lost each day. Use of bus transportation, naturally eliminates this delay for passengers are taken to the edge of the curb and other vehicles proceed upon their way undisturbed. In discussing bus design the question was raised as to whether or not an ordinary truck chassis is suitable for a bus body. Opinions expressed on this subject were decidedly in favor of a specially designed chassis. The motor bus is a carrier of human freight, and this class of freight demands a definite amount of space. About seven ft. is the width required for comfort and economy and this is about 14 in. wider than the dimension adopted by most truck manufacturers. The frame of a standard truck is also about 30 to 40 in. from the ground and this requires from three to four steps for passengers to enter and leave. In order to secure the maximum of efficiency and satisfaction in bus transportation the general opinion prevailed that special chassis should be employed.

Economics of Motor Transport

Horine's paper and the discussion following its presentation was centered, to a great extent, around the relation of the motor truck to the highways.

"The highway," said the paper, "which until the development of the railroad was the chief factor in the economic and military progress of nations, is once more taking its place as the most important factor in transportation."

It is for this reason that automotive engineers must turn their attention to highway development. Legislation that practically drives the heavy truck from the highways has been enacted in many states. Such legislation, on the surface, may appear to be the result of sound reasoning, but flimsy highways will not stand the wear and tear that is bound to result if heavy trucks are used upon them. On the other hand, heavy trucks, Horine contended, offer a

more economical means of transportation than do those of lighter weight and not only the truck operator, or shipper, benefits from their use, but the general public as well. Reduced transportation costs mean reduced costs of goods to the consumer.

The highway built to carry only vehicles of small load capacity, said Horine, will be put to a harder test and will be compelled to bear more weight than will the one designed to carry heavy vehicles. There is a certain amount of freight which must be hauled over the highways. The combined weight of several small vehicles is greater than the weight of one large one. The operation costs are considerably higher for a fleet of small trucks than for a single large one. Roads built to carry heavy trucks need not be built as wide as those for the lighter vehicles, since there will not be the density of traffic.

These points and many others were brought out to show that the elimination of the heavy truck is unsound from an economic standpoint, and to show that automotive engineers must carry their research work farther than to the truck itself and concern themselves with the surface upon which it is to travel.

The question of road building was discussed pro and con by several speakers, one who voiced the opinion of most of those present when he said, "Build foundations and you'll have roads; drain them and they'll stay."

Truck design was also taken up by several in the discussion and it was predicted by one speaker that a few years hence pneumatic tires would be used upon all motor vehicles. W. P. Kennedy made a plea for better spring suspension and suggested that there are now too many sizes of trucks produced for maximum economy in manufacture.

Francis W. Davis commented favorably upon the Connecticut law which limits the weight carried to the rated capacity of the truck and per inch width of tire, saying that such legislation, at first considered radical and detrimental, may after all prove a boon to the industry.

Passenger Car Session

By P. M. Heldt

THE session on Friday morning was inaugurated by the presentation of a paper on passenger car brakes by J. Edward Schipper. Mr. Schipper pointed out that during the past ten years great efforts had been spent on endeavors to increase the acceleration of cars, because the quality of a quick "get-away" made a car not only more enjoyable but also safer to handle in traffic. On the other hand, the problem of quick deceleration, which was just as important, had been more or less neglected. In testing out experimental cars, test drivers are often instructed to try and break the car up in driving over rough roads, the engineer feeling pretty safe that he will not succeed, but no instructions are ever given to descend long hills and try to burn out the brakes, because it is only too well known that the tester would succeed. The best brakes now carried on American cars are inadequate for service in mountainous districts, although they serve satisfactorily in flat and moderately hilly country.

In stopping a car the brakes convert the kinetic energy of the car into heat energy and radiate the heat to the atmosphere. Many of the present brake systems are absolutely incapable of disposing of the heat as fast as it is generated without reaching an excessive temperature if the descent is of considerable length. The steeper the grade, the more quickly the brake temperature will reach the danger point. Many of the hills encountered in the Allegheny Mountains, for instance, are so long that the lining materials will reach a temperature sufficient to burn them.

Mr. Schipper in his paper discussed the factors of design, means for securing uniform and effective braking power, exposed and protected types of brakes, brake actuating means, formula for brake drum size, car stopping ability, brake equalizers, brake linings, brakes of the future, the engine as a brake, four-wheel and front-wheel brakes, the servo principle of operation, miscellaneous braking methods and truck brakes.

H. W. Alden, who presided at the session, in throwing the paper open for discussion, said that as the time was limited, it would probably be best to confine the discussion to the use of the engine as a brake, the transmission brakes compared to two pairs of brakes on the rear wheels, and four-wheel brakes.

H. W. Slauson referred to trouble with breakage of brake shoe anchorages. Mr. McCulla said that in fuel economy contests it was the practice to use an overrunning clutch in the transmission, to bring the car up to speed and then let it coast. The objection to the use of the engine as a brake was the effect this practice had on the fuel consumption. Even though the throttle was nearly closed while the engine acted as a brake, a considerable amount of fuel was still being pumped through the cylinders, unless the expedient of providing the carbureter with an air valve opening the engine cylinders to the atmosphere was resorted to. In England a carbureter was being marketed which possessed this feature.

One member said that a car which he had driven thousands of miles was provided with a transmission brake and that he was very much pleased with its service. He had never had any skidding with this brake. The brake also required less effort to apply than a rear-wheel brake. Another member expressed the view that, if the transmission brake could be made with sufficient heat radiating capacity to dispose of the heat generated, it was the brake to use

H. M. Crane said that for smooth action of any kind low unit pressures were required, but low unit pressures involved high surface speeds. In American cars the rotary speed of transmission brakes was anywhere from 3½ to 5 times as high as that of the rear-wheel brakes. Uniform distribution of pressure over the whole brake surface was equally necessary, and that was where the shoe type of brake fell down. We had only 4 or 5 in. pedal motion available, and if a considerable portion of this pedal motion were required for taking up lost motion, there must necessarily be a loss in brake power. With the brake of his design, which was described and illustrated in the paper, it was possible to slide the wheels of a 5500-lb. car with less than 50 lb. pressure on the brake pedal. The car had a rear-axle ratio of 4 to 1, and this, together with the use of a large diameter brake drum, made for a high surface speed in the brake.

To design brakes so that they alone would be adequate for controlling the speed of large cars in mountainous country was practically impossible. The engine was an ideal brake. In serving as a brake it acted substantially as an air compressor, the kinetic energy of the car being

expended in compressing and heating the air. The engine was thoroughly lubricated and it was also efficiently cooled. With small cars it might be possible to make the brakes sufficiently powerful to serve satisfactorily in mountain districts without recourse to the engine. One advantage of the transmission brake was that there was much less lost motion in the brake connections, as there was only a single set of linkages, instead of two. Mr. Crane said that he did not believe in four-wheel brakes; that he considered them to be less safe than the ordinary braking system.

Four-Wheel Brakes

Fred Duesenberg, as a user of four-wheel brakes, was called upon to say something on the subject. He said that, when driving a car equipped with rear-wheel brakes only in the Uniontown race, he burned out both sets of brakes and had to resort to the use of the engine. He had then adopted four-wheel brakes. In connection with these he used drop-forged brake drums with cooling flanges turned upon them, which, of course, made a rather expensive construction, but the cooling surface had been increased from 10 to 12 times, and after the descent of a long hill the drums were still sufficiently cool so one could put his hands upon them.

It had been held recently that there should be some difference in the effectiveness of the front and rear brakes, that the rear brakes should be stronger. They had put heavier springs on the front brakes so that the rear brakes took hold first, and this had given them excellent service. The hydraulic operation of the brakes, to which reference had been made, did away with a lot of parts and it gave perfect equalization without the use of any special equalizing gear. (The objection raised to the hydraulic brake gear was that if there was a break in any part of the system all of the brakes became ineffective. Of course, an emergency brake in the form of a transmission brake is generally provided for such eventualities.)

The second paper of the session was on Developing a Method for Testing Brake Linings, by S. von Ammon, associate mechanical engineer of the Bureau of Standards. The investigation of brake lining materials by the Bureau of Standards was undertaken as a result of the general policy of the Motor Transport Corps to standardize the requirements for materials and supplies for automotive vehicles for army service. Many tests of brake lining materials had been made in the engineering laboratories of the Motor Transport Corps in 1917 and 1918. At that time, however, it was not possible to devote much study to the determination of the most satisfactory conditions for a laboratory test. The conditions under which manufacturers of brake lining materials had tested their products and under which acceptance tests were made by car builders were so varied that results were not comparable and had yielded but little information. This lack of definite information and a recognized method of test made it necessary to develop a standard test for determining the relative merits of brake linings which could be used as a basis for specifications. In December, 1919, a subdivision of the Truck Division of the Standards Committee formulated a tentative program for developing a standard method for testing brake linings and invited brake lining manufacturers to have engineering representatives attend a conference at the Bureau of Standards on Dec. 18, 1919, to discuss the proposed program. The equipment designed jointly by the Motor Transport Corps and the Bureau of Standards, and built by the former, was completed so that preliminary tests could be begun in August, 1920.

The various features which it was thought required investigation are shown in the following abbreviated form of the original program. Its main divisions are considered as (*a*) fundamental and (*b*) supplementary. Under (*a*) the coefficient of friction is investigated in relation to

(1) Dry lining.
(2) Influence of water, oil, temperature and wear.
(3) Constancy of the coefficient.

Durability also is studied under (*a*), it having been decided to adopt the following:

(1) A standard rate of energy input, with consideration of established practice and limited to engine power.
(2) A drum of standard material and surface, and 12 to 16 in. in diameter, at a speed of about 1200 r.p.m.
(3) Stock sizes of linings; preferably the actual size considered.
(4) A policy of wearing linings down to about one-half of their original thickness.
(5) A long-time endurance test with the temperature kept constant by cooling water.
(6) A severe service test, the temperature of the drum being allowed to rise to equilibrium with constant power absorption.

The supplementary division includes

(1) Rivet-holding ability.
(2) Sticking after cooling on a hot drum of both new and worn linings.
(3) Change of thickness due to the absorption of water and oil.

The general considerations are inclusive of the

(1) Use of flexible-band shoes for supporting linings.
(2) Adoption of a standard method of riveting samples to shoes.
(3) The determination of the proportion and quality of asbestos and other materials used is not considered necessary, nor is a test for volatile matter thought important.

In the paper the apparatus used for the tests was described and various test results were given. In some of the tests water-cooled drums are used to prevent the brake lining from attaining such a temperature that the resinous material in it melts. The coefficient of friction of brake linings was found to range between 0.25 and 0.75 for water-cooled drums, and between 0.11 and 0.75 for uncooled drums. The majority of the averages for complete runs were between 0.35 and 0.45 for water-cooled drums and between 0.45 and 0.50 for uncooled drums. Tests were also made to show the influence of water and oil on the drum on the brake power and the results plotted, the curves being included in the paper. The tests also covered relative durability and rivet-holding ability. It was found that the latter is not a very important factor, as there is no trouble whatever from rivet holes tearing out. The author summarized his conclusions as follows:

The work done thus far permits the conclusion that the equipment and general methods developed are satisfactory for laboratory tests to ascertain the relative merits of fabric brake linings. To establish a suitable test for determining the relative behavior of brake linings under the more ordinary service conditions, where the application of brakes is intermittent and the resultant temperatures are comparatively low, further work is necessary. The severe service test as used with an uncooled drum is, however, believed to give a fair comparison of the behavior of linings when subjected to severe service. The results obtained indicate very low values of the coefficient of friction as a result of the action of heat on the impregnating compounds.

Very wide differences in the comparative endurance of linings now in use are indicated by the tests, as well as the possibility of marked improvement in durability under severe service conditions. Owing largely to the user's inability to obtain reliable information of the relative merits of linings otherwise than by prolonged use in actual service, purchases are made almost exclusively on the basis of first cost and without adequate consideration of quality or economy in operation. The general adoption of standard tests, such as have been described, will assist the producer materially in the systematic improvement of his product.

The better understanding by the user of the relative merits of brake linings, which can be brought about in the same way, will cause an increased demand for the better materials, those giving the most reliable and most economical braking service. The manufacturer will be spared the indignity of having to market materials on the basis of first cost alone, while aware that a relatively slight increase in first cost would permit him to offer materials that will give the user from 50 to 200 per cent more value in braking service.

The final paper of the session was on Photographic Recording of Engine Data, by A. Trowbridge, professor of physics at Princeton University. Professor Trowbridge during the war developed an automatic high-speed camera which he considers to possess great merits for the purpose of recording the motions of high-speed apparatus. The sensitized paper is automatically developed and fixed before it leaves the camera, and a simple mechanism allows the record to be taken at one speed and the paper to be developed at another speed. The author suggested the use of this camera for taking engine diagrams, especially at high speed.

It is possible to study variations which occur in time intervals as short as 0.001 sec. It is more convenient to transmit electrically to the camera the motion that actually takes place in the mechanism than to attempt to set up the camera itself close to the mechanism. It was found that a special form of simple string galvanometer is very convenient and meets satisfactorily the necessary condition that its moving part shall move synchronously with the motion of the mechanism. The moving part of the galvanometer is practically weightless, as it is a short piece of wire 0.004 in. in diameter, and its motion is strongly damped by the magnetic field in which it is placed. When a current is sent through this wire it moves in the magnetic field and a shadow of this motion is photographed by the automatic camera.

In practice almost any slight motion can be converted into a flow of electricity, so that the applications of photographic recording to the study of vibrations in running machinery are very numerous.

If it is desired to study the pressure changes in the cylinder of a running engine, a capsule with a stiff diaphragm can be screwed into a pet-cock opening and the motion of the diaphragm recorded as the motion of the string of the galvanometer. On any one record it is possible to secure a great many successive explosions and so compare them and draw conclusions as to the constancy of performance under supposedly constant conditions. The timing of the valves or the spark can be determined *dynamically* with an accuracy of about 0.0005 sec. This means in the case of an engine running at 2000 r.p.m. about 6 deg. of crankshaft travel. Thus the lag between the static and the dynamic timing can be determined at various engine speeds.

In a cylinder diagram obtained by means of this apparatus the cylinder pressure is plotted against the time, instead of against piston position. This is claimed to be a great advantage, as practically all the important changes in the cylinder occur near the ends of the stroke, when in the ordinary diagram the time scale is very small. By using the time for the horizontal scale, changes occurring near the ends of the stroke could be studied on the diagram with much greater accuracy.

There was very little discussion on the last two papers presented.

Body Engineering Session

By J. Edward Schipper

A VARIED program covering a field of wide interest in body engineering practice was offered at the session devoted to this subject. Papers were presented on body seating dimensions, California tops, harmony in car upholstery and the manufacture and application of automobile varnishes and paints. All of these were discussed from a number of different standpoints resulting in one of the most valuable sessions of the Winter Meeting.

George E. Goddard presented the paper on Body Seating Dimensions. In this paper the dimensions of automobile body seats received consideration with regard to the features that are conducive to comfort. A diagram was presented upon which the dimensions treated were indicated, and a tabulation of seat dimensions of 12 representative cars was included.

Comments were made upon the factors influencing seat dimensions, as well as recommendations regarding the different desirable dimensions. The considerations were inclusive of cushion height, depth and slope, leg-room and head-room, upholstery shape and softness of trimming, foot-rest and other control-element locations, factors influencing entrance and egress provisions, seat widths and advisable front and rear-compartment heights.

The author recommended the standardization of a range of locations for the different control elements.

This paper is printed in full on other pages.

Attention was called in the discussion to the necessity for allowing sufficient space between the rim of the steering wheel and the edge of the body seat. This is the width which determines the ability of the driver to enter and leave the car from the left side. In Goddard's paper he gives this dimension as 9 in. This is about an average but, in the discussion, it was pointed out that some cars have as little as 7 in. at this point.

Another point which was brought up in the discussion was that the location of the starter pedal should be very carefully chosen so that the driver would not step upon it as he entered the car. In certain locations this is apt to happen and if it occurs while the engine is running the results are apt to be costly, owing to the great danger of stripping the starter gear.

Quite a little interest was excited by the suggestion for a standardized dummy or mannikin to be used in determining the seat layout and dimensions of the front and rear compartments. L. C. Hill stated that at McCook Field, Dayton, a standardized aviator is used to help lay out the control system; in fact, he said a great many

ships had been built around the aviator mannikin with very satisfactory results. A point to be considered is that the mannikin has not the adaptability of the human frame and, consequently, allowance must be made for this fact. Whether this allowance should be in the form of making the dummy larger or smaller than the average man it was supposed to represent, was a debatable point at the meeting and there was some discussion on both sides.

The California Top

P. W. Steinbeck discussed California tops. This type of top, with which the industry is familiar, was designed very largely as a result of the California climate, where the days are warm and the nights cool. The top is a convertible type with a permanent top but removable side glasses. The early forms incorporated side glasses at the side and rear but a rolling curtain at the front adjacent to the driver's seat on both sides of the car.

The present type, as described by Mr. Steinbeck, has sliding side glasses which roll back into the rear glass and extend forward all the way to the windshield, giving a completely glassed-in body when desired.

W. C. Karns of A. M. Karns & Sons, criticised the California top because of the fact that the side glasses do not open with the doors. On a request for the cost of such a body as described by Mr. Steinbeck the latter stated that it would run between $350 and $650. Another inquiry was as to the advantage, with this cost, of this type of body over a sedan. The author replied that it had no advantage as far as body construction is concerned but, due to the climatic conditions requiring quick change from an open to a closed type of body, it is admirably suited to the climate of California or other places where sudden changes from heat to cold are experienced.

Harmony in Upholstery

R. C. Quaintance discussed harmony in car upholstery. Taking the artist's viewpoint, the author discoursed on the subjects of color, color harmony and the psychological effects of color, as a prelude to a discussion of how the decoration of car interiors can be made most effective, this being necessary because of the elusive quality of good taste, a quality of appraisal rather than one of creation, and because esthetic taste depends upon the degree of mental development of the individual, although possessed in some degree by all.

The primary, secondary and complementary colors were defined and their mode of selection described preliminarily to a consideration of color values and the selection of the most effective color-schemes, application of these principles being made thereafter to the decoration of car interiors, inclusive of comments on the most suitable fabrics and patterns. The author believes that color will be considered eventually in the automotive industry as being on an equal plane with lines and form.

In speaking of the decoration of car interiors he said, "It cannot be emphasized too strongly that, in the natural expression of refined taste, the purer color must be used sparingly and with great care. The tints and shades or tones are to be favored. The chief function of the purer colors is emphasis only or, if one can so refer to it, the purer colors are for punctuation only. While it is agreed by most students that complementary colors are harmonious, there are certain conditions that must be considered, chief among which is area. For instance, green is the complementary of red. For certain purposes this combination is an excellent one. When applying it to a closed-car interior, we must neutralize the dominant hue. Professor Munsell has compiled a color chart which shows that red is twice as strong as green in what he terms 'chroma'. In this instance, he says, we will regulate the area; so that our dominant color is green and considerably lowers the value of the red by darkening it. The green itself might well be grayed, preferably to an olive, and we then find, in applying the two complementary colors to a closed-car interior, that the color scheme has worked out to an olive-green cloth with a maroon stripe. It is a combination that is suggestive of spring and of the garb of nature and is representative of life, youth and freshness; a combination of warm and cold colors that is agreeable and restful, since the maroon stripe supplies sufficient life to tone up the combination.

"In passing it may be well to remark that nature supplies a wealth of harmony which must be studied to be appreciated. The student will observe quickly that nature employs a relatively small amount of pure colors. Even the beautiful sunsets are devoid of pure colors; all of the beautiful effects arise from ever-changing combinations of tints and shades.

"A point to be borne in mind in regard to harmony in car upholstering is the fact that the less obvious the color element is, the most quality the different tones possess. This is applicable equally to color harmony in other fields.

Warm Tones in Enclosed Cars

"The warmer tones are to be preferred for use in a closed car as against the colder tones. By those who have understood the subject, the warmer tints have been selected with a view to making the interior cheerful and inviting in its appeal, and to make it as pleasant as a well-appointed drawing-room in its season of greatest usefulness, winter. The same interior can be made cool, quiet and restful during summer, by the use of slip-covers having a color scheme based upon the cold side of the color circle. Slip-covers serve other purposes, chief among which is the protection of the upholstery from dust and dirt during periods in which the windows frequently are lowered when driving.

"A still different kind of color harmony that, I am sorry to say, is extremely popular with many car-builders, is what is termed a mono-chromatic group. This is made up of two or more tones of the same color. It is the most unobtrusive and conservative harmony scheme possible. It is always safe, but seldom interesting. There is, however, an even more severe treatment, that of employing a single solid tone. This practice requires painstaking care in the selection of laces, curtains, curtain cords and other trimming accessories to insure perfect matching. I have seen some excellent examples of this type in the products of custom body-builders, but I do not commend its use to large manufacturers. This treatment would not wear well with some personalities; it would become extremely monotonous and probably tiresome.

"In the mono-chromatic harmonies, those employing two or more tones of the same color and any other schemes except the solid tone, it is possible to give the interior that natural balance of light over darkness that is considered of prime importance in all decorative fields. In this case the floor covering would be of the darkest shade, the body cloth a trifle lighter and the trimmings and head lining, if one is used, of a still lighter shade. In interiors of this nature, it is possible to make the color scheme interesting by the use of one or more bright spots such as an enameled handle or vanity case, or by using other interior fixtures. This should be of a color complementary to the dominant color. If we must have mono-chromatic car-interiors, let us at least liven them up. If we insist that the cloth manufacturer supply us with fabrics containing two or more neutral shades, then let us liven up the interior by the use of color in other interior fittings.

"I wish to urge, however, that we be reasonable. Judging from the descriptions I have read of the cars shown at the recent Paris Salon, our European friends have achieved some remakably grotesque discords in this line; apparently, this is a reaction from the recent war. Some of the cars shown must have been extremely ludicrous; nevertheless, we can learn much from the Europeans. Not all of their creations are to be classed as freakish; in fact, all Latins are more artistic than Saxons as a rule and, generally, they are much more fond of color.

"There are three general types of fabric, cotton, wool and mohair. Of the first, cotton, little need be said. Cottons are used generally in the cheaper cars only, although the cotton velours had an extensive run in the medium-grade cars during the war period, as did the cottons also. These velours, while giving a rich luxurious effect, are not really serviceable. The mohairs woven from the hair of the angora goat are extremely serviceable and have enjoyed several years of popularity. But the fabric that seems to be the most desirable from all angles of style, wearing quality and appropriateness is the various kinds of woolen cloths. They vary in weaves and weights and a particular type can be found for any upholstery purpose.

"A point to be borne in mind when selecting fabrics is that any pronounced figure will soon grow extremely tiresome. The eye requires complete rest in a closed car, rest from the continuous motion outside. The influence of the interior should be one that is felt rather than seen; for this reason the brocades, tapestries and chintzes, or other furniture upholsteries, have no place in the correctly appointed motor-car. The pattern should be small and unobtrusive and appear in the body lining only.

"Some manufacturers have experimented extensively with woolen cloths and to-day are weaving a cloth on looms especially designed for automobile fabrics. Special finishing machinery has been built to impart a broadcloth finish to all woolen cloths. A fabric that promises to become extremely popular is the new worsted cloth. Some of this is all worsted, and some grades are only worsted faced. These cloths trim well and have unusual wearing qualities. Another new fabric that has great promise is the mohair sateen, a flat woven mohair. This can be made in a wide variety of shades and various patterns and, strange as it may sound, is guaranteed by the manufacturer to outwear the car.

A Plea for More Color

"In conclusion, I want to enter a plea for more color; more color in the interior and more color in the exterior. We literally have worked the funereal color, black, to death. For years we have painted the majority of our cars black. We have had too much of it. We should brighten the cars with color. As a result of the continued practice of using black, we have killed many an owner's pride in his car. When one drives home in a new car in these days, it is impossible to feel that one is creating any stir in the neighborhood. In fact, one's neighbor is very apt to remark over the back fence, 'I see you got the old bus washed up'."

Discussion on this paper brought out the fact that there was a live interest among manufacturers in getting away from the drab color scheme which has come to be part of production bodies. Due to the chemistry of certain colors, particularly blue, these colors have a tendency to fade more rapidly than others which necessitates using them with cars.

L. Valentine Pulsifer presented a paper on the Manufacture and Application of Automobile Varnishes and Paints. Pulsifer stated that the ability of an automobile finish to remain new is the product of four elements, the slighting of any one of which is bound to be fatal to satisfactory results. The four elements are the proper quality of the materials, engineering of the system, method of application, and care of the finish. The responsibility for these four essential elements is divided among three different interested parties, the maker of the varnishes and paints, the builder of the automobile and the owner of the finished product.

The automobile manufacturer is interested particularly in two phases of this preservation, the engineering of the system and the method of application. Given the proper quality, the manufacturer can secure good results if he properly lays out the system of application.

Materials for Painting

Five basic materials are used in automobile painting; those for priming, surfacing, coloring, rubbing and finishing. Each of these performs a distinct and different function and all are necessary to a complete painting operation.

The primer forms the bond between the surface to be painted and the subsequent coats of material; it is the foundation of the whole structure.

It must be of suitable nature to perform its duties properly and be applied over a surface properly prepared to receive it. The surfacing materials are used for the purpose of building up a smooth surface on which to apply the color, rubbing and finishing coats. There are two types, those surfaced by sandpapering and those by pumice. The latter are tougher and more dense and, although they require more time and labor, give more complete and durable results. Coloring materials include the so-called ground colors, Japan colors, flat colors or body colors. They form a dense, opaque ground on which to apply the subsequent rubbing coats. They are extremely rapid in drying, show no gloss and should be semi-porous in nature to permit the varnish of the first rubbing coat to penetrate to a certain extent. Rubbing materials comprise all types of clear and colored rubbing varnish and a preponderance of gum in their make-up gives them a hardness that permits of their being rubbed to a smooth surface. This is done preferably with pumicestone flour, a felt pad and water. They range from materials that air dry to rub overnight to those that take four days to reach the requisite hardness for proper rubbing down. The colored rubbing varnishes are either factory made by grinding the proper dry pigment into the varnish or shop made by the careful addition of japan color to the clear rubbing varnish. The type of rubbing varnish selected is gaged by the character of the work, the slower and more durable grades being indicated for the finer types of finish.

Finishing varnishes used in automobile work represent the most highly developed type of oleo-resinous varnish used for any purpose. They must work and flow faultlessly, dry within a reasonable time, present a surface of mirror-like smoothness and possess adequate toughness and elasticity to insure long life. Hardening to a final thickness of less than .001 in., they must protect the whole paint and varnish structure against all the elements, and only too often against the abuse or neglect of a careless or ignorant owner.

Body varnishes should be chosen for their paleness of color, freedom and safety of working, speed and perfection of flowing, speed of drying and hardening and relation to durability, fullness of body and brilliancy of finish. A different type of finishing varnish should be chosen for the hood, fender and wheels from that used on the body, since there is need for a varnish more resistant to the action of mud, water, oil, grease and soap than is required on the body.

Pulsifer in his paper brings out the necessity for properly engineering the paint system. The five basic materials outlined must be applied in proper combination into the finished paint structure. He points out that it is just as bad to pile on unnecessary coats as it is to leave off materials that are necessary to the system. Just enough coats should be specified to produce the desired degree of fullness of finish.

In laying out the system for a given job it cannot be overemphasized that the five basic materials must be chosen not only for their individual merit but for their ability to pull together. To obtain the proper correlation of the various coats the elasticity of the succeeding materials should be gradually decreased from the primer to the flat color and then gradually increased up to the finishing varnish. This result is obtained by using an elastic primer. Next, a coat intermediate in elasticity between the primer and the surfacer is used; it is the so-called half-and-half or elastic roughstuff. Then the surfacer itself, possessing less elasticity, is applied and next the flat color possessing practically no elasticity. This should be followed by gradually increasing the elasticity of the rubbing coats produced by making each succeeding coat lower in japan color or pigment content and, finally, capping the whole with a finishing varnish possessing the greatest degree of elasticity possible.

In discussing the method of application, of which there are four, namely dipping, spraying, flow coating and brushing, Mr. Pulsifer stated that the dipping process is used principally for the application of black baking japans. Spraying by air brush or air gun affords the best method for the application of the primer surfacer and flat color coats. Flow coating is a method of applying rubbing and finish varnish that was first tried on a very small car and now is in use in a number of large plants producing higher-grade cars. It has to be used cautiously, as in a great many instances it is not highly successful in obtaining the desired fullness and durability. Flow coating finishing varnish results in a thinner residual film than is produced by the proper brushing of the same varnish. The lack of fullness of a flow coated finishing varnish can be corrected by extreme care, but such care is hardly possible with piecework.

If time and space were no object there would be no choice in final results between proper air drying and proper forced drying. Care must be taken, however, against too great an application of heat or too rapid application of the heat, or too little moisture content for the amount of heat used, all of which will cause case hardening of the surface rather than proper hardening throughout.

Surfaces in finishing are either sandpapered or rubbed with block rubbing stone and water. Sanding surfaces should not be rubbed along with the use of water because they are too porous. The best practice on rubbing coats is by felt pad and water, as it gives the best combination of appearance and durability.

Some discussion was created by this paper on the desired number of coats, and Pulsifer emphasized the fact that too many coats is just as bad as too few because of the tendency toward cracking and chipping under the influence of the weaving of the body. He stated that for a long time it was considered meritorious to apply a great many coats to a body, but that experience has brought out the fact that this is not in the interest of durability.

Another point which was brought out into the discussion is that in cleaning it is much more preferable to use benzol than gasoline, because of the greater volatility of benzol. The same primer can be used for aluminum as for steel, but owing to the nature of aluminum surface it is highly important that it be properly cleaned if anything like a durable paint job is to be secured. It is particularly necessary that any solder which may be present on the body be cleaned off before the primer is applied.

Material Session

By J. Edward Schipper

DISCUSSION of materials entering into the makeup of automotive products occupied the attention of various members of the S. A. E. for an entire afternoon. Papers on chrome molybdenum steel, continuous die rolling, drop forging practice and malleable iron castings made a program which excited the interest of a number of metallurgical members of the Society.

C. N. Daw, metallurgical engineer, Studebaker Corp., presented a paper on "Chrome Molybdenum Steel Applications from the Consumers' Viewpoint." This concern has used over 2,000 tons of molybdenum steel of various analyses. This has been put through production in the form of rear axle shafts, transmission gears and shafts, steering knuckles, steering knuckle pins, ring gears, drive pinions and, in fact, for all alloy steel parts.

Mr. Daw states, in his paper, that by a process of elimination, it became clear that steel containing molybdenum approximating .30 to .40 per cent with chromium 1.00 per cent and carbon above .30 per cent should be avoided when water is desired as the quenching medium and where cracker shearing is used. An analysis, showing a carbon content below .30 and above .23 per cent with a chromium content of .70 to .90 per cent and molybdenum, .30 to .40 per cent gives satisfactory results with water as a quenching medium, there being no cause for concern pertaining to the development of quenching cracks.

A great number of tests were cited by Mr. Daw and his paper is largely concerned with the results obtained from these tests and with the prospects of other data which will be secured from subsequent tests. An extensive test was run involving the pulling of approximately 400 tension pieces turned from heat treated stock varying in size from ⅞ in. round to 2 in. square. The sizes used were ⅞, 1 and 1½ in. rounds and 2 in. squares. The three smaller sizes were obtained by forging down from the 2 in. square hot rolled forging bars. The 2 in. square test pieces were taken directly from the bar, no work having been put upon them.

The wide heat treating range of a given steel is a property upon which great stress always seems to be laid, but in Mr. Daw's tests he states that no attempt has been made to determine this for the reason that in this present day of accurate metallurgical control we do not need a 100 to 200 degree quenching range. What consumers are mostly interested in is to determine the lowest quenching temperature that can be commercially used and still obtain the maximum physical properties. With this in mind, quenching temperatures ranging from 1550 to 1650 deg. Fahr. were used in the case of the chrome molybdenum, chrome vanadium and chrome steels, while 1475 to 1575 deg. Fahr. were used in connection with the chrome nickel steel.

Mr. Daw interprets the results of his tests by means of the merit index suggested by H. T. Chandler and presented in a paper by John D. Cutter before the American Society for Steel Treating. This formula is as follows:

$$I = \tfrac{1}{2}\, e\, (E + S) \div (100 - R)$$

where

I = the merit index
e = the percentage of elongation in 2 in.
E = the elastic-limit in terms of 1000 lb. per sq. in.; in the tests it is taken as the yield-point
R = the percentage of reduction in area
S = the ultimate-strength in terms of 1000 lb. per sq. in.

A conclusion, drawn by Mr. Daw from his tests, is that chrome molybdenum steel for heat treated automobile parts has considerable merit. In view of the fact that this steel apparently can be produced in unlimited quantities, with no danger of shortage of molybdenum, and because it has been produced and sold at a lower price than its closest competitor, chrome vanadium steel, its adoption has been sanctioned. It forges entirely satisfactorily with the particular advantage that the scale formed breaks away from the forgings very easily. With proper composition, and for sizes within ordinary limits, it cold shears as readily as the other grades of commercial alloy steel. It responds very readily to the heat treating operations, and the percentage of forgings falling outside of the required Brinell hardnesses are very small.

With reference to its machining qualities, no figures can be given to corroborate the claims which have been made with regard to the reduction in tool cost. In tests of this type, there is always doubt as to the exact uniformity of the tools performing the tests, also the results obtained are very likely to be peculiar to a given shop and not applicable universally. The Studebaker Corp. has satisfied itself, by noting the machineability of the tonnage that has passed through its shops, that chrome molybdenum steel machines at least as well as the best there is. There has not been a failure insofar as the corporation has heard of any part made of this steel out of the 50,000 cars that have been thus far produced since its adoption.

To obtain the best possible results with case hardened molybdenum steel parts, it has been found necessary to quench from the carbonizing box into oil and follow this by the regular double heat treatment and a final draw at 375 to 400 deg. Fahr., timing each operation as carefully as possible. Mr. Daw draws attention to two particular advantages that should be noted in that chrome molybdenum will take on a given case depth in 10 per cent less time than chrome nickel steel. Also there will be a resultant average increase in Shore hardness of from 5 to 7 points. Despite the fact that the Studebaker Corp. has not received many complaints with regard to failures of case hardened parts of chrome molybdenum steel, it has seen fit to discontinue this particular grade for this purpose. Chrome nickel steel apparently still holds the first place among commercial steels for case hardening of important parts. It is the opinion of Mr. Daw, however, that nickel molybdenum steel will be a serious contender. Chrome molybdenum steel should prove entirely satisfactory for parts in which hardness alone is the chief factor but should be considered carefully before being used in important parts in which combined toughness and hardness are requisite, such as gears, steering knuckle pins and the like.

Considerable discussion on this paper brought out very strongly the fact that engineers and metallurgists believe the Brinell hardness to be an essential specification. John H. Nelson, metallurgical engineer of the Wyman-Gordon Co., brought out the fact that the Brinell hardness is used by a great many consumers for testing steel and, consequently, should be included in the tables. Ralph H. Sherry, metallurgical engineer of the Willys Corp., agreed with Mr. Nelson on the desirability of including Brinell hardness figures in the specifications. He also stated that he was not quite in agreement with the use of the merit index formula as a means of determining steel qualifications. A number of other members brought out the same objection but no suggestions as to another method of arriving at comparisons were offered. A question was raised as to whether the molybdenum steels referred to in Mr. Daw's paper were calcium molybdenum alloys or ferro molybdenum. It was made clear that these were manufactured with ferro molybdenum. In commenting on the merit formula, Mr. Nelson stated that he preferred all of the steels shown in one of Mr. Daw's tables to those contained in another, although the merit index does not make clear the superiority of these steels.

Continuous Die Rolling

G. R. Norton, in his paper on "Continuous Die Rolling," described this process of manufacture and the product possible with it. The improvements that have been made have been as a result of efforts to produce more complicated sections by this process with greater accuracy. The method is of considerable interest to automotive engineers in view of the fact that it has been very satisfactorily used for such structural parts as front axle I-beam blanks, and rear axle drive shafts. Mr. Norton illustrates in his paper front axle I-beam blanks that can be finished under one hammer for either the Elliott or reverse Elliott type of axle. He also mentions blanks for camshafts which are ready to strike for finishing thus eliminating the blocking or upsetting operation and the rolling in dies immediately preceding forging. Spring clips can be rolled with the offsets for bending exactly as forged. A small amount of flash is produced which requires cold trimming before the clips are bent. Rear axle driveshafts can be rolled and, after trimming, are ready for hardening and machining.

Drop Forging Practice

J. H. Nelson, chief metallurgist of the Wyman-Gordon Co., presented a paper on "Drop Forging Practice." He states, in his treatise, that the drop forging industry has contributed largely to the phenomenal growth of the automotive industry during the past decade. Drop forgings for automotive construction are made to-day in large quantities from a great variety of steels, both plain-carbon and alloy, the particular grade of steel used being dependent upon the part to be forged and the duty required of the part. With the increase in the number of forge-shops that has occurred within the last few years, it is no longer a problem to have a forging made, but rather to secure the necessary quality in the forging when completed; and this matter of satisfactory quality is not something that is apparent on the surface of the forging. Two forgings may be identical in appearance, size, shape, amount of finish and even forged from the same grade of material; yet, from a quality standpoint, they may be decidedly different. This difference may be due to any one or to a combination of the following factors:

1. Method of forging
2. Method of heating for forging
3. Inspection and supervision of forging
4. Inspection of raw stock
5. Segregation of raw stock
6. Heat-treatment of the finished forging.
7. Testing of the finished product

Inspection of Raw Stock

Inspection of raw stock should consist of (a) surface inspection to determine the fitness of the material for use in forgings, such as an examination for size, seams, scale, burns and the like, and (b) chemical analysis to determine the fitness for use in the various parts, to determine the segregation of the elements in the bars and to determine mixed heats.

Mixed heats are of two kinds, those that are deliberately mixed at the mill and those that are accidentally mixed at the mill. Under deliberately mixed heats, we find steels of the same grade but from different melts that are rolled into bars and furnished to a customer under the same heat number. Such heats are made up from ingots that have the same or nearly the same chemical composition, as to the hardening or alloying constituents. Heats of this character are of an endless source of trouble to forge-shops that endeavor to keep melts of steel of the same grade segregated. Unintentionally mixed heats are due to a few bars of a different grade of steel becoming misplaced. While this is a source of annoyance, it is readily detected chemically and the bars are then rejected.

Segregation of Raw Stock

Segregation of raw stock of the same grade by melts is absolutely essential if quality forgings are to be produced. It is not only necessary to segregate the stock in the yard but it is equally necessary to segregate the forgings made from the stock until they have been completely heat-treated and are ready to ship to the customer.

Nelson gave in his paper tabular data of the chemical analyses and physical properties of 107 different heats of carbon steel used recently. They show a variation in drawing temperature of 140 deg. Fahr. in steels of practically the same chemical composition to meet the same physical property specifications based on more than 1,000 tests on this grade of steel taken from production stock. Nelson drew the following five conclusions in his summary:

(1) Steels of the same grade and of the same chemical composition do not respond in the same way to heat-treatment.
(2) To heat-treat with minimum loss, only steels from the same melt should be included in a furnace charge.
(3) Stock subjected to heat-treatment should be carefully segregated into piles of the same melt, it should be kept segregated throughout the entire process of fabrication to produce satisfactory forgings of uniform quality.
(4) Tensile and hardness tests should be required on all heat-treated forgings to check the thoroughness with which the various heat-treatment operations were performed.
(5) At least one hardness test should be made on all heat-treated forgings to insure that all have responded to the heat-treatment operations in the same manner.

Ralph Sherry, metallurgist of the Willys Corp., called attention to the fact that in drawing by the use of the lead pot on a large scale, he has avoided variations in physical properties. He stated that it is difficult to attain uniform results with different types of furnaces, whereas with the lead pot it is possible to hold the temperatures within very close limits. In replying to this view, Mr. Nelson stated that this is solely a matter of temperature control and that by using balanced furnaces, uniform results can be obtained. He states that even in production it is possible to hold the temperature within a 5 deg. range. He is perfectly satisfied with the uniformity obtained in this way and believes that it is solely a matter of getting good furnaces accurately controlled. In the Wyman-Gordon plant, pyrometers are used at the front and rear end of each furnace.

Ralph Sherry stated that it was his experience with different furnaces held exactly uniform and checked by six pyrometers variable results were obtained, whereas, with the lead pot greater accuracy was secured at less cost. W. F. Graham, metallurgist of the Spicer Mfg. Co., supported Mr. Sherry's stand on the use of the lead pot. He also commented that it was necessary to take into consideration the percentage of carbon and manganese to determine the drawing temperature range. He stated that there are difficulties in the way when the carbon content is below .30, at which time the draw is practically eliminated.

Standards Committee Meeting

A SYNOPSIS of the meeting of the Standards Committee was given in our last week's issue. Practically all of the reports were accepted. Some proposals, however, met with opposition, and after the subject had been fully illuminated from both sides, a vote was taken and the recommendation was either accepted or referred back to the Division for further consideration. One of these items was that in the report of the Electrical Equipment Division regarding a change in the shaft extension for electric generators in connection with the flange system of generator mounting.

There are two sizes of this flange mounting, known as Nos. 1 and 2, respectively. The first is designed for a small size and the second for a large size generator. The dimensions of the flange and those of the shaft differ in the two. It appeared that some users of the small size generator have been calling for the flange intended for the large size generator, and this has compelled manufacturers of generators to make the small size generator with two different shafts; that is, the driving ends of the two shafts had to be different. This, naturally, is undesirable from the production standpoint, and it is also illogical from an engineering standpoint, because the torque to be transmitted is exactly the same in both cases. It was sought to remedy this difficulty by having the shaft lengths of both mountings changed so the two would be alike. Shaft diameters were not to be affected. There was determined opposition to the proposal on the part of one member, on the ground that only one of the mountings was intended for one size of generator, and if so used the difficulty which it was sought to remedy would not occur. The final result was that the item was referred back.

Several other reports engendered a fairly lively discussion. Among these was the report of the Roller Chain Division providing for revised minimum breaking strengths of S.A.E. roller chains. This report was presented by H. S. Pierce of the Link-Belt Co. Mr. Pierce explained that the proposed strength requirements were less severe than the present ones. The reason for the proposal was that manufacturers of chains, in order to be sure to obtain the ultimate tensile strength called for by the standard, used materials and processes which impaired the quality of the chain in other respects. The pins of the chains are case-hardened, and rather than use a very low carbon steel, which gives the best case, the manufacturers would use a steel with a higher carbon, which would give greater core

strength. The heat treatment also was adapted more to getting a strong core than a hard case. It was a fact, though, that to every chain that broke in service perhaps 5000 wore out, and resistance to wear was a much more important factor than ultimate tensile strength. A letter from the Morse Chain Co. was read opposing the proposal, on the ground that it would discourage the adoption of superior grades of steel in the manufacture of roller chains. The proposal was also objected to by M. C. Horine of the International Motor Co. He pointed out that the committee which drew up the proposal was a joint committee of the S. A. E., the American Society of Mechanical Engineers and the American Gear Manufacturers Association, and that the requirements in industrial transmission work had been given undue attention, so that the proposal really did not meet automotive requirements. He was of the opinion that the proposed strengths were too low; Hans Renold, when on a visit in this country some years ago, had said that even the requirements of the standard which it was proposed to cut were quite low. Any chain maker who would sacrifice wearing quality to high tensile strength would quickly come to grief, and he did not believe that the retention of the present standard would work out that way. Besides, foreign manufacturers of roller chains were beginning to make a bid for American business, and American chain makers would have to look to their interests. Mr. Pierce in reply said that the object of the committee was to check a bad tendency. The wearing quality of a chain depended on the quality of the case and the depth of same. A better chain was obtained by not aiming at too high ultimate strength, because the ultimate strength in any case was many times the maximum working load. The figures proposed for standardization were testing machine or static values, and, moreover, they were minimum values; average strengths were generally about 10 per cent greater. E. A. Johnston of the International Harvester Co. suggested that a table giving safe working loads would be a better guide to the designer than the proposed table of minimum tensile strengths, to which Mr. Pierce replied that the committee was taking up problems in connection with chain standardization one at a time, and that data on safe working loads was now being gathered. Upon this item of the report being put to the vote it was accepted, together with an amendment by H. M. Crane to the effect that the point that the values in the table were *minimum* values be made clearer.

Engine Numbers Proposal Adopted

There was also considerable discussion on the subject of engine numbers. The proposal of the Division has already been given in these columns. H. M. Crane expressed the view that numbers formed in the casting would be much more difficult to alter than numbers stamped on as proposed, but he admitted that casting the numbers on might involve difficulties in the case of those manufacturing engines for the trade. He wanted to know whether there was any objection to the S. A. E. standardizing two methods of numbering—casting on numbers for those who could use that method, and a second preference in the form of stamping numbers on in the way suggested in the report, for those whose practice did not admit of the first plan. J. B. Fisher of the Waukesha Motor Co., who presented the report, agreed that casting the numbers on was ideal, but the plan presented difficulties in the case of engine builders supplying engines to a dozen or more customers. A. J. Scaife of the White Motor Co. asked whether the approval of the Underwriters' Laboratories to the numbers had been received. It was replied that the Underwriters' Laboratories had asked for samples of the numbers for the purpose of testing them out, and these had been supplied them, but no report had yet been received. Mr. Burnett of the Standards Committee reported that a representative of the Underwriters' Laboratories had attended the meeting of the Division held in November, and had given it as his opinion that the proposed system of numbering was the most promising one heard of yet. C. O. Guernsey of the Service Motor Truck Co. suggested that the recommendation be referred back to the Committee until the approval of the Underwriters' Laboratories was obtained, because without this approval the method would have no practical advantage. H. M. Crane moved that the number proposal be made a recommended practice instead of a standard. In commenting on this Mr. Burnett said that the proposal was really a revision of an existing standard on Engine Numbers now on the records of the Society, but Mr. Crane disagreed, saying that the old system of numbers was merely for purposes of record, whereas the proposed system was a safety measure, and therefore was really a new subject. Rising votes had to be taken both on the amendment and the amended motion, the former being adopted by a vote of 11 to 10 and the latter by a vote of 14 to 9.

Fan Belts and Pulleys

Another item in the report of the Engine Division that stirred up considerable discussion was that on fan belts and pulleys. G. W. Gilmer of Philadelphia pointed out that fan diameter alone is no criterion of the size of belt required to transmit the power necessary to drive it. The fan belt width and the pulley width should be fixed in accordance with the power requirements. It is a mistake to put a crown on both the driving and the driven pulley, for the reason that it is impossible to get the two crowns absolutely in line, and the belt will then follow a crooked path. Only one of the pulleys should be crowned and that should be the driving one, because the crowning cuts down the contact surface, and in a fan drive the driving pulley is always considerably larger in diameter than the driven one and has more belt contact surface, hence cutting down this surface is not so serious a matter as it would be if the surface on the driven pulley were cut down.

In the report the terms fan drive and power drive were made use of, and Mr. Fisher was asked what was meant by these terms, and also how the angle for Vee belts recommended was arrived at. He said that the term "fan drive" applied to a drive for the fan only, whereas "power drive" was intended to apply to a drive to the fan and other accessories at the same time. The angle of Vee (28 deg. for power drives, 38 deg. for fan drives) was arrived at by averaging present practice.

A proposal was made by the Engine Division to extend the S. A. E. engine testing forms to make them applicable to stationary engines. It was suggested that on Specification Sheet B provision should be made for recording, under Item No. 32, Lubrication, the Saybolt viscosity at Cold Test, 150 deg. Fahr. and 350 deg. Fahr. A communication had been received from the Bureau of Standards protesting against the adoption of 350 deg. Fahr. It was pointed out that at that high temperature all oils would show practically the same viscosity. Standard temperatures for viscosity tests of 70, 130 and 210 deg. had been adopted by the Institute of Petroleum Technologists, and it was felt that these should be adhered to in determining the viscosity of lubricating oils. In favor of the recommendation it was urged that these standard viscosity temperatures had been fixed long before the advent of the automotive engine and that the conditions to be met in these engines could not have been foreseen. The temperature of 350 deg. was chosen because it was thought to represent very closely the temperature of the walls to be lubricated. The cylinder walls may not be as hot as this but the piston walls certainly reach that temperature. In opposition to the proposal it was stated that the oil on the piston and

cylinder walls in normal operation is not the same oil that is put into the crankcase. It is generally strongly diluted with condensed fuel and therefore has a materially lower viscosity than the oil put into the engine. The suggestion concerning the extension of the engine test forms was accepted as made, but on the following day, at the business meeting of the Society, on motion of H. M. Crane, the proposal to provide for the insertion of the item relating to the oil viscosity at 350 deg. Fahr. was stricken from the report.

Business Session

A DEVIATION from practice at previous S. A. E. annual meetings was made this year during the business session, in that each of the vice-presidents gave a brief review of the progress made in that particular branch of the industry which he represents. President Beecroft in opening the session said that while the Society was still young in years it was great in accomplishments. He called attention to the excellent program which had been prepared for the meeting, and extended congratulations to Chairman Scott of the Meetings Committee. A total of twenty-three papers had been secured for the meeting; for the first time practically all of the papers had been printed in advance and members and manufacturers who might be interested in any particular paper had been circularized. He welcomed Harry Ricardo as guest of the Society, Mr. Ricardo having come over to attend the meeting at the invitation of H. L. Horning. In giving a brief survey of the activities of the Society during the past year Mr. Beecroft expressed the view that the most important accomplishment had been the establishment of the Research Department.

Dr. Dickinson, who was to start the program of the session with a talk on Automotive Research in 1922, was unfortunately unable to be present on account of sickness in his family. H. M. Crane said that the greatest piece of work accomplished by the Society the past year had been the acquisition of Dr. Dickinson's services. Whether consciously or unconsciously, we all came to the meetings of the Society to meet other engineers and by contact with them learn something that would help us in solving the problems that confronted us. Unfortunately many of the younger members could not come to these meetings, and it was this that would make the research department be of great value. The idea which Mr. Crane conveyed was that members who seldom had the opportunity to profit by listening to the discussions at S. A. E. meetings should take advantage of Dr. Dickinson's familiarity with automotive literature and his experience in automotive experimental research to get help on their problems.

Progress of Aviation

Speaking on the progress of aviation, Mr. Crane said the past year had been a period of marking time. Still, the efforts here and abroad to adapt the airplane to commercial services had resulted in great forward strides. Attempts to use war machines for commercial purposes generally had ended in failure, but even these failures had proven instructive. Mr. Crane referred to the great handicap to the commercial exploitation of aircraft that lay in the lack of suitably located landing fields, illustrating this point by the actual experience of an acquaintance who traveled by airplane from the upper part of New York City to Atlantic City. Owing to what may be described as inadequate landing and terminal facilities the entire trip occupied four hours, whereas the train time between New York and Atlantic City is only three hours. Passengers board their train in the center of New York City, and the terminal station in Atlantic City is located right in the center of the hotel district. The importance of carrying passengers as near to their destination as possible was shown by the fact that the Pennsylvania Railroad, although it had three ferry connections with Manhattan Island before the construction of the Hudson tunnels, was willing to spend many millions of dollars for facilities enabling it to carry its passengers right into the center of the city. It seemed the company was compelled to do this by the competition of the New York Central Railroad, but subsequent events showed the investment to be a wise one.

Mr. Crane said that the past year had seen many new records made in aviation, of speed, altitude and endurance, but the most important records had been made in the U. S. Mail Service and in the transportation lines, both here and abroad. Records of the sporting type had their uses in stimulating the imagination and in arousing general public interest; they also furnished considerable engineering information of value, but the things that we need now, he said, are the knowledge of how to conduct a regular daily service at a minimum cost and fairly certain data as to what the cost of such service will be.

Conditions Affecting Passenger Car Field

B. B. Bachman, reviewing progress in the passenger car field, said that uncertain industrial conditions had had their effect on this development. The two outstanding problems had been the fuel problem and the highways problem. To the fuel problem a great deal of time had been devoted at the meetings of the Society and as a result much had been added to the knowledge of the fundamentals. As an example of the problems that would demand the attention of automotive engineers, Mr. Bachman stated that the city of Philadelphia recently had passed an ordinance prohibiting the parking of the cars in the city streets, which made it impossible for automobile owners, unless they were fortunate enough to have a chauffeur, to make use of their cars in transacting business in the downtown district. It behooved engineers to call attention to the absurdity of such regulations and to work for their repeal.

Joseph Van Blerck, in a report on the advances in marine engineering, said that when the S. A. E. inaugurated standardization in the motor boat field enthusiasm was high and interest keen. Many promising projects were undertaken and some of them were well started when the war interfered and it became almost impossible to get members together on this work. After the war, by the time the work could be taken in hand again, the present depression in business had set in, and the matter had been practically at a standstill. Old members were followed up with the idea of keeping the subject alive, and attempts to get new members in this industry were made, but with organizations shifting and personnel changing little success was attained. One of the things that intensified the depression in the marine engine business was that large numbers of old airplane engines were refitted for marine use. While no new standardization was accomplished during the year, the standards previously adopted were almost universally accepted, although there were certain exceptions to be noted.

A report on stationary engines was made by Theodore C. Menges. Mr. Menges divided stationary internal combustion engines into ten classes, as follows:

1. Large engines.
2. Electric light engines.
3. Pumping engines.
4. Concrete mixer engines.
5. Milking machine engines.
6. Railroad handcar engines.
7. Contractors' engines.
8. Air compressor engines.
9. Well drilling engines.
10. Farm engines.

Each class of engine was briefly described, and Mr. Menges' report also contained paragraphs on ignition, governors, cooling systems and lubrication.

E. A. Johnston, reporting on tractor engineering in 1921, referred to the effect of the drop in price of farm products on the sale of farm machinery. Price cutting in agricultural machinery, both domestic and foreign, he said, was carried to the limit by manufacturers, who sold much of their product below the cost of production. Foreign trade decreased to such an extent that it might be said that samples only were sold during the latter half of the year. The United States Government statistics showed foreign shipments in tractors as follows: January, 2500; February, 1500; March, 1170; May, 254; July, 58. Production naturally decreased noticeably, although there was a marked increase in the demand for tractors to be used for road making and for industrial purposes.

The lightening of tractors by the use of high grade materials and designs required more and more attention to wheels and lugs. Therefore, considerable work was done during the past year to establish the relative values of various types of lug, the widths and diameters of wheel, and the relation of speed to draft, although there is still much research work to be done along these lines. The generally accepted operating plowing speed is now approximately 3 m.p.h.

While many two-plow outfits had been produced, and these excelled in sales, there was a tendency toward a larger or three-plow tractor that would do 50 to 60 per cent more work at the same labor cost. Further, there was a marked tendency toward operating the wheels of a wheeled tractor in the furrow, which limited the width of the drive wheels to 12 in. for 14 in. bottom. This, together with the movement toward reduced weight, resulted in the more difficult problems of developing lug equipment, lubrication, and the meeting of the various conditions due to slippage and steering.

The ever present question of liquid fuel, its cost, supply and suitability, has caused a marked demand for alcohol developments. This call comes largely from foreign fields, where sugar refuse is available, such as the Philippines, Hawaii, Cuba, Brazil, Argentina, Esthonia and France.

Other reports received were those of the Standards, Membership, Meetings and Sections committees and the report of the Treasurer. The latter report this year for the first time was illustrated by graphs to give the membership a clear picture of the relation between the income and expenditures of the Society and a comparison of the various items of income and expenditure. The total income of the Society the past year was $242,846.11 and the total expenditures were $233,115.01. The Society owns Government and high grade railroad bonds of a par value of $100,000 and of an actual value of very little less. All reports were accepted. President Beecroft spoke on the Status of the Engineer in Automotive Economics and H. L. Horning on International Affiliation of Engineers.

Demonstrations at Industrial Shows

EXHIBITORS at industrial shows are coming more and more to a realization that demonstrations impressing the visitor with the most important qualities of the machine or products exhibited are a great sales help. Such demonstrations were given at the recent New York automobile show by a great number of exhibitors. The General Electric Co. gave demonstrations of its Genelite synthetic bearing bronze and its water japan.

One of the salient features of Genelite is its porosity, which makes it capable of absorbing 2½ per cent by weight of oil. To demonstrate this feature, three small stands were prepared, each carrying a beaker of oil on top, with a rod of Genelite, babbitt, and bronze, respectively, set in the beaker. Below was another beaker, and a wick connecting it to the top of the rod in the upper one. In the case of the Genelite, oil from the upper beaker was siphoned into the lower one by capillary attraction in the metal and the wick. In the cases of the bronze and babbitt there was no siphoning effect.

Another exhibit consisted of a small flywheel driven by a motor, and running in Genelite bearings. One of the pedestals was equipped with an electric heating unit, and two wells filled with babbitt on each side of the Genelite bearing. The pedestal was heated by the coil to a degree sufficient to keep the babbitt molten, without affecting the Genelite, which showed that the latter would operate without trouble at a much higher temperature than babbitt.

In connection with the water japan exhibit eight tests were performed to show its resistance to corrosion, and two to show its flexibility. The latter consisted of a bending test and torsion test. Strips of metal coated with japan were continually twisted and bent, to show how the coating stands such treatment.

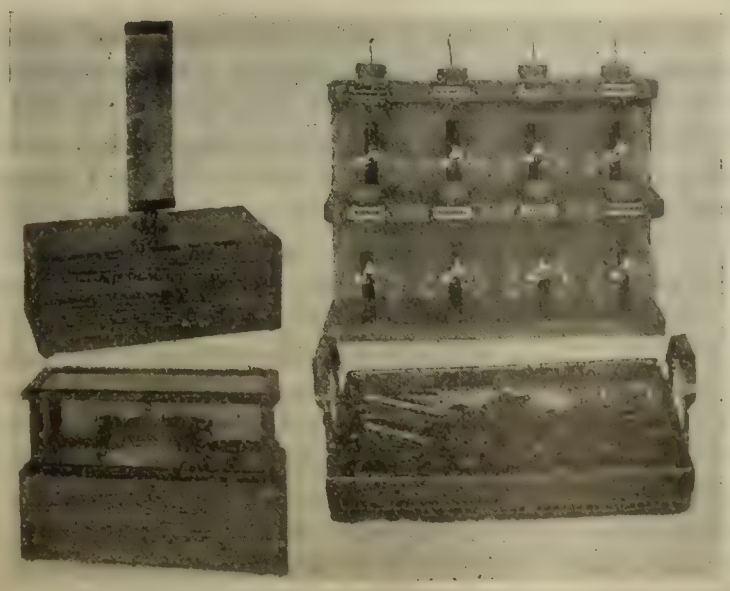


Exhibit of water japan

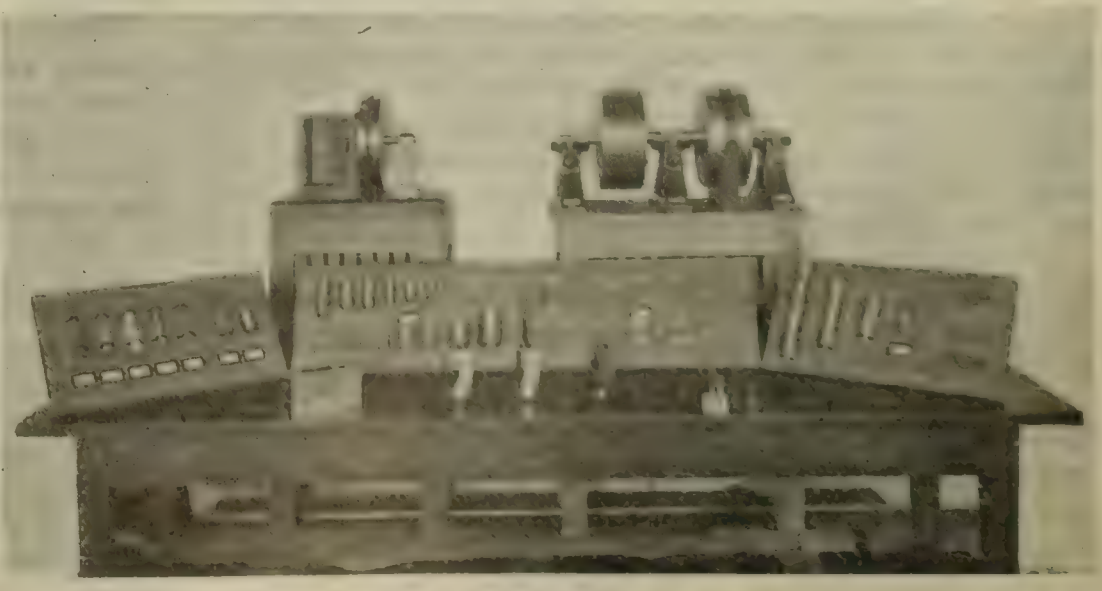


Exhibit of Genelite bearings

Recent Research Work on the Internal Combustion Engine

An important contribution, supplementing earlier reports which were published in these columns last year. The effect of latent heat of vaporization, mean volatility, temperature, pressure, dilution, mixture strength, stratification and other factors upon the combustion, and especially the detonation, of various fuels is discussed at length. Much other data given.

By Harry R. Ricardo*

IN this paper I propose to deal with the work that has been carried out recently at my laboratory, and with the deductions I have drawn therefrom. The deductions are based upon analyses of the evidence I have obtained to date; therefore, they represent the opinions I hold at the moment and, like all such deductions, are liable to be overthrown or superseded in the light of future work.

Fuels

We have been carrying out a great amount of research work on the subject of the influence of different fuels on the performance of an internal combustion engine, during the past few years. The experiments have all or nearly all been carried out on single cylinder engines, into which the problems of distribution do not enter. Therefore, until we have more data on this very intricate subject, I can deal only with the conclusions reached in so far as they are applicable to single cylinder engines. The three most important factors appear to be

1. Tendency of a fuel to detonate.
2. Latent heat of evaporation of the liquid fuel.
3. Mean volatility of the fuel.

Broadly speaking, it can be said that all volatile hydrocarbon fuels have the same heat value per cubic inch of mixture giving complete combustion and that, therefore, the power obtainable from all is the same within very close limits when used at the same compression ratio and at the same volumetric efficiency. The limit of compression ratio is determined by the tendency of the fuel to detonate; it is a function both of the chemical composition of the fuel and of the maximum flame temperature. The tendency to detonate controls at once both the power output and the efficiency, by limiting the expansion ratio. The latent heat of evaporation controls the suction temperature, and hence the weight of charge retained in the cylinder; therefore, for the same compression ratio, the latent heat controls the power output obtainable from any fuel, although the efficiency is, of course, unaffected.

The mean volatility of the fuel determines the use that can be made of the latent heat of evaporation, because the lower the volatility is, the greater the amount of heat becomes that must be added externally to the cylinder, and the more the weight of charge will be reduced thereby. It does not appear to be realized generally how important a part the latent heat of evaporation of a liquid fuel plays in the performance of an internal combustion engine. During the suction stroke of a four-cycle engine, heat is added to the working fluid by

1. Preheating the carbureter and induction system.
2. Contact with the hot valves and cylinder walls.
3. Admixture with the hot residual exhaust products in the cylinder clearance space.

Heat is abstracted only by the latent heat of evaporation of the liquid fuel.

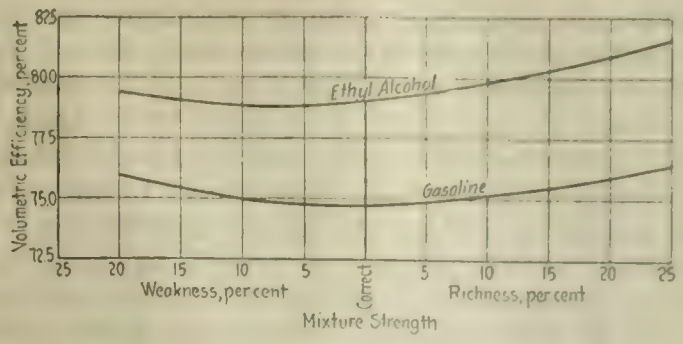
For any given aggregate value of 1, 2 and 3, it does not matter whether the fuel is evaporated inside or outside the cylinder, so far as power output is concerned, provided only that the fuel is completely evaporated before the inlet valve closes. In the former case, the heat applied to the carbureter and induction system will raise the temperature of the air without evaporating the fuel; in the latter, it will evaporate the fuel without raising the temperature of the air. However, in either case, the amount of heat absorbed by the evaporation of the liquid fuel will be the same; and the final suction temperature, and therefore the weight of charge retained in the cylinder will be the same also.

So far as pure hydrocarbon fuels are concerned, the latent heat of evaporation is low and does not play a very important part; but, in the case of ethyl alcohol, and still more so in the case of methyl alcohol, the very high power output obtainable is due almost entirely to the high latent heat of the liquid, which is playing an even more important part than is apparent at first sight from a comparison of the mean effective pressure available, because the total internal energy of the alcohols is appreciably lower than in the case of gasoline, benzol and other hydrocarbons.

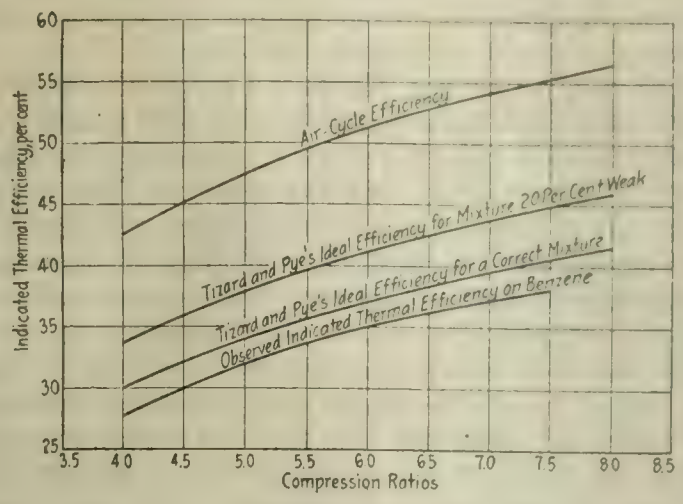
The curves shown in Fig. 1 give the measured volumetric efficiency at normal temperature and pressure, taken over a wide range of mixture strength with both typical gasoline (see Fig. 1), and nearly pure ethyl alcohol, each at a compression ratio of 5 to 1. Table 1 gives the weight of charge per hour, the power output per pound of mixture, the indicated m.e.p. as found experimentally and the total available internal energy, in the case of tests made with the same three fuels, when each is run at the same compression ratio, with the same amount of preheating and at a mixture strength giving complete combustion. Column 1 gives the observed weight of charge entering the cylinder per hour at a mixture strength that permits complete combustion. Column 2 shows the observed i.hp., at 1500 r.p.m. and with a "correct mixture," per pound of mixture per hour. Column 3 states the observed indicated mean pressure, at correct mixture strength, in

*Condensed from a paper presented at the Annual Meeting, Society of Automotive Engineers.

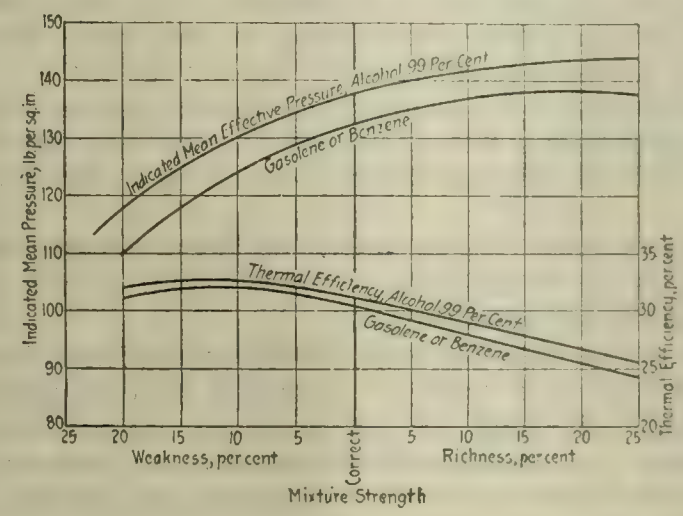
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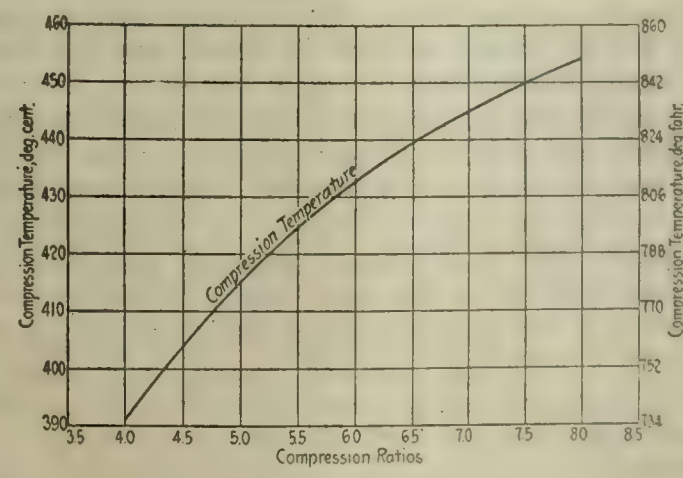
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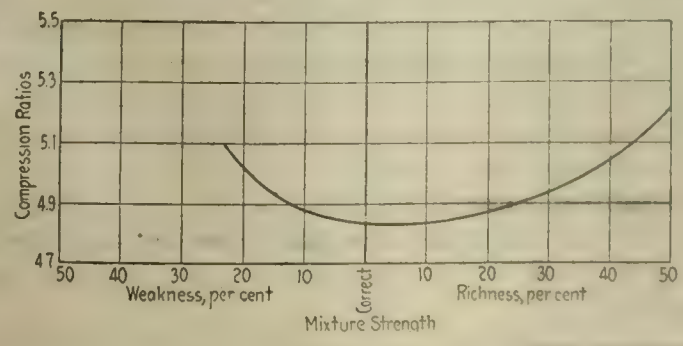
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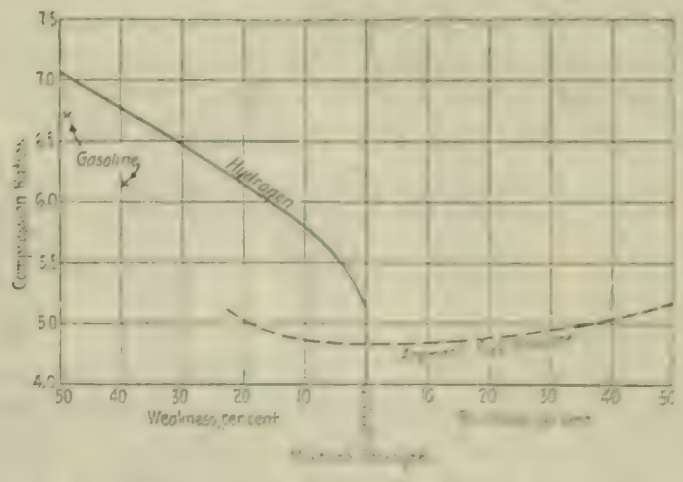
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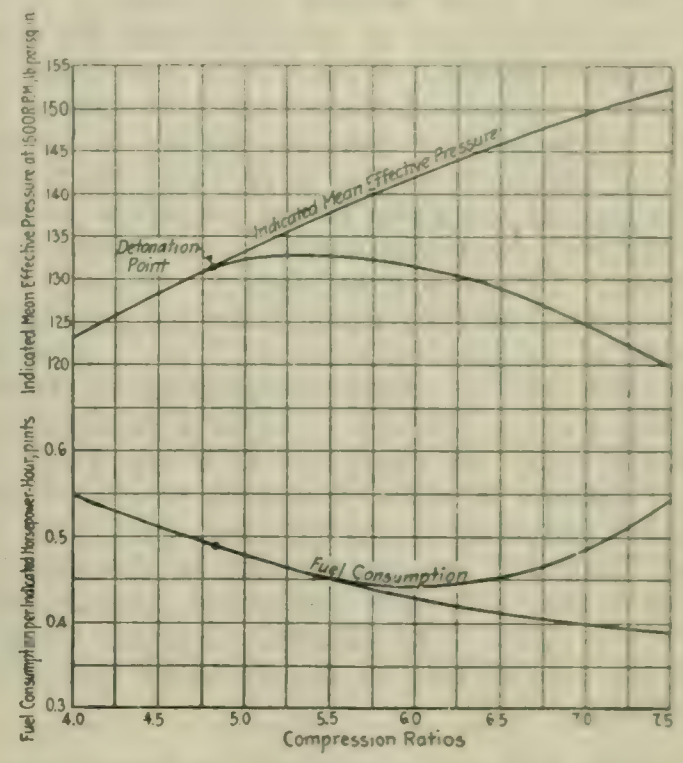
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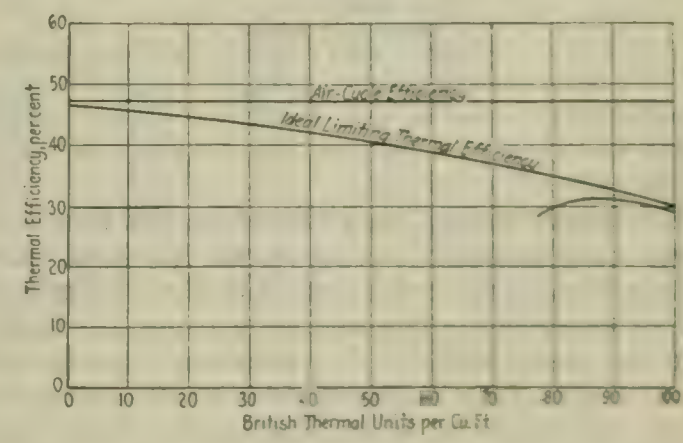
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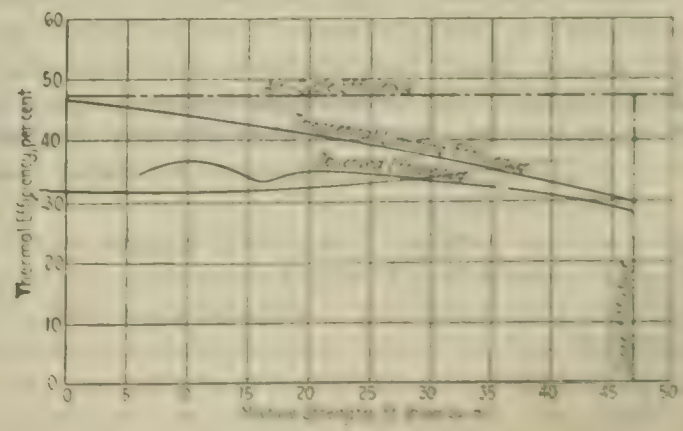


Fig. 1—Volumetric-efficiency and mixture-strength curves for a typical gasoline and nearly pure ethyl alcohol. Fig. 2—Indicated thermal efficiency for various compression-ratios. Fig. 3—Indicated mean effective pressure and thermal efficiency for various mixture-strengths of heptane, benzol and alcohol. Fig. 4—Curve showing the compression temperature for compression-ratios ranging from 4 to 1 to 8 to 1. Fig. 7—Curve showing the compression-ratio at which the detonation-point becomes apparent with varying mixture-strengths of aromatic free gasoline and air. Fig. 8—Compression-ratio at which the detonation-point becomes apparent with varying mixture-strengths of hydrogen and aromatic free gasoline as well as two points obtained with a stratified charge of aromatic free gasoline. Fig. 9—Indicated mean effective pressure and fuel-consumption curves obtained by adding varying quantities of additional exhaust-products. Fig. 10—Curves showing relation between the theoretical thermal efficiency and the energy content of the mixture. Fig. 12—Efficiency-mixture-strength curves obtained from the tests on this engine

pounds per sq. in. Column 4 presents the calculated heat of combustion of the fuel in foot-pounds per cu. in. at normal temperature and pressure. The engine speed is 1500 r.p.m. and the heat input is 0.0433 B.t.u. per revolution.

Table 1—Identical Tests with Three Different Fuels

Kind of Fuel	1 Weight of Charge Per Cylinder Per Hour, Lb.	2 I.hp. Per Pound of Mixture Per Hour	3 Indicated Mean Pressure, Lb. Per Sq. In.	4 Heat of Combustion, Ft.-Lb. Per Cu. In.
Gasoline	209	0.153	132	48.2
Benzol	212	0.151	132	47.6
99 per cent ethyl alcohol	224	0.149	138	47.4

It will be seen from Table 1 that, although the power output on ethyl alcohol is greater than on gasoline or on benzol, the power output per pound of charge is actually somewhat lower. I have debated this question of the influence of the latent heat of the fuel upon the power output obtainable, because I think it is a very important one which does not appear to have been appreciated, and the influence of preheating does not appear to be fully realized. Many designers appear to be under the impression that, so long as the gases in the induction manifold are reasonably cool, the power output of an engine is not being penalized. This is a great fallacy. Table 2 gives the i.m.e.p. obtained at 1500 r.p.m. from the same group of fuels, with a compression ratio of 5 to 1, a correct mixture strength and an engine temperature of 15 deg. Cent. (59 deg. Fahr.). Column 1 is at a constant heat input of 0.0433 B.t.u. per revolution of 0 deg. Cent. (32 deg. Fahr.); Column 2, when preheated to give a temperature in the induction pipe of 25 deg. Cent. (77 deg. Fahr.); and Column 3, the temperature in the induction pipe with each fuel and with a constant heat input of 0.0433 B.t.u. per r.p.m. The difference between Columns 1 and 2, in the case of alcohol, is sufficiently striking to need no comment.

Table 2—Indicated Mean Effective Pressure and Temperature of Inlet Gases

Kind of Fuel	Indicated Mean Effective Pressure 1 Lb. Per Sq. In.	2 Lb. Per Sq. In.	Temperature 3 Deg. Cent.	Deg. Fahr.
Gasoline	132	133	26.0	78.80
Benzol	132	128	7.7	45.86
99 per cent ethyl alcohol	138	119	16.5	61.70

Since the internal energy, and therefore the flame temperature, are substantially the same for all fuels at the same mixture strength, it follows that the thermal efficiency will be the same. The available range of mixture strength on the weak side is also substantially the same for all the available volatile liquid fuels; so, in effect, we can say that the thermal efficiency is the same in all cases, with the exception of the members of the alcohol group. These, owing to their lower heat value per gram molecule and higher latent heat, yield a somewhat higher efficiency, because both the compression temperature and the rise of temperature after compression are considerably lower; hence, the direct heat losses and those due to change of specific heat are reduced.

Before proceeding further, I will add a few words as to the method of calculating thermal efficiency. It is generally agreed by engineers and scientists that the useful calorific value of a fuel is its total heat value less the latent heat of evaporation of the water formed. It is customary, therefore, to reckon the efficiency on the basis of this lower calorific value. It is legitimate to do so, because the temperature cannot be extended sufficiently in ordinary cycle to make any use of the heat of condensation of steam.

In determining the heat value of any liquid fuel in a bomb or other calorimeter, some of the heat of combustion is devoted to overcoming the latent heat of the liquid and is therefore not recorded. In an engine working on the explosion cycle, the entire amount of the heat required to evaporate the liquid is supplied either by the exhaust or by some other source of waste heat; in any event, it is supplied externally to the heat cycle and the actual heat of combustion available is greater than that found by the ordinary methods to the extent of the latent heat of evaporation of the liquid. Therefore, I contend that if it is legitimate to deduct the latent heat of evaporation of the water formed because it cannot be used, in common fairness the latent heat of the fuel should be added to the calorimeter determination because its equivalent value in the heat of combustion can be and is used in the case of explosion, but not of Diesel, engines.

Some two years ago Messrs. Tizard and Pye completed a very thorough investigation into the limiting efficiency obtainable in a gasoline engine, assuming no loss of heat to the cylinder walls but taking fully into account the losses due to increase in specific heat and to dissociation. They traced very carefully the degree of dissociation and recombination throughout the entire combustion and expansion process, and were thus able to arrive at very nearly the true ideal efficiency for any fuel. Their findings, based upon the latest researches in thermo-chemistry, represent probably by far the most accurate information available at the present date. Briefly they show (*a*) that the efficiency obtainable with any hydrocarbon fuel is the same when burnt at the same compression ratio, within extraordinarily narrow limits; (*b*) that the ideal efficiency for a chemically correct mixture is as given by the equation $E = 1 - (1/r)^{0.258}$; and that, for a mixture strength 20 per cent weak, it is as given by the equation $E = 1 - (1/r)^{0.295}$.

Fig. 2 gives Tizard and Pye's ideal thermal efficiencies for a range of compression from 4 to 1 up to 8 to 1; also, the air standard efficiency.

It will be seen that both the theoretical and the observed efficiencies rise with an increase of compression at a greater rate than the air standard, as the latter is increased and the terminal temperature reduced, due to further recombination during expansion. Tizard and Pye's deductions, as calculated for heptane, benzol and alcohol, cover a wide range of fuels in effect, and the whole available range of mixture strength for each. For the weakest possible mixture consistent with complete combustion, they have assumed a 20 per cent excess of air. We have been unable to obtain sufficiently rapid or complete combustion with so weak a mixture as this and, in practice, we found that the highest thermal efficiency is always obtained with a 15 per cent excess of air in the case of all the fuels we have examined, except ether and hydrogen.

Fig. 3 shows the observed variation in both mean effective pressure and thermal efficiency over a wide range of mixture strength for the same three fuels. It will be seen that in each case the maximum thermal efficiency is obtained with a mixture strength about 15 per cent weak beyond which the efficiency falls away due to slow and incomplete combustion. Even with a 15 per cent excess of air, it was found necessary to advance the ignition to become some 15 deg. earlier, that is, from 32 to 47 deg., than that required for a mixture giving complete combustion. In all these experiments the fuel and air consumption per cycle were recorded automatically and simultaneously.

Mean Volatility

While it would appear that the vapor pressure determines the readiness or tardiness of a fuel to start from a cold condition, it is the mean volatility which decides the amount of preheating required. When considering various fuels, it is desirable to divide them into two groups; those which are homogeneous, such as benzol or alcohol,

and those which are heterogeneous, such as gasoline or kerosene. With the homogeneous fuels, comparatively little preheating is required because, although their vapor tension and latent heats may be high, their final boiling point is low; and, since the object of preheating is primarily to prevent precipitation of the liquid on the walls of the induction system, it is necessary only to raise the temperature of these walls to above the boiling-point of the fuel. When the boiling point is low, it is possible to raise the whole surface temperature of the walls to a sufficient degree without adding much heat to the mixture flowing within.

In the case of fuels having a wide range of boiling points, such as gasoline, and with a final boiling point of any value up to 230 deg. Cent. (446 deg. Fahr.), it is very difficult to prevent precipitation and, at the same time, avoid imparting too much heat to the mixture, for, although the mean volatility of high boiling point gasoline and benzol may be, and actually is, nearly the same, the temperature required to prevent precipitation of the heavier fractions is much higher in the case of gasoline, and for the latter only high temperature heat is of much use. It would appear that in the case of high boiling point gasolines it is best to apply a little high temperature heat just at those points where, owing to changes in velocity or direction in flow, precipitation is most liable to occur, while in the case of the homogeneous fuels low temperature heat will suffice. There can be no greater mistake than to suppose that, because a fuel's latent heat of evaporation is high and its vapor tension relatively low, it requires excessive preheating.

Vapor tension governs ease of starting but, once started, it probably has very little further influence; thorough pulverization and the avoidance of precipitation then become the most important considerations. This is particularly marked in the case of alcohol which, if properly handled, requires very little preheating; but it does require the most thorough pulverization.

Detonation and Turbulence

The principal factor controlling both the power output and the efficiency of any internal-combustion engine operating on the explosion cycle is the tendency of the fuel to detonate. It is, therefore, not unnatural that so much thought and experimental research have been devoted recently both in the United States and in England to the study of this subject. The phenomenon of detonation appears to be the setting-up in the cylinder of an explosion wave. This occurs when the rapidity of combustion of that portion of the working fluid first ignited is such that, by its expansion, it compresses before it the unburnt portion. When the rate of temperature rise due to compression by the burning portion of the charge exceeds the rate at which it can get rid of its heat by conduction, convection and the like by a certain margin, the remaining portion ignites spontaneously and simultaneously throughout its whole bulk. This sets up an explosion wave which strikes the walls of the cylinder with a hammer-like blow and, reacting in its turn, compresses afresh the portion first ignited. This raises the temperature of that portion further and, with it, the temperature of any isolated or partially insulated objects in its vicinity; thus, it soon gives rise to preignition. Therefore, it would appear fairly certain that detonation depends primarily upon the rate of burning of that portion of the charge first ignited, and it remains to discover what actually controls this rate.

I have always maintained in previous publications that turbulence has an important influence upon the tendency to detonate. This seemed probable, and there was much circumstantial evidence in favor of this assumption. From more recent investigations, my belief in this has been considerably shaken. I now feel bound to confess that I can find no real evidence that turbulence, while invaluable for other reasons, influences detonation one way or the other. In the case of combustion-chambers designed to give very high turbulence, I found a marked reduction in the tendency to detonate, but I am satisfied now that in each case this was due not to the turbulence but rather to the fact that, in each instance, the maximum distance that the flame could travel from the spark-plug was exceptionally small. More recent tests on two engines with multiple valves, in which the turbulence could be varied by cutting out one or more of the inlet valves, showed that this made no difference whatever as regards detonation.

It was supposed until recently that detonation is dependent upon the temperature of compression; this appeared plausible enough at first sight, but it most certainly did not fit in with the observed facts. For example, the difference in compression temperature between a compression ratio of 4 to 1 and 6 to 1 is actually only about 40 deg. Cent. (104 deg. Fahr.), and this difference can easily be more than counterbalanced by a change in the amount of preheating of the charge; but, we all know from experience that, while detonation on say a reasonably good gasoline will not occur with any amount of preheating at a compression ratio of 4 to 1, it will inevitably occur far below a compression ratio of 6 to 1 without any preheating at all, and even with stone cold cylinder jackets. The curve in Fig. 4 shows the compression temperature for a range of compression ratios from 4 to 1 to 8 to 1, assuming (*a*) the same amount of preheating and the same latent heat in every case, and (*b*) allowing for the varying proportion and temperature of the residual products at each compression ratio.

Our experiments appeared to show pretty clearly that detonation has very litte connection with the temperature of compression, but is closely dependent upon the compression pressure. Therefore, I concluded that it is the pressure rather than the temperature of the working fluid which controls the initial rate of burning, and therefore the tendency to detonate. This seemed reasonable. It fitted in nicely with the facts of the case and did duty as an explanation until the chemists objected on the ground that the rate at which chemical reactions take place is generally influenced but little by relatively small differences of pressure. It then became necessary to cast about for another explanation, and to find one that would satisfy the chemists also.

For the purpose of such an investigation we designed and built a machine for igniting fuel-air mixtures by adiabatic compression alone, and in which either the temperature or the pressure of compression could be varied at will over a wide range. A sectional drawing of this machine is shown in Fig. 5. In this apparatus the piston is operated by a toggle mechanism in such a manner that it makes one rapid stroke and then remains locked at the top dead center. By varying either the pressure or the temperature of the charge within the cylinder, a condition could soon be found under which any fuel-air mixture would just self ignite. It was found with this machine that, for every specific fuel and for any mixture strength of that fuel with air, there was a fairly definite temperature at which self ignition occurred. This self ignition took several forms; for example, at x minus 5 deg. Cent. (9 deg. Fahr.) the mixture would start to burn immediately on the completion of the compression, but would burn so slowly that the pressure would actually fall slightly, although not so rapidy as when no combustion took place, of course. Such burning would often continue for a matter of 2 or 3 sec., the rate of heat supply not

wholly balancing the rate of heat loss. At, say x deg. the same phenomenon would be observed at first, but with the difference that the pressure would fall slightly for the first 0.25 sec.; it would then rush up almost instantaneously to a maximum at which combustion would be complete.

This is shown in the typical diagrams in Fig. 6. If the temperature were raised a further degree or two, the interval of slow burning at nearly constant pressure would

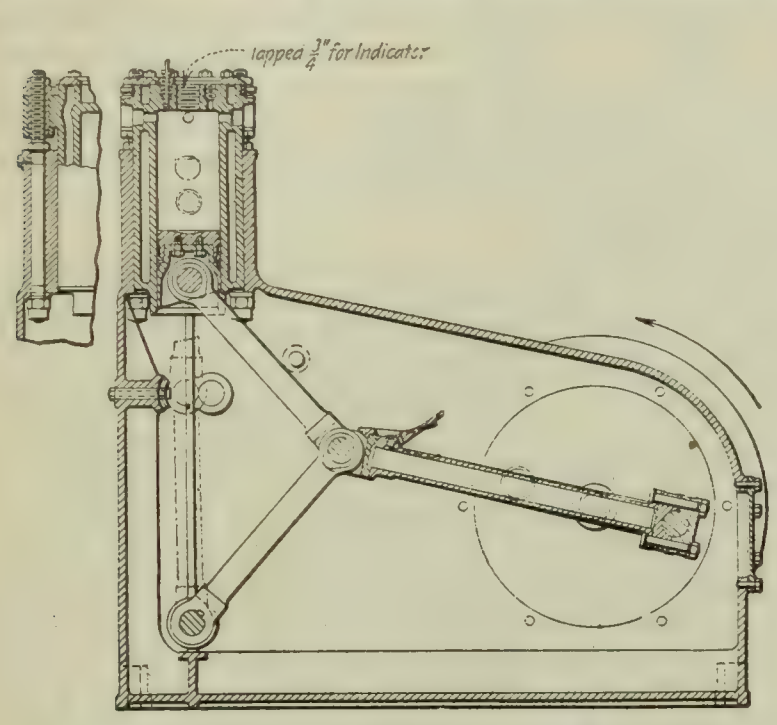


Fig. 5—Sectional elevation of a machine developed by the author for igniting fuel-air mixtures by adiabatic compression

be reduced to perhaps 0.10 sec. Thus, between the most timid and hesitating, and the most prompt and decisive burning, there would be found in each case a range of temperature of perhaps about 30 deg. Cent. (54 deg. Fahr.); but, since it was possible to vary the compression temperature within fine limits, this range could be explored very thoroughly. It was most extraordinarily consistent and, for any given mixture strength or any given fuel, one could adjust the machine beforehand with the certainty that one could obtain a 0.10, 0.20, or even a 1.00 sec. interval between the commencement of combustion and the sudden pressure rise. These first tests were all run with a stagnant charge; later a fan was fitted inside the cylinder and driven at a speed of about 2500 r.p.m. by a small electric motor. With the fan revolving, precisely the same phenomena were observed, and at nearly the same compression temperature; but the intervals between the commencement of burning and the sudden pressure rise, although relatively the same, were much smaller in all cases. In short, the fan speeded up the whole process; but it did not alter perceptibly its character, nor the temperature at which combustion occurred.

These investigations have been carried out very recently at our laboratory by Mr. Tizard. Since he has not yet had time to prepare his work for publication, it would not be fair for me to enlarge upon it; but he has made public some of the conclusions he reached, and they have been so amply confirmed, not only by tests on our own research engines but also by their close agreement with general experience, that there seems to be little doubt as to their correctness. Briefly, Mr. Tizard's conclusions are that, for any given fuel

(1) Detonation depends primarily upon the rate of burning of that portion of the charge first ignited; in this he confirms the usually accepted theory

(2) The rate of burning increases very rapidly with a slight increase of the flame temperature; and whether it will prove sufficiently rapid to produce detonation, depends upon the ratio between the rate of evolution of heat by the burning mixture and the rate of heat loss

(3) The rate of burning of the first portion of the charge depends, so far as practical engine conditions are concerned, upon neither the temperature nor pressure of compression, but rather upon the flame temperature

(4) For any given mixture-strength, the maximum flame temperature depends primarily upon the proportion of diluent or exhaust products present. It depends also, of course, upon the compression temperature; but this varies very little over a wide range of compression ratio, while the variation in the proportion of residual exhaust products over the same range exerts a much greater influence in diluting and so lowering the temperature of the initial flame. Thus, a difference of ± 1 per cent by weight of exhaust diluent will raise or lower the flame temperature by about 25 deg. Cent. (45 deg. Fahr.), which is equivalent to a range of compression from 4 to 1 to 5 to 1

(5) If the flame temperature be reduced by weakening the mixture strength, a very much higher compression could be used at once. In practice, with the exception of hydrogen, it is not possible to weaken the mixture so as to effect any appreciable reduction in the flame temperature because, within the narrow range available, weakening the mixture with air results merely in reducing the amount of dissociation without affecting appreciably the flame temperature

Fig. 7 shows the observed variation in the compression ratio at which detonation become apparent over a wide range of mixture strength. In this experiment the engine was run with wide open throttle at constant speed and constant temperature, and the compression ratio was adjusted at each mixture strength until detonation just became apparent. With both hydrogen as a homogeneous charge and with a stratified charge of aromatic free gasoline, it was found possible to operate at a compression ratio of about 7 to 1 with a mean mixture strength 50 per cent weak, and without the least trace of detonation. Fig. 8 shows a similar test with hydrogen, but with the mixture strength much further reduced, as is possible only with this fuel. On the other hand, with hydrogen the range of burning on the rich side could not be explored because, as soon as any excess of hydrogen was admitted, backfiring occurred through the inlet valves.

It will be seen that the new theory, although based on much sounder reasoning, squares with my older theory; and that, in the case of a normal homogeneous mixture, the tendency to detonate depends, in effect, upon the compression pressure, not, as I supposed, because the pressure has any marked influence, but rather because, in any actual engine, the compression pressure is, in itself, a measure of the proportion of inert diluent present in the cylinder. It differs in practice only when, by the use of hydrogen, by stratifying the charge or by the introduction of inert diluents, a weak mean mixture strength can be used. Mr. Tizard's theory has been further confirmed by other tests that we have run, in which

(1) The residual exhaust products have been cleared away by scavenging with air; it was found then that detonation became severe at once, even with very low compression pressures

(2) Additional exhaust products were added, by way of the carbureter; the compression could be raised then to almost any degree, depending upon the quantity admitted

Fig. 9 shows the variation in compression ratio permissible when, to a gasoline detonating normally at a compression ratio of 4.85 to 1, varying quantities of additional exhaust products were added and the compression adjusted in each case until detonation just became

apparent. Other tests using nitrogen, steam and carbon dioxide have given similar results. The effectiveness of such inert gases appears to be closely proportioned to their specific heats; that is, to their direct influence upon the flame temperature.

Broadly speaking, it would appear from our experiments that two factors determine whether or not a fuel will detonate. These are (*a*) the self ignition temperature of the fuel air mixture and (*b*) the rate of acceleration of burning as the ignition temperature is exceeded.

Both the true self ignition temperature, if indeed such a term can be used, and the rate of acceleration of burning appear to depend primarily upon the chemical composition of the fuel. As a broad generalization, our experiments confirmed that, as regards groups, the paraffins are the worst offenders from the viewpoint of detonation, the napthenes are better, the olefins better still, the aromatics next and the alcohols the best of all. This, however, can be regarded only as a very broad generalization, because the individual members of the various groups behave very inconsistently among themselves. Thus, pure pentane will withstand a compression ratio of 5.85 to 1 and is, in fact, comparable with a napthene. Pure hexane detonates at a compression ratio of 5.1 to 1, but pure heptane will barely withstand even a 3.75 to 1 ratio, which is the lowest compression we could reach. The behavior of heptane is particularly striking. The first samples used were obtained from California, from a vegetable source; and, although on investigation they were found to be pure samples of normal heptane and not isomeric forms, we still felt some doubt. Later, and with great difficulty, some small quantities of heptane were isolated from aircraft gasoline. Later still, some further supplies were obtained from Germany from Galician oil. Both these later lots of samples gave exactly the same results. Therefore, it will be seen that, while the average of these three members of the paraffin series agrees reasonably closely with the results obtained from a nearly pure light paraffin gasoline, the individual effects are widely different. The same thing could be observed in the case of the aromatics, where toluene was markedly better than xylene, and xylene was markedly better than benzol. The majority of the experiments on which the above conclusions are based were carried out on our 4½ x 8-in. variable compression research engine.*

Stratification

Careful analysis of the behavior of the working fluid in an internal combustion engine cylinder, shows that under ordinary circumstances, we must not look for an efficiency relative to the air cycle of more than about 70 per cent., at ordinary compression ratios. The principal sources of loss are

(1) Increase of specific heat at high temperatures
(2) Dissociation with incomplete recombination during expansion
(3) Direct loss of heat to the cylinder walls

These amount collectively to an absolute minimum of 30 per cent. In practice they generally approach nearer to 40 per cent.

Each and all of these sources of loss are directly dependent upon the flame temperature, and more particularly the flame temperature, during combustion, for we must be careful to distinguish between loss of heat during combustion and that lost during expansion.

With any volatile liquid fuel and, with the exception of hydrogen, with such gases as we have examined, the range of burning on the weak side is so narrow that the maximum flame-temperature cannot be reduced to any appreciable extent. Any attempt to do this with a homogeneous mixture results merely in slow and incomplete combustion. Flame lingers in the cylinder, and the fresh charge is ignited on entry. This sets a definite limit to the range that can be used on the weak side, but the practical limit is reached before this when, owing to delayed and incomplete combustion, the thermal efficiency falls off as the mixture strength is reduced. Fig. 3 shows the variation in thermal efficiency with mixture strength, over a wide range. Within exceedingly narrow limits, these relations can be said to hold good for any volatile liquid fuel we have ever encountered. It is indeed very surprising that, no matter how the chemical or physical characteristics of a fuel may vary in all other respects, they all apparently have this one characteristic in common, namely, that the highest thermal efficiency is always obtained with an excess of air about 15 per cent, with the one very striking exception of hydrogen. If, by any means, it were possible to work with a weaker mixture and still retain equally rapid and complete combustion, the flame temperature would fall in relation to the proportion of fuel present.

Benefits of Weak Fuel Mixtures

It would appear that, if the mixture could be weakened to an unlimited extent, the efficiency would rise from about 70 per cent of the air cycle in a nearly straight line until, with a mixture strength 15 per cent weak at the point of no heat supply, it would become coincident with the air cycle efficiency, much as is shown in Fig. 10. But this is not all, for, as the mixture strength and therefore the flame temperature are reduced, so also is the tendency to detonate; hence, if means could be found for extending the range of combustion on the weak side, and an engine were designed to use always a somewhat weak mixture, a very much higher compression ratio could be employed.

I have always believed that the benefits of working with a weak mixture could be realized by the employment

*A cut of this engine was published in AUTOMOTIVE INDUSTRIES for Sept. 15, 1921.

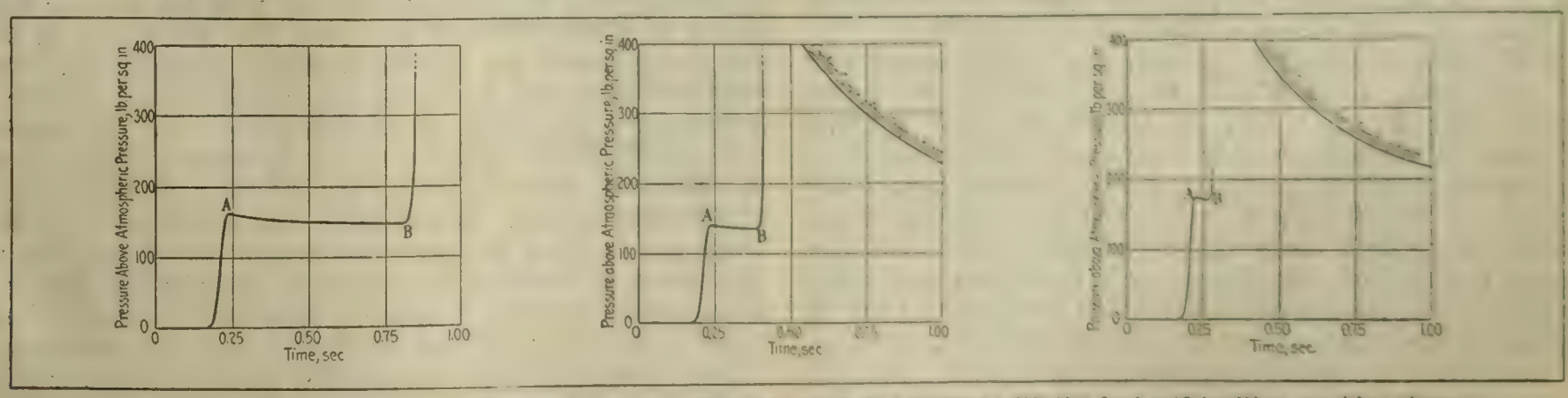


Fig. 6—Three typical indicator-diagrams of a heptane-air mixture obtained with the fuel self-ignition machine shown in Fig. 5. Reading from left to right the maximum compression temperatures were 282 deg. cent. (540 deg. fahr.), 310 deg. cent. (590 deg fahr.) and 307 deg. cent. (585 deg. fahr.). In the central diagram the fan was running at full speed. While in the other two it was stationary

of stratification; that is to say, by using a little relatively rich mixture and a large proportion of pure air, and keeping the two separate until after the ignition of the former. I have succeeded in doing this experimentally, and in approaching very nearly the results which theory would lead one to expect. In fact, I did this so easily and obtained such excellent results at the first attempt that I was at first misled into supposing that I could apply it to existing engines. Subsequent bitter experience has shown that I had a very unusual measure of good luck in my first attempt. I use an engine with a conical combustion chamber in which the air inlet and exhaust valves are fitted, and a small pocket connected with the main combustion chamber through a narrow neck.

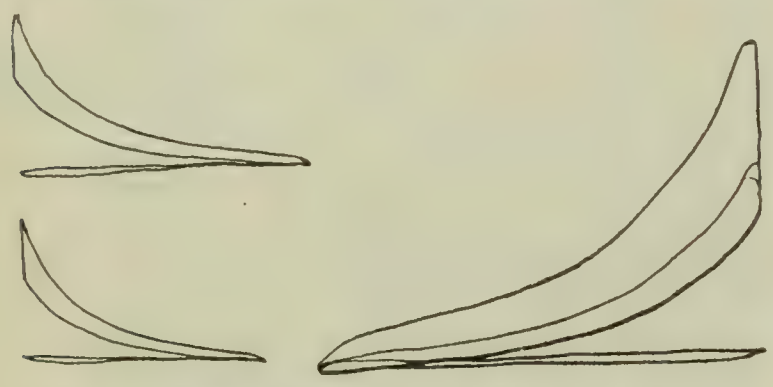


Fig. 11 — Three Indicator-cards obtained with the stratified charge engine

An automatic inlet valve for the admission of a little fuel and air, and the sparkplug, are fitted in the pocket. The main air inlet valve is set to open rather late. The result is that, as the piston descends during the suction stroke, the automatic inlet valve in the pocket or bulb opens first, and air and fuel are drawn in through a throttle valve from what can be termed the simplest possible expression of a carbureter, that is, a plain uncompensated jet in a choke tube. About 20 per cent down the stroke, the main air valve is opened and thereafter pure cold air enters the cylinder below the pocket. At the time when the main air valve opens there is a considerable depression in the cylinder, and it is probable that any rich mixture that has overflowed from the pocket retires back into it when the depression is relieved. On the compression stroke, the contents of the cylinder are compressed and some air is driven into the bulb, creating great turbulence therein. The mixture in the bulb is fired at the end of compression and, owing to the turbulence, it burns with extraordinary rapidity. The flaming mixture then rushes out through the narrow neck where it meets and immediately mixes with a very large excess of air; thus, by igniting a small proportion of rich mixture in the first place, I succeeded, in effect, in igniting a large volume of very weak mean mixture strength. The power output of this engine could be varied, either by the quantity of fuel alone, or by varying the proportion of mixture of nearly constant strength admitted to the bulb.

With either method of control, the engine would run at any load from light to an i.m.e.p. of about 120 lb. per sq. in.; but, to obtain the best thermal efficiency throughout so wide a range, it was found necessary to combine both methods. All this seemed beautifully simple and wonderfully effective, and the running of the engine on the light loads was almost exactly like that of a steam engine for smoothness and sweetness generally. The experimental engine had a water cooled bulb; but it had no water-jacket or fins on the cylinder and, although of 5-in. bore, it would run continuously at an average m.e.p. of about 20 lb. per sq. in. without blistering the paint on the cylinder walls, while the exhaust, although somewhat free, sounded almost like deep breathing. In Fig. 11 a number of indicator diagrams taken from this engine are shown.

Fig. 12 shows the thermal efficiency obtained from it with a compression ratio of 4.8 to 1 and when running at a speed of 600 r.p.m. So far, everything seemed satisfactory and, indeed, so far as this one engine was concerned, it certainly was satisfactory, the only defect being that, do what I would, I could not avoid a small zone of relatively low efficiency over some part of the range. I could vary the position of that zone up and down the range, but I could not eliminate it. Next, I tried the experiment of fitting similar bulbs to several engines with different types of combustion head, merely substituting the bulb in place of the spark plug. This proved a disastrous failure in every case. At certain loads, generally at about one-quarter load, I could obtain a very high efficiency indeed; but this was counterbalanced by a miserably low efficiency and irregular running at other loads and, in most cases, I failed utterly to carry more than from one-half to two-thirds the load of which the engine was ordinarily capable. Subsequent experience showed that everything depended upon the

(1) Shape of the combustion chamber below the pocket
(2) Shape and size of the neck connecting the pocket with the combustion chamber
(3) Position of the sparkplug in the bulb

The dependence upon (3) is remarkable, in view of the excessive turbulence set up in the bulb; but it has proved very sensitive, none the less. During the war I was forced to discontinue experiments along these lines, but I was able to devote much time to experimenting with a supercharging engine in which I made use of stratification to a limited extent. After many initial difficulties, this eventually proved to be very satisfactory. Since the war I have had little opportunity to return to these experiments. However, some two years ago, I did convert one of the two high speed gas engines supplying power to the laboratory, to run with a stratified charge, but I was careful to fit a cylinder head and bulb exactly similar to that which I used on the first engine. This has proved to be entirely successful after about twenty months of continuous running. The engine runs in parallel with a sister engine similar in every respect, but operating with a homogeneous mixture and throttle governed. There is no comparison between the two in general behavior.

Fig. 13 is a sectional drawing of this gas engine. On the one hand, the engine using a homogeneous charge requires a top overhaul and having the exhaust valve reseated every two months. The engine using a stratified charge has had its cylinder head removed only once in twenty months. The exhaust valve was found to be in excellent condition at that time. There was no carbon on the piston, there being only a little coating of thick oil of the consistency of tar that could be wiped off with a rag, thus leaving the pistion clean and bright. When running in parallel on a fluctuating load, but with an average load factor of about 50 to 60 per cent, the governing on the gas supply alone has proved perfectly satisfactory. The only defect is that, while its sister engine will develop a maximum brake m.e.p. of 100 lb. per sq. in., the engine using a stratified charge will not do more than about 80 lb. per sq. in., showing that it has not the overload capacity of its sister engine. Incidentally, this engine also will run without a trace of detonation on aromatic free gasoline up to a m.e.p. of about 80 lb. per sq. in., despite the fact that its compression ratio is 6.5 to 1, thus supplying additional evidence in favor of Tizard's theory about detonation.

As a result of these experiences, I believe there is little doubt that, sooner or later, the system of working with a stratified charge will become commercial, for, as I have shown, this is possible and can approach the high efficiency

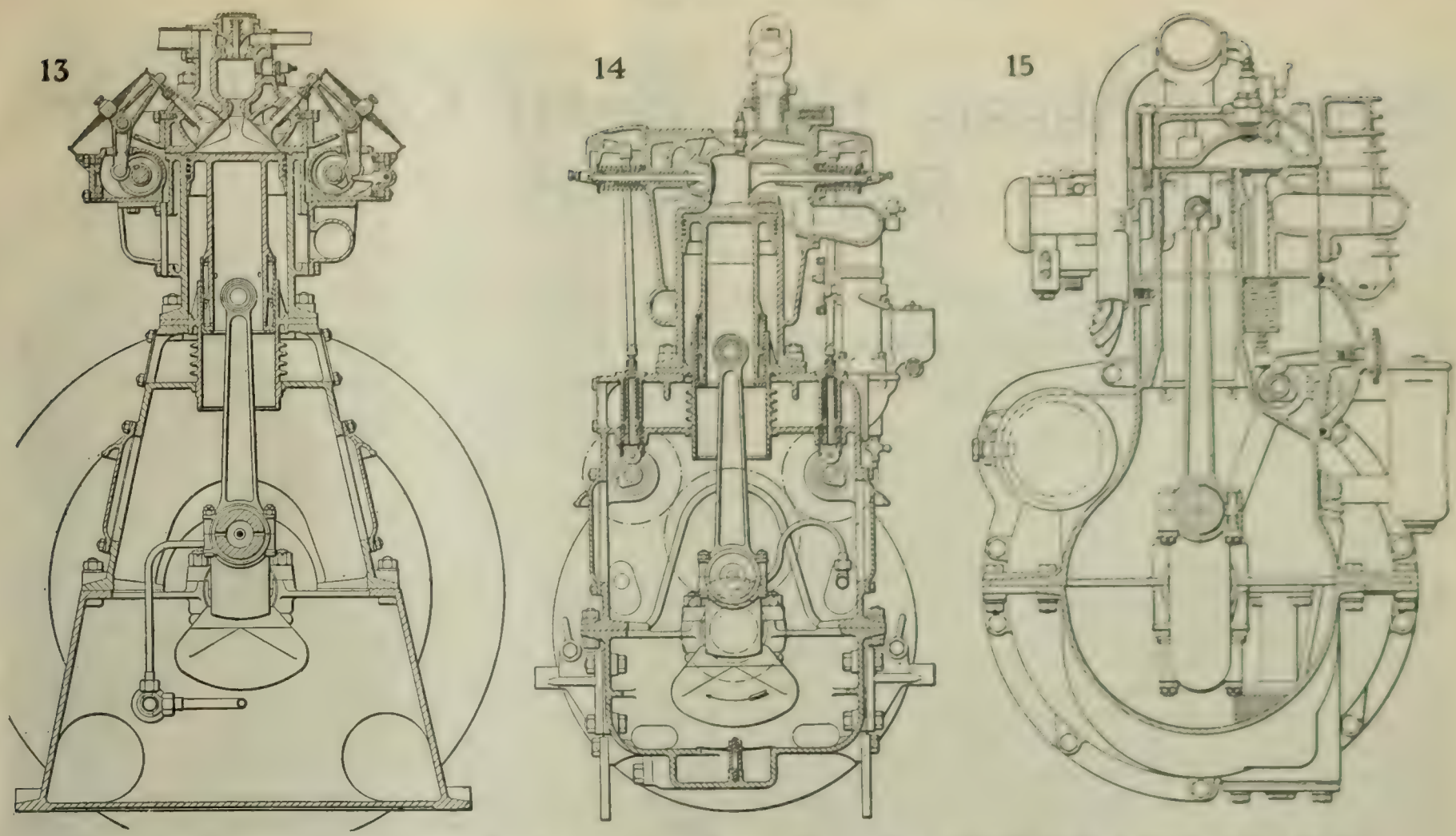


Fig. 13—Sectional elevation of the stratified charge gas engine. Fig. 14—End elevation, partly in section, of the 225-hp. Ricardo tank engine. Fig. 15—Elevation, partly in section, of a 11.9-hp. engine. The form of cylinder-head was adapted for all side-valve engines since it produced additional tubulence during the compression stroke and also the maximum distance from the point of ignition to the farthest point in the combustion-chamber

theoretically obtainable. The worst feature about it is that, if not just right, it may be very wrong; a very small change in form or dimension may upset the whole system. In such a case the thermal efficiency may very easily be much worse than that of a throttle governed engine. It will not be a commercial proposition, I fear, until the influence of each of the variable factors has been determined separately and evaluated correctly.

The great value of turbulence lies, in my opinion, in the

(1) Speeding-up of the process of combustion by the mechanical distribution of flame
(2) Scouring effect it produces in washing away the stagnant layer of gas adhering to cylinder walls

It appears now to be clearly established that the normal rate of burning of a fuel air mixture is, at the start, far too slow to be of any value; however, as shown by our experiments on the adiabatic compression machine, its acceleration after a certain stage is extremely rapid. It is probably in speeding up the initial stages of combustion by spreading mechanically the pale and timid flame brought into life by the spark plug, that turbulence plays its most important part, and this becomes most conspicuous when operating with weak mixtures.

Again, there is much presumptive evidence to show that, in any combustion chamber, there is always a layer of gas adhering to the walls of the chamber which, owing to its proximity to these walls, can get rid of its heat so rapidly that it does not burn completely. The effective thickness of this layer depends very largely, no doubt, upon the degree of turbulence. It appears to be this factor rather than the greater direct heat loss which renders certain forms of combustion chamber commonly used with side valve engines so inefficient. There is much to be said in support of this theory, because it explains the very marked difference in efficiency and power as between a high and a low degree of turbulence in the same combustion chamber, even when using relatively rich and prompt burning mixtures and firing from two points. Also, while the efficiency obtainable from two forms of combustion chamber of much the same surface area may be very different, the heat loss to the cooling water is generally much the same in both cases, showing that it is in the proportion of heat rejected to the exhaust that the difference in efficiency appears to lie rather than in that lost to the cylinder walls.

We have found the form of combustion chamber used in the 150 hp. tank engine* remarkably efficient from the viewpoint of power output and efficiency, for, with a compression ratio of only 4.3 to 1 we were able to obtain, both in the Mark Webber* and in the tank engines, a brake mean effective pressure of 108 lb. per sq. in. and a fuel consumption of only 0.55 lb. of gasoline per b.hp-hr. in the Mark Webber single-cylinder and of 0.57 in the six-cylinder tank engines. But we always found it bad from the standpoint of detonation; so bad that in the larger and later tank engines we decided very reluctantly to abandon it in favor of a much more compact form using horizontal valves, and with the spark plug in the center, as shown in Fig. 14. This gave about equal results as regards efficiency and mean effective pressure, but was remarkable as regards its freedom from detonation; in fact, these large engines would run comfortably even on kerosene with a compression ratio of 4.3 to 1 and without any cooled exhaust products. Later, we adopted the form of head shown in Fig. 15 for all side valve engines. This has proved the best of all side valve engines we have tried, for it produces additional turbulence during the compression stroke and, moreover, the maximum distance from the point of ignition to the farthest point in the combustion chamber, the factor which apparently controls detonation beyond all others, is about the smallest possible. It appears to combine the virtues of both the forms of combustion chamber we used in the tank engines.

NOTE.—The paper as presented included nine appendices containing much valuable research data.

*See paper by H. L. Horning, AUTOMOTIVE INDUSTRIES, June 2, 1921.

Elgin Chassis Has Been Completely Redesigned

New Model 700 is fitted with special Falls engine, a new single plate clutch, larger fan and radiator, and new hand brake on the gearset. Cutler-Hammer automatic gearshifter is furnished as an extra when desired. Higher gear ratio, made possible by lighter weight, improves economy.

By P. M. Heldt

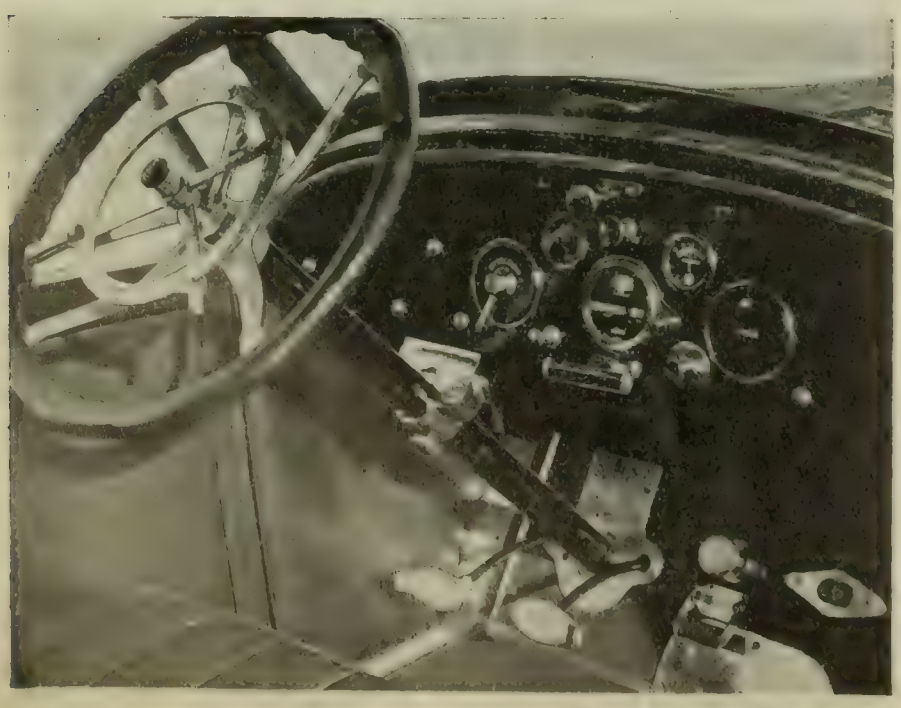
ALTHOUGH the cylinder dimensions of the new Elgin model are the same as those of its predecessor, it is practically an entirely new design. The engine is the Falls Special, a six-cylinder valve-in-head type of 3⅛ by 4½ in. By changing from circulating splash to force feed lubrication and making some other improvements the peak horsepower has, it is claimed, been increased from 37 to 46. The engine now peaks at 2700 instead of 2400 r.p.m. A new Stromberg carbureter, which gives a greater range at both the upper and the lower end of the speed, is fitted. A hot spot is now provided in the manifold, and this is claimed to result in higher torque throughout the speed range, but especially at the ends.

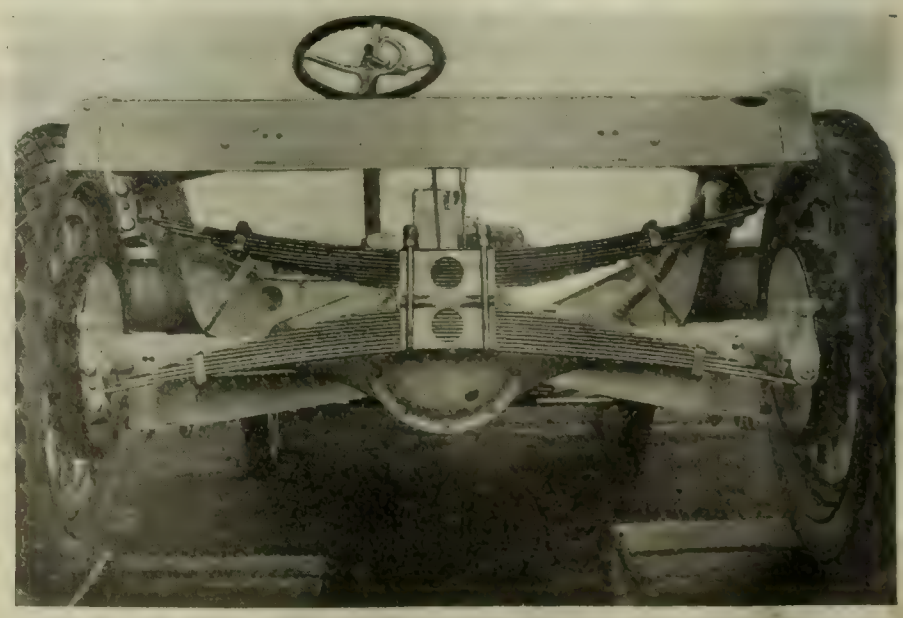
The Remy ignition system with both hand and automatic advance is now used, while the Westinghouse generator and starting motor are continued. The Willard battery also is continued, but instead of a 95 ampere-hour a 100 ampere-hour battery is now furnished. An increase in the height of the radiator of about 2 in. has added materially to the core area, and this, together with an increase in the fan diameter from 14 to 15 in. and the substitution of a Vee belt for the flat belt, has greatly added to the cooling capacity, making allowance for the increased output of the engine. On the fan there is now provided an adjustment which requires no tools. Circulation is by thermo-siphon, the same as last year.

The clutch, which is of the single dry plate type, and is made by the Rockford Drilling Machine Co., has an improvement in the way of an equalizer which divides the pressure equally between the three levers. There has been no change in the transmission, which is combined with the engine and clutch into a unit power plant that is supported on the main frame at three points. The Snead propeller shaft assembly, consisting of a tubular, electrically heat-treated propeller shaft and fabric disk type universal joints, is used. Driving thrust and torque reaction are taken up on a torque member made up of two channel steel members which are joined to the rear axle housing at the hubs of the brake spiders and come together in a forked end in front which has a ball joint attached to the cross member of the frame on which the rear end of the power plant is supported.

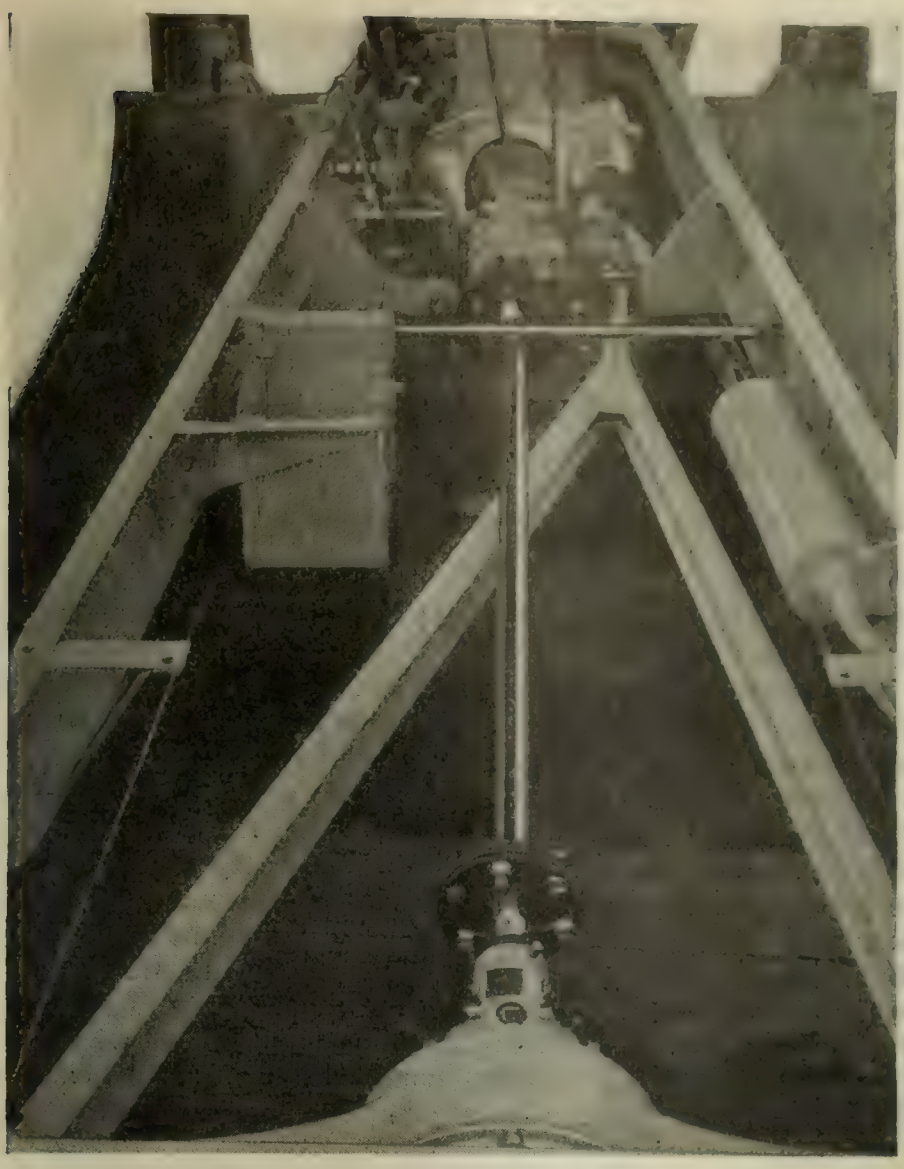
The power plant is set at a slight angle, to obtain a straight line drive when the car carries a normal load. The use of fabric joints, of course, makes it specially desirable that the angularity of the drive be minimized. The forward end of the torque member is almost the same distance from the axis of the rear axle as the forward universal joint, with the result that there is very little pulling and pushing action in a fore and aft direction on the disks of the joint.

This year the emergency brake is placed on the transmission and only the service brake is located on the rear wheels. In placing the hand brake on the transmission, several advantages were aimed at. The braking action of a transmission brake is equally divided between the two rear wheels without any special equalizing mechanism. Removing the brake from the rear axle reduces the unsprung weight. A transmission brake is easier to operate, requiring less effort to apply. Furthermore, placing one of the brakes on the transmission cleans up the

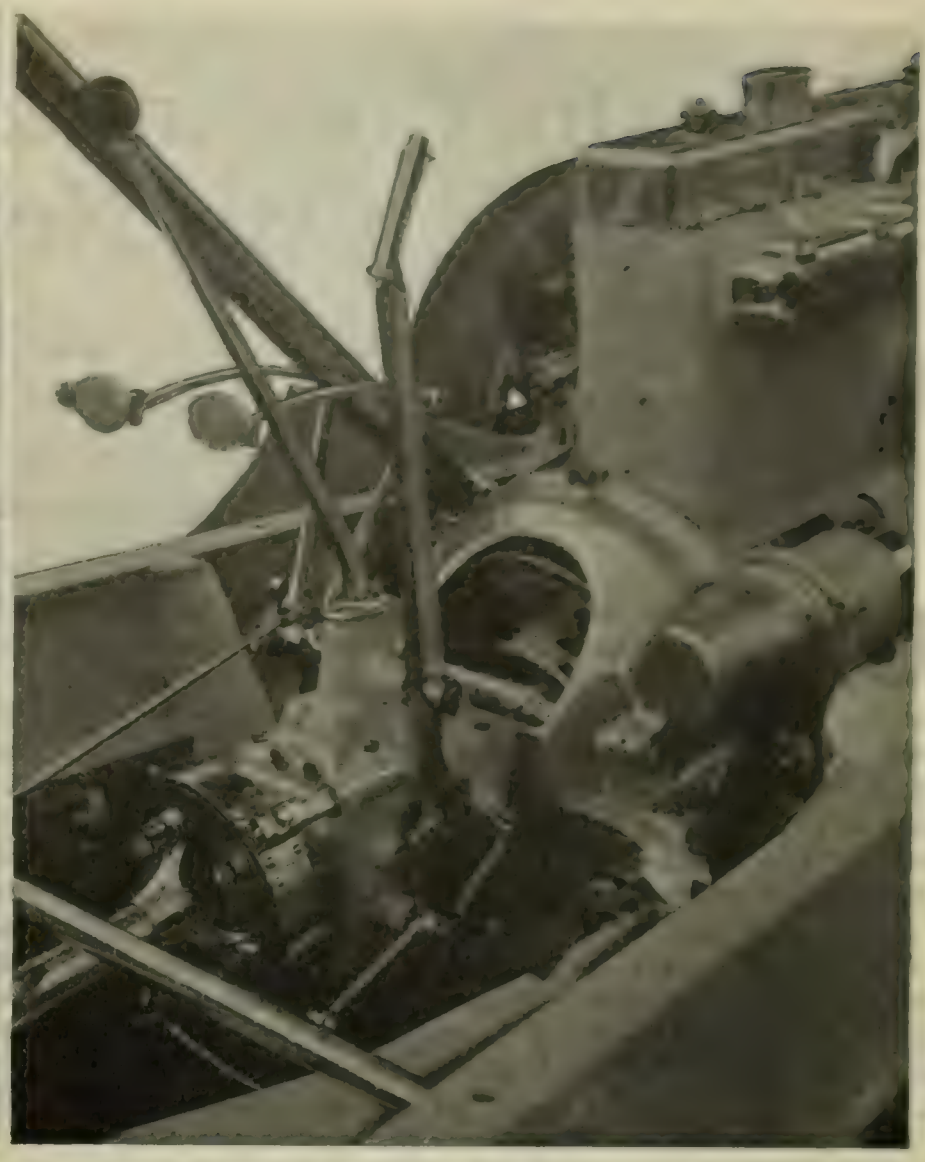




On left—Driver's compartment of car fitted with automatic gearshift. Note selector lever on steering wheel and brake pull rod on instrument board. On right—Rear X springs



Central portion of chassis showing torque member



Engine, transmission and emergency brake

chassis, in that fewer long brake rods are required, and incidentally the transmission brake is cheaper. The rear wheel service brake, which is of the band type, is 14 in. in diameter. A small rubber cushion is provided on the brake so that it goes on gradually.

The gear ratio has been reduced from 4.6 to 4¼ on the open models. This was made possible by the fact that this year's model weighs about 100 lb. less than last year's. As a result of the lower gear ratio the engine has to make fewer revolutions per mile and the fuel economy is somewhat increased. Last year the Elgin Motor Car Co. used cantilever springs at the rear, but this year it uses the type known as X springs, which consist of two half elliptics clamped together at the middle, one end of each spring being pinned to the frame rear cross member and the other end shackled. The two shackled ends are both at the same side of the frame. One of the two members of the spring is made considerably stiffer than the other, which is claimed to produce a damping effect, dampening out oscillations. The rear axle, which is of the same make as last year (Columbia), is somewhat lighter.

Some changes have been made in the steering gear which is the product of the C. A. S. Products Co. The reduction ratio of the worm and wheel, which was formerly 7 2/3, has been increased to 8½. This gives a more favorable condition in the gear, which is made with three leads and heavier teeth. A double bearing is now used on worm shaft—one bearing on each side of the worm. The connection between the worm wheel shaft and the steering arm is made by a serrated joint. A ball thrust bearing is now provided in the front axle spindles to ensure greater ease of steering. The frame is made of lighter stock but deeper section.

As an extra the company furnishes the Cutler-Hammer mechanical control. This is of the type in which a change in gear which may appear to be indicated by road conditions ahead, can be selected by means of a small lever on the steering wheel, and later the change made automatically when the clutch is withdrawn. This dispenses with the usual gear lever, and in order to remove all obstructions to ingress and egress from the driver's compartment, the emergency brake in this case is applied by a pull rod projecting backward from the instrument board.

The body of the new model is made a little longer and its sides and backs are higher. The top lines of the body are the same distance from the ground, but the bottom edge is closer to the ground than in the last year's model. The lines are somewhat similar to those of last year's model, the body being of the stream line type. A change has been made from the built-up type of crown fender to the one-piece type. The top is of the clear vision type, no sockets being exposed at the sides. At the front end the top curves in, in conformity with the lines of the body.

The equipment now includes a Stewart speedometer and a windshield wiper and Moto-Meter are now furnished on all models, instead of only on the closed models as heretofore. An electric primer (the Master) has also been added. The weight of the open touring model has been reduced to 2550 lb. A one-piece windshield, which swings around an axis close to the top edge, is now furnished.

ACCORDING to correspondence in *Engineering Production* there are four plants in Czecho-Slovakia producing automobiles. These employ together about 100,000 hands and turn out 5000 automobiles and 400 motor plows annually. The production seems exceedingly low for the number of men employed.

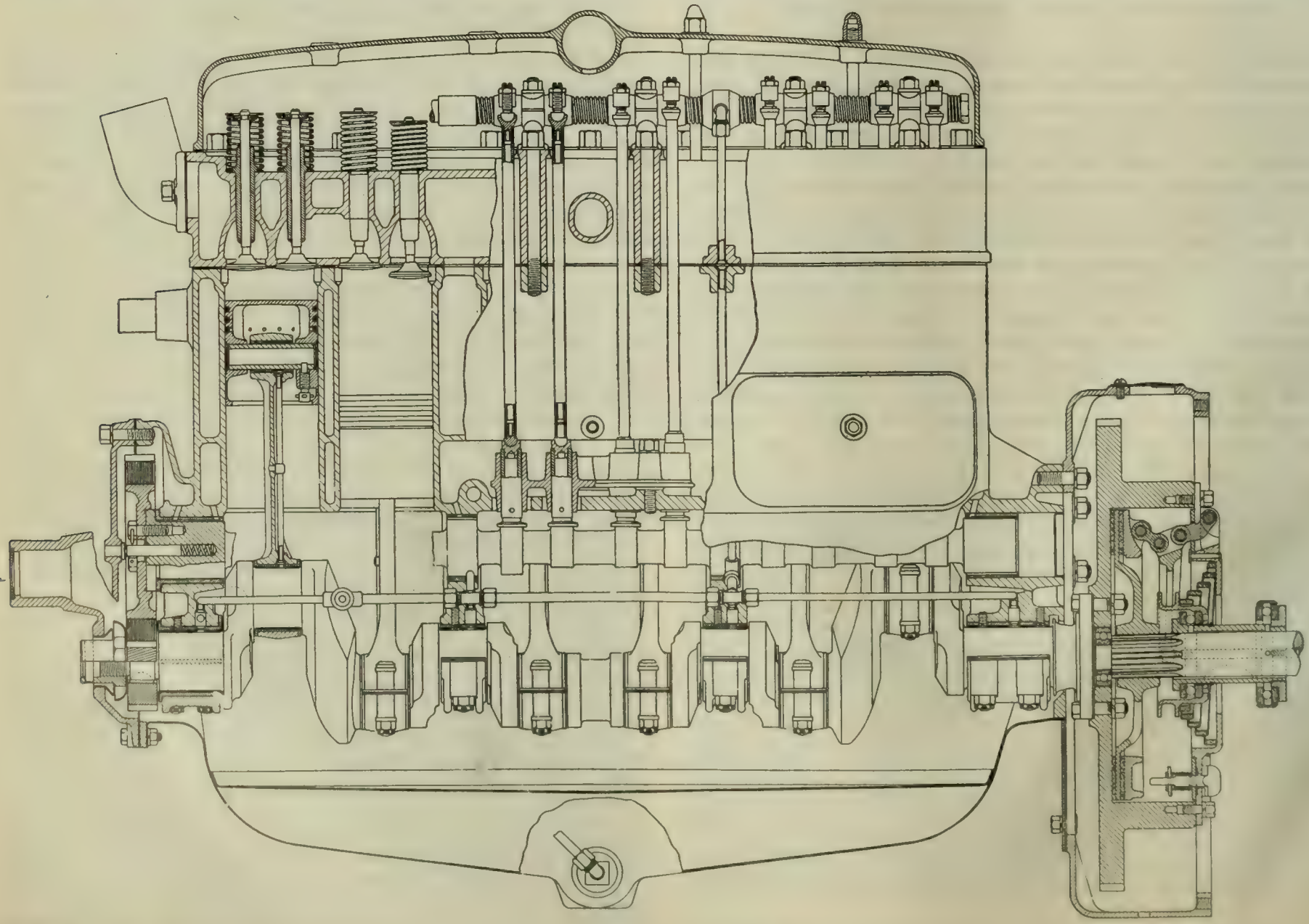
Velie to Concentrate on Production of One New Model

This is to be fitted with a new engine and clutch of their own manufacture. Engine has overhead valves operated from camshaft in crankcase, and is provided with pressure feed to practically all bearings, piston pins included. Single plate clutch has positive release and easy adjustment.

THE Velie Company has announced that its entire manufacturing facilities will be concentrated on the new Model 58, with 115 in. wheelbase. The chassis has been modified somewhat to accommodate the new powerplant, which is of Velie manufacture. It is a six-cylinder overhead valve type. Much thought has been devoted to the development of effective means of fuel vaporization. The cylinder head casting is so designed that the incoming gas mixture impinges upon exhaust heated walls to assist vaporization.

A desire to secure accessibility, good lubrication and smoothness of operation were governing factors in laying out the new engine. The cylinder bore is 3⅛ in. and the stroke 4¼ in., giving total piston displacement of 195.6 cu. in. and an N. A. C. C. rating of 23.4 hp. Timing gears are 9 pitch and are helically cut; the camshaft gear being of Micarta.

A gear pump is used to provide full pressure lubrication. The pump is mounted on the generator drive shaft housing and draws oil through a strainer from the oil pan in the crankcase. The oil from the discharge side of the pump is conducted to a distributing pipe, which leads the oil to each main bearing. The drilled crank cheeks provide a path for the lubricant to the bronze-backed connecting rod bearings. The upper halves of the big end connecting rod bearings are drilled to receive small copper tubes clipped, to the side of the rod, which lead oil under pressure to the wristpins. The oil distributing line is provided with a T, at the third main bearing, from which a branch leads oil to the hollow rocker arm shaft. Oil issuing from this



Longitudinal section of the new Velie engine and new single-plate Dooley clutch. Note large size of bearings employed

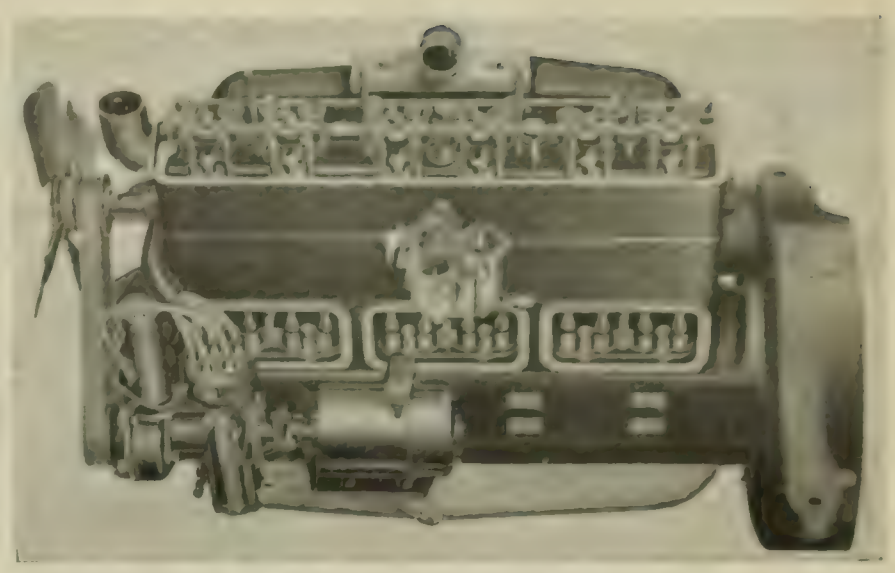
shaft lubricates the rocker arm bearings and the overflow oils the pushrods and valve lifters on its way back to the sump in the crankcase. Some of the overflow is caught in the shallow tray in the valve lifter chamber, and oil ducts drilled in the casting carry this oil to each of the four camshaft bearings. An oil pressure relief adjusting valve is located on the outside of the crankcase at the right front corner. The oil allowed to escape by this relief is discharged directly onto the crankshaft gear and thrown over the other gears, a portion of it being caught in a pocket over the generator drive shaft bearings and fed into these bearings through suitable passages.

The crankshaft is drop forged from S. A. E. No. 1045, 40-50 carbon steel, suitably heat treated. The camshaft is made from S. A. E. No. 1020, 15-25 carbon steel, case hardened on the cams and bearing surfaces.

Camshaft and generator shaft bearings are die cast babbitt. There are four crankshaft bearings of 2 in. diameter and lengths from front to back as follows: 2¼, 1½, 1½ and 2¾ in. The camshaft is 1⅛ minimum diameter and has bearings which measure as follows: 1 5/16 x 2 9/32, 1 29/32 x 1, 1⅞ x 1 and 1 27/32 x 1¾ in. The makers state that the bearing areas are greater than for any other passenger car engine of equal displacement.

The connecting rods measure 8⅛ in. center to center. Connecting rod bearings are fastened in place and then expanded to completely fill the rod ends and caps. The bearings are broached after they are bolted together and are finally run in under tension. The length of the big end bearings is 1⅝ in. and the diameter 2 in.

The cast iron pistons are unusually light and are provided with three rings, all above the piston pin. The pistons are 3½ in. long and are given 0.001 in. clearance per inch of cylinder diameter.



Inlet side of the new Velie six-cylinder engine

The cylinder block is a good example of thorough water jacketing, as is shown by the sectional views. The water jackets completely surround each cylinder as well as each valve seat. The block is first rough bored and then set aside for a time to season. A second boring operation is performed and then the bores are accurately ground to size.

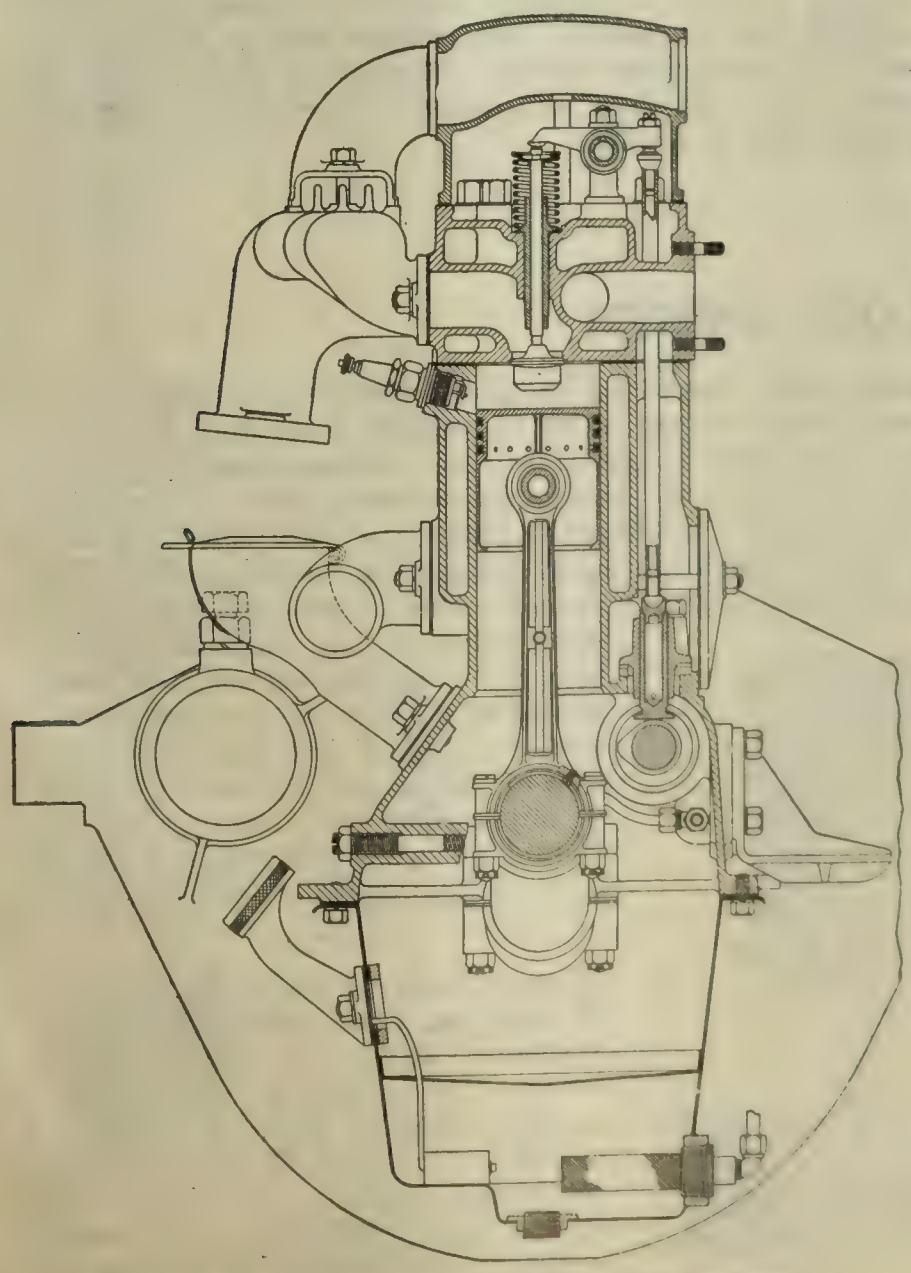
The piston pins are .740 in. diameter. They are held in the piston bosses by setscrews passing entirely through the pin and into the opposite wall of the boss. The rings are of cast iron and are 3/16 in. wide.

The removable cylinder head is held down by thirteen nickel steel studs. The rocker shaft is anchored to the head independent of the cylinder head studs and can be removed as a unit with the head. The time of the service operation of grinding the valves is considerably lessened by this constructon.

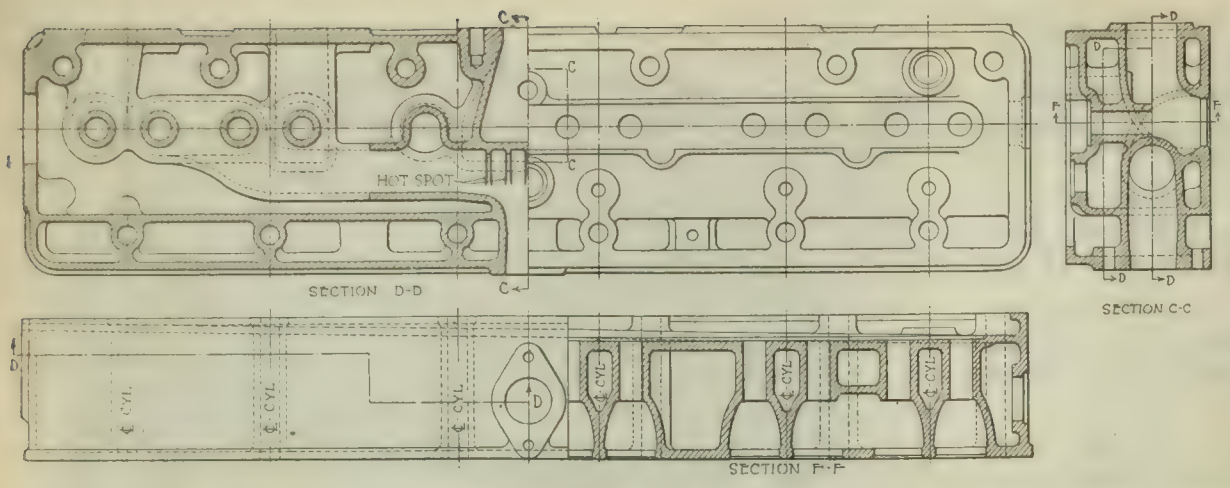
The valve stem guides are 3¼ in. long and are reamed by hand to accommodate the 5/16 in. valve stems. The valve lifters are hollow and are of the mushroom type. A cushion of oil is constantly present in the valve lifter and pushrod cup joint, and the usual noise incident to the action of overhead valves is thereby greatly decreased. The valve lifter assemblies can be taken out through the inspection plate holes after removal of two cap screws for each assembly. The timing is as follows: intake opens 7 deg. past top center, intake closes 47 deg. past bottom center; exhaust opens 45 deg. before lower center and closes 5 deg. past upper center. The clear lift is 5/16 in., the tappet clearance is 0.004 in., warm. The valve cover is an aluminum casting. The warm air for the carbureter flows through a passage in this casting. The fitting on the carbureter which takes the heated air from the exhaust stove has manually operated butterfly valve for controlling the admission of cold air.

The engine accessory drive is well worked out. The generator can be removed without disturbing the ignition unit, or vice versa. The exhaust side of the engine presents a clean appearance. A breather and filling spout of unusual size is mounted on the crankcase on this side. The starter is readily removed by loosening the retaining screw and locknut. The electrical units include Atwater Kent ignition, Bijur two-unit six-volt starting motor and lighting generator. The amount of oil in the oilpan, which has a capacity of 5 qts., is indicated by a gage on the exhaust side of the engine. S. A. E. standards have been followed throughout in the construction of engine and chassis. The flywheel housing is an S. A. E. No. 3.

The flywheel is machined to accommodate the Dooley clutch. A sectional view of this clutch is shown in one



Transverse section of engine showing valve and manifold arrangement



Sectional views of cylinder head

of the cuts. This is a Velie product and is novel in two respects. First, the method of adjustment, which is accomplished without the aid of tools. The thumb nut shown in the drawing is movable and is positioned by notches on the clutch housing, similar to a notched throttle quadrant. It is necessary only to pull the thumb nut up and over one notch to secure the desired adjustment. The operating mechanism is carried on the clutch housing. The second feature is the method of securing the pressure plate. The usual practice in single plate clutches is to have this member driven by dowels fastened to the flywheel. A system of toggles provides for positive withdrawal of the clutch plate from the friction plate when declutching and also takes the drive.

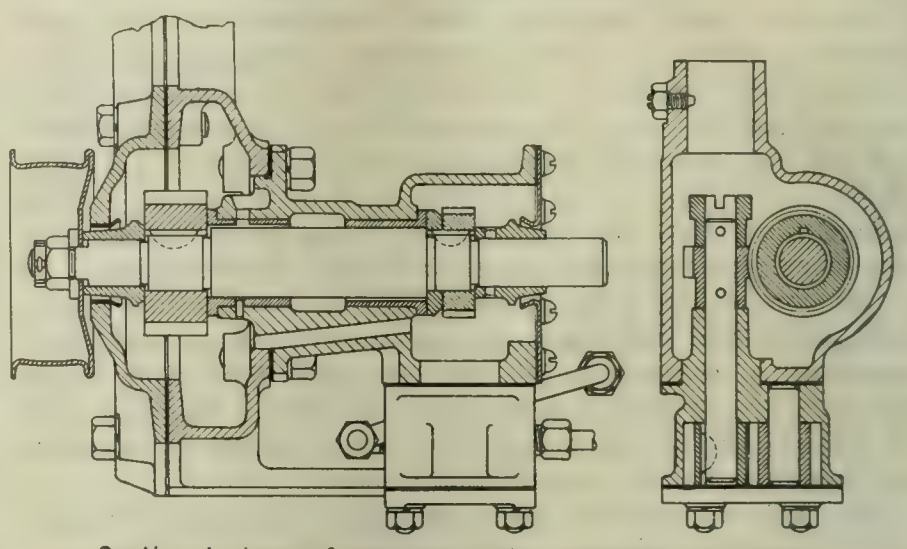
A Durston three-speed transmission is bolted to the housing behind the clutch. The main shaft is mounted on annular ball bearings and the countershaft is carried on plain bearings.

The powerplant is suspended at three points. The maximum speed of the engine is 3100 r.p.m., but a maximum of 45 hp. is obtained at 2500 r.p.m. The maximum torque is 115 lb. ft.

The frame is manufactured in the Velie shops. Semi-elliptic springs are fitted front and rear. The purchaser has the option of wood or disk wheels. The tire equipment is Miller cords 32 in. x 4 in. non-skid on all wheels. The rear axle is the latest model Timken, semi-floating. The pinion shaft is fitted with two bearings, one in front of the pinion and the other at the rear to insure a rigid pinion shaft.

Brakes are on the rear wheels. The hand brake is internal expanding and the foot brake external contracting.

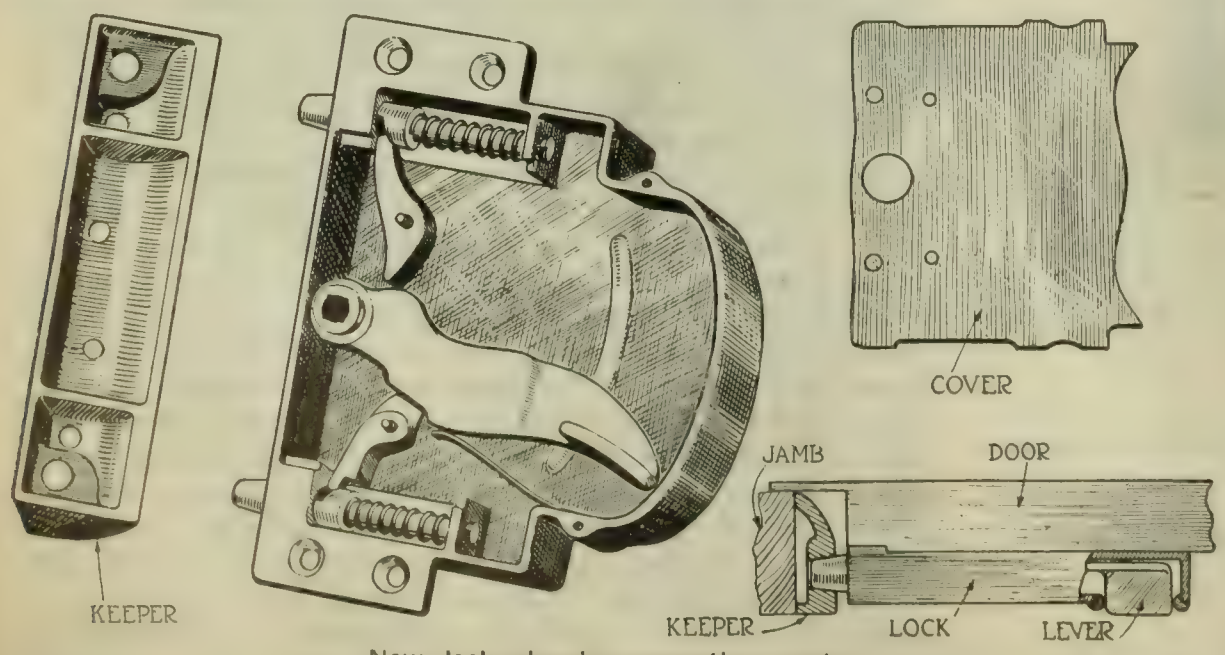
The Velie bodies are provided with genuine leather upholstery, and body lines are more rounded than formerly. The chassis will be fitted with both open and closed bodies. The prices on the inclosed models have not been announced. The touring car and roadster list at $1,395.



Sectional views of generator drive shaft and oil pump

A New Door Lock Design

AN automobile door lock with two tapered bolts is manufactured by Carl Mack and distributed by M. Eberhart & Son Co., Inc. The latch bolts have double guides in the frame of the lock. Their rear end is reduced in diameter and the bolts are forced into tapered keeper holes by coiled wire springs surrounding the reduced portion and bearing against a shoulder on the bolt. A flush lever operating handle operates the lock. The operating pressure is 22 oz., which is said to be much less than that required by the average door lock. In the opening and closing movements, one of the lock bolts has a considerable lead over the other. There are three operating parts moving the locking bolts. The double lock plungers are claimed to prevent accidental opening of the door and personal injury resulting therefrom. The compression springs on the bolts prevent rattling of the door. Elimination of the projecting handle makes it impossible for clothing to get caught in same. The lock is made in both right- and left-hand models.



New lock showing operating parts

IOWA leads all states in the total value of farm products and in number of motor cars registered on farms. The State is third in the average value of products per farm and in the number of motor trucks registered thereon. During 1921, the total registration of motor vehicles was 430,003, or one car to 7.31 persons.

Exports of Automobiles, Tires and Motorcycles for November, 1921

COUNTRIES	COMMERCIAL				PASSENGER				Parts	TIRES			All Other Tires	MOTOR CYCLES	
	Complete Cars		Chassis		Complete Cars		Chassis			Casings	Inner Tubes	Solid Tires			
Europe															
Azores, etc., Islands					1	$350	1	$300							
Belgium	25	$10,928	18	$6,012	39	27,791	10	4,371	$3,111	$525	$99			19	$2,800
Bulgaria									62						
Denmark					13	17,375			91,963	23,399	1,295		$549	1	300
Finland									1,559	426	474	457			
France	1	1,240			4	9,800			8,350	13,445	495				
Gibraltar									26						
Greece	8	3,556			34	15,986			5,476	37,420	4,063		92	1	650
Jugoslavia									2,606	1,490	373				
Iceland and Faroe Islands					2	2,500			299						
Italy									3,068						
Malta, etc., Islands					1	383			1,036	3,469				15	1,400
Netherlands	29	12,675			21	24,416	1	1,000	27,071	16,623	955	200		29	7,260
Norway			1	1,576					5,336	6,566	828	1,300			
Poland and Danzig					1	700			4,717						
Portugal									8,126	4,598	28			1	350
Roumania									6,295						
Spain					5	4,911	1	375	15,538	15,122	2,567	7,795		34	9,444
Sweden	3	2,293	2	2,280	81	83,208	2	1,456	12,816	49,337	3,146			2	417
Switzerland					8	11,366			3,467	6,211	526		113		
Turkey in Europe					4	5,162			687	1,238	147				
England			11	11,349	51	70,471	61	17,957	573,668	648,739	47,966	13,414		64	5,434
Scotland									781						
Ireland					1	385			7,322	700	80				
North and South America															
Bermuda											64		16		
British Honduras					2	2,025			295	300	185		14		
Canada	21	35,592	22	38,509	180	235,883	12	11,808	651,649	5,034	4,495	5,950	228	11	3,481
Costa Rica									778	314	15		97		
Guatemala					10	12,735			3,714	3,166	120				
Honduras			2	625	1	372			1,699	1,348	60	837	14		
Nicaragua									202						
Panama	1	437			28	26,842	1	1,250	3,175	16,076	994	1,461	1,727	1	350
Salvador	1	3,166			9	2,218			1,315	3,273	369				
Mexico	69	38,809	26	20,424	424	331,063	15	7,399	116,950	154,971	13,076	4,851	2,750	9	1,986
Newfoundland, etc.									454						
Barbados					6	3,730			1,594	2,629	163		97		
Jamaica	3	2,694	3	1,887	32	21,704	1	728	9,483	14,781	1,419	1,948			
Trinidad, etc.	11	6,387			17	7,336			3,239	7,195	419	248	81		
Other British West Indies	2	818			9	9,297			1,432	894	70		141		
Cuba	7	2,923			33	43,727			132,116	55,968	3,238	1,830	1,708	5	1,545
Virgin Islands									582	910	22	1,869	421		
Dutch West Indies					6	2,415			686	1,192	165		43		
French West Indies									1,353	5,879	313	771			
Haiti	1	437			11	9,238			2,967	4,484	865		264		
Dominican Republic	1	3,000			3	1,683			6,253	11,161	1,909	908	160		
Argentina	1	5,221	1	3,600	67	54,744			558,262	48,366	1,800	2,958		1	1,300
Bolivia										990					
Brazil	1	5,150			19	10,672			9,352	4,403	60	1,009			
Chile	2	4,286	2	5,207	2	1,801			4,840	5,886	941		531		
Colombia					15	10,751	4	1,890	11,007	7,239	452			1	300
Ecuador									1,964	5,856	500				
British Guiana					3	2,424			3,329	808	20	160			
Dutch Guiana									464						
Paraguay										96	3				
Peru							2	920	11,543	11,816	564	173	75		
Uruguay			10	2,990	2	3,000			12,084	12,295					
Venezuela					20	14,611			5,639	9,426	1,641	250			
Asia															
Aden									136						
Armenia, etc.					12	4,519									
China			4	3,012	2	3,500	1	1,520	3,657	9,992	608	417		1	175
Kwantung					1	1,107				106					
Chosen									3,000						
British India	1	1,164	1	1,116	68	62,537			24,814	3,695	2,864	11,274	72	8	1,118
Straits Settlements									3,300	4,334	868	2,861			
Other British East Indies					10	7,294			2,036	1,534				1	531
Dutch East Indies					5	6,250			1,250	1,200		2,100			
French Indo China									833	196					
Greece in Asia									846	3,146	120	137			
Hejaz, Arabia, etc.									1,487	1,876					
Hongkong					4	5,358			80	658					20
Japan	2	7,310	50	21,500	19	27,927			32,137	20,399	1,248	6,819	38	60	15,654
Palestine and Syria					63	27,673			1,540	9,909	1,725		1,200		
Persia										1,048					
Siam					6	3,972			292	466					
Australia	6	11,503	37	42,590	45	55,208	310	272,624	33,754	11,266	439	1,881		124	40,129
New Zealand			1	300	85	93,414			21,403	71,365	4,035	3,000		12	1,800
Other British Oceania					4	4,848			1,355	200	28		135		
French Oceania									1,851	1,335	180	930	240		
Other Oceania									1,279	195			70		
Philippine Islands	17	12,670	1	1,985	15	19,825			5,002	47,153	1,500	4,500	4,905	1	150
Africa															
Belgian Kongo			5	2,185					6,400					1	660
British West Africa	9	17,024	1	1,194	5	4,200	2	2,779	17,072	11,742	960			1	275
British South Africa					76	73,610			23,457	27,208	1,577	468	50		
British East Africa					1	1,857			1,143	4,548	442				
Canary Islands	3	1,311	3	3,959	11	12,945			3,839	1,900					
French Africa									2,845	150					
Morocco					6	5,732			7,100						
Egypt					10	4,292	5	1,670	3,916	6,412				6	1,989
Portuguese Africa	1	1,500													
Spanish Africa														3	899
Total	226	$192,094	201	$172,300	1,616	$1,509,143	459	$338,047	$2,546,424	$1,474,056	$115,411	$88,211	$15,608	500	$144,696

Distributors or Factory Branches?

Part I

Here is a fundamental discussion of this vital question. Present day practices are the result of rapid developments. The pressure from now on will be on the merchandising rather than the production phase of the industry. Later articles will continue the discussion of this important problem.

By Harry Tipper

THE present method of distributing the passenger car did not arise wholly out of the economic necessities as they exist in the fully developed business of to-day. In fact, the economic necessities of the present-day business are themselves entirely different from those necessities facing the manufacturer in the early days of the history of the automotive industry. As in other lines of business growing rapidly into their place in the social or industrial fabric, the distribution of the product was carried out along the lines of least resistance and in response partly to the pressure from the potential market outside the manufacturer's establishment, and only partly from the manufacturer's conceptions as to the advisability. There was little or no necessity for the manufacturer to study the economics of distribution in those days, because the unsatisfied virgin market was waiting for the passenger car to come within reach and exerted a constant pressure upon the manufacturer to improve the vehicle itself and to enlarge his production possibilities so that the vehicle itself would be available to them.

This was the great time for the engineer and the production man, as the future of the business depended almost entirely upon their work. The automobile is the only product of modern industrial times that has fixed the public's attention upon itself at all moments of its use. Every automobile running in the streets or roads was a spur of so effective a nature to the potential desire of those who did not own an automobile that the pressure of the market was very quickly felt as soon as the car became sufficiently reliable and produced in sufficient quantities to meet the demands of any section of the population.

As a consequence, manufacturers distributed the cars according to the pressure of the market, and the distribution system itself grew out of the market pressure until, as the business enlarged, it assumed the proportion existing to-day.

In the experimental era of the automotive business, when the production of cars was counted in single units, and the sale of cars was similarly counted, the man who sold cars for any individual manufacturer went into the business from his interest in the product. He was interested in the development of the automobile. Almost unconsciously he was dragged into the development of this new business by the character of his enthusiasm in the possibilities of the product. At this stage there were no distributors as they exist to-day. There were some few retail establishments selling automobiles, keeping them in order and keeping the salesrooms where the machines could be inspected. The men who sold cars in those days had to acquire sufficient knowledge to rescue them from their innumerable troubles and, in the course of that experience, they practically discovered a great many things not yet a part of the manufacturer's equipment of knowledge. By force of circumstances they became experts in the business, and the relation existing at that time is indicated by the fact that many of those distributors went into the manufacturing business later, while some of those in the manufacturing business went into the distribution field as the business developed.

As the automobile passed from the experimental stage and became available to a larger section of the virgin market, these dealers found it possible to sell a larger and larger number of cars. They received calls and inquiries for cars from the bicycle repair shops and other places in smaller communities in the trading area, and they began to develop into distributors, bringing those establishments in smaller communities into existence as dealers. Of course, this was not so in all individual cases. In the establishment of a new business like this there was a great deal of flux and change going on in all the individual territories as they opened up, and in individual cases. People came into this business in the retail end and in all branches from all kinds of business and professional work because of their interest in the product. They were able to establish themselves with comparatively little money. A number of those who were enthusiastic about the automobile projected themselves into the business, exerting their pressure upon the manufacturers and the older distributors who were included in the chain of distributing and merchandising the product itself. Naturally, these enthusiasts possessed an influence with the other members in their communities who were potential buyers of the product and a part of the virgin market. In those days the man who could own and successfully drive a car and keep it in shape was a man who possessed a considerable amount of knowledge in the eyes, at least, of those who had not yet summoned up sufficient courage to avail themselves of the possibility.

Thus, in one way or another, partly because of the human reactions in the case, partly because of the rapid growth of the business and partly because of the extent of the virgin market, there has grown up a system of distribution comprising distributors, those who secure the cars from the manufacturers and who wholesale those cars to retailers, doing at the same time a retail business of their own; dealers who are doing a retail business in a restricted territory, and branches of the manufacturing establishments developed in large centers to meet the possibilities of those centers as markets.

It was obvious in the early stages of the business that the man who went into the selling and maintaining of an automobile would be obliged to confine his interests to one individual car or one or two non-competing cars,

and the exclusive territory became a concomitant of this interest. Furthermore, the demand upon the dealer and distributor to maintain the cars in condition to perform their service was more insistent in the early days than it was in the later growth, because of the more or less experimental character of the product for a number of years and the constant development of weaknesses here and there in the building of production to its present proportions. As the product became stabilized, this necessity for service of the right character diminished somewhat in proportion and was partially overlooked.

It is necessary to consider the place of the various elements of distribution in the development of the passenger car market and its maintenance, to what extent they are fulfilling their functions, and the changes which must take place in order to meet the new requirements. In this examination the merchandising of the car must be expressed in its true relation to the maintenance of the car when it has been bought. The sale of an automobile is not concluded with the purchase of the machine, like the sale of a suit of clothes. It is purchased for service. The appearance of the car, its continued appearance, its reliability, the day-in-and-day-out efficiency for service, the amount of time which must be spent in repair and adjustment—are all elements in the sale of more and more importance as the virgin market is absorbed and the replacement market becomes a larger element of the future consideration. All the elements of distribution, therefore, must be considered from effectiveness in both developments and their functions determined for service as well as merchandising.

MANUFACTURERS who contemplate the establishment of factory branches to take the place of their regular distributors should approach the question with great care. The efficiency of such branches has a tendency to decrease in proportion to the centralization of their control.

The present elements are (1) the factory branch; (2) the distributor; (3) the retailer; (4) the repair shop, which does no merchandising.

The factory branch functions entirely as a distributing point of a wholesale character, controlled by the manufacturer. It is not in any sense a factory branch from the standpoint of production unless cars are assembled at that point. It is altogether a warehouse point receiving the complete product and redistributing it to the retailers or other elements in the distribution chain. The term "factory branch" is a misnomer, therefore, except as it refers to the financial control. It is really a distributing organization controlled by the factory, and it must function in this respect with an average efficiency equal to that provided by the independent competition. In other words, a factory sales branch, so called, must be able to pay its rent, its interest on the investment on its fixed charges, its sales work, its accounting, its warehousing and handling, and all the other elements which enter into the sale of the car for the same discount which would be allowed to the distributor of the same product were he an independent business man operating in that way.

The distributor of an automobile functions to the advantage of the factory in three ways:

1—By providing an orderly basis of production because of his ability to obligate himself for a large number of cars on a regular contract.

2—As a sales organization capable of exercising a more intensive contact with the retailers and of maintaining a better sales condition.

3—As a central service organization, capable of executing complicated repairs and adjustments with a definite standard of efficiency and price, and capable of seeing that the dealers are established to conduct the service for their more restricted areas.

The retailer functions with the automobile manufacturer because of the following advantages:

1—The ability to obligate himself for a definite number of cars over a definite period and to permit the factory to continue its future work with less speculation.

2—The ability to place the car conveniently for buying in a naturally restricted area adjacent to the trading center and to intensively operate sales work there.

3—The ability to make reasonable repairs and adjustments, keeping the car in service with less consumption of time and upon a decent basis of efficiency in the operations and the charges.

The exclusive repair shop, while it does not function as a part of the merchandising chain, is involved in the distribution of the car because of its ability to serve different makes of cars, particularly those models at present out of production; its influence in the choice of cars, and its contact with the users of cars make it a functional part of the chain of marketing in this field.

These several distributing functions must be performed for the manufacturer of cars, either by distributing depots financially controlled by the manufacturer or by independent organizations established for that purpose. The question as between those operations financially controlled by the manufacturer and those controlled by independent concerns is one of relative efficiency and cost entirely.

Bearing in mind that the marketing cost has a tendency to increase in proportion to the area covered from a single manufacturing unit, and the intensity of the competition in its group, the question of establishing factory branches should be approached with great care because the efficiency of such branches has a tendency to decrease in proportion to centralization of control.

It is quite natural in the rapid growth of a business like the automotive business, supplying a virgin market with a manufacturing capacity unequal to its demand, until this last year, that the distribution system should show a great variation. The distribution system has grown with the same rapidity as the production of automobiles and has had a very high mortality rate, as in all new lines of business. Comparatively few dealers, distributors, repair shops or storage points have secured a long experience in the business, and the variation in their individual efficiency is naturally very great. This variation is not due to the weaknesses in the system or the fact that it does not function economically, but is more largely due to the conditions of its growth and the rapidity with which the business has expanded. It would be impossible for this business to present an orderly system of distribution, a fair standard of general efficiency or a fair degree of understanding as to its problems through all the elements of its distributing area, when the business has grown from almost nothing to a five thousand million dollar distributing proposition in twenty years.

Manufacturers should avoid any hasty conclusions as to the deficiency in the system or any hasty decisions to change the present system of distribution under which they are working without a careful examination of the functions and purposes, because the difficulties are almost altogether elements of the growth and not functional disorders.

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Using Standards

FOR many years past the National Automobile Chamber of Commerce and more recently other similar organizations have assisted in bearing the expense of the excellent standardization work carried on by the Society of Automotive Engineers, but so far as we recall the trade organizations have done but little of moment to encourage the use of standards by the concerns represented in their membership. We are now pleased to note that efforts are being made to bring the advantages which accrue to manufacturers who use standards to the notice of executives in the industry. A recent N. A. C. C. bulletin, for example, is devoted to this subject. It points out, among other things of importance, that standardization has reduced production costs some 30 per cent in the case of ball bearing and electrical equipment manufacturers and 20 per cent in the case of steel manufacturers. Actual savings by the use of standards are difficult to determine in precise figures, but they are evidently very much worth while, as we have often pointed out.

In spite of this fact we frequently hear of some new car being fitted with non-standard parts for which there appears to be no excuse whatever and which often mean trouble and expense for some other manufacturer—an expense which the user must ultimately bear. Thus, for example, we learn that a certain new car has an exhaust pipe which is an odd and non-standard size ($\frac{1}{8}$-in. larger or smaller would have made it standard). Either the engineer who laid down the design or his draftsman didn't know of the existing standard or didn't bother to look it up. Or perhaps he thought it concerned nobody else.

But now comes the exhaust heater manufacturer and complains that he must make, and his agents stock, special sizes of fittings in order to accommodate his heater to the new model. Doubtless the muffler manufacturer had a similar story to tell, and so it goes. It sometimes happens that a non-standard size of part saves the car manufacturer a little money in the first instance, but if the part is one that may require replacement, it is likely to add to the parts stock which must be carried by many service stations and thus result in added expense for service, which reacts unfavorably upon the manufacturer. The user's interest must not be forgotten, especially when in so doing the matter of service, which is already a sore point, is unnecessarily complicated.

This is but one example of many in which standardization plays a part. Another way in which standardization may aid in the future will be in the increasing of used car values. At the present time the most valuable used car is the one which is the most easily serviced, all other things considered, and standardization should have an important bearing in this respect.

Number of Cylinders and Repair Costs

WHEN, a few years ago, the question as to how many cylinders a passenger car engine should have was being discussed there were many who predicted that the greater number of cylinders and other parts in the eights and twelves would mean much larger repair bills, when overhauling became necessary. Advocates of the multi-cylinder job, however, maintained that less frequent overhauling would be required, but this is open to some question if it is assumed that an equal quality of workmanship and material is used in the first instance.

Some further light is thrown on the subject as a result of repair shop experience. *Motor Age*, in a recent issue, publishes a table giving the fixed prices charged by a Chicago shop for certain repair operations on thirty well known cars, not including Fords. One of these operations, overhauling the engine, includes grinding of valves, removing carbon, adjusting tappets, refitting bearings, overhauling all accessories including starter and generator, cleaning entire engine and furnishing the following: new rings, new plugs, new radiator hose and new oil. In the list are included seven cars with four-cylinder engines, twenty with sixes, two with eights and one with a twelve. Presumably the price for this job is based upon cost. In any case, the price for over-

hauling in each class, including necessary parts and material, is as follows:

Number of Cylinders	Charge for overhauling Maximum	Minimum	Average	Av'age charge per cylinder
Four	$72.80	$47.60	$54.41	$13.60
Six	87.50	59.00	69.17	11.53
Eight	112.00	99.00	105.50	13.19
Twelve	167.00	167.00	167.00	13.92

There are, of course, some qualifications necessary in the comparison. The eights and twelves are in the high priced class while among the fours and sixes are a preponderance of moderate price cars, though both these classes include also a fair proportion of cars selling in the same price class as the eights and twelves. The average charge per cylinder, it will be noted, does not vary greatly, although the cost of overhauling the accessories must be nearly the same in all cases. This is another way of saying that the average cost of overhauling an engine is roughly proportional to the number of cylinders.

Getting Facts

THE relation between car design and sales has always been recognized as important, but only recently have definite attempts been made to find out just what that relation is in particular cases. The buyers' market which obtains at present has tended to shift design out of the realm of pure engineering and into that of merchandising. The difficulty has been a lack of specific facts or data upon which to base procedure, and the only way to obtain such facts under present conditions is to go out and get them.

It is interesting to note that one of the largest car manufacturing companies has recognized the need for marketing data of this kind and has, consequently, prepared a comprehensive questionnaire, to be answered by all of its salesmen, designed to find out exactly what design characteristics are desirable from a sales angle. The questionnaire asks the salesman to outline the general specifications of the car he would build if he were to design a car of the class made by this manufacturer. It asks for suggestions regarding improvement in the present model; whether a yearly change in models is desirable from a sales standpoint; what criticisms of the present car owners usually make; the desirability of the permanent top as standard equipment; what accessories should be included as standard equipment; what type of body is desirable.

When the replies to these questions come in from salesmen in all parts of the country the results will furnish valuable data for use in design work. Such factors should always be considered by the engineer as well as by the general executive.

The consensus of these salesmen should not be allowed, of course, to dictate design in any sense, but their point of view should be given definite consideration. From a standpoint of automotive progress, however, nothing could be more detrimental in the long run than to have cars designed by the sales department. A search for facts upon which to base plans, nevertheless, is always desirable and the tendency to accumulate such facts and to use them intelligently is one of the gratifying outgrowths of the recent business depression.

Aids to Starting

MUCH remains to be done in the way of making cars easier to start in cold weather. More attention was given to this factor when hand cranking was the rule, but it has in general been overlooked or given inadequate consideration on a majority of modern cars fitted with electrical starters. As a result there is a great burden placed upon the battery and much trouble resulting from the effect of fuel which passes the pistons and dilutes the lubricating oil.

Experiments recently carried out by one manufacturer who was seeking to remedy troubles of this kind are reported to have shown that thirty seconds of cranking with the carbureter strangler closed resulted in a half pint of fuel flowing by the pistons into the crankcase. Four cranking periods of this length per day would thus result not only in wasting a quart of fuel, but in serious dilution of the lubricating oil with its consequent difficulties. This may be an exceptional case, but it is indicative of a very prevalent trouble which may be less or greater in degree in other cases. A large percentage of all cars are kept in unheated garages or are allowed to stand out of doors for long periods during which the engine becomes cold, and even in warm weather there is frequent difficulty in starting, for the initial boiling point or the proportion of light ends in the fuel is usually less in warm weather. Consequently the problem of obtaining a quicker start as well as that of so controlling the cooling system as to bring the engine up to a good operating temperature quickly is worthy of careful study.

The heat necessary for actual vaporization of the fuel needed in starting is sometimes obtained by the use of an electric heating element and sometimes by burning a small amount of fuel. Primers using fuel which is easily vaporized even at quite low temperatures have also been employed with satisfaction in some instances. Probably all devices or systems used to aid in starting have certain drawbacks as well as certain advantages, but the need for a simple, dependable and inexpensive device for this purpose is becoming increasingly evident and seems likely to become more necessary than ever as motor fuel is made less and less volatile.

Automotive Industries Index

THE index for Volume 45 of AUTOMOTIVE INDUSTRIES, comprising the last half of 1921, will be off the press in the near future. We will be glad to send a copy of this index to any subscriber who may have use for it. Those who received the index last year are still on our list and will receive this year's index automatically.

If you want a copy of this index, just send us your name so that we can mail one to you promptly.

Price Situation Again Befogs Air

Uncertainty Brings Show Buying to End

Early Impression Fades as Prospects Question Bottom Being Reached

By JAMES DALTON

NEW YORK, Jan. 17.—The first half of the New York automobile show indicated that the volume of sales at retail would be comparable to that of 1919, but buying stopped the last three days. It was due to another striking demonstration of "mass psychology."

After the show opened with an almost general revision of prices, the public evidently was almost persuaded that prices had reached rock bottom or practically that level. "Live" prospects were many and actual sales were frequent. Then along came one of the large production companies with the announcement to its dealers that its prices would be reduced Feb. 1, retroactive to Jan. 1, but that the size of the cut would be kept a secret.

After that news became generally known buying stopped dead, both at the show and in the Broadway salesrooms of companies in similar price classes. People went to the show just the same and evinced a lively interest in the models displayed but they did not buy. When asked their views they stated almost unanimously that they would wait "for the rest of the price cuts."

Second Cut May Come

Whereas the atmosphere within the industry had been cleared by the early days of the show, it again became foggy. Factory executives thoroughly familiar with the production costs of their own and other companies had been certain prices had been stabilized. They are not so certain now and prospective buyers have decided to wait and see what happens.

Several companies which did not announce reductions for the New York show undoubtedly will do so before the opening of the Chicago show on Jan. 28 or coincident with it. Whether second cuts will be made by those who already have made concessions remains to be seen.

Certain it is, however, that prices on popular priced lines cannot go much lower if the makers of them are to remain in business, no matter how large their production. The industry as a whole is praying that there will not be a price war, but individuals in the manufacturing division seem to be making mental reservations.

Manufacturers declare with every evidence of meaning what they say that they simply cannot make their prices any lower, for if they do they might as well go out of business. Even if they are making mental reservations in what they say, their statement undoubtedly is true if they manufacture cars in the lower price classes.

Economic laws will govern the situation. As a consequence prospective purchasers of motor cars in these classes will not be going far wrong if they buy now. They will find eventually one of two conditions. Either the car they bought will be selling for little less than it is to-day, or they will have an "orphan" on their hands.

Chicago Bank Buys Assets of Allen Motors for $570,000

COLUMBUS, Jan. 18—Judge Sater in the Federal Court has approved the sale for $570,000 of the assets of the Allen Motor Co. to Frank Shaw of Chicago, representing the Continental-Commercial Bank, the sale including all assets excepting cash in bank and notes receivable. Included are the plants at Columbus and Bucyrus, together with all finished cars, partly finished cars and raw materials. The Bucyrus plant was the motor manufacturing concern. Shaw expects to operate the company, making automobiles, but has not announced detailed plans.

With the bills and notes receivable estimated at close to $100,000, including cash on hands, there will be between $650,000 and $670,000 for distribution to the company's creditors. The claims not counting many of the contingent liabilities filed with the receivers are in excess of $2,000,000. Contingent liabilities will bring the amount much higher, leaving about 15 cents on the dollar to be distributed to creditors. Stockholders will get nothing.

PORTER PRODUCTION SOLD

NEW YORK, Jan. 16.—It is stated that George Van Tuyl, receiver of the American & British Manufacturing Corp. has sold to the F. S. Pearson Engineering Corp. of 115 Broadway, the entire Porter automobile product in stock and the entire future production of Porter automobiles.

Waiting Attitude Adopted by Public

New York Show Sees Buyers Bewildered—Must Be Convinced of Stabilization

By NEAL G ADAIR
Editor Motor World

NEW YORK, Jan. 14—Since the New York automobile show opened its doors 29 manufacturers have reduced the prices of their passenger cars. During two weeks previous to the show 20 others made price cuts. This makes 49 producers, out of 92 exhibiting at the show, who have brought their prices down to a new level in such sensational fashion that prices, rather than new cars, are the talk of the show and the talk of the town.

After this statement it hardly seems necessary to say that the show which closed tonight was not a satisfactory selling show.

As compared with some of the larger dealer shows, New York never has been a strong selling show. It has served more to introduce the season's cars, both to the trade and to the public, and to give the show season around the country a flying start. However, there have always been some sales, and there are some this year, but the big harvest of the show is in deferred business. How long this business will be deferred depends entirely on the ability of the industry to convince the public that prices have been stabilized.

A Series of Reductions

Speaking bluntly, the public is bewildered. It has seen price cut after price cut made over a period of 15 months and just at the present moment it is not inclined to take anybody's word that the present cuts are final, even for a reasonable period.

What the industry does the next month is going to tell the tale, both of the business at the dealer shows and of spring business.

Throughout the first two or three days of the show there was an encouraging amount of actual order placing. This continued while news of the earliest first two or three price cuts was slowly sinking into public thought regarding the show. After several days of full page, half-page and quarter-page announce-

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Lincoln Plan Rouses Keen Interest

Ford Will Use Own Production Methods

Expected to Make Big Price Reduction If His Bid Is Accepted

NEW YORK, Jan. 17—Nothing in recent years has caused greater interest and wider speculation within the automotive industry than the announcement that Henry Ford and his family probably will obtain control of the Lincoln Motor Co. when it is sold by the Detroit Trust Co., as receiver, on Feb. 4. The bid of $8,000,000 filed with the Federal Court by Harold H. Emmons as attorney, came from the Ford family, including Mr. and Mrs. Henry Ford and Edsel Ford.

No Opposition Expected

The offer of $8,000,000 was the upset price fixed by Judge Tuttle, and it is stated the Fords are willing to raise their offer to $11,000,000 rather than have the property get into other hands. It is not believed, however, that they will have any serious opposition.

If the property goes for $8,000,000 it will fall short by $2,000,000 of meeting the liabilities, which approximate $10,000,000. There are outstanding 146,000 shares of Class A stock of $50 par value, which would get nothing from a sale at that price.

The industry is not so much interested in the financial details of the transaction as in what use the Fords will make of the property if they get it, and there seems little doubt that they will. No details of their plans have been made public, but it is not denied that they will put into effect the well known Ford production methods.

Prices May Be Reduced

Purchases of parts and materials, it is understood, will be made through the Ford purchasing department and the result, with the introduction of efficiency methods in production, would be much lower costs, which would make possible a sharp reduction in prices. Reports that these would be scaled down to $2,500 for the touring car have not been denied, although there is no probability that any such cut will be made immediately. The effect of such a policy upon other companies in the higher price classes needs no discussion.

It is not the Ford plan, so far as can be determined, to lower materially the quality of the Lincoln car. It is generally conceded, however, that a car of practically the same quality can be turned out in much larger quantities at a materially lower cost by the elimination of construction refinements and tests which have been insisted upon hitherto by Henry M. Leland, the founder of the company.

The Lincoln plant, which is considered the finest of its kind in the world, has a potential capacity of 20,000 cars a year. Comparatively few changes will be necessary to put the plant on a Ford production basis, and Ford engineers have been working on this problem for several months.

While he does not intend to sacrifice quality, it is believed Ford intends to bring into the manufacture of the Lincoln the same production and management methods which have made his cheap car such a success. Nothing radical is contemplated and it is not expected any material changes will be made in the immediate future. Preparations have been made to proceed with production as soon as Ford takes over control of the property. It can be stated that the present line of cars, which numbers 15 models, will be continued.

The belief that Ford will have little competition in seeking to purchase the property is based largely upon emphatic denials by other leaders in the industry

(*Continued on page* 152)

E. V. Rippingille Joins Watson Stabilator Forces

DETROIT, Jan. 16—E. V. Rippingille, assistant sales manager for Hudson and Essex for a number of years and particularly interested in sales promotion and service work for these concerns, has resigned to handle the Watson Stabilator throughout the Michigan zone.

Rippingille is particularly known for his many sales promotion efforts, particularly in organizing and carrying through to a successful finish the Hudson and Essex transcontinental records and other record runs both on the road and track with these two cars. He has been associated with the industry abroad as well as in this country almost since its inception and recently has been devoting his efforts to the organization and establishment of the Hudson-Essex service policy.

The Watson stabilator is a shock absorbing device counteracting spring rebound by means of an internal brake arrangement so designed as to graduate the resistance in proportion to the severity of the impact. It has been installed through local dealers on a great many cars throughout the East and is now under tests by manufacturers, one of the first cars definitely to adopt it being the new Duesenberg.

Show Attendance Shatters Records

More Dealers Come from West—Public Interest in Automobiles Evident

NEW YORK, Jan. 16—From the standpoint of attendance, the New York automobile show which closed Saturday night was the most successful ever held in the United States. All records for paid attendance were shattered, contrary to expectations. The increase over last year was approximately 20 per cent and it was much in excess of 1920, which was the best previous year.

The attendance Thursday was the largest for any single day in the history of automobile shows. It was 4106 greater than Thursday last year and 2210 ahead of the best previous day on record.

Another record which was broken was the attendance of dealers from the West. In previous years dealers from Chicago have come on for the show, but the representation from other western cities, such as Kansas City and St. Louis, has been small. The reverse was true this year.

Bankers Enthusiastic

Manufacturers who attended the exposition were enthusiastic over the conclusive demonstration of public interest in automobiles. They would have been satisfied if the attendance had been no larger than last year and all of them were amazed at the number of New Yorkers who paid their money to get into the show.

Bankers interested in the automotive industry were equally enthusiastic over this feature of the exposition. They are more firmly convinced than ever that the motor vehicle has become an absolute essential in the life of the country and that it should be regarded by them hereafter in that light.

In fact, the show was a great success from every standpoint except that of sales. The first three days were entirely satisfactory in this respect but the slump in the last three after the announcement by Dodge Brothers of the deferred price cut proved conclusively that the public expects further concessions.

McGRAW ELECTS DIRECTORS

EAST PALESTINE, OHIO, Jan. 16.—Stockholders of the McGraw Tire & Rubber Co. have elected the following directors for the coming year: John Morgan, William H. Marlatt, C. H. Wheeler, L. M. Kyes, Maynard H. Murch, W. S. Quinlan, G. E. Randles, R. V. Mitchell, Mac S. Bethel, F. W. Treadway and Ben H. Davis.

Refinancing Plan Offered for Earl

New Issue of Debentures Contemplated—Creditors' Committee to Guide Company

CHICAGO, Jan. 13—Following a day and night meeting of the banking and merchandise creditors of the Earl Motors, Inc., a plan for the refinancing and rehabilitation of the $8,000,000 corporation, which was the outgrowth of the old Briscoe Motor Co., was agreed upon last night. The reorganization of the company was made necessary by the troubles of the Fort Dearborn banks and Edward Tilden & Co., which had undertaken to finance the company.

The reorganization, it is said, will place Earl Motors in fine shape financially, but the stockholders will have to depend largely upon the future success of the company for their equity in the concern. The business will be continued with the present staff of officials, but under the guidance of a creditors' committee.

Banks to Furnish Capital

At present, Earl Motors has unsecured indebtedness in excess of $3,000,000. It has outstanding $2,100,000 of debenture bonds, $1,500,000 of preferred stock and about 291,000 shares of common stock of $10 par value. The debentures and 91,000 shares of common represented the holdings of Edward Tilden & Co.

While the plan of settlement agreed upon will undoubtedly go through, the final formula for stock issue is not absolutely settled.

The financial reorganization contemplates a new issue of deferred debentures, on which interest will be deferred for a year, and a new issue of prior preference preferred stock. The unsecured creditors would be given these debentures and the new stock in satisfaction of their claim.

Edward Tilden & Co. is to surrender the present debentures, receiving in exchange $1,400,000 of prior preference preferred stock and $700,000 in new debentures. The creditors may receive debentures and stock in equal proportions. The banks are to furnish the company with $1,000,000 or more for working capital.

Will Be Long Term Maturities

The new debentures will probably be long-term maturities, whereas the present securities mature $500,000 each year. This plan, which was agreed to by creditors representing claims of $2,000,000 will enable the company to retire the debentures without payment of interest on the new ones for a year and will also enable the payment of all current liabilities.

The creditors' committee named to carry out the plans consists of Ralph Van Vechten, vice-president of the Continental-Commercial Bank, Chicago; Percy Johnston, president of the Chemical National Bank, New York; R. T. Forces, vice-president of the Fort Dearborn Bank, Chicago; William Sparks, president of Sparks-Withington Co., Jackson, Mich.; Benjamin Gotfredson, president of the American Auto Trim Co., Detroit; W. V. C. Jackson, vice-president Auto Body Co., Lansing, and Charles Hayes, president of Hayes Wheel Co.

Grants Extension of Time for Kelley Reorganization

NEW HAVEN, CONN., Jan. 14—Dating from Jan. 9, following a petition by Attorney Edward D. Newman of New York, who seeks to form a new corporation to take over the Kelley Tire & Rubber Co. of this city and West Haven, Judge John E. Keeler in the superior court has granted a 45-day extension of time for the reorganization.

To permit the transaction, $350,000 will have to be raised before the time limit expires. With the additional period in which to raise this amount, Attorney Albert H. Barclay of this city, receiver for the company, says that the prospects for securing the money are encouraging.

According to figures submitted by Newman, approximately $50,000 worth of bonds have been sold up to Jan. 9.

The money is needed, it is pointed out by the receiver, to pay off the debts and expenses of the receivership of the Kelley Tire & Rubber Co. and of the Martin Tire & Rubber Co.

Newman's proposal is to form a new corporation, which will buy the plant and equipment, and thus save at least part of the investment of the present stockholders. It is estimated that about 20 or 25 per cent of the total number of Kelley tire shares are held in Hartford and vicinity.

Goodyear Tire Sells Plant on Long Island

NEW YORK, Jan. 16.—The Goodyear Tire & Rubber Co. has sold its land and buildings in Long Island City to the Standard Sanitary Mfg. Co., of New York and Pittsburgh. The transaction involves approximately $500,000. The property consists of a six story fireproof building having 63,000 sq. ft. of floor space and about 69,000 sq. ft. of vacant land adjoining with a railroad siding.

After the Goodyear company abandoned the building it was leased by the Chevrolet Motor Co. for a term of 10 years.

COTTA INCORPORATES

ROCKFORD, ILL., Jan. 14—The reorganized Cotta Transmission Co., manufacturer of parts for motor vehicles, has been incorporated with a capital stock of $750,000. The new company takes over the plant of the old and will operate along similar lines, but with new officers and directors. The new name will be Cotta Transmission Corp.

Court Considering Miniger Contract

Ohio Bank Asks Continuance of Agreement Which Provides His Salary

TOLEDO Jan. 16.—There is a possibility that Clement O. Miniger, president of the Electric Auto-Lite Corp., and one of the receivers for the Willys Corp., may not remain as head of the company if the federal court refuses to allow a continuance of the agreement entered by him and the corporation, Jan. 25, 1919.

This agreement makes his salary approximately $240,000 a year.

The Ohio Savings Bank & Trust Co., the complainant in the receivership proceedings, has moved the court to continue the salary and commission arrangement under which Miniger is working. The bank points out that depriving the company of Miniger's services would mean a loss to the stockholders and creditors through possible loss of much business now being done outside the Willys-Overland accounts.

Under the agreement Miniger was to receive $60,000 annually, and 20 per cent of the net profits on sales, except Willys-Overland sales. It was stipulated that the commissions should not exceed $150,000 a year for the first year beginning Jan. 1, 1919, and not exceeding $190,000 the second year beginning Jan. 1, 1920. He was to have a drawing account of $15,000 a month but this was not to exceed the commissions for any one month.

Miniger Inspects Property

NEW YORK, Jan. 16—C. O. Miniger, receiver for the Willys Corp., has returned to Toledo after an inspection of the company in New York and New Jersey. The plants of the New Process Gear Corp. at Syracuse and the Electric Auto-Lite Corp. at Toledo are running on a satisfactory basis.

The big problem of the receivership is to dispose of the so-called Chrysler plant at Elizabeth in which the Chrysler six was to be built but which never went into production. It is understood that an effort is being made to induce the bank interests which are large creditors of the Willys Corp. to form a company which would take over the Elizabeth plant and manufacture the Chrysler car in it. These negotiations have not yet passed the preliminary stage.

REORGANIZING ADKINS COMPANY

CANTON, OHIO, Jan. 16—Reorganizing and refinancing of the Adkins Manufacturing Co. is now under way, the company already having taken over the assets of the Adkins Sales Manufacturing Co.

The company manufactures a high pressure lubricating system, aimed at obviating the use of grease cups on automobiles, trucks and tractors.

Ford Joins Parade with Cut in Prices

Reductions Range from $6 to $15 —Made Advisable by Persistent Rumors

DETROIT, Jan. 16—Price cuts ranging from $6 on the runabout to $15 on the sedan are announced by the Ford Motor Co. A statement made in connection with the announcement says:

"Persistent rumors relative to our reducing prices make reduction advisable, despite present rock bottom prices."

The Ford prices as they stood in January, 1921, with the successive reductions since that time follow:

Model	Jan. 1921	June 1921	Sept. 1921	Jan. 1922
2-passenger ..	$395	$370	$325	$319
5-passenger ..	440	415	355	348
Coupe	745	695	595	580
Sedan	795	760	660	645

The passenger chassis will sell for $285; the truck chassis for $430, a reduction of $15; the tractor will remain at $625. The starter price stands at $70 and the demountable rims at $25.

A statement on 1921 business issued by the Ford company says:

Ford Sales Exceeded 1921

Retail sales of Ford cars, trucks, and Fordson tractors have again exceeded the million mark for the year 1921.

The Ford factory and assembly plant production figures reached a total of 1,050,740 cars, trucks and tractors for the year, with retail sales by dealers approximately 1,093,000 which in the United States alone surpassed the 1920 retail sales record by 104,213 Ford cars and trucks.

The outlook for 1922 is decidedly optimistic. In fact, concrete evidences already exist in that car and truck retail sales for December 1921 exceeded December 1920 sales by almost 25 per cent, and Fordson tractor retail sales for the same periods show an increase of over 100 per cent for December 1921, as well as an increase over the total tractor sales for the month of November.

These facts seem to indicate that not only are the farmers buying more freely, but that the general public is becoming more responsive and receptive.

Another point brought out by a comparison of production figures for the past two years shows that Ford enclosed cars are gaining in popularity, as 23 per cent of the 1921 production were sedans and coupés as against a total of 18 per cent for the year previous.

Ford is giving employment at present to approximately 40,000 men in its main plant at Detroit, the importance of which is emphasized when consideration is given to the fact that nearly 20 per cent of the city's population is directly dependent upon the Ford Motor Co.

Performs Service to Industry

NEW YORK, Jan. 16—For once in his life Henry Ford has done what other automobile manufacturers admit is a service to the industry. They believe his most recent price cut of $7 on the touring car and $15 on the closed models will do more than anything else to convince the public that automobile prices are down as far as they can go.

Other manufacturers say it is evident that even Ford, with his tremendous production, has reached the point where he can reduce prices no further and still make a profit on each vehicle. Most of them contend they are in the same position. It undoubtedly is true that most manufacturers in the lower price classes cannot do much more cutting if they expect to remain in business.

While Ford is being thanked, unofficially, for his latest reduction, companies making cars in the higher price classes are waiting with genuine anxiety to see what will be done with the Lincoln car if Ford gets control of that company. They are inclined to take seriously reports that the price of the Lincoln will be reduced to something like $2,500 with Ford methods applied to bring about quantity production. If this is done competition in the higher price classes will be fully as keen as among cars selling for $1,000 or less.

Durant and Columbia Prices Are Guaranteed

NEW YORK, Jan. 16.—Durant prices were guaranteed to the dealers until Aug. 1, 1922, and Columbia to April 1 by representatives of the factories producing those cars at a meeting luncheon of fifty-five dealers of the Poertner Motor Car Co., Metropolitan distributor.

The Durant announcement was made by M. B. Leahy, General Sales Manager of the Durant Motor Car Co., of New York. In view of the recent announcement of a proposed price reduction by another manufacturer in the Durant price class, the Durant guarantee was regarded as significant.

Leahy told the dealers that the Long Island plant was running on a production of 85 a day and that the schedule soon would be increased to 100. He said the Long Island plant would continue to manufacture cars for the Pacific Coast territory until the plant in Oakland got into operation. Leahy also told the Metropolitan dealers that production of the new Durant Six would begin in about two weeks.

The announcement of the Columbia price guarantee was made by Colonel William Guy Wall, vice-president and chief engineer of the National Motor Car & Vehicle Corp. of Indianapolis.

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BESSEMER TO MOVE PLANT

PHILADELPHIA, Jan. 14—The Bessemer Motor Truck Co. is making final preparations to remove its headquarters to its new plant of Holmesburg, where the production of trucks will be undertaken on a large scale. The plant is situated on an 18-acre tract and the plant has a capacity of 3000 trucks a year, which will soon be absorbed if the company's plans develop in accordance with the predictions of the president, I. M. Lewis.

Low Price Basis Set for New Tire

Seiberling Clincher to Sell for $12.50—Straight Side for $44.50

AKRON, Jan. 14—The new cord tire invented by Frank A. Seiberling and to be manufactured ready for delivery at the Barberton, Ohio, and New Castle, Pa., tire plants, now controlled by the Seiberling Rubber Co. of Akron, will be placed on the market upon a price basis remarkably low, officials of Seiberling's company announce.

The main new structural feature of the Seiberling tire is the extension of the tread stock from bead to bead, replacing the fabric side walls and calculated to afford added protection against customary side wall abrasions and curb and rut wear.

The tire is also designed to reduce possibility of tread separation to a minimum. Among its other new features are added shoulder strength, and reinforced chafing strip and double flipper strip strength. The tire has a semi-flat tread which, it is claimed, will afford better traction through greater road contact area which will offer an added resistance to skidding.

New Tube to Be Produced

Although the Seiberling company announces it will place the new tire on the market as one of the best cord tires manufactured, its prices will range only slightly above standard cord prices of other companies. The consumer price on the 30 x 3½ Seiberling clincher cord tire will be $12.50, and the 34 x 4½ straight side will sell for $44.50.

The tires will be marketed under the standard tire guarantee of the Rubber Association of America.

Seiberling will also place on the market a new tube, which it is claimed will embody new features giving it greater durability. The new tube is made over a large size mandrel of pure gum floating stock, and is designed to reduce chafing and "set" to a minimum.

The Seiberling company will continue to manufacture the Portage Skidlock tread tires of the Portage Tire & Rubber Co. of Barberton, which Seiberling has purchased. The company will have a capacity of 5000 casings and 6000 tubes daily at its Barberton and New Castle plants.

Diamond Has New Tire

AKRON, Jan. 16—A new cord tire, said to possess unusual road gripping qualities and to offer special resistance to skidding, has been introduced by the Diamond Rubber Co. of Akron, according to announcement of H. E. Keller, sales manager.

The new feature of the tire is said to be the fact that its road gripping qualities will last throughout the entire life of the tread.

Studebaker Head Sees 100,000 Year

Company Closes Most Successful Period With No Bank Indebtedness

NEW YORK, Jan. 13—Expectations of a 100,000 Studebaker year were expressed by President A. R. Erskine to 500 distributors and dealers gathered at a dinner in the Hotel Plaza last night. Erskine stated that the schedule for the first quarter would be 25,000 as against 11,000 for the last quarter of 1921. Total production for last year he told them was 68,000 and for the year previous 54,000. The company has $36,000,000 invested in its factories.

H. A. Biggs, vice-president in charge of sales, acted as toastmaster. Addresses were made by M. F. Wollering, vice-president in charge of production; L. J. Ollier, vice-president in charge of exports, and Frank E. Hering of South Bend. The dinner was the occasion of the maiden speech of Harry B. Harper since joining the Studebaker organization in the capacity of sales manager.

Corporation in Good Condition

NEW YORK, Jan. 14—Studebaker on Dec. 31 last closed the most successful year in its history and while final figures have not been announced, it is said that the gross for the year will approximate $95,000,000. The company has on hand more than $8,000,000 in cash and has no bank indebtedness. A year ago the cash account stood a little more than $4,000,000 and the bank indebtedness was $8,500,000.

Probably the largest individual holder of common stock is W. C. Durant, formerly head of General Motors Corp. and now president of Durant Motors, his holdings, it is understood, approximating 65,000 shares, representing an investment of between $4,500,000 and $5,500,000.

Six Companies Produce 84 Per Cent of Total Cars

NEW YORK, Jan. 16—Discussing the production of passenger automobiles, the *Wall Street Journal* says:

There are upward of 100 active passenger automobile manufacturers in the United States and six of them (considering the half dozen General Motors divisions as one unit) account for more than 80 per cent of the cars produced. Last year approximately 1,535,000 passenger cars were turned out. Ford, General Motors, Dodge Brothers, Studebaker, Willys-Overland and Nash produced nearly 1,300,000, or about 84 per cent of the total. Ford's output of something like 875,000 passenger cars was more than half the combined turnout of all manufacturers.

Following tabulation for 1921 and 1920 shows total passenger car output, individual outputs of the six companies mentioned, their total and per cent of grand total made by them. Figures for 1921 are approximated:

	1921	1920
Total passenger car output	1,535,000	1,883,150
Output of:		
Ford	875,000	*885,000
General Motors	192,000	327,681
Dodge Brothers	89,350	129,624
Studebaker	66,000	52,653
Willys-Overland	51,300	104,569
Nash	23,600	34,634
Total six companies	1,297,250	1,534,161
Per cent of grand total made by six companies	84 per cent	81 per cent

*Approximately

Jewett Unveiled to Dealers; Price Announced as $1,065

NEW YORK, Jan. 13—A large number of Paige-Detroit dealers enthusiastically received the new Jewett six which was unveiled at their annual banquet last night. President H. M. Jewett of the Paige company who was the speaker of the evening announced that the price of the new car would be $1,065.

Jewett confined his remarks largely to the opportunity for the motor car dealer in 1922 and spread an atmosphere of optimism throughout the meeting. He declared the day of making big allowances on used cars to promote sales had passed and that henceforth only the soundest of business tactics would be employed. The financial condition of the Paige-Detroit Motor Car Co., he declared, is sound.

There was no announcement as to how many of the new Jewett sixes had been contracted for but the dealers were not slow in expressing their enthusiasm during the meeting.

Developing Organization for New Franklin Product

SYRACUSE, Jan. 16.—The H. H. Franklin Manufacturing Co., expects to be producing its new 4-cylinder model at the rate of 100 a day by April, 1923.

Just now the organization for the development of the new model is being worked out. Ralph Murphy, assistant to John Wilkinson, designer of the Franklin engine, is in charge of the organization development. He is being assisted by R. G. Scott, R. P. Lay, J. L. Yarian, Roscoe Tennant, F. J. Ludwick, Allie Morris and Joseph Babcock. Other changes made in preparation for the new car include the selection of William Lane as assistant production manager, George W. Scott as plant engineer, and Charles Dewald in charge of the factory cost department.

"The outstanding features of the new $1,000 Franklin Four," said H. H. Franklin, in discussing the car, "aside from its low price, will be its easy riding and handling, road ability, gasoline and tire economy and its air-cooling system. It will be a world-wide utility car.

"Merchandising of the car will extend to world markets, and means considerable expansion of dealerships in this country."

Nash Makes Profit of $2,226,078 in Year

Company's Surplus Nov. 30 Stood at $13,418,094; Liquid Assets, $14,476,768

KENOSHA, WIS., Jan. 16.—A net profit of $2,226,078 for the fiscal year closed Nov 30, is shown by the Nash Motors Co., after deducting all expenses, reserves, inventory mark-downs and taxes. Allowing for dividend requirements $288,750 this is equivalent to approximately $35 a share on the 54,600 shares of common stock outstanding. In 1920 the company showed a net income of $7,007,471.

The balance sheet shows accounts payable of $520,164, as compared with cash on hand and in the bank of $13,275,966 and Liberty loan bonds amounting to $1,200,802. The company's surplus stood at $13,418,094 on Nov. 30. Real estate, plant and equipment are valued at $7,589,040 after charging off $2,551,686 for depreciation.

In his remarks to the stockholders President Charles W. Nash said in relation to prices:

"We feel now that the price situation is pretty well leveled out. The prices of automobiles have been reduced to near pre-war prices, and without doubt automobiles are being sold to-day at a smaller margin of profit than ever before since the inception of the industry. We are of the opinion that volume of sales for 1922 will not be extremely large, but we have a feeling that the business will run along in a more uniform manner, which makes a better manufacturing proposition."

Cleveland Companies Augment Plant Forces

CLEVELAND, Jan. 14—The Fisher-Ohio Body Co. business is operating at almost top speed. There are 2000 employed at present, but E. F. Fisher states that 1000 more will be added within the next three months. The plant is now engaged in making bodies for General Motors, Chandler and Cleveland.

The Chandler factory has doubled its factory force within the last three weeks. The number of employees is to be increased an additional one-third by Feb. 1. At the factory it was stated that in addition to men given employment at the company's plant, Chandler activities have within recent weeks put back on the payroll in subsidiary plants either controlled by the company or patronized by it an additional 2000 men. These are establishments in which accessories and parts are made.

The Cleveland company has been putting men to work recently, and the production has been augmented greatly. This company also is hiring more men and will continue that policy through the month and February.

Propose Bus Lines for All New York

City Administration Plan Would Mean Scrapping of All Surface Cars

NEW YORK, Jan. 14:—What probably is the most ambitious motor bus program ever proposed has been laid before the Board of Estimate by Mayor Hylan and Grover A. Whalen, Commissioner of Plants and Structures. Their proposal includes the scrapping of all the present surface car lines in the Borough of Manhattan and the substitution of 3,500 motor buses which, it is estimated, could carry 2,240,000 passengers a day.

$25,000,000 to Be Provided

The Board of Estimate has gone so far in approving the project as to adopt a resolution declaring against further elevated construction or rapid transit lines and expressing the opinion that future passenger transportation within the city should be by subways and buses.

Commissioner Whalen asked that $25,000,000 in corporate stock be set aside to carry out the program as soon as the city has obtained the legal power to establish a system of bus routes. The plan will be acted upon later by the board and then will be submitted to the state legislature for approval. Whalen estimated that the profit from the operation of 3,500 buses would be $4,031,000 a year for the city.

Whalen's request that the board set aside $25,000,000 for a bus system was addressed to the mayor. It read, in part, as follows:

Program Is Outlined

Pursuant to your directions, a comprehensive bus program has been worked out for the entire elimination in the Borough of Manhattan of the surface car tracks and the substitution therefor of a bus system. In the Boroughs of Brooklyn, Bronx and Queens a bus system has also been worked out to augment the trolley car system now in operation.

In the Borough of Manhattan at the present time there are operating in the neighborhood of 1,060 trolley cars. In the program outlined below, we have planned to substitute a bus seat for every trolley seat now operating in the Borough of Manhattan.

In order that this department may be properly equipped to meet its responsibilities to the public in the matter of passenger transportation, I respectfully recommend to your honorable board that corporate stock (revenue producing) be set aside in the amount of $25,000,000 for use as follows:

For the construction of 3,500 modern, well-built, sanitary, stable, safe and properly equipped motor buses, according to the plans perfected by the department	$19,250,000
For the purchase of spare parts and garage equipment	700,000
For the construction and equipment of a central motor bus repair shop	1,000,000
For the construction and equipment of garages	3,800,000
For contingencies	250,000
Total	25,000,000

While making this recommendation primarily in order to meet the transportation necessities of the public, and as a measure necessary to protect the vested interest of the people in the five cent fare, I am submitting this request also as a sound business proposition.

From the experience of this department in motor bus operation and from study of the transportation needs of the city, I believe that there is need for 200 bus lines in the Boroughs of Manhattan, the Bronx, Brooklyn and Queens, conditions in Richmond making the trackless trolley system better suited to the needs of that borough.

On these lines it is estimated that the traffic would average 2,240,000 passengers a day.

These passengers, at five cents each, would pay $112,000 a day, or $40,880,000 a year.

The fixed charges, including interest, depreciation and liability insurance, would amount to $9,089,000.

The administration and maintenance cost would be $4,400,000, making the total fixed charges $13,489,000.

Estimate Net Revenue, $4,031,000

The operating cost for an average of 3,200 buses in service would be $23,360,000, making a total cost-fixed charges plus operation $36,849,000, leaving a net revenue to the city amounting to $4,031,000.

Therefore, I trust that your honorable board will approve this recommendation whether viewing this proposition as a duty to the people who require transportation, or as an economic proposition attractive to the taxpayers, who require reduction of taxation.

Although the initial appropriation made for this purpose by your honorable board on March 12, 1920, is not available for the service of the people, owing to the injunction obtained by a traction bondholder, it is not to be seriously believed, that this impediment will remain indefinitely. Whether by reversal of the court ruling or by legislation, the city will no doubt come into the enjoyment of its fundamental right to serve the transportation needs of its people.

It seems, therefore, that in scheduling the corporate stock funds to be set apart

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Reimported Trucks Sold for 50 Per Cent List Price

LITTLE ROCK, Jan. 16—Tom Laser of the Laser Motor Co. recently arranged in New York to handle a number of motor trucks in Arkansas for the British Government. A few have already been sold in the State and will be used in road work by contractors.

They are new American-made trucks that were bought by the British Government in the closing days of the war, and were not needed. They were ordered sold at prices ranging from 40 to 50 per cent of the present list price on the same make of trucks. They include 5-ton Pierce-Arrows, 3½-ton Whites, 3-ton Rikers and 1-ton G. M. C's. The total number is said to be about 1600.

Bullard Machine to Make Cycles

Four Cylinder Machine, Equipped With Side Car, Planned by Company

BRIDGEPORT, CONN., Jan. 16 — Manufacture of motorcycles, on what is planned ultimately to be an extensive scale, has been inaugurated by the Bullard Machine Tool Co. of this city, for years one of the representative metal trades establishments of southern New England and during war days prominent in the production of munitions. During the past ten days the working force of the concern has been increased by 150 employees and more will be employed as the motorcycle department develops, according to an announcement by Stanley H. Bullard, vice-president of the concern.

The motorcycle to be manufactured is a four-cylinder machine, equipped with a side car. All parts are to be made and assembled at the Bullard plant and shipped to the selling agencies. The Bullard company, according to announcement, will merely manufacture the motorcycle and is not interested in the sales end of the business. The concern is now working on several contracts, including a large one from the firm of Sinclair & Militor of New York.

Bullard says that the manufacture of motorcycles is now confined to a part of the big plant building heretofore used for storage. "Of course, we anticipate that the motor department will grow," he said, "but there is ample room for the expansion. It will in no way hamper or interfere with our manufacture of machines and our general work."

Receiver Is Appointed for Stephens Companies

KANSAS CITY, Jan. 16—The A. J. Stephens Rubber Co. and the Stephens Stores Co. have been placed in the hands of receivers, for the purpose of reorganization to meet the demands for large recent expansion in business. The rubber company, organized in 1916, bought the Kansas City Tire & Rubber Co. plant in 1920, the controlling interest of which was purchased later by J. H. Phillips of Pottstown, Pa.

The Stephens Stores Co. was established about a year ago to market the product of the manufacturing company. It eventually operated about 14 stores, in various cities, expanding very rapidly, and doing a volume of business that has now required additional capital. R. C. Ford, its manager, has been made receiver for that company, and C. F. Wilhener was appointed receiver for the rubber company.

The receiverships were asked by Charles E. Gregory of Chicago. It is said both companies are solvent and that the receivers will work out a plan for reorganization.

Waiting Attitude Adopted by Public

New York Show Sees Buyers Bewildered—Must Be Convinced of Stabilization

(*Continued from page* 144)

ments in all the newspapers all featuring prices, the public began to see what was happening and prospective buyers, though evidently in the market for cars, became decidedly cagey and signed contracts were few and far between. The only thing that will convince them that stabilization is here is stabilization, with prices left alone, so that people who are thinking of buying cars can have time to exercise their sober judgment and come to a realization of the fact that prices, in the average case at least, have gone about as low as the manufacturer can bring them and still do business at a profit.

Dodge Affects Situation

There are some indications that the price avalanche has spent itself and that quotations on motor cars are going to remain stationary. This is a big note of encouragement in the New York show and for the many shows in large and small cities all over the country which are to follow.

The Dodge Brothers announcement of a reduced price is retroactive to Jan. 1, but with the new prices withheld from buyers as well as prospects until Feb 1, it had a startling effect on the entire show situation. It sent people to the Dodge Brothers exhibit in a vain effort to learn what the prices would be, but it did not start them buying cars. New reports of another Ford reduction also were a disturbing factor.

Dodge Brothers' dealers, who were in town in great numbers from almost all parts of the country, say they did not expect any immediate stimulation of sales, but look for it when the prices become known Feb. 1, and possibly even a few days before. And prospects did not besiege alone the Dodge Brothers exhibit for Dodge price information. They went around the show asking salesmen in other booths if they knew what the prices would be, how they would compare with other prices, and numerous other questions hatched by fertile imaginations.

Some Sales Good

Naturally there were all kinds of guesses as to what the new Dodge quotations would be, but the public seemed to have remembered that the last advertised "substantial reduction" amounted to $300 and that another substantial reduction from the present price probably would be proportionate.

The Dodge advertising seemed to form a sort of climax to the public reaction to upwards of half a hundred cuts, and when mid-week came there was noticed a decided slowing up in sales and a decided increase in the "We'll-wait-awhile-and-see-what-happens" attitude of prospective buyers.

Several New York distributors of well established cars whose prices have not been changed recently, or who made their reductions before the show, gave confidential figures which indicate that a few lines, at least, were running far ahead of last year in actual sales. Some others were doing immediate business on a par with that done at last year's show, and there were several whose sales records at the end of the week were ahead of those of any New York show except the dealers' show held in 1919, a few months after the signing of the armistice. On the other hand, several distributors frankly stated that the annual show business was considerably below last year's record.

But the metropolitan distributors, and distributors and dealers who were here from different States, had their thoughts centered on the prospects for late winter and spring business rather than on the show week sales, and there was much to encourage them in this respect. All through the show exhibitors were getting long lists of bona fide prospects. Far fewer fictitious names and addresses were given than last year and far more appointments were made for later interviews or demonstrations.

More people than the most optimistic show boosters hoped for came to the show with the intention of preparing themselves to buy. A majority of them plainly were not satisfied that the time was quite ripe, as far as prices are concerned, but they are on the lists as active prospects, and it was difficult to find in the show, or about town anywhere, progressive merchants handling popular, or at least fairly well established lines,

(*Continued on next page*)

Portage Trustee Sues Under Bankruptcy Order

AKRON, OHIO, Jan. 18.—George D. Bates of Akron as trustee of the bankrupt Portage Rubber Co., of Barberton, has filed suit against the Rubber City Clearing House of Akron and A. H. Noah, its president, for $136,153 under order of the bankruptcy courts. The Portage Rubber Co. was the parent concern of the Portage Tire & Rubber Co., recently purchased by the new Seiberling Rubber Co.

According to Bates an agreement was reached between Noah and the Portage Rubber Co. in November, 1919, whereby the Rubber City Clearing House was to purchase all the "second" tires to be manufactured by the Portage Tire & Rubber Co. during the ensuing year. Bates claims several car loads of tires were delivered to the Clearing House but were rejected. He specifies the sum of $163,153 as representing the loss sustained and as being the difference between the price to have been paid by the Clearing House, and the ultimate price for which the tires had to be sold.

Kelly-Springfield Names Sales Force

Prepares for Intensive Drive in Anticipation of Big Truck Business Year

. SPRINGFIELD, OHIO, Jan. 16—Severing its sales connection with Hare's Motors, the Kelly-Springfield Motor Truck Co. is organizing its own sales force and is preparing for a big increase in business during 1922.

General Manager E. O. McDonnell announces that the company's sales organization is about completed. A number of the branch managers and district representatives have been in Springfield for the past few days preparing for the intensive sales drive planned.

Personnel of Organization

The following sales representatives have been appointed:

Middle West, Pearl A. Lewis, Springfield, Ohio; South, P. W. Maguire, headquarters at Atlanta; Pacific coast and district manager, Clifford N. Snow, formerly of the Selden Motor Truck Co., headquarters at San Francisco; Eastern district, J. W. Dyson, formerly in charge of the sales department of the Link Belt Co., headquarters at New York City; New England district and branch manager at Boston, P. S. Aultman, headquarters at Boston; district branch manager for Illinois, Western Michigan, Minnesota and Wisconsin, A. H. Gibbons, headquarters at Chicago; district branch manager for Kansas, Iowa, Missouri, Oklahoma, North and South Dakota, B. J. Saunders, headquarters at Kansas City.

Aultman, Gibbons, Saunders and Lewis have been with the Kelly organization for a number of years. Maguire was formerly with Hare's Motors as zone manager of the eastern half of the United States with headquarters in New York City. Several years ago he was treasurer of the Kelly-Springfield company with headquarters in Springfield.

The present organization includes Charles W. Young, member of the banking firm of Emerson McMillin & Co., and also of the American Light & Traction Co., who is president of the Kelly company; E. O. McDonnell, vice-president and general manager, formerly lieutenant commander in the United States Navy and later secretary and treasurer of the Mexican International Corp.; W. K. Jamison, factory manager, formerly production manager for the Delco Light Co. and P. H. Diehl, secretary and treasurer.

MAY TAX G. M. STOCK TRANSFER

NEW YORK, Jan. 16.—The General Motors Corp. declines to comment on reports that stockholders of the corporation who participated in the distribution of five shares of the Delaware company stock for one share of the New Jersey company in 1916 may have to pay a Federal tax on the stock received. It is understood the case will be tried in the Federal court.

Report Canadian Car Demand Good

Collections Slow and Used Product Situation Bad—General Conditions Improve

TORONTO, Jan. 16—Dealers and distributors are practically unanimous in reporting the new car demand good, collections slow and the used car situation execrable or a near impossibility. Almost without exception, the fall and winter to date have yielded much more business than a year ago and considerably more than anticipated.

Unemployment has been considerably reduced, a number of leading merchandising concerns in non-automotive lines including the largest department stores in Canada and even leading jewelry houses report business to be gratifyingly improving and to have enjoyed one of the best and, in a number of cases, the best Christmas trade in their histories.

Quebec Shows Gain

As yet complete registration returns for the Dominion for the past year are not available. Up to the end of October there were registered in Canada, according to provincial returns, 469,310 motor vehicles, an increase of 60,311 during the first ten months of the year. The 1920 increase was 85,639. Ontario's increase in the first ten months of 1921 was 30,000 against 44,600 in 1920.

Quebec, while making a far poorer showing compared with Ontario as well as in proportion to population relative to the preceding year, showed a gain in increment of approximately 40 per cent or an increase of 14,807. The Western provinces' annual increase sagged badly, Alberta making the poorest showing with a nominal increase of 250 motor vehicles.

Ontario boasts roughly 45 per cent of the motor vehicles in the Dominion with a little better than a third of Canada's total population.

The figures quoted above and in the table are exclusive of the motor cars and trucks in the extra provincial parts of the Dominion, such as the Yukon, Northwest territories, Ungava, Labrador and Newfoundland.

	1919	1920	1921
Ont.	132,000	176,600	206,900
Sas.	54,750	59,708	62,958
Que.	34,987	44,900	59,707
Man.	29,163	36,322	40,430
Alta.	34,000	38,500	38,750
B. C.	19,500	28,000	31,000
N. S.	9,900	12,450	14,250
N. B.	8,061	11,101	13,564
P. E. I.	999	1,418	1,750
Total	323,360	408,999	469,310

Conditions in South Improving

NEW YORK, Jan. 16.—Conditions in the south are improving slowly but the improvement is substantial and promises to be lasting, in the opinion of Charles W. Tway of Atlanta, southern distributor for Haynes cars and vice-president of the Hanson Motor Co. Tway says:

I am convinced that sales of automobiles in southern states in the current year will exceed the total of 1921. Banking conditions show improvement, which is in contrast with the situation last year when difficulty was experienced by business men in obtaining adequate financial accommodations. That I have confidence in the future of the automobile industry in the south is evident from the fact that I have under construction a building at Atlanta to cost $200,000, which will be used largely by the Haynes Company.

Waiting Attitude Adopted by Public

(*Continued from preceding page*)

who did not confidently look for a satisfactory volume of early spring business.

Many prospects frankly said that they were still running the old cars they would have got rid of a year ago but for the uncertainty as to future business conditions which prevailed at that time. This year there was apparent in the show conversations confidence in the gradual but steady betterment of industry and commerce, and the old cars, these people said, are going to go and new ones take their places in their garages as soon as they feel satisfied that they can buy at a real low level of 1922 prices.

In the automotive equipment section of the show the prevailing spirit was in sharp contrast with the uneasiness evident on the passenger car floors. Automobile equipment prices, even if a few of them have dropped, do not get the wide publicity that attends a reduction in the passenger car field and the equipment manufacturers went on about their business, which was decidedly encouraging, throughout the entire week. A manufacturers' sales agent who distributed several lines made an interesting summary of the situation when he said that while motor car owners and jobbers showed no more interest this year than in former years in the accessory exhibits, dealers and garagemen, who were present in great numbers, made the most thorough canvass of the equipment section in the history of the New York show.

He expected this condition to be productive of results because the growth of the automotive equipment industry must depend not upon the inclination of car owners to buy, nor the urging of jobbers to sell, but on actual selling of them by the retail trade. It remains a fact, however, that the aisles in the automotive equipment sections were pretty well thronged throughout the week.

APPERSON MAKES OTHER CUTS

KOKOMO, IND., Jan. 14.—Additional reductions on three of its models have been made by the Apperson Bros. Automobile Co. The four-passenger sedanette has been reduced from $3,895 to $3,625; the seven-passenger sedan from $3,995 to $3,695 and the limousine from $4,195 to $3,895.

Stockholders Buy American Motors

Flat Sum of $200,000 Is Realized from Sale of Physical Assets

NEWARK, N. J., Jan. 18—Sale of the physical assets of the American Motors Corp. to a syndicate of stockholders was confirmed after a hearing before Judge Charles F. Lynch of the United States District Court. A flat sum of $200,000 was realized from the sale, which included production and service stores and the plant at Plainfield, N. J., other assets being retained by the receivers.

The sale was approved on the recommendation of a large majority of creditors. The property will be taken over by a new corporation to be known as the American Motors Corp. of New Jersey, which will continue the manufacture of the American line of cars substantially in their present form.

Company Reorganized

The reorganized company will have a capitalization of $500,000 of 8 per cent debenture stock, retirable at the rate of 10 per cent yearly beginning Jan. 1, 1925, and 50,000 shares of Class A (voting) common stock and the same number of shares of Class B (non-voting) common stock, each having a nominal par value and participating equally in earnings.

One half of the issue of debenture stock and the entire issue of Class B common stock will be taken up by stockholders of the present company.

Gramm Truck Prices Cut; Name Changed to "Pioneer"

LIMA, OHIO, Jan. 16—Price reductions are announced on the various models made by the Gramm-Bernstein Motor Truck Co. The list follows:

	Old Price	New Price
Model 10—1 ton	$1,365	$1,365
Model 15—1½ ton	2,050	1,900
Model 65—1½ ton	2,725	2,500
Model 20—2 ton	3,175	2,925
Model 30—3 ton		3,275
Model 75—3½ ton	4,375	4,225
Model 40—4 ton		3,975
Model 50—5 ton	5,275	4,895

The name of the line has been changed to the "Gramm Pioneer" instead of "Gramm-Bernstein."

RUGGLES CANADIAN PRICES

OTTAWA, ONT., Jan. 14—Ruggles 1-ton chassis are now being advertised at $1,585 f.o.b. London, Ont. Bodies and cabs are supplied at net extra cost when required and time payments arranged. Two-ton chassis are quoted at $2,285.

LAMPERT BILL PASSES HOUSE

WASHINGTON, Jan. 16—The Lampert Patent bill providing for increased salaries in the patent office has passed the House.

Lincoln-Ford Plan Arouses Interest

Latter Will Use Own Production Methods and May Decrease Price of Car

(*Continued from page* 145)

that they expected to bid for the property at the receiver's sale. Among those who have been reported as interested in the property, but who assert there is no basis for such statements, are the banking interests back of the Hupmobile and Mitchell; W. C. Durant and the Studebaker Corp.

If Ford is successful at the sale he will operate the Lincoln plant as a unit of the Ford Motor Co. The Lincoln car and the Lincoln company will retain their identity, however, and the management will be vested in Henry M. Leland and his son, Wilfred C. Leland, who operated the company before it went into the hands of the courts.

Stockholders' Interests Considered

Nothing definite can be stated at this time as to what will become of the investments of present stockholders. The Lelands stand to lose more than any other interest, but they have urged that some means be found to protect from complete loss the interest of legitimate investors who staked their money on the reputation of the elder Leland, who is regarded as one of the "grand old men of the automotive industry" and who is held in affectionate esteem by the Fords.

It is recalled that in the early days of the industry there was in Detroit a firm called Leland & Faulkner which ran a machine shop. Next door to this shop was a little repair shop conducted by Henry Ford in which he was trying to build an automobile. Ford had to give up his shop when he reached the end of his financial resources. It was taken over by Leland, who installed in it an engineer named Brush, who was given instructions to continue the development of an automobile. Brush kept at work and built a car which was called the Cadillac.

Ford Once Declined Help

Although he always has held the Lelands in high esteem, Ford was deaf for months to their appeal for assistance when it became apparent they would be unable to surmount the difficulties which confronted them after their plant finally went into production soon after the business depression really got under way. The negotiations with Ford were conducted by W. C. Leland. He had made his first appeal for assistance in June, 1921, but Ford declined to take on any new ventures at that time. He maintained this position in several subsequent interviews, but in November told Leland to return when he and his father had lost everything.

This admonition was kept in mind by Leland and he went back to Ford after the receivership. All the facts in the case were presented to Ford and he then agreed to take over the company if he could obtain it for what he considered a reasonable price. So far as can be determined, his only purpose was to aid the men who had devoted all their energies to the development of a highly respected enterprise and prevent its destruction. It is tacitly understood that the influence of Mrs. Ford and Edsel Ford was responsible for the decision of Ford to back his friends.

The views of Ford on the Lincoln situation are contained in this statement by him:

"It would be a stain against the motor car industry and against Detroit to permit outsiders to secure control of the Lincoln plant merely because the Lelands have been caught in a financial pinch. Henry M. Leland is one of the great motor car men of America."

BRISBANE SAYS FORD HAS A 2-TON TRUCK

NEW YORK, Jan. 17—Arthur Brisbane is the latest representative of the Hearst interests to obtain an interview with Henry Ford. He labels it "All About Ford" and sketches briefly his plans for the purchase of the Lincoln plant. The chief interest of the industry in the Brisbane report, however, is the statement that Ford pointed to a mechanical drawing with the statement:

"There's the two-ton truck. It will have the front end of my tractor, the engine and the rear end of the present Ford truck. See how much space we save by putting the driver close up in front."

Brisbane quotes Ford as saying the truck will be ready "perhaps next July."

Propose Bus Lines for All New York

(*Continued from page* 149)

for public purposes it would be wise to make definite provisions for meeting this greatest of all civic needs—the need for adequate, safe and dependable passenger transportation.

While the present obstruction is being dissolved in the crucible, the time may be well spent in perfecting plans, routing, organizing and preparing for the prompt installation of motor bus service on the 200 routes which will be required to provide proper surface transportation to supplement and feed the city's vast underground system of rapid transit and to afford communication in the outlying sections of the city where vacant lots and fields await the home-builder while the homeseeker is forced to remain in congested areas for lack of such transportation.

George McAneny, chairman of the Transit Commission, has stated that the resolution of the Board of Estimate with relation to future subway building was in accord with the commission's policy.

Daugherty Drafts Association Policy

Action Taken Earlier Than Contemplated—Public Announcement Expected Soon

WASHINGTON, Jan. 17—It finally has been definitely determined by the Government to issue a statement regarding practices of open price associations. This proposal which originally had been planned and which trade associations have been urging with increasing persistence since the decision of the Supreme Court in the Hardwood case still is the subject of conference between Attorney General Daugherty, Secretary of Commerce Hoover and members of the Federal Trade Commission.

Attorney General Daugherty states that he has prepared a tentative draft outlining the attitude of the Government toward practices of trade associations with the expectation of making it public soon. This follows on the heels of the understanding that the Department of Justice had concluded not to issue the statement.

No Conflict with Law Suits

While the character of the statement to be given out is not known, it is believed that it will be scrupulously drafted so as not to cause any conflict with cases before courts or that may come before them bearing on trade association activities. It was stated by the attorney general that the Department of Justice will give its judgment to show how far such associations may go and to provide a guide for them as far as possible.

The department, it was declared, desires to encourage lawful associations both by reason of constructive work they may do for the trades they represent and through co-operation with the Department of Commerce.

Kentucky Wagon to Raise $500,000 New Capital

LOUISVILLE, KY., Jan. 16.—The Kentucky Wagon Mfg. Co., manufacturer of the Dixie Flyer probably will be reorganized with $500,000 additional capital, it was announced following a special meeting of the stockholders. No final action was taken as all details had not been worked out, but according to James R. Duffin, attorney for the company, the $500,000 additional capital will be raised.

Two schemes of reorganization were proposed. Under one of them the company would be merged with a number of automobile manufacturing concerns under the name of the Associated Motor Industries and the other proposition would place a mortgage of $750,000 on the plant of the Kentucky Wagon Mfg. Co., and the organization of a new company to be known as the Kentucky Mfg. Co., to which the real estate, machinery and equipment of the wagon company would be leased for a period of from five to ten years.

George B. Selden, Pioneer, Dies

Defeated by Ford in Patent Fight

Early Inventor Laid Claim to Conceiving Basic Principle of Automobile as Whole

ROCHESTER, N. Y., Jan. 17.—George Baldwin Selden, one of the first inventors of a gasoline propelled vehicle, and a large stockholder in the Selden Motor Truck Co., died here to-day after a brief illness. He had been in poor health for several years, but it was not until the last few weeks that his failing became marked. He was 75 years old and leaves his wife, Jean Shipley Selden; two daughters, Louise Selden Cary of New York City, and Clara Sayre Selden of San Diego, Cal.; two sons, Henry Rogers Selden and George B. Selden, Jr., both of Rochester, and three grandsons.

Claimed Basic Patent

Selden's name will stand out in automotive history chiefly through the long controversy which raged in the courts about his claim of a basic patent on the automobile as a whole, which affected practically every manufacturer of several decades ago and which finally terminated with an adverse decision directed against him and in favor of Henry Ford.

The Selden patent was first applied for on May 8, 1879, with the filing of a claim on a self propelled gasoline vehicle. The patent was not issued until Nov. 5, 1895.

The real start of the patent litigation was made in 1899, when the Columbia & Electric Vehicle Co. of New Jersey made a license agreement by which it secured the exclusive rights in Selden's patent. The following year this company was absorbed by the Electric Vehicle Co., and with it was acquired the Selden license agreement.

Sues Winton Company

The leap of this company to the front as the most powerful element in the automobile field was marked by the vigorous enforcement of the Selden patent and a complaint alleging infringement on the part of the Winton Motor Carriage Co. of Cleveland was drawn up and filed in July, 1900.

The patent was sustained in general terms by the United States District Court. The suit was carried along, taking testimony from 1900 until 1903, when a movement was instituted by George H. Day and others to form the Association of Licensed Automobile Manufacturers, with the Selden patent as its foundation. This was accomplished March 5, 1903, and the Winton company and nine others signed the agreement as charter members.

Under the agreement the licensed companies agreed to pay as royalty to the Electric Vehicle Co. 1¼ per cent of the retail list price of all cars sold by them and the company agreed to pay two-fifths of the sum to the A. L. A. M.



GEORGE B. SELDEN

Automobile veteran shown in car of his invention which was built in 1905 as an exhibit in the patent suit

As the popularity of the automobile increased the royalties became so large that they proved burdensome to the industry and long before the annual output of licensed cars passed the total of $100,000,000 a year a supplemental agreement had been reached under which only $150,000 annually was paid to the Electric Vehicle Co. and the remainder was placed in the general fund of the association. No public statement ever has been made with reference to the total royalties paid by the manufacturers on account of the Selden patent. It is probable that the inventor received all told not far from $200,000 gross.

The litigation between Selden and Ford is regarded as one of the most spectacular chapters of automobile history. The original suit was filed on Oct. 21, 1903, against C. A. Duerr & Co., New York agents of the Ford Motor Co. John Wanamaker, O. J. Gude and Panhard & Levassor later were made defendants. The action was brought at the request of the A. L. A. M. in the name of the Electric Vehicle Co. and Selden in the southern district of New York.

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Headlight Makers Consider Grouping

Will Meet in Chicago to Decide Matters Pertaining to Organization

NEW YORK, Jan. 16—Manufacturers of headlight devices for automobiles have been invited to send representatives to a meeting which will be held in the Old Colony Club at the LaSalle Hotel, Chicago, Jan. 30, to decide whether to form a separate organization or to affiliate with the Motor and Accessory Manufacturers' Association as a group. Affiliation with the M. A. M. A. has been recommended by a committee which was appointed at a meeting of representatives of ten manufacturers held here.

Decision on the subject was deferred at that time because not all manufacturers invited to join in the movement were represented. Among the activities proposed either as a separate association or as a group of the M. A. M. A. is an educational and publicity campaign to teach public officials and the public generally something of the principles of headlight construction and adjustment as a means of promoting safety.

Wood Wheel Group Elects

Another proposition is that the manufacturers co-operate with the Society of Illuminating Engineers and the National Safety Council in an effort to obtain uniform state legislation in regard to headlights.

The chairman of the committee which is arranging the Chicago meeting is Fred H. Ford of the C. A. Shayler Co. at Waupun, Wis. Manufacturers who wish to send representatives to the meeting are urged to communicate with him.

The Wood Wheel Group of the M. A. M. A. which succeeded the Wood Wheel Manufacturers' Association, has elected the following officers:

Chairman, Thomas A. White, president of Crane & MacMahon, Inc., St. Mary's, Ohio; vice-chairman, C. F. Field, general sales manager of the Hayes Wheel Co., Jackson, Mich.; secretary and treasurer, Phineas Jones, general manager of Phineas Jones & Co., Newark, N. J. The executive committee is composed of the officers and S. Vance Lovenstein of the Schwarz Wheel Co., Philadelphia and A. E. Krick, vice-president of the National Dry Kiln Co. of Indianapolis.

The Leaf Spring Group of the M. A. M. A. is considering better methods of testing springs and spring metal with a view to establishing a uniform standard of tests throughout the industry.

George B. Selden, Pioneer, Is Dead

Figured for Years in Patent Litigation—Defeated in Court by Ford

(*Continued from page* 153)

There was an impressive array of legal talent on each side and never was a patent suit tried more exhaustively. The record of testimony made 36 large volumes and Judge Charles W. Hough declared in his opinion on the case that more than half of this testimony was utterly worthless. As a consequence of this suit the present simplified equity rules were laid down by the Supreme Court of the United States.

Hough Sustains Claim

The taking of testimony began after the complainants had proved the patent. In the meantime an automobile embodying the claims of the patent had been constructed to prove that it would run. Among the witnesses for the complainants was Dugald Clerk, a British engineer considered the highest authority on the gasoline engine. The defense called, among others, Charles E. Duryea, the Amercan pioneer. It is reported that when Duryea read a copy of the Selden patent soon after it was issued in 1895 he said: "Why, this patent covers only the Brayton type of motor." From the viewpoint of the highest court his opinion was correct although it was voiced 16 years before the court handed down its opinion.

The opinion of Judge Hough, rendered in September, 1909, sustained the patent in every particular; declared Selden the pioneer and granted the complainants an injunction and accounting. The result of this decision was to strengthen the A. L. A. M. but Ford soon took steps to protect the users of his cars by taking an appeal from the decision and depositing a bond to cover the damages of the complainants.

While the appeal was pending the Ford company laid the foundations for the tremendous increase in its business which has developed since that time.

Noyes Renders Opinion

The opinion of the Circuit Court of Appeals was written by Judge Noyes. He found that the patent had been held in the patent office for 16 years after application for it had been filed. He had ample evidence that the patent possessed novelty and invention but he also had evidence that the motor propelled road vehicle was not new and that the gasoline engine was not new.

The opinion of Judge Noyes, which was handed down during the National Automobile Show in New York in 1911, held that the patent was valid but that Ford did not infringe because the patent described an engine of the Brayton type while all the defendants and almost all the modern automobile makers used the engine of the Otto type to which Selden had referred contemptuously in his diary as "another of those damned Dutch engines." The complainants decided not to carry the case to the United States Supreme Court.

This decision removed the chief purpose of the A. L. A. M. which at that time included the makers of 90 per cent of American automobiles but there was no way for the members to withdraw during the life of the patent and it proved such a powerful constructive influence that it could not be abandoned. Out of the resulting situation and involving a merger with the National Association of Automobile Manufacturers there developed the National Automobile Board of Trade now known as the National Automobile Chamber of Commerce. The decision, however, put an end to Selden's royalties. If his patent had been sustained and he had continued to receive a gross royalty of one-fifth of one per cent on the cars made up to Nov. 5, 1912, which was the date upon which the patent would have expired, his receipts would have made him many times a millionaire.

Home City Loyal to Him

In spite of his gruffness and aloofness toward his neighbors, Selden always was warmly interested in his home city and in the automotive industry. In his later years, at least, Rochester has held that Selden should be given credit for conceiving the idea of the automobile as it has developed in America. It always has contended that he was entitled to the credit of having built the first "horseless carriage" used in this country in spite of the claims of the Appersons, Haynes and Duryea.

Selden first became interested in the idea of a self propelled vehicle for common roads when he was a boy. He heard his father and D. S. Morgan of Brockport, N. Y., a manufacturer of agricultural implements, discuss the subject and both of them believed that it would be impossible to use a road vehicle driven by its own power.

Later Selden entered Yale University. This was in 1865 and when he was at New Haven he tried to get some information on the subject from the college library. From that time on he conducted experiment after experiment and concocted device after device, all bearing directly or indirectly on the subject of a self-propelled vehicle. In 1869 he filed an application for a patent on a hard rubber tire, the first of the type now generally in use.

From that time on he worked away in his spare hours. His time was necessarily limited, because he was a patent attorney.

The real idea, Selden said, came to him in 1877, and in 1878 his three-cylinder engine was shown to a number of Rochester men.

LAMP COMPANY BANKRUPT

ROCHESTER, N. Y., Jan. 18 — The Denlinger Lamp & Ignition Co., Inc., of Syracuse has filed a petition in bankruptcy with liabilities of $21,169 and assets of $12,819.

Location of Motor Changed in Dirigible

Engines Will Be in Cockpit of Machine Being Assembled by Goodyear

AKRON, Jan. 14—Hangars of the Goodyear company at Wingfoot Lake east of Akron will be opened Jan. 23 for assemblage of a new dirigible for the United States Army which will embody transmission principles said to be entirely new to dirigible navigation.

Instead of having its motors perched upon the outriggers of the car in front of the propellers as is the method employed on all present dirigibles, the new army blimp will have its twin engines in the cockpit of the car. A new system of gear shifts and transmission invented by Herman Kraft, chief aeronautical engineer at Goodyear, makes possible this new engine arrangement. The new system has been tested and approved by the Government. It permits shifting of gears, throwing the propellers into reverse, operation of the propellers separately or the throwing of the power of both motors to either propeller.

Repairs Possible in Air

One of the advantages of the new system, according to Goodyear aeronautical experts, is the fact that it permits motor repair in mid-air without imperiling the members of the crew. The possible throwing of the propellers into reverse will greatly facilitate the landing of the big ship, it is stated.

Kraft's new transmission invention, it is stated, promises to revolutionize dirigible construction. It will also be applicable to heavier-than-air craft and will probably be used on all Government blimps and airplanes in the future. Aeronautical engineers have worked for years to accomplish that which Kraft and Government officials say will be achieved when the new army ship is completed.

The blimp will be 170 feet long and will have a gas capacity of 180,000 cubic feet. It will have a speed of 60 miles an hour, and a cruising radius at full speed of 14 hours, with a 20-hour cruising radius at reduced speed.

Another feature of the blimp will be the first all-enclosed car ever made for a non-rigid dirigible. The car embodies Pullman accommodations and sleeping quarters for its crew of seven, and will be equipped with wireless apparatus and all modern appliances.

GREGORY PLACES ORDERS

MOLINE, ILL., Jan. 14 — Gregory Front Drive Motor Co. has placed orders with the O. E. Szekely Co. for the five front-drive automobiles. The possible location of the plant here devoted to the manufacture of a car of that type is likely. The Gregory car, it is said, will sell for about $1,550. The company has a capitalization of $200,000.

MEN OF THE INDUSTRY

George W. Cushing, advertising manager of the Hudson Motor Car Co. and Essex Motors, was tendered a complimentary dinner in Detroit upon the occasion of his resigning that position to become affiliated with Barton, Durstine & Osborne, Inc., an advertising agency. Addresses were made by Roy D. Chapin, Hudson president, and C. C. Winningham, president of the Detroit Adcraft Club who was Cushing's predecessor with Hudson. He has been affiliated with the Hudson company since November 1916 and became advertising manager in January, 1920. He is active in all advertising movements and has been a director of the Audit Bureau of Circulation since 1919.

Henry Sheridan, foreign representative of the Avery Tractor Co., Peoria, Ill., has returned from a two-year trip around the world, surveying export conditions, establishing agencies and booking orders. **E. M. Brown** has been appointed sales manager of the company to succeed **C. E. Bronner** who has been made credit manager. The former has been with the company for seventeen years and the latter for twenty years. **A. Y. Bartholomew,** formely assistant sales manager, has been given the post of field manager.

Roland Gerry, a director of the Jones & Laughlin Steel Co. and manager of sales of the cold-rolled department, has been advanced to the position of special sales representative of the company for the United States and Canada. He will be succeeded in the cold-rolled department by **William B. Todd,** vice-president of the Union Drawn Steel Co., Beaver Falls, Pa.

Harry H. Anderson, formerly connected with the sales department of the Firestone Rubber Co. on the Pacific Coast and later associated with the California distributor of the Oakland, has been appointed assistant general sales manager of the Leach Biltwell Motor Car Co.

George W. Cole, for many years associated with O. J. Rohde, general manager of the Wire Wheel Corp. of America, returns to that organization as manager in charge of the New York Branch, Eleventh avenue at 57th Street.

R. B. Perry, for the last six years connected with the Allen Motor Co., has resigned as director of sales and service to become general sales manager for the Atlas Brass Foundry Co., also of Columbus.

H. G. Evans, for four years associated with Winther Motors, Inc., Kenosha, in various sales and service capacities has been appointed advertising manager for the company.

George B. Hendrick, who recently resigned his position as publicity manager for the Fisk Rubber Co., has been appointed sales manager for the company.

Roy D. Tyler, well known in industrial engineering circles, has become associated with the Standard Conveyor Co. of North St. Paul.

Albert S. Holly, formerly New England representative for the Pollack Tire Co., has been appointed sales manager of the Bridgeport Motor Truck Corp. of Bridgeport, Conn.

Harry Eisner has opened an automotive electric equipment station at 907 Boylston Street, Boston, Mass.

SUES FOR TIRE RECEIVER

McALESTER, OKLA., Jan. 16—Suit for appointment of a receiver for the Great Republic Tire & Rubber Co. and for an accounting looking to the recovery of money alleged to have been secured by the company on an issue of $100,000 in notes in October, 1919, has been filed in the District Court by H. A. Boyles of Muskogee, Okla. The defendant company owns a plant site and equipment north of this city. Boyles alleges that the company made an effort to transfer its property to the Prudential Tire & Rubber Co., and that this latter is a bankrupt.

American Bosch Perfects Selling Arrangements

SPRINGFIELD, MASS., Jan. 17—At a meeting of more than 50 sales managers and agents of the American Bosch Magneto Corp., representing all parts of the United States, the company's new selling arrangements were further perfected.

It is said the sales force will comprise more than 2000 members, the new policy being to have a large number of agency dealers in close relations with the factory. Engineering and production experts will be taken from the plant to assist in promoting sales. Factory branches will be maintained in New York, Chicago, Detroit and San Francisco.

In extending its line of motor accessories one of the main purposes, it was said, is to give increased efficiency to cars already in use.

Beall Heads Syndicate Making Crude Oil Tests

DETROIT, Jan. 18—The Barnsdall Corp. of New York is working under a license from a syndicate headed by Frank F. Beall, vice-president of the Gray Motors Corp., testing the commercial possibilities of a new motor fuel derived from crude oil. Beall says that although the chemical results have proved conclusively, the commercial possibilities have not been demonstrated and the results of further experiments will be awaited before an organization is formed by the syndicate now controlling it to market the product.

It is expected the experiments will be completed early in February. Under the formula used the oil is said to yield from 70 per cent to 80 per cent of the motor spirit and if it works out commercially the price will be considerably lower than that of gasoline.

Allan A. Ryan Resigns from Stutz Directorate

NEW YORK, Jan. 18—Allan A. Ryan, who sailed for Europe yesterday, resigned as a director and chairman of the board of directors of the Stutz Motor Car Co. before he left the city. He retains his stock interest in the Stutz company but it is in the hands of trustees and does not require his attention. Upon his return, Ryan expects to devote most of his time to the Frontenac Motor Co., of which he is chairman of the board.

Street Car Makers Are Building Buses

Expect Motor Vehicle Business to Equal Volume of Regular Lines

CLEVELAND, Jan. 16—The G. C. Kuhlman Car Co. and the Gustav Schaefer Wagon Co. have found the motor bus field surprisingly large and profitable. In fact the two companies, which are among the oldest and best established of the city, are looking forward to the time when the motor bus business will equal the volume of their regular lines.

The Kuhlman car works is a subsidiary of the J. G. Brill Co. of Philadelphia. It has for years been an extensive builder of street railway and interurban cars and is one of the largest producers of those products in the country. Two years ago it began the construction of motor buses, to meet a quickening demand. The Brill company also builds street cars in Philadelphia, but has been concentrating upon the building of motor buses in the plant in this city. The rate at which the motor bus business of the company has grown leads company officials to predict that within three years this class of work will occupy as much time as the building of street and interurban cars.

Standardizes Bus

Last week the company shipped four motor bus shells to its Preston, Ont., plant to be finished for the Toronto transportation commission, which will use them for extension purposes.

The Kuhlman Co., recently standardized its light bus after development work extending over two years. Within the last three months a new form of tapered front has been designed and patents applied for on a method of clamping the light wooden roof to the rim and fastening it to the sides. Except for the roof the body is of steel construction built upon the same principles as those used in constructing street cars. The same factory buildings and similar patterns are used.

Low Type of Chassis Used

Most of the buses built are on the new low type of chassis designed to keep the center of gravity far down in the machine and prevent upsetting. These have been on the market six months. An emergency door also is a helpful equipment. The central and far west have been the best markets for the buses, reports show.

The Gustav Schaefer Wagon Co. has eight motor buses under construction and during the year just ended built more of them than ever before, according to Ernest C. Schaefer. A light body is featured by this company. H. G. Schaefer of the company visited New York last week discussing plans with an electric railway company, which proposes to use buses for extension purposes.

5 Benz, 3 Mercedes For European Race

Italy, England and France to Enter Event Scheduled for September

PARIS, Jan. 7 (*By Mail*)—Five Benz and three Mercedes cars have been entered in the European Grand Prix automobile race to be held in northern Italy, either at Brescia or near Milan, next September. This race promises to be the most international speed contest in Europe this year, and is the only one in which German firms are admitted. It is believed that Opel will put in a full team. Among Allied firms practically certain starters are Fiat for Italy, Sunbeam for England, Rolland-Pilain and Bugatti for France.

Rumpler Patents Used

The Benz cars, which are already under construction, are being built under the patents of Dr. Rumpler, one of the leading German aviation experts. Rumpler, who has sold his license to Benz, places his engine at the rear of the chassis, drives to the rear wheels, and in addition to abolishing practically all unsprung weight obtains a perfect streamline form. Nothing projects from his bullet shaped car excepting two short lengths of axle at the front and rear. The road springs are inside, as well as all spare wheels and accessories.

For touring purposes Rumpler claims improved suspension, more comfort and room for the passengers and greater fuel economy. For racing, particularly under the 122-cubic inch rule he claims an immense advantage by reason of a scientific streamlining hitherto unknown in automobile practice. The racing cars have six cylinders in line, the center of the engine being just a little to the rear of the center of the chassis, while the drivers and mechanic are seated ahead of the engine with only just sufficient of the head projecting to give a view of the road. Height of the cars from the ground will not exceed 26 in. With this design it is possible to keep down to the minimum weight of 1430 pounds. Rumpler claims that the 2-litre racers will show a speed of 115 miles an hour.

Nineteen Cars Entered for French Grand Prix

PARIS, Jan. 7 (*By Mail*)—Nineteen cars, representing France, Italy and Great Britain, have been united for the French Grand Prix automobile race for 122 cubic inch machines to be held at Strasbourg on July 15. The French representatives are Rolland-Pilain 3, Delage 2, Bugatti 4, Mathis 1, and S.L.I.M.-Pilain 1. Italy is sending a team of three Fiats; England has ntered three Sunbeams and two Aston Martins.

On the day following the 122-cubic inch race and over the same course, there will be a fuel consumption speed test, in which sixteen French cars will start. The competitors comprise Voisin, Bignan and Peugeot with three each; Delage with three and Bugatti with two, and A.M. and S.L.I.M.-Pilain with one each. These cars must have four seater bodies, weigh 3086 pounds empty, and must run 13.7 miles to the gallon of gasoline. This allowance of fuel will comprise oil for the engine and oil or grease for the rear axle and transmission.

It is understood that Ralph de Palma has signed a contract to drive a Voisin in the fuel consumption Grand Prix.

FINANCIAL NOTES

Amazon Rubber Co. during the last six months of 1921 reduced its indebtedness by $70,000, the Dec. 31 statement showing an entire indebtedness to be less than $50,000 on notes and accounts payable. None of this is past due. The company has no bank loans. The company has started the new year with all its material bought at market prices and it is stated that on account of efficient factory methods and low sales and administration expense is able to show a good profit on its merchandise with the present low prices.

American-La France Fire Engine Co., Inc., shows total profits for eleven months ending Nov. 30 of $843,600; dividends, $370,400 and surplus, $185,900. Earnings for the year, it is stated at the factory, will equal about 18 per cent on the common stock. The company would close the year, it was also said, with $450,000 cash and $120,000 government securities.

Ajax Rubber Co. stockholders have approved the issuance of $3,000,000 first mortgage 15-year 8 per cent bonds and also a change in the present capital stock from 400,000 shares of $50 par value to 500 000 shares of no par value. A total of 169,861 shares were represented at the meeting, all of which were voted in favor of the change.

Wayne Oil Tank & Pump Co., Fort Wayne, Ind., declared a 20 per cent stock dividend on the outstanding common stock, a 12 per cent per annum dividend to be paid in monthly installments during 1922 and an extra cash dividend of 1 per cent to be paid Feb. 1. Reports made at its annual meeting indicated a highly prosperous year.

Nash Motors Co. declared a dividend of $10 a share on the common stock, payable Feb. 1 to stock of record Jan. 20. The regular quarterly dividend of $1.75 a share on the preferred stock was also declared, payable Feb. 1 to stock of record Jan. 20.

White Co. inventories during 1921 were reduced from $23,000,000 to $15,000,000. Further reductions are being made by keeping the output under the level of current sales. Bills payable were reduced from $7,200,000 to $3,600,000.

Wedgerste Piston Ring Co. of Plattsburg, N. Y., has filed a voluntary petition in bankruptcy with liabilities of $59,474 and assets of $14,049.

OBTAIN CONTROL OF NICE

PHILADELPHIA, Jan. 14—Control and ownership of the Nice Ball Bearing Co. by Budd G. Nice, the president, and members of his family, was obtained by the terms of a settlement entered into before the United States Circuit Court of Appeals in New York.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

The easier tendency in the local money market which had developed in the previous week was still more pronounced during the past week. Call money ruled at the lowest figures since September, 1919, the week's range being from 3 per cent to 4 per cent as compared with 3½ per cent to 5½ per cent in the previous week. On Wednesday, Thursday and Friday of the past week, a flat rate of 3½ per cent prevailed. There was also a further decline in the quotations for fixed-date maturities, 4½ per cent being the prevailing rate for all maturities from 60 days to 6 months as compared with 4¾ per cent to 5 per cent in the previous week, while a few loans on Liberty Bonds were reported at 4¼ per cent.

Prime commercial paper rates remained unchanged at 4¾ per cent to 5 per cent. On Monday of this week the rate for call money jumped from 3½ per cent to 6 per cent.

The Federal Reserve statement of Jan. 11, 1922, showed a rise in the reserve ratio from 71.7 per cent to 74.7 per cent.

For the first time since September, and the second time since July, 1920, the unfilled orders on the books of the United States Steel Corp. on Dec. 31, 1921, showed an increase. The forward business as of that date was 4,268,414 tons, as compared with 4,250,542 tons at the close of November, and 8,148,122 tons on Dec. 31, 1920. The December increase of 17,872 tons was due mainly to reduced operation in the mills, which in December were running at about 45 per cent of capacity, as against slightly more than 50 per cent in November.

The production of pig iron in the United States for December was reported to be 1,649,086 tons, an increase of 233,605 tons over the amount reported for the previous month and just a little short of twice the amount reported for the month of July, 1921, when the bottom in the decline in the production of pig iron was reached. The total number of active furnaces on Jan. 1, 1922, was 125, or five more than at the beginning of December.

The preliminary foreign trade figures made public last week by the Department of Commerce showed a decline of $3,743,250 in exports, which, in conjunction with a $2,770,029 decline in imports, resulted in a favorable trade balance of $973,221,000 less than for 1920. In spite of this apparently unfavorable showing, our export trade for 1921, even after allowing for changes in price levels, was in excess of that for 1913.

PACKARD TO MAKE NEW TRUCK

DETROIT, Jan. 16.—The Packard Motor Car Co. expects to go into production some time this year on a ¾-ton truck which it has been designing and experimenting with for several years.

METAL MARKETS

Demand from automotive consumers is becoming more and more of a factor in the steel market from day to day, but steel producers are chafing under the self-imposed restraint of purchasing agents in the matter of tonnages involved in their orders. Steel sales managers naturally lean to the view that automotive consumers are making too many bites of one cherry and propaganda is being resorted to in an effort to bring about heavier commitments.

From Pittsburgh and Youngstown emanate inspired statements on this order: "A prediction made by a well informed (steel) maker is that in April the automobile factories will be crowding each other trying to get deliveries, not so much on account of their requirements being especially heavy as on account of their delaying purchases." The chief interest's sheet mills are operating at about two-thirds capacity and those of the "Independents" at two-fifths. Thus the rate of operations for the entire sheet industry is about one-half of its capacity.

Far-sighted automotive purchasing agents are bearing this in mind; they are buying conservatively but consistently. In numerous negotiations preceding sheet transactions the Pittsburgh base has figured of late. Youngstown sheet rollers assert that orders for large tonnages on a mill basis have been declined and that consumers west of Pittsburgh have been obliged to place all orders on a straight Pittsburgh base, the actual freight differential accruing to sellers. Of the steel market in general, however, it may be said that the Pittsburgh base has largely fallen into innocuous desuetude, so much so in fact, that when this trade custom is again reviewed before the Federal Trade Commission it will have become an almost obsolete issue.

Pig Iron.—Michigan and Wisconsin automotive foundries have been taking on modest tonnages of both foundry and malleable iron with quite a few representative inquiries still overhanging the market. If changed at all, however, the market's tone is a shade weaker and this in spite of continuing protests on the part of blast furnace operators that they are losing money on every ton of iron sold at present prices.

Steel.—It is difficult to reconcile the utter lethargy which prevails in the sheet bar market with the brisk demand that characterizes that for full-finished sheets. It is the rollers of the latter who are one of the mainstays of the sheet bar market. One of the large producers of full-finished sheets in the Mahoning valley claims to have his entire capacity booked until the middle of next month. The leading manufacturer of low-priced passenger motor cars is reported to have concluded placing of orders for between 10,000 and 12,000 tons of sheets at prices very close to the quoted market.

Aluminum.—The aluminum market appears to have turned the corner. Sellers of imported virgin ingots, 98 to 99 per cent pure, are asking 17½ cents as inside price.

Copper.—Prospects of additional producers resuming mining and smelting in the spring are imparting an undertone of weakness to the market which still has much surplus metal to digest.

HEARING ON FREIGHT CAR LOADS

NEW YORK, Jan. 18—The traffic department of the National Automobile Chamber of Commerce has been informed that it will be given a hearing in Chicago on Feb. 1 by the Transcontinental Freight Bureau on a proposal to increase the minimum loadings of freight cars carrying passenger cars and trucks to California. The railroads now contemplate raising the present special minimum to the regulation classification minimum. If this is done it will considerably increase the cost of transporting motor vehicles to the Pacific Coast.

Continental Shows Loss of $371,534 During Year

DETROIT, Jan. 18—In the fiscal year ended Oct. 31, 1921, the net loss of the Continental Motors Co. was $371,534, compared with a profit for 1920 of $3,567,504. In addition the company took a $904,293 inventory loss in 1921. The balance sheet surplus, as of Oct. 31, 1921, of $4,779,066, and at the end of the previous fiscal year, $6,345,309.

After readjustments made during the year, value of orders on the books on the October date, was $38,568,686, or 28 per cent less than at the close of previous year. Contracts during the past two months, however, bring the total to over $50.000,000.

Substantial manufacturing schedules, especially of truck motors, are being released, and shipping schedules for the first two months of the current calendar year are considerably in excess of any two months of the past fiscal year.

Cobleigh Makes Address at Service Convention

NEW YORK, Jan. 14—The third annual convention of Service Associations was held here yesterday with less than a score of delegates. It has been the custom to hold this convention during show week because a number of service executives from all parts of the country are in the city. Due to curtailment of expenses this year, however, not many service men have been away from their factories, and it was not expected that the meeting would amount to more than a get-together dinner.

H. R. Cobleigh, service secretary of the N. A. C. C., spoke at length on the work the chamber had done in promoting local associations and gave a list of seventeen now in existence, and reported several others in the process of formation. Representatives from Brooklyn, Newark and New York comprised the bulk of the delegates.

Paige Opens Warehouse

ATLANTA, Jan. 13—A wholesale factory warehouse has been established in this city by the Paige Detroit Motor Car Co., with B. J. Rector in charge as manager. A complete stock of motor cars and parts will be carried for the southeastern territory. Edward A. Thilenius, district manager, and W. R. Morse, representative in Georgia, will maintain their headquarters at Atlanta.

INDUSTRIAL NOTES

Kelly-Springfield Tire Co. is turning out approximately 4,500 tires daily, against 3,500 a day last summer. A night shift is being operated at the Cumberland, Md., plant where it is purposed to concentrate all the company's activities. To this end the Buffalo plant has been completely shut down and the Wooster, Ohio, factory is about to stop operations. These latter plants subsequently will be disposed of. The company has worked off its high priced raw materials and has been purchasing crude rubber and cotton fabric at market prices for some months. No effort is being made to contract ahead for any large supplies.

Association of Automotive Equipment Manufacturers, Chicago, has re-elected Nathaniel Leverone as president and W. E. Green as secretary. Although a large percentage of the present members of the association are located in Chicago, Milwaukee and vicinity, the scope of the organization is national in character. It includes in its membership manufacturers of automobile accessories, parts and equipment.

Jacques Manufacturing Co., Philadelphia, manufacturer of automobile bodies, has moved into its new factory building in that city, which affords greater facilities to care for 1922 business. The company has specialized in closed cars on a production basis, the output during the past year going into the product of four of the makers of cars in the $3,000 to $5,000 class.

Harley Co., recently reorganized with Albert W. Morris as president, announces that negotiations are under way that are expected to bring $6,000,000 in contracts to the company. It is understood these will come from a single concern. Operations have been started at the plant with a small force with a view to adding men as rapidly as conditions permit.

Fisk Rubber Co. has resumed operations at both its own plants at Chicopee Falls and Federal Rubber plant at Cudahy, Wis., on a schedule in excess of that at any time during 1921. As of Jan. 14 the company was turning out 9,000 casings daily while Federal was producting 3,000, or an average of 70 per cent capacity against 50 per cent in November, 1921.

Wall Pump & Compressor Co., Quincy, Ill., has added to its line of vacuum pumps a complete line of air cooled single stage compressors and a line of air cooled two stage compressors. Included are approximately thirty different combinations suitable for all automatic requirements. C. A. Dickerson is in charge of sales.

Brandenburg Bros. & Eccleston of Chicago, Detroit and New York, selected as sales agents for the gear shift division of the Cutler-Hammer Mfg. Co., Milwaukee, will also market the latter's new small mechanical gear shift.

Metal Specialties Manufacturing Co., Chicago, has added the Jorgensen vapor primer to its line. The primer was formerly manufactured by the Jorgensen Manufacturing Co., Waupaca, Wis.

Parish & Bingham plant at Cleveland has resumed operations after the usual shut down at the end of the year. The principal operations are on Ford orders.

Hoover Body Co. has opened an Eastern sales branch at Long Island City with William M. Miller in charge.

Calendar

SHOWS

Jan. 28-Feb. 4—Chicago, Automobile Salon, Hotel Drake.

Jan. 28-Feb. 4 — Chicago, National Automobile Show, Coliseum, Auspices of N.A.C.C.

Feb. 6 to 11 — Seventh National Tractor Show and Educational Exposition, Minnesota State Fair Grounds, Minneapolis.

Feb. 6 to 11 — Winnipeg, Can., Automotive Equipment Show, Western Canadian Automotive Association.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

CONVENTIONS

Jan. 17-20, 1922—Chicago, American Road Builders Association.

Jan. 30-31—Chicago, Fifth Annual Convention, N. A. D. A., La Salle Hotel.

Jan. 30-Feb. 2—Boston, Sixth Annual Conference of the International Delivery Association, Copley Plaza Hotel.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Feb. 24, Mar. 24, April 28, May 26.

Chicago, Feb. 1

Minneapolis, Feb. 8-9—Annual Tractor Meeting.

Industrial Films Elicit Some Interest

Association of Manufacturers Plans Moving Pictures Showing Methods at Factories

WASHINGTON, Jan. 14—Several automobile manufacturers are interested in a plan of the National Association of Manufacturers to have industrial motion pictures made showing production and distribution methods now employed in many industries. The motion pictures would be of an educational nature under the auspices of the Department of Commerce.

The Chevrolet Motor Co. advises the association that the suggestion in regard to consolidation of distribution for industrial pictures is under consideration and undoubtedly would be favorable to manufacturers, provided it was adequately handled. The Cole Motor Car Co. asked for further details. The Firestone Tire & Rubber Co. and the Kelly-Springfield Tire Co. also ask for additional details.

Former Cleveland Mold Company Officials Sued

CLEVELAND, Jan. 16—Several suits have been started by William A. Ahelton, vice-president of the Cleveland Rubber Mold & Machine Co., for the recovery of $248,612.16 in connection with the promotion and management of the company, which was organized to manufacture and sell rubber products.

In two of the petitions it is charged that the Davis Co. and the Fairwin Co. were formed to sell stock in the Cleveland company and that the organizers collected commissions amounting to $191,-112.16. The defendants include I. R. Davis, former president; George H. Burrows, former vice-president; A. S. Davis, former treasurer; C. B. Hurd, former assistant secretary; George S. Winner, F. J. Fairchild and three unnamed persons.

Other suits ask that the former officials be enjoined from selling capital stock now held in escrow by the State Securities Department.

447,675 Carloads Produced in First 9 Months of 1921

NEW YORK, Jan. 16.—A compilation made by the traffic department of the National Automobile Chamber of Commerce of Interstate Commerce Commission statistics for 1920 shows a total of 447,675 carloads of passenger cars, truck chassis and parts, not including tires, shipped in that year and a total of 273-845 carloads shipped in the first nine months of 1921.

Carload shipments of passenger cars and trucks in 1921 totalled 195,153 as compared with 251,064 in 1920. Driveaways in 1921 were 144,377 as compared with 470,867 in 1920. Machines shipped by boat in 1921 numbered 22,244 and 32,-833 in 1920.

NAMED FOR FARM MEETING

WASHINGTON, Jan. 18—Representatives of the automotive industry have been assigned to two important committees of the Agricultural Conference which will convene here next week. Windsor T. White will serve on the railroad committee while Roy C. Chapin and H. S. Firestone will be members of the highway committee. These three spokesmen for the industry will act in an advisory capacity and will have much to do with shaping the conference program.

EXHIBITING AT BROOKLYN

NEW YORK, Jan. 18 — Seventeen manufacturers of automotive products are among the exhibitors at the Brooklyn Industrial Exposition, being held this week to show the output of Brooklyn factories of all kinds. The automotive manufacturers represented are: Advance Rubber Co., Mohegan Co., Marko Storage Battery Co., Robert Gain Co., C. Kenyon Co., C. J. Taghabue Mfg. Co., Sperry Gyroscope Co., Electrose Mfg. Co., Westinghouse Lamp Co., Peelle Co., E. W. Bliss Co., J. H. Williams & Co., American Machine & Foundry Co., Adriance Machine Works, Inc., Doehler Die Casting Co., Batley Corp., A. Schrader's Son, Inc.

Good Motor Market Is Found in Hawaii

Johnson of Honolulu, Rickenbacker Agent, Thinks Field Neglected

BOSTON, Jan. 18—"If the motor business in Hawaii can jump more than 100 per cent from 1919 to 1920 and then climb again some 30 per cent more in ten months during 1921, there is nothing the matter with our place, from a selling standpoint," according to J. A. M. Johnson of Honolulu. He came over to this country to look over new lines, and stopping in Detroit he decided to take the agency for the Rickenbacker car.

"In 1919 our islands did a business in cars, trucks and accessories of $1,344,-149. We thought it was pretty good until the 1920 figures were made known showing that they had been run up to $3,257,791. And up to Nov. 1 of last year the business was $4,696,325. And we have not got started yet. For example, some men handle a dozen lines of cars and, of course, there is no chance to specialize on sales or service. But we are learning. In a few years the manufacturers will pay a little more attention to our territory."

ASKS INLAND RECEIVER

INDIANAPOLIS, Jan. 16—Receivership suit has been filed against the Inland Automobile Co. of this city, manufacturer of convertible delivery bodies for Fords, which began business early last year.

C. C. Knudsen, president, lists the asests at about $90,000 and the total amount of unpaid bills at $1,350. He claims the company is entirely solvent.

K-W IGNITION LOSES

WASHINGTON. Jan. 17—A petition for a rehearing of the case of the K-W Ignition Co. against the Ford Motor Co. for infringement of a patent on ignition coil used on automobiles was denied by the Supreme Court. This gives a victory to the Ford company, involving several million dollars.

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Manufacturers Can Help Solve the Used Car Problem

Dealers must be given a fair chance to get rid of their stock of used cars. Education in sound business methods necessary. "Inside billing" should be discontinued. A thorough market analysis will help.

By Norman G. Shidle

THE used car as a factor in automobile sales has recently assumed large proportions. The problem has always been present in the industry, but business depression brought it to the acute stage. Automobile manufacturers have long since recognized the vital nature of the difficulties confronting them because of the used car and have been particularly active during recent months in discussing ways and means of bettering the situation. Many suggestions have been made, some of which advocate a major operation, others of which lean toward less drastic means.

But the really striking development, in recent opinions on this subject, is the recognition by manufacturers themselves of their own responsibility in helping to solve the problem. While it may properly be said that the used car problem is primarily a dealer problem, it must be added in the same breath that the manufacturer has so large a part to play in cooperating that his actions may mark the difference between success or failure in meeting the situation.

It is perfectly possible for manufacturers to create conditions so unfavorable that the dealer simply cannot operate on an efficient basis as regards used car sales. Certain actions in the past have tended in this direction. In considering his relation to the dealer and the used car problem, the individual manufacturer must consider his organization as one of a group, all of which are seeking the same end. An individual company is not likely to be so strong that it will not be affected by the adverse factors which affect others. It is not sound logic for any individual organization to believe that it alone will be able to carry on at the expense of the others. There is nothing in the situation to indicate that such will be the case.

The sales manager of a leading company voiced a sentiment recently which is becoming more common among manufacturers. He said, "Unfortunately there are some manufacturers who have in the past and are now urging their dealers to make long trades. Some are offering large allowances and this, in my opinion, is a very serious menace. How can we expect dealers to become real business men and careful merchants when we advise them to do things that we know are wrong. The dealer must either stop the second-hand car losses or he must get out of business. If this condition doesn't change soon it will be difficult to attract any sane business men to the industry. This would not look well in print but it is true nevertheless, and I can see no other possible solution if some concerted action is not taken on the part of the dealers backed up by the factories."

There are several definite things the manufacturer

can do—or refrain from doing—that will aid materially in improving the used car situation immediately.

The dealer must be given a fair chance to get rid of his stock of used cars. The manufacturers recognize the unsoundness of overloading the dealer with new cars. The manufacturer can be successful only insofar as his dealers are successful. Weathering the present storm must be a co-operative effort in which both dealer and producer must share the burden. Many manufacturers have shouldered their share cheerfully and fairly, and as a result are coming through the trying period with an enthusiastic and loyal dealer organization.

It has been estimated that there are close to 200,000 used cars on the market in the United States to-day. Manufacturers must give their dealers a fair chance to get rid of this burden. Such action may mean less production temporarily, but will build solidly for the future and for permanent profits.

What the N. A. C. C. has chosen to call "inside billings" should be discontinued, since they smack of unfairness in their conception and operate to hinder dealers in general from working out their used car sales on a sound business basis.

But manufacturers have a constructive part to play as well. Since the actual solution of the problem lies with the dealer, the manufacturers' part is to help the dealer and to make conditions for him as favorable as possible. This can be done in several ways, important among which are the following:

1. General educational methods, showing the dealer the folly of overallowance from the standpoint of sound business methods and profits.
2. By urging dealers to properly recondition cars before making a resale and to give a guarantee with his used cars commensurate with what he honestly believes the performance of the car will warrant.
3. By urging the dealer to build confidence in used cars by keeping used car sales, service and advertising methods at the highest level both ethically and materially.
4. By aiding the dealer in market analysis methods; showing him how to properly evaluate the buying capacity of his territory. In some cases the manufacturer's organization may make market analyses and pass them on to the dealer for his use.
5. By aiding the dealer in actually reconditioning cars. This is not practicable in every case, of course, but may properly be considered in many instances.
6. By selling parts for rebuilding cars at a price lower than that charged for regular repair parts.
7. By planning and adjusting factory production on the basis of comprehensive market analyses, so that there will not be a temptation to overload the dealer.

These are the ways in which manufacturers can best help in the solution of this pressing problem. There is some merit, of course, in some of the suggestions contained in the recent survey of the used car situation published by the N. A. C. C., but analysis reveals little that is new or fundamental. As regards these suggestions, certain vital points must be considered.

The tendency of the public to form buying habits, for example, is important when considering the practical application of these suggestions, especially those advocating a wholesale solution of the difficulty.

This very strong tendency is well illustrated by the present habit of the public in turning in used cars. The owner has been educated by the automobile trade to shop around from one dealer to another seeking the highest allowance on his used car. He has been taught to believe that the sum allowed him for his car has little relation to the actual value of the car, but a great deal of relation to the competitive conditions of the local market.

To overcome this habit is one of the chief difficulties in solving the used car problem. The best way to overcome any habit is to substitute for it another habit. There must be a positive action. But the possibility of substituting another bad habit must not be overlooked. If the present buying habit were successfully replaced by another, and later that other were found to be detrimental to the industry, manufacturers and dealers would have expended much time and money in useless effort.

This possibility emphasizes the necessity for very careful and conservative action as regards concerted attempts to solve the used car problem. Methods and plans must be tested not only on the basis of their immediate effects, but also in the light of their probable future influences. Immediate problems, of course, require immediate solutions, but these current actions must be correlated as closely as possible with sound long range policies if permanent success is to be achieved.

Many plans have recently been suggested. Some of them have merit, but many contain fundamental defects which might render their adoption rather dangerous for one reason or another.

One suggestion which has gained considerable support is that each manufacturer in advertising his new cars shall also advertise the market price of his older models. It is suggested that this advertised used car price would be based on reports from around the country. This evidently assumes some sort of an average price computed from reports gathered from various sections. It is claimed that such a plan would protect the dealer in that the customer could not expect a greater allowance than the advertised price. If the dealer did make a greater allowance, he would be doing it with his eyes open.

The fundamental difficulty with a plan of this kind is that there is no sound basis available for comparison of values. The value of one 1918 Sennett car may be double that of another 1918 Sennett car in 1922. The value of each one depends upon numerous factors such as care, upkeep, mileage, road conditions under which the car has been operated, etc. Even though the average price should be based upon "Rebuilt," "Reconditioned" or "Remanufactured" cars, the case is not materially altered since there is no common definition of these terms.

Consequently, any average price quoted for the country by the manufacturer in connection with his new car advertising would be almost certain to work an injustice to individual dealers if they abided by

THE manufacturer is responsible for creating conditions under which it is possible for the dealer to handle used car sales on a sound business basis. Intelligence is necessary in the individual dealer, but the best dealer methods cannot avail if unsound conditions are imposed through the actions of manufacturers.

The used car problem cannot be solved by the stroke of a magic wand. Solution will be a gradual process and will be the result of intelligent co-operation between manufacturers and dealers. This article outlines the constructive part the manufacturer has to play.

it or to cause them difficulties with their customers if they did not. There is nothing more dangerous than a standard when that standard is not based upon accurate definition and sound facts.

It has also been seriously proposed that the problem might be solved by dealers in each locality authorizing one or more independent and impartial appraisers (similar to real estate appraisers) who, for a fee, paid by the dealer or car owner, shall give the sales value of any car submitted by a dealer or customer. This idea is sound in that if properly worked out it would benefit all concerned.

Its weakness lies in the possibility of individual dealers refusing to abide by the decisions of the appraisers. In other words, its weakness is the one which has caused the whole used car difficulty. When it is possible to convince the individual dealer that it is poor business to allow more for a used car than he can get for it, and when all the reputable dealers in a given community are sold on that idea—then the used car problem for that locality will be well on the way to solution.

Thus, if the conditions were brought about under which this appraisal plan could operate successfully, the necessity for the plan itself would be almost eliminated.

Certain of the suggestions that have been made in the N. A. C. C. bulletin would undoubtedly serve to better the situation if adopted, although many of them involve methods that would seem to be obvious from a standpoint of common sense in business operations. It is almost obvious that used car customers should be treated with the same respect as new car purchasers, that service should be given at a fair price, that bookkeeping and financial practices as regards used cars should be such as to give a credit standing, that local used car dealers should be treated fairly, that high grade men should be placed on used car sales, and that just as good salesmen should be selling used cars as new cars.

This analysis of current suggestions leads directly to the conclusion that the solution of the used car problem rests fundamentally upon the exercise of individual intelligence on the part of those directly handling new and used cars at retail. The root of the problem is struck when the individual dealer is sufficiently strong to refuse to make a sale without making a profit; when he knows how much it costs to operate his business, intelligently evaluates cars offered in trade, knows thoroughly the possible market for those cars as well as the mechanical value of them, and makes an allowance commensurate with the value of the car after these factors are considered.

But there are many things operating to hinder the individual dealer from operating on this basis. Financial stress and immediate needs force the best of men temporarily to unsound practices. And it is here that the manufacturer comes in. Under ideal conditions, the individual dealer would be able to operate as outlined. But conditions are far from ideal, and the manufacturer must do his part to make conditions for the dealer as favorable as possible.

The used car problem cannot be solved by the stroke of a wand; it may be with us always. The used car may remain, however, when the problem has vanished. The manufacturer can help out materially and definitely in the present situation.

Gases in Metals

THE wide field and great practical importance of exact knowledge of the gas content of metals is brought to the attention of the Bureau of Standards more and more frequently. Aside from the more or less familiar importance of gases as related to the deoxidation of steel and the production of sound ingots and castings, many operations in refining, working and treating of metals are vitally concerned with the action or effect of various gases.

Many of the inherent differences in quality of steels made by different processes are generally attributed to the amounts and compositions of the gases with which the metal is in contact when in the molten state in a converter, open-hearth or electric furnace, or in a crucible. It is reported that steel converters operating in a vacuum have recently been successfully used on a commercial scale in England to produce cutlery steel of unusually fine quality. The presence and nature of occluded gas in cast iron has been said to be closely connected with two important characteristics of such material, namely. the graphitization of cast iron and the growth of gray cast iron.

Of no less importance are dissolved or occluded gases in non-ferrous metals. For example, the fire-refining of copper is wholly a matter of intentionally dissolving a gas (oxygen) in crude copper and then removing nearly but not quite all of this same gas. If the final step of this refining is carried to the complete removal of oxygen by poling only a minute or two longer than necessary, the whole furnace charge must be entirely reworked as if it were a fresh charge of crude copper.

In the working and fabrication of copper, gases must be again considered. Operations involving the cleansing of steel or iron by pickling in acids must be followed by treatments designed to remove hydrogen taken up from the metals by the gases. If not removed, this occluded gas will make the metal too brittle to work or will give trouble in subsequent operations when the metal is exposed to heat, as, for instance, causing blisters in enamel. Occluded gases have also been shown to have a marked effect on the electrical conductivity of metals, their magnetic properties, their consistency in dimensions, as well as their mechanical properties.

British Motorcycle Exports Slump

THE British motorcycle export business suffered a severe slump in 1921. During the first nine months of the year the Union of Cycle and Motorcycle Manufacturers, which comprise over 250 firms, exported only 7000 motorcycles as against three times that number in 1920. The manufacturers, however, exported some 30,000 bicycles, but five times that number were exported in 1920. The accessories and tire export trade also decreased considerably and a total loss of about £6,000,000 was experienced in the export trade up to the end of September. This loss includes that suffered from bicycles and accessories as well as motorcycles.

A prominent manufacturer, speaking of the causes of the slump, said the attitude of trade unions was largely responsible as well as the collapse of the German mark. He said manufacturers were cutting profits to the bone in an endeavor to increase production and reduce manufacturing expenses. Some criticism of the British roadbuilding program was heard, some declaring that they were not satisfied that the road fund was being wisely spent.

Low Fuel Consumption Features New Taxicab Design

New Renault four-cylinder models replace two-cylinder taxicabs of large French company. Overhead valve type engine averages 22.43 m.p.g. Engine designed for high torque at low speeds. Cone clutch, three speed transmission, and spiral bevel rear axle with transverse rear spring used.

By W. F. Bradley

GASOLINE consumption averages 22.43 m. p. gal. under normal city traffic conditions, on the new four-cylinder Renault taxicabs, of which 3200 are about to go into use in Paris. Owing to high fuel costs in France, economy of operation must be very closely studied and the smallest possible engine capable of doing the work made use of. It is for this reason that the great majority of Paris taxicabs have twin cylinder (3.1 x 4.7 in.) engines.

During the last two years the public has been educated to the point of insisting on a four-cylinder taxicab, running more silently and possessing a higher degree of flexibility than the old twins. Citroen was largely responsible for this change, when he put a fleet of his two-seater small four-cylinder (2.67 x 3.93 in.) taxicabs on the streets of Paris. These vehicles are practically the standard touring car chassis with a suitable taxicab body. They are fitted with a Solex carbureter and average 24.7 m. p. gal. The average weight of this taxicab, with two passengers aboard, is 2640 lb.

Renault Parts Assembled by Taxi Co.

Chiefly because of keen competition the Compagnie des Automobiles de Place, which is the largest concern of its kind in France, having a fleet of 3200 taxicabs, has decided to scrap all its two-cylinder models and replace them, within one year, by specially designed four-cylinder models. The most interesting point in connection with these cabs lies in the fact that they have been designed exclusively from a taxicab standpoint by the taxicab company's engineers, with fuel economy as one of the most important considerations. The parts are all being built in the Louis Renault factory, but the taxicab company will do all the assembly work and body building.

Because of competition this company has decided on the use of what is considered to be in Paris a big engine (2.95 x 4.72 in.). With average load the cabs weigh 3300 lb., which is about 660 lb. more than the Citroen. This additional weight is represented by bigger dimensions all around, the Renault having two fixed and two folding seats inside and provision for baggage by the side of the driver. All the tests have been made with Zenith and Solex carbureters, and it is with these that gasoline consumption has been reduced to 22.43 m. p. gal. It should be noted that this figure represents average performance under normal street conditions, with an average driver at the wheel, but, of course, with the carbureter and the mechanism in the best condition.

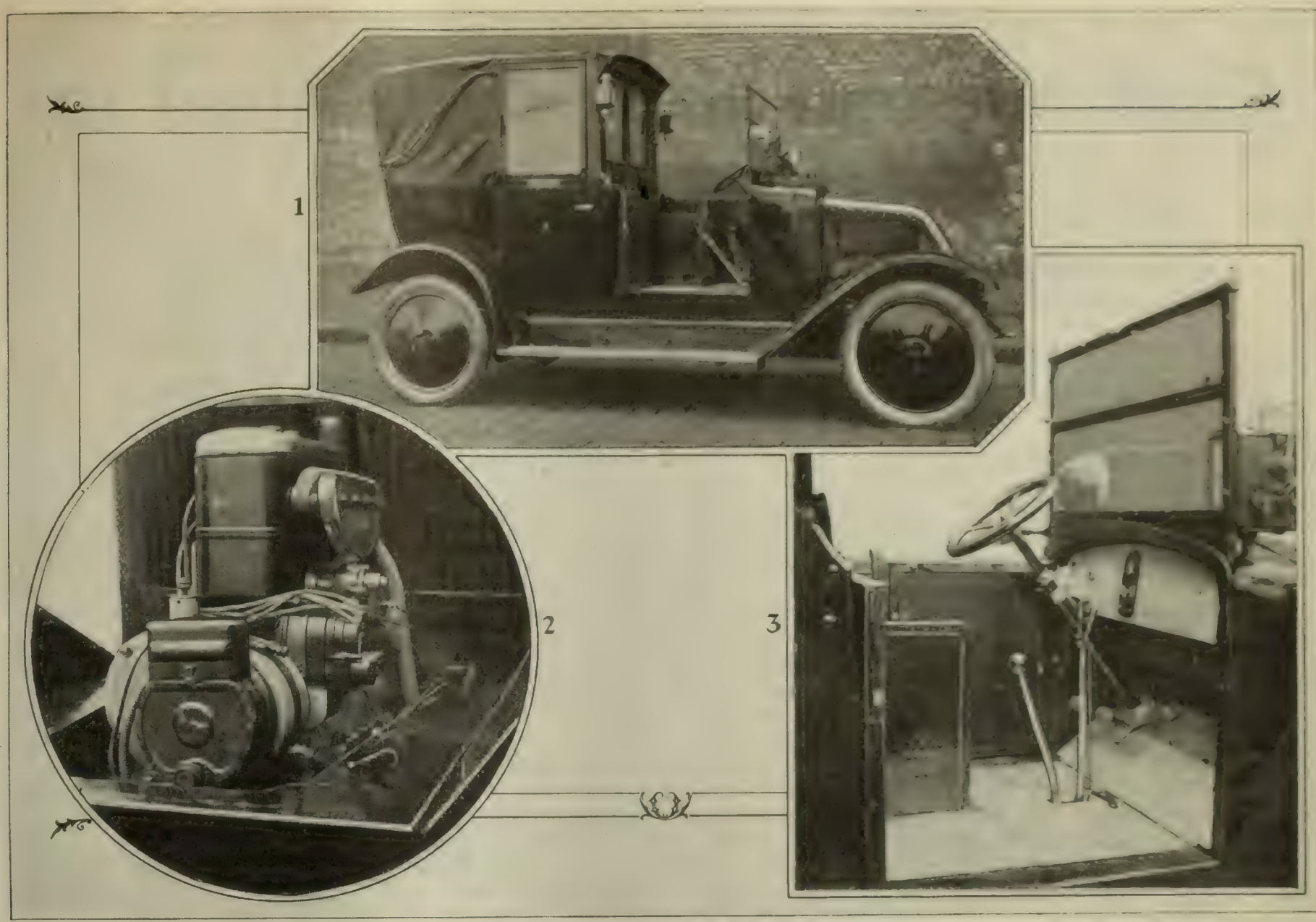
The engine is an overhead valve type, with detachable head. The valves, which have a diameter of 1.22 in., are mounted vertically in the head, and are operated by push rods and rockers, the rods being hidden under a detachable aluminum plate and the overhead gear protected by a cast aluminum cover. The crankshaft is carried in two plain bearings. A cross shaft in front drives the high-tension automatic advance S. E. V. magneto, which delivers current to plugs inclined in the right-hand side of the cylinder head. An S. E. V. single unit electric generator and starter is at the front end of the engine. Cooling is by thermo-siphon flow, with the radiator back of the engine, in accordance with Renault practice. A flywheel fan creates a draft through the radiator.

Lubrication is pump circulating type, with the supply of oil first brought up to a copper ramp immediately over the rocker shaft. The lubricant drops directly into oil holes on the shaft bearings and on the rocker arm pivots. A groove on the top of each rocker arm carries the oil to the ball head of the push rod, and the return is made through the hollow push rod to the cam. Surplus oil returns by the pushrod housing to collectors for the main bearings and the connecting rod bearings.

Because of the special work these vehicles have to do, the engine has been laid out for high torque at low speeds. The exhaust opens with a lead of 30 deg. and closes on dead center; the intake opens 4 deg. after upper dead center and closes 20 deg. after lower dead center. The old two-cylinder models had fixed ignition. On the new four-cylinder types the advance is 0 at 500 r.p.m., increasing to 27 deg. maximum at 1500 r.p.m. Compression has been carried to 85 lb. p. sq. in., this being possible with the I-head type of engine and by the use of a 50 per cent mixture of gasoline and benzol. The power curve shows 17 hp. at 1200 r.p.m. and remains practically straight to 1800 r.p.m., dropping off abruptly after this figure.

Operating Methods Employed

The method of operating by the Compagnie des Automobiles de Place is for the drivers to purchase their own fuel, and to retain a certain percentage of their earnings, on a sliding scale, the amount going to the driver increasing with the total earnings. In this way the men are interested in operating with the smallest amount of fuel, and they are the first to object if gas consumption becomes abnormal. Thus when this company found it necessary, in order to meet open competition, to adopt a four-cylinder engine in place of a twin, it had to be certain of getting the same gas consumption with the



1—New Renault four-cylinder taxicab for use in Paris. 2—Power plant of Renault taxicab. 3—Driver's compartment, showing baggage space

larger engine as with the smaller. The company was also interested in adopting a bigger and more flexible engine than those used by rivals, if this could be done without running the gasoline costs too high. The actual gas consumption is higher with the Renaults than with the Citroens, but if weights and seating accommodations are taken into consideration the Renault shows a higher fuel efficiency.

The gasoline-benzol mixture is sold to the drivers at the rate of 5 frs. per 5 litres. Considering the dollar as worth 12 francs, this works out at 31.6 cents per American gallon, compared with the average retail price around Paris of 62 cents per gallon. The explanation is that having guaranteed gasoline prices would not rise to more than three times pre-war prices, the company is obliged to sell to the men at this figure. The cost to the company is about 48 cents per gallon. The gasoline is imported from America and the benzol is obtained from Germany. Owing to the depreciated German mark the latter fuel is cheaper and would be used exclusively if it were possible to get sufficient supplies. This cannot be done, however, owing to the fact that the French Government monopolizes large quantities of the benzol imports in order to market its "national fuel" composed of equal parts of benzol and alcohol.

The new taxicabs have a cone clutch, three-speed transmission and spiral bevel rear axle with transverse rear spring, as on the Renault touring car. This transverse suspension has proved specially satisfactory for variable loads. The change speed lever is in the center, the driver being seated on the left. As the most frequent change is from second to third, the mechanism has been laid out so that the lever is pushed ahead to go into top speed. This because the average taxicab driver possesses little skill.

The two sets of brakes are side by side on the rear wheels, the foot brake being on the outside and the hand brake on the inside. As drivers almost invariably use the foot brake, this has been given the outside position, to facilitate adjustment and repair. Dimensions of each brake are 12 by 1.37 in. With rear wheel brakes big surface was necessary to get a quick stop at medium and low-car speeds. This quick stop was obtained in the old cabs by the transmission brake.

Electric lighting will be retained, for it is essential in order to attract clients; but from economy considerations the electric starter probably will be disconnected. Wheel equipment on these taxicabs always has been wood of the fixed type, and although tests have been made with detachable steel disc wheels, it is doubtful if they will be adopted. The argument in favor of wood wheels is that they constitute the weakest part of the car, and in case of an accident they generally break first and thus protect some more vital part. The broken spokes of a wood wheel can be replaced, whereas a steel disk wheel is generally beyond repair after a smash. Tire size always has been 765 by 90 mm., but an increase to 765 by 105 probably will be made.

Features of the body are a landaulet type with two folding seats. There is a door on the left hand or driver's side, and on the opposite side the panel is double hinged so as to fold back against the body division, leaving the whole of the space to the right of the driver free for baggage.

Case Making Many Parts Used in New Model

New product, known as Model X, has 122 in. wheelbase and 224 cu. in. engine. Several of major units are purchased from parts makers, but clutch, gearset, frame and some other parts are manufactured in the Case plant. Car is said to have unusual accelerating ability and high economy.

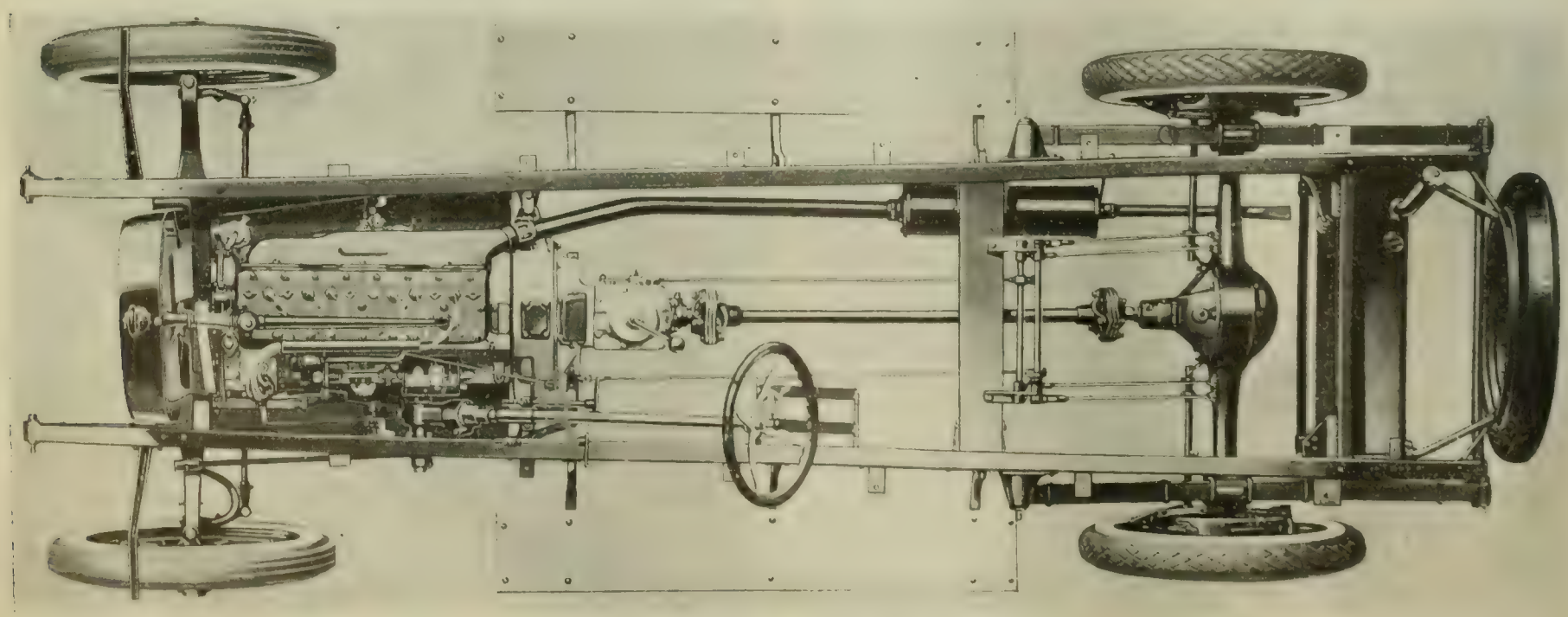
DURING the past year the J. I. Case T. M. Co. manufactured a car equipped with a Continental Model 9-N engine which has a piston displacement of 303 cu. in. For 1922 the company has brought out a new model which has the Continental 7-R engine, a six-cylinder of 3¼ in. bore by 4½ in. stroke which has 224 cu. in. piston displacement. The Model 7-R is a high speed engine which at 2600 r.p.m. develops 55 hp. The new car, known as the Model X, has a wheelbase of 122 in., as compared with 126 in. for last year's model, and with open touring body weighs 3050 lb. The chassis is also furnished with a Sedan body and then weighs 3350 lb.

A 15 gal. fuel tank is carried at the rear of the frame and provided with a tank gage. Fuel feed is by the Stewart vacuum system to the Rayfield 1¼ in. carbureter —the same make and size of carbureter used on last year's model. As an aid to starting in cold weather the car is fitted with the Jorgensen primer. An indirect advantage claimed for this primer is that it tends to increase the life of the storage battery, this claim being founded on the fact that when the engine is properly primed it will pick up its cycle more readily and the starter will not have to turn it over for so long a time, thus reducing the drain on the battery.

Ignition is by the Delco battery system, while the starting motor and the generator are of Bijur make. The starter drive is by means of the screw shift. A Willard 118 ampere-hour storage battery is provided, as is a Delco combination switch for lighting and starting. All wiring is enclosed in flexible metallic conduit. The radiator, which is made in the Case shops, is of the flanged tube type and has a copper core. A Rayfield thermostat is included in the cooling circuit to insure more rapid warming up of the engine in cold weather.

Last year's model was equipped with a clutch and transmission manufactured by parts makers, but these parts in the present model are made in the Case factory. The clutch is of the multiple dry disk type and of a design similar to that used on earlier Case cars. The transmission is mounted on Timken roller bearings throughout. Both the gears and the shafts are made of nickel steel. In order to permit of making the case oil-tight the shifter forks are arranged to slide on their shafts, instead of the shafts sliding in guides in the case. The control levers, which are exceptionally long, are located for convenient operation by the right hand. The pedals are made adjustable to suit the driver. A tubular propeller shaft is used, with two Griptite rubber and fabric universal joints incorporated in it. Patented tubular steel spreaders at each bolt hole of these joints are claimed to allow of greater original clamping pressure on the bolts and to reduce the need for further tightening.

Both axles are of Columbia make. The rear axle has a helical bevel gear drive with a reduction ratio of 4⅔ to 1. The helical gears and pinion shaft are of nickel steel. The Hotchkiss drive is employed, obviating the need for a torque arm or torque tube. Bock roller bearings are used on both the rear and the front axle. The steering gear is a Jacox with 18 in. corrugated composition handwheel rim and aluminum spider. The brake drums for both the service and emergency brakes measure 16 by 2½ in. Oilless bushings are fitted in the brake shafts.



The chassis of the new Case model

The frame is put together in the Case factory. It has 6 by 2¼ in. channel section side members which are straight from end to end, and are connected by three channel section cross members and one tubular cross member at the rear end. Semi-elliptic springs are used all around. These have alloy steel main leaves and bronze bushings in the spring eyes. The front springs measure 39 by 2 in. and the rear springs 54½ by 2¼ in. It is pointed out that the rear springs are placed close to the wheels, which increases the stability of the body. Chassis lubrication is by the Alemite grease system, with connections at 28 points.

Body Construction

The bodies are built of kiln-dried ash and maple wood, with all joints screwed and glued. Frames are covered with No. 20 gage body steel with door moldings formed in the steel. Doors are 22½ in. wide and are hung on outside hinges. All doors are provided with strap door checks. The body is mounted on ten supports riveted to the frame side members, and anti-squeak fabric is used at all points between the body and supports. Anti-squeak fabric is also provided at all points of contact of aprons, body and frame. Backs and cushions are upholstered in dull finish black leather. The cushions have 8-in. double deck springs and the interiors of both the front and the rear compartments are lined throughout. In the driver's compartment the floorboards are covered by linoleum bound with aluminum. Fenders and aprons are black enameled, while the bodies are given sixteen coats in the finishing process. In the open car the rear seat is 47 in. wide, providing plenty of room for three grown persons. The instrument board, which is of inlaid walnut, carries the combined lighting and ignition switch, speedometer, ammeter, oil pressure gage, choker, Jorgensen primer, dashlight and ventilator adjuster. The panel in the rear of the front seat is also of walnut.

Drum type headlights are fitted, with double bulbs, one for dimming. There is a tonneau lamp on the rear cowl. A windshield of the Case company's own manufacture is fitted, and is set at an angle of 10 deg. The lower part is stationary and claimed to be absolutely rain-tight. All wing nuts and screws are copper and nickel plated. The top is a five-bow, one-man type covered with double texture material. It is provided with an 8 x 20 in. plate glass rear light. Curtains open with the doors and when not in use are folded in a compartment back of the solid front seat. The side aprons, which close in the space between the body, running boards and fenders, are made of No. 22 gage steel. A front apron of No. 20 gage steel fits over the frame horns and protects the radiator against dirt.

Accelerating Ability and Fuel Economy

Emphasis is laid by the makers on the acceleration of the car. It is said to be possible to pass from 5 to 20 m.p.h. in 6.5 seconds; from 5 to 30 m.p.h. in 11 seconds and from 10 to 30 m.p.h. in 9 seconds. Notwithstanding this very creditable acceleration the car is said to make 22 miles per gallon of fuel. The speed range is given as 1 to 70 m.p.h. on the high gear. The lower limit of 1 m.p.h. probably assumes slipping of the clutch, for it is hard to conceive of the engine running at 50 r.p.m., as it would have to without slippage to give this car speed.

The equipment includes a Stewart 75 m.p.h. speedometer driven from the transmission by enclosed gearing; a Boyce Motometer, a Kellogg power tire pump driven from the transmission by enclosed gearing and a Klaxon motor-driven horn. The tires are 34 x 4½ in. Goodyear cord with heavy tourist tubes.

Facing Transmission Cases on Disk Grinder

A NEW vertical spindle type of disk grinder is now being built by the Badger Tool Co. The steel disk wheel is 42 in. in diameter and is faced with an abrasive compound which is molded directly onto the steel disk wheel ½ in. thick. The accompanying illustration shows the machine surface grinding the face of a large tractor transmission case and cover. It will be noted that this machine is direct motor-driven, the shaft of the motor serving as the grinding disk spindle. Positive or force feed lubrication is supplied to both the radial and thrust ball bearings. The motor used is a 20 hp. and runs at 600 r.p.m. A circular dust channel completely surrounding the periphery of the wheel terminates in two openings to which the dust exhaust system is attached. This dust channel is exposed by removing the outside guard ring, which forms the outer wall of the dust channel.

The casting shown in place on the disk wheel measures approximately 32 in. in length by 28 in. in width and weighs 300 lb. The flange to be surfaced clean and flat is 2 in. wide, giving a total area to be surfaced of 250 sq. in. Stop bars are attached to the guard ring to prevent the work from revolving with the disk wheel. The actual grinding time on this piece was 8 min. We are informed that by altering the pattern of the casting to conform to correct disk grinding principles this grinding time could be substantially reduced. A quarter-ton chain hoist mounted on a trolley and an I-beam located over the center of the disk wheel is a great convenience in handling heavy work on the grinder.

It will be observed that this machine is accessible from all sides, so that on smaller parts more than one operator can work on the machine at the same time. The No. 142 Badger grinder complete with one disk wheel weighs 3800 lb.



Surface grinding the face of a large tractor transmission case and cover

Utility Closed Cars Feature New Dort Line

Roadster and touring car bodies are used as basis for new coupe and sedan which are but little more expensive than open models. Dry multiple disk clutch replaces cone type. Weight of pistons and connecting rod reduced.

TWO new utility closed models are the chief features of interest in the Dort line for 1922. The new coupe is priced at $1,165, which is just $180 higher than the touring car price. The new sedan will sell for $1,195, or $210 more than the open job. The former coupe and sedan, priced at $1,495 and $1,645 respectively, are being continued without material change. The chief mechanical change consists of the substitution of a dry multiple disk clutch for the cone type formerly used, although there have been numerous minor refinements in both engine and chassis construction.

The new closed jobs, with their low price difference, in comparison with the open models, appear to be a definite attempt to give an all-year-round car to the man who needs it for utility purposes. The general trend in this direction which appeared at the New York show makes the details of these models of particular interest at this time.



New Dort coupe, a closed job in which the roadster body is used as a basis

To get these new designs down in cost the touring body is used as a basis. Over this a solid windshield, similar to that used on the regular sedan, has been built in and the standard windshield body post is used. The pillars which support the roof are permanently built in as a part of the framing of the lower portion of the body, and are not spliced on, as in some separable winter top designs. The doors are made integral from the top to the bottom. The space between the front door pillar and the windshield is filled by a narrow, triangular panel. The windows of all doors can be raised and lowered by means of a strap, but the rear quarter windows are stationary, as is also the large rear window. The exterior of the rear panel and the top, which is of the soft type, is covered with imitation leather.

The leather trimming of the touring car has been kept for the seats and inside of the lower portion of the doors, but the roof and sides above the touring body line are trimmed with cloth. A dome light is provided. It may be said in a general way that the saving in cost on these closed bodies is due to the use of the touring car body as a basis. The elimination of mechanical window lifters is also a factor in reduced cost. The entire construction is strong, though not elaborate. The joints around the doors have been carefully closed up, so that the car is warm and comfortable. A windshield sunshade is fitted and a package compartment is provided back of the seat in the coupe.

There have been other interesting changes incorporated in the Dort line, although they are, in general, of minor importance. As noted previously, a dry multiple disk clutch takes the place of the former cone type. It consists of six friction disks, 7⅞ in. in diameter. The clutch is released through an improved radial thrust bearing. It is lubricated from an oiler on the floor board. Another refinement in the transmission system is in the widening of the gears in the gearset. The gears in the new assembly overlap each other in such a way as to increase the effective driving surface of the teeth. It is claimed that the combined effect of these changes results in about 1/16 in. increase in tooth width.

Refinements have been made in the carbureter to handle the present quality of fuel. Dort, some time ago, reduced the size of the high- and low-speed carbureter jets to effect a saving in the consumption of gasoline. Difficulty has occasionally been experienced with the clogging of the high- and low-speed jets in their reduced diameter. This possibility has now been eliminated by replacing the present wells with new ones which are provided with circular screen strainers.

Lighter pistons and connecting rods have replaced those used previously, the weight of the new piston and connecting rod being 4¾ lb. against 5 lb. 14 oz. for the former assembly. The decrease in weight in the reciprocating parts has resulted in a smoother engine.

A new type of ignition switch has been installed, this switch being made by the Clum Mfg. Co. and furnished with a combination key. The ignition coil now used is the new type Connecticut.

The final drive has been changed to the spiral bevel gear type. The ring gear has 49 teeth and the pinion 11, giving a reduction of 4 5/11 to 1. To make the most satisfactory use of the spiral bevel gear differential and take care of the thrust there has been incorporated with this change a hardened and ground sleeve in place of the soft liner previously fitted.

Split spring seats are provided with shims which can be removed if play develops at the spring seats, and thus a tight connection is assured with a minimum of cost and labor. Thrust collars have been incorporated in the design, along with the split spring seat, to remove the possibility of side slapping. An adjusting screw has been provided in the rear of the service brake band so that excessive clearance at that point is eliminated.

Small Caterpillar Tractor Built for Farm Work

Engine has overhead camshaft. Novel track mounting scheme obviates danger from clogging track. Alloy steel used largely in construction. A feature claimed for this model is its ease of handling in restricted space. Is adaptable for industrial as well as for agricultural purposes.

By P. M. Heldt

A SMALL tractor designed on the caterpillar principle has been developed by the Holt Mfg. Co. and was recently announced by the Stockton plant of the firm as the Model T-35. The purpose in developing this model was to build a small tractor that would be easy to operate, incorporate only features proved out under field conditions, be economical in fuel and oil consumption and cheap to maintain.

Having a three-speed transmission, the T-35 has a range of adaptability that includes all sorts of farm, orchard, vineyard and industrial work. To make it suitable for row crop cultivation the width was kept down to 48 in., and to suit it to vineyard work the height was limited to 52 in. The machine is claimed to possess exceptional handling ability in restricted spaces. Weighing only 4000 lb., it can be readily loaded onto a small motor truck and transported from one place to another. With a track width of 10 in. the pressure on the track is only 4 lb. per square inch, and the tractor is, therefore, able to work on the softest ground. The ground clearance is 11 in.

In the design of the T-35 the unit or backbone form of construction has been followed, whereby the frame is eliminated. The engine base with flywheel bell housing is bolted to a flange on the transmission with sixteen ½-in. bolts. At the rear the tractor is suspended by means of a cross pivot tube on which the trucks are pivoted through the intermediary of a drive link. The latter is hinged to the truck in front of the tube, its rear portion resting on a heavy rubber pad directly under the pivot tube. This method of mounting the trucks removes the weight from the track sprocket and transmission, and these parts are subjected to strains of propulsion only.

Advantages of Track Mounting

Two distinct advantages are claimed for this method of mounting the tracks on the pivot shaft and pushing them with the drive link. The first is that it gives easy riding qualities, and, the second, that it permits of a track release which is said to be an exclusive feature with the Holt. This release is designed to operate if the track becomes clogged with dirt or rocks and permits the truck to "jack-knife." When that happens the track can slip over the rear sprocket, thus obviating the danger of damaging parts of the machine.

The front end of the tractor is supported by a cross-leaf spring, which pivots at its center on a pin secured in the engine crankcase directly under the center bearings. The outer end of this spring rests on a bracket on the truck frame, which is so shaped that the weight exerted by this spring on the truck frame comes in the middle of the frame and not on one side. The pivoting, as well as the action of the spring itself, serves as an equalizer on rough or irregular ground and gives the whole tractor a full three-point suspension.

Engine Details

The engine of the T-35 "Caterpillar" tractor is the result of the joint efforts of Pliny E. Holt, vice-president in charge of engineering of the Holt Mfg. Co., and Col. E. G. Hall, one of the designers of the Liberty aircraft engine. The bore is 4 in. and the stroke 5½ in. The crankshaft is a chrome vanadium steel forging, 2¼ in. in diameter. It is heat-treated to from 50 to 60 points scleroscope hardness. The bearings are of bronze-backed babbitt. The rear bearing is 3¼ in. long, the center bearing 3 in. and the front bearing 2⅝ in. At a speed of 1000 r.p.m. this engine develops 28 hp. on the block.

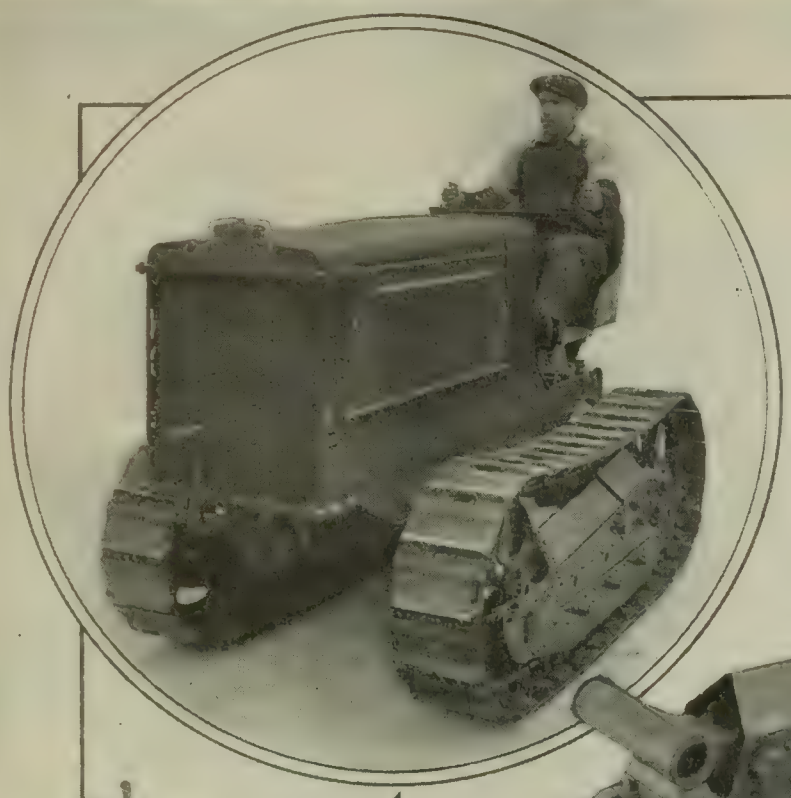
By the use of an overhead camshaft the crankcase is kept free from obstructions; tappets, tappet guides and inclosures for same are eliminated, and all moving parts in the head are provided with an oil bath. By removing the cylinder head cover, not only are the valves and valve springs exposed, but the camshaft and its bearings are rendered accessible. The camshaft carries only four cams, which operate the valves through forged nickel steel rocker arms. The valves are set in the heads at an angle.

The governor is mounted in the camshaft driving gear. The throttle valve is controlled by a shaft which runs from the inside of the head cap directly into the intake manifold.

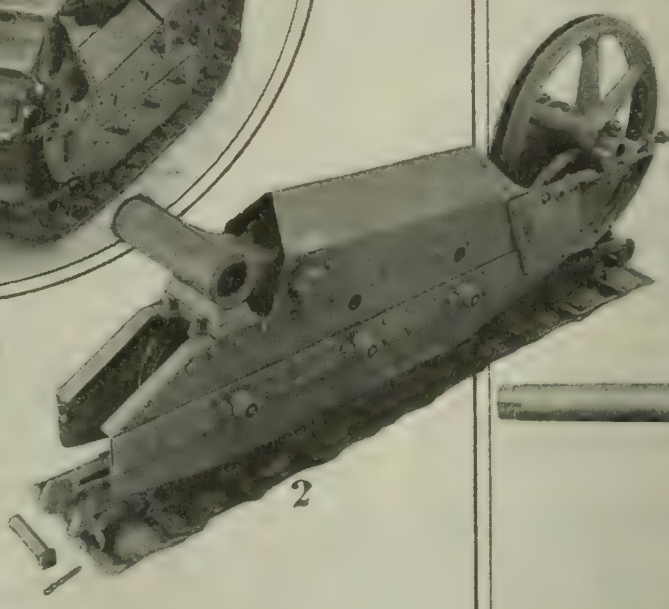
Lubrication is by pressure. A two-stage oil pump is bolted to the front of the engine and can be completely removed in five minutes. The pan under the connecting rods remains dry and all oil is carried in the sump. This permits the tractor to work on any hill, up or down, without flooding any portion of the engine.

The crankshaft has ducts from the main bearings to the connecting rod bearings, and oil is forced by the pump to all the main crankshaft and connecting rod bearings. Oil is also forced through a hollow stud up to the cylinder head and from this stud into the hollow rocker arm shaft. From here the oil is forced to the three camshaft bearings and to all of the rocker arms. It is also forced to the end of the camshaft, where it lubricates the governor from the inside and gives a dash-pot effect that insures smooth governor action.

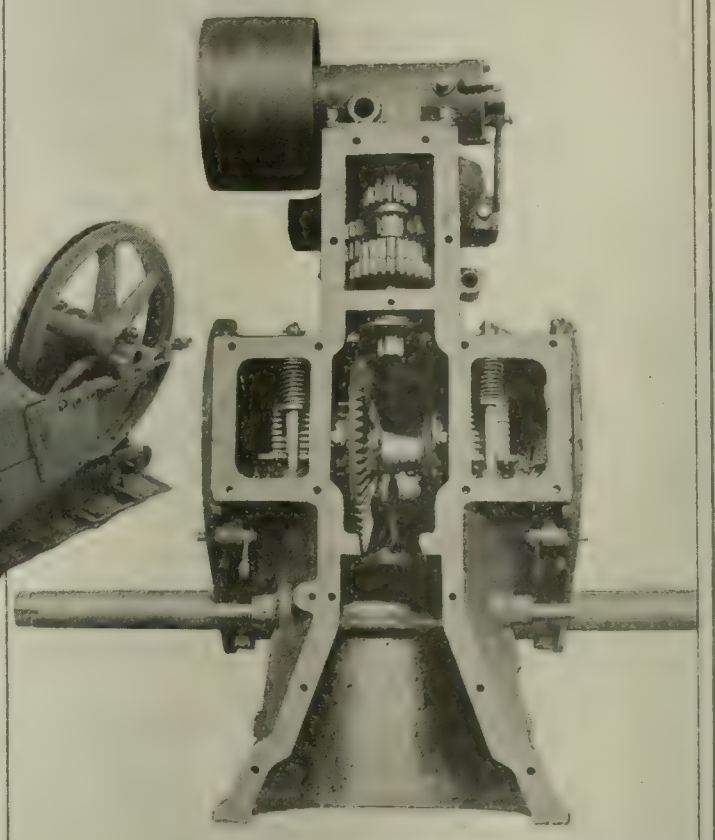
On the front end of the crankshaft is a wide-faced chrome nickel steel pinion which drives through an intermediate gear to the fan. The fan gear drives the main



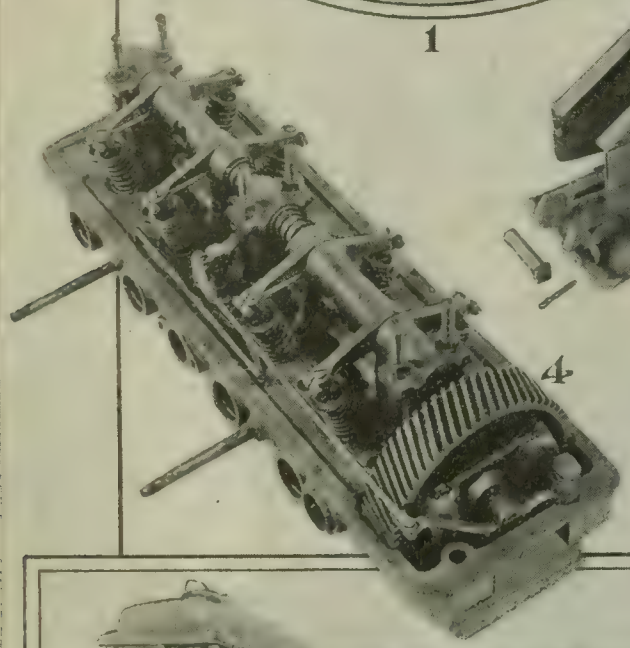
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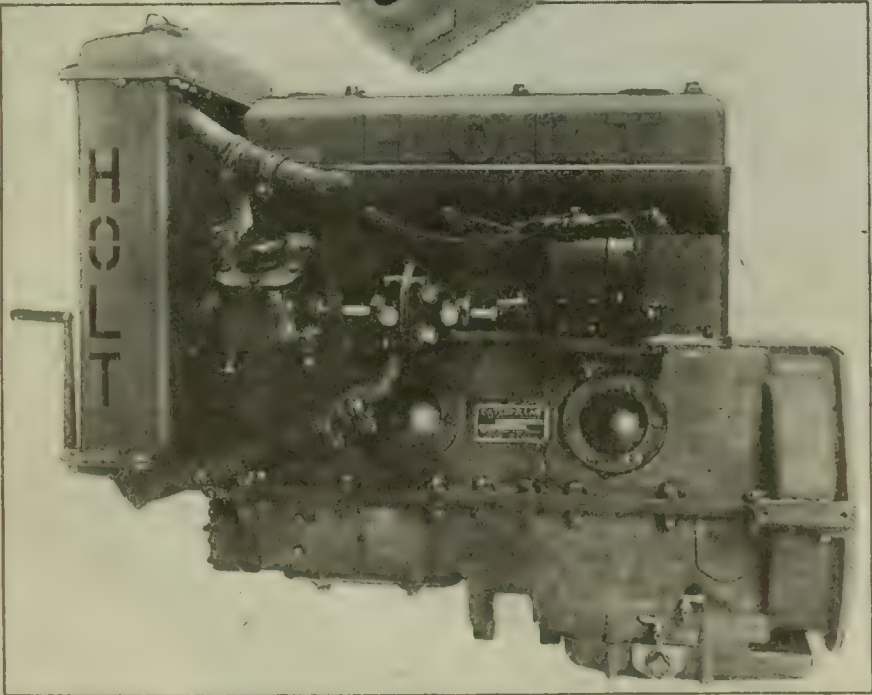
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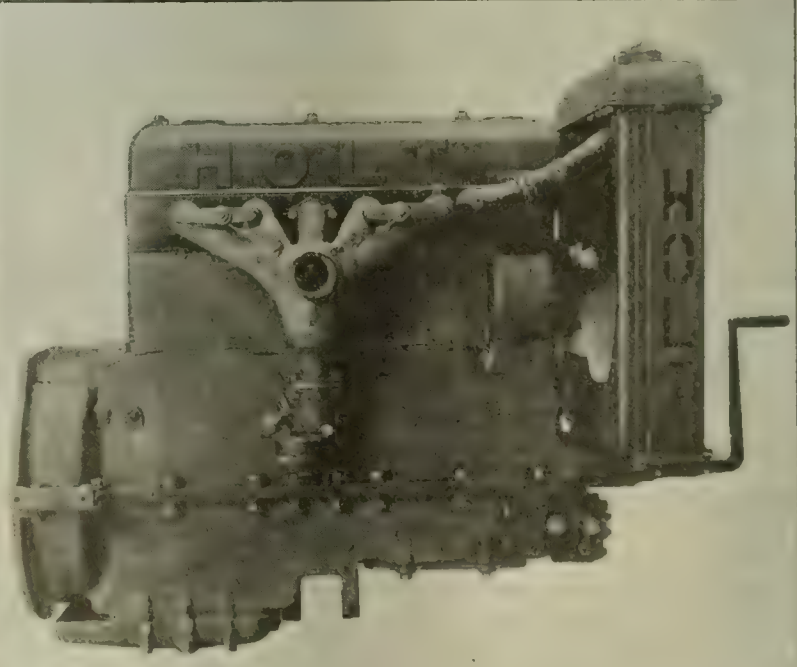
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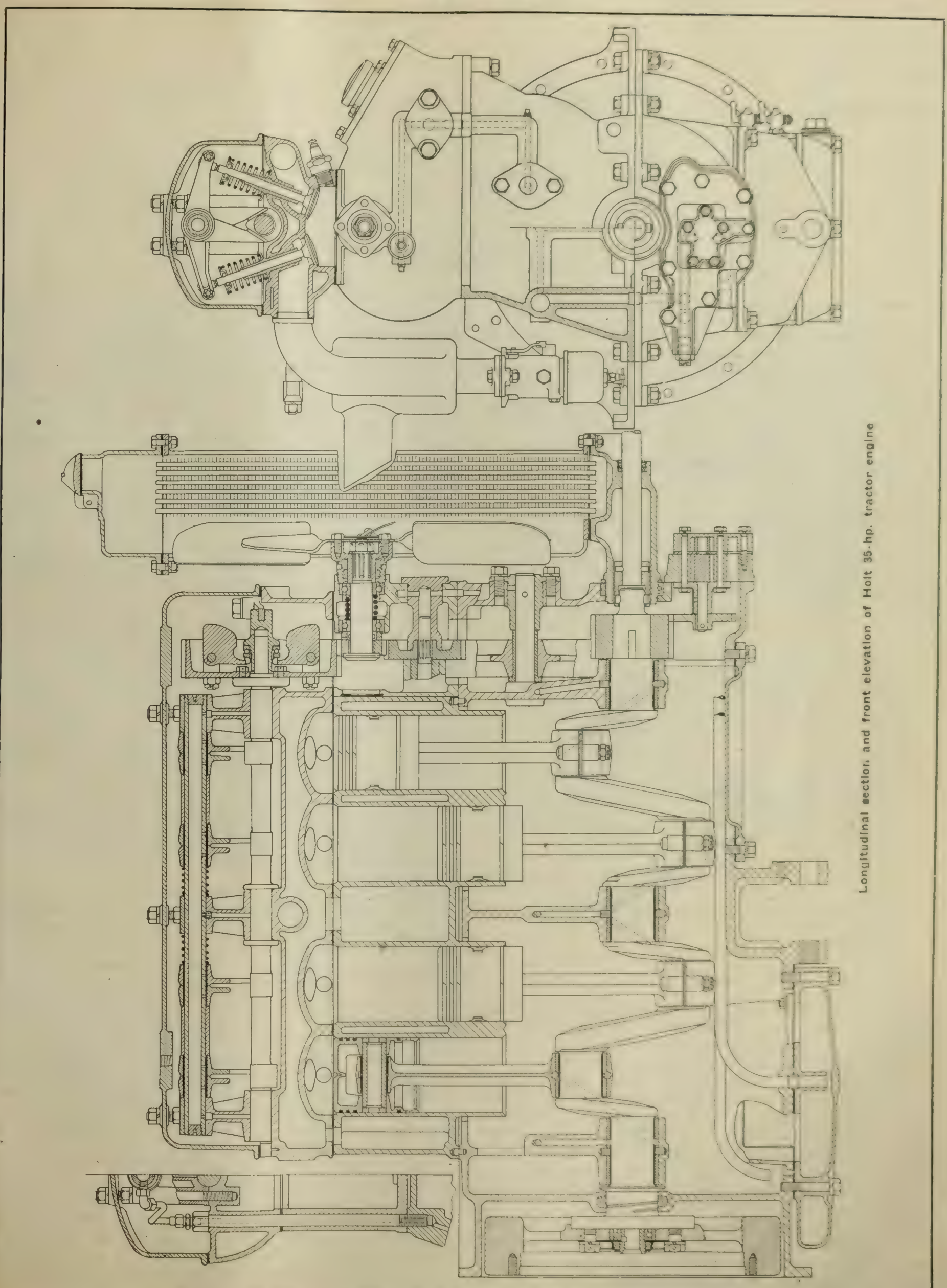


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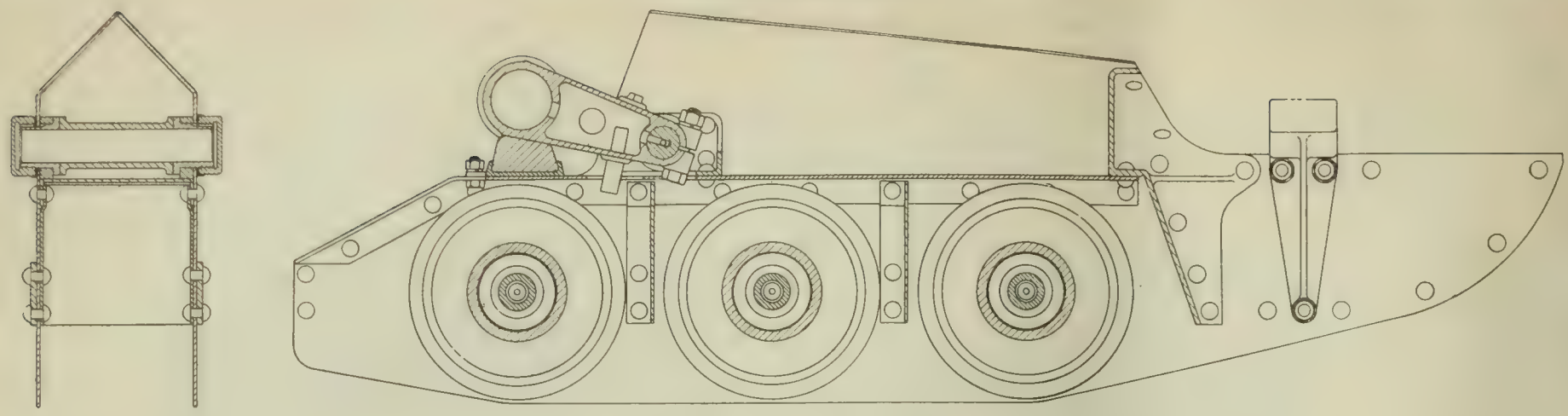


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1—Holt Caterpillar light tractor Model T-35. 2—Track assembly, showing rear suspension of tractor and track release link feature, shed type frame and front idler. 3—Transmission unit, including change speed gears, side clutches and stationary attachment. 4—Valves, camshaft, governor and timing gear in removable head. 5 and 6—Left and right sides of engine and radiator assembly



Longitudinal section and front elevation of Holt 35-hp. tractor engine



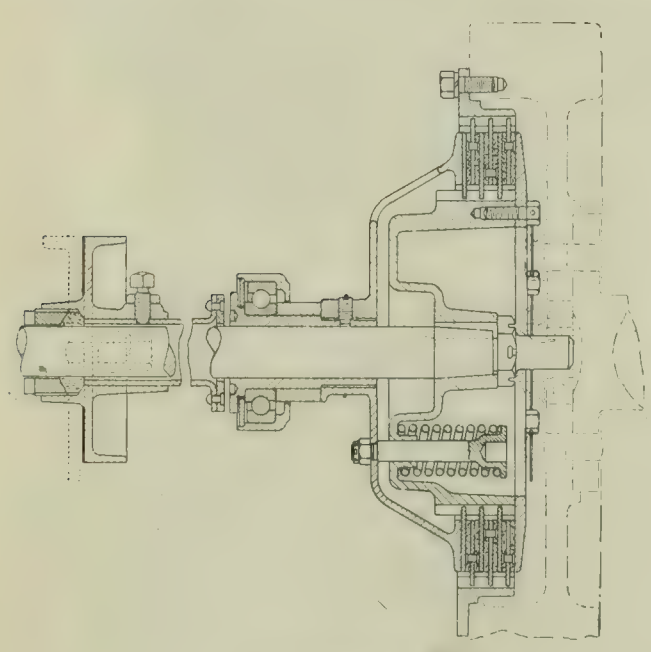
Track frame assembly

camshaft gear and also the water pump. All gears operate in an oil bath.

The cylinders are cast in a block which is made of gray iron of 40 point scleroscope hardness. There is a liberal water space around the combustion chamber of each cylinder and around each valve. The fan is gear-driven and has a slip clutch on the inside running in oil. Quickly removable plates on the bottom of the crankcase allow all bearings to be easily adjusted and permit pistons and connecting rods to drop right out.

Engine Cooling

The radiator is of the finned tubular type. The tubes are made up into a core and this core bolts solidly to top and bottom headers of cast iron. A projection from the front end of the engine is machined into a spindle. The lower header of the radiator is machined to fit this spindle, and the radiator is slipped onto the spindle from the front. Two ¾-in. nickel steel studs hold the radiator to the crankcase, and to remove the radiator it is simply necessary to unscrew these studs.



Master clutch

Water returns to the top of the radiator by two outlets—one on each side of the cylinder head. Instead of the regular hose connection between the cylinder head and the engine itself there is a connection to the cylinder head by a single center stud. To remove the top radiator connections the hose itself is not disturbed, all that is necessary being to remove one stud on each side.

A multiple dry plate type of clutch, spring-actuated and automatically taking care of wear, is used. The driving plates have regular gear teeth cut on their outer diameter which fit into teeth in the driving flange bolted to the flywheel. The driven plates have gear teeth cut on their inner circumference which fit into the teeth on the hub clutch shaft. The spring pressure per square inch of area is made low, to insure a soft engagement and long life of the friction lining. A clutch brake is provided to facilitate shifting of gears.

The driving plates of the clutch are of cold rolled steel, and asbestos friction disks are riveted to both sides of the driving plates. The driven plates are of saw steel, properly tempered to give a very hard wearing surface. The driving flange and driving hub are of carbon steel. The pressure release plate is of malleable iron and the clutch shaft of nickel steel.

The clutch forms a self-contained unit and is readily accessible; it is only necessary to remove the transmission cover, whereupon the clutch may be taken out as a unit without disturbing any other parts. The clutch throw-out bearing is a radial and thrust ball bearing which is lubricated by an Alemite grease plug.

Transmission

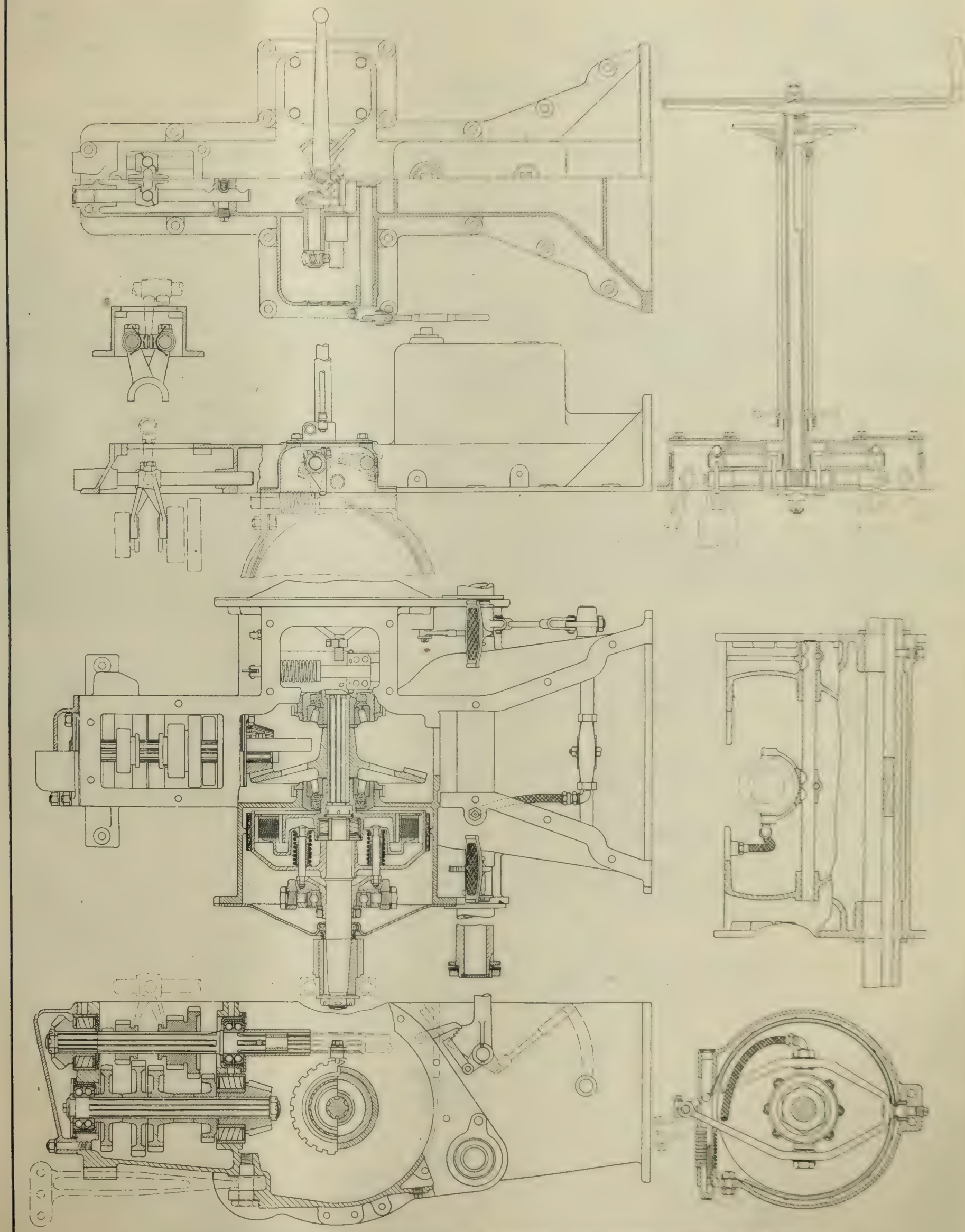
The transmission provides three speeds forward and one reverse. In every case the power is applied to the rear sprocket through three gear contacts. Power is transmitted from the engine through the main driveshaft to a selective sliding gear and thence through a longitudinal countershaft on which the bevel pinion is mounted, to the bevel gear on the clutch shafts, on the opposite end of which the final drive pinions are mounted.

All shafts and gears in the transmission are made of nickel steel, heat-treated. All sliding gears are splined. The main transmission shaft is fitted with a heavy-duty roller bearing at the rear and a double row ball bearing at the front.

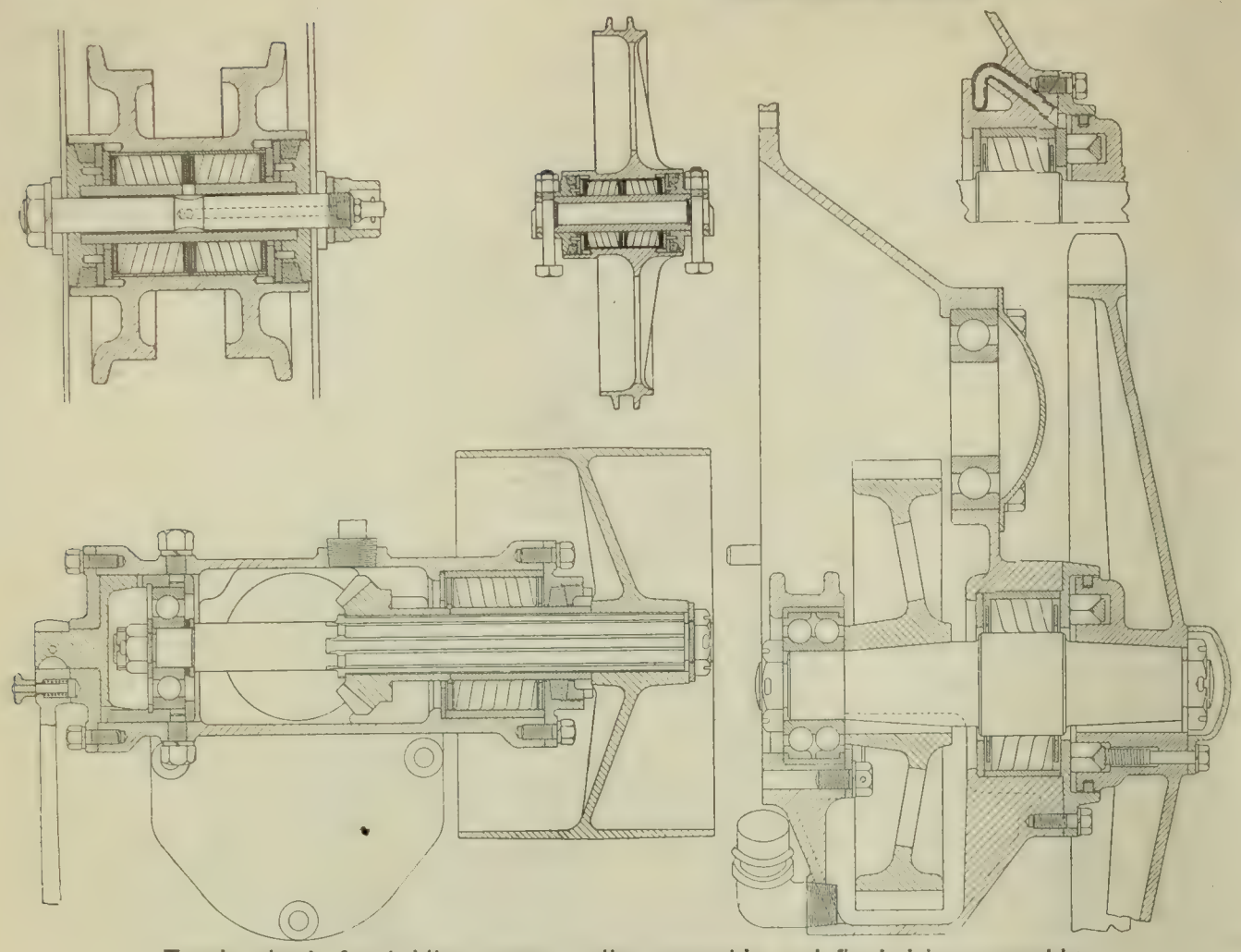
The countershaft in the transmission has a double row combined radial and thrust bearing on the rear end and a heavy-duty roller bearing on the front end that carries the main drive pinion. The bevel gear (a nickel steel forging) is mounted between adjustable taper roller bearings. The main bevel gear is splined to take the side clutch driving hub and the inner end of the clutch shaft is carried in a high-duty roller bearing located in the center of this hub.

The side clutches are of similar construction to the master clutch, in that the plates drive and are driven by gear teeth cut on their outer or inner diameter, instead of by driving lugs. The side clutches run in oil, all of the plates are made of hardened saw steel and none have asbestos facings.

To facilitate turning a Raybestos-lined brake band is used around the housing of each side clutch. These brakes come into play only after the clutches have been completely disengaged, when a further movement of the steering handles causes the brakes on the desired clutch to engage. These brakes can be adjusted from the driver's seat without the use of tools.



(Upper half)—Transmission cover and control assembly. (Lower half)—Transmission assembly



Truck wheel; front idler; power pulley assembly and final drive assembly

By means of a pedal both of these brakes can be applied when the tractor is either running or idle. This brake is provided for use in descending steep hills, and it can be locked in position if the tractor is standing.

Final Drive

The final drive gear is a nickel steel forging, heat-treated, and is mounted on the final drive axle with a taper fit and straight key. It is mounted in the final drive gearcase. The shaft is supported on the inner end by a double row ball bearing and on the outer end by a roller bearing.

The only opening in the final drive case is where the shaft passes out to the final drive sprocket, and that opening is protected as follows: Two felt washers are inserted in a cavity machined in the final drive gearcase, one within the other; springs are placed against these felt washers, and when the small cap on the end of the track drive sprocket shaft is secured in place with three cap screws, these cap screws put pressure on three springs and they, in turn, put pressure on the heavy felt washers.

As the felt washers wear, these springs follow them up and keep any opening closed at all times. On the outside of the cavity containing these felt washers a piston ring is inserted into an inclosure, which gives added protection against the entrance of dirt.

The truck frames are made of heavy pressed steel. The shed roof is part of the frame itself and adds to its strength. An apron, a part of the truck frame itself, projects below the gudgeons, extending down close to the track shoes, thus preventing dirt and rocks from getting into the track. The truck wheels are made with chilled iron rims. The hubs are machined, and each wheel is fitted with two flexible roller bearings. The gudgeons are hollow, of nickel steel, heat-treated, and are fitted with Alemite grease plugs. They require lubrication only once a day.

The front idler, which is mounted in the front end of the truck frame, is made of carbon steel. The track is adjusted by drawing this idler forward with two nickel steel draw bolts. The front idler is carried on two flexible roller bearings. It has a flanged rim and the weight of the track is carried on this rim, rather than on the space blocks.

The track of the T-35 is 10 in. wide. Its links and shoes are made in one piece of medium carbon steel, heat-treated. A bushing of high carbon spring steel, oil tempered, is forced into a machined hole in one end of the link. When this bushing is forced into place it springs outward, which insures that it will remain tight at all times. On the outside of this bushing there is an oil tempered spring steel roller which moves slightly as each tooth comes in contact with it. This tends to prolong the life of both the track sprocket and the bushing.

The track pin is made of chrome nickel steel, heat-treated. It is turned from a solid square bar, a square head being left. When the pin is inserted into the track link, this square head is tight in a slot in the link. Instead of putting a cotter pin through the opposite end of the pin, a cotter pin is placed behind the head and through a drilled hole in the lugs that hold the square head.

Lubrication

Grease cups are almost entirely eliminated, only two being found on the whole tractor. These are on the water pump. Alemite grease plugs are used where daily lubrication is required. The engine has one oil filling point. An oil pressure gage located in plain view of the operator tells him the pressure of the oil in the lubricating system. Lubrication of all truck wheels and the front idlers is accomplished by eight Alemite grease plugs, to which a generous supply of grease is to be furnished once each day.

Track oiling and the oiling of the pivot shaft and truck drive link is accomplished in a very simple manner. The track oil tank is on top of the transmission cover, and two valves within easy reach of the operator distribute oil to the points mentioned. The oil flows through a tube to the hollow pivot shaft and through this shaft into the drive links, automatically lubricating the pivot shaft and the drive links as it passes to the tracks.

A bucket-shaped seat with a good spring cushion is supplied. The controls are easily handled. The gear shift lever is operated with the right hand, the clutch throw-out with the left foot and the emergency brake with the right foot. Spark and throttle controls are mounted on the steering column.

An Aid to Starting

FIAT cars are now being fitted with a patented solenoid-operated valve which acts as a strangler, closing automatically when the electric starting motor switch is closed, and opening again when the foot is removed from the starter switch. The object is, of course, to insure a rich mixture for starting without depending upon hand operation.

A New Departure in Vehicle Spring Design

Unusual type of construction employed requires no shackles or lubrication, and is said to eliminate rattles, improve riding qualities and effect a considerable saving in weight and manufacturing costs. Three or more main leaves can be used to take braking and torque reactions.

AMONG the interesting developments tending toward less expensive and at the same time more satisfactory automotive vehicles is one having to do with the spring suspension system which appears to possess unusual merit. This improvement involves the use of a new type of leaf spring which, it is claimed, can be made lighter than present springs and at the same time give superior riding qualities, especially at light loads. The construction is such that spring shackles as well as spring eyes, bushings and pins are eliminated, consequently there are no parts to wear or rattle and no need for lubrication save that which is considered desirable between the leaves of any conventional spring. This, of course, results in considerable economies in manufacture, not alone because of the spring parts eliminated, but because cheaper frame brackets can be employed, and, at least in some cases, the frame can be cheapened by elimination of certain cross-members. Furthermore, since the spring itself is lighter and requires no eye, it is less expensive to manufacture.

This new development, which is due to Arthur M. Laycock, chief engineer of the Sheldon Axle and Spring Co., involves the use, in most cases, of a compound or double sweep in the plate, instead of a single bend used in conventional leaf springs. This double bend takes care of variations in length which in most conventional springs is the function performed by the shackle. In the semi-elliptic type shown here, however, the main plate is not continuous from end to end of the spring, but at one end is allowed to float a sufficient amount to take care of length variations.

An excellent idea of the characteristic construction employed is conveyed by Fig. 1, which shows a full-elliptic type which has been broken in laboratory tests on the vibratory machine. It will be noted that the two main leaves are continuous from end to end, but have the double bend form. The secondary plates are arranged quite differently than in conventional types, the thickest portion of the spring being at the ends rather than in the center. By this arrangement, it is claimed, the stresses in the steel are more uniformly distributed throughout the mass of the metal than with the conventional arrangement. In support of this claim it is stated that one test spring shown broke in six places under the influence of the repeated loading imposed by the vibratory machine. These fractures were noted at the same time in all six places and a considerable time before actual breakage occurred. Conventional types usually break at a point close to the anchorage, and the break at first occurs in one leaf only, and then successively in adjacent leaves above or below the original fracture. The type of fracture in several places as shown in Fig. 1 is said to be characteristic of all springs embodying the new feature of construction.



Fig. 1—The new Sheldon full elliptic spring

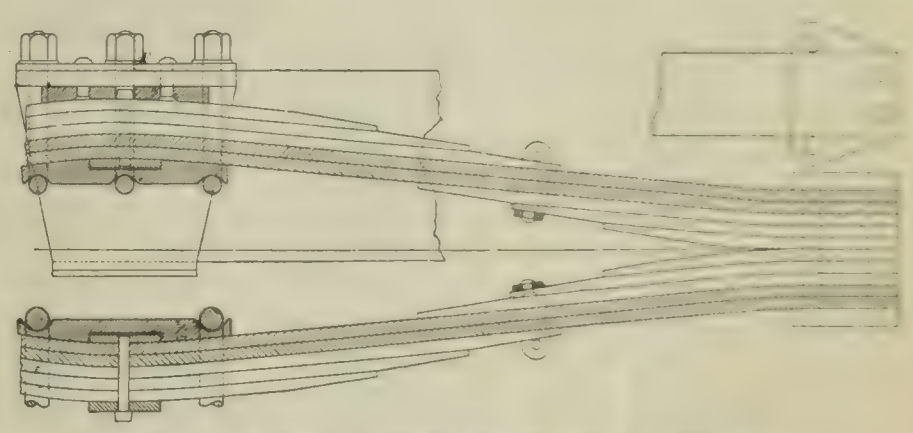


Fig. 2—A design adapted for use on a 5-ton truck

If, as some contend, there are advantages from weight and other standpoints obtained by tapering leaves for a considerable proportion of their length, it may be possible in the new type of spring to effect some saving in weight on this score, since it is made up of a larger proportion of short leaves than most other designs, and it is said to be possible commercially, under present quantity production conditions, to taper leaves for only six to seven inches of their length.

The effective length of the new type of spring automatically decreases as the load increases, due to the fact that as the spring is compressed the two halves bear against each other over an increasingly greater proportion of their total length. Because of this fact the deflection is not in direct proportion to the load, but can be made to vary in any desired way by proper shaping of the contact surfaces and the leaves, and consequently the riding qualities can, we are informed, be made as good with light loads as with full loads. Furthermore, it is possible to design a lower vehicle, since it becomes impossible for the spring to close far enough to permit the axle to bump the frame.

Fig. 2 shows a design of spring employed on a five-ton truck in which radius rods and a torque arm are used. The variation in load per in. of deflection is from 1500 lbs. at light loads to 2300 lbs. under heavy load.

The curves in Fig. 3 show the relation between deflection and load for two springs, one of conventional full-

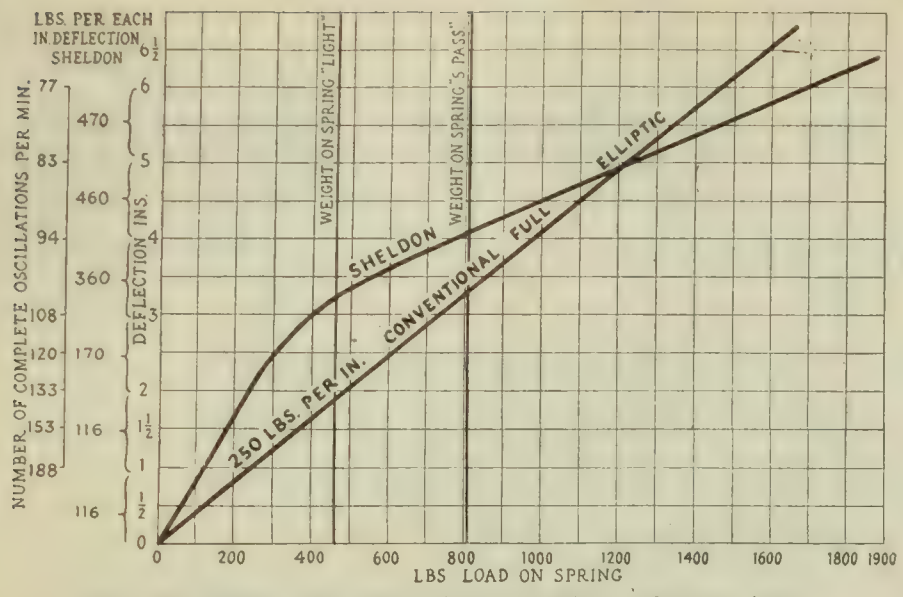


Fig. 3—Curves showing characteristics of new type and conventional type

elliptic type in which the deflection is directly proportional to the load (250 lbs. per in.) throughout the range, and a second of the newer type in which such a relation holds through only the upper and lower portions of the curve, while near the center the relation changes (116 lbs. per in. for first 2 in. and 460 to 470 lb. per in. for the fifth and sixth ins.). The vertical lines on the chart are drawn through abscissa corresponding respectively to weight on the spring when the car is empty and when carrying five passengers. The intercepts of the two curves with these lines show that there is much less difference between the deflection of the two springs under light and full load respectively in the case of the new type of spring than in the case of the conventional type, and consequently the former should be easier riding, especially at light loads. A second scale giving number of complete oscillations per min. plotted at the left shows that the Sheldon spring has a considerably lower period under both light and full load than the normal full elliptic. The particular Sheldon spring shown is, however, too stiff under bumper conditions, but this and other characteristics can be changed by slight changes in design.

A three-quarter elliptic spring of the new Sheldon design is shown in Fig. 4. It is similar in most respects to the full-elliptic design. The half-elliptic design shown in Fig. 5 differs from the other two in that the main plate is not continuous from end to end. It is bolted rigidly at one end—in the particular spring shown, to the spring horn—while the other end is allowed to float between two other plates held apart by a spacer of slightly greater thickness than the main leaf. The two guiding leaves and the spacer are bolted rigidly to the rear bracket of the spring. The lower half of this bracket is turned up to form a side guide for the free end of the main leaf, and a clip, disposed as shown, serves as a further guide. The main leaf is the only one which extends from the front to the rear bracket. The other leaves are short and are placed in the manner shown.

The bolts which hold the springs of the new type together and fasten them to the brackets are said not to be subjected to shear as a result of flexing the spring under vertical loads. We are informed that the reamer used in finishing the bolt holes will drop through the hole, even when the spring is flexed. Shear is, of course, imposed by brake and torque reactions, but these reactions are said to add considerable pressure between plates and render the spring unusually stiff in respect to longitudinal deformation. In addition, three or more main leaves can be used to take braking and torque reactions when a torque arm is not employed, thus making it possible to materially strengthen what is often a weak point.

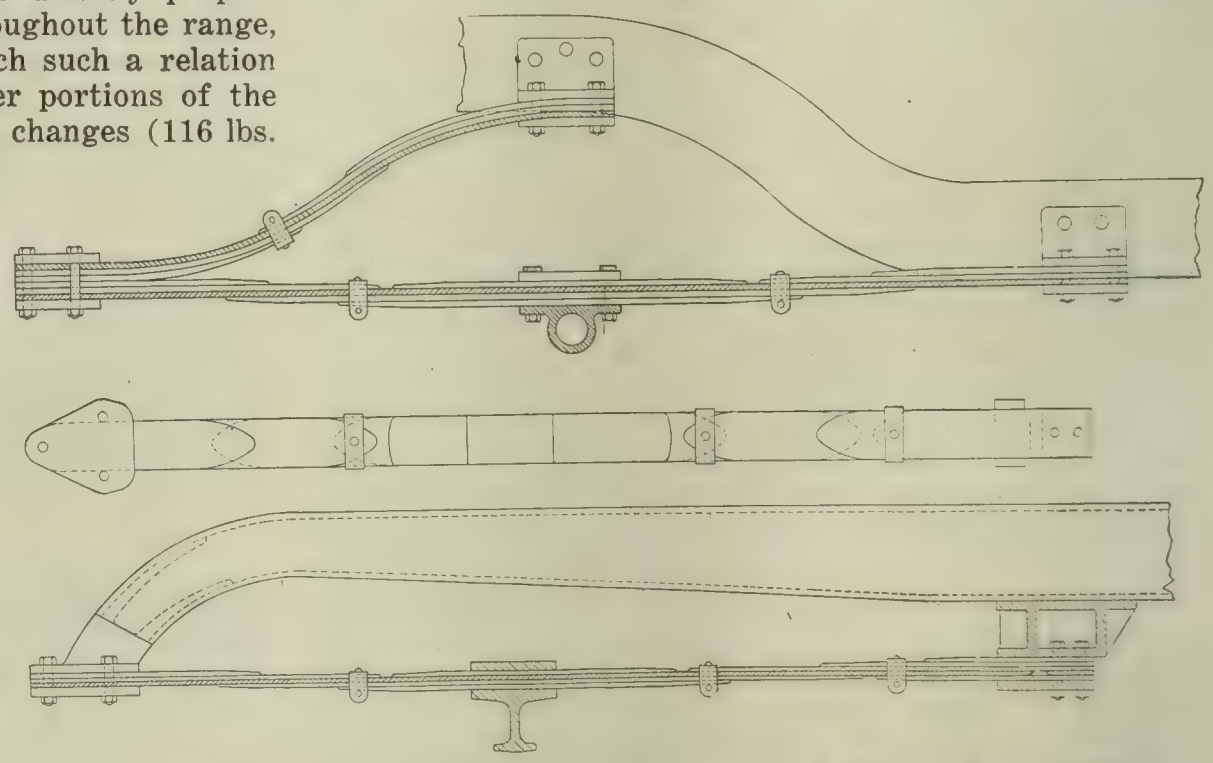


Fig. 4 (Above)—A three-quarter elliptic spring, and Fig. 5 (Below)—A half elliptic spring of the new Sheldon design

Study of Depreciation Is Urged

PRACTICAL studies by the various industries for the purpose of ascertaining within each industry a normal rate of depreciation shown by experience on buildings, machinery, etc., which may be used as a basis for reckoning depreciation in individual plants is urged by the Fabricated Production Department of the Chamber of Commerce of the United States. Such studies have the approval of the United States Treasury Department.

It is not the purpose to create within any industry an inflexible standard rate of depreciation for the buildings, machinery, etc., of each unit within the industry, but it is proposed to set up something that may be used as a guide to fit usual conditions.

There are certain conditions affecting the wear and tear upon buildings and machinery that are similar in most of the plants within any industry. Another advantage in establishing typical rates, to which attention is called, is that they would prove of as much or more benefit to an industry in determining the accuracy of depreciation to be included in costs as they would in making up tax statements.

"Trade associations representing a single line of industry," says the bulletin, "are particularly well fitted to take up such studies."

A MOTOR car, which is said to compare favorably in quality of workmanship with European cars, has been produced by the Yangtze Machinery Works, China, and will enter into competition for the native market.

Brakes for Automotive Vehicles

A comprehensive survey of present practice in brake design, setting forth the advantages and disadvantages of the various types and discussing factors which enter into the design of brakes and brake actuating mechanisms, especially as applied to passenger cars. Most brakes inadequate.

By J. Edward Schipper*

IN giving so much attention to acceleration we have run somewhat ahead of the other problem that is relatively just as important and just as necessary of solution. This is the problem of deceleration. It should be as much a matter for consideration on the part of the engineer that a car be able to get back to a standing position as it is that the vehicle be able to leap quickly from a standing start to speeds of 10, 25 and 50 m.p.h.

If we were to stop for a moment and take stock of the passenger cars and trucks put out by American builders to-day, we would find qualities of acceleration that are the marvel of the world. On the other hand, we would find qualities of deceleration that many consider to be deplorable. This statement is not made in a haphazard way, but is absolutely warranted by the engineering opinion of those who are responsible for our present-day design. Scores of engineers of the highest standing in the industry have been consulted regarding the subject, in connection with the preparation of this paper, and the opinion is practically unanimous that our present-day brakes, if not the weakest, are assuredly one of the weakest points in design. Whether this is a difficulty that we can rectify under our present system of brake design remains to be seen. The best brakes we have designed under present methods are inadequate in mountainous country, although they serve very well and efficiently in flat and moderately hilly country. When it comes to real mountainous country, however, the engine must be called upon to augment the brakes. Whether or not this is desirable is debatable.

Brakes of the Present

If we turn the problems of acceleration backward and look at them from a deceleration standpoint, we have something of the same nature to deal with. In accelerating we are taking heat energy and transforming it through the mechanism of the car to dynamic energy as represented by the weight of the car and the speed at which it is traveling. This kinetic energy must be dissipated by transforming it back to heat energy through use of the brakes. To bring the vehicle to rest it is necessary to absorb its momentum by making it do work against friction, and this friction produces heat which must be dissipated. The friction brakes act, therefore, by dissipating in the form of heat the energy represented by the momentum of the vehicle. To accomplish this they must produce the heat and radiate it to the atmosphere. It is evident that the radiation of the heat must be as rapid as possible, in order that the temperatures of the braking parts shall not rise above a safe value for the materials contained in the braking mechanism, particularly at the contact surfaces. Since there is an appreciable time element in the radiating ability of any surface, it is clear that, with the ordinary braking systems, there will only be a certain length of time before the brakes become overheated, because the heat generated is imparted to the brake bands much more rapidly than the heat can be dissipated through the ordinary braking systems now provided. The steeper the grade is, the more quickly the brake temperatures will reach the danger point. Many of the hills encountered in the Allegheny Mountains, for instance, are sufficiently long and steep for this temperature to run above the capacity of the lining to withstand burning, with the result that is all too familiar to engineers. To sum this up in simple language, it is possible to burn out the brakes on a car by using them in going down a long grade, provided the engine is not used to assist the brakes and we depend solely upon the braking system of the car.

Design Factors

When an engineer is laying out the brakes for a passenger car, assuming that he intends to work along the conventional lines, he has several different combinations and types of braking layout available from which to choose. By far the greater majority use two sets of brakes on the rear wheels, these being the internal and the external types, one set being operated by the pedal and the other by the hand lever. This system is used widely because it has the advantage of simplicity and low cost of manufacture, and provided the brakes are laid out with sufficient regard to proper brake area and with the centers of the operating levers arranged so that spring deflection does not cause grabbing or releasing of the brakes, it is fairly satisfactory. In addition to this type of layout, we have the side-by-side internal brakes, which operate on the same drum, this having the advantage of providing two sets of inclosed brakes that are naturally less exposed to water, mud and grit. They are somewhat more complicated in assembly, however; they require a much deeper drawn drum and probably never will be used widely because the complications introduced are not compensated for by any marked advantages in performance.

Another choice which has been favored by an increasing number during the past few years, after first having been used and discarded by several manufacturers, is the installation of the foot or service brake on the rear wheel and the hand brake on the transmission or propelier shaft. This arrangement has the advantage of providing an independent brake drum for emergency use. In case one breaks, it does not affect the other and, furthermore, the installation puts into the hands of the driver

*Condensed from a paper presented at the Annual Meeting of the Society of Automotive Engineers. Descriptive matter, relating in particular to four-wheel brakes and the Crane transmission brake, which has heretofore appeared in AUTOMOTIVE INDUSTRIES has been omitted.

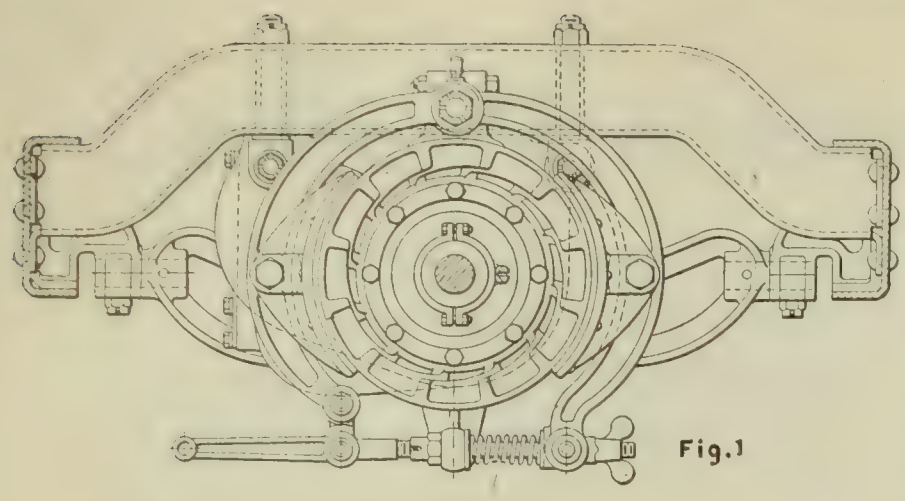


Fig. 1

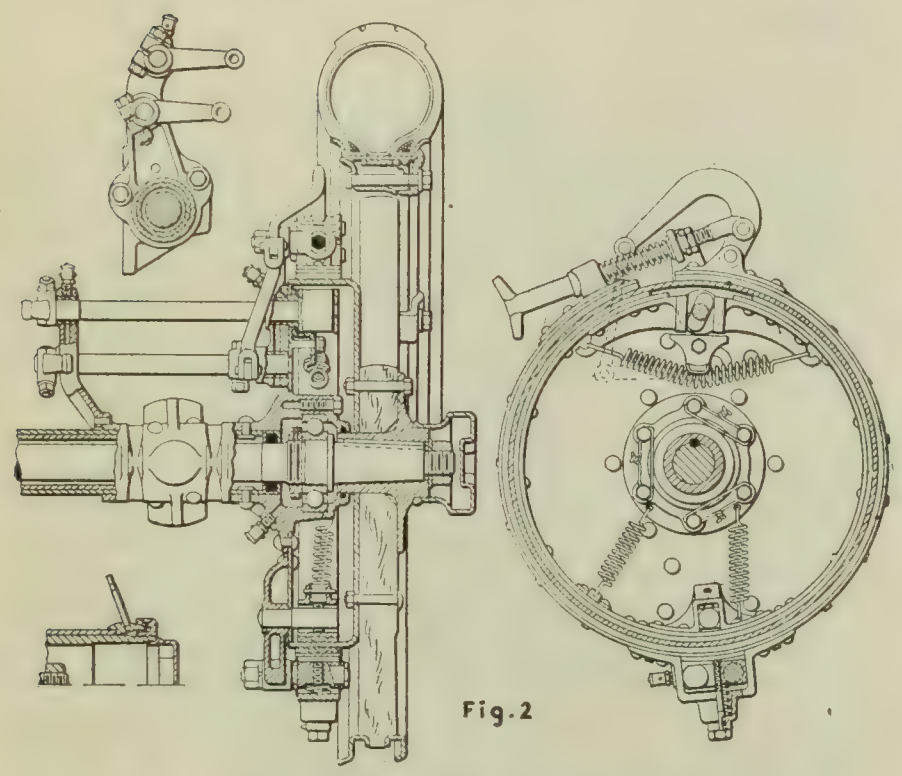


Fig. 2

Fig. 1—Pierce-Arrow truck transmission brake. This brake, which is of the contracting-shoe type, has a drum 12-in. in diameter with a 5-in. face. Fig. 2—Double external and internal brakes used on the Packard single-six car. The internal brake is cam-operated and substantial release springs are provided to prevent drag

a very powerful emergency braking system. Because of the location of the brake on the propeller shaft, the brake has the benefit of the reduction through the rear driving system and also of the equalization secured by the differential gear. The propeller shaft brake has disadvantages, however; otherwise all manufacturers would use it. The disadvantages that frequently are cited against it are the tendency to chatter, the excessive stresses that must be imparted to the universal joints and rear axle parts and the difficulty of dissipating the tremendous amount of heat absorbed by the small brake drum. Naturally, the size of the brake drum is limited, because of the location of the propeller shaft immediately under the floor boards of the car. Most engineers have been partial to the wheels as being the proper location, because it involves stress in the least number of parts and hence is safer. In worm drive and bevel gear axles, where the spiral angle is fairly steep, many of the pinion and worm shaft bearing failures have been the result of too severe propeller shaft brakes. Overheating of the propeller shaft brake is, of course, the point that is cited most against it.

After having determined the location of the brakes, the engineer has a choice of the flexible band type of brake or the rigid shoe type illustrated in Fig. 1. These again have advantages and disadvantages. The former sometimes has a tendency to grab severely, particularly at high speeds, on account of its wrapping action. With it, however, practically 100 per cent of the brake surface is effective. With any type of rigid brake shoe it is practically impossible to secure anything like effective surface for the full circumference of the drum. There are two classes of rigid shoe brake: the pivoted or locomotive type and the simple type. In the former a separate brake beam is pivoted to the shoe at its center, so that the entire shoe surface is pressed against the drum. The greatest pressure is found to be under the pivot in this type, the pressure tapering off toward the end. If shoes of this type are made to cover 180 deg. of drum surface, the tips will present practically no pressure and from those points back to the pivot the pressure will gradually increase. This naturally causes unequal wear of the shoe facing and is apt to cause brake squealing. The relatively small area of surface engaged cuts down the friction materially and, consequently, the brake efficiency.

In the simple type of rigid shoe, one end of which is pivoted fast to the spider, the other end being acted upon by the cam, as in Fig. 2, or the toggle, as in Fig. 3, the greatest pressure will be on that part of the lining closest to the fixed pivot and the pressure will taper off to zero at the tip. Unless specific provisions are made to the contrary, the movement of such a shoe will vary as the distance from the pivot, so that the portion of the lining closest to the pivot will have the greatest pressure if it is brought into contact with the drum, and still have so little movement that it may not establish the desired amount of contact and hence be ineffective. On the other hand, the portion of the brake near the other end of the shoe, being at the distance most remote from the fulcrum point, will have but very little pressure on the drum, the pressure it obtains being all from the direct action of the cam or toggle. To give full contact area, brake linings should be cut back from the end of the shoe.

A band brake, examples of which are shown in Figs. 4 and 5, will give practically 100 per cent surface contact, which, of course, is highly advantageous not only from the standpoint of effectiveness but from the standpoint of quietness in the brake action and the life of the lining. It is a well-established fact that brake squeal is due largely to concentration of the braking pressure on limited areas of braking surface. These high spots or contact points, being highly stressed, are caused to chatter and set up vibrations. There are many band brakes in use to-day which, although designed primarily on the contracting band principle, do not really work out in this way. Instead of causing the operating levers of the brake shoe to draw the band down snugly over the entire surface of the drum, the construction of the brake toggles is such as simply to bring great pressure on the few inches of the brake band nearest the toggle, and the rest of the brake shoe, which probably represents nearly 75 per cent of the possible braking area, is doing very little or no work.

External brakes for passenger cars can be used with lighter drums than internal brakes because the expansion of the drum, due to heating, does not reduce but rather increases the power; whereas, internal brakes have insufficient travel on the levers to follow up the increased circumference. Neither does the distortion of a thin drum noticeably affect the power of the brake in contrast with internal brakes which, except in the wrap-up internal type, rarely fill the circumference of the drum, and especially in the case of internal shoe brakes where practically no more than half of the drum circumference is utilized. In such cases the drum must be stiffened or ribbed to minimize distortion. Exposure to dirt and sometimes a rather unsightly appearance are objectionable features of the external brake. The cheapness of manufacture and upkeep has been respon-

sible largely for the popularity of this type of brake on passenger vehicles. The external brake is, of course, very accessible. Consequently, it is used as the foot brake because of the relative ease of relining and to reduce the cost of upkeep.

Uniform and Effective Braking Power

To secure uniform and effective braking power the operating levers of the brake should be of such construction as to not only draw the brake band against the entire surface of the drum, but the operating principle should be such as to draw this brake shoe band down with uniform pressure on the brake drum. If, when the brake pedal is pressed down and the operating levers of the brake shoe begin to tighten, the pressure of the brake shoe is 50 per cent more on one side of the drum than on the other, it is obvious that the effectiveness of the brake has been lowered greatly, and the condition created that is apt to cause the squeal that is giving so many builders of cars much anxiety at present.

It will sometimes be found that brake band linings are not worn at the ends where the toggles are, or at the hinge point to a perceptible extent, but that they are worn through to the steel at a point about one-half way between the hinge of the brake and the operating toggles. This condition is due purely to an imperfect arc of a steel band. The band either has been bent or sprung, or it never was shaped up so as to conform to the circumference of the brake drum against which it was intended to work. Another point of weakness is that when the adjustment of the brake is too close to the drum the blowing in of sand on a sandy, dirty road can create objectionable friction between the surfaces of the brake shoe and the drum. There is no perceptible drag while the car is clean, but as soon as a sandy type of road is encountered, considerable drag is introduced.

Drag is due also to insufficient strength of the releasing mechanism; or the action of the brake may not be adequate to insure a proper release of the brake band from the drum when the brake pedal is released by the driver, as shown in Fig. 2. When the car is new, it may work very nicely; however, traveling in the dust and mud of the road for some months often has the effect of causing the parts to work heavily. It is not uncommon for the springs used to release the brake shoes to prove inadequate for their work, and this results in a drag on the car, premature wear on the face of the shoe and often the generating of sufficient heat to blister the paint on the brake drum. A brake drum should be very well fitted and run true. Many brake drums run out over 1/64 in. and, as the clearance between the liner and the brake drum is generally less than this amount, the brake lining is in frequent cases rubbing continuously.

Exposed and Protected Types

From the standpoint of heat radiation, the exposed type of brake is evidently best on account of the ability to secure air circulation and consequently more rapid heat dissipation. Unfortunately, however, especially on rear-wheel applications, the open type of brake is subject to the severe drawback of exposure to water, dust and grit. Because of the composition of the brake linings, which are heat-resisters primarily, practically all of the radiation is from the drum and, naturally, the most efficient radiation is secured when the entire outer surface of the drum is exposed to the air. With reference to heat radiation from the drum, it would be very hard to imagine any worse condition possible than that obtained in the conventional internal and external types of brakes used on the majority of passenger cars and on many of the lighter trucks. No more efficient insulation could be imagined than the two asbestos linings, one applied within the inner and the other on the external surface of the drum, when both sets of brakes are engaged. For normal driving over level country, such a system is all that is necessary, of course, because the length of time of brake application is insufficient to raise the temperature of the drum beyond a safe value. On the other hand, as soon as cars equipped with brakes of this type attempt to negotiate any long, steep hills, relying on their brakes alone, they get into trouble. In other words, it is perfectly possible to burn out the brakes on even the best of our passenger cars on a trip, say, over the Lincoln Highway from Philadelphia to Pittsburgh, where the long, steep grades of the Allegheny Mountains must be encountered. The motorist has only one resource and that is to use his engine for a brake. If he fails to do this, or does not know how to do it, his brakes will fail.

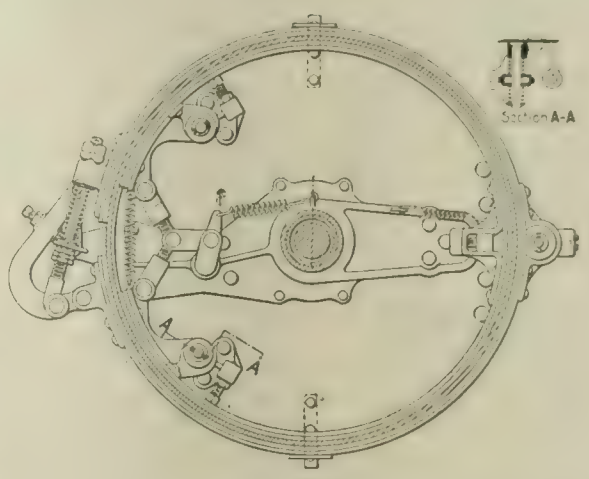


Fig.3

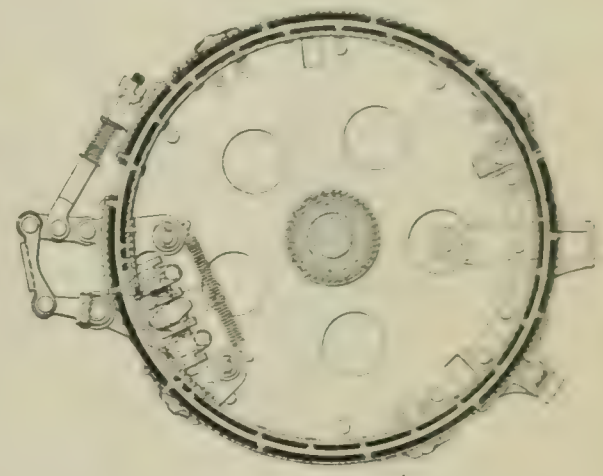

Fig.4

Fig. 3—Internal and external brakes used on the Lafayette car. The external-contracting band brake is operated by a bell-crank and the internal-expanding brake is actuated by a double-adjustable toggle. Fig. 4—Double internal and external brakes used on the Marmon car. This is a cam-operated internal-expanding brake which is anchored in the usual way with a bell-crank-operated contracting-band type on the same drum

Side-by-side internal brakes, which allow the external surface of the brake drum to be exposed and, consequently, permit more rapid radiation, are only a partial solution of this problem. The brake drum becomes heated upon the application of one set of brakes for any considerable length of time, of course, and there is no great advantage in being able to alternate the use of the two braking system, since both sets in use are compelled to operate against the same hot drum. Another drawback to the double internal brake is that, unless the manufacturer has been unusually careful, there is a tendency to sacrifice brake shoe widths on this type of brake layout to accommodate the widths of the drum without getting too deep a brake drum flange, which, of course, requires an exceptionally deep draw in manufacturing the drum. Two concentric drums on each wheel would separate the two braking systems entirely from each other, of course, but introduce complications that lead to rattles and possibly even structural weakness. Furthermore, the inner drum is apt to be of insufficient diameter and, consequently, the inner brake of insufficient surface area. It is very difficult to design a brake of this kind that is not too light to have sufficient strength and still be crowded into the necessarily confined space provided. In addition, the inner brakes will

be very apt to have insufficient radiating surface on account of the insulating effect of the outer brakes. To obviate the use of the single drum for the two sets of brakes, one is forced to consider the propeller shaft brake, or front wheel brakes, of which more will be said later.

Brake-Actuating Means

The placing of the service and the emergency brakes on the inside of the drum has an advantage in the greater protection from dirt, but in this case both sets of brakes have to be cam-actuated. Where only one internal brake is used, the toggle construction can be utilized.

Brake actuating means are so well known that there is no need of discussing them in this paper. The practice on the external contracting type is practically universally in favor of the pivot anchor directly opposite

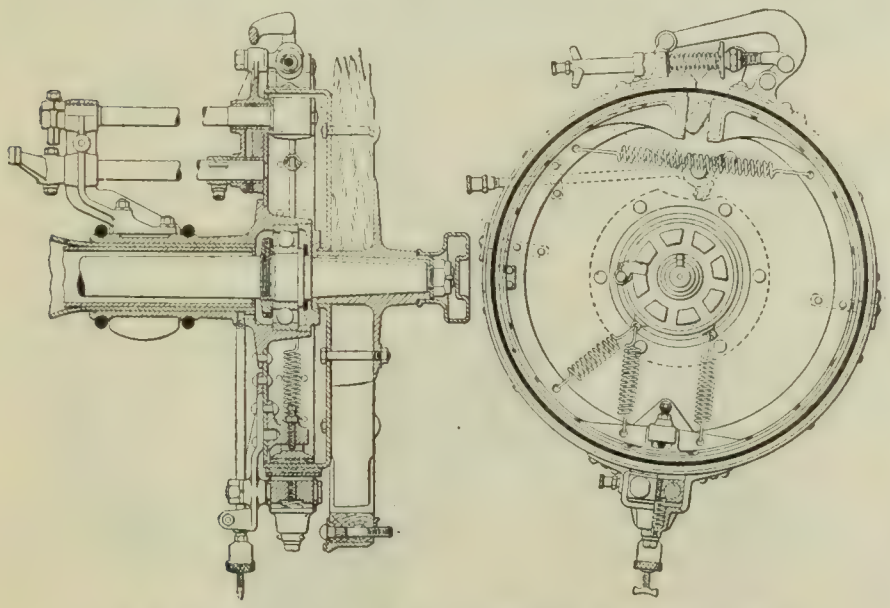


Fig. 5—Double internal and external expanding band type of brake used on the Packard twin-six car, the former being cam-operated

the contracting mechanism. The brake segments are formed with eyes for the anchorage joint or the steel bands have a fitting that is riveted to them to serve the same purpose. The brake support consists of a bracket secured to the rear axle tube or to the radius rod. The contracting mechanism is nearly always a floating bell crank lever similar to that shown in Fig. 3, to the short arm of which one end of the brake band is connected by a riveted bracket, while the other end of the band connects through a short link to the fulcrum of the bell crank. The operating rod is connected to the long arm of the bell crank. The short link is hinged to the free end of the brake band and passes through the fulcrum pin, the bell crank being forked at the lower end. A butterfly nut is screwed over the end of the link and provides a convenient adjustment. The adjustment is locked by the spring surrounding the link, which forces the arms of the bell crank over the flat end of the wing nut, thus preventing it from turning. The coil springs help at the same time to release the band when the pressure is taken off the brake lever. This method, while offering a simple and efficient means of applying the brakes, has also the advantage of providing a simple adjustment means.

The operating means for expanding brakes are of four types; the cam as shown in Fig. 5, the toggle illustrated in Fig. 3, the wedge and the double-arm lever. In the cam type the internal shoes are pivoted opposite the expanding point. An expanding cam is placed between two flat surfaces or is contoured to fit a follower surface that permits spreading the shoes apart to secure their contact with the drum. The toggle expanding mechanism also is employed very frequently. In this the ends of the brake segments are connected by a pair of toggle-links from the joints of which another link runs to a bell crank whose shaft has a bearing in the brake supporting bracket. Sometimes one or both of the toggle links are adjustable. The toggle mechanism and the cam both have the advantage that they afford quick engagement at first, and then a slower engagement as the movement progresses. In other words, a greater leverage is obtained when desired and so is greater speed. The wedge expander is simply the action of a wedge that is forced between the two ends of the segments, spreading them apart in the same way as the cam, and the double-arm mechanism consists simply of two levers that throw over a center, forcing the ends of the segments apart when actuated.

Little need be said regarding brake releasing except that the anti-drag features on brakes should be sufficiently strong to free the bands or shoes from the drum positively on disengagement. There are too many instances of dragging brakes, due to having these made too weak for the purpose. The type of brake adjustment selected will, of course, depend on the design of the brake-operating mechanism. With some types of mechanism, such as the cam expanders used in internal expanding brakes, these adjustments are difficult to make. However, the question of adjustment is one of a detailed nature that is of great consequence in one or two particulars. In the first place, the adjustment should be extremely accessible so that the owner can adjust his own brakes, or, if he needs to have them adjusted, so that his bill for this work will be as small as possible. Another important matter regarding brake adjustment is that it should be arranged so as to preclude much possibility of upsetting the layout of brake centers when it is made. It is very encouraging to note that there is a marked tendency to increase the diameter of the brake-drums even on the lighter cars. We have always had fairly good-sized brakes on our heavier and more expensive cars, but it is well known that this is a feature that has been neglected on the light and medium-weight cars, particularly those which sell for a low price. Few, if any, brake-drum sizes have been worked out by formula. Most of them have been made by guesswork at the start and increased gradually as complaints come in from owners and dealers as to the braking ability of the cars.

Formula for Brake-Drum Size

I have checked a formula that was worked out by a passenger car engineer who had given the subject considerable attention. It gives results that are very good in the light of present accepted practice. The formula is

$$d = [(Wf \div 2w) + 1.5] \div \pi$$

where

d = Diameter of the brake-drum in inches
f = Factor of 0.045 sq. in., or the total effective service-brake surface per pound of the maximum weight of car
W = Maximum weight of car and load in pounds
w = Assumed width of brake in inches
1.5 = Allowance for clearance between the ends of the brake-lining

Applying the formula to the Ford car and assuming the total weight to be 2500 lb. with passengers and a 1½-in. width of brake band, it will give a drum diameter of 12.4 in. or, say 12½ in. This would be about correct for this size of car. Applying this formula to a large, closed car having a weight with passengers of say 6000 lb. and a 2½-in. width of brake band, it would give a 17½-in. diameter of brake drum.

A brake exercises its maximum efficiency when it is just short of locking the wheels. This has been demon-

strated in railroad practice and is well known by experienced drivers.

It will be interesting to note what is considered good braking in the ordinary rear-wheel-brake application in stopping a vehicle. Table 1 has been taken from a test made on a car which, with passengers, weighed close to 4000 lb.

TABLE 1—REAR-WHEEL BRAKE STOPPAGE-ABILITY

Speed, m.p.h.	Distance Required for Stop on Actual Test, ft.—in.	Standard Given by Thermoid Rubber Co., ft.—in.
10	9— 0	9—2.4
20	34—11	37—0.0
25	53— 7	58—0.0
30	74— 5	83—3.6
40	135— 6	148—0.0
50	178— 0	231—0.0

An allowance of 17 lb. of car-weight per sq. in. of brake area can be recommended for light and medium-weight cars; 20 lb. for heavier cars, and 30 to 50 lb. for medium and heavy trucks. Although the diameter of the brake is the main consideration in determining the holding power, since it determines the braking or retarding leverage, the width of the brake is a highly important factor. On the other hand, engineers should not be misled into putting too great a width on the brake, because of the difficulty to secure a full contact between the linings and the drum when the brake is new or when the lining is replaced. The engineer who recommends the formula presented, after having determined the size of the drum (assuming that he is designing an internal contracting brake), lays out the contracting mechanism so that the operating lever hangs down and the pull on it is in the opposite direction to that of the torque reaction. After having located properly the center of the eye of the operating lever as near the center of the torque-reaction circle as possible to keep the brakes from grabbing, the linkage is then laid out to produce a 30-lb. pedal-pressure to lock the wheels.

Brake Operating Mechanisms

The linkage ratio generally is determined finally by experimenting. So far as we know, there is no formula that is reliable enough to recommend. Tentative linkage-ratios are first determined by assuming a 5-in. stroke at the pedal and juggling this with the stroke of the lever that operates the contracting mechanism on the drum, as determined by the layout. The cross-shaft location and the location of the center line of the eyes of the levers on the cross-shaft can be determined by making a half-size wood model of the main leaf of the rear spring, and this is fastened to the drawing on the board by wooden pins and shackles representing actual conditions. Fastened to the wooden single-leaf spring is a simulation of the rear-axle with the location of the brake operating-lever eyes. The model is then moved upward and downward a distance representing the maximum deflection of the spring. The curve of the movement of the lever eye is then easily plotted; the curve for torque reaction also can be plotted; and from these data it is easy to determine accurately the proper location of the centers of the eyes to the levers on the cross-shaft. This layout can be checked experimentally by bolting a metal shield to the frame of the car between it and the brake-drum, to which drawing paper is glued. Pencils, held against the paper by spring plungers, are located in the same planes as the operating-lever eyes and, when the car is driven, trace the actual movement of the lever eyes for torque reaction and spring deflection. These curves are then checked against the curves determined on the drawing-board layout and the levers and their locations are then determined finally. The engineer who uses this method states that it has never failed to produce a good braking system.

The subject of proper layout for the brake linkage is a large one in itself. This matter was covered very fully in a paper on the Correct Location of Brake Levers, by Walter C. Baker. With the Hotchkiss drive this is a very important matter, and is now receiving the consideration it deserves, although a few car builders have realized the importance of it for some time. It is a fact, however, that an alarming percentage of automobiles having the Hotchkiss type of drive gives a very unsatisfactory brake action over a rough road. I have noticed some extreme cases where the links have been far off from the desired center. In one particular instance, when driving a certain car not long ago, the pedal moved through 3 or 4 in. of travel when running over extremely rough roads, and actually applied the brakes. When attempting to apply the brakes over roads of this kind, the wheels would alternately lock and release as the obstructions in the road were encountered, causing a tremendous chatter to be set up that not only made driving very unpleasant, but was extremely hard on the tires as well as on the entire structure of the car. Mr. Baker described in his paper the use of a simple measuring device that permitted locating the proper center for the link-eyes. This center should coincide with the center of torque rotation and the center of spring flexure so that little or no pedal action can be caused, either by the flexure of the springs or by the torque reactions in the rear axle tube to which the brake support is connected.

An important point that should be taken into consideration in determining the position of the operating levers is that the pulling levers should all be arranged so that they will start in the longest position, or at approximately 90 deg. in relation to the rod, and end their movement at the shortest radius and with angles greater than 90 deg. The pulled levers are arranged to start operating at their shortest radius and end their movement at the longest radius with an angle of approximately 90 deg. when the brakes are applied. There is a general belief that the best results can be obtained by the use of brake-rods having front joints that are as nearly as possible in line with the front pivot of the radius-rods or torsion-tube, where used, or with the front spring-eye of the rear spring in the Hotchkiss-drive arrangement. Good results can be obtained when the rear ends of the rods are joined to brake levers at the back of the axle, instead of at the front. In this position, the radius of their motion is longer and, consequently, the chord of the arc through which they travel in response to spring action is flatter, producing less push-and-pull effect. This position sometimes has the advantage of placing the rear ends of the rods where they are more accessible for adjustment. To emphasize this point of adjustment it must be pointed out that poor adjustments often will spoil a good brake-layout. The burden of blame, however, should be borne by the designer, because of his failure to provide adjustments that are more nearly fool-proof. The brake adjustment means should be simple and accessible so that the operator can keep the brakes properly set up. It should be possible to take up wear on a brake by hand, without the use of any tools, the adjustment being made so as to be self-locking and proof against loosening from vibration or road shocks.

Brake Equalizers

Regarding brake equalizers, there are two directly opposite schools; one believes that brakes cannot be equalized commercially, and the other uses brake equal-

izers as stock practice only on the service brake, generally, but sometimes on both. The reasons given by both sides are interesting and cast some light on the entire question of brake-linkage layout. Some of those who do not use equalizers believe in equalization, but think that it is secured inherently in the mechanism that they employ, without a special equalizer-bar. Equalization is secured by some of the companies through use of cross-shafts that are sufficiently long and flexible to spring enough to distribute the pressure. This has the advantage that in case rods, pins or any parts break or become loose on one side, it will not cause the other brake to be inoperative. An interesting reason that has been cited against the use of equalizers is that if they are not used and if oil collects on any one of the brakes and then the brakes are applied, greater braking is received from this wheel than if an equalizer were used. There is doubtless a great amount of difficulty in getting equalizers to work so that they will be absolutely certain. For this reason they have not been used by many firms. One builder states that it is possible to obtain a set of equalizers that work perfectly before the car is painted and never work afterwards, or be very satisfactory after the car is painted but go out of commission after the first piece of dirt gets into the brake-shaft bearing.

The question comes back to whether the equalizer can be made a commercial proposition. There is no doubt that a perfectly equalized brake is better than one that is not equalized, the matter being more of a commercial one as to whether brakes can be equalized so that they will remain so under service conditions. Of course, without equalizers it is absolutely essential that a very careful adjustment be made in the brakes so as to have both take hold with equal strength. When cars are not equipped with equalizers, there is a tendency for a brake to take hold at one wheel only if the adjustment is not proper. The result is that this wheel is often swung toward the center line of the axis of the car. In other words, if the brake that holds be the rear right brake, the rear end of the car would have a tendency to swing to the left, an action that is dangerous at high speed or over slippery roads.

The Pro and Con of Equalizers

Some of the constructions of the equalizing bars are very ingenious. They must be made rattle-proof but at the same time capable of taking all the stresses of brake application without noise. One company in the low-priced field uses two equalizing bars as well as four pull-back springs hooked to the rear axle. The result has been a low-priced installation, particularly in view of the fact that it has been necessary to run the brake leverage inside the frame with this design. It has been found economical by some to put the equalizer on the rear axle. This eliminates the necessity of having to employ a more extensive construction near the center of the car. One of the best compensating devices is a special differential gear that has been used for years on the Rolls-Royce and has been seen on one of the higher-priced American cars brought out within the last two or three years.

When all phases of the matter are considered, it is found possible to get good results with either equalized or unequalized brakes. The question is really one of commercial practice rather than actual mechanical preference. An objection to unequalized brakes is that if the connections to the brake on one side are a little stiffer than the connections to that on the other side, the brake on the freer side will release before that on the tight side, tending to cause skidding. This condition is in rare cases so exaggerated that the freer side will release enough to allow the pedal to come back to the stop without releasing the tight brake. This naturally will cause the dragging of one brake, with an increased fuel consumption and unnecessary wear on the bands.

Some recent installations of cable equalizers are interesting. Care should be taken against stretch and excessive back-lash. The entire question of equalization must be solved by individual preference, for there is much to be said on both sides and it is feasible to get good results either with or without equalizers. It is possible to prevent rattle in any case throughout the entire linkage by the careful installation of take-up springs which keep the linkage under tension at all times.

Brake Linings

There are some qualities of brake lining that should be taken into consideration. Good results cannot be expected from any brake lining unless the brakes are designed so as to allow its good qualities to assert themselves. It is unfair to expect any brake lining to give good results when the brake design is such that it is impossible for the heat generated in deceleration to be dissipated. It must be remembered that the coefficient of friction of brake lining is different when the brakes are cool from what it is when they are hot. This has been demonstrated very effectively by the Bureau of Standards which, in co-operation with the Motor Transport Corps and the Society of Automotive Engineers, has made extensive tests of brake lining materials. Many of these have been published. One interesting fact was demonstrated regarding the coefficient of friction. During the long-time runs with cooled drums, the coefficient remains more nearly constant than during hot tests. The average value of the coefficients of a number of samples of brake linings was nearly 0.40. In some places it was as low as 0.30, while in a few samples only was the average over 0.50. The extreme values of the coefficients were approximately 0.28 and 0.60. The effect of leakage of oil to the brake shoes was demonstrated in these tests by saturating samples of the lining with oil and then noting the coefficient of friction. A few samples saturated with oil and with oil constantly supplied showed a coefficient between 0.10 and 0.20. After discontinuing the supply of oil, the coefficient rose in from 15 to 30 min. to values between 0.20 and 0.30 and was then maintained steadily. The question of how much brake area a car should have is one that has been given considerable attention since the tests mentioned were made. One prominent manufacturer of brake lining states that a car should have a brake with a surface equal to 1 sq. in. for every 17 lb. of car weight. This alludes to the actual surface of brake lining that should be used.

As a general matter, it can be stated that the prevailing view among brake lining manufacturers is that the average passenger car and truck is under-braked and, consequently, that too severe stresses are being placed upon the lining and exaggerated requirements exacted. Looking at the matter from the other side of the picture, one prominent engineer in the passenger-car field states that he believes there is much room for improvement in brake linings. Most of them are woven very loosely and are compressed easily, he says, "so that the brakes frequently must be taken up on account of the great pressure exerted on the brake shoes compressing the woven asbestos, rather than because of actual wear that has taken place."

The Engine As a Brake

It must be admitted frankly that the heat-dissipating qualities of our present braking systems are not sufficient to care for the extreme load of mountain driving.

To come through safely, we must use the engine as a brake. If this is acceptable and desirable, there is little more to be said; because, by using the engine as a brake, the braking system can be nursed carefully so that it will not be worn out in an unduly short period of time. If, on the other hand, the procedure is unsatisfactory and we should have a braking system independent of the engine, we are driven to other methods. It should be stated that if automobile and truck designers expect the engine to be used as a brake, the elements receiving the braking stresses, such as the universal joints and power-transmission parts in both the gearset and the rear axle, should be designed accordingly. It is necessary only to stand at the foot of the hill on the New Jersey side of the ferry from Dyckman Street, New York City, or at the foot of any of the long, steep hills around Pittsburgh, and listen to the squealing of dry and overheated clutch and transmission bearings to realize that there are many instances in which the engine and transmission system is not adapted to taking the braking stresses.

Four-Wheel and Front-Wheel Brakes

The four-wheel brake offers some very interesting possibilities for both passenger cars and trucks. The chief criticism that has been directed against it is its complications. Whether this will be sufficient to kill the idea remains to be seen. I believe that within the next five years we will find a very marked increase in the use of this system of brakes. With a braking system in which all four wheels are equipped with brake drums, the brakes being applied simultaneously by the service-brake pedal, and an emergency brake on the propeller shaft, it would seem that a very efficient layout could be obtained. We are limited in braking ability by the frictional contact between the tires and the ground. There are four points of contact and, if all four wheels were locked, a total braking drawbar-drag of a fixed quantity would be available to stop the car. This quantity is different for every condition of the ground but, inasmuch as the car weight can be stated as being approximately 60 per cent on the rear and 40 per cent on the front wheels, if we add the two front wheels to our braking equipment, we increase the braking possibilities by 66 per cent; or, to put it in another way, we reduce the amount of heat that must be dissipated through the rear drums by a like amount, in bringing the car to a stop. This reduction can be made in either the time or the temperature factor, provided we are bringing the car to a stop within a definite distance or in the shortest possible time.

There is no doubt about the increased efficiency of braking with four-wheel brakes. The tendency to skid is recognized to be less, and the question simmers down to whether the additional complication necessary is compensated by the increased braking ability. It is a fact that the use of front-wheel brakes would tend to reduce the number of accidents due to skidding. They would be well justified even at a slight increase in the cost of manufacture and in spite of the added complication. With the present heavy traffic in all cities it is not unusual for 100 or more vehicles to suffer skidding accidents during the morning or evening rush hours. In the first light snowfall of 1921 in Detroit I counted 10 cars, during a single trip downtown, that had suffered rear-wheel fracture due to skidding over the slippery paved streets into the curbs. If front-wheel brakes would tend to cure this situation, as well as to increase the safety of both pedestrians and vehicles during wet and slippery weather, they should be carefully considered by the industry, which must hold itself responsible for all accidents due to imperfection of design. In hilly cities, such as Pittsburgh, the number of skidding accidents in wet weather is tremendous, in spite of the fact that cinders are spread on nearly all of the bad curves and grades to prevent these accidents. It is useless to say that operators should not drive at 20 to 35 m.p.h. down these wet and icy hills and then try to stop suddenly. If they do drive that way and are within the law, it is incumbent upon the industry to provide brakes that will meet the conditions if it is possible to do so.

It is possible to operate four-wheel brakes mechanically, hydraulically, pneumatically or electrically. All these methods have been tried with varying degrees of success. The hydraulic system probably shows the greatest promise at present because of its simplicity and also from the standpoint of perfect equalization. It has received one marked criticism in that failure of one of the pipes throws the entire system out of order. However, with a suitable large transmission brake as emergency equipment, this objection is largely overcome.

A criticism of some weight that has been offered on front-wheel brakes is the tendency to go into a front-wheel skid; but this fault can be overcome. The front-wheel skid is caused by attempting to steer the car when the brakes are applied. It is apt to occur, for instance, in going into a curve at high speed and attempting to check the speed suddenly. The dragging action of the front wheels on the ground, enhanced by the angle at which the wheels are turning in steering, will throw the car into a front-wheel skid if the ground is at all slippery, or covered with a loose and non-adhering top-dressing. A remedy for this is to make the rear-wheel brakes slightly more powerful than the front-wheel brakes.

Truck Brakes

On truck brakes, the following statements have been made by an engineer specializing in this work and seem to represent what is considered good practice.

(1) Truck brakes should be designed in terms of truck weight in pounds per square inch of lining. This has, of course, a distinct bearing upon the durability of linings. It is a very much neglected factor in some designs. A weight of from 30 to 50 lb. per sq. in. of lining for a hand-brake on the rear wheels gives satisfactory results. For a foot-brake applied to the transmission, a greater value can be used, namely, 100 to 150 lb. per sq. in. In both cases a smaller value is much to be preferred; in fact, the lower this can be kept the better

(2) The average brake lining will give the best results provided the pressure does not exceed 100 lb. per sq. in.; as in item (1), the lower the pressure is, the better the results become

(3) Calculations should be made for leverage on a value of about 26 to 1 for the transmission brake; 50 to 1 for the hand-brake on the rear wheels; and 20 to 1 for the foot-brake on the rear or the front wheels; these values have been found through experience to be very satisfactory

(4) The average man can exert a pressure of approximately 200 lb. on a pedal and about a 100-lb. pull on a lever. It should be remembered that 75-per cent efficiency for linkage is a high figure in view of the fact that the joints invariably lack lubricant and therefore stick

(5) Other important values are 0.25 for the coefficient of friction of fabric and 0.50 for the coefficient of friction of the tire on the road

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A NEW course in aviation has been added to the curriculum of the Research University in Washington. Special attention is paid to airplane engines and the course has appealed to many automobile mechanics who have become interested in this type of engines. Both resident and correspondence courses are offered.

France Tests Trucks and Tractors for Military Service

Three types entered in trials to determine on what makes subsidies shall be granted. Classes included agricultural tractors for hauling 155 mm. guns; 7½ ton trucks for carrying light tanks and four-wheel drive artillery tractors for pulling 15 and 20 ton loads. Three makes fail.

By W. F. Bradley

FRANCE having decided to motorize her entire artillery service, has just completed a series of trials to ascertain what makes of trucks and tractors shall be granted State subsidies. As in the past, it is desired to develop types of vehicles which, while suitable for agricultural or business purposes, can also be used to advantage by the army in case of war, thus making it unnecessary for the Government to maintain big fleets which will be little used and will be costly to keep up. In order to attain this end the Government offers purchase and maintenance subsidies to the owners of trucks and tractors meeting with its requirements.

The trials just brought to a close were for three distinct types: agricultural tractors to be used for hauling 155 mm. guns across country; 7½-ton trucks for carrying light tanks, and four-wheel drive artillery tractors pulling 15 and 20-ton loads and capable of operating over good roads and across country to a certain extent.

Only Four-Wheel Drive Admitted

Because the army would admit only four-wheel drive and creeper band agricultural tractors, the competitors in this class were reduced to Renault, Peugeot, Pavesi and Blum-Latil, each with two machines. The Renaults and the Peugeots are creeper band purely agricultural type tractors, with four-cylinder engines; the Pavesi is a four-wheel-driver, with a twin-cylinder horizontal engine and metal wheels, and is also a purely agricultural type. The Blum-Latil differs from the others by being a road tractor with semi-elliptic springs and rubber-shod driving wheels.

In order to test the suitability of these tractors for artillery service, each one was kept at work for fifteen days on prepared tracks on the artillery camp, near Versailles, where they had to haul a 155 mm. gun, on a four-wheel gun carriage, weighing about 4 tons. The conditions were such as would be met with in actual warfare, for the tracks comprised thick mud, short, steep gradients, shallow trenches and a certain amount of haulage over hard roads. Over an average cross-country stretch the tractors had to show a speed of 3.1 miles an hour, while the stunt performances comprised longitudinal stability on a 40 per cent gradient and lateral stability on a 70 per cent gradient.

The Renault, Peugeot and Pavesi machines gave equal performances. Greatest interest lay in the Blum-Latil machine which, although not an agricultural tractor, met the technical requirements, and, consequently, was eligible to start in the competition. This machine proved itself equal to the others for general haulage across country and over mud roads, but owing to its higher center of gravity was unable to meet the requirements regarding lateral stability. When working on soft roads, or away from made roads, chains were used on all four wheels, but under similar conditions the Pavesi agricultural tractor was obliged to fit four or five strakes to each of its wheels. Under very heavy going the speed of the machines was practically equal, but on normal cross-country work the wheel type tractors were faster than the creeper band machines, and as soon as hard roads were reached the Blum-Latil had an immense advantage.

Having fulfilled the road tests the four makes of tractors are being stripped for a close technical examination, which will determine whether they are to be accepted as artillery types and be given the advantage of a State subsidy.

Berliet, Renault and Dewald entered in the 7½-ton truck competition, each maker having two vehicles. This type of truck is required by the French army for the rapid transportation of light Renault tanks, which weigh, together with their crew and all equipment, from 7 to 7½ tons. Although a truck of this capacity is not extensively employed in France, there is nothing in the military regulations which would mitigate against its general use. Designers are given a very free hand, the only important restrictions being in the body space, which must be equal to 148 by 78 in., in order to receive a tank.

How Various Makes Performed

The two Berliets had to be withdrawn during the first days of the trials owing to a defect showing up in the frame members. The two Renaults and the two Dewalds went through the trials in a satisfactory manner and doubtless will get the Government subsidy. The trucks had to carry the full load of 7½ tons, in the form of a Renault tank and munitions, for fifteen consecutive days, and to average 6.2 miles an hour on each day's run. Only hard roads had to be covered, but the routes were selected so as to throw in as many hills as possible. These two types are of entirely different design. The Dewald has a four-cylinder 4.3 x 5.9-in. engine, under a hood, four-speed gearset and final drive by side chains, its total weight being only 9940 lb., with body, water, gasoline and tools. The Renault has a four-cylinder 4.8 x 6.3-in. motor, radiator behind the engine, four-speed gearbox, live axle and final reduction by planetary gears in the rear wheel hubs. Its weight in running order, without load, is 12,880 lb.



1—Peugeot creeper band tractor hauling gun across country in French military trials. 2—Pavesi four-wheel drive agricultural tractor hauling 155 mm. gun. 3—Renault and Peugeot creeper band tractors hauling 155 mm. guns. 4—Latil four-wheel drive 20-ton artillery tractor

Renault and Blum-Latil were the only competitors in the 20-ton four-wheel drive tractor class. These machines failed to give the results that were expected of them. A cylinder block had to be changed; a connecting rod bearing burned out; the brakes failed to hold on one of the hill tests and the tractor narrowly escaped turning over; there was gearbox trouble; some of the test hills were not climbed and the average speed of 6.2 miles an hour was not observed on several occasions. The poor results in this class is all the more surprising in view of the fact that these tractors were used to a considerable extent by the French Army during the war and are a well-established type. The tractors never had to leave hard roads, but gradients were found, with rough granite-paved surfaces that they were incapable of climbing with their full load.

All the vehicles were called upon to operate with both gasoline and with a 50-50 benzol-alcohol mixture. Only modifications were made in the carbureter for this latter fuel. There was a falling off in power with the benzol-alcohol mixture and general complaints on the part of the competitors that the alcohol was of poor quality and left solid deposits in the carbureter and the gas passages.

THE Allgemeine Electricitats Gesellschaft manufactures a little device suitable for electrically burning names, marks, etc., on tools and other metal parts, using electric current at very low tension. A small transformer produces a current at 1.5 volts. One terminal is connected to the part to be marked, and the other to a pencil with copper point. Upon writing the name, etc., upon the tool with the pencil the mark is melted out by the electric current. The tool requires no special treatment either before or after marking and the cost of operation of the device is low.

New Automatic Type of Heald Piston Ring Grinder

The rings are fed automatically from a magazine above the magnetic chuck. Rings up to 5 in. diameter can be handled. Is also designed for grinding other parts such as thrust washers, collars, gear hubs, etc. Use of heat-treated alloy steel and roller bearings shows influence of automobile practice.

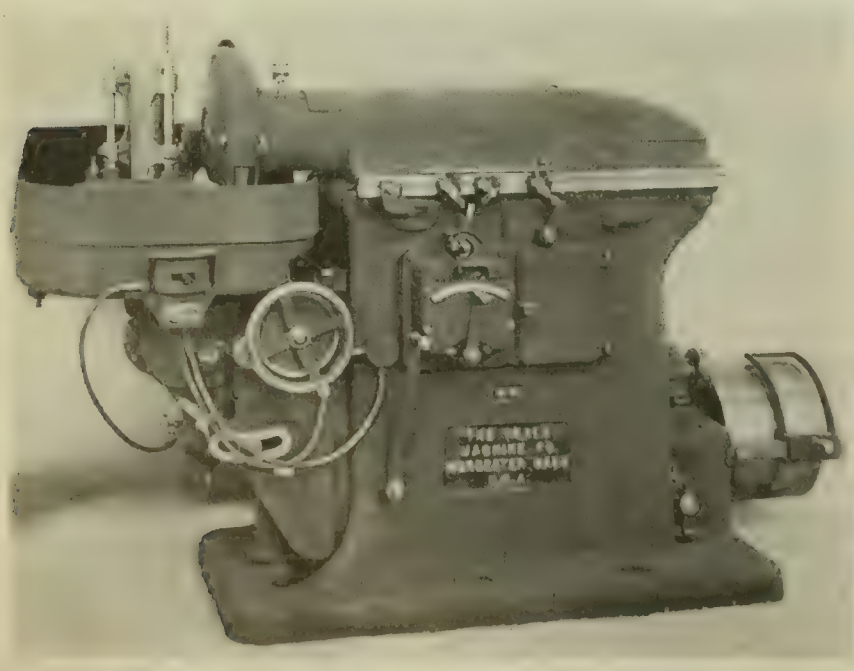
INCREASED production, together with reduction in cost, is the order of the hour, and machine tool manufacturers are certainly accomplishing remarkable things in the way of devising tools rendering this possible. Heretofore piston ring grinders have been hand-fed machines, the operator putting one ring in, passing the wheel over it and then removing it. The output was not so bad if a ring was finished for every double stroke of the wheel slide, but often the operator's attention is diverted or he relaxes a little and the wheel slide then makes a stroke without any ring in the grinder.

In the new Heald ring grinder, known as Style No. 25, the rings are fed automatically and there is no possibility of a stroke being missed. The rings are stacked in a magazine above the magnetic chuck. Between this magazine and the chuck there is a revolving feeding plate with five holes which are bushed to fit the rings to be ground. Rings up to 5-in. diameter can be handled in this feeding plate. As the plate indexes, a ring is slid from the magazine to the center of the chuck, is ground and then slid off the chuck. The feeding plate is indexed by a lever having a link connection to the crank disk at the back of the machine, operated by a friction device. This crank disk is held stationary by a latch while the wheel slide is moving forward and the ring is being ground; when the wheel slide is on its return motion and passes off the ring, the latch is tripped, and this allows the crank to make one revolution, whereby the feeding plate is indexed from one hole to the next. This indexing motion removes the ring which has just been ground from the chuck and moves another into its place. There is a guard over the ring which obviates all danger of flying pieces in case a ring should break.

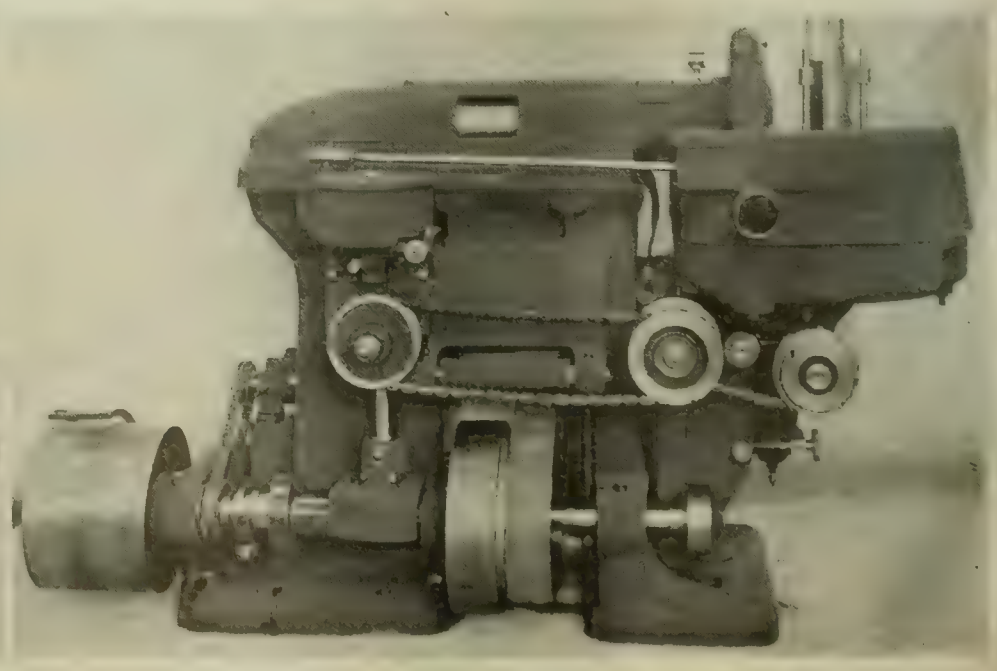
The automatic feed is, however, not the only improvement which has been made to the grinder. The wheel slide is now driven by a hydraulic mechanism using oil as a working fluid. This enables the operator to quickly get any desired speed from nothing to the maximum and also to reverse the feed instantly at any point of the stroke. This reversal is accomplished by means of a tripping lever in front of the machine and two adjustable stops.

The diamond for truing the wheel is located on the chuck pan and can be readily adjusted to give the desired thickness of ring. To bring the wheel over the diamond for truing, the left-hand reversing dog is thrown up, allowing the slide to pass until the reversing lever engages a safety dog. This dog is of the latch type and reverses the slide at both ends of its stroke, allowing it to move back and forth the proper distance for truing the wheel. Movement of the dogs at the front of the machine not only controls the travel of the wheel slide, but also the action of the feeding device.

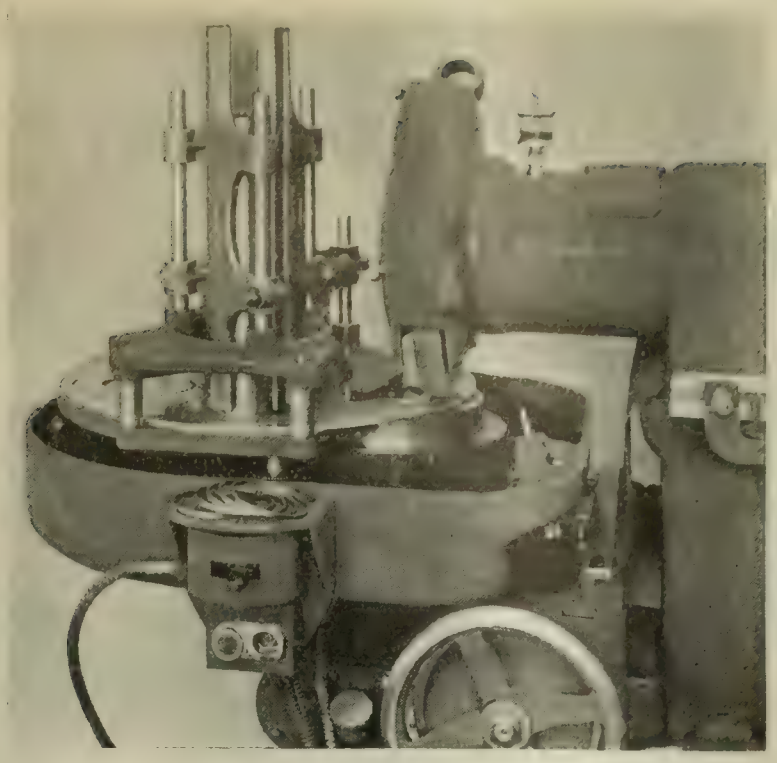
As in the older piston ring grinder, the rings are held on the chuck by magnetic attraction, and in order to be able to readily slide the ground ring off the chuck it is necessary to break the circuit of the chuck coils before the feeding plate begins to move. Not only this, but in order that work having any pronounced magnetic retentivity may be handled with ease the current through the coils must be reversed for an instant and the chuck



Heald Style No. 25 Automatic piston ring grinder



Rear view of Heald piston ring grinder



View showing magazine, feeder plate and truing diamond

and work thus demagnetized. For this purpose there is a disk at the rear of the machine on which there is an electrical contact through which current passes to the coils of the magnetic chuck while the ring is being ground. As the disk revolves, the current is automatically shut off for an instant and reversed, thereby demagnetizing the chuck before the ring begins to move. By the time the next ring has been slid into place the current is automatically switched on again. With parts of hardened steel this demagnetizing feature is essential, and it is also quite valuable with parts of other ferrous material.

It is interesting to note to what extent automobile practices are made use of in the design of this new machine tool. The more heavily stressed parts, such as the wheel spindle, are made of alloy steel, heat-treated, and ball and roller bearings are used wherever possible. The wheel slide has wide, flat and Vee ways, which insure great rigidity. The wheel spindle is made of chrome vanadium steel and is mounted in a straight, plain, adjustable bearing at the wheel end. This bearing can be adjusted through an opening in the top of the wheel slide specially provided for the purpose. The rear end of the wheel spindle is mounted on a ball bearing. Lubrication of the spindle bearings is taken care of by a large oil cup. The main drive shaft on the rear of the machine is mounted on roller bearings and carries a two-step cone pulley, permitting of giving two speeds to the wheel. The main object of this double wheel speed is to permit the operator to maintain the peripheral speed of the wheel fairly constant as the wheel wears. The vertical chuck spindle is mounted on ball bearings and is driven through helical gears. This gearing is fully inclosed and therefore can be run in an oil bath.

This machine is furnished with either 8-in., 12-in. or 16-in. magnetic chucks, and it can also be used for grinding other parts besides piston rings, such as thrust washers, collars, gear hubs, etc.

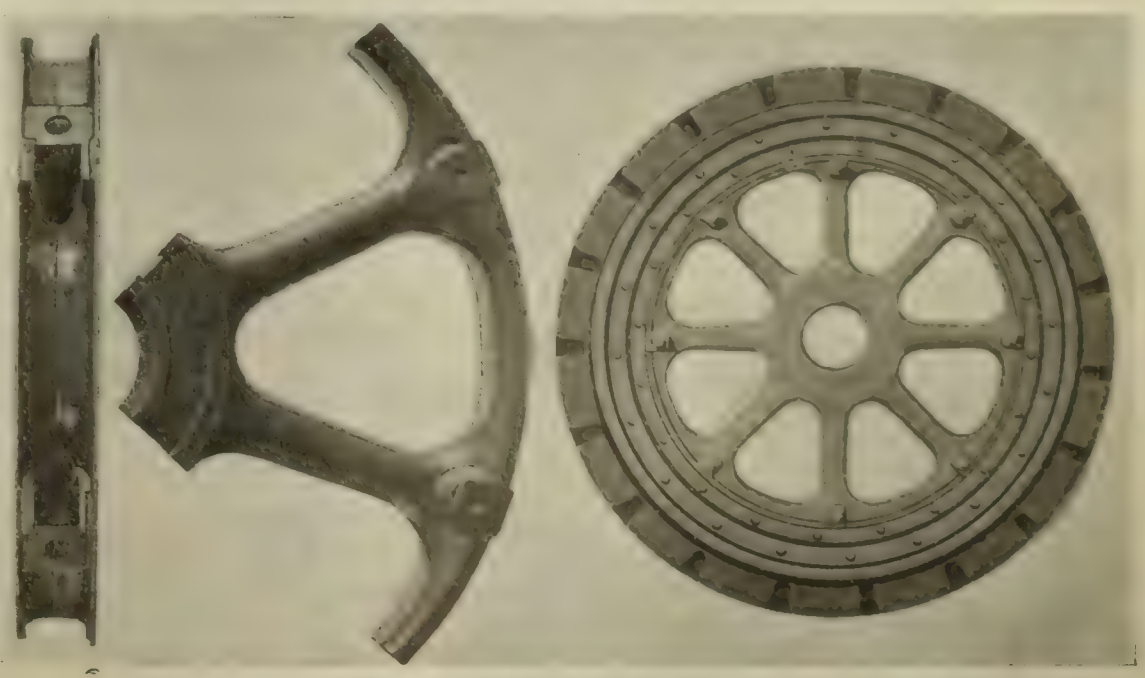
Segmental Section Hollow Spoke Metal Wheel

REDUCED weight is one of the greatest needs in truck wheels, and manufacturers of such wheels are making every effort to lighten their product. In the production of cast wheels difficulties are encountered, however, mainly on account of the tendency of the spokes to crack in cooling when cast very thin. To eliminate this trouble and that arising from the danger of inaccurate setting of cores in the casting of hollow-spoked metal wheels, the Van Wheel Corp. has brought out a design of cast metal wheel which is cast in sections. These sections are later united by means of tongued and grooved joints and electric welding. When completed, the wheel is of the same general appearance as a hollow-spoked one-piece cast wheel.

A wall thickness of ⅛ in. is used in the smaller sizes of segmental section hollow spoked wheels, as compared with 3/16 in. in most one-piece cast wheels. It is claimed that the percentage of rejected castings is far less in the case of the segmental wheel, the figures given being 15 per cent for the one-piece wheel and 5 per cent for the segmental wheel. With the segmental section wheel the castings are of the shape of irregular triangles, and shrinkage strains are said to be eliminated. It is possible to get a better support for the cores; hence, the wall thickness will be more nearly uniform and the walls can be made thinner. Savings of three kinds are claimed to result from the sectional plan of manufacture — namely, reduction in the amount of metal used, elimination of the labor necessary to remove excess metal, and a reduction in the percentage of scrapped castings.

In the manufacture of the segmental wheel, after inspection of the castings, each section is machined, and tongued and grooved at the ends; the sections are then put together and welded electrically along the joints. The complete wheel is held together not only by the electrically welded joints, but also by the hub and the rim, the same as the parts of a wood wheel.

Undoubtedly this wheel is somewhat more expensive to manufacture than a hollow spoked steel wheel made in a single casting, as the machining and welding of the joints represents extra work.



The Van wheel, showing one of the segmental sections

Economics of Highway Research Demand Attention

Advisory Board of Highway Research will lay emphasis on economic side of their work during the coming year. Other highway problems will get attention. The program outlined here is of vital importance to the entire automotive industry. Reports show considerable progress in past year.

CONSIDERABLE progress has been achieved in the co-ordination of highway research and in the encouragement of constructive research activities during the first year's work of the Advisory Board on Highway Research of the National Research Council. The first annual meeting of the Advisory Board, held in New York City Jan. 16, brought together the various agencies co-operating in this work for the purpose of outlining the results of the first year and of considering definitely a future program.

The report of Prof. W. K. Hatt, Director of the Advisory Board, showed how the Advisory Board has developed, the various organizations which are behind it, and told of the activities of the director during the past year in laying out a comprehensive plan for highway research and in attempting to co-ordinate the various research activities along this line which are being carried on in various parts of the country.

The director touched briefly on the work of the research committees and the chairmen of these committees presented full reports.

The outstanding feature of the meeting was the determination to lay particular emphasis on the economic phases of highway research during the coming year. The entire program outlined by Director Hatt is familiar to the automotive industry, having been published fully in AUTOMOTIVE INDUSTRIES several months ago. The decision to concentrate considerable attention upon the economic phases of the problem came as a result of the Director's investigations during the past year and of the general sentiment of those attending the meeting.

An excellent survey of the field of activity which is being covered by the Advisory Board is contained in the following brief outline on "Suggested Researches and Research Committees," which was submitted to the meeting and unanimously approved:

1. Committee on Economic Theory.
   Problems: To determine all of the elements of cost of highway improvement.
   The following will suggest the type of research involved:
   - A. Effect of grades, alignment, rise and fall, weather and speed and methods of operation on cost of transport.
   - B. Determination of all of the elements entering into the resistance to translation of vehicles (Tractive Resistance) and magnitude of each element.
   - C. Determination of the elements of cost of vehicle transportation classed as capital costs, and operating costs exclusive of those included in A and B.
   - D. To determine the relation between traffic and capital and maintenance costs of roads.
2. Committee on Structural Design of Roads.
   Problem: To establish all of the data required for the rational design of a road surface.
   The following will suggest the type of research involved:
   - A. Determination of all facts relative to the behavior of the soil upon which roads are constructed, when under load from the road structure.
   - B. To determine the relation between traffic loads and stress in road surfaces, and to establish the laws that control.
   - C. To determine the effects of the elements on road structures.
   - D. To determine the structural strength of all types of road surfaces.
   - E. Relation of the vehicle to the road.
3. Committee on Road Materials.
   Problem: To determine the most effective combinations of materials to give desired strength and to investigate possible new combinations of materials.
   The following will suggest the type of research involved.
   - A. To establish the most effective combinations of materials now in use, with particular reference to the exigencies of field control.
   - B. To promote research looking to the establishment of new combinations of materials, or of the new materials suitable for road surfacing.

New Committees

4. Committee on *Highway Traffic Analysis.*
   Problem: To establish an adequate method of studying highway traffic and to show how traffic records should be interpreted.
   The following will suggest the type of research involved:
   - A. A study of relation of community development to the origin and destination of traffic, and to devise means for estimating potential traffic.
   - B. Proper methods for studying and recording volume of traffic, and for interpreting traffic records.
   - C. To devise units of measure to apply to traffic and to define those units.
   - D. To study the relation of highway betterment to traffic increases.
5. Committee on *Highway Bridges.*
   Problem: To establish all of the data required for the design of highway bridges.
   The following will indicate the type of research required:
   - A. Determination of loads for which bridges should be designed.
   - B. Study impact on highway bridges.
   - C. Determination of the proper requirements for standards of design as regards allowable stresses, widths and requirements of foundations.
6. Committee on *Highway Finance.*

Problem: To determine the equitable basis for financing highway improvements.

The following will indicate the type of research involved:

A. Definition of an equitable basis for highway financing.

B. Study possible methods of financing improvements in the various political units.

C. Administrative methods required to insure equitable financing.

7. Committee on *Maintenance.*

Problem: To determine the relation between traffic and maintenance, costs of roads, to investigate methods of maintenance and organization of maintenance forces.

The following will suggest the type of research involved:

A. Establishment of accounting methods that will give accurate data on cost of maintenance.

B. Methods of correlating maintenance costs and volume of traffic.

C. Relation of maintenance costs to methods of maintenance.

8. Committee on *Subgrade.*

Problem: To determine the supporting power of soils under all conditions; to investigate methods of increasing the stability of subgrades and to consider any similar problems having to do with the characteristics of subgrades.

The reports of the three committees, which have been functioning during the past year, served to corroborate the soundness of this decision. The three committees to report were as follows:

1. Economic Theory of Highway Improvement, T. R. Agg, Chairman.
2. Character and Use of Road Materials, H. S. Mattimore, Chairman.
3. Structural Design of Roads, A. T. Goldbeck, Chairman.

The committee on Economic Theory was the only one to report very definite progress. A. T. Goldbeck, reporting for the committee on the Structural Design of Roads, stated that "The Committee on the Structural Design of Roads has not been formed up to the present time. . . . Therefore, no report can be presented." He went on to say, however, that the preliminary work which such a committee will finally consider has not been neglected and that the work on structural design of roads is being pushed vigorously through a number of different sources.

Goldbeck cleared up any confusion as regards the function of the board and its various committees, however, by making this statement, which was generally indorsed after some discussion:

"My conception of the work of the various committees is that they shall not perform researches, nor even direct them, but through discussion the various lines of activity will be molded voluntarily in a way such as to lead most directly to the desired end without too much duplication of effort."

H. S. Mattimore, in his report for the Committee on Character and Use of Road Materials, brought out the difficulty of getting satisfactory work from committee members who are able to devote only a limited amount of time to the task and who are busy men in other lines of endeavor. He pointed out the necessity for active co-operation from committee members if results are to be accomplished.

As regards the work of his own committee he stated:

"Although very little has been accomplished through the membership functioning as a committee, there is a considerable amount of work being carried on throughout various organizations interested in highway work along the line proposed by the chairman in the preliminary program submitted Aug. 5, 1920. Some contact is maintained with this research work through correspondence, and occasional advice is given to the individual investigator where this is sought."

T. R. Agg, reporting for the Committee on Economic Theory, reported considerable progress during the year. He discussed briefly the experimental work on economical grades which he has been carrying out at Ames, Iowa, and outlined some interesting results which have already been obtained.

Work on the effect of relative air speeds is being carried on by Professor Conrad of Kansas and preliminary results have already been obtained. The S.A.E., through its Research Department, has offered to lay out the items of cost to be included in a survey of elements of cost of highway transportation, so far as the vehicle itself is concerned. Agg's report also touched upon the matter of personnel.

Embodying as it does some very practical steps in advance in highway research, a brief summary of the activities now under way, as reported by Agg, is worth more detailed examination. Following is a brief outline of the report:

"It will be of interest to record the highway investigations of note now under way in the United States. These have not all been sponsored by the Research Council, but are directly or indirectly the result of the persistent effort on the part of the Advisory Board on Highway Research to focus attention upon the vital need of a knowledge of the basic principle of highway engineering.

1. Economical Highway Grades, at the Iowa Engineering Experiment Station—90 per cent completed.
2. Tractive resistance of certain types of vehicles and certain types of surfaces, at Iowa Engineering Experiment Station—under way.
3. Tractive resistance of certain types of vehicles on concrete road surfaces, including a study of methods of observation and of internal power losses in vehicles and tires, at Massachusetts Institute of Technology in co-operation with the Bureau of Public Roads, and at Yale University.
4. Tractive resistance and economical grades at University of Michigan.
5. Effect of relative air speed, at Kansas Agricultural College.
6. The establishing of the relation between traffic and maintenance costs; recently inaugurated by the Bureau of Public Roads.

New researches for which arrangements are complete or are pending:

1. Relation between the roughness and the rigidity of a road surface and rolling resistance, at Iowa Engineering Experiment Station, in co-operation with the Bureau of Public Roads.
2. Elements of cost of highway transport, by Society of Automotive Engineers (pending).
3. Operating costs of motor transport, project pending for studies in connection with motor transport activities in and near Los Angeles.

Statements were made by representatives of each of the member societies of the Advisory Board, each representative appraising the work of the Board from the standpoint of his organization. J. J. Brosseau represented the N. A. C. C., while H. M. Crane and David Beecroft represented the S.A.E. T. H. McDonald, chief of the Bureau of Roads, praised the activities of the board and offered to continue his hearty co-operation.

Officers for the coming year were elected as follows: Chairman, Dean Anson Marsden; vice-chairman, A. L. Flinn; board of directors, H. M. Crane, C. E. Adams, T. H. McDonald.



Transmission Gear Losses and Tooth Wear

Editor, AUTOMOTIVE INDUSTRIES:

I have read with considerable interest E. R. Ross's paper on the investigation of tooth wear, as reprinted in the Nov. 3 number of your paper.

Mr. Ross's investigations show that the subject of automobile transmissions is at last beginning to receive the attention it deserves. It is to be hoped that additional data regarding the effect of gear material and its heat treatment upon the tooth wear will be published shortly, but in this connection it would be desirable that the investigations be carried on also with different lubricants so as to determine their effect upon tooth wear.

In the investigations which I have been carrying on for the last two years in the laboratory of the Joseph Dixon Crucible Co. on the subject of transmission lubricants, the questions of gear wear and transmission efficiencies have received considerable attention, although the latter has been studied at considerably greater length than the former.

The investigation showed quite clearly that lubrication of automobile transmission can be materially improved by the selection of proper lubricants. My investigations have shown that lubricated with the transmission oils generally used, transmissions are very efficient at summer driving temperatures only. This favorable condition, however, was not shown in tests duplicating winter driving conditions. The transmission efficiencies dropped materially, indicating a considerable churning resistance of the lubricant at low temperatures, which is readily borne out by gear shifting difficulties in the winter. The employment of a semi-fluid grease of low congealing and high melting point made it possible to maintain the efficiencies practically constant regardless of the outside temperature.

The efficiencies obtained by Mr. Ross in his tests seem to be extraordinarily high, and in my opinion may be accounted for by the fact that the transmission was tested at an overload which was necessary to have a measurable amount of wear in a test of reasonable duration.

In the course of another test conducted by the writer, similarly high efficiencies were observed originally, but a check of the dynamometer equipment disclosed certain slight errors in the scale equipment and improperly balanced field frames of the dynamometers which accounted for this. A correction of the above errors resulted in obtaining the correct and lower figures for power losses and efficiencies.

Mr. Ross's observations regarding the rise of oil temperature being proportional to the amount of wear are very interesting, but do not seem to be borne out by the writer's experiments. These experiments disclosed that temperature rise, and consequently power loss, seem to be chiefly due to the churning of the lubricant. This was very effectively shown in tests run for a short period of time with the lubricant drained from the transmission. The power loss in these tests dropped very materially, indicating that the power loss due to tooth friction represents only a small proportion of the total power losses.

The results of the writer's experiments will be ready for publication in the near future, and it is hoped that other investigators will come forward with their own experience covering the subject of transmission efficiencies and gear wear.

G. A. UNGAR.

Cheaper Bodies Coming

Editor, AUTOMOTIVE INDUSTRIES:

It has been something of a task to get one's mind from the best coach and chassis work down to a low priced car or body. It is my understanding, from reading the article on "Growing Demand for Low Priced Closed Car," that the reduction in price, and therefore quality, would be taken wholly from the body.

There are two principal units that go to make up a complete automobile, the chassis and the body. The chassis is not of much use without a body of some description, if it only be a soap box construction. So we can say, from a practical viewpoint, that the body and chassis are of equal importance. I realize this is a statement that would not go unchallenged a short time ago, but to-day the body is coming into its own and along with it the body engineer. The Society of Automotive Engineers held its first meeting devoted entirely to body engineering only last year. From now on I believe we will see some remarkable strides in body construction and design.

Does the so-called motor public demand a low priced car? I believe they do, but not a $1,000 chassis with a 50 cent body, or a $2,000 chassis with a $1 body; not just at present. The motor public believe they know all about bodies. You can talk to anyone about transmissions, engines, clutches, frames, rear axles or any part that goes to make up a complete chassis; tell them anything in fact and at least get away with part of it. Try it with the body. The whole motor public, from the office boy to the president, knows all about how the body should be designed, constructed, painted and named.

Would the enclosed body buyer of to-day be satisfied with an all metal, black enameled body, say on a Packard chassis? A body with straight, severe lines, no turn-under or side sweep to give it a pleasing appearance, a flat roof, no mouldings, cushions of the old style spring construction covered with cane-work, no trimming above the belt or in the place of cane-work a cheap, cotton fabric trimming material, trimming tacked on frames and stuck in place, such a body would have little appeal to the car buyer. He would be outraged at all the squeaks and rattles that go with such a construction, the common window glass with all its ocean wave effect in place of the selected mirror quality that is demanded by the public to-day, the tin-like sound when the doors are closed and the hearse-like color.

In my opinion, it is more or less a matter of keeping up with the Joneses, not only with the public, but with the manufacturers themselves.

No, I think the public must have a radical change of heart before we reduce body prices materially, for they demand the expensive at present with all the accessories

thrown in. I believe, however, that in time we will have a good, low priced closed body, although we must stop considering the body as a plaything and simply an appendix to the chassis. It must be given just as much consideration as the chassis.

I believe the inexpensive body in the future will probably be developed in two ways. First, by a body made entirely of stampings riveted together, in place of the expensive welding operations now employed, and enameled. The other, and probably more logical solution, would be the discarding of metal panels entirely and the expensive die cost connected with such work, and building the body of some material other than metal. This has been tried out to some extent, but has not proved a success as yet. However, that does not mean that it is a failure.

The more one thinks of the idea of an inexpensive body on a good, substantial chassis and the corresponding reduction in purchase price has certainly an appealing side, and it can and will be done before long even to the elimination of painting operations.

A. L. KNAPP, Assistant Body Engineer,
Packard Motor Car Company.

Steering Track-Laying Vehicles

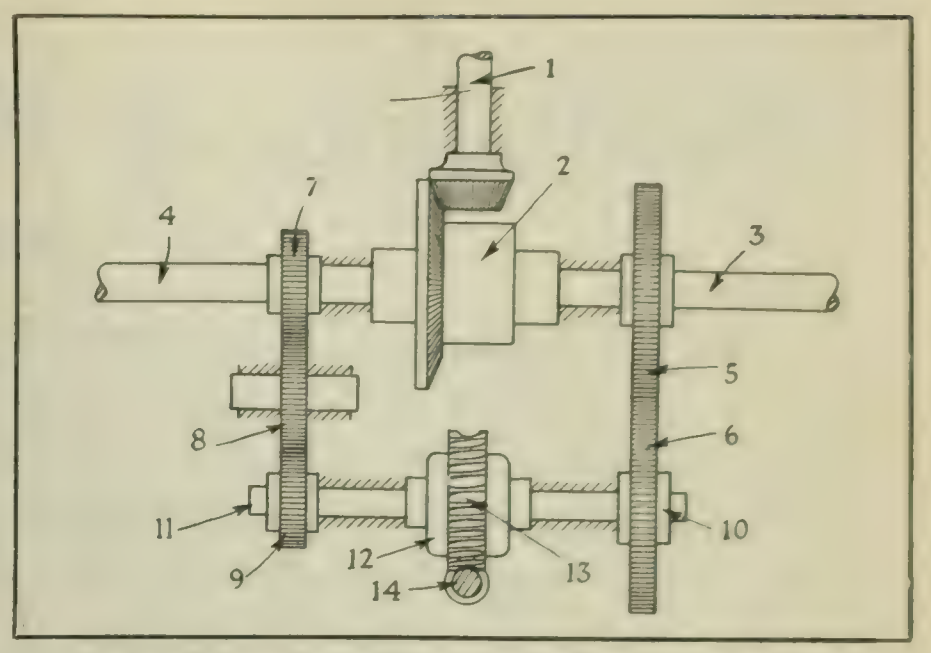
Editor, AUTOMOTIVE INDUSTRIES:

Steering mechanisms for track laying vehicles and the like are still of crude construction; their clutches and brakes involve wear and loss of power, as well as difficult steering. Therefore the construction, suggested in the design herewith, may be of interest.

The engine is connected through shaft 1 and an ordinary differential 2 with both driving shafts 3 and 4. These shafts carry the gears 5 and 7; gear 5 meshes with gear 6 and gear 7 with gear 9 through the idler 8. The gear ratio between 5 and 6 is the same as between 7 and 9.

Gears 6 and 9 are fixed on shafts 10 and 11, which are connected through an ordinary differential 12; the housing of 12 carries the worm wheel 13 meshing with worm 14. Worm wheel and worm are non-reversible. The spindle of worm 14 carries the hand-steering wheel.

As long as the vehicle travels on a straight track



Suggested type of steering device for track-laying vehicles

there is no difference in speed between shafts 3 and 4; hence shafts 10 and 11 revolve with equal speed, but in opposite directions to each other. It is obvious that the housing of differential 12 therefore remains stationary, as well as the worm-wheel and worm. These being non-reversible the differential 2 is automatically locked, hence zig-zagging of the vehicle is impossible.

As soon as the hand-steering wheel is turned, however, shafts 3 and 4 receive a supplementary motion in opposite directions to each other, causing the vehicle to turn. The direction of turning depends upon the direction in which the hand-steering wheel is revolved; the vehicle keeps turning as long as the hand-steering wheel is kept turning and immediately resumes a straight track as soon as the hand-steering wheel is kept stationary, independent of the position of the latter.

It is obvious that many similar solutions are possible as long as between shafts 3 and 4 there is a stationary gear or part, such as 13, the turning of which changes the position of shafts 3 and 4 with regard to each other.

I think that the principle of this construction completely solves the problem of directional control of track-laying vehicles and the like. H. C. OLIVIER.

Making Clutch Operation Easier

J. G. KOPPEL has developed a number of new devices intended to make the operation of passenger cars easier, suiting them particularly for lady drivers. He claims that many drivers, men as well as women, let in the clutch too quickly and thereby subject their cars to unnecessary strains. To obviate this he proposes to fit the clutch with an hydraulic dashpot. This consists of a cylinder and piston connected to the clutch pedal. When the clutch is opened the piston rises in the cylinder and encounters very little resistance, because the oil can flow freely through a large automatic poppet valve. On the other hand, when the clutch is being let in the oil has to pass through an adjustable needle valve, whereby its flow is retarded, so the time of engagement can be adjusted as desired.

In order to facilitate gear shifting Mr. Koppel has devised an hydraulically operated gearshift with electromagnetic selection. The actual pressure for shifting the gears is derived from oil under pressure being admitted to cylinders in which there are pistons that are connected to the shifting bars. The valves admitting the oil to the cylinders are operated by solenoids controlled both by a selective switch and by a main switch, which is connected to the clutch pedal, closing as the pedal is depressed. A special feature of this system is that the oil in the shifting cylinders and pipes is under pressure only while the shifting takes place and that the electric current flows only during these periods.

Mr. Koppel has obtained patents and applied for others on this system and now is laying plans to build a sample car of the "Ladies Special."

THE Governing Board of the French Committee for Aeronautical Propaganda has decided to establish a prize of 1,000,000 francs which will be awarded to the manufacturer of a commercial aircraft engine which has demonstrated, in meeting the conditions of a test organized to this end, qualities of longevity, dependability, easy demountability and maintenance. The engines must be ready for the tests on June 1, 1923, at the latest. The competition will be international, with the reservations of the present regulations of the Aeronautical Federation. Nevertheless, non-French manufacturers must engage themselves to arrange for the manufacture of their engine in France.

Distributors or Factory Branches?

Part II

Present deficiencies in the car distribution system may not be inherent in the system itself, but simply the result of rapid growth. The fundamental functions of the distributing agency is the prime consideration in determining whether or not distributors or factory branches are most efficient. The danger of overcentralization should be recognized.

By Harry Tipper

IT is necessary to emphasize the rapid growth of the automobile business in order to indicate properly the reason for the present condition in the distribution system. In all new and rapidly growing businesses there is a great flux and change among individual concerns, whether in the manufacturing or the distribution end. This is particularly true of all the elements involved in the distribution and sale of automotive products. Although there are to-day 66,000 dealers in the field who have some influence upon the distribution of products, only a very small number of these have been in that business more than ten years, and a majority of them much less than that length of time.

With this rapid influx of new concerns into the retail and wholesale distribution of automotive products there has not been any time or opportunity to bring this distribution system into any settled policies or settled methods of doing business. This is true of the car dealer as it is true of those handling other products in connection with the field.

The sale of an automobile does not end with the delivery of the product itself — it includes a great deal of work to be done after the product has been delivered and it requires a continuity of contact, a competence and a consideration of service very different from the line of contact required in the case of the man selling household machinery or other hardware.

The contact between the user of the automobile and the retail establishment selling the cars has not been established very long in most cases, because a majority of the concerns now doing business entered this field less than seven years ago and a large number of those less than five years ago. While a good many of these may have been connected with the automotive business in some way or another before, they were not intimately associated by long experience with the detail problems involved and they have not been able, up to the present time, to settle down into a regular policy of operating their business which would permit the manufacturer to depend upon certain efficiencies and to recognize certain difficulties to be generally considered.

While it is true that these retail establishments are all concerned with the sale of cars, they are not yet welded together in a common occupational body with common traditions and methods of operation. Under the conditions it would be impossible to expect this, and the manufacturer's calculations must be affected by that consideration.

The functional values of the wholesale establishments dealing in cars and the retail establishments similarly dealing in the sale and the maintenance of cars are not altered by the inefficiencies and difficulties involved in the present state of the distribution system. If there are certain fundamental values to be secured through the distribution of cars from factory to wholesale distributor — to retail dealer — these fundamental values are not altered because the present concerns do not exhibit a fair standard of efficiency all through the distribution system in this respect.

The manufacturer of automobiles, therefore, must consider this distribution problem from two points of view: First, the recognition of the weaknesses of the present state of affairs in connection with the distribution of cars; the rapid growth in the number and the great variation in the character of these establishments, and the impossibility of securing any fair agreement in efficiency under such conditions of growth. Second, the fundamental values to be secured out of the particular elements in the distribution system and how these values are to be obtained in working from the present condition.

The individual manufacturer cannot afford to ignore the great variation in efficiency, the lack of co-ordinated policy, the difficulties with service and the other conditions facing him in his attempt to market his product under present conditions. At the same time it is necessary for him to be wary in considering any radical changes in the system of distribution because the present inefficiencies and difficulties are not necessarily inherent in the system. They may be only due to the rapidity of its growth and the lack of long experience in the individual concerns comprising it.

Considering the question of what use is the distributor to the car manufacturer—the advantages of the distributor are these:

IN this series of merchandising studies Mr. Tipper is presenting vital information concerning the most pressing current problems of the industry. This article, together with the one which preceded it last week, discusses a question which is receiving considerable attention from many important car manufacturers. The wide experience and constant study which Mr. Tipper brings to bear on these marketing problems make this group of articles the most timely and valuable that have yet been published in this field.

1. The distributor permits a better and more orderly credit condition and a larger and more regular control of production fluctuations so that a better manufacturing condition may be maintained. Due to his ability to obligate himself for a larger number of cars and due to the fact that his credit conditions may be more easily determined, the extent and character of the obligation permits a more definite consideration of the manufacturer's position in the necessary speculation upon future operations.

2. The distributor is in a position to supervise intensively and to develop the sales and service conditions and methods of the individual retailers in the several localities in his territory.

It will be contended by the manufacturer of automobiles that the distributor does not actually perform these functions properly in most of the cases. The contention has some merit, but it arises principally out of the newness of the business and the conditions of its growth in the absorption of the product into a virgin market. If these functions can be performed more economically by a factory branch than an independent establishment, there is some ground for considering the factory branch as a proper element in the distribution scheme. If the most efficient of the distributors are able, under the best practice of to-day, to perform these functions satisfactorily, their success is a demonstration of the feasibility of the system to fulfill the economic necessities and consideration should be given accordingly. The method of using independent distributors has the advantage of being more flexible. It does not commit the manufacturer to a certain policy involving actual location, area and development in each particular city in which the central distribution point is considered.

The disadvantages of the distributor are:

1. The intervention of the distributor under the present conditions makes it a little more difficult to control the conditions of sale and the market for the product.

2. The intense application of the market which is necessary under the present conditions of marketing may not be secured through the distributor's system except in certain individual cases.

These disadvantages, however, are not inherent in the system of going through the distributor, but are concerned largely with the present conditions in the field and the great variation in the character of distributors' organizations due to the rapid growth and the economic conditions surrounding that growth. They are very practical difficulties and they must be overcome, but they do not make it necessary for the distributors to be eliminated from the system, except as the individual circumstances of the individual manufacturer operate to demand a change in his particular case.

In this consideration of the distributor no comparison has been made from a general economic standpoint between the distribution of cars through the wholesale organization and the distribution of cars directly from the factory to the retailer. The comparative advantage of either method depends somewhat upon the particular circumstances of the individual manufacturer. If the manufacturer is making a small number of cars and has a limited production in his factory, depending upon getting his market because of the intense individuality of his sales work and the character of his product, it is feasible to be in touch with a few well-selected dealers and to keep a close factory contact with those dealers. Where the production is large and the cars must be distributed through a great many local points in order to secure the market, maintain their place and deliver adequate service, the organization required to deal direct with the retailers under these circumstances may become unwieldy and require the establishment of numerous branches that are in reality nothing but wholesale establishments controlled by the factory. Where car production is large, practically all such production goes through establishments of a wholesale character. Whether they are controlled by the factory as branches of the factory or independent organizations concerned only with the sale of the cars does not alter the function.

It should be noted at once that the control of the market apparently resulting from direct contact between the manufacturer's organization and the retailer does not necessarily mean an increased efficiency in the market. Marketing is a business of ideas, initiative and judgment. Systems and methods, standardized values and appeals and similar mechanical circumstances of marketing are subordinate to the psychological values of initiative, judgment and adaptability in those conducting the marketing work. The great competition in marketing is a competition of ideas, and one of the greatest difficulties in this marketing competition is the tendency to a similarity of market ideas and methods which robs the product of its individuality and decreases the efficiency of the whole marketing effort.

This part of the efficiency of marketing has been neglected to a very large degree, not only in this business, but in many other lines. It has not received the proper attention and it has a tremendous bearing upon the methods of distribution, which will maintain and improve the market under the more difficult economic conditions confronting us. The control of the manufacturer, exercised through factory branches to the dealer, may result in centralizing the decision and judgment, so that the efficiency of the individual work is lessened and the face of improvement considerably decreased. The present difficulties with which the manufacturer is faced are naturally the result of the rapid growth, a great influx of dealers into the business, a wide variation in the standards of business operation and in the understanding of the necessities involved in the marketing.

These things cannot be wisely changed by means of any patent medicine methods which cannot be applied equally to all cases. Such methods are likely to add confusion to the present difficulties instead of clarifying the situation. Some of the main elements involved in these difficulties are contracts, quota deliveries, requirements of service, credits and the handling of used cars.

Discussions of these subjects will follow a general consideration of the car dealer and his economic place, which will form the subject of the next article.

Material Handling Machinery and Methods

A MATERIAL Handling Encyclopedia has been published by the Simmons Boardman Publishing Company that embraces under one cover available information on material handling machinery and methods. The editors have made the book interesting and valuable alike for the executive or for the operating man. Detailed descriptions of methods of operation and illustrations of practically every known device used in the handling of material are contained in the volume. Separate sections are divided off in the book, each one containing the information concerning different types of machinery, such as hoisting machinery, elevators, etc. Another feature is the definition section which serves as a dictionary of material handling terms.

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A. B. Swetland, General Manager
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U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
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DETROIT OFFICE
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WASHINGTON OFFICE
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Developing Leaders

PRESENT production conditions offer an exceptionally good opportunity for the development of capable supervisors in the production ranks. With the plant operating at only part of its capacity, the possibilities are increased for allowing a promising worker to shift from one related job to another, thus giving him a chance to visualize a larger part of the production scheme.

The lack of the feverish haste sometimes necessary during peak production times gives a better opportunity for executives to study the work of their subordinates and to give more attention to the development of those qualities of leadership which the subordinate may possess. Thus prospective foremen and sub-foremen may be developed in the shop and capable junior executives made ready in the office.

The management which takes advantage of this comparatively dull period to discover and properly develop prospective leaders will have a firm foundation upon which to rebuild its working force as production increases. The present time offers particularly good opportunities for a study of the human problems of industrial management. The fact that there is no pressure from labor is a strong reason for, rather than against, spending considerable effort at this time in a consideration of the human element.

Air Cleaner for Road Vehicle Engines

THERE seems to be a growing belief among automobile engineers that the use of air filters on motor trucks and even on passenger cars would be a good thing. The idea of filtering the air for use in internal combustion engines used on road vehicles is by no means new, for it was suggested as long ago as 1900 by a French engineer, who developed a centrifugal type of air cleaner. This man was evidently ahead of the times. At that time automobile designers had other and more pressing problems to solve and they gave scant attention to this pioneer. Automobiles of that period, as a rule, were not worn out but were discarded because of obsolescense. Hence there was no particular need for reducing their rate of wear.

Since then the air filter or air cleaner has come to be recognized as a necessity on farm tractor engines. Some of the older manufacturers for a long time relied upon the expedient of fitting the engine with a sort of conning tower through which air was taken into the carbureter from above the dust clouds. However, these conning tower type air inlet pipes do not seem to have met requirements, for they are gradually disappearing.

All air contains a certain amount of dust, though this may not always be directly visible. When a beam of bright sunlight falls into a room through a window, the dust can be plainly seen floating in the air. This dust is no doubt of an extremely fine division, but it is hard to believe that it is too fine to have an abrasive action on the cylinder walls. The relative amount of dust in the air is immeasurably greater when a lot of cars travel in procession over an ordinary dirt highway after a run of dry weather in summer. During extremely dry periods such roads are sometimes covered with a layer of dust, inches in depth, and the amount of dust stirred up by a motor vehicle under these conditions is enormous. With only a slight amount of dust on the road a fast moving car probably does not draw into the engine much of the dust stirred up by itself, as the dust cloud rises only after the vehicle has passed, but if the road is covered with dust an inch or more in depth the whole car will be enveloped in a dust cloud.

Attempts are now being made abroad to introduce air cleaners for use with stationary air compressors, so as to eliminate the wear on the cylinders and pistons resulting from the dust carried by the air. These compressors in the great majority of instances operate in localities comparatively free from dust, but with the enormous quantities of air passing through a large air compressor in the course of a year a dust content of even a grain per thousand cubic feet will give a very considerable total. There is a natural tendency for the dust to adhere to the walls of the en-

gine cylinder which is moistened by lubricating oil. Chemical analysis of the "carbon" scraped from the walls of the compression space and the piston head have shown that this consists very largely of siliceous material, in other words, road dust. The oil furnishes the binder for this dust and is later carbonized by the heat, making the mixture of oil and dust a solid mass.

There is considerable objection to the use on high-speed engines of air cleaners of a type which offer high resistance to the passage of air, because such a cleaner cuts down the volumetric efficiency and the maximum output of the engine, but it is quite possible to make an efficient cleaner which offers only an inconsequential resistance. With truck engines this objection does not exist, or at least has not the same force, as truck engines are generally run at moderate speeds. Moreover, long life and freedom from need of frequent expensive repairs are particularly desirable in commercial vehicle engines. It is evident that the greatest need of air cleaners exists in connection with farm trucks which most of the time are being driven over dirt roads and fields, and it is quite likely that the air cleaner will enter the truck field through adoption on farm trucks. Some of the manufacturers of these trucks also make farm tractors and through experience in that line have learned to appreciate the advantages of the device.

Front Wheel Brakes

THERE is no immediate possibility that front-wheel brakes will be adopted by makers of low and medium-priced automobiles in this country. On the other hand there is a very marked interest in the subject on the part of those engaged in the making of the higher-priced heavier cars. Experimental jobs so equipped are on the road in several parts of the country and makers in this class who are just about to enter production have announced their intention to use them.

There is some possibility that the use of this type of brake on the higher priced cars will almost make it imperative on the part of makers in the medium priced field to do something, at least, either along the same line, or on some other line which will provide more efficient braking.

Rear-end collisions in crowded city traffic because of the ability of the car ahead to stop more quickly than the car behind are increasingly frequent. Provide more of the cars in the traffic stream with brakes capable of cutting the distance required to stop in half, and the number of such collisions will also increase. Most rear stop signal flashes begin to act only after retardation has commenced, and the hand is not always thrust out in time to signify the intention of the driver to come to a stop.

A few years of development on the four-wheel brake may well lead to some simplified installation that will be low in cost and yet highly effective. Good brakes have more influence on speeding traffic than good acceleration and since the question of emptying the business section of the cities by bus and passenger car is becoming more and more acute, good brakes will play their part in helping solve this great problem. The front wheel brake should be studied closely during the next two or three years. We are apt to see more of them.

Aids to Better Service

MANY manufacturers are to-day paying more attention to the matter of giving, through their branches and agencies, better and less expensive service than has heretofore been common. The whole industry is more inclined than ever to seek a solution of the service problem, realizing that the attention which it is given is one of the most important elements establishing the good-will without which every enterprise is, sooner or later, bound to fail.

Aside from the expense involved in repair work, and sometimes even more serious from the owner's viewpoint, is the inconvenience of being without the use of the car, the necessity of which is seldom so keenly realized as when the car is laid up for repairs. It is, therefore, desirable to minimize in every possible way the time required for repairs. The element of accessibility plays an important part in this regard.

It is important, of course, to lay down a design in such a way as to facilitate production, but this should not and need not interfere with having the assembled car or unit accessible, though it has all too frequently been allowed to do so. Too often the production engineer, whose advice is frequently a controlling factor in the design of the ultimate product, is so much interested in making parts so as to be easily machined and easily assembled, that he is apt to lose sight of the need for making them so they will also come apart readily when in place in the completed vehicle. The advice of competent service men should always be considered before a design is finally approved.

Parts which are apt to require attention can often be so made that they can be quickly disconnected, say by the removal of one or two bolts, and replaced as quickly by an identical unit which is new or has already been repaired. The unit removed can then be put in condition for use on the next car, which requires a similar job done upon it. Much time can be saved in this way, and the replacement can often be made by less skilled workmen than are required in the actual repair work. Thus the best workmen are kept at the bench where, if the quantity of repair work is sufficient, they can specialize in a certain line and become very expert and rapid at it. This method of operation is now used chiefly on electrical units and more or less similar parts once regarded as "accessories," but might well be extended to other parts, with great savings both in time and expense, though it has, of course, certain limitations. It can, for example, be used in the case of brake bands and brake shoes which require relining. A few sets of relined parts can be kept on hand, and when a car comes in to have its brakes relined, instead of waiting for the lining to be drilled and riveted in place, a set of ready relined parts is quickly inserted. The parts replaced are then relined for use on another car.

There is nothing very new about all this but the possibility of extending a system of this character to other parts of the car is worthy of consideration.

See More Activity After Chicago Show

Price Atmosphere Expected to Be Cleared Then—Uncertainty, Retarding Sales Factor

By James Dalton

NEW YORK, Jan. 24—Uncertainty of the public on the question of prices continues to some extent to hold up retail sales of automobiles. In New York the week following the show closed with a fair volume of business on the average. Some dealers had a remarkably good week, indicating that there had been an easing up of speculation regarding further price reductions, but others experienced a continuation of the holding back which became evident the latter part of show week, when news of approximately 50 price changes became generally known.

More Cuts Certain

Indications now are that the apparent sizable volume of deferred business uncovered by the shows in New York, Philadelphia, Buffalo and several other large cities, will not become active until after the Chicago show, which opens Jan. 28. It is practically certain that some further price changes will be made by companies which did not reduce in connection with the New York show. These changes probably will be announced at the Chicago show and at the same time it will become known whether any manufacturers already in line with reductions contemplate "second cuts," which the industry does not consider likely, in view of the present pre-war, or near pre-war level of the majority of prices.

Lincoln Plan Causes Concern

One factor which is causing considerable concern to manufacturers in the higher price classes is the announced decision of Henry Ford to take over the Lincoln plant if he can get it at what he considers a fair price. There now seems little doubt that he will be successful. While it is not expected that anything revolutionary will be attempted by Ford in the immediate future, there is little probability that he will be long content with limited production. The Lincoln plant has a potential capacity of 20,000 cars a year. At present prices there is no market for any such number of Lincoln cars. But if the introduction of Ford production methods, the Ford system of buying supplies and a sharp curtailment of costs will permit the sale at $2,500 of a Lincoln car in which little of the quality has been sacrificed, the market for the product will be greatly enlarged.

So far as his own car is concerned, Ford has done the industry generally a good turn by his recent price reduction of $7 on the touring car and $15 on the enclosed models. It will do much to convince the public that motor car values are about down to rock bottom. There are few companies in the lower price classes which can afford to make further material cuts.

The biggest job at present is to convince prospective purchasers that they can save little money by deferring purchases. By far the largest proportion of the "live" prospects now are owners of automobiles and they expect to trade-in their old cars. In their case every price cut automatically reduces used car values, so they will make practically nothing on any reductions which may come.

The record attendance at the New York show demonstrated that public interest in motor cars is keener than ever. Bankers have been particularly pleased at the manifestation and it has had something to do with the recent rise in motor stocks. Manufacturers were deeply gratified and all of them are making preparations to meet the spring demand which they consider inevitable. As a consequence business of parts and accessory makers is running on practically the same basis as for the last three months.

No New Financing Plan Proposed for Overland

NEW YORK, Jan. 24—Reports that some new plan had been worked out for refinancing the Willys-Overland Co. are erroneous. The negotiations with preferred stockholders to gain their assent to a plan which will permit liquidation of the company's bank loans are progressing as rapidly as can be expected. It is probable that the refinancing will take the form of a bond issue for approximately $15,000,000.

The company has paid 20 per cent of its bank loans and they now stand at about $16,000,000. It is probable that another 10 per cent will be retired in the near future and if this is done $15,000,000 will be adequate to take care of the remainder of the bank indebtedness. The earnings of the company now are ample to provide working capital.

DELAWARE TO TAX GASOLINE

WILMINGTON, DEL., Jan. 23—Although the Delaware Legislature does not meet until next year, a bill to be introduced at the next legislative session is being prepared taxing gasoline two cents a gallon. The proceeds from the tax would be applied to the construction of new roads.

34 Cities Chosen for Parts Depots

More to Be Added—Sub Dealers Will Be Appointed For Smaller Communities

DETROIT, Jan. 23—Central parts distribution depots of the new unit parts group have been located in 34 leading cities of the country and with the addition of some half dozen more, the main distributing organization will be complete. The companies and cities thus far selected are:

Atlanta, Motor Parts Corp.; Baltimore, Quaker City Motor Parts Co.; Boston, Campbell Motors Corp.; Buffalo, Units Parts Corp.; Charleston, S. C., Carolina Motor Parts Co.; Chicago, Standard Unit Parts Corp.; Cleveland, Automotive Parts Co.; Columbus, Automotive Parts Co.; Cincinnati, Automotive Parts Co.

Dallas, Motor Parts Depot; Denver, Gall Auto Specialty Co.; Des Moines, Standard Motor Parts Co.; Detroit, Automotive Parts Co.; Harrisburg, Pa., Quaker City Motor Parts Co.; Indianapolis, Central Motor Parts Co.; Kansas City, General Auto Parts Co.; Louisville, Edigen Motor Parts Co.; Los Angeles, Colyear Motor Sales Co.; Memphis, company's title not chosen.

Milwaukee, Standard Unit Parts Corp.; Minneapolis, Baldwin Service Co.; New York, Chadick Delamater Corp.; New Orleans, Standard Motor Parts, Inc.; Omaha, Omaha Motor Parts Co.; Philadelphia, Quaker City Motor Parts Co.; Pittsburgh, Superior Motor Parts Co.; Portland, Ore., Colyear Motor Sales Co.; Richmond, Standard Parts Co.

Salt Lake City, Mendenhall Auto Parts Co.; San Francisco, Colyear Motor Sales Co.; Seattle, Colyear Motor Sales Co.; St. Louis, Authorized Motor Parts Co.; Spokane, Colyear Motor Sales Co.; Toledo, Automotive Parts Co.

The companies whose products will be distributed through the parts depots are Continental Motors Corp., Timken-Detroit Axle Co., Brown-Lipe Gear Co., Borg & Beck Co. and Spicer Mfg. Co.

Must Carry Adequate Stocks

Each of the unit parts depots will be financed by local capital entirely and will be operated according to conditions existing in the different cities. Contracts have been signed for handling the distribution of the unit makers' products, and in turn they will sign sub-dealers who will handle the unit parts in the smaller cities of the 40 districts.

These contracts in the main only require that the station maintain an adequate supply of parts at all times, the supply to be based on the population served and the total registry of cars in the districts. Prices are set by the factories, freight variations causing any difference that may exist in prices in any section.

The business of signing distribution agencies in the smaller cities will be carried through during the early months of the year and by April, factory parts will be available in any section of the country in five to six hours.

To Change Lincoln Price, Leland Says

Will Follow Sale—Changes Will Be Instituted in Factory Methods

DETROIT, Jan. 24—Purchase of the Lincoln Motor Co. at the receiver's sale Feb. 4 by interests friendly to the Leland control will mean carrying through for the first time the complete Leland policy, according to a statement made to-day to AUTOMOTIVE INDUSTRIES by W. C. Leland, vice-president and general manager of the company. Under the old régime, he said, clashing elements in the directorate made it impossible to put these policies into effect.

There will be many changes in the conduct of the company's affairs, Leland said, but they will be mainly in the merchandising and not in the production end of the business. The former standards of manufacture for the Lincoln car will be adhered to closely with the steady improvement of the product always in mind. Better markets will be opened under the reorganization, he added, and buyers of Lincoln cars will be given the full benefit.

No Change in Organization

There will be a revision of prices after the sale, Leland declared. Since the factory has been in the hands of a receiver a careful study has been made of the possibilities of the plant and several changes in manufacturing methods will be instituted. The equipment has been brought to the highest point of efficiency and everything is ready for immediate resumption of production. It is expected that from 6000 to 8000 cars will be made in 1922.

The Lincoln sales organization will be continued as it stands. The new prices and the improved quality of the product are counted upon to bring sales to a point where the factory may be operated up to capacity. The Lelands hope to make and sell 12,000 cars in a good business year. The factory organization will be strengthened but no radical changes are contemplated.

Many parts which formerly have been purchased by the company will be made in the Lincoln factory hereafter. This will include eventually the manufacture of its own bodies, but for the present the company will continue to buy bodies.

Gardner Statement Shows Clean Financial Slate

ST. LOUIS, Jan. 24—The Gardner Motor Co., in its statement as of Dec. 31, has wiped its financial slate clean. It has taken a loss of $800,000 for the year but presents a balance of $600,000 in cash and not a dollar of indebtedness. The loss on inventory for 1921 was $990,000.

Organization and prepaid expenses, tools, dies and patterns all have been wiped out as balance sheet items. Buildings and equipment have been reduced from $600,000 to $400,000 and inventories from $1,700,000 to $500,000 representing cost or market. These items with the $600,000 in cash and $50,000 accounts receivable bring the total assets to $1,550,000.

The company expects to develop the South and Southwest as its principal sales field. It is confident the South has turned the corner and with the markets developed on the Atlantic and Pacific coasts the company hopes for much larger sales in 1922.

80 Per Cent of Merchandise Creditors Accept Earl Plan

CHICAGO, Jan. 23—The proposed reorganizatiou plan for Earl Motors, Inc., has been accepted by nearly 80 per cent of the merchandise creditors who have claims aggregating $3,000,000. Preferred and common stockholders have been asked to deposit their holdings, as voting trusts will be formed under the direction of the bankers' committee.

Preferred stockholders will be asked to waive their right to dividends. No changes will be made in the present stock outstanding, but it will take rank after the deferred income debentures and 7 per cent prior preference stock which will be issued. The creditors will receive two-thirds of their claims in the new debentures and one-third in prior preferred.

Reynolds Spring Shows $572,658 Current Assets

JACKSON, MICH., Jan. 24—The Reynolds Spring Co. in its general balance sheet as of Dec. 31 shows current assets of $572,658 and current liabilities of only $1,705. Cash amounts to $392,190; accounts receivable to $37,675 and inventories to $142,791.

The inventories are priced at cost or market, whichever is lower. The total assets are $1,912,571 and the surplus is $162,539. The company anticipates occupying next month a new two story fireproof addition to its factory. This is expected to make a considerable saving in expense of operation. The company is carrying life insurance amounting to $140,000 on some of its officers and employees, payable to the company in case of their death.

DORRIS ELECTS OFFICERS

ST. LOUIS, Jan. 23—At the annual stockholders' meeting of the Dorris Motor Car Co., held at the company's offices, George P. Dorris was re-elected president and chief engineer; Webster Colburn, vice-president and general manager, and J. F. Culver, secretary and treasurer. Frank C. Thompson was elected second vice-president. Re-elections to the board of directors include Dorris, Colburn, Thompson, H. B. Krenning, George C. Griffith, Parker H. Woods and Judge Jesse McDonald.

Rail Commissioner Is Urged in Report

United States Chamber Committee Recommends Congress Authorize Appointment

WASHINGTON, Jan. 24—The committee on railroads of the Chamber of Commerce of the United States has prepared a report recommending that Congress be urged to enact legislation authorizing the President to appoint a special administrative officer with the title of Commissioner General of Transportation, who would hold office subject to the will of the President, who would prescribe his compensation. The report will be considered at a meeting of the national council to be held in Washington, Feb. 8 and 9.

The report says the commissioner should be selected because of his familiarity with transportation problems and that he should make to governmental agents in charge of the regulation of interstate transportation such recommendations as would be for the public interest and tend to co-ordinate the administration of laws respecting "interstate transportation by land, water and air for the promotion and development of a national system of rail, water, highway and aerial transportation and will make possible the articulation and economical use of all transportation facilities, including tracks, highways, terminals, transfer facilities, docks and landing places."

Wide Scope of Powers

The report proposes that the commissioner should reconcile so far as possible conflicting rulings of boards, commissions and bureaus and where they cannot be reconciled in a way to promote the general development of a co-ordinated system of interstate transportation make recommendations designed to correct inharmonious provisions.

Another section of the report states that the commissioner should be entitled to be heard at any hearing given by a governmental agency and to produce evidence that would tend toward the promotion and facilitation of the continued development of an interstate transportation system that would be adequate to meet the transportation needs of the country. The committee believes the commission should be authorized to grant Federal charters to corporations proposing to engage in interstate transportation by land, water or air.

WICHITA PLANS CHANGED

WICHITA FALLS, TEX., Jan. 23—Wichita Motors Co. has canceled its plan of consolidation with the Price-Campbell Cotton Picker Corp. and announces that it will continue the manufacture of Wichita trucks under the name of the Wichita Motors Co. No reorganization of the company is now under contemplation.

Bosch Head Makes Denial of Rumors

Says Martin E. Kern Sailed for Europe with Full Knowledge of Government

SPRINGFIELD, MASS., Jan. 24—Arthur P. Murray, president of the American Bosch Magneto Corp., asserted to-day that there was no basis for a sensational report that the departure for Europe of Martin E. Kern was the result of the investigation by the Department of Justice into the sale of the Bosch plant to the present owners by the Alien Property Custodian in 1918. Murray declared that Kern sailed with the full knowledge of the Department of Justice and that he was, as a matter of fact, on a mission for the Department of Commerce, carrying letters of introduction to many embassies and consulates.

Characterized as "Political"

The Federal inquiry into the sale of the old Bosch Magneto Co. by A. Mitchell Palmer was characterized by Murray as a "political move." He declined to amplify that assertion beyond stating that the company's books containing the record of the sale had been placed in the hands of United States District Attorney Harris at Boston. He declared that none of the company's officials had been called before the Federal authorities to be questioned.

It has been learned in Washington that the inquiry by Harris was instituted upon instructions from Attorney General Daugherty and is in connection with the charges filed last summer by representatives of Robert Bosch, the original German owner.

Attorneys for the former German owners of the plant alleged that whereas the property was sold by Palmer for $4,150,000, it was really worth more than $7,000,000 and that the company's patents, copyrights, trade marks and good will had been valued at only $1. They have charged that measures taken by the Alien Property Custodian were such as would not tend to bring about a favorable sale of the property; that the sale was not well advertised, that it was held in a remote place, and that an excessive deposit was required of bidders; that the information furnished about the property by Palmer did not do justice to the owners. Most of these allegations were met with denials from Palmer.

Kern Friend of Palmer

The attorneys for the former owners charged specifically that the property thus sold went into the hands of Martin Kern, treasurer of the Bethlehem Motors Corp., a lifelong friend of the Alien Property Custodian, with whom he had been interested in various transactions, and that other of Palmer's friends were associated with Kern in acquiring the property.

John A. MacMartin, secretary of the American Bosch Magneto Corp., has declined to make any statement in relation to the Federal inquiry. George A. MacDonald, treasurer, has intimated that the trouble was being fomented by the former owners for advertising purposes.

M. A. M. A. MEMBERS' DECEMBER BUSINESS MUCH BETTER THAN FIRST MONTHS OF 1921

NEW YORK, Jan. 24—Purchases of supplies from members of the Motor and Accessory Manufacturers Association by automotive manufacturers in 1921 aggregated $238,062,591. The total of past due accounts held by members of the M. A. M. A. declined from $8,099,727 in January to $4,220,450 in December. The total of notes outstanding fell from $4,359,871 in January to $3,384,250 at the end of December.

December showed a sharp falling off in sales as compared with November, although the decline was not as great as had been expected. Sales in November were $18,998,490 and in December $14,349,750, a falling off of 24.47 per cent. Business in October aggregated $22,053,327. It was significant of the improved conditions in the automotive industry that December business was very much better than sales in January and February. In fact, it did not fall far short of equalling that done in the first two months of the year together. The statistics by months for the entire year follow:

Month	Total Purchases	Per Cent Change	Total Past Due	Per Cent Change	Total Notes Outstanding	Per Cent Change
January	$6,264,587	.....	$8,099,727	.....	$4,359,871	.....
February	10,408,962	66.15 Inc.	6,717,165	17.07 Dec.	6,063,118	39.08 Inc.
March	20,120,386	93.30 Inc.	5,603,992	16.57 Dec.	5,069,877	16.38 Dec.
April	26,746,580	32.93 Inc.	5,352,271	4.49 Dec.	5,371,086	5.94 Inc.
May	26,781,350	.13 Inc.	4,505,176	15.64 Dec.	4,460,355	16.77 Dec.
June	22,703,414	15.19 Dec.	4,720,973	4.79 Inc.	4,012,670	10.37 Dec.
July	23,096,214	1.68 Inc.	5,242,046	10.79 Inc.	3,690,154	7.90 Dec.
August	23,397,640	1.31 Inc.	4,348,790	17.06 Dec.	3,494,510	5.30 Dec.
September	23,141,891	1.09 Inc.	4,358,545	00.22 Inc.	3,677,500	5.24 Inc.
October	22,053,327	4.70 Dec.	4,512,680	3.54 Inc.	3,463,500	5.82 Dec.
November	18,998,490	13.85 Dec.	4,352,000	3.56 Dec.	3,661,900	5.73 Inc.
December	14,349,750	24.47 Dec.	4,220,450	3.02 Dec.	3,384,250	7.58 Dec.

Parts Makers Map Out Group Expansion Program

NEW YORK, Jan. 23—An ambitious program for the expansion of its group organization has been mapped out by the Motor and Accessory Manufacturers Association. The main purpose of the group idea is to promote "greater unity of purpose in the direction of economies of production and distribution, thus eliminating duplications of effort and expense."

The following preliminary classification of contemplated groups is announced by the association:

Asbestos products, axle, bearing, bumper, carbureter, chain, clutch, engine, fan forging, foundry, gear, headlight device, piston ring, radiator, sheet and pressed metal, shock absorber, spark plug, spring, starting, lighting and ignition, steel producers, steel products, top, transmission, warning signal, wheels and windshield.

TO LIQUIDATE MONITOR

COLUMBUS, Jan. 23—Receiver E. W. Pavey of the Monitor Motor Car Co., which was forced into the hands of the receiver about six months ago, has sold tools, parts, stocks on hand and patterns to the American Motor Parts Co., which held an auction of certain tools and parts recently. The sale was confirmed by the court and it is the policy to liquidate the concern. No offer for the real estate, appraised at $85,000, has been received. Creditors' claims will be paid to the extent of 15 or 20 per cent.

Dixie Flyer Makers Will Join Combine

Stockholders Accept Plan for Reorganization Superseding all Former Arrangements

LOUISVILLE, KY., Jan. 24—Plans for the reorganization of the Kentucky Wagon Mfg. Co. and a merger with the Associated Motors Industries have been accepted by stockholders of the company.

Details of the new company that will be formed and those of the merger were not disclosed by John W. Barr, Jr., of the company, who made the following statement:

"The concern which will be formed will be one of the largest of its kind in this part of the country. Representatives of the large financial interests from Chicago and from the East, which will be partners in the merger, provided it is effected, were at the stockholders' meeting.

"It is possible that the merger will be accomplished, and if it is it will enable the Kentucky Wagon Mfg. Co. to operate on a larger scale than before."

The plan adopted by the stockholders completely supersedes all former reorganization and merger plans.

(*Continued on page* 202)

20,400 TRACTORS IN UTAH

COLUMBUS, Jan. 24—C. J. West, Federal-State farm statistician in Ohio, has completed a survey of the State to list the number of farm tractors in use. He reports that the number has been practically doubled in the past two years. The number two years ago was 10,469 and now is about 20,400.

Body Manufacturers Speeding Up Output

Sub-Contractors in Philadelphia Receive Orders from Builders of Automobiles

PHILADELPHIA, Jan. 23—Manufacturers of automobiles are giving subcontractors orders to speed up production, in anticipation of an improvement in business by spring. The effect has been felt here locally and one large stamping shop is producing a record number of bodies, 400 a day, for Dodge Brothers. The E. G. Budd Mfg. Co. has taken on 500 extra men in the last few days in its body-making plant, the shops now running at 80 per cent of normal, with some divisions on full time and a few on overtime.

Orders since the first of the year call for substantial increases in daily production. The Studebaker Corp. has ordered deliveries of 150 bodies a day, with prospects of an early increase. Orders for fenders for the new type 61 Cadillac have increased and Overland bodies also are being built in greater number.

Two reasons are advanced for the sudden turn in production demands. Manufacturers had not increased orders prior to the New York automobile show, desiring to close the year with small inventories, but since the show, business has received a sudden impetus and quick orders for increased production became imperative. Price reductions is the other reason to which the inflow of orders is attributed.

Antigo Starts on Schedule of 200 Tractors for 1922

ANTIGO, WIS., Jan. 23—At the annual stockholders' meeting of the Antigo Tractor Corp., John Manser was elected president; Ernest Hirt was re-elected vice-president, and Edward Faust was elected secretary and treasurer. The past year has been spent in perfecting the organization and completing engineering details, so that production will start at once on a schedule calling for 200 to 250 machines in 1922 and 300 to 400 in 1923.

The stockholders in fifteen minutes subscribed $25,000 additional to properly finance production. B. F. Appleby, head of the Erd Motor Co., Saginaw, Mich., was among the out-of-town stockholders present and made valuable suggestions for conducting the operation and further development of the business. The product is known as the "Quad-Pull" tractor, having a direct drive to all wheels, and has been under practical test for more than two years.

DURANT PLANT NEARS CAPACITY

NEW YORK, Jan. 24—Production at the Long Island City factory of the Durant Motor Car Co. of New York is rapidly approaching capacity and 100 cars were turned out in one day last week. As originally designed the capacity of the plant was to be 100 a day but by the application of efficiency methods this can be increased, it is believed, to 150. The Lansing plant is turning out about 25 cars a day. The Muncie plant will begin production of the Durant six for delivery to purchasers some time in February.

Cadillac Reopens Factory School for Its Mechanics

DETROIT, Jan. 20 — Cadillac Motor Car Co. reopened its technical and repair school at the factory this week for the benefit of service managers and mechanics doing Cadillac work. The school continues under the direction of Charles Rogers, who has been connected with Cadillac for seventeen years and has directed the repair school for the past four.

The instructions will be given in two week courses during which the adjustments on the Cadillac type 61 and earlier models will be completely reviewed. An examination will be held at the end of the course and distributors and dealers will be notified of the examination and attendance rating of the men they have sent to the school.

Winfield Barnes Plant Is Sold by Receiver

PHILADELPHIA, Jan. 21 — Otto R. Heiligman, receiver for the Winfield Barnes Co. automobile factory, has sold the plant at Twentieth Street and Erie Avenue to B. Foster, for $86,000. The property is assessed at $75,000. Other premises belonging to the company and placed in the receiver's hands, was sold to F. C. Schaeffer for $30,000. The latter property in Cherry Street was assessed at $20,000.

These properties were put up at public auction last summer, but the bids were not accepted. The contents of the factory, including the machinery, were sold in parcels at that time, for very small sums.

Gasoline Consumption Less; Production Shows Increase

WASHINGTON, Jan. 23 — Domestic consumption of gasoline decreased 104,500,000 gallons during November, according to figures compiled by the Bureau of Mines. The daily average production increased 171,856 gallons as compared with October and the stocks of gasoline increased 39,320,000 gallons.

It is significant to note that the stocks of gasoline on Nov. 30, 1921, were 140,750,000 gallons in excess of those on the same date in 1920. Exports decreased 1,250,000 gallons but shipments to insular possessions increased 1,000,000 gallons. There were 24 more plants in operation in November than in October.

Stocks of lubricating oils were increased 11,267,000 gallons during the month.

Milwaukee District Shows Further Gain

Reflects Results of New York Exhibition in Large Orders for Parts Received

MILWAUKEE, Jan. 23—Firms manufacturing parts, equipment and accessories for popular-priced passenger cars have large orders on hand for late winter and spring delivery, according to the monthly survey of Milwaukee industry and business contained in the current issue of *Business and Financial Comment*, published by the First Wisconsin National, Milwaukee's largest bank.

It says further that the motor truck industry is still quiet, but "should receive stimulation from the prospective activities of building and construction this year." It shows that the number of persons employed in Milwaukee County in December increased 2065, or 5.7 per cent, compared with November, in which month there was a decrease of 3.02 per cent from October. Motor car parts and equipment industries gained 5.07 per cent, while iron, steel and machinery gained 6.2 per cent.

Distributors Cheerful

It is encouraging to note that more recently the automotive industries have established further gains, which are believed to have grown directly out of the stimulation of passenger car demand by the New York show. Milwaukee is one of the principal centers of the parts industry in the United States, and consequently shows an almost immediate effect of rise and decline in passenger car and truck production which is based on immediate and prospective demand.

The attitude of Milwaukee distributors and dealers at this time is, perhaps, the most cheerful the trade has been able to assume in several months. The reason is the interest aroused by the fourteenth annual winter show, which opened Jan. 19 and runs until Jan. 25. The opening of the show marks the beginning of the most vigorous sales campaign of the year, and dealers generally consider the prospects for business in the coming three months more favorable than last year. Momentarily tax-paying time is creating some resistance, however.

TO LIQUIDATE PAN-AMERICAN

DECATUR, ILL., Jan. 24—E. A. Danner, president of the Pan-American Motors Corp., who took charge after the old management was ousted, will attempt to liquidate the business as quickly as possible. He believes the preferred stockholders will get 100 cents on the dollar but the common stock will not realize more than 30 cents. The common stock sold aggregated $1,162,000 and the preferred stock $102,000. Promotion of the company cost $307,000. Danner has informed stockholders that approximately $800,000 was expended by the old régime with practically nothing to show for it.

Too Much Price Talk Arouses S. A. Miles

Says Lack of Interest in Prospects Was Another Fault at the New York Show

NEW YORK, Jan. 24—Some of the exhibitors at the New York automobile show were guilty of three grave errors in the opinion of S. A. Miles, the veteran manager who probably knows more about motor car expositions than any man in the country. These three errors were:

Incessant conversation about prices.

Incompetent salesmanship.

Lack of interest in prospective purchasers.

"There were very creditable exceptions," says Miles, "but speaking generally we descended from the high class salesmanship of earlier years to a lugubrious week-long discussion of falling prices. We placed ourselves on the level of the drummer who sells pig iron by the ton or the farmer who sells corn by the bushel."

He stated further:

We suffered from price hysteria. We relegated salesmanship to the scrap heap. We encouraged the public to postpone purchases, expectant of still further declines.

We did not dwell to the extent we should have done on the results of the 20 years' experience and studious endeavor. We made all too little reference to the design and mechanical excellence of our cars and their meaning in the matter of durability, comfort and economy.

Neglected Opportunities

We neglected opportunities to discuss materials, weight, strength, durability and made little effort to compare it with that of bygone years. We did not make the most of improved workmanship. We did not present an adequate picture of the car of today, of the value of the dollar and the car, compared with pre-war times, or the added cost of material and men. We did not dwell upon the service of today and the long life of the car. We did not talk our prices up. We talked them down.

We talked price from morning until night. We radiated price. We daubed our cars with bargain counter announcements of price.

Have we salesmen with brains, familiar with the points of our machines, capable of comparison, able to ascertain what the inquirer expects in a car; to tell him how good a car is and sell him on the merits of the car?

Or have we merely automatons to tell the prospective buyer how cheap the car is and how much we expect to allow him on his old vehicle?

It is too late to prevent the harm that was done in New York but it is not too late to prevent a repetition of it in Chicago.

RUBBER PROCESS OPENS OFFICES

DETROIT, Jan. 20—Rubber Process Corp. has opened offices in the Kresge Building, this city, for the development of sales in the automotive field, particularly the tire service end, of their product, which is designed to increase the life of rubber. Tire treating stations will be opened throughout the country. Robert W. Ingersoll, well known in the automotive field, will be in charge of the Detroit office. Other officers of the company are Frank A. Bigger, president; Eugene Siegel, treasurer, and Leo Siegel, secretary.

New Executives Join Warren F. Fraser Co.

WESTBORO, MASS., Jan. 20—Five new executives have associated themselves with the reorganized Warren F. Fraser Co., incorporated in 1914 to manufacture cylindrical grinding machinery, plain cylinder grinders of all types, special machine tools and metal products.

Warren F. Fraser, inventor of the new automatic cylindrical grinder which the company will market, is president, and Frank McClaskey, vice-president. Sydney Player, general manager, was formerly production manager of the Taft-Peirce plant at Woonsocket, and Joseph N. Bethel, sales manager, was connected with the same company for 23 years. Maurice J. Cashman is treasurer. His assistant is Richard S. Staples. Herbert S. Indge, consulting engineer, and Alfred W. Box, factory superintendent, were, like Staples, formerly associated with the Taft-Peirce organization.

Studebaker-Wulff Buys Marion Tire; Rotary Unsold

MARION, OHIO, Jan. 23—Failing at the last minute to negotiate the purchase of the Rotary Tire & Rubber Co. of Zanesville, the Studebaker-Wulff Rubber Co. has bought the property of the Marion Tire & Rubber Co., located in this city, from Jesse P. Dice of Akron, as trustee. The Studebaker company will produce both cord and fabric tires under the Marion brand and will gradually develop the production of special cord tires to be known as Studebaker-Wulff cords.

The Marion plant is under the direct supervision of H. C. Buchanan, a director of the company and formerly production superintendent for the Kelly-Springfield Tire Co. The other officers are P. E. Studebaker, president; B. F. Wulff, secretary and general manager, and F. A. Rendon, vice-president.

The Marion company experienced financial difficulties by reason of large contracts for raw materials at high prices, which it was unable to pay on account of the depression. Before the plant shut down, 300 casings and 800 inner tubes were being produced daily. Alterations and additions which were in progress and are almost completed will increase this capacity.

Plans for taking over the Rotary plant had been completed with both the creditors and stockholders, but when the composition agreement came before the referee in bankruptcy for final acceptance, minor differences proved so great that they could only be settled by the courts.

Salesmen to Give Same Data at Show

Taught of Conditions in Industry Through Instructions from Chicago Association

CHICAGO, Jan. 23—The Chicago Automobile Trade Association has sent to its members a list of nine questions which, it is believed, large numbers of visitors to the Chicago show will ask, together with answers to these questions which the association believes salesmen might make with profit to themselves, their dealers and the industry.

The idea behind this piece of association activity is to have salesmen in the show all telling the same story to the public.

Members are asked to instruct their salesmen on these questions and answers, and there will be a general review of the subject, together with a final show of enthusiasm for the work of show week, at a mass meeting of dealers and salesmen to be held Friday evening preceding the show.

Here are the questions and answers:

Question No. 1—How is business?

Answer — Much improved. Nineteen hundred and twenty-two will be a good year in the automobile industry.

Question No. 2—Have prices reached the bottom?

Answer — Present prices are below cost anticipating quantity business. If not secured, prices must advance.

Question No. 3—What is my used car worth?

Answer—Just what it will sell for less conditioning and sales cost. New car price reductions have, of course, lowered used car values.

Question No. 4—How about price guarantees?

Answer—We don't guarantee. Practically all manufacturers have discontinued price guarantees.

Question No. 5—What is your opinion of ..... car?

Answer—I am unfamiliar with that make of car and cannot, therefore, give an opinion.

Question No. 6—Will there be more failures among the manufacturers this spring?

Answer—No. All the weak ones have already been eliminated.

Question No. 7—The industry was pretty hard hit last year, was it not?

Answer—No. The automobile industry suffered less than the other two larger manufacturing industries—steel and packing. The steel industry suffered a shrinkage of 60 per cent; the packing industry suffered a shrinkage of 50 per cent; the automobile industry stood a shrinkage of only 25 per cent.

Question No. 8—With the new low prices, have the manufacturers cheapened the product?

Answer—No. They have not. On the other hand, the cars are vastly improved as, for instance, cite your own improvements over 1914.

Question No. 9—Where is ..... car exhibit?

Answer—Each salesman should be equipped with a diagram showing the location of the passenger car exhibits at the show and should carefully and courteously direct inquirers.

Business Follows New York Exhibit

Evidence in Metropolitan District, However, That Much Trade Is Being Deferred

NEW YORK, Jan. 23—The week following the New York show closed with an encouraging volume of passenger car sales in the metropolitan territory. There was further evidence of the fact brought out at the show that there is a decidedly sizable volume of deferred business waiting to be convinced of three things, that prices have been stabilized, that dealers mean to stick to their current announcements that they will make nothing more than value allowances on used cars and that the new and refined 1922 cars are as great a step forward in design and performance as salesmen claim them to be.

Price Still Talked

Even within a week prospects have shown some weakening in their skeptical attitude regarding prices. Cars which had big show week sale records have been going right along since and some others which did not do much more than attract interest at the show had quite a bit of closed business to boast of at the end of this week. There is still price talk along the row by prospects, but it is not quite so insistent as it was and a little extension of the period of stabilization, dealers expect, will just about silence it.

Dodge Brothers sales, on the basis of an unknown reduction retroactive to Jan. 1, are better than they were before the impending price cut was announced, but there has been no rush and a good many prospects who have made inquiries at the salesrooms and have found salesmen ignorant of the future price have declared their intentions of waiting to see what happens before they buy. Uncertainty as to the Dodge price naturally is having some retarding effect on sales in competing lines.

Many more dealers here than before the show are holding allowances on used cars down to resale values. Several dealers are not trading at all and one who has been in this class for several months reports that he made a profit in November, which was the first profitable November in the entire history of his business.

See Large Spring Business

Dealers have conducted a great many demonstrations during the week, thus convincing prospects of the truth of claims, particularly regarding new or redesigned cars, made at the show.

Prospect lists and salesmen's reports give indication that a large spring business awaits the New York trade. Some of it is being turned into cash already and it is expected that sales will increase steadily week by week unless some such unlooked for occurrence as another wave of price reductions upsets the steadily gaining public confidence in the value of cars as they are priced to-day.

Optimism in Chicago

CHICAGO, Jan. 23 — Decidedly the spirit prevailing in the automotive industry in Chicago is one of optimism. This view has been taken since the closing days of the old year. With the opening of the new year, sales that were expected to be very slow did not follow expectations and up to the present time Chicago business is better than for the same period a year ago. Country sales are slow but there is a healthy flow of sales in the cities. This is especially true of Chicago.

It is the general opinion of Chicago dealers that nothing sensational is to be expected in sales for 1922. They believe that the volume of business will increase as the season advances until business will be good. Nothing better than good business can be hoped for is the general expression. A turn for the better is expected either in March or April.

Factories in Chicago in all lines report better business than a year ago with prospects for the year infinitely better. Some of the local truck makers are doing a fair volume of business. All report sales far in excess of those of a year ago at this time. Nothing like capacity production is in evidence but sales are increasing and general business seems healthy.

Aims at Increased Truck Sales for Railway Service

DETROIT, Jan. 21—Two big avenues for motor truck business in 1922 will be in the augmentation of street railway service through the sale of buses to trolley companies and individual operators, and of railroad freight handling facilities through the adaptation by the carriers themselves, of trucks for short haul work.

Special sales campaigns are being mapped out by General Motors Truck Co. to develop this market for its product in 1922. This, with the large potential market afforded for trucks by the highways projects of the year, is expected to create a volume of business which will compare favorably with truck business prior to 1921 and keep the big plant at Pontiac on close to normal production.

5819 More Motor Vehicles Licensed in Utah in 1921

SALT LAKE CITY, Jan. 23.—A total of 48,523 motor vehicles were licensed in Utah in 1921. The truck licenses numbered 6936. The total shows a gain of 5819 over 1920.

The increase is considered entirely satisfactory, inasmuch as the population of the State does not exceed 450,000 and in view of the fact that the mining industry, especially copper, wool growing, stock raising and the sugar beet business, which are the mainstays of the intermountain region, have not yet recovered from the depression.

Syndicate Takes Seiberling Issue

Will Offer $1,500,000 Stock of Rubber Company—Assets Listed at $4,300,000

AKRON, Jan. 23—A syndicate of Cleveland financiers headed by Roland Meacham, Cleveland broker, has underwritten the stock issue of the new $10,000,000 Seiberling Rubber Co. recently formed by F. A. Seiberling, former president of Goodyear. The syndicate expects shortly to offer $1,500,000 of the Seiberling rubber stock on a basis of four shares of 8 per cent preferred with 60 shares of no par common stock for $1,000.

The total assets of the Seiberling Co. are listed, based on appraised value, at 286 per cent of the outstanding preferred stock. Net current assets are shown to be 125 per cent of the outstanding preferred stock. The preferred stock is callable at 110, while 5 per cent is redeemable each year after Jan. 1, 1925. The proceeds of the stock issue will be used for working capital.

The Seiberling Company's first financial statement just issued shows assets of $4,300,000 which include $1,550,000 in the Portage plant and equipment; $750,000 in the Lehigh plant and equipment, and cash of $2,000,000 subject to the expenses on account of the organization.

Liabilities include 8,000 shares issued of a total of 50,000 shares authorized, of Seiberling preferred 8 per cent cumulative stock of par value of $100, totaling $800,000; 75,000 shares of no par common stock issued for the New Castle plant, of $750,000, and 120,000 shares of no par common stock sold, of $1,200,000; also $800,000 in 7 per cent cumulative preferred stock issued for the Portage Rubber Co. Liabilities also list a capital surplus of $750,000 based upon appraised value of $1,559,378 for the Portage plant and represented by ownership of 7,500 shares of common stock of the Portage Company.

Belsize Passes Dividend; Future Regarded Bright

LONDON, Jan. 14 (By Mail)—Belsize Motors, Inc., in a circular to the stockholders, states it has deferred payment of the past half-year's dividend upon the cumulative preferred stock. Last year a final dividend of 6 per cent on the common stock was recommended, but the subsequent share holders' meeting deferred payment of it.

The circular adds that there are distinct signs of an improvement in trade as it affects the company and that the momentary obligations will be fulfilled as soon as the money can be withdrawn from the business without detriment to its trading commitments. Contracts for the new model, the oil-air cooled Granville-Bradshaw two-cylinder two-seater light car just placed on the market, are stated to be sufficient to keep the works running at high pressure for a considerable time.

Manager of Overland in England Honored

Wm. Letts, Now in This Country, Becomes Baronet—Mays Smith Awarded Title

LONDON, Jan. 14 (*By Mail*)—Mays Smith, president of the British S. M. M. & T. and director of the company importing Delaunay-Belleville cars from France, and W. M. Letts, managing director of Crossley & Co. and Willys-Overland-Crossley, Ltd., have received the title of "Sir," which henceforth will replace "Mr." as a prefix to their names, the honor being conferred by the Government for their "public services."

Letts has had a lifelong connection with the industry, handling many makes of American and European cars. For years his fortunes were linked with C. Jarrott, with whom he began importing the old Locomobile steamer. Their business relations were severed when Sir William became more closely identified with Crossley cars.

Sir William in New York

NEW YORK, Jan. 23—Sir William Letts, managing director of Willys-Overland-Crossley, Ltd., is receiving the congratulations of his American friends on having been made a baronet. The title of "Sir" was awarded him after he sailed for this country some three weeks ago. He said to-day he had received through the mails a large number of newspaper clippings which he expected to read on his way back as he did not think he would find time before he sailed.

Sir William came to the United States to place orders for a large supply of materials for the Overland car which is being assembled in England. The orders are being placed in anticipation of the substantial spring business which now seems certain.

Conditions in the automotive industry in England are similar to those which prevail in this country but Letts said Englishmen could not conceive how Americans could feel that they were in the midst of hard times when they have "all the money in the world" and when their taxes are only a fraction of those paid in other countries, especially England.

Disappointed in Show

He believes substantial progress in the process of reconstruction has been made within the past year but that another 18 months at least must elapse before anything like normal conditions can be restored in Europe. The general economic situation must improve radically and exchange must be stabilized before the automobile market will expand materially.

The New York Automobile Show did not particularly impress Sir William. He said he was unable to find anything really new in a mechanical way and was much disappointed in this respect although he found improved designs in body models. He was of the opinion that the Olympia show was much more interesting than that held in New York.

Letts spoke with pride of the Overland car produced by the English company and said that it had been designed to find favor with English buyers. He said it might be possible ultimately to have the entire car English built. He believes continued price cutting either in England or the United States will lead to "financial suicide."

Letts will return to England Feb. 7 after a trip to the Middle West and Canada.

Midgley Urges Mechanical Improvements to Save Fuel

WILMINGTON, DEL., Jan. 23—In discussing the economic phases of the motor fuel problem, before the Delaware Section of the American Chemical Society, Thomas Midgley, Jr., chief engineer of the motor fuel section of the General Motors Research Corp., urged mechanical improvements.

"For obvious reasons," he said, "it is of the utmost importance to make the most efficient use we can of motor fuel from petroleum. Increased mileage per gallon can be obtained in a variety of ways. The most practical method is to increase the compression ratio of our present internal combustion engine."

He presented data to prove his contention that doubling the compression pressure will result in doubling the mileage per gallon. "This method of increasing mileage," he stated, "has only one drawback, and that is the so-called 'fuel knock'."

He said that "fuel knock" is troublesome and tends to reduce the power, but this can be overcome by the use of such materials as orthotoluidine, xylydine and monomethylaniline, thereby allowing the benefits from high compression to be fully realized.

PREMIER SECURES BOND ISSUE

INDIANAPOLIS, Jan. 23—The Premier Motor Corp. has filed a blanket mortgage for $60,000 with the Fletcher American Bank to secure a temporary bond issue of $60,000. M. A. Whipple, the vice-president, stated that this bond issue will be used to pay county, State and Federal taxes and to conserve working capital. It is only a preliminary step in connection with the refinancing plan now under way. The last obstacles to refinancing have now been removed, it is asserted, and a definite announcement is expected soon.

BRITAIN WANTS NEW LAMP

WASHINGTON, Jan. 23—Advices from the American Consul General at London, England, state that American manufacturers of automobile lamps may expect considerable business from Great Britain if they are able to evolve a new type of lamp which the British Minister of Transport anticipates will entirely meet the needs for a non-dazzle headlight.

Fewer Car Thefts, Aim of Legislator

Bill Introduced in New York Make Changing Identification Marks a Misdeameanor

ALBANY, Jan. 24—Designed to curb the traffic in stolen automobiles, and to render easier the recovery of cars which already have been stolen, a bill has been introduced in the 1922 Legislature which would make it a misdemeanor to "remove or deface" an identification mark on any automobile or accessory for the purpose of destroying its identity. The bill is introduced by Assemblyman T. Channing Moore.

The Moore bill is but one of a dozen measures of vital interest to the automobile world which have made their appearance before the Legislature. Among the most important of the others is one by Assemblyman James Male which would require owners of taxicabs and motor trucks to exhibit to the State Tax Commission an indemnity policy of not less than $1,000 for property damage and $5,000 for personal injuries before obtaining licenses.

Assemblyman Arthur E. Brundage has introduced a bill requiring motor trucks and trailers more than 6½ feet wide and of one or more tons capacity to carry a green light on highways outside of cities from one-half hour after sunset to one-half hour before sunrise.

Truck Weights Considered

Regulation of the weight and dimensions of motor trucks with penalties for violations is provided in a bill introduced by Senator Lowman. The measure provides that except with a written permission from the State Tax Commission no person shall have the right to operate on a public highway or bridge a truck with a width of body, inclusive of load, in excess of 8 ft. or with a height from pavement to the top of the vehicle or load of more than 12 ft. 6 in.

When the truck has a trailer the combined weight of truck and load or the trailer and load must not be in excess of 28,000 lb. where the vehicle has four wheels. The axles of trucks must not be closer together than 8 ft. and the weight of four-wheel trucks must be so distributed that no more than 5600 lb. rests on each wheel nor must there be more than 800 lb. of pressure per inch width on the tire of any wheel.

EXHIBITS LONDON TRACTOR

SPRINGFIELD, OHIO, Jan. 23—Before shipping one of its new tractor plows to the Minneapolis show the London Motor Plow Co. exhibited the machine in this city. The exhibition was in charge of E. H. Daniels of London, inventor of the tractor plow. Daniels states that the company will be reorganized and the manufacture of the plow will be started here at an early date.

Trade Is United on Tractor Show

Implement Dealers Give Assurances of Good Selling Year and Place Orders

CHICAGO, Jan. 24 — The seventh annual national tractor and power farming show will be held Feb. 6 to 11 in the New Exhibit building in the Minnesota State Fair grounds midway between Minneapolis and St. Paul. The dates are the same as those of the Twin Cities automobile show, which will be held in the Overland Building; which also is available to the residents of the two cities. A special bus service will be available to visitors of either show to reach the other exhibition.

There has been a tractor show in the Twin Cities for the last several years, but all previous shows have been held as a part of the automobile show. This year the National Association of Farm Equipment Manufacturers decided to make the show entirely independent of other attractions so that the educational feature might be made more important and more closely hold the attention of those who wished to learn this new and important science of farming.

Critics Change Opinion

When the show was first suggested for this section there was considerable division in the ranks of the Northwest Tractor Trade Association as to the wisdom of such a move. Much of this division of opinion it seems was based on the experience at Fargo last summer when the farmers refused to attend a demonstration and a belief that the farmers of the Northwest would not be ready to buy additional equipment before the 1922 crop was harvested. Since the time this was suggested, and the beginning of the year, this opinion has been changed and practically all of the critics are now optimistic as to the show.

One of the factors in bringing about the change of opinion was the meeting of the Minnesota implement dealers last week. These men not only declared that they were going to sell implements this year but they backed up these declarations by placing orders with the jobbers for the instruments. And it is quite surprising that many of these orders were placed with companies that are selling for cash.

Showing of Complete Lines

The nature of the exhibits have not been clearly outlined. It is expected, however, that as space allowance has been ample in most cases complete lines will be shown. Trucks made by implement houses are expected to be quite prominent. There will be at least four new tractors on exhibition.

There is ample evidence that the educative value of the show has made the proper impression in certain quarters. Governor Prues has written a letter warmly indorsing it. A very helpful indorsement has come from the railroads, which have granted a fare of one and one-half fare for the round trip and half of that fare for children, which is said to be the lowest rate ever granted on the Northwestern railroads.

During the show the Society of Automotive Engineers will hold a session at the Radisson Hotel on Thursday. The day will be devoted to the reading of papers and to discussions on subjects of interest to the tractor industry. Standardization will be one topic, and P. M. Heldt, engineering editor of AUTOMOTIVE INDUSTRIES, will read a paper on this topic. There will be a dinner at night.

The same evening there will be a dinner for county agricultural agents and farm bureau men. James R. Howard, president of the American Farm Bureau, will be the speaker. During the week the Minnesota Brotherhood of Threshermen will hold its annual meeting.

December Employment Decline, 6.9 Per Cent

WASHINGTON, Jan. 20—Comparison of employment in 52 identical establishments in the automobile industry, in December, 1920, and December, 1921, by the United States Department of Labor, through the Bureau of Labor Statistics, shows a decrease of 6.9 per cent in the number on the payroll, and a decrease of 2.7 per cent in the amount of the payroll for the period of one week. The 52 establishments show that 94,475 were on the payroll as of December, 1920, and 87,990, in December, 1921. The amount of the payroll in December, 1920, was $2,651,912 as against $2,316,053 in December, 1921. Eight of the 14 industries included in the survey reported increases in the number of persons employed.

A study of the changes in wage rates per capita during the period Nov. 15 to Dec. 15 showed that in the automobile industry as covered by the survey there was a decrease of 4.3 per cent in the per capita earnings due to part-time operation of shops. A decrease of 30 per cent was reported by one establishment, which affected 10 per cent of the men. The wages of the entire force of one plant were reduced 20 per cent.

Malta Offers Good Market for Low Priced Small Car

WASHINGTON, Jan. 23—There is a market for small cars selling for between $500 and $1,000 in Malta, according to Consul Carl R. Loop. American manufacturers are advised to act promptly in the classification of this market, inasmuch as English and Italian exporters are making a strong drive for this business. It is reported that one local dealer has been trying for some time to secure a shipment of small cars, and another has repeatedly failed in his attempts to interest American manufacturers in establishing an agency.

The Automotive Division of the Bureau of Foreign and Domestic Commerce has a list of dealers in the Malta territory.

Hanch Tells Needs for Tax Changes

Points Out to Agricultural Conference How Present Levy Affects Farmers

WASHINGTON, Jan. 25 — Need for repeal of excise taxes on motor vehicles as a means of lowering transportation costs of farm products was emphasized to-day by C. C. Hanch, chairman of the taxation committee of the National Automobile Chamber of Commerce, before a committee on agricultural credit and insurance of the national agricultural conference.

He pointed out that excessive and discriminatory taxes levied against motor vehicles affect agriculture and industry alike. He stressed the fact that elimination of excise taxes on motor vehicles was as essential as the removal of transportation tax on freight and passenger railroad lines.

In the course of his remarks, Hanch said:

Farmers' Costs Increased

About 3,000,000 motor vehicles are owned and operated by the farmers of the United States. The excise tax levied against the motor vehicle is passed along and paid by these farmers whose operating costs are thus increased. Furthermore, the tax on the rubber and repair parts of the motor vehicle is a penalty charged to the misfortune of the owner, the only tax of its kind levied in the United States to-day.

No one to-day will deny the utility of the motor vehicle. In a word, it is simply transportation and just as a charge against freight and passenger travel on the railway was a charge reflected directly in the loss of profits of every farmer in the country, so does the charge against the motor vehicle effect the farmer and in even larger proportion since large quantities of his produce are carried on the highways which never reach the railways, while none may be said to go direct to the railway without traveling on the highway. The repeal of excise taxes on motor vehicles is just as essential as was the repeal of the tax on freight and passenger railroad transportation.

Speaks of Less Production

The second effect is an indirect one but none the less burdensome to the farmer and to industry. Nothing can be done to slow down the productive capacity of a major industry without affecting the prosperity of all. There is no such thing as a non-essential industry. Every industry is essential to those engaged therein and the permanent prosperity of all industries is absolutely contingent upon maintaining substantially general consuming ability.

It should be obvious that any decrease in motor vehicles means a corresponding decrease in the production of all those countless raw materials, rubber, cotton, wool, leather, steel, copper, lumber, etc., which go into the motor vehicle and consequently a narrowed employment which means a narrowed consuming power. Since all use the products of the farm, a restriction on the consuming ability of the nation must be felt by the farmer.

Referendum Favors Adjustable Tariff

United States Chamber of Commerce Membership Votes on Current Policies

WASHINGTON, Jan. 25—A referendum vote by its members on fundamental tariff questions has been completed by the Chamber of Commerce of the United States. The results put the membership on record for policies which would mark important departures from earlier American procedure.

The vote for continuation of present ad valorem duties was 979 as against 833 for instituting an American valuation system. The vote on postponement of tariff legislation was 734 in favor and 1110 against. The chamber can be committed by only two-thirds majority of the votes cast.

The program to which the chamber has been committed includes flexible tariff rates to be administered by a tariff adjustment board; reasonable protection for American industries in destructive competition; maintenance of the anti-dumping principle; encouragement of export trade; measures to meet foreign discrimination.

Adjustable rates already have been proposed by President Harding. The proposal that a new board be created to administer adjustable rates was made with the idea that the tariff commission would make available pertinent facts gathered in its investigations and that the adjustment board should be distinct from a commission making investigations.

Dixie Flyer Makers Will Join Combine

(*Continued from page* 196)

It is believed that all negotiations will be completed within thirty days. The automobile companies figuring in the negotiations are New York, Michigan and Ohio concerns. Under the plan, each stockholder of the wagon company will receive in stock of the new company, 140 per cent of the stock held in the wagon company. The stock will be issued half in 8 per cent preferred and half in common, figured on the net tangible assets of the company. The common is expected to yield about 7 per cent.

The Louisville plant as well as the properties of the other concerns will be appraised by experts with a representative of each of the merged companies present.

The new company will manufacture motor trucks and automobiles, wagons and automobile accessories. All automobile wheels used by the Associated Motor Industries Co. will be manufactured in Louisville, it was said. Each concern in the merger would continue to operate as at present. Employment for 5000 workers, it is hoped, will be provided at the Louisville plant within twelve months. No change in the personnel of the Louisville company will be made.

According to the terms of the consolidation and reorganization plan, the Associated Motor Industries Co. takes over everything belonging to the Louisville company, including its charter, its good will and the rights to use the names: "The Kentucky Wagon Mfg. Co.," the "Dixie Flyer Automobile," "Old Hickory and Studebaker," and names of all other products manufactured by the company.

"Old Hickory" and "Studebaker" are names of wagons manufactured by the company and it is said that the new company will develop the wagon manufacturing activities on an even broader scale than has the present company.

The wagon company's financial difficulties were said to be a result of depression in cotton production districts, the principal market of the company. It is capitalized at $1,400,000.

Sloane Chosen Treasurer of Continental Motors Corp.

DETROIT, Jan. 24—Robert M. Sloane was elected treasurer of Continental Motors Corp. at the annual directors' meeting this week and A. A. Engstrom was elected assistant treasurer. Sloane has been with the company nine years, latterly as assistant treasurer. B. F. Tobin, Jr., was elected secretary and T. M. Simpson, assistant secretary. Both the secretary and treasurer positions are newly created, the work having been done by the executive vice-presidents.

President R. W. Judson was re-elected as were the four vice-presidents, G. W. Yeoman, W. R. Angell, W. A. Frederick and J. E. Bourquin.

L. W. Brice is the new purchasing agent of the company, succeeding H. R. Viot.

Harley Co. Makes Plans for New Type of Tractor

SPRINGFIELD, MASS., Jan. 24—Production at the plant of the reorganized Harley Co. will be under way within 30 days and in order to handle contracts for which negotiations are in progress the company has arranged to occupy additional space in a large manufacturing plant in this city. It is expected both plants will be in operation by July 1. It is further proposed to sublet portions of the contracts.

It is stated that the company will manufacture a new type of tractor and a special cultivator to be used in connection with it. The tractor is to be of such design that it can be fitted with a wide variety of implements now on the market. An extensive line of automotive equipment will be produced. Equipment for gasoline motor cars to be used on established steam railway lines is mentioned as one of the lines of production in contemplation.

A meeting will be held at an early date to choose a board of directors and perfect reorganization arrangements.

May Make All Trade Information Public

Plan Understood to Be Considered by Government Relative to Associations

WASHINGTON, Jan. 24—Announcement by the Government outlining its policy with regard to trade associations is still hanging fire. Attorney General Daugherty states that a new draft has been prepared of a statement which he and Secretary of Commerce Hoover may put out jointly, but added that this had not been agreed upon by any means.

It is the position of the attorney general that the decision of the Supreme Court in the Hardwood case was explicit as to its meaning and that the department cannot afford to discuss a subject that would make courts of the country think it necessary for the Department of Justice to supplement a decision of the Supreme Court.

It is understood that one plan in mind is to have trade associations make information public so as to overcome that feature of the Hardwood decision which condemned the practice of limiting the information to members of the Hardwood association only. This information, it is said, would take on the nature of averages as to production, stock and prices and would not deal with such statistics for individual members of trade associations.

Distribution of Data a Question

It is a question as to how the information would be distributed. Use of the Department of Commerce as the agency for this purpose, it was pointed out, might not be satisfactory on account of the delay incident in preparing the reports and forwarding them to Washington, and also by reason of the time this would require, it is contended that the value of the information would be either greatly lessened or entirely destroyed.

The most logical solution of this problem would be to use the business papers as a means for the distribution of trade information, according to some officials.

Ohio Nut & Bolt to Move from Berea to Louisville

LOUISVILLE, KY., Jan. 25—The entire office force of the Ohio Nut & Bolt Co., which will locate a plant here within the next sixty days, will be moved to Louisville from Berea, Ohio, where the company has operated for the last sixteen years, but its factory forces will be recruited locally. The concern has an annual payroll of $100,000 and employs about 75 men.

The company will manufacture all kinds of bolts under five-eighths of an inch in diameter. A large part of the products will be handled by Louisville jobbers and manufacturers.

Incorporation will be made here with a capitalization of $200,000. H. G. Wilkinson is president of the company.

Improvement Seen in Foreign Trade

Lee, of Commerce Bureau, Says Stocks of Cars Are Well Liquidated

WASHINGTON, Jan. 23—Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce, will leave Washington the latter part of this week on a trip to several automotive centers not previously touched in his work of forming contact with the industry. He will be at Buffalo on Jan. 30, going from there to Chicago, Cincinnati, Dayton and Lima, Ohio, at each of which he expects to spend a day.

"Our export figures show the improvement that has been accorded to our foreign trade," Lee said to-day. "The stocks of cars in foreign centers are well liquidated, as is evidenced by the small but regular shipments to various countries. Viewed in relation to the exports from other producing countries, the percentage of American cars being sold in most of the buying countries has never been larger." He said further:

The automotive division has been functioning about five months and in that time we have formed close contact with more than 100 chief executives of the important automotive firms. Recently, we have had requests for assistance in developing their foreign trade from firms which three or four months ago had absolutely no idea as to going after foreign trade. These companies have sensed the conditions aright and are seeking now to enter this field.

As a result of deflation, intensive sales methods have been developed in foreign countries. In several places, for instance, the method of time sales of passenger cars, so common in this country, has been adopted in order to cut down the stocks that were so large the first part of 1921 and, thus, we have gained something of much importance from that once-serious situation.

The New York show revealed that our industry, so far as it pertains to foreign trade, had gotten its feet down on the ground and was ready to go after business as never before. The fly-by-night exporter has gone and in his place has come those companies which are seeking to develop foreign sales through the practice of sound, honest and fair merchandising methods.

Detroit Factory Branch Opened by Martin-Parry

DETROIT, Jan. 20 — Martin-Parry Corp. has located a factory branch in Detroit as one of 29 similar branches the company is now operating throughout the country. The purpose of the branches, in addition to handling sales of commercial bodies, is to give immediate service on replacements of parts of the bodies.

The Detroit branch takes over the business conducted by Schoof-Gracey Body Co., formerly distributor for the company. The same personnel will continue, A. F. Schoof as service manager and C. W. Gracey as sales manager. R. P. Henderson, vice-president of the corporation, will make his headquarters at the Detroit branch.

Branches in addition to Detroit thus far located are in Boston, New York, Buffalo, Chicago, Atlanta, Dallas, Houston, San Francisco, Kearny, N. J., St. Louis, Kansas City and Cleveland. The remaining branches will be located during 1922.

The factories of the company at York, Pa., and Indianapolis will ship to the branches bodies of standard to light truck chassis in knockdown condition. These bodies are now so made that any damaged part may be replaced immediately, all parts being carried at the branches complete. The branches in addition will manufacture special bodies to order and will also service all makes of bodies.

Battery Sales Increase Through Show Stimulus

PHILADELPHIA, Jan. 24—Automobile shows have encouraged the industry here to expand the volume of orders of batteries, according to Herbert Lloyd, president of the Electric Storage Battery Co. November and December, he said, brought very little automobile business. He denied the rumor that the company contemplated consolidation with another large battery manufacturer.

While there is but little buying in advance, orders recently have taken a steady pace and Lloyd expects greater demands later from this quarter. Users, other than automobilists, are maintaining normal demands and replacement is fair. Foreign business shows no improvement over last year. Lloyd added that no new types of batteries or price revisions were contemplated by the company. Prices of Exide batteries were reduced 28 per cent, effective Jan. 1, 1921.

BANKS WILL AID FARMERS

SPRINGFIELD, OHIO, Jan. 23—W. S. Thomas president of the Mad River National Bank and of the Thomas Manufacturing Co., announces that the National banks here are ready to accommodate farmers under the War Finance Corp. Motor truck manufacturers feel that this corporation will benefit them, as it will enable the farmers to secure loans so that they can enter the market. The Springfield plant of the International Harvester Co. is turning out 50 high-speed trucks daily with shipments made steadily.

HARTFORD GETS MORE TIME

HARTFORD, CONN., Jan. 24 — The stockholders protective committee which is trying to work out a reorganization plan for the Hartford Automotive Parts Co. has been given until March 20 to frame its proposal. The creditors' protective committee has been given permission to present its offer between now and March 20. If neither of these plans materializes, the sale of the assets at public auction will be taken up.

S. A. E. to Discuss Service Problems

Two Technical Sessions Will Be Held in Chicago During Show Week

CHICAGO, Jan. 23—As in former years the Society of Automotive Engineers will hold a series of technical meetings and a dinner during the week of the Chicago show. The technical sessions will be held at the Chicago Automobile Club, beginning at 10 o'clock in the morning and will be devoted to automotive service and maintenance subjects in general.

On Friday, Feb. 3, the Society members and friends are scheduled to visit the Ryerson Physical Laboratory, where at 8 p. m. Prof. H. B. Lemon of the University of Chicago will present a paper on "Modern Ideas on the Nature of Matter."

The dinner will be at the Drake Hotel, Harry Horning of the Waukesha Motor Co. acting as toastmaster.

To Discuss Owner Criticisms

The technical sessions will be held on Feb. 1 in the rooms of the Western Society of Engineers, Monadnock Building. B. M. Ikert, technical editor of *Motor Age*, will present a paper pointing out some of the criticisms of present-day cars which are voiced by repairmen and owners.

J. F. Page, service manager of the Packard company of Chicago, will make an address on the problems of the man who faces the car owner when repairs are made. His talk will deal largely with commercial or executive matters and not the engineering details.

Another paper will be read by C. B. Veal which describes a novel plan of building commercial car bodies so that they may be repaired at less cost and without serious delay. This will be followed by a paper from H. C. Buffington of the Weaver Mfg. Co., maker of special garage tools and automotive repair equipment.

R. H. Grant, general manager of the Delco Light Co., will carry an unusually pertinent message to the S. A. E. members in his talk at the dinner on "How the Engineer Can Help Business at This Time."

Banker to Speak

Commercial and financial logic will form the basis of the talk to be given by H. M. Byllesby, president of the H. M. Byllesby Co., bankers of Chicago. He has chosen as his subject, "The Business Situation in Relation to the Automotive Industry."

Tickets for the dinner will be on sale during show week at the society headquarters in the lobby of the Hotel Blackstone. All members of the society will also be obliged to visit this headquarters in order to have their railroad reduced fare certificates validated on Jan. 31 or Feb. 1.

December Exports Approached $7,000,000

Upward Trend of Trade Indicated—Passenger Car Shipments Form Chief Item

WASHINGTON, Jan. 23—The foreign shipment of American made automobiles, trucks, parts and equipments and tires totaled almost $7,000,000 for the month of December, according to advance figures issued by the Bureau of Foreign and Domestic Commerce, through its new automotive and rubber divisions. All branches of the trade, except tires, showed a healthy increase over the preceding month, the figures proving the belief that American export trade is again in the ascendency.

2646 Cars Shipped

The chief item in this large total, which exceeds the value of the combined shipments since the early part of 1921 when delayed shipments on old orders were still going forward, was passenger cars. A total of 2,646 cars was shipped out of the United States during December, a gain of practically 600 over the preceding month. The increases, however, extended to trucks and parts, both of which aided materially in running up the larger volume of overseas shipments for the closing month of the year.

The detailed figures show:

1921	Cars	
December	2,646	$2,355,282
November	2,075	1,847,190
	Trucks	
December	511	$495,790
November	427	364,394
	Parts	**Tires**
December	$2,683,850	$1,391,625
November	2,546,424	1,577,678

Subject to Revision

These figures are possibly subject to some revision, particularly those relating to tires, but they are sufficiently close to the totals that will officially be announced within a few days to show that American foreign trade is steadily pointing upward. Unfortunately, however, they do not present a complete picture of this trade, because General Motors began in December the shipment of Buick and Chevrolet cars from the Canadian factories to several countries, such as Argentina, to which shipments previously had been made from the United States. The trade, of course, is familiar with the fact that Ford, General Motors and other companies having Canadian factories have shipped for many years from that country to the British Dominions, because of preferential tariffs or other reasons.

These shipments never have shown on the official United States statistics. Now General Motors has undertaken shipments to other than British countries from its Canadian plants and officials of that company are authority for the statement that the December exports from Canada, particularly to several of the South American countries, reached large totals. The improvement in General Motors shipments has been one of the manifestations of the bettered world-wide business situation which is sending upward the curve of automotive exports.

New Form of Tabulation

With the December figures, the Commerce department ends its tabulations upon the base of complete cars or trucks and chassis. Beginning with January, the figures for which will come out during the latter part of February, the shipments will be shown in three price classifications on cars and three tonnage capacities for trucks. Details of the December figures were:

	Trucks		Cars	
	No.	Value	No.	Value
Complete	161	$173,595	1,784	$1,709,264
Chassis	350	322,195	862	646,018

The tire shipments were divided as follows: Casings, $1,193,160; inner tubes, $98,553, and solid tires, $99,912, the latter division showing an increase of about $11,000 over November. The chief countries to which the tire exports went were England, Argentina, Canada, British South Africa, Mexico, New Zealand, Cuba, Dutch East Indies, Sweden, Philippine Islands, Spain, Australia, Denmark and Chile.

EXPORTS OF AUTOMOTIVE PRODUCTS FOR NOVEMBER AND DECEMBER 1921

Washington, Jan. 24—The following table shows the automotive exports for the last two months of last year as compiled by the Bureau of Foreign and Domestic Commerce of the Department of Commerce:

	November, 1921			December, 1921			Per cent of increase (+) or decrease (—)	
	Number	Value	Unit Value	Number	Value	Unit Value	Number	Value
Passenger cars	2,075	$1,847,190	$890	2,646	$2,355,282	$890	+28	+28
complete cars	1,616	1,509,143	934	1,784	1,709,264	958	+10	+13
Chassis	459	338,047	736	862	646,018	749	+88	+91
Motor trucks..	427	364,394	853	511	495,790	970	+20	+36
Complete cars	226	192,094	850	161	173,595	1,078	—29	—10
Chassis	201	172,300	857	350	322,195	921	+74	+87
Parts of cars and trucks....	...	2,546,424	...	...	2,683,850	....	....	+05
Motorcycles ...	500	144,696	289	863	250,457	290	+73	+73
Airplanes	...	.....	...	4	35,000	8,750	....	....
Airplane parts.	...	19,173	...	...	1,480	....	....	—92
Total.....		$4,921,877			$5,821,859			+18

Pabst Corp. to Produce Valve Rotating Device

MILWAUKEE, Jan. 23—Production of a valve rotating device for poppet valve engines, which has been in experimental processes for several years, is one of the new lines of activity being undertaken by the Pabst Corp., formerly the Pabst Brewing Co., which has recently reorganized its ownership and management.

Col. Gustave Pabst, son of the founder, has retired as president and is succeeded by his brother, Frederick Pabst. Harry W. Marsh, secretary-treasurer, becomes vice-president and general manager.

Supports Federal Export Fund Plan

Industry Backs Effort to Obtain Appropriation Approved by Director of Budget

WASHINGTON, Jan. 26—Various automotive export organizations have announced that they will support the program of the Department of Commerce for increased appropriations which will be used for foreign trade promotion. Practically the entire industry is behind the Department in the latter's efforts to obtain the full appropriation as approved by the Director of the Budget, a movement which was instituted by the National Automobile Chamber of Commerce.

It is understood that the General Motors Export Corp. will take definite action to emphasize the utility of the Department to the business interests of the country. The Pierce-Arrow Motor Car Co. is leading a movement among foreign trade and export clubs and the Chamber of Commerce of the United States for this purpose.

The success which has marked the efforts of the automotive division under Gordon Lee is responsible for the action of the Foreign Trade Committee of the N. A. C. C. to pay the salary of one male clerk to the chief of the automotive division and one research assistant, effective Feb. 1.

SEES GREATER ALUMINUM OUTPUT

WAUKESHA, WIS., Jan. 23—A. C. Pankratz, vice-president of the Werra Aluminum Co., manufacturing aluminum castings, expresses the belief that following the New York, Chicago and lesser of the shows being held this month and next, the automotive industries will produce a large volume of orders which will enable aluminum casting companies to extend their production schedules.

MEN OF THE INDUSTRY

William J. Cleary has been appointed assistant general sales manager of the Sharon Pressed Steel Co. with headquarters in Detroit. His duties will cover the automotive industry in general. Cleary will take up his work Feb. 1. He spent 12 years with the Studebaker Corp. as assistant general purchasing agent and for the past two years has been general purchasing agent of the Willys Corp. with headquarters at Elizabeth, N. J.

W. D. Blatz has been appointed general sales manager of the Bridgeport Brass Co. Blatz joined the company in 1915, after having had twelve years experience in the banking and brokerage business. **J. H. Brooks** has become sales manager of the automotive accessory department of the company. Since 1906 he has been associated with the automotive industry and for the past eight years has been special representative of the American Chain Co.

C. W. Hadden, actively connected with the Minneapolis Steel & Machinery Co. since 1917, has been made assistant to President W. R. Wilson of the Maxwell Motor Sales Corp. in Detroit. In 1918 Hadden took over the New York office of the Minneapolis company, for two years was manager of foreign sales with headquarters abroad and since last May has been organizing the export department in the home office.

Gregory (Gig) Flynn has resigned as vice-president and director of Edward A. Cassidy, Inc., New York. He went with that company four years ago from the Rajah Auto Supply Co., which he served for ten years, part of the time as sales manager. Flynn has not announced his plans for the future, but it is understood he intends to leave the automotive industry for some time.

John C. Hill, formerly export manager of the Westcott Motor Car Co., has become associated with the Maxwell Motor Sales Corp. and Chalmers Motor Car Co. as special sales representative in foreign fields. Hill has gone to Mexico City, where he will make his headquarters and will cover Mexico and Central America for the Maxwell-Chalmers interests.

R. Norman Miller, formerly of the Willys-Overland Corp., has been appointed director of sales of the Stewart Storage Battery Co., organized several months ago at Marshfield, Wis., and now manufacturing storage batteries. An active sales campaign will be inaugurated covering the entire United States and several foreign countries.

H. B. Price, formerly advertising manager of the Belden Manufacturing Co., Chicago, and associated with that company for several years in various engineering, production and sales capacities, has resigned, to join the advertising agency of George J. Kirkgasser & Co. He will specialize in electrical and technical advertising.

Ralph S. Wiltrout, formerly of the Stewart-Warner Speedometer Corp., the Crow-Elkhart Motor Corp. and the Huffman Bros. Motor Truck Co., has become general manager of sales of the Ogren Motor Car Co., Milwaukee, with **Foster D. Miller,** formerly of the Barley Motor Car Co., as assistant.

A. M. D. Martin has resigned as assistant general manager of the Adria Motor Car Corp., Batavia, N. Y. He was formerly general manager of the Gray Machine & Parts Corp. While he has not announced his plans for the future, he expects to locate permanently in Buffalo.

J. L. Justice, vice-president and general manager of the Edward H. Baker Corp., Buffalo, has resigned, to take an executive position with the Maxwell-Chalmers organization. He was formerly eastern supervisor for these companies and prior to that served as Pacific coast supervisor.

Julian S. Friede has resigned his position as body engineer with the Moon Motor Car Co., St. Louis, a position he has held for the last two years, to enter the retail merchandising business in Texarkana, Texas.

Harry R. Viot, for many years purchasing agent of the Continental Motors Corp., is now connected with the Werra Aluminum Foundry Co., Waukesha, Wis., in the capacity of sales manager.

Ernest R. Fried has been appointed passenger car engineer of the Pierce-Arrow Motor Car Co., Buffalo, in place of D G. Roos, who has become chief engineer of the Locomobile Co.

W. Y. W. Rabb, foreign sales manager for the Pierce Motor Car Co., has resigned his position, effective Feb. 1. Rabb will open offices in Buffalo as foreign trade adviser to several firms.

Martin Gomez will leave the Pierce-Arrow Motor Car Co. Feb. 1, to return to Colombia, where he will establish an automobile agency.

Government Sets Lincoln Tax Due at $610,000

DETROIT, Jan. 25 — Lincoln Motor Co.'s tax obligations to the Government have been definit ly set at $610,000. Official confirmation of the amount was received to-day from Washington by Fred L. Woodworth, Collector of Internal Revenue. The Government originally had entered a claim of $4,500,000.

Judge Tuttle, at the request of counsel for the Detroit Trust Co., receivers for the company, to-day issued an order making the back taxes a preferred claim. He also issued an order permitting the Detroit Trust Co. to issue receiver's certificates, not to exceed $500,000, to operate the Lincoln plant.

CUBITT SHOWS LOSS

LONDON, Jan. 14 (By Mail)—The year's report of the Cubitt Engineering Co. of Aylesbury, manufacturer of the Cubitt car, discloses a gross loss of £79,368 up to July 31, 1921, of which £15,749 represents the carryover of the preference dividend to June 30, 1920. The management has reduced its inventory to current market values and generally has placed matters on a rock bottom price basis.

Major Dodson, managing director, is now on a tour of the world.

OAKLAND RESUMES OPERATIONS

DETROIT, Jan. 23—Oakland Motor Car Co. division of General Motors Corp. resumed operations to-day after a month's closing for inventory and re-equipment of the factory to manufacture its new models. Business resulting from the New York and Buffalo shows, as well as sales in other sections, has been heavy and the factory will operate on a schedule which will produce 3800 cars in February.

Winton Co. Makes Big Cut in Price

Ranges from $1,200 on Roadster and Touring to $1,950 on Victoria

CLEVELAND, Jan. 23—Sweeping reductions in the prices of its various models are announced by the Winton company. They range from $1,200 on the roadster and touring to $1,950 on the victoria. The schedule follows:

	Old Price	New Price
Roadster	$4,600	$3,400
4-passenger Touring	4,975	3,600
7-passenger Touring	4,600	3,400
Coupe	5,950	4,450
4-passenger Sedan	5,950	4,450
Victoria	5,950	4,000
7-passenger Sedan	6,200	4,550

Franklin to Announce Price Increase of $100

SYRACUSE, Jan. 23—An increase of $100 in the price of Franklin automobiles is to be announced within a short time. It is said that dealers have already been notified of the increase. Officials of the company refused to discuss the matter.

H. H. Franklin, president of the H. H. Franklin Mfg. Co., when asked about the increase said: "The public is not so much interested in whether the price is going up or down, as it is in whether or not the market will be stabilized."

Moon Builds Smaller Six; Will Be Priced at $1,295

ST. LOUIS, Jan. 24—The Moon Motor Car Co. is bringing out a smaller and lighter six to be known as the 6-40. It will be shown for the first time at the Chicago automobile show.

The engine is a Continental Red Seal 3⅛ x 4¼. The wheelbase is 115 in., smaller than either the 6-48 or 6-68. Other standard units used in the construction are Delco, Rayfield, Exide, Spicer, Borg & Beck and Fedders. At present only the open cars are coming through, but closed jobs will be put through shortly, at which time the price of the enclosed models will be announced.

FORD CANADIAN PRICES

TORONTO, Jan. 23—The Ford Motor Co. of Canada has announced reductions on Ford models somewhat larger than those made in the United States. Price of the sedan is cut $60 to $930; the coupe $50 to $480; the truck chassis $40 to $575, and the touring car is lowered $30 to $535.

WITT-WILL PRICES CUT

WASHINGTON, Jan. 23—The Witt-Will Co. Inc., has announced a reduction of $500 on its 1½-ton and 2½-ton trucks. The former now lists at $2,250 and the latter at $2,750.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During the past week, call loans covered a range of 3½ per cent to 6 per cent, as compared with 3 per cent to 4 per cent in the previous week. On Monday, while a low figure of 3½ per cent was quoted, there was a brief flurry which carried call rates up to 6 per cent. On Thursday, the high was again 6 per cent, and on Friday all loans on call were put through at 5 per cent. For fixed date funds, the situation was quieter and there was a lessening in the amount of offerings. The range moved up to 4½ per cent to 4¾ per cent as compared with 4½ per cent in the previous week. Prime commercial paper rates remained unchanged at 4¾ per cent to 5 per cent.

The Federal Reserve statement of Jan. 18, 1922, showed the following reductions: $64,122,000 in Federal Reserve notes in circulation, $65,482,000 in the holdings of discounted and purchased bills, and $57,866,000 in total earning assets. Total deposits, on the other hand, showed an increase of $7,988,000, and total reserves an increase of $10,209,000, of which gold reserves constituted $3,103,000. The reserve ratio registered an increase from 74.7 per cent to 76 per cent.

The New York institution showed a decline of $16,656,000 in total reserves, and a decline of $7,089,000 in total bills on hand. Total deposits decreased $15,679,000, and Federal Reserve notes in circulation $14,538,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 86.9 per cent to 87.6 per cent.

During the past week, there were 71 fewer failures in the United States than in the previous week, which may be taken as an indication that the amount of failures due to year-end settlements are receding.

The year 1921 has proved to be a record-breaking year in the building industry. According to the statistical summary for 164 cities, building expenditures for the last three months in 1921 showed an increase of 89 per cent over the corresponding period in 1920; those for the third quarter an increase of 40 per cent.

During the past week two additional foreign bond issues were made in this market, when $25,000,000 20-year 7 per cent external gold bonds of the department of the Seine, and $3,500,000 40-year 8 per cent gold bonds of the city of Porto Alegre, capital of the State of Rio Grande do Sul in Brazil were sold by banking syndicates.

CORRECTION

NEW YORK, Jan. 25—The statement was made in the Jan. 19 issue of AUTOMOTIVE INDUSTRIES that an announcement had been made by Colonel William Guy Wall, vice-president and chief engineer of the National Motor Car & Vehicle Corp. of Indianapolis, that Columbia prices had been guaranteed to April 1. This obviously was an error as the guarantee referred to the National cars and not to the product of the Columbia Motors Co., which has no connection with National. The announcement of the National guarantee was made by the Poertner Motor Car Co., which also is the metropolitan distributor for Durant cars.

B. F. Goodrich Declares Preferred Dividend $1.75

NEW YORK, Jan. 25—Following a meeting of the directors of the B. F. Goodrich Co. to-day a preliminary statement was issued covering the company's position at the close of business Dec. 31, 1921. Total sales approximated $87,000,000 and the loss was about $9,000,000, due chiefly to further heavy decline in the market values of raw materials which required additional adjustment of inventory valuation at the close of the year.

Current assets were put at $51,500,000 as of Dec. 31, 1921, and current liabilities at $3,300,000. It was stated that the company entered the year 1922 with no bank indebtedness, against bank loans of $29,000,000 a year ago. Officials say that combined inventories of rubber and fabric on hand and under contract have been adjusted to the market values as of the close of 1921.

Directors declared the regular quarterly dividend of $1.75 a share on the preferred stock, payable April 1 to stockholders of record March 22.

Pietsch Will Direct Sales of Kelly Truck

SPRINGFIELD, OHIO, Jan. 25—Frank Pietsch of Chicago has been appointed sales manager of the Kelly-Springfield Motor Truck Co. and has already taken charge of the new sales organization.

Pietsch was formerly manager of the National truck division of the Packard company with headquarters at Detroit. He was also at one time manager of the White company's branch in Chicago and comes highly recommended to the Kelly-Springfield Motor Truck Co. Grayson F. Lathrop has been appointed assistant sales manager and R. B. Fuller as national accounts representative in the East, with headquarters at 120 Broadway, New York. Lathrop has been identified with the Kelly organization for seven years. Fuller was formerly in charge of the West Indies export business of the Armours.

HARES-TRAYLOR PLANS

NEW YORK, Jan. 25—If negotiations which now are pending are successful, Hares Motors will take over the sale of the line of trucks made by the Traylor Engineering & Mfg. Co. of Cornwallis, Pa. Final details of the contract have not been worked out but it is expected the plan will go through successfully in the near future.

FINANCIAL NOTES

J. I. Case Plow Works for the 15-month period ending Sept. 30, 1921, shows a total loss before Federal taxes of $2,985,797, as compared with a surplus of $673,365 before taxes for the year 1920. After an inventory shrinkage of $1,244,543 in adjustment to current replacement values inventories stood at $3,890,600. The company started its new year with inventories written to market replacement costs. For the first half of the year the company reports that orders were very heavy, more business being written from June to February than was written during the entire previous year.

Ninigret Co., recently combined with the Fisk and Federal companies, has filed a certificate with the Commissioner of Corporations in Boston stating that a reduction has been made in capital from $4,000,000, consisting of 35,000 shares of preferred stock par $100 common and 100,000 shares common par $5, to $100,000, divided into 20,000 shares of common stock of $5 par. The reduction has been effected by the cancellation of all the authorized and issued preferred stock and 80,000 shares of common.

Ajax Rubber Co. for the first nine months of 1921 shows a loss, before providing adjustment of inventory and commitment valuation, interest on borrowed money and Federal taxes, of $2,446,642. Total loss for the period, after interest, adjustment of inventory and other charges, was $2,966,445. The profit and loss surplus on Jan. 1, 1921 was $1,615,480, so that the deficit of $3,966,445 for the nine months caused a profit and loss deficit of $2,350,964 as of Sept. 30, 1921.

Yellow Cab Co. has voted to place dividends on a 33⅓ cents monthly basis instead of a quarterly one. After Feb. 1, when a quarterly dividend of $1 a share will be paid, the rate will be 33⅓ cents a share monthly. John Herz has been re-elected president and Charles H. Ritter was chosen treasurer. Edward N. D'Ancona, general counsel of the company, has been made secretary.

Russel Motor Car Co., Ltd., Toronto, has declared a quarterly dividend of 1 per cent on the common stock. This compares with previous quarterly declaration of 1¾ per cent. The regular quarterly dividend of 1¾ per cent on the preferred stock has also been declared. Both dividends are payable Feb. 1 to stock of record Jan. 23.

Willys Corp. receivers, C. O. Miniger, F. P. Dennison and Francis G. Caffey, have been authorized by Judge Killits in United States district court at Toledo to employ an auditor to make a general audit of the books of the corporation and report back to the court.

Parish & Bingham Corp. reports inventory was reduced 62 per cent during the ten months to Oct. 31, 1921, and notes payable dropped nearly $1,000,000 during the year. Gross sales in 1921 were 46.7 per cent of those in 1920.

Auburn Automobile Co. directors have authorized cancellation of 2,000 shares of preferred stock, par $100, redeemed during 1921 in anticipation of redemption requirement to Jan. 1, 1925.

Hart-Parr Co. balance sheet as of Oct. 31, 1921, shows a deficit of $807,767; total current assets, $930,806 and total current liabilities, $160,835.

Martin-Parry Corp. has declared a regular quarterly dividend of 50 cents a share on capital stock, payable March 1 to stock of record Feb. 15.

INDUSTRIAL NOTES

Powertown Tire Corp., Rochester, reports that the volume of tires manufactured in 1921 was more than 300 per cent greater than for the preceding year. One hundred persons are employed, capable of turning out 150 tires a day. At the third annual meeting Thomas J. Costello was chosen president; H. J. Crowder, vice-president; Ernest W. Ewell, treasurer; A. M. Johnson, secretary, and E. O. Benning, director. **Powertown Sales Co.**, a subsidiary, elected, at its annual meeting: A. M. Johnson, president and treasurer; J. B. Corcoran, vice-president, and Arthur E. Hagen, secretary. Both companies have declared a 3½ per cent dividend.

Minneapolis Steel & Machinery Co. has reopened its foundry and in a month will open its machine shop. Castings made in the foundry will be ready for the machine work in less than one month. President George M. Gillette states that the last thirty days have been the best the company has enjoyed in the truck business. Many orders have come from cities for trucks for road building. In the first fifteen days of January the general business of the company equaled that of January, 1921.

Hayes Wheel Co. of New York has been formed with branches in Chicago and San Francisco. The company announces the appointment of Donald Ganiard as the manager in that city. Roy H. Voss heads the organization at San Francisco and C. E. Giltner at Chicago. The company expects to enlarge its production schedule through supplying wire wheels to automobile manufacturing companies other than those now being taken care of.

Sterling Metal Products Co., organized recently at Racine, Wis., to make automotive and other metal specialties, has acquired the entire assets of the Splitex Radiator & Manufacturing Co., which made an assignment to Richard G. Harvey in favor of creditors. The Sterling company will undertake the manufacture of Splitex radiators for passenger and commercial cars, tractors, etc.

Wright Roller Bearing Co. receivers are making arrangements to resume operations at the factory of the company in Philadelphia. The receivers, Harry W. Champion and William B. Stratton, were authorized by the court at the time of their appointment to carry on the company's business.

International Harvester Co. has resumed the operation of its Milwaukee works, specializing in tractors, farm engines, etc. The force is now 1300 with hopes of increasing this number to 1500 by Feb. 1. The largest number ever employed by the Milwaukee works is 5000.

Colonial Tire & Rubber Co. stockholders have organized a protective committee for the purpose of investigating the business affairs and management of the company. Nathan Doyle, 121 West Sixty-ninth Street, New York City, is chairman.

Du Bois Tire & Tube Co. has completed installing all machinery in its new plant at Chattanooga, Tenn., which is now in full operation. Company officials state that the entire first year's output has already been sold.

Franklin Automobile Co., reports that during 1921 sales of closed cars exceeded the sales of open cars for the first time in the company's history. Fifty-two per cent of Franklin business last year was in closed cars.

Strong Textile Co., 245 West Fifty-fifth Street, New York City, has consolidated with **William Wiese Co.** and will operate hereafter under the name of William Wiese & Co. at 234 West Fifty-sixth Street, New York.

Victor Screw Works, Inc., and **Peninsular Milled Screw Co.** announce a consolidation under the name of Victor-Peninsular Co. After March 1 the firm will occupy its new factory in Detroit.

St. Louis Car Co.'s annual meeting of stockholders, scheduled for the fourth Tuesday in January, has been postponed.

Car Show at Cleveland Is Making Fair Sales

CLEVELAND, Jan. 25—The Cleveland Automobile Show is drawing the largest crowds in local show history and sales are being made in fair numbers, but by only a few exhibitors. There is evidence of a narrowing of interest, at least as far as actual business is concerned, to some of the better known cars and to some cars in the second class of popularity but with particularly good local representation.

Cars whose manufacturers have done least in the way of price changing during the past year also seem to be receiving more general attention. The crowds and the large listing of prospects indicate, as at earlier shows, a latent demand for cars but dealers in virtually all lines confidently expect to turn these prospects into customers as soon as price stabilization is effected.

Legislative Committee Suggests Truck Measures

ALBANY, Jan. 25—Creation of a new state department for the regulation of motor vehicle traffic is recommended in a report submitted to the legislature by a joint committee appointed to investigate the causes of automobile accidents and propose remedial legislation. The report finds that overloading of trucks and their operation at excessive speed is one fruitful cause of accidents and also tends to destroy highways. It is asserted that all trucks should be limited as to load and speed. Defective and inadequate equipment is listed as another direct cause of many accidents.

As remedial measures the report proposes: compulsory bonding by every motor vehicle owner as security to others; compulsory insurance against liability to others; compulsory compensation insurance to cover all causes of injury to persons or property.

PACKARD TRUCK SALES GAIN

NEW YORK, Jan. 25—Lee J. Eastman, president of the Packard Motor Car Co. of New York, in a comparison of Packard truck sales and deliveries for the last three months of 1921 with those of the preceding year, states that sales were practically doubled during the latter period, that during December the sales were 100 per cent better than for that month in 1920 and that deliveries for the month were 52 per cent greater.

METAL MARKETS

Accentuated as the easy tone of the steel market has become in the last few days, it is very easy to misinterpret this condition. Producers, while eagerly competing for every ton of orders, are making concessions only on specified tonnages and appear eager to safeguard the prevailing market quotations. Concessions are relatively more difficult to obtain on sheets than on other steel products, due to the fact that sheet mills are operating at a far better rate than other branches of the industry. In spite of the readiness of many producers to shade quoted prices on most steel products when tonnages, deliveries, and specifications are inviting, sellers have the market well in hand and, if the present drive for larger orders should not be successful, it is quite likely that concessions will disappear.

Meanwhile it is psychologically interesting to note that the steel producers are convinced there will be no higher steel prices in 1922 than those now prevailing. Some of them even go so far as to make this statement for publication.

In the aggregate a considerable amount of automotive steel buying is hanging fire. Large orders have been placed, however, for full-finished sheets with the result that this commodity is looked upon as the strongest in the list of steel products. Stocks of alloy steels and cold-drawn products in consumers' hands are reported to have dwindled to such slight proportions that fresh buying has become a matter of compulsion. Alloy steel makers assert that the prices they are now quoting are rock bottom until their rate of operations is perceptibly increased through a larger volume of orders or until freight rates come down. It is surprising, however, how much "fancy" steel is still being offered by second hands. As a rule these offerings consist of specifications, descriptions and sizes which consumers do not hanker after, but the prices at which this material is offered exert, nevertheless, a depressing influence on the market.

Pig Iron.—A fair demand for malleable and foundry iron is noted from automotive foundries. The volume, however, is not impressive and most of the business consists of carload sales.

Steel.—Producers of both hot and cold-rolled strip steel claim to have received a number of contracts covering the first three months of the current year, the automotive industries leading other consumers. Although the tonnages involved are said to be modest, the contrast of this buying with the utter lack of demand that prevailed a few months ago is imparting a very cheerful tone to the strip steel market. A similar betterment is noted in cold-drawn steel bars for which contracts, ranging from 100 to 1,000 tons have been booked for delivery over the next ten weeks. In some of these transactions buyers are said to have obtained concessions of $1 to $3 a ton from the prevailing quotation of 2.00 @ 2.15¢, Pittsburgh base. Automotive demand for bolts and nuts continues extremely light.

Aluminum.—A fair-sized business in foreign sheets is reported. The market is irregular. Sheets, such as automotive consumers buy, are fairly steady while ingot metal is a shade weaker. Large tonnages of the latter remain in warehouses awaiting quickened demand.

Copper.—The smaller producers are cutting under the price quoted by the large interests.

Calendar

SHOWS

Jan. 28-Feb. 4—Chicago, Automobile Salon, Hotel Drake.

Jan. 28-Feb. 4 — Chicago, National Automobile Show, Coliseum, Auspices of N.A.C.C.

Feb. 6 to 11 — Seventh National Tractor Show and Educational Exposition, Minnesota State Fair Grounds, Minneapolis.

Feb. 6 to 11 — Winnipeg, Can., Automotive Equipment Show, Western Canadian Automotive Association.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

CONVENTIONS

Jan. 30-31—Chicago, Fifth Annual Convention, N. A. D. A., La Salle Hotel.

Jan. 30-Feb. 2—Boston, Sixth Annual Conference of the International Delivery Association, Copley Plaza Hotel.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Feb. 24, Mar. 24, April 28, May 26.

Chicago, Feb. 1

Minneapolis, Feb. 8-9—Annual Tractor Meeting.

New Trucks Shown at Roads Exhibit

Annual Display of Highways Building Material Finds Buyers Fewer Than Formerly

CHICAGO, Jan. 23—An estimated attendance of from 10,000 to 12,000 road engineers, contractors, State and county highway officials and members of highway associations, a greater variety of exhibits and dull interest in buying equipment marked the twelfth annual good roads congress and show which has just ended.

The road-making machinery exhibits were more complete than ever before and were given especial care and thought because of the belief among manufacturers that contractors would be in the market with a large volume of business. The buying power of those in attendance, however, did not develop into anything like the proportions of former years.

The truck manufacturers represented at the show included: Reo, Autocar, Republic, Titan, G. M. C., Parker, White, Fageol, Mack, Stoughton, Indiana, Ford, Cook, Kissel, Schacht and Four Wheel Drive. The old contention as to whether the heavy duty or light duty truck is better adapted to road-making work was very much in evidence.

Resolutions Adopted

Reo fitted up a Speed Wagon with scraper and hoist body. This was one of the new machines at the show and was the center of much interest. Another new machine was the Cook 2½-ton truck, a product of the Cook Motors Corp., Kankakee, Ill. This truck, made from standard parts, is not in production as yet.

Before the delegates to the Good Roads Congress the big questions lay in the financial, legislative and engineering aspects of improved highway construction.

Alfred Dryland, highway engineer of Middlesex, England, told the congress that American roads were dangerous because of their narrowness and predicted that at the rate of increase in American highway transportation it would not be a great while before roadways 150 ft. wide would be necessary.

In face of this prophecy, Clifford S. Lee, of the resolutions committee, offered a resolution that met with the almost unanimous approval of the congress declaring for a minimum roadway of 20 ft.

The association also approved these additional resolutions:

Petitioning the Interstate Commerce Commission to reduce freight rates on roadbuilding materials.

Recommending the removal of interurban tracks from public highways.

Indorsing the principal of Federal aid to states in highway financing.

Endorsing the Woodruff bill, now before Congress, asking for $100,000,000 for Federal aid purpose in highway construction for each year for five years beginning July 1, 1922.

Condemning speeding on country roads and asking for better police protection and regulation in country districts.

Spain Amends Tariff On Automotive Imports

LONDON, Jan. 8 (*By Mail*)—Following the issue in July of the draft of the revised Spanish import tariff, the markedly increased rates sought to be imposed caused a wide protest in Britain and a request for amendment. A provisional tariff has since been in vogue, but a revised rate is expected to be stabilized commencing Jan. 20.

The following figures show that the expected revisions mean a reduction of 50 per cent on the duty as first proposed, the figures in the second column denoting the new rates.

	Per cent ad val. 1st tariff	2nd tariff
Internal combustion engines		
(a) weighing up to 1,000 kilos..	50	25
Over 1,000 kilos.....	30	15
(b) Driven by liquid fuel		
With one or more cylinders up to 1,000 kilos.....	50	25
Over 1,000 kilos.....	30	15
(2) With more than two cylinders	50	25
Automobiles up to 20,000 pesetas	30	15
More than 20,000 pesetas.....	40	20
Wagon, coaches, etc.....	20	15
Frameworks (armaduras) without motor	40	20
Bodies	60	30
Bodies for airplanes.....	60	30

Shipment of Tires Started for Europe

Goodyear Makes Largest Consignment to Distributor—Akron Output Gains

AKRON, Jan. 21—One of the most positive signs of the return of the tire industry to normal is found in the shipment of pneumatic and solid motor truck tires made out of Akron this week to the Atlantic seaboard for export to Europe.

The shipment is the largest ever made out of Akron to a single distributor, and is the second largest in the city's history. It consisted of 23 freight cars and represented a value of nearly $500,000.

The largest tire shipment on record was made during the war to the French Government by Goodyear. It consisted of 26 cars of motor truck and automobile tires.

Tire production in Akron steadily is mounting. Many companies report the heaviest production in their history. Labor efficiency has increased from 40 to 58 per cent in all factories. More tires are being built daily in Akron than at any previous time with the exception of about three months during the high mark of the tire industry's unprecedented spurt and peak prosperity in the spring of 1920.

A survey of the industry made by Akron's business leaders shows that it is beyond its pre-war peak basis, and is closely approaching the old peak of 1920. Production now exceeds 100,000 tires daily, with all companies reporting increasingly heavy spring orders from all parts of the United States and from many European points.

BILL GIVES LIEN TO INJURED

BOSTON, Jan. 24—A bill permitting a person injured by an automobile driven by another to have a lien on the automobile for the satisfaction of any settlement he may recover against the owner, is recommended for the consideration of the Legislature in a report filed to-day by the Special Insurance Commission.

AUTOMOTIVE INDUSTRIES
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Farmers Are Eager to Buy Motor Trucks

Delegates to agricultural conference almost unanimous in regarding truck as economic necessity. Farmer will be back in market by August, 1922. Some sections are already financially recovered.

By James C. Dalton

WASHINGTON, Jan. 28.—Motor truck manufacturers who study, analyze and develop farm markets will be the ones who will reap the rewards in the near future.

This fact was evidenced indisputably by interviews with delegates from all sections of the country who attended the national agricultural conference which closed its sessions here last night. They believe the development of the truck will be fully as spectacular as that of the passenger car. They regard it as an economic necessity in the expansion of the co-operative marketing movement, which is one of the biggest things on the agricultural agenda at this time.

One after another representatives of big agricultural organizations declared the market for trucks has scarcely been scratched. Not only that, but they believe the farmer will begin to come back into the market in August or September. In some sections sales can be made even now and the demand will expand as the year advances. The number of sales this year will not be startling, but it promises to be greater than truck makers have expected.

The automotive industry seems to have taken it for granted for the past year that the agricultural districts are absolutely dead as markets at this time, but such is not the case if the delegates to the conference know what they are talking about and, if they didn't, they wouldn't have been invited to attend.

After "blue Monday," when all the pent-up grief of the agricultural industry was spilled at the opening sessions of the conference, the lobbies and grand ballroom of the Willard, where the convention has been held, have not been shrouded in gloom. As a matter of fact, the optimism of a majority of the delegates is rather surprising.

Except in the great grain-growing states and in the cotton belt, the farmers are not so badly off. Many of them are making some money and few are bankrupt. They have serious problems to face and have heavy debts to pay, but they are coming back.

All the delegates interviewed were asked the specific question, "When do you think farmers in your section will be back in the market for motor trucks?"

Almost without exception the reply was, "In the late summer or early fall."

Some of the delegates declared trucks are being sold now on a small scale. Districts in the South, which have diversified crops and which have not shared in the depression which has hit the cotton growers, are markets even to-day for the real automotive merchandiser.

This conference probably was the most representative of its kind ever held in this country. Every

branch of agriculture was represented by its leaders. Not all the delegates were real "dirt farmers," but a majority of them were. They could speak with authority for their neighbors. They knew what the farmers were thinking and what they intend to do.

The delegates were interested in all the problems which confront the farmer, but they all took it for granted that co-operative marketing on a gigantic scale is one of the assured developments of the future. This movement, which has been brought to a head partly by high freight rates and partly by discontent because of the wide margin between what the farmer gets for his products and what the consumer pays for them, already is well under way.

Future developments, however, will be on a vastly more ambitious scale. They will be engineered in large measure by the American Farm Bureau Federation, which is the real power behind organized agriculture. Its whole marketing program is based on co-operative effort. The real foundation for it is the motor truck. If the farmer were still dependent upon the horse-hauled vehicle he could not put it over, because distances would be too great and he would still be dependent upon the railroad.

But the farmer, aided by the motor truck, has tested his power and is eager to test it still further. He knows that for distances up to 150 miles the truck can do the work. He now can reach directly markets more remote than he dreamed of reaching a few years ago. The expansion of direct marketing has come with the "hard road," and its development means a rapid and nation-wide development of good roads.

One man from Minnesota was asked if he thought the use of the truck would be greatly expanded in his state.

"For what other reason do you think we are going to build 7000 miles of good roads?" he replied.

That answer was typical of the thought of the leaders of farm opinion from every section.

A man from Texas made this equally significant statement:

"We thought for a while that we'd tax the trucks off the roads, but we've changed our minds."

To determine just what representative farmers from every section of the country think of motor trucks and the potential market for them, the representative of AUTOMOTIVE INDUSTRIES at the convention buttonholed delegates at random and put the question up to them. No attempt was made to talk with the "outstanding figures" at the conference. In fact, quite the reverse was true, for the views of real "dirt" farmers were sought. Here are the opinions of some of those interviewed:

HUBERT F. BAKER, Michigan Potato Growers' Exchange.—"Within five years 75 per cent of the farmers in northern Michigan will be using motor trucks. They are beginning to realize that they must have them if they are to market their products successfully. I believe there is a wonderful future for motor trucks on the farms. Farmers in our section are buying them as fast as they can, and if everything goes well I expect many more to be in the market by next fall. My own experience has convinced me that trucks are indispensable for potato growers."

O. G. SMITH, President, National Farmers' Congress, and President of the Nebraska Good Roads Association.—"The hog growers in our section are using many motor trucks and many more will be placed in use as soon as funds are available to buy them. We are thoroughly sold on the motor truck and it must be used if co-operative marketing is to be successful. I believe that northern Nebraska will be back in the market in the fall for motor trucks if the price of hogs stays where it is now. The use of trucks provides a wider and better market and tends to make friends of consumers."

HENRY C. STUART, formerly Governor of Virginia, President, State Farm Bureau.—"The farmers of Virginia are sold on the motor truck. In fact, they are oversold just at present, but they will be back in the market as soon as they can get a little money. High railroad freight rates make co-operative marketing necessary and motor trucks are essential to co-operative operations by farmers. By the use of them a few farmers can get together and market their products more profitably than they can hope to do in any other way."

C. V. TOPPING, Southwestern Millers' League.—"I believe that farmers in the territory covered by our league, which includes Kansas, Nebraska, Colorado, Texas, Oklahoma and Missouri, will be back in the market for trucks in the fall. The farmer who has owned and operated a truck is the best possible advertisement for a motor vehicle because nearly all of them have found them efficient and economical. Jobbers in our section are using them exclusively for hauls up to 150 miles. This work is particularly profitable because a system has been worked out which provides return loads."

W. B. HUNTER, President, Georgia Fruit Growers' Exchange.—"I believe the demand for motor trucks has not really started and, although they already are widely used in Georgia, they are not yet operated to anything like the extent they will be when funds are a little more plentiful. They are particularly valuable in marketing fruit crops which require prompt transportation. The service question is the most important of all for us, and automobile manufacturers must be made to realize that service is more important than the vehicle itself. We cannot buy certain makes of motor vehicles because the service for them is so unsatisfactory."

C. A. COBB, Editor, *Southern Ruralist*, Atlanta, Ga.—"The South is about a year ahead of the rest of the country on the way back to prosperity. We were practically broke a year ago, but we have already begun to go upgrade. Credit is much easier and there will be enough for legitimate needs. Some of our people have a little money to spend and I believe there is a great future for motor vehicles in the South."

G. M. PUTNAM, President, New Hampshire Farm Bureau Federation.—"When a farmer has to go six or eight miles or more to his market I believe a half-ton or a ton truck is essential to profitable operation of his farm. Many more of these vehicles will be sold in New Hampshire."

CHARLES L. HILL of Wisconsin, largest importer in the United States of blooded stock.—"We've just got to have motor trucks. Mine is the best investment I ever made. The demand for them is bound to grow. I believe some of them could be sold now, but not many. The farmers in our State are not by any means down and out financially. Most of the extreme pessimism comes from the grain-growing states. Other states are not so badly off."

W. M. BURLINGAME, American Society of Equity, a farmers' life and fire insurance organization, Great Falls, Mont.—"Conditions in Montana are not so bad as they might be, and I believe the farmers in our section will be back in the market for motor trucks in the fall or even earlier. Others will buy as soon as they can get the cash. There is no question of the ultimate demand."

O. F. E. WINBERG, President of the Gulf Coast Citrus Exchange, Mobile, Ala.—"There is a good market for trucks in our section right now, for the farmers down there don't realize that times are hard. They have a diversity of crops, and trucks are being used more and

more extensively. The use of trucks will expand with the development of good roads and we are going to build them."

C. H. MACDOWELL of Chicago, President of the National Fertilizer Association.—"The use of motor trucks will develop parallel with the building of hard roads. There's where the economy in their use is manifested."

CARL WILLIAMS, Editor of the *Oklahoma Farmer-Stockman*.—"Farmers in our section will begin to come back into the market for trucks after the wheat crop is harvested in June. This business will be nothing tremendous, but at the same time there will be a fairly good demand. Sales of motor trucks in our section are just in their infancy."

GEORGE B. TERRELL, Texas State Commissioner of Agriculture.—"Trucks are here to stay. Our farmers will buy when they get the cash. The volume of sales this year all depends on the cotton crop. There has been a strong reaction in our State against the movement to tax motor trucks off the roads. We have changed our minds on this subject, although we still believe trucks should bear a fair share of the burdens of taxation in maintaining and building highways."

H. B. NICKERSON, President of the Minnesota Co-operative Creameries Association, Inc.—"There are in our State 600 co-operative creameries which make 100,000,000 lb. of butter a year. By far the largest part of this product is handled by truck. We are building in Minnesota 7000 miles of improved roads and it is all because of trucks. Why else do you think we would spend all that money? We're going to put $10,000,000 a year into good roads. The market for trucks in our State hasn't been touched. Co-operative marketing will open a big field for them. Freight rates are too high and the economic value of the truck has been demonstrated."

T. C. ATKESON, Washington Representative of the National Grange.—"Use of the motor truck is an economic question. If the farmer can reduce expenses and lower his costs by the use of a truck he is justified in borrowing money to buy one, for it is a good investment. It certainly has been demonstrated that marketing costs are reduced by the use of trucks when the farmer is any distance from his market."

C. V. GREGORY of Chicago, Editor of the *Prairie Farmer*.—"A survey of the State of Illinois shows that farmers are turning more and more to the use of motor trucks as a means to expedite the delivery of farm products and reducing transportation costs. Large grain elevators at Stronghurst, Ill., report 95 per cent deliveries by motor trucks. The tremendous increase in the use of trucks for hauling farm products to the grain elevator owners made it necessary to construct special dumps for trucks. Hauling live stock in motor trucks across the State instead of using freight cars is becoming more and more the rule. Conditions of the farmers are slowly improving and eventually they will be on the market as large purchasers of motor vehicles and tractors."

R. R. WALKER of Dallas, Texas, Agricultural Agent of the Missouri, Kansas & Texas Railway.—"The motor truck and tractor are fixtures on Texas farms and are becoming just as essential to the farmer as binders or gang plows. I am convinced that the motor truck will, within a few years, replace all other means of transportation from farm to market, with the exception, of course, of railroads. In Texas the good road movement is encouraged by railroads because it brings more farm products to their terminals for long-distance hauling."

The need for the proper servicing of trucks is in the back of the head of every farmer who owns one. They do not complain bitterly of the situation as do their city cousins, but that is one factor which must be given serious and scientific consideration by the manufacturer who expects to develop a permanent farm demand for his products. The farmer will buy the truck which has the best service facilities in his district, even though he may like another make better.

Service is particularly important for those farmer merchants who have perishable products, such as fruit, to handle. The extent to which trucks are used in the fruit industry is really remarkable, but lack of proper service in this field has aroused some criticism. One big peach grower said that when he started his crop to the railroad by truck he always kept teams in reserve to take over the load if a truck broke down.

ALL the delegates interviewed at the national agricultural conference were asked this question by the representatives of AUTOMOTIVE INDUSTRIES:

"When do you think the farmers in your section will be back in the market for motor trucks?"

Almost without exception the answer was, "In the late summer or early fall."

While the farmer asserts positively that the railroads have lost the short-haul business permanently, he is not enthusiastic over heavy-duty vehicles. It seems to be the almost unanimous opinion that half-ton and 1-ton trucks are the best for all-round farm purposes. This preference may continue, even with the expansion of co-operative marketing, because it is felt that heavier vehicles wear out the roads too fast without compensating advantages.

Another thing which rankles more or less in the minds of the farmers is that their individual needs have not been considered carefully enough by the dealer from whom they bought their truck. They feel that the dealer was more interested in selling them the vehicle on which his commission was largest than in considering what was best suited to the purchaser's needs.

Taking these points into consideration, it is evident that the truck maker and dealer who studies the farm problem and the subject of operating costs most carefully will be the one who will make the most sales.

One point which the farmer has not overlooked and which has strengthened the position of the automotive manufacturer, both passenger car and truck, is that the prices of their product have been reduced to pre-war or approximately pre-war levels. The farmer feels that it is one industry which has been "liquidated" almost as thoroughly as he has and that he is getting the benefit. On this score at least he does not feel so friendly toward the farm implement manufacturer.

Apart from the opportunity it afforded of determining the view of the farmer on the essentiality of the motor truck in agricultural operations, the conference was important from the viewpoint of the industry. The intimate relationship between agriculture and the automotive industry was recognized by Secretary Wallace when he selected the delegates.

Roy D. Chapin, Windsor T. White, C. C. Hanch and Harvey S. Firestone represented the industry in the committee conferences, chiefly in an advisory capacity. The taxation views of Hanch were presented to the committee on taxation and those of Chapin to the committee on highway transportation. White and Firestone also

gave the benefit of their experience to the committee on transportation, which was divided into sub-committees on highways, rail and waterways. The developments of the conference most important to the industry in this respect were:

Adoption of a strong resolution demanding more extensive development of good roads which will permit "orderly marketing."

Adoption of a resolution calling for the appointment of a private organization to co-ordinate transportation, thus evidencing the crystallization of farm thought in this direction. This resolution was offered from the floor.

Adoption of a resolution insistently demanding the prompt reduction of freight rates. Adoption of a resolution positively and earnestly protesting "against any consumption or sales or manufacturers' tax or any other tax which shifts the burden onto those least able to pay and has proved disappointing financially and socially unjust wherever tried." This applies directly to the obnoxious excise taxes now imposed on the sale of motor vehicles.

The text of the highway resolution follows:

"County highways are the farmers' first and principal transportation means of marketing their products. They are the arteries of the economic and social system of the country. On their condition rests the amount of the transportation charge that must be added to the gross cost of farm product and the more fully they are developed the less that weather conditions and soil are allowed to clog the flow of traffic, the greater will be the health of the body politic and the added profusion of enjoyments and privileges to the people.

"The loss from bad roads should be reduced to a minimum, not only to enlarge the farmer's market but to shorten the time and reduce the spread of price between the farmer and the consumer.

"The farmer ought to be able to haul to market twice as much twice as often as he has been able to do in the past. If the farmer is to be put in a position to help influence the price of his products by not dumping them on the market for fear of unseasonable weather, he must control the condition of the roads to his markets. Without proper road conditions "orderly marketing" can never be accomplished. Rapid growth of traffic over the highways has been so greatly intensified during the past few years that this method of transportation needs earnest and careful consideration. To this end,

"We urge the closest co-ordination between the three major forms of transportation, so that railways, waterways and highways may each carry the kind of traffic that it can the most economically, expeditiously and efficiently serve.

"We commend the Department of Agriculture, State Highway Departments and colleges for their research in connection with highway construction, maintenance and transport over the highways and urge full support be given these investigations.

"We approve the action of Congress in continuing Federal Aid for the building of interstate, postal and farm-to-market highways under the Department of Agriculture and making appropriation therefor. We believe this policy to be equitable and constructive. We urge Congress to continue this policy for a definite period, so that the States may plan adequate co-operation.

"We call particular attention of Federal and State authorities to the growing necessity for regulation of traffic on highways, in order that they may be protected from excessive and destructive abuse. Research into causes of highway wear should be continued by the Department of Agriculture and State Highway Departments and traffic regulated according to the facts developed.

"It is self-evident that farm products are the most cheaply transported over well-kept highways. We, therefore, urge that all possible safeguards should be placed about the maintenance of highways.

"Safety of life and limb on the highways is paramount and we favor every effort to make the use of streets and highways less dangerous to all citizens.

"We commend the Department of Agriculture for its policy in highway improvement, of providing roads suitable for horse-drawn as well as motorized vehicles and urge that wherever practicable side roads be constructed adjacent to the metal surfaced portion of the highway.

"Rapidly changing traffic conditions on our thoroughfares make the construction and maintenance of our highways an important engineering and business undertaking, therefore, all partisan or political consideration must be eliminated."

When asked what, in his opinion, was the most important result of the conference from the point of view of the automotive industry, Chapin said:

"The farmers have accepted the idea that highway transport must be developed for the benefit of the agricultural districts. This cannot fail to expand the market both for trucks and passenger cars."

Another resolution of interest to the industry, offered from the floor of the convention and adopted with virtual unanimity, was a recommendation that Congress accept the offer of Henry Ford to take over the Muscle Shoals project. It was felt Ford would make good on his offer to provide cheaper fertilizer. It was significant that the principal opposition came from the fertilizer interests. This resolution was offered almost simultaneously with the announcement that Ford had reduced the price of his tractor from $625 to $395.

It was generally conceded that the conference was a success and that its recommendations will lead to tangible results. Many of the suggestions made by President Harding in his opening address were indorsed and this will tend to make him, willingly or unwillingly, the sponsor for some of the legislation which probably will be framed by members of the "agricultural bloc" in Congress.

Another rather incongruous development was that while Attorney General Daugherty is inclined to think that the gathering of production statistics and kindred data by trade associations is a violation of the Sherman anti-trust law, a committee of the conference called upon Congress to provide funds which will permit the Department of Agriculture to collect information of every conceivable kind bearing upon production and marketing.

Farmers want this information, not only from every county in the United States but from every country in the world, and they want agricultural attachés upon the staff of every embassy. This program is indorsed by Secretary Wallace and there is nothing as yet to indicate that his efforts in this direction will meet the obstacles which have confronted Secretary of Commerce Hoover in collecting data along almost identical lines. The farmers even want this information sent to them by wire and radio.

THE American Farm Bureau Federation is the real power behind organized agriculture. Its whole marketing program is based on co-operative effort. The real foundation for it is the motor truck. If the farmer were still dependent upon the horse-hauled vehicle he could not put it over, because the distances would be too great and he would still be entirely dependent upon the railroad.

Chicago Show Indicates Return to Stability

The price shower at the New York Show cleared the air. Cars are being merchandised at Chicago exhibit. Columbia, Moon, Hudson, and Nash show new models. Utility closed car prominent. Training of salesman brings excellent results. Manufacturers are releasing orders for parts.

By J. Edward Schipper

CHICAGO, Jan. 30.

THE eyes of the automobile industry are on Chicago and the twenty-second annual National Automobile Show. Never have they been focussed here more closely, for there is a keen appreciation that what transpires in the Windy City this week is fraught with importance. The Chicago show is always the real index of at least the first six months of the year, but this year it is more truly a barometer than ever.

Vision was so obscured by the price shower which took place in New York this year that one left a little more bewildered than before. But that shower was necessary to clear the air. The general feeling is now abroad that we have come down to brass tacks and that the Chicago show marks the beginning of a new era in the business.

There has been considerable comment on the fact that prices were talked too much at the New York Show. But, how could it have been helped? At Chicago it is different. Not only are the price cuts out of the way, but the plan of the Chicago dealers to omit price talk and to concentrate on the merit points of the cars themselves has served to create an entirely new atmosphere which is going to make itself felt in a greater volume of actual business at the show.

Factory executives have arrived early and are going to stay most of the week. The realization is abroad that the battle of this industry is going to be fought out on the firing line of the retail salesroom during the coming year. The result of this is closer scanning of the retail sales and service methods by the factories. This show is performing a valuable work in establishing new contact points.

All of this has provided a foundation for some real development work along certain well defined lines. This is very apparent from what new developments we find at Chicago as well as in the new features at New York. Probably the two outstanding developments are the utility closed car and the thousand-dollar six. It is very easy to see in the light of the present frame of mind of both public and industry a reason for both.

At this show the new Columbia is being shown privately to dealers. This is priced at $985 and incorporates Timken axles and the new Continental light six 6-Y line. This same engine is found in the new Moon shown at the Coliseum and the new Davis in the Armory. In fact Moon has engine No. 1, Columbia No. 2 and Davis No. 3 of this series.

The utility type of closed car which was conceded to be one of the interesting developments disclosed at New York is augmented by two new recruits here. These are the new Hudson coach, built along lines similar to those of the Essex coach, and selling for but $50 more than the seven-passenger phaeton, and the Nash cariole for $305 more than the touring car.

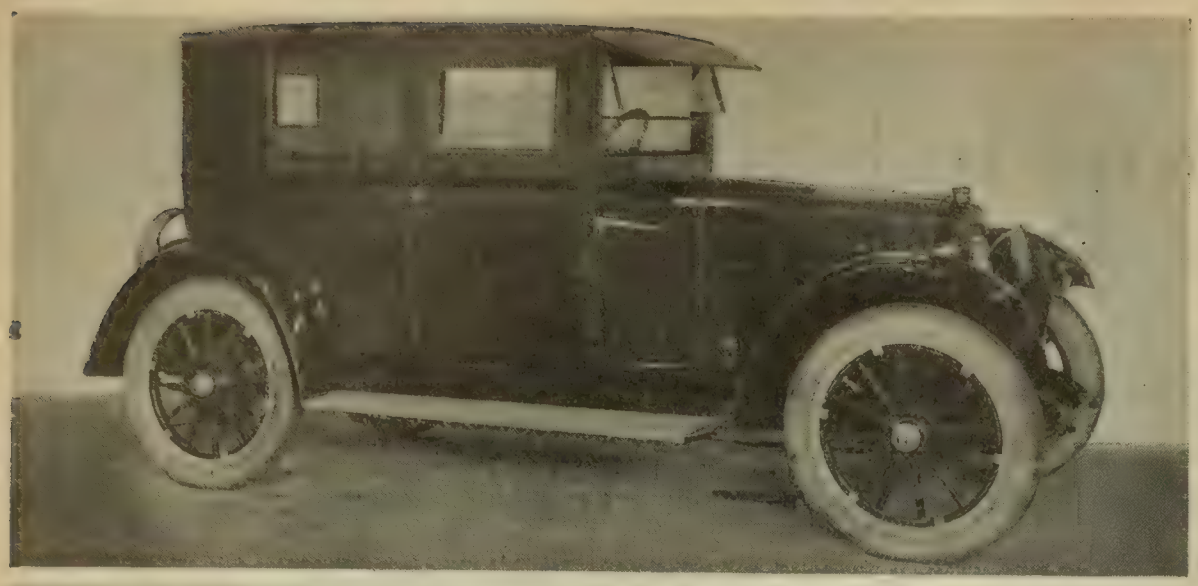
Real credit for the movement to dignify both the show and the industry in the eyes of the public must be given the Chicago Auto Trade Association. The night before the show opened this organization held its annual dinner and at that time completed its plans in the campaign to properly train dealers and salesmen for a proper presentation of the industry to the public at the show. More than 1000 dealers were present and they were addressed by George Graham, vice-president of Chandler, who impressed upon his hearers the necessity of maintaining the high standing of the industry upon which they depended for their living.

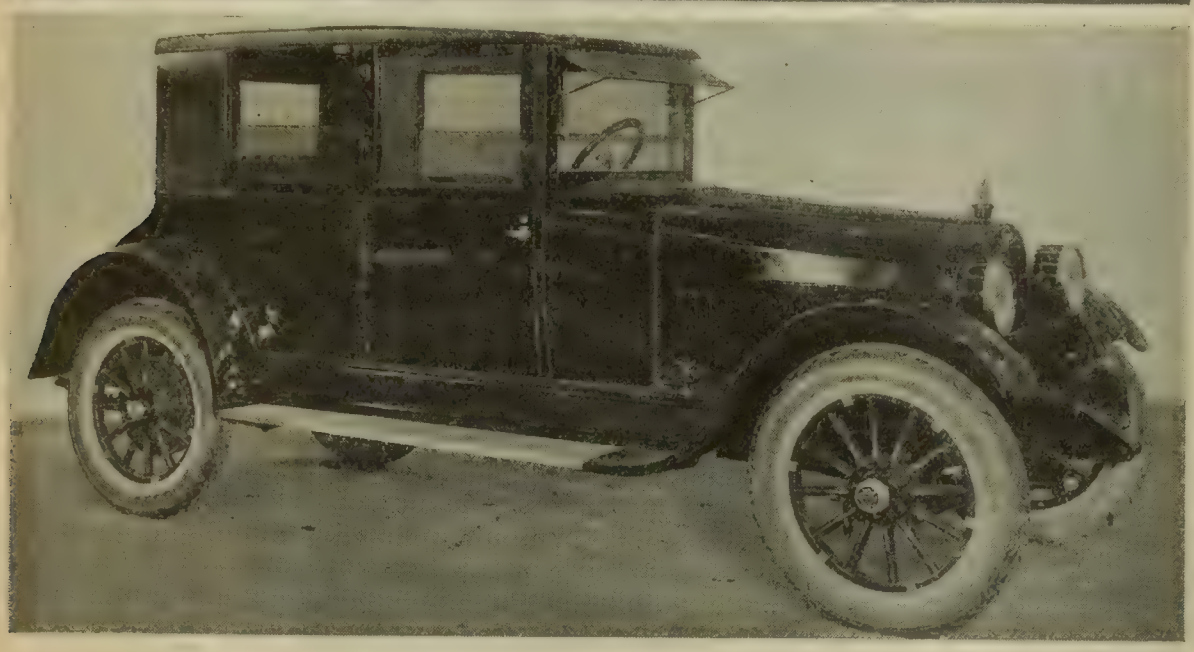
Already this salesman training is bearing fruit and there is a markedly more happy attitude at the Coliseum than there was at the Palace. Furthermore, there are few replies of "I don't know" to questions of price, and the entire situation is much more clean-cut. There is better salesmanship and more sales right off the floor are resulting. One make, for example, of which seventeen cars were sold off the floor during the New York Show, had two actual sales to its credit and four in immediate prospect before the show was 4 hr. old. This is a $2,500 car.

Members of the industry, other than the car manufacturer, are vitally interested in this show. The parts makers are here in large numbers. One of the most



Chassis of the new Columbia





Above—The Nash Carriole. Below—The New Hudson Coach

significant developments of the show is the effort of the assembled car maker to get down into a lower price field than has been possible during the past few years. It is quite evident that there will be a move of further standardization on the part of the parts manufacturers in order to increase production of particular parts models and meet the necessity for getting down in the price scale to where the assembler can put the car together and sell it on a competitive basis with the maker of the complete vehicle.

The $1,000 six is a good example of this and it is not surprising to note almost the same list of parts in cars which are assembled to sell at this price figure. This has called for the design of parts which give the required performance for these light-weight economical vehicles, and which are capable of low-cost production. At the Chicago show there are a number of these parts which are on exhibition for the first time. The Continental 6-Y type of engine is an example. Weidely is showing a new light six passenger engine. At the hotels are scores of parts companies with exhibits of parts which are not yet in production but which are ready now. Long Mfg. Co. has its new plate clutch which the trade has been expecting for some time. It would mean a listing of practically all the names of those well known in this phase of the business to tell what these producers of specialized parts have done or will shortly do to produce satisfactory units of new design and by new methods to make it possible to give the American public just as good or in fact, a better vehicle, at the lower price which now exists.

The New York show over-emphasized price to such an extent that, in their hurry to fix a price which would seem attractive to dealers, costs were not as closely calculated as they might have been. In the case of assembled car makers there are a few instances where the price on certain units was estimated too low. The result is that there may be a tendency among assemblers to shade upwards again when production is actually started. This condition, though, is much more the exception than the rule.

A lesson which the engineer and factory executive can take home with him is the marked interest of the public in economy of operation. Stroll about the booths and listen to the questions that the average man in the street asks the salesman and you will hear him ask, "How many miles to the gallon of gasoline?" or, "How many miles to the gallon of oil?" Almost invariably these questions are brought up in discussing cars up to and even over the $2,000 mark.

A large dealer attendance was manifest even the first day, and trains Sunday and Monday are bringing them in by hundreds from all over the country. Large delegations are here from the West as far as the coast, and it is quite natural that the manner of handling the public at this show will have a beneficial effect on the way the smaller shows are conducted.

What business will be done during the week remains to be seen. The stage has been set, however, and all indications are that this show is going to do more to clear the atmosphere than anything else that could have been planned. It is thought that the eliminating of the price bug-a-boo will in a large measure solve the used car problem.

The show has its by-products and one of these is very happily significant. It is to be found in the inner, innermost whispers of those who are in the heart of the business. Whispered news of larger releases during the past week than at any time since the dread fall of 1920 are in the air. These are all the more striking because they are not only from the passenger car field but the truck field as well. One large bearing manufacturer has just received the "go ahead" on a truck bearing order of large size, and this means truck production which affects all other makers in the truck parts business. Purchasing agents are placing orders now over a longer delivery period than for many a long month and nothing could indicate more closely than this something of a return of confidence in price stability.

Following are brief descriptions of the new models which made their first appearance at the Chicago show:

New Columbia Six

The new Columbia Six is being shown at the LaSalle Hotel, the exhibition being intended for dealers only, as the car will not be in production before April 1. Besides the low price, $985, this car makes its appeal through its connection with the name of prominent parts manufacturers from whose products the car is assembled and its tasteful body lines. It incorporates the new Continental 6-Y engine, which is claimed to develop 50.7 hp. on the block. The axles are Timken and the other parts manufacturers interested are equally prominent but may not at this time be mentioned. The clutch is a disk unit, the gearset a three-speed selected, the tires 31 x 4.

The sample body which is shown at the LaSalle is an Erdman-Guider product and is an excellent sample of the

(*Continued on page* 238)

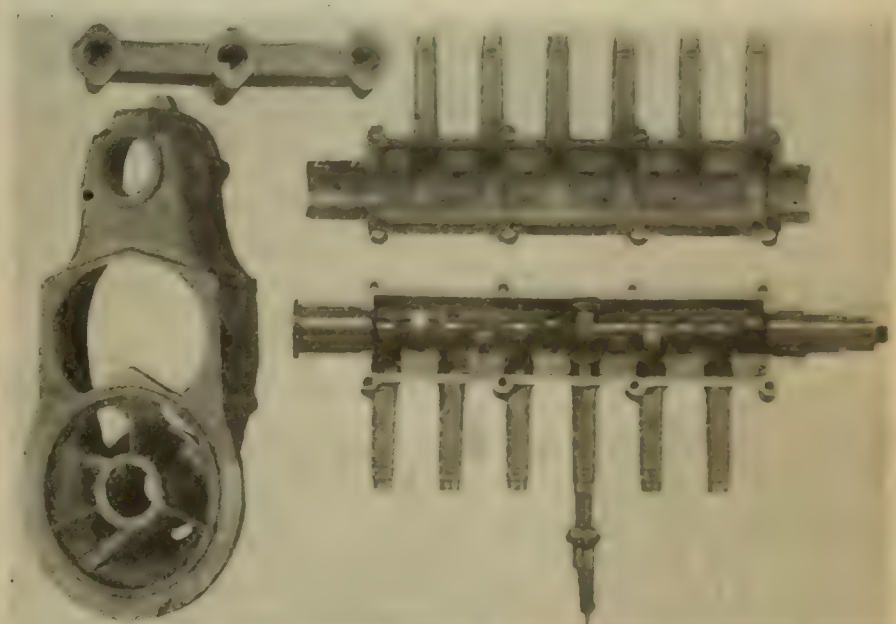
New Air-Cooled Car Has Twin-Three Engine

Detroit air-cooled car has 115 in. wheelbase and weighs 1700 lb. Twin-three six-cylinder engine used. 30 miles to gallon claimed. Crankcase is diecast and weighs 14 lb. Service and emergency brakes are interchangeable. Camshaft in separate housing between cylinder blocks.

A NEW air-cooled car was shown at the Detroit Automobile Show for the first time. In view of the fact that the car has been brought out by W. J. Doughty, who has been for many years a distributor of air-cooled cars, it is claimed that some of the features which have been installed on the new product are the direct result of experience with the servicing of air-cooled products.

Some unusual claims are being made for the car, which, although it has 115 in. wheelbase, is claimed to weigh but 1700 lb. It has a six-cylinder engine rated at 32 hp., for which a consumption of 30 miles to the gallon is claimed in ordinary driving. The price of the car is set at $1,250. Economy is claimed to result from the unusual powerplant design and the light car weight.

The engine is a 2⅞ x 4 in. twin-three, six-cylinder, being divided into two banks of three each, which are staggered. It is claimed that this permits of a short and strong crankshaft and an unusually compact powerplant which weighs 192 lb. The clutch and gearset, which are included with the engine in the unit powerplant construction, are accessible by lifting the hood. The cylinder blocks are set at a 30 deg. angle and are of valve-in-head type. The valves operate by direct pull from a camshaft placed in a separate housing in the "V" between the cylinders. All the rocker arms, push rods, tappets and similar parts have been eliminated by this type of construction and the designers claim that by this method thirty-six parts have been removed from each cylinder.



Camshaft housing and die-cast pump housing

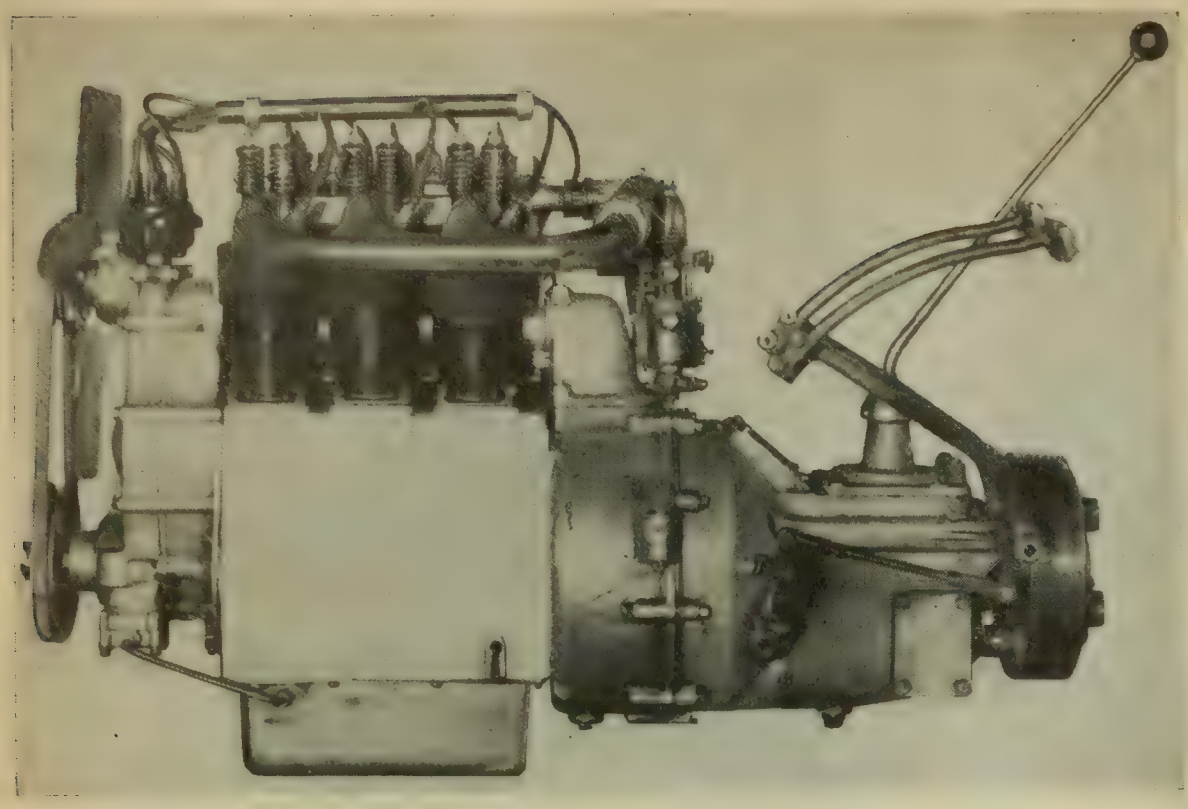
The valve adjustments are in sight at the top of the engine and by removing a clamp, it is possible to remove the entire camshaft assembly. The valves may be inspected and ground by removing the manifold and turning one part.

The cylinders are machined both inside and outside for uniform expansion which Doughty claims is one of the difficulties with air-cooled construction. Each cylinder has more than twenty cooling fins and the fan is supplemented by air-chutes which direct a constant current of air through the fins. The crankcase is a die casting weighing 14 lb., to which the oil-pan is bolted. When the pan is removed the pistons and connecting rods can be taken out. Extra long connecting rods are used to prevent piston slap, and aluminum has been used liberally throughout the power plant to save weight. The gasoline system is fed from a cowl tank by gravity to the carbureter. Vaporization is also assisted by a hot-spot. The intake manifolds are tapered to assist in distribution, and the intake and exhaust manifolds on both the cylinders are interchangeable.

Lubrication is provided by a pump driven from the crankshaft. Oil is pumped directly to the camshaft housing and the fan bearing is lubricated from the same source. Through another channel oil is pumped to the hollow crankshaft.



New Detroit air-cooled car



Left side of engine, showing short overall length

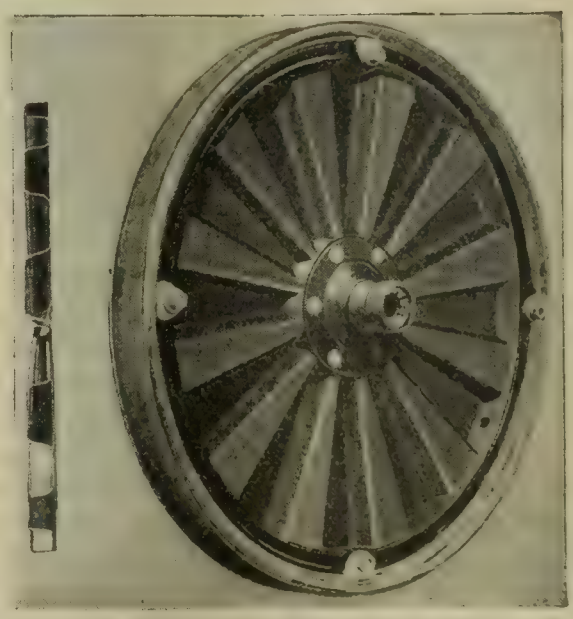
Both the service and emergency brakes are interchangeable, although the service brake acts upon the transmission, while the emergency brakes are on the rear wheels. The emergency brake lever is located at the left side of the driver. A novel idea which has been worked out in this car combines the throttle with the horn button, a disk being rotated to open and close the throttle, while the same disk, when pressed down, sounds the horn. The frame is 6 in. in depth and the body lines provide a high side body with wide doors. The springs are of the long, thin-leaved, semi-elliptic type and in order to assist the car in holding the road, the rear end is made slightly heavier than the front end. This, the designers claim, counterbalances the usual custom of a single driver with an empty tonneau, which very often causes a light car to be out of balance. The car is mounted on 31 by 4 in. tires.

A New Metal Disk Wheel

THE Gier-Lewis steel wheel, now being manufactured by the Gier plant of the Motor Wheel Corporation, represents a new departure in steel wheel design and construction for light cars. Instead of the curves or depressions in the disk running concentric with the hub, the new Gier-Lewis wheel is distinctive in that the corrugations in the disk extend radially from the hub to the felloe. This design makes it possible to use light gage metal and at the same time provide the necessary strength and rigidity. The wheel is said to overcome the usual objection to steel wheel equipment on light cars, as it is within a few ounces of the same weight as the standard wood wheel.

The center core is cast into the radially corrugated disk, the pouring of the core into the disk makes the latter an integral part of the hub casting. The outer circumference of the disk is welded into a standard steel felloe manufactured in the rim plant of the Motor Wheel Corp. This felloe will take either straight side or clincher rims.

Arrangements are now being made to furnish the new Gier-Lewis wheels either with or without hubs at the option of the customer. Wheels of this type have been used experimentally on heavy as well as light cars.



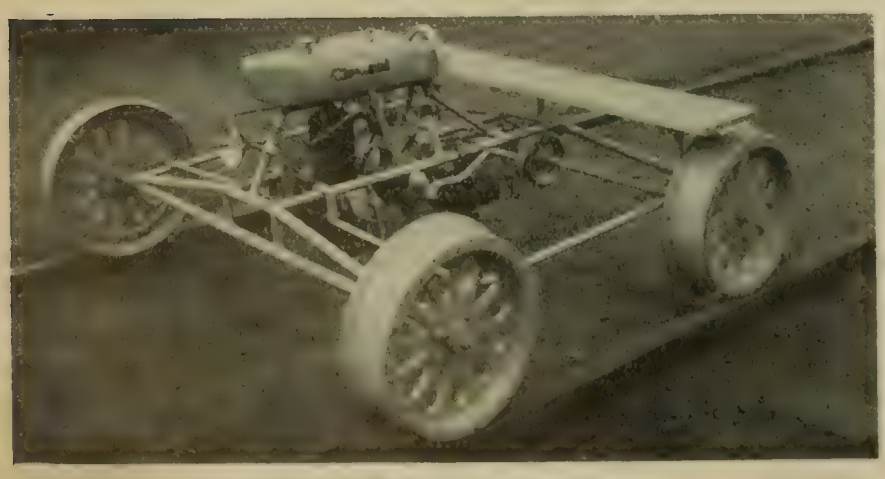
Gier-Lewis metal disk wheel

Lightweight Railroad Inspection Car

A LIGHT-WEIGHT railroad inspection car has just been put on the market by the Cleveland Motorcycle Manufacturing Co.

The powerplant of the inspection car is identical with that of the 1922 model Cleveland motorcycles, except that the gear shift is being operated by a lever instead of by the right foot pedal as on the motorcycle. The weight of the machine is hung low, a large part of it being below the top of the wheel. Both rear wheels are driven and all four wheels are the same size.

The speed of the vehicle is low, ranging from 5 to 20 miles per hour. This is advantageous for the purpose for which the machine has been designed, since proper inspection work cannot be done at high speeds.



Cleveland railroad inspection car

A Mechanical Gear Shifting Mechanism

Actual shifting of gears is accomplished by cam blocks actuated by motion of the clutch pedal following the selection of the desired gear by a finger lever. Mechanism is compact and is said to weigh less than parts it replaces. It is entirely mechanical in operation. A driving seat space saver.

THE Gear Shift Department of the Cutler-Hammer Mfg. Co. has developed a smaller, simpler gear shifting mechanism, which, while not previously announced to the trade, has been put to more than a year's service on several motor cars, its performances having been closely checked.

The shifting mechanism occupies little space and is said to weigh no more than the parts it replaces. It is mounted on top of the transmission, as shown in the photograph of the Cadillac installation herewith, the latest type (fitted to the Elgin car) being so small that the inclosing case occupies only the space between the transmission case and the floor board. On the Cadillac car the hand lever is replaced by the automatic gear shift mechanism, and emergency brake lever is moved to the extreme left. The entire front seat compartment is thus clear.

Shifting of the gears is accomplished by means of cam blocks. These are made of a single piece of steel, machined and provided with different cam profiles. With a given speed pre-selected by means of the finger lever, throwing out the clutch results in the shifting of the gear. Coasting by releasing the clutch pedal part way without shifting is also possible, since a gear change is not made unless the pedal is moved past a point indicated on the vertical elevation.

The accompanying diagrams will serve to make the operation of the gear shift clear. Referring to the drawing of the shifting mechanism, the movement of the selector lever on the steering wheel quadrant, through the various linkages, moves a pair of roll levers inside the gear shift casing into the position corresponding to the speed selected. Then, when the clutch pedal is depressed, the cams are rotated, one roll lever being moved into the selected gear position, the other held rigidly in the neutral position. Owing to the slot in the slip link, the initial movement of the clutch pedal can take place without moving the operating rod of the shift.

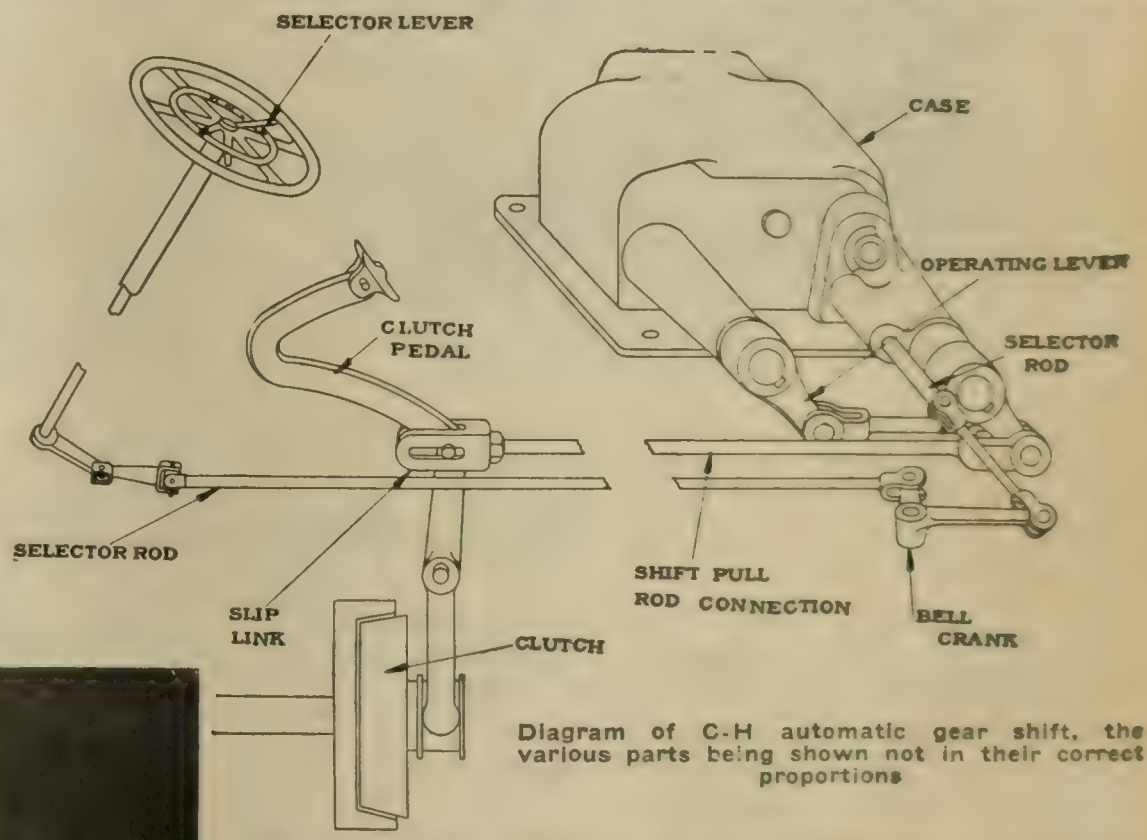
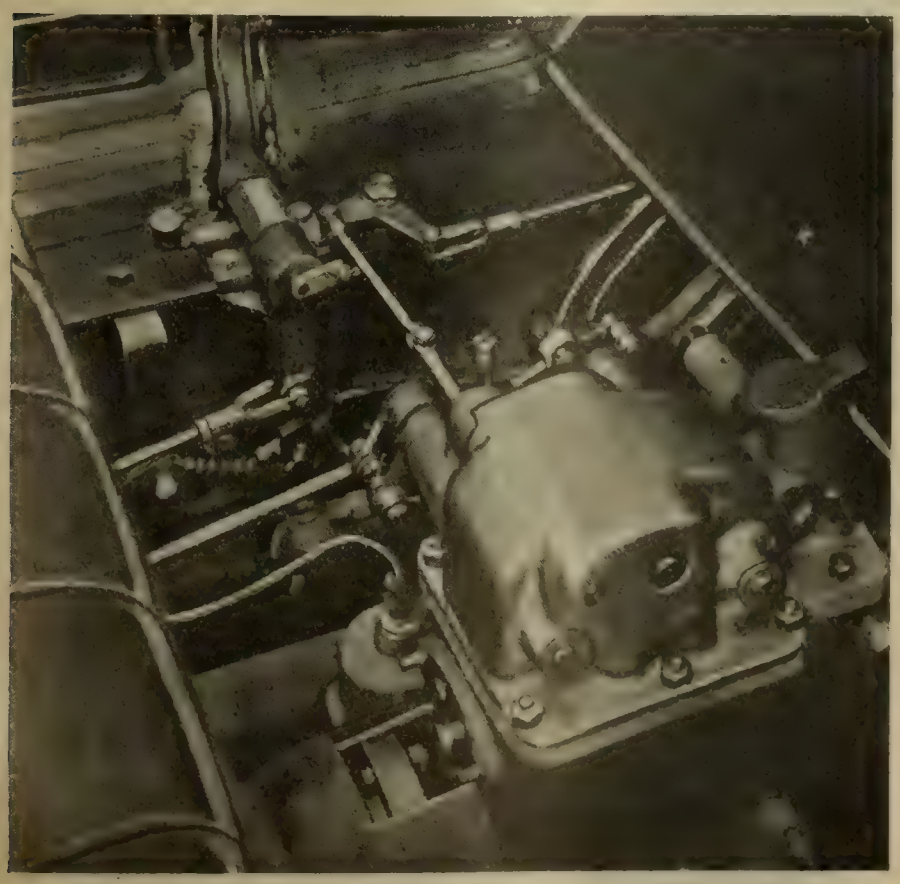


Diagram of C-H automatic gear shift, the various parts being shown not in their correct proportions



C-H automatic mechanical gear shift applied to Cadillac car

Each of the two roll levers acts with a pivoted fork, each being free to be moved forward and backward independent of the other fork and roll lever. With the case and its contents mounted, as shown on the Cadillac car, arms extending from the shifter forks drop down into the transmission and shift the gears into the speeds selected.

The cam blocks previously referred to operate on two sides of the rollers carried by the roll levers. Pushing the clutch pedal forward moves these cams through a limited arc in such a way as to move the roll levers forward and backward.

The diagrams show how these rollers act in connection with the cams. In the reverse position, R, one roller is opposite the neutralizing cams and the other is held between the upper cams of the blocks, which causes the forks to neutralize the gears and throw them into reverse. The rollers are held in position by the cams, preventing the slightest overthrow.

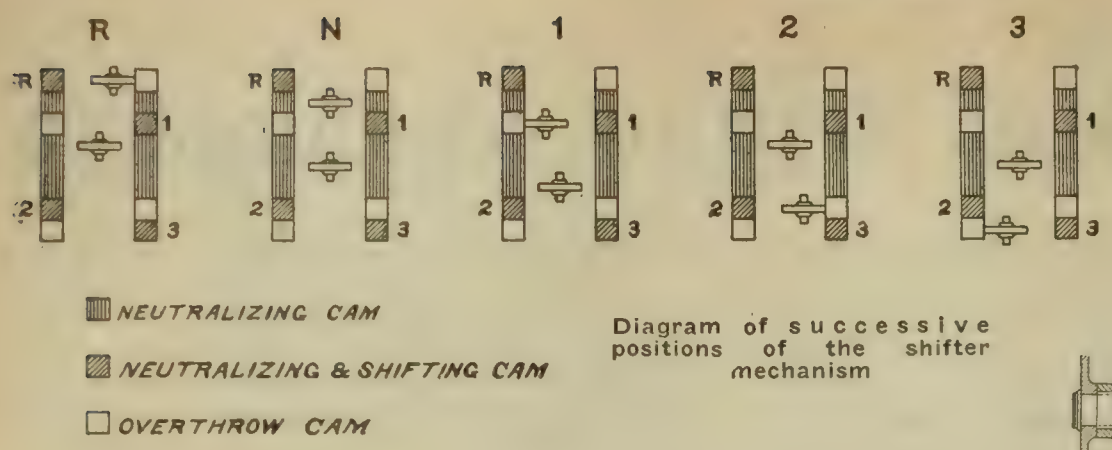
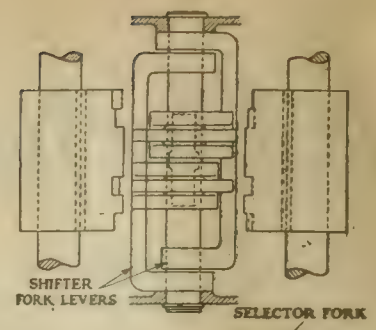
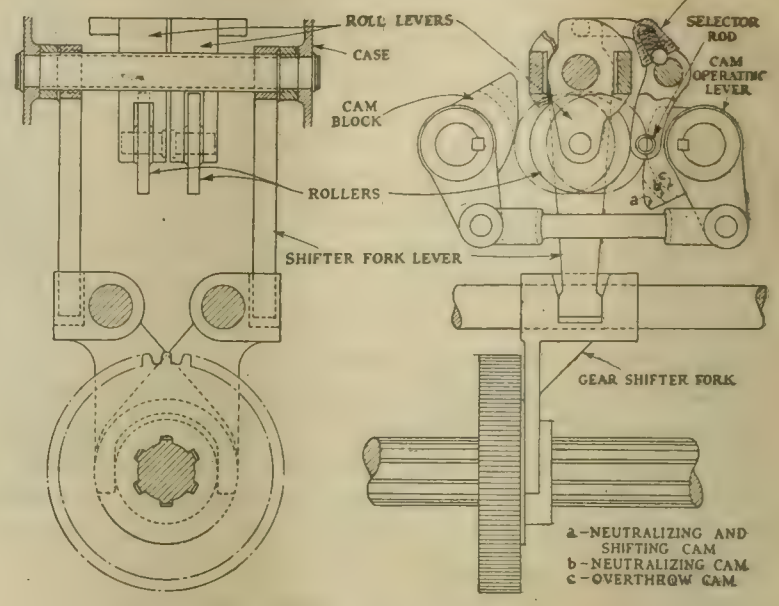


Diagram of successive positions of the shifter mechanism



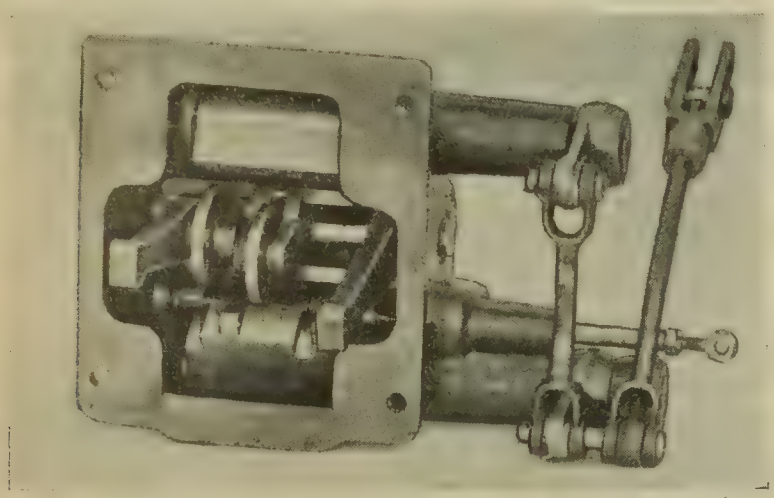
Three projections of the gear shifter, showing arrangement of all parts



In the neutral position, N, the rollers are held between the neutralizing cams, while in the next position one roller is still between neutralizing cams and one between a shifting cam and an overthrow cam. The positions of the rollers for second and third speeds are also shown.

It will be observed that the gears are positively held in position, no reliance being placed on springs. The friction of the sliding gears and shifting mechanism is very slight, and it is claimed that the operator cannot notice any difference in the amount of pressure required to depress the clutch pedal.

Manufacture of the magnetic gear shift is being continued by the Cutler-Hammer Mfg. Co., this shift being an option on the Premier car.



Photographic view of the gear shifter mechanism from below

A Heavy Hydraulic Body Press

AN all-steel press for use in forming pressed metal parts for automobile bodies has recently been constructed for a large producer of such bodies.

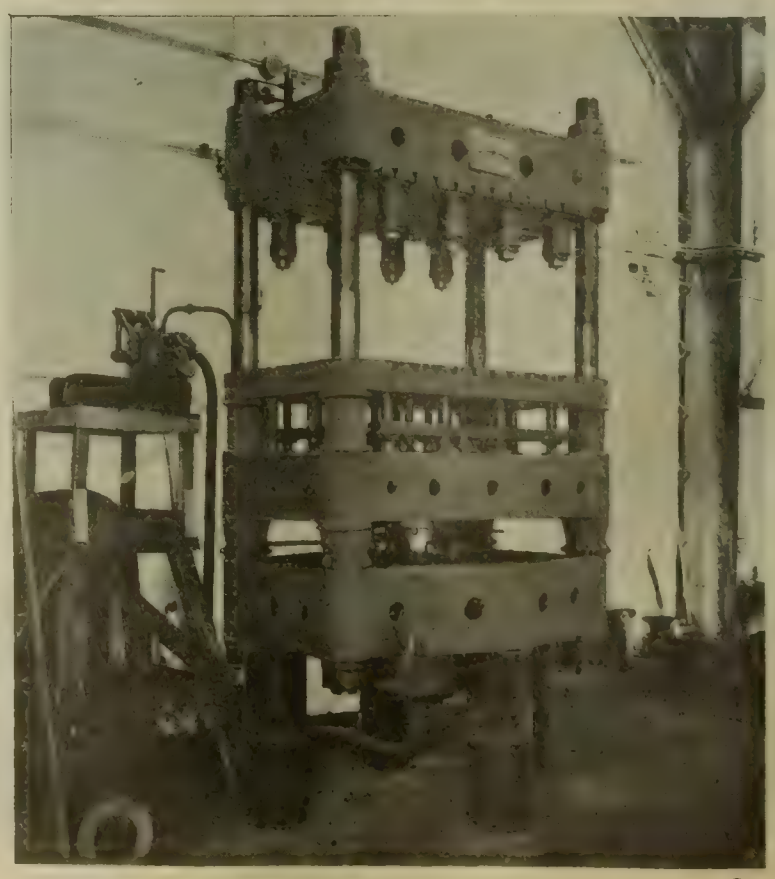
By reference to the accompanying cut it will be seen that the main ram is located in the lower base, to which are secured the four press columns. The press is provided with one clamping platen and one stripper platen. The heavy stripper platen carries four hydraulic cylinders, which act upon a forged steel plate which, in turn, carries sixty stripper pins 1½ in. in diameter. These stripper pins project through the clamping platen.

The clamping platen itself is a solid steel casting and is provided with T slots. The top platen carries 8 hydraulic jacks which are used for clamping and which have 5-in. diameter rams, 5-in. stroke. The top platen itself is adjustable so as to meet conditions of the various sized dies which may be employed under the press.

This press is controlled by a single lever operating valve, which admits low pressure to the four jack cylinders and at the same time admits low pressure to the main ram. As soon as the dies come together high pressure is admitted through the steel operating valve, thus completing the work on whatever shape is to be formed in the dies.

The clamping cylinders are controlled automatically from low-pressure filling tank and are capable of standing a hydraulic pressure of 5000 lb. per sq. in.

This press has a die space of 7 ft. by 5 in. and vertical opening between the platens is 18 in. minimum and 4 ft. maximum.



Southwark hydraulic body press

Gear-Driven Airship Has Novel Transmission Features

This new military airship of the pony blimp type, being built for the government, has new mechanical features. Power is transmitted from engine set in central car to two propellers at sides through spiral bevel gearing with reversing feature, at reduction of 2 to 1. A detailed description.

By H. T. Kraft*

THE envelope of the new military airship being built for the U. S. Army is of the pony blimp type, having an aspect ratio of 3.6 to 1. While there has been considerable question as to the head resistance of a large diameter ship, the entire absence of tail droop and the maintenance of a perfect streamlined shape on non-rigid ships are items which are usually overlooked, and are important factors tending to reduce the resistance of the envelope, apart from the fact that there is a tremendous reduction in skin friction due to the short length of the hull. From a dynamic standpoint, ships of a small aspect ratio have been considered somewhat unstable, but there, again, the high static stability due to the low center of weights, of course, is not represented in wind tunnel tests on the model of the envelope itself, and a ship of this type should be as stable, in view of this condition, as any airship of this capacity built in the past. The envelope and the car are faired together with an elastic fabric immediately below the envelope, making the entire ship a well streamlined body.

There is a great saving in surface weights of the envelope proper, in this particular unit over 1000 lb. With that, of course, goes the reduction in diffusion, which should be about one-sixth less than for ships of the same capacity built in the past. Because of the design, there should be no surging of the ballonet. The base line attachment to the envelope being greater than its lateral area, it is impossible for the ballonet to travel beyond this fore and aft base attachment point.

Arrangement of Control

The car is of the inclosed type, with two longitudinal sills 18 in. deep, which constitute the backbone or principal strengthening members of the structure. The balance of the car is simply a shell, housing the crew and permitting a closed car to be built of approximately the same weight as any open type of car constructed in the past. While the development of airships in the past has necessitated the adoption of various instruments, they were usually attached as an afterthought in a rather makeshift arrangement, but before attempting the construction of this unit, we formulated plans for the unification of the control. The control board carries every instrument that is required for successful lighter-than-air navigation, and is set in the car in such a manner as to permit all instruments to have the highest degree of accessibility. The pilot controls the entire transmission, clutches, reversing device, etc., from the navigating cabin. The engineer is located in a separate cabin to the rear of

*Chief Aero Engineer, Goodyear Tire & Rubber Co.

aft surging that is usually experienced when a car is hung too far away from the hull. The dispensable load is located directly under the center of volume of the ballonet, thereby permitting a single ballonet to be used, without any possibility of getting out of trim, irrespective of the loads carried within the car.

The Transmission Problem

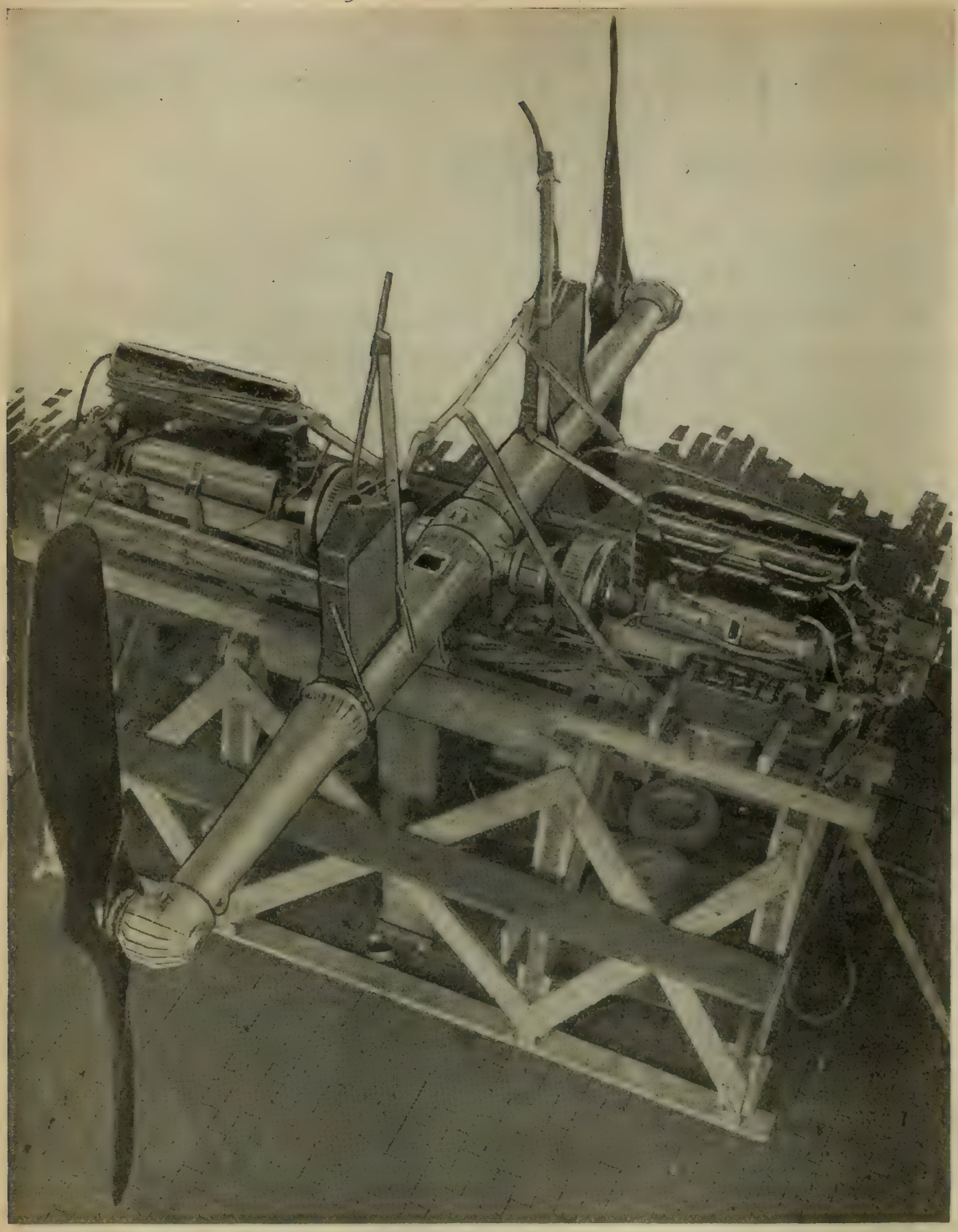
After going over all the data we could secure on transmissions built in the past, we well realized the problem that confronted us, as there had been so many failures along this line. The outstanding difficulties in the past had been heating up of the oil and excessive torsional vibration also, the transmission would get out of step with the motors, causing excessive gear noise. It was our aim to design a transmission that would be entirely free from these defects. In closely scrutinizing the construction of other gear drives, we found that the principal defect was the lack of unit construction, the designer depending upon struts or other connections to the car or fuselage, and in the case of airplanes, upon attachments to the wing struts, which, of course, invited trouble.

In laying out plans for the Goodyear transmission, our first thought was to make the entire assembly one integral unit, that is, to build the clutches, couplings, gears, shafts and propeller gear housing as close together the car, with an instrument board for reading all pressures and temperatures of the motors and transmission assembly. The mufflers are of the dual type, in which a part of the air which is delivered to the ballonet is circulated around the exhaust chamber and then into the exhaust itself, to assist in muffling the exhaust noises.

Water Ballast in Floor of Car

Water ballast is carried in the floor of the car immediately below the navigating cabin, in which latter there is a dial indicating the amount of water available for ballast. The fuel tanks are located in the rear part of the navigating cabin; there are two 160-gal. tanks, so constructed as to permit them to be used as sleeping cots in case of long flights. Provisions are made for a crew of seven.

It will be noted that all suspension cables run to the floor of the car, thus permitting veneer sides of 3/32-in. thickness to be used. As all loads are concentrated at the floor line, the surge of the car while in flight is resisted by two lateral cables and four longitudinal cables attached to the center bulkhead. This, in addition to martingales, which are also attached to the floor line, have proven very successful in overcoming the fore-and-



Powerplant of Goodyear gear-driven dirigible on testing stand. Two Aeromarine 135 hp. engines connected through friction clutches, fabric universal joints and spiral bevel gear transmission gear to two propellers at side of testing stand

as possible. It was largely on this basis that the success of the transmission was assured. We next analyzed the gears of several different types of transmissions and found that the use of straight bevel gears resulted in excessive gear noises.

Spiral Bevel Gears Used

The Goodyear transmission contains spiral bevel gears as used for the rear axle drives of automobiles. The teeth are of 4/5 pitch, have a 30 deg. angle of spiral and were cut by the Gleason Gear Works of Rochester, N. Y. In making the preliminary test run on a dynamometer, we found that there was an entire absence of gear hum, and while this dynamometer test forced us to allow two gears to idle in the case, we experienced very little heating up. To determine the absolute efficiency of this unit in the airship itself, we constructed a large wooden stand upon which were mounted two Aeromarine 135-hp. type U-6-D engines fitted with two clutches of the multiple disk type, manufactured by the Twin Disc Clutch Co. of Racine, Wis. Couplings between the clutches and the transmission are of the flexible type and are so designed as to allow of some degree of misalignment and angularity.

While theoretically this unit is in perfect alignment, the couplings were inserted to absorb any misalignment that might occur due to the weaving of the car proper. The transmission tube, which is one complete unit, is held on the cross sills by eight bolts at the outer edge of the car. A test load of 1000 lb. was hung on the propeller tip with a deflection of only 0.098 in. We were thus convinced that a propeller of only 80 lb. would not cause any excessive bending of this tube. Also, the thrust of the propeller, which is approximately 700 lb., is provided for with a theoretical factor of safety of 8. The tubes were cast by the Aluminum Manufacturers, Inc., of Cleveland, Ohio, and were produced of their No. 195 metal, heat treated, having an ultimate strength of 40,000 lb. per square inch, or approximately twice that of plain cast aluminum. The elastic limit of this metal is 30,000 lb. per square inch.

The propellers were attached and all necessary clutch adjustments were made before the motors were started on the stand run. We found that at half power, with both motors, the tubes were absolutely steady and there was an entire absence of gear noise, while the oil temperature rose only gradually, but we opened both motors wide and both tachometers indicated 1550 r.p.m., giving a propeller speed of 775 r.p.m. This being a static test, the propellers would go up to their design speed of 800 r.p.m. in flight. The motors were left open for three hours, at which time the center gearbox showed a temperature of 78 deg. Fahr., or 13 deg. above room temperature, which for a transmission of this type is quite remarkable. At this speed and during its entire operation there was not the slightest sign of vibration and an entire absence of noise, gear hum or any mechanical trouble that would indicate improper design. An additional run of 10 hours was completed without the necessity of making any adjustment on the transmission.

While the preliminary drawings and general arrangement were laid out by the Aeronautical Design Division of the Goodyear Tire & Rubber Co., the entire detail design and production of the transmission was put in the hands of John Riise, chief engineer of the Tractor Division of the Wellman-Seaver-Morgan Co., to whom we credit the remarkable success of the transmission unit.

The weight of the transmission without propellers is 593 lb. The blowers and clutches weigh 88 lb. This is only slightly greater than the weight of outriggers on some of the airships built in the past.

Advantages of the Gear Drive

The transmission-driven airship permits the motors to be placed within the car, where they are very accessible, and, in the case of non-rigid and semi-rigid airships, sirocco type fans may be attached directly to the motors, thereby permitting the elimination of scoops, which offer considerable resistance and add considerable weight. It permits any mechanical adjustments to the engines and, in the case of the unit above described, a complete cylinder head could be removed while in flight. As the heating is a direct indication of power losses in a transmission, the entire absence of this trouble in the Goodyear type transmission leads us to estimate that an efficiency of 98 per cent is obtained. As the propellers are 11 ft. in diameter and have a pitch of 10 ft. 6 in., and as the head resistance is reduced and there are no protruding members, there should be a considerable gain in the speed of the unit.

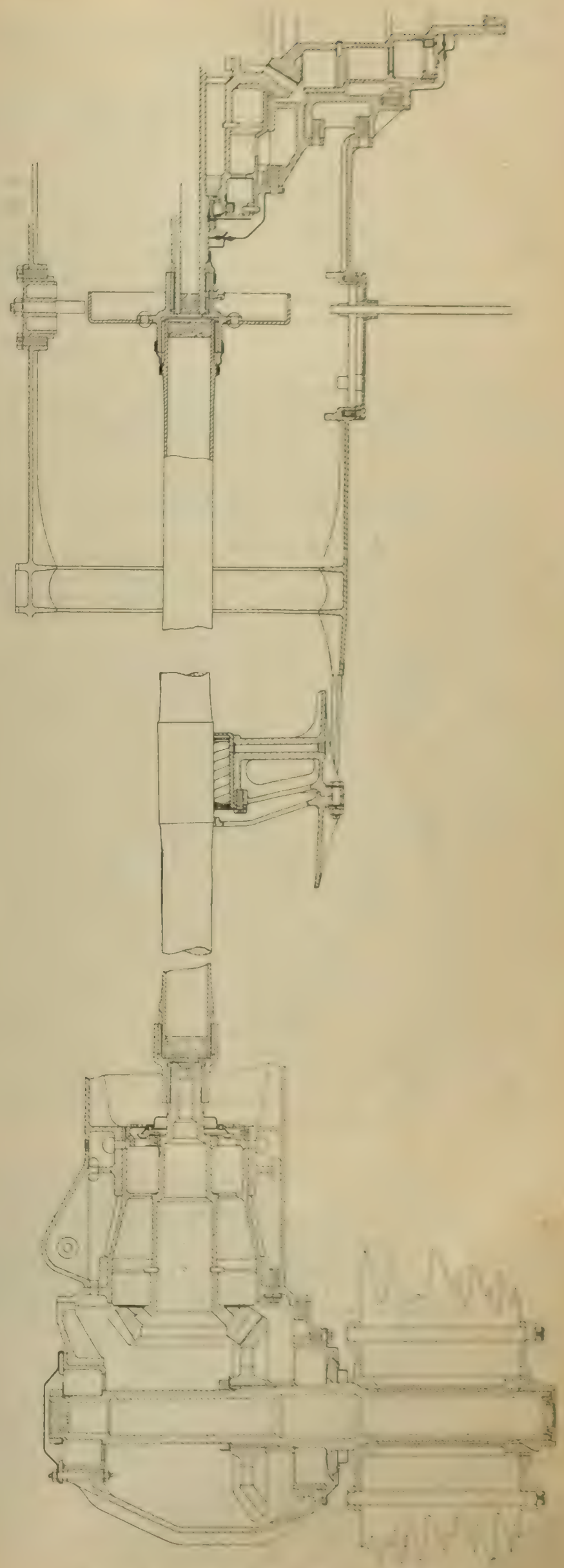
In view of the unit arrangement of the transmission, a reverse gear was inserted, which permits the propellers to be reversed without difficulty. The tractor type propellers were so arranged as to permit the edge of the tube to be streamlined. The radiators are to be set on bosses located on the tube, thereby placing them directly in the slip stream. The tractor type propellers offer the advantage of greater safety by keeping all these mechanical parts to the rear of the blade.

The characteristics of the unit are as follows: Speed, 60 m.p.h.; rate of climb, 1000 ft. per minute; rate of descent, 800 ft. per minute; cruising radius, full throttle, 14 hr.; cruising radius, reduced throttle, 20 hr.; percentage of useful load, 39; length, 170 ft.; diameter, 48 ft.; crew, 7.

While this is an experimental airship, it has proved that even with the inclosed car, transmission, reverse feature and two additional passengers, it is a decided improvement in the non-rigid class. Ships of this design could be constructed up to 300,000 cu. ft. capacity without the slightest difficulty. The entire design adapts itself to the insertion of a rigid keel, which would permit ships up to at least 1,000,000 cu. ft. to be built with a tremendous saving in the structural weights and with an assurance of a very high percentage of useful lift.

Additional Data on Gear Transmission

AUTOMOTIVE INDUSTRIES is indebted to John Riise for additional data of the gear transmission and blue-prints of parts of same, reproduced herewith. The gears, as already stated, are of 4-5 pitch, hence are of the stub-tooth form with a pressure angle of 20 deg. Their width of face is 1½ in. At the center of the transmission there is a nest of four spiral bevel gears meshing together, of which the two with their axes in the fore and aft direction are connected to the clutch shafts by the Goodyear fabric flexible universal joints. The driving gears have 24 teeth and the driven gears 34 teeth each. The gears are formed integral with their shafts, which latter are hollow and provided with splined fittings. Each gearshaft



Sectional views of parts of the spiral bevel gear transmission

or hub is supported in two ball bearings, of which one takes radial loads only, while the other takes both radial loads and end thrust. The ball bearings are mounted in steel sleeves or housings which are shrunk into the aluminum casings. That is, both the casing and the sleeve are raised to a temperature of about 200 deg. Fahr. and slushed with oil, and the sleeves are then forced into the casings under a moderate pressure. The driven shaft floats in the hubs of the driven gears on a pair of conical roller bearings. At their inner ends the hubs of the driven gears are provided with internal teeth with which corresponding teeth on a sliding member or clutch are adapted to engage. When this sliding member is in engagement with one of the gears the drive is forward, and when it is in engagement with the other gear the drive is reversed.

The central shaft carrying the reversing clutch is comparatively short, and just outside the oil guard beyond the bearing it connects by a splined coupling to another hollow shaft of greater diameter but less wall thickness. At this coupling there is provided a brake drum to which a contracting band may be applied for the purpose of quickly absorbing the momentum of the propellers and thus permit of quick reversals of the gear. In other words, the brake serves about the same purpose as the clutch brake in automobile transmissions.

An aluminum housing incloses the entire transmission. This is made in several sections bolted together, as with the very thin section of metal wanted it is impossible to cast the whole of the housing to one side of the center of the transmission in a single piece. The gears at the outer ends are of exactly the same dimensions as those at the center, the driving and driven gear having 24 and 34 teeth, respectively, of 4-5 pitch and 1½-in. face width. Mr. Riise confirms the statement made in Mr. Kraft's article that the transmission worked satisfactorily under conditions of continuous full load without vibration and without noise. The efficiency of transmission is apparently very high and there was only a slight increase in the temperature of the lubricating oil.

A Sixteen Cylinder Air-Cooled Rotary Aircraft Engine

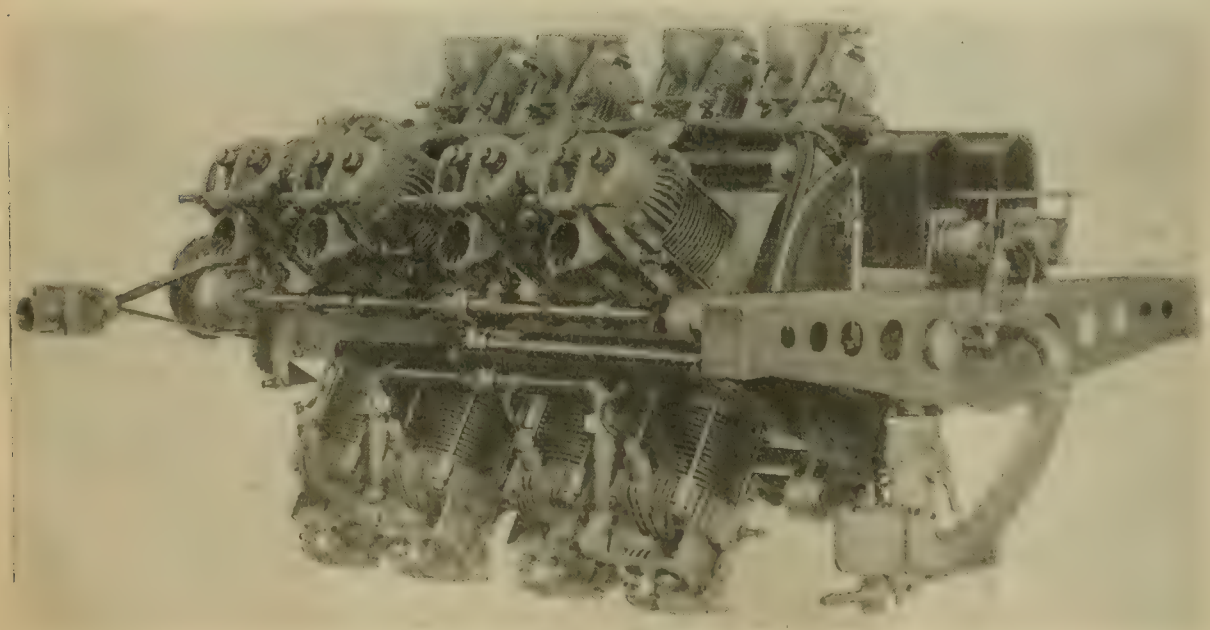
A NEW aircraft engine has been designed by Henry Trebert, long known in the gasoline engine industry. It is a rotary air-cooled type, and possesses the peculiar feature that the connecting rods are replaced by Scotch yokes rigidly connecting the pistons of oppositely located cylinders together, so that they reciprocate as a unit. The cylinders are arranged in groups of four, at angles of 90 deg., and the engine can be built with any multiple of eight cylinders. The axis of the Scotch yoke to which the pistons are connected is slightly offset from the cylinder axis, so that the yokes of two pairs of cylinders whose axes are in the same plane may pass each other. The connecting rod bearing is contained in a square box which slides in this yoke. The use of a common bearing for two opposite cylinders permits, it is claimed, of obtaining ample crankpin bearing surface. There are eight cylinders in a unit, with four crankpin bearings, and this is said to allow of a bearing width of 2 in. for each bearing. All of the eight pistons are connected to a single throw of the stationary crankshaft.

The poppet valves are mechanically operated, opening inwardly against the action of the centrifugal force and closing outwardly with the centrifugal force. Gas is taken into the motor through a carbureter connected to the hollow crankshaft. It then enters a distributing chamber separate from the crankcase, and from this chamber the intake manifolds carry it to the cylinders. These manifolds are of such design that the paths of the gases to all cylinders are of the same length, whereby equal distribution is assured.

On the sixteen-cylinder engine illustrated ignition is by two two-pole magnetos which are driven at twice engine speed, giving four sparks per revolution of the engine. The sparks from these magnetos are distributed to the various cylinders by means of a distributer consisting of contact brushes and a distributer ring comprising metal segments embedded in insulating material, which is carried on the engine at the forward end. There are eight explosions to every complete revolution of the engine.

Lubricating oil is forced through the hollow crankshaft to the crankpin bearings under a slight pressure. Radial holes are drilled through the wall of the crankshaft at the centers of the crankpin bearings. To other parts oil is distributed by centrifugal force. The engine is air-cooled by means of the usual cooling ribs on the cylinders. In order to intensify the cooling action on the exhaust valve a sort of air scoop is secured over the valve, which scoops up air as the engine cylinder block rotates and brings it into direct contact with the valve stem and head.

A new feature in rotary engines is claimed to be the provision of a case-hardened plate in the face of each Scotch yoke which works against a hardened bearing surface, and this rotates the engine. In this way the cylinders and pistons are freed of side thrusts. Among the advantages claimed for the engine are absolute rotating balance, simplicity of design and low weight. The engine is built by the Trebert Airplane Motor Co.



Trebert rotating aircraft engine

THE Manufacturers' Aircraft Association is attempting to compile a list of all the aviators in the country together with a general scope of their activities. It is hoped to have every operator in the country fill out this questionnaire, a copy of which can be obtained by request to the association at 501 Fifth Avenue, New York City.

New Features Added to Many 1922 Body Models

Although manufacturers are striving for lower cost of production there is no tendency to cheapen the product by using inferior materials or leaving off appearance improving equipment. A detailed study of designs exhibited at the New York show revealed several new points of interest.

By George J. Mercer

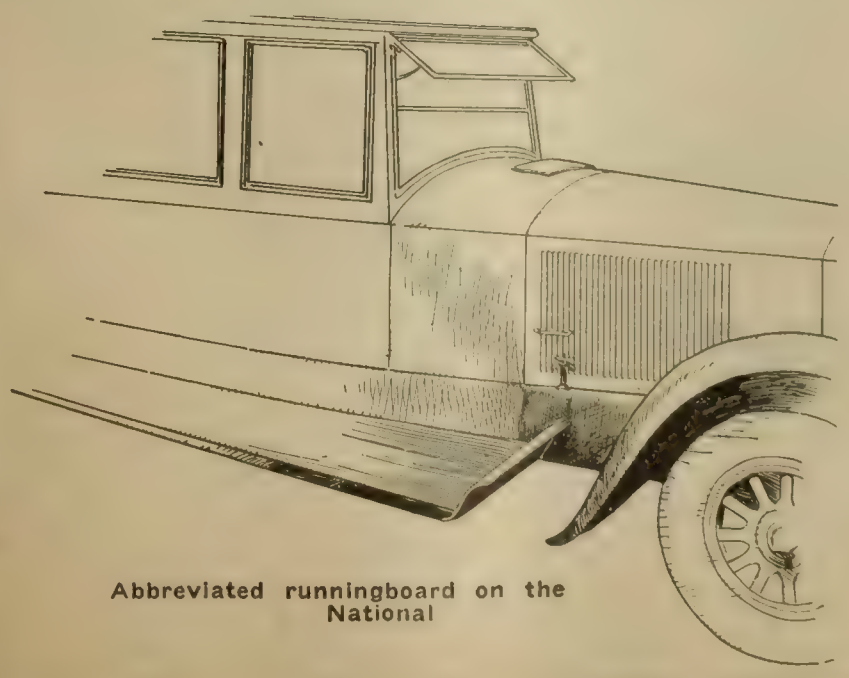
A STUDY of details of passenger car body designs at the recent New York show brought to light a number of new features. A noticeable point in connection with these features was the use of them on so many new models. It was largely due to this fact that a casual inspection gave the impression of great similarity in construction. In fact, many a visitor was heard to remark, "They all look alike to me."

Dealers, however, who visited the exhibits of the cars they sell were inspired by changes that have remedied some faults that were previously so apparent. These changes were clearly visible to the family of business associates whose living depends upon the product of the manufacturer.

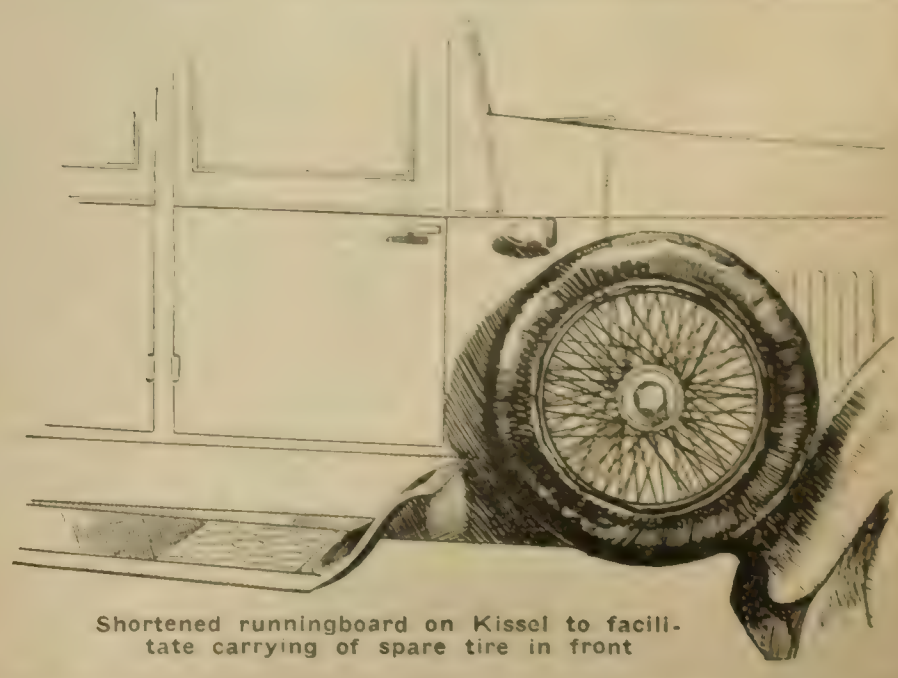
A few of the bodies were absolutely new and were shown for the first time as a manufacturer's model. One of these was the inside driven cabriolet—exhibited by Lincoln, Vauxhall, Stevens-Duryea and Roamer and illustrated in a previous article in AUTOMOTIVE INDUSTRIES. All of these models were good examples of body work. The inside driven cabriolet is new in a few respects only. It has been used on British cars for many years, but until recently failed to find favor in this country. The changes made to adapt it to the American market included removing of the collapsible roof feature. To the casual glance, however, the principal characteristics of the collapsible roof are retained, the most noticeable of these being the outside joint at the rear quarter. The question naturally arises as to the need of retaining features that do not add to the usefulness of the body and are, therefore, an unnecessary expense. It cannot be denied, however, that the retention of some of the original features, although not actually necessary, do add to the exterior appearance and balance of the design. Not all bodies shown made use of the joint, however, since its use necessitates omitting the window in the quarter or else making it very small. The advantages of the larger window are apt to outweigh the style appearance that the use of the joint conveys, with the result that it will probably be used to a less extent in future designs.

On these bodies, however, the use of the full door and the elimination of the folding feature have made a more acceptable body for the American public. This feature eliminated means less rattling and a longer life to the leather or fabric covering the top.

Another new feature of 1922 models is the close coupled body, of which the Jordan and Maxwell are examples illustrated. This design is one that will probably find increased favor as time passes. It is intended to meet the demand of the buyer who is not satisfied with the rather cramped seating accommodations offered by a coupe and who is not willing to have as large a body as the regulation sedan. Others exhibiting this type of body were Stanley, Patterson, Earl, Essex, Peerless, Cole, Stearns, Franklin and LaFayette. The majority of these bodies had two doors, with the front seat made in two sections, the right one being made to swing about for access to the rear of the car. Several had the driving seat made to fold, to permit the occupants to get out from the left side in case of emergency. A few of these bodies had four doors, as shown on the Maxwell.



Abbreviated runningboard on the National



Shortened runningboard on Kissel to facilitate carrying of spare tire in front

These bodies have an advantage in seating over the average coupe, because the rear seat is built straight across. In fact, the seat accommodations are the same as the sedan, but closer set up, and some of the manufacturers advertise them as sedanettes. Essex uses the name coach, and there are some other appellations given the design.

It might be asked why the Body Standards Committee of the S. A. E. did not clean up the matter of naming this model. Their reason probably lies in the fact that time will be required to sift it into more sharply contrasting lines and that, for the present, it will be best considered as belonging either to the coupe or the sedan class. With the two doors it belongs to the coupe and with four doors it will be nearer the sedan.

There is somewhat of a tendency on the part of manufacturers to create a low-priced, durable service model body that will be acceptable as a closed body for business purposes. Dort showed this type in both the four- and two-passenger models. The latter is probably the most sensible size for this type.

There was a rather general tendency among exhibitors to place the spare tire at the forward side. This is the first time that quantity-built cars have made use of this location for the spare tire. Addition of trunk racks at the rear is largely responsible for the change. The two illustrations, one of the Kissel and the other of the National, show the runboard shortened to permit the carrying of the spare tire in this position.

All styles of trunk racks were used. Some were of the platform type, while others used the folding rack. The majority, however, used the stationary slat design. With but few exceptions, the rack and the guard rods were nickel or bright metal, wood slats forming a base for the trunk.

Among the larger sized bodies shown, the illustrated Pierce-Arrow berline is a good representation. The slant front may be noticed, and this is common with this type of body. The slant pillars on this body, however, are much lighter than usual, and the front is exceptionally light and attractive looking. This picture also shows the fabric visor, which was used on a majority of the cars. There were a variety of visor designs. Some were painted metal, others metal covered with fabric and in some cases fabric was fastened over a frame. The finish at the ends also varied, some having the flat panel supported by brackets and others having the ends closed by the fabric, as shown on the Maxwell and the Jordan.

For appearance, the last two named are superior. There is a more complete and finished look to these than to the type having open ends and supported by brackets. There were a few glass visors, some being painted, while others had the frosted finish.

Exterior features of inclosed bodies, generally, harmonized with the best characteristics of last year. The single wide belt molding, the ventilator top of shroud, the lower part of windshield stationary, the use of dash lamps and a slight increase of the use of the soft roof were the predominating features on new models.

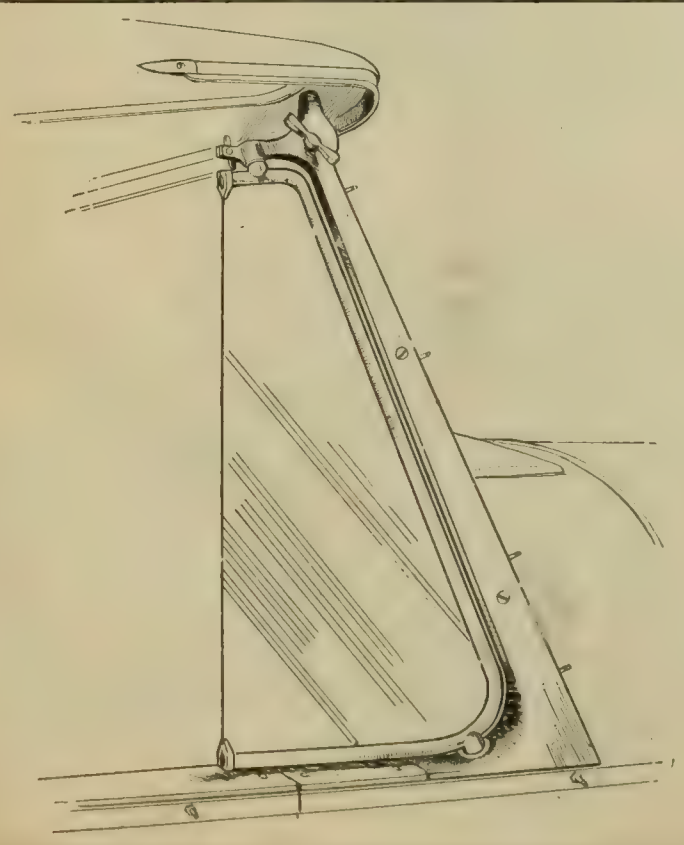
Some doors were made flush, some with the overlap and others with moldings. More outside hinges were used than the concealed. The straight bar handle was general and this was divided about equally between nickel and black finish.

There is a lack of uniformity in the manner in which the doors on inclosed bodies are made to open. On open bodies it is the general practice to have the hinge at the front of the door. On inclosed bodies the best practice for satisfying the largest number of users is for four doors to open with their handles together at the center. Two-door bodies, as on the coupe, give greatest satisfaction when the doors have the hinge at the front. Five of the close coupled bodies at the show had two doors. Four of these were hinged at the front and one at the rear. Of the four-door type four bodies had the doors open with the handles at center and one had doors hinged at rear. From these examples it would seem that the newer bodies have a tendency to be more uniform as to methods of hinging.

Nickel was more generally used this year than ever before. Approximately two-thirds of the exhibitors had one or more cars with all-nickel or nickel-trimmed headlights. One-half of the cars with nickel headlights had nickel radiators and there were three with gold plate.

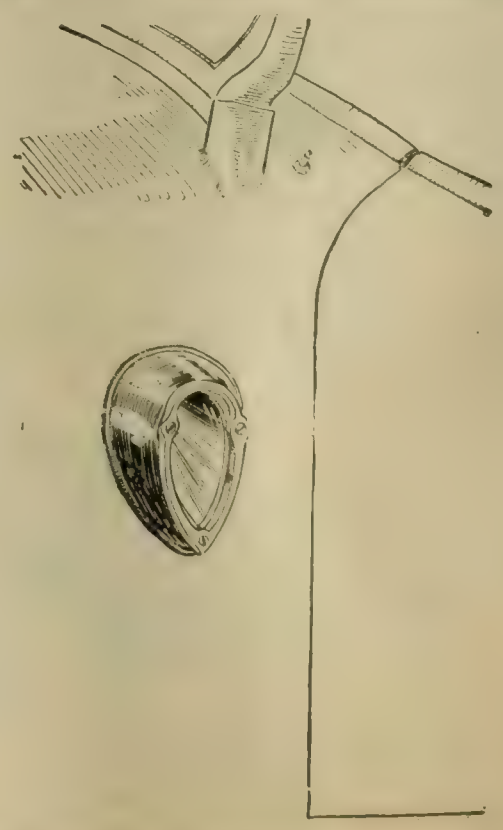
Nearly all the headlights were the drum shape—dash lamps corresponded in pattern to the headlights. Windshields on open cars were also quite often trimmed with nickel.

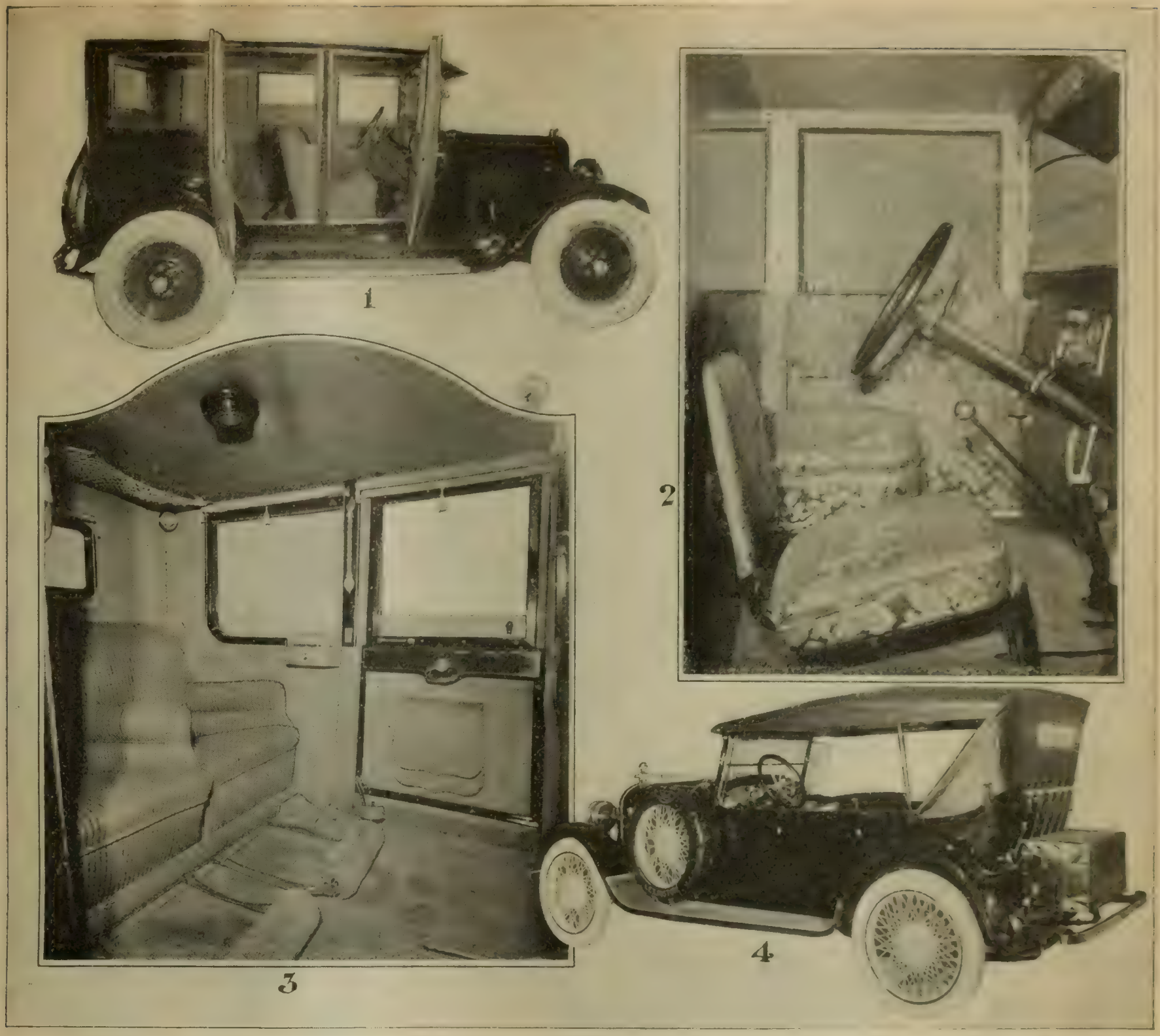
The illustration of the windshield foot on the Chalmers shows the tendency to change the method of attaching



Auburn design of side wing forming integral part of windshield

Courtesy light on Wills-Sainte Claire





1—Maxwell coupe. 2—Maxwell coupe, forward section. 3—Interior of Itala. 4—Lexington phaeton with trunk rack

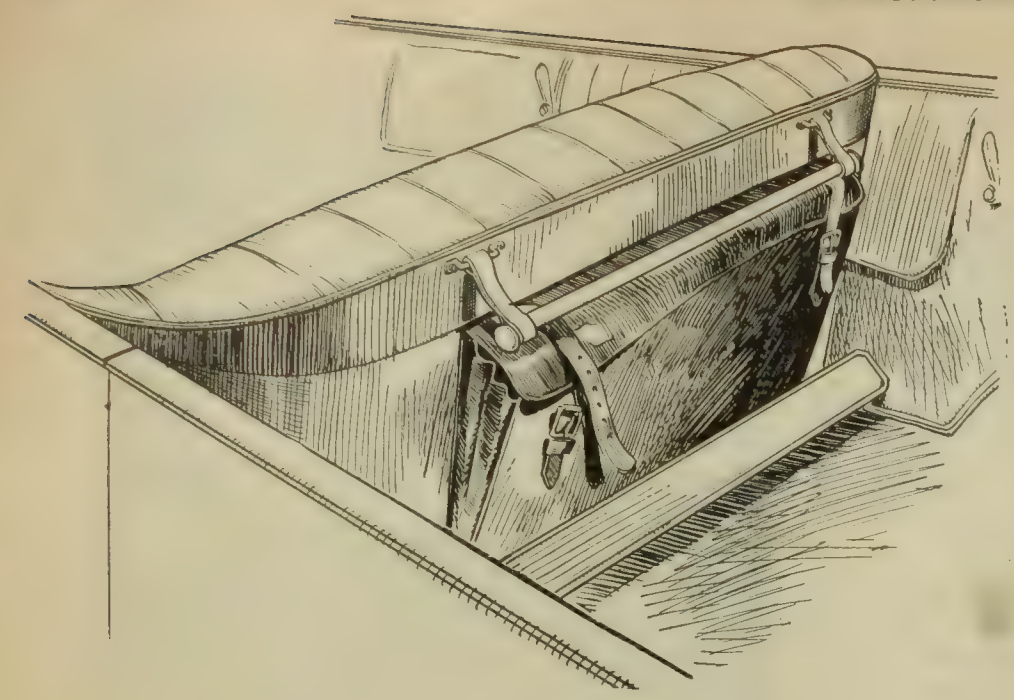
the shield to the shroud on open bodies. This is due to the prevailing round lines on radiator, hood and shroud. The illustration of the Chandler phaeton shows one of the new body designs in which the round lines of the front are well carried out.

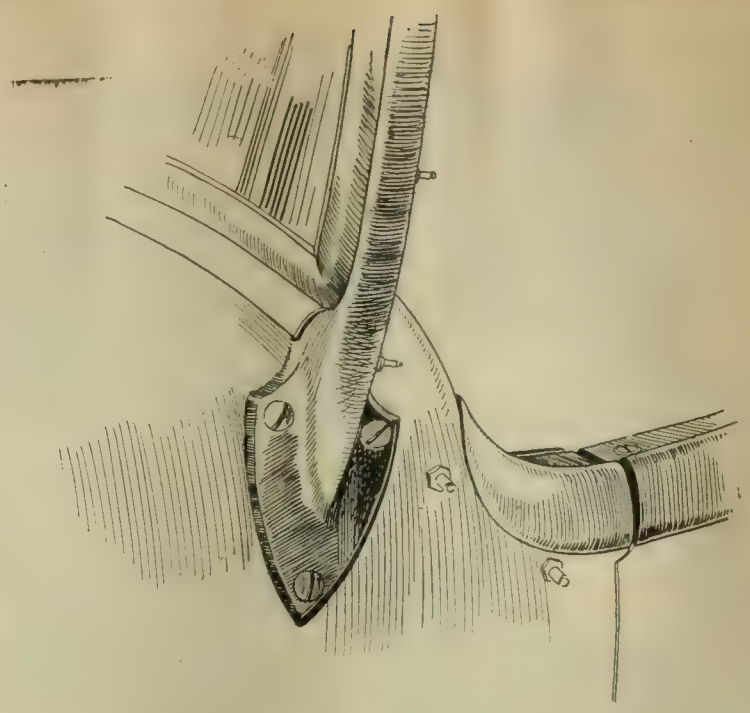
This body carries the convex on the body side and the top edge of the body is drawn in. The rounding is taken from the body thickness and the top edge is thinner than usual and rounded over. One other feature on this body was the use of flush ventilators, which is an improvement over the conventional type. As shown, the shield has side wings. These wings were well represented and there is evidence that thought is being concentrated along the lines of developing improvements in open car windshields. The illustration of the Auburn shows a new design side wing that is an integral part of the shield. The Leach used a shape that is similar to that used by the Paige, and some others attempted to make the shield side arm nearer perpendicular at the rear. This was done to facilitate the fastening of the storm curtain, the idea being to accomplish this object at less expense.

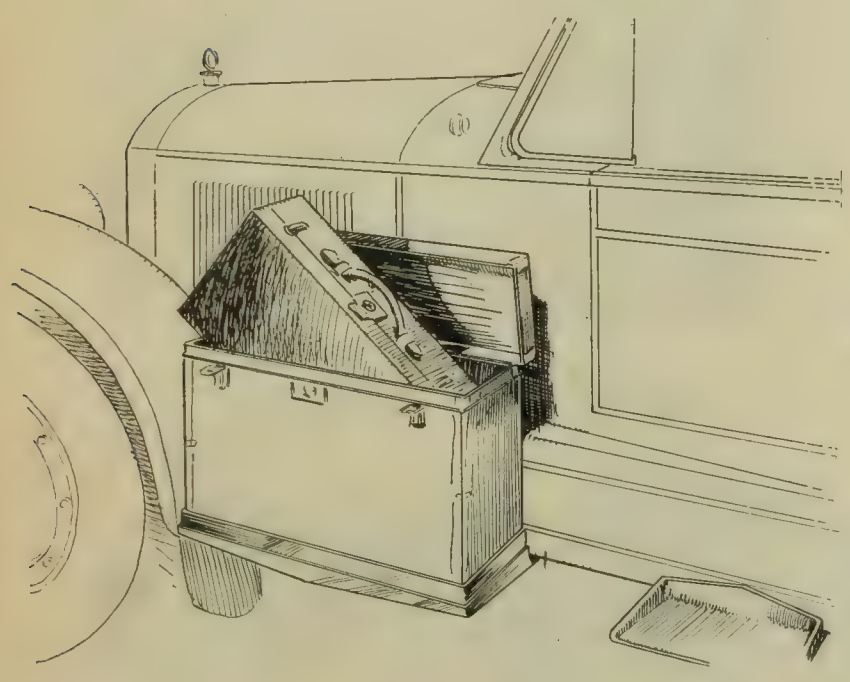
The problem of storing the storm curtains on phaetons has occupied the attention of some designers. In some instances a space in the back of the front seat has been utilized for this purpose. The illustration of the Lexington shows one way that this locker space may be covered, the bellows pocket being so arranged as to cover a recess in the seat-back. Others use a natural wood finish door; in fact, the rear of the front seat was quite often finished with wood and had small locker space above the curtain pocket. The use of wood on open bodies was used to a considerable extent as a covering for the top edge. It is advantageous to have some protecting edge to the top of the doors on these bodies because in opening and closing the doors, as well as at other times, the hands of the occupants of the car rest upon this surface.

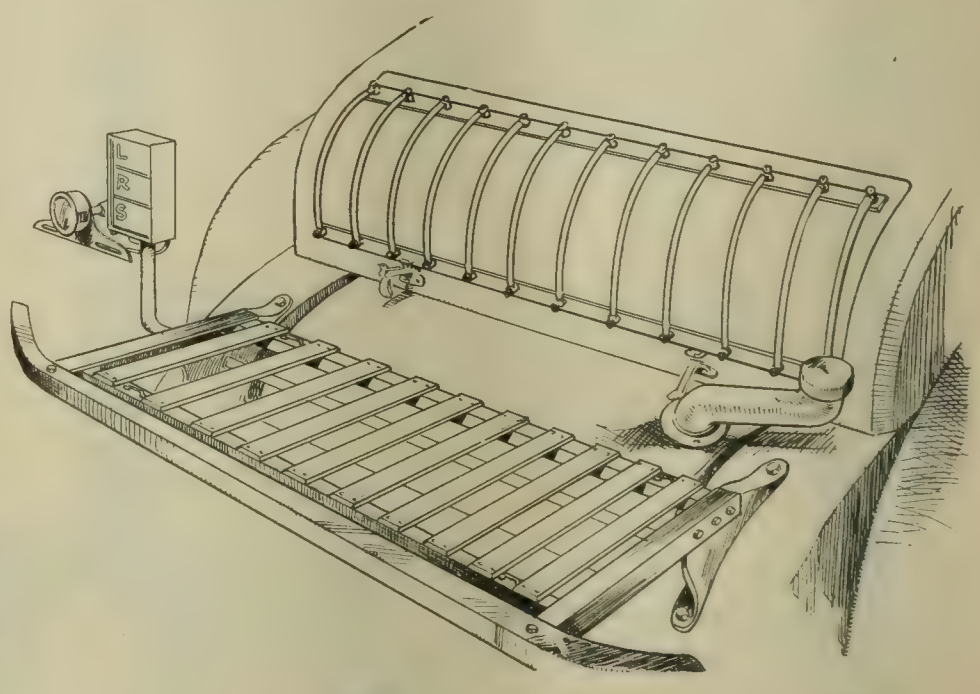
The illustration of the Itala body shows a box footrest. This was seen on several cars. On the one illustrated it was used to contain the storm curtains, but generally it formed a toolbox. It was made both as a separate unit and as a part of the seat-back. It was generally shorter than the width of the body to allow easy entrance, and the outer corners were rounded.

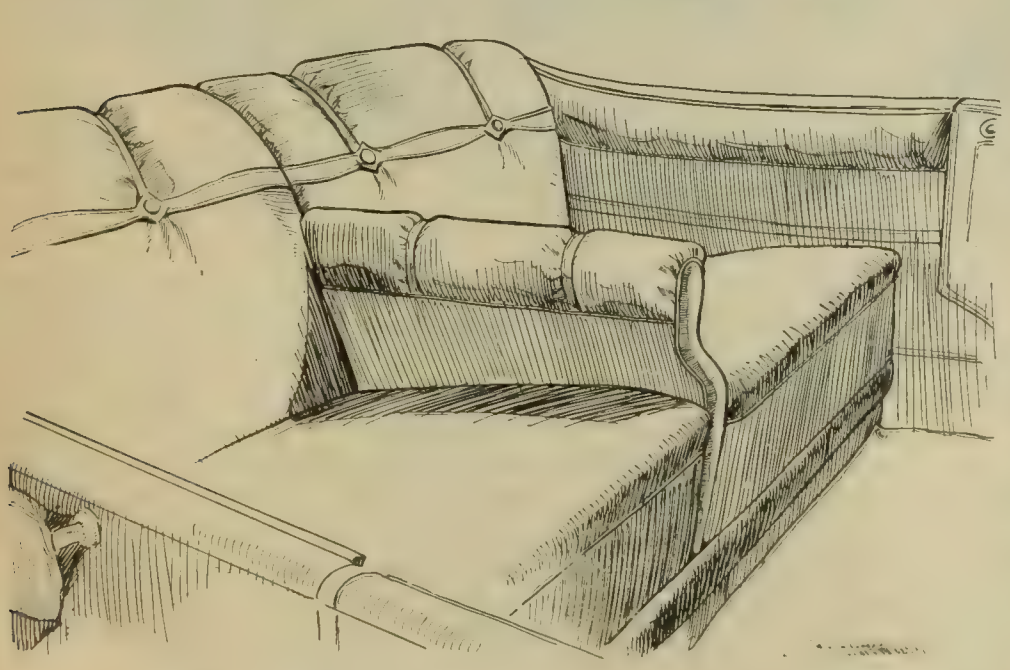
The rear section of this same body shows the permanent division of the rear seat and the trimming design of Spanish leather. Use of this leather for trimming material on both roadsters and phaetons was more general than in previous years. It was also used for trimming the driving compartment of berlines.

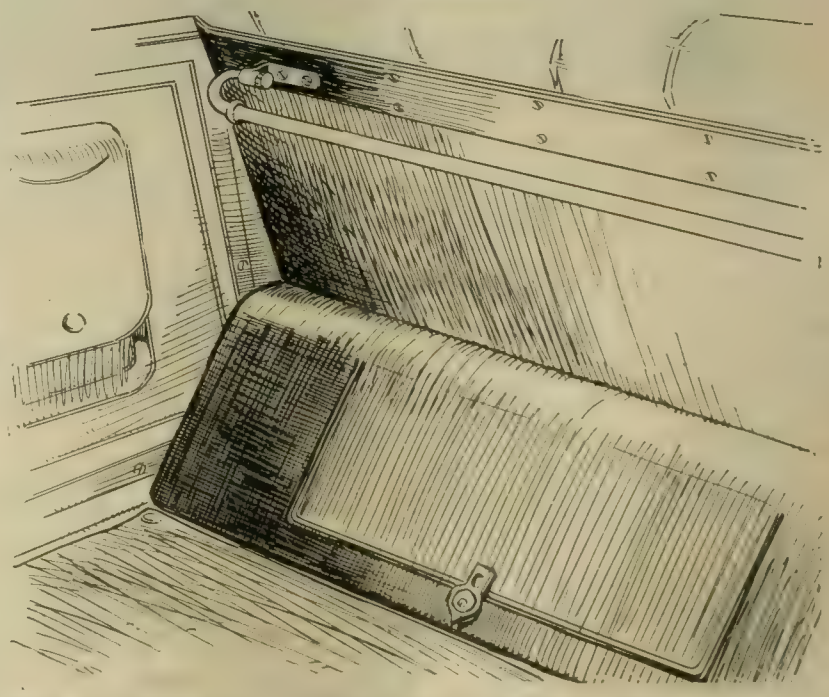










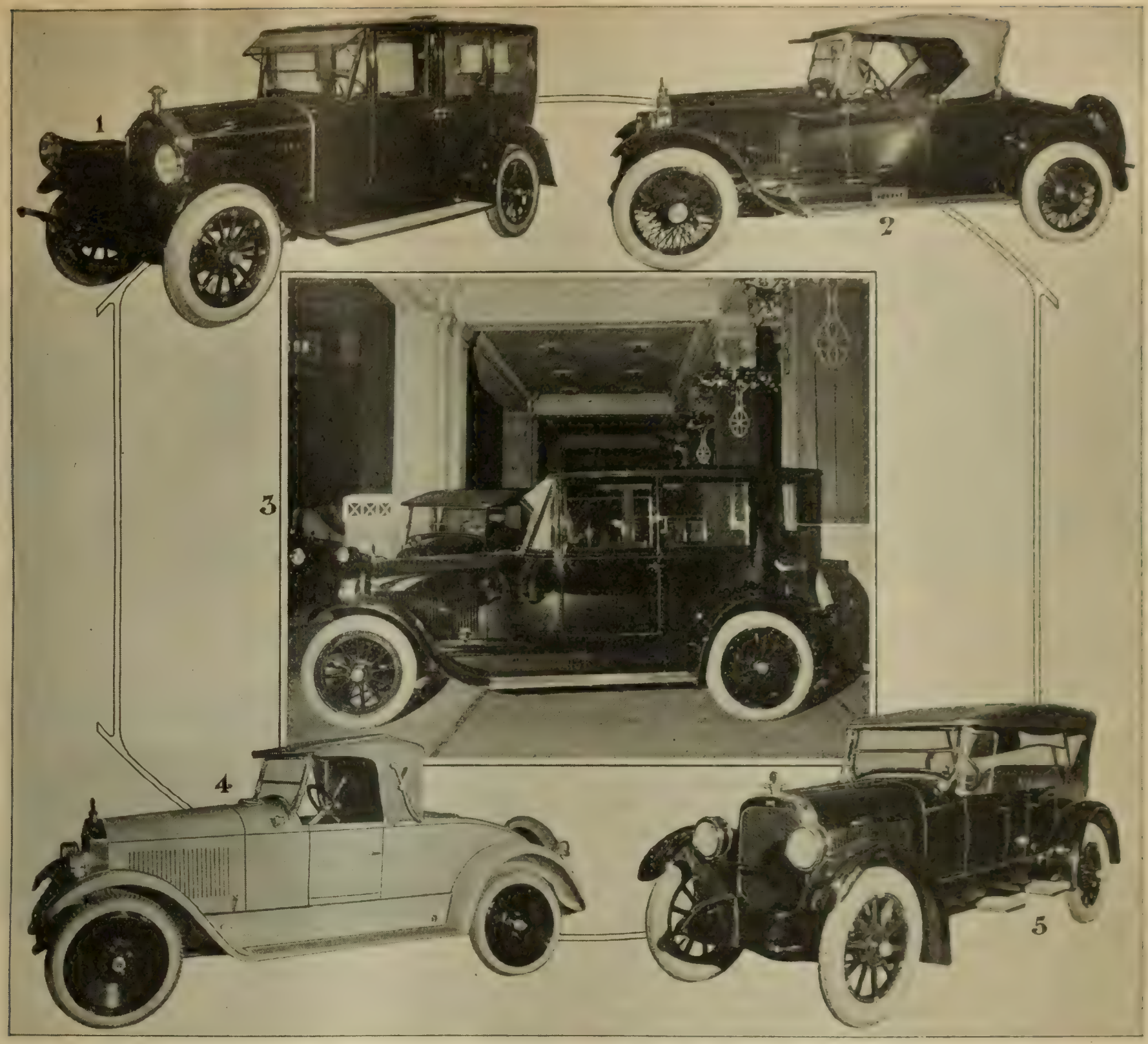


(Upper left)—Lexington method of storing storm curtains on back of front seat. (Upper right)—Base of windshield bracket on Chalmers. (Center left)—Auburn suit case carrier. (Center right)—Leach trunk rack. (Lower left)—Itala permanently divided rear seat. (Lower right)—Itala box foot rest

The extensive use of this material, together with nickel parts, increased use of the trunk rack, as well as the fact that a number of cars were equipped with khaki-colored fabric tops with wood bows and nickel slat irons or sockets, indicated that the sober car has taken a temporary recess.

The body builder is now, and has been for some time past, making one dollar the equal of two and sometimes three in purchasing power for his product. Low selling price is the ultimate goal of practically every manufacturer. Yet only in the service car do we see the effect of cheapened value. The standard body has as much merit as a specially built article. Good workmanship and good material are the rule and more of the ornate is to be seen than ever before.

The deduction that can be drawn from the above summary is that the car manufacturer, strive as he will to bring the body cost to a new low level, is not willing to go before the public with an inferior article. Therefore, the bottom in body prices sought is something that



1—Pierce-Arrow berline. 2—Buick roadster with novel top. 3—Jordan coupe. 4—Moon roadster with special top. 5—Chandler phaeton with round lines

is desired in excess of what will be actually attained. The effort to reach the goal will be productive of results, but never at the sacrifice of the product.

The interiors of the inclosed bodies present further evidence in support of this summary. There was not a body, with the exception of service models, that did not have all the garnishment of former years and perhaps a few more.

Two of the illustrations presented herewith, one of the interior of the Itala brougham and the other of the Maxwell coupe, are examples of this fact. Both, however, were more ornate than the average. The former was trimmed with gray wool fabric having a fine black stripe. The rear seat was divided and the trim design was plain. The wood trimming was Circassian walnut and vanity cases were made of the same material. There were also toggle grips and foot pillows and pockets on the doors. The Maxwell was a show job, trimmed with silk brocade and an all-metal finish of gold.

As to the materials used in the various used cloth trimmings, velours and wool fabrics were about equally divided. On the new models, wool fabric was favored and the preferred color seemed to be dark gray with pin stripes. Grays that had a considerable mixture of green were also used, as were some blues. On the town-car types, broadcloth was the favorite. Vanity cases were usually the visible, natural wood finish. Very few concealed vanity cases were used.

Pockets on the doors were the rule. Robe-rails, footrests, heaters, dome and corner lamps, as well as silver-finished interior hardware, were commonly used. The use of natural wood trim is trying for a comeback. The Noma sedan had the entire roof panel of wood, as well as the standing pillar inside, so finished. This year will see many of the little interior furnishings that go to embellish the special body made part of the equipment of many stock cars.

The capacity of the medium-priced inclosed body model was five passengers. The new Durant and Rickenbacker had this size on all models. Many of the cars, however, having small capacity inclosed bodies had seven- as well as five-passenger phaetons. The majority had, however, the regulation five-passenger sedan, four-passenger coupe and roadster. Two manufacturers

showed the new close coupled closed body as their only inclosed car. In other instances it was exhibited as an additional model.

Top designs on phaetons have not undergone change except that more used khaki-colored fabric and more tops were lined than usual. A few were made with semi-victoria quarter curtains. The illustrated view of the Moon roadster is an indication of one way that tops for this type of car are designed. That of the Buick shows yet another top design.

The California top of the original character was exhibited by Leach. It was also exhibited by the H. C. S. in a modified form. Two other cars had tops of regulation California design, as it has been made over to suit eastern trade. There is no evident leaning toward a more general use of this top, despite its many advantages. The cost of these tops are their greatest impediment to more common use.

Color combinations exhibited were varied enough to enable any phase of discriminating taste to be suited. There were only two unhappy color combinations. If the colors displayed are indicative of what the production colors are to be, maroon and black have superseded the blue and black that have been the standard for so long on inclosed bodies. In some cases, when these colors were used on phaetons or roadsters, the wheels were red. Sometimes natural wood finish was used and at times wire wheels were nickeled or white. Disk wheels usually had nickeled rim and hub flanges.

Yellow, when used for inclosed bodies, was combined with black, and on open bodies with brown or blue. The extent to which colors were used can be estimated by the fact that over two-thirds of the bodies had bright or near-bright color combinations. This does not include bodies that have merely added striping. When we add to these attractions the large number of cars with wire and disk wheels, cycle mudguard and steps, together with the various features previously noted, the attractiveness of the body presentation ranks well ahead of previous years.

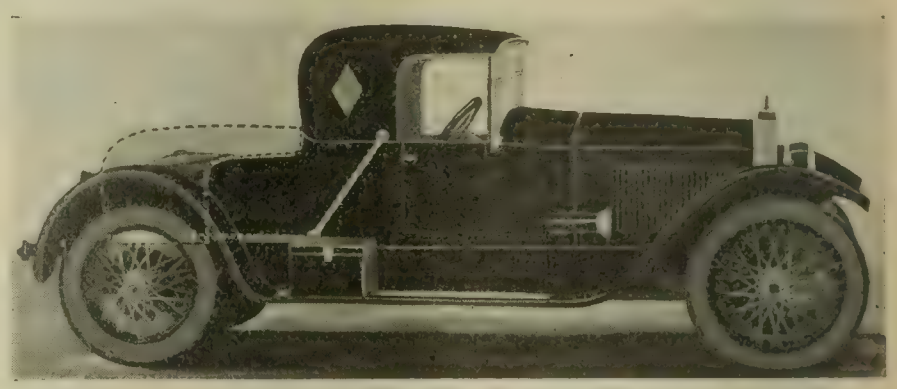
From the viewpoint of design, the bodies are uniformly good. Conventional trade has stabilized various models for specific use. The line of demarkation is more defined, the selling quality is the strongest controlling factor, and the writer's deduction, from a careful review of the season's offering, is that there is no evidence of cheaper quality or methods of manufacture to warrant the current talk in the trade of very low-priced bodies. Neither is there any evidence of cheap models that are available as substitutes for the standard models exhibited.

A New Type of Convertible Body

THE body shown in the accompanying cut has been designed to meet the demand for a body which can be quickly changed from the open to the closed type, and vice versa. This body is similar to that used in roadsters seating two to four persons, except for the top, which is of rigid construction, preferably pressed from sheet metal. The top is arranged to perform a double function. It can be used to form a completely closed body when in the raised position, or, when down, to serve as the rear portion of the body and inclose the spare tire or wheel. This double use is obtained by shifting the top bodily from one position to the other on rotating arms fastened to the sides of the car.

When the top is in the lowered position it forms a continuation of the body in rear of the seat, the edges of the top fitting into a recess in the body surface to preserve unbroken body lines. The lower rear edges, resting on a narrow apron formed by flaring the extreme edge of the body, prevent dust or moisture from reaching the inner surface of the top. The design is such as to allow a spare wheel to be mounted in back of the seat, as is done in several cars now being marketed, this wheel being inclosed when the top is down. The general contour of the top is such as to harmonize with the body, and, as the top is enameled to conform to the color scheme of the car, it serves to provide an open car with pleasing body lines.

When a closed car is desired the top is drawn up and forward, being carried during this movement on the side arms. These rotate about their lower ends as a center, while the top is free to swing on the upper ends, allowing it to be maintained in a practically horizontal position. A handle concealed in the upper forward portion of the top serves for raising or lowering the top, and interlocks with clamps to hold the top in either position. The movement of the top is accomplished without alighting from the car. When the top is in the forward position it rests on the body edges, being clamped to the body and to the windshield. If the car is to be completely inclosed, windows carried in the side doors are racked up. A rubber strip pressed into the edges of



The Ellerbeck convertible body

the top all around assures a weather-tight job and prevents rattling of the top in either raised or lowered position. Vision in all directions is provided by windows at the sides and rear.

The supporting arms are turned at right angles at their ends to journal into bearings. The lower ends are connected so as to maintain the arms parallel, and are connected with a spring which is under tension when the top is in the lowered position. This spring relieves much of the weight of the top when it is being raised, and cushions the movement of top in lowering it.

When the body is closed, pleasing body lines are still maintained by carrying the metal of the body sides up and around the spare wheel, as is done with cars mounting the wheel in rear of the seat. Such appointments as inside covering, dome lights, etc., can be used if desired. This type of body is said to be simple and inexpensive to manufacture. It is the design of B. B. Ellerbeck.

A HISTORY of aeronautics, tracing the development of flying craft from the time when the idea was but a dream to its present important stage, has been written by E. C. Vivian, former editor of *Flying*, and Lieutenant-Colonel W. Lockwood Marsh, secretary of the Royal Aeronautical Society. Mr. Vivian takes up the first part of the book with a discussion of the development of flying generally, while Lieutenant-Colonel Marsh discusses progress in design in the second part.

Fatigue of Metals Investigated

University of Illinois report on tests describes materials, apparatus and specimens used in investigation. Results indicate effectiveness of proper heat treatment in raising endurance limit of ferrous metals.

AN extended investigation on the fatigue of metals has been made at the Engineering Experiment Station of the University of Illinois with the co-operation of the National Research Council, the Engineering Foundation and the General Electric Co. by H. F. Moore, Research Professor of Engineering Materials, and J. B. Kommers, Research Associate Professor of Engineering Materials. A report on this investigation has been published, and copies of it may be had from the University of Illinois at a nominal price.

After a brief historical outline of the subject, notes on the organization of the test party and acknowledgments, the report describes the materials, tests, testing apparatus and test specimens used in the investigation. The results of the tests are given in the form of tables and curves; these results are discussed and the following summarized conclusions are drawn therefrom:

(1) For the metals tested under reversed stress there was observed a well-defined critical stress at which the relation between unit stress and the number of the reversals necessary to cause failure changed markedly. Below this critical stress the metals withstood 100,000,000 reversals of stress, and, so far as can be predicted from test results, would have withstood an indefinite number of such reversals. The name **endurance limit** has been given to this critical stress.

(2) In the reconnaissance tests made in the field of ferrous metals no simple relation was found between the endurance limit and the "elastic limit," however determined. The ultimate tensile strength seemed to be a better index of the endurance limit under reversed stress than was the elastic limit. The Brinell hardness test seemed to furnish a still better index of the endurance limit. The reason why the Brinell test and, to a less degree, the ultimate tensile strength seem to be better indices of the endurance limit than the elastic limit is not clear, and this result should be regarded as tentative. Elastic limits determined from compression tests and torsion tests gave no better index than did those from tension tests.

(3) The single-blow impact tests (Charpy tests) and the repeated-impact tests did not furnish a reliable index for the endurance limit under reversed stress of the ferrous metals tested.

(4) Accelerated or short-time tests of metals under repeated stress, using high stresses and consequent small numbers of repetitions to cause failure, are not reliable as indices of the ability of metal to withstand millions of repetitions of low stress.

(5) The endurance limit for the ferrous metals tested could be predicted with a good degree of accuracy by the measurement of rise of temperature under reversed stress applied for a few minutes. This relation is explicable in view of the intercrystalline and intracrystalline slippage under repeated stress shown by the microscope. It is believed that this test, which is a development of a test proposed by Mr. C. E. Stromeyer, can be developed into a reliable commercial test of ferrous metals under repeated stress. Its applicability to non-ferrous metals has not been investigated.

(6) Abrupt changes of outline of specimens subjected to repeated stress greatly lowered their resistance. Cracks, nicks and grooves caused in machine parts by wear, by accidental blows, by accidental heavy overload, or by improper heat treatment may cause such abrupt change of outline. Shoulders with short radius fillets are a marked source of weakness.

(7) Poor surface finish on specimens subjected to reversed stress was found to be a source of weakness. This weakness may be explained by the formation of cracks due to localized stress at the bottom of scratches or tool marks.

(8) Stress above the endurance limits, due to either a heavy overload applied a few times or a light overload applied some thousands of times, was found to reduce somewhat the endurance limit of two ferrous metals tested.

(9) In none of the ferrous metals tested did the endurance limit under completely reversed stress fall below 36 per cent of the ultimate tensile strength; for only one metal did it fall below 40 per cent, while for several metals it was more than 50 per cent. However, these metals were to a high degree free from inclusions or other internal defects; the specimens had no abrupt changes of outline and had a good surface finish.

(10) It is well known that subjecting steel to a stress beyond the yield point raises the static elastic tensile strength to a marked degree. The effect is less marked on the endurance limit, although some increase was observed for 0.18 carbon steel with the surface polished after being stretched well beyond the yield point. Annealing of commercial cold-drawn screw stock was found to lower its endurance limit somewhat less than it did its static elastic strength.

(11) The test results herein reported indicate the effectiveness of proper heat treatment in raising the endurance limit of the ferrous metals tested. Here, again, it should be noted that an increase in static elastic strength due to heat treatment is not a reliable index of increase of endurance limit under reversed stress.

(12) The phenomenon known as "fatigue" of metals under repeated stress might better be called the "progressive failure" of metals. The most probable explanation seems to be that such failure is a progressive spread of microscopic fractures. A nucleus for damage may be a very small area of high, localized stress, due to a groove, a scratch, or a crack; in other cases failure may be due to internal inclusions or irregularities of structure; it may be due to internal stress remaining after heat treatment; it may be due to a grain or group of grains unfavorably placed to resist stress; or failure may begin in the weaker grains of a metal whose structure consists of two or more kinds of grains; or it may, of course, begin in any portion of the metal which, by accidental overload or otherwise, is stressed to the yield point.

Recommended Seating Dimensions for Passenger Car Bodies

A discussion concerning various controlling dimensions which require consideration in laying out the seats and other closely related portions of the modern body. The author recommends the standardization of a range of locations for control elements and gives average dimensions.

By George E. Goddard*

BODY seating dimensions vary. Naturally, we do not all agree upon what constitutes the most comfortable chair; if we did, we might all be buying the same chair. Therefore, body seating dimensions are not a subject for standardization; they can, however, be given very serious consideration and the intention of this paper is to elucidate certain necessary features conducive to comfort.

Cushion Height, Depth and Slope

The mode of women's dress is of prime importance. It is very fortunate for the body designer that women are wearing shorter skirts at present, and that they girdle themselves with a support of minimum proportions, particularly as to vertical dimensions. Seat cushion heights are now, or can be made, as low as is necessary to secure the assumption of a comfortable sitting position, or to arise from that to a standing position; in other words, it is necessary that the passenger be able to sit down and to arise easily and naturally.

I will call the space in front of the seat "leg room." Naturally, this space must be increased to conform to the lowered sitting position. It is here that one of the greatest variations in seating dimensions occurs. When this leg-room is restricted, the final position must be made comfortable by incorporating the proper slope in the cushion and the corresponding slant in the seat back. It has been stated that the semi-reclining position attained in the deck chair, so common on ocean liners, is ideal. This may be entirely correct, but I doubt if it can be duplicated in conservative motor body design. However, it can and should be approached in the passenger car, because it contributes to the attainment of a horizontal line of vision that is more nearly equal in elevation to that of an individual who has assumed a standing position. The more nearly the eye line height of the passengers is brought to that of a person who is walking, the more they will be at ease, if for no other reason than that man's work is carried out mainly from this viewpoint.

The depth of the cushion, from front to back, is affected by both the height and the leg room. If the latter is not restricted, the slope can be made slight and the depth greater. If it becomes necessary to draw the legs back, the knees are raised and the body must be supported by the cushion at a greater slope. In coming back, the calves of the legs would interfere with the front of the cushion and it must be made more shallow. The seat back must be slanted more, the back springs slightly stiffened and the "foot rest position" located within comfortable reach. These seem to be the elements to be given major consideration. I recommend 12 in. at the front of the cushion as a good compromise position, with a minimum depth of 17 in. on a 2-in. slope and a minimum back height of 17 in.; also, for the rear seat, a 14-in. height at the front of the cushion, with a minimum depth of 19 in. on a 2-in. slope and a minimum back height of 19 in. These dimensions are, of course, dependent upon the pedal position from the front edge to the cushion of 19 in. and a foot rail position of 18 in., measured correspondingly, and reference is made to the illustration and last line of figures in the tabulation. It has been found preferable to have rear seat passengers ride slightly higher than those in the front seat, to secure clearer forward vision. The 2 in. recommended, when combined with the slope of the chassis, which should be from 1 to 2 in. with a full complement of passengers, is sufficient under average conditions.

Upholstery Shape

To deviate for the moment from the actual dimensions of seats, the correct shaping of the seat, the upholstery contour, is of far greater importance than either its proportions or softness. The dimensions may be such as to provide a well proportioned seat, and yet it may be a very uncomfortable seat for even a short ride. The angular relation of the cushion and the back upholstery must be right. This relation will vary somewhat with the height of the cushion and the foot rest position, but the angle will average about 95 deg. The cushion should have an approximately flat slope, but the back upholstery shape must have a properly curved contour. This contour naturally does not vary to a great extent as to characteristic shape regardless of the height, depth or slope of the cushion, or the height of the back upholstery itself. It is obvious that the occupant's back must be supported, but proper support is lacking in a great many seat backs. If, when seated, one's back can "cave out," there are very few who can ride 10 blocks in comfort; but, if one's back is properly supported against curvature, one could drive or ride for a four day 1000-mile trip and feel sufficiently fit at the finish to turn around and do it again. Strange to say, the average trimmer fails, without considerable coercion, to produce this desirable shape, and particularly a properly graduated resistance to prevent curvature. The back upholstery must be shaped so as to have a prominence of the proper resistance, and be at the proper height from the cushion to fit the small of one's back. It must, nevertheless, taper off toward the top to provide ample shoulder freedom. This is particularly important for the person at the wheel. The resistance at this point can be fairly stiff and yet be comfortable. In fact that supposed 1000-mile

*Slightly condensed from a paper presented at the Annual Meeting of the Society of Automotive Engineers. The author is assistant chief-engineer of Dodge Brothers.

ride depends upon making it stiff. There should be very little movement of one's back at this point; the movement should occur at the hips. The driver needs this resisting prominence in particular, to enable him to attain a confident and comfortable operation of the clutch and brake pedals, if for no other reason. Without attempting to give details of the layout of this shape, I would say that the gradation of the springs of four row backs can be made so that the bottom row has No. 13, the main row No. 12, the third row No. 13 and the top row No. 14 springs. However, this can all be laid out on paper. From this, drawings and specifications of the back spring constructions, as well as of the cushion, the back and the final inspection templates, can be determined.

Softness of trimming is controlled to a great extent by the trimmer but, if the final contour of the combined cushion and back is obtained, together with a properly related foot rest position, the slight variation occurring as to softness is inconsiderable. If it is to be featured, softness should be obtained in the spring construction almost entirely, especially in the straight pleated type. The cushion top should be firm, to enable it to endure for a proper length of time.

Position of Foot Rest, Steering Wheel and Controls

The term "foot rest position" has been used as applying to the brake and clutch pedals and to the foot rail. It applies, also, and perhaps more particularly, to the accelerator pedal. It is obvious, then, that the last named should be located at a slightly greater distance than the other pedals for, when operating clutch or brake, sufficient freedom of movement between the thigh and the cushion must be allowed for, when determining the slope of the cushion. Since the accelerator pedal has less effective travel, it must be positioned to take up practically all of this freedom in order that the thigh be comfortably supported along the entire length of the cushion slope. An accelerator pedal toe rest cannot accomplish this; it can merely produce ankle comfort. The height *H* of the pedal pads from the floor, as shown in cut, is a dimension that deserves much study. How the improper position of some of the existent pedal pads has been arrived at, is a mystery. I suggest that the Society formulate a diagram of control dimensions locating pedal pads, lever grips, the handles and knobs on the instrument board, and the like, from the center of the bottom of the steering wheel rim. The height of the foot rail *L* should be such that the front of a man's shoe heel can be braced underneath the lower edge. This height will then be such that the ball of a woman's foot will usually rest on the center of the rail. The slope of the toe board should be approximately at right angles to the calf of the leg, located so that the thigh rests along the entire length of the cushion slope and within comfortable reach. The sitting position should be determined properly, regardless of the control.

It has been shown how the pedals should be located in relation to the seat. The steering wheel and hand levers should be treated in the same manner. I recommend a minimum distance below the wheel of 8 in. and a space of 15 in. to the back upholstery, as indicated by the letters *I* and *J* in the illustration.

The arm rest position also must be given due consideration. On open cars, the height of the body side properly should be determined from this viewpoint, unless the seat width is sufficient to provide a built in arm rest. A minimum of 9 in. is recommended.

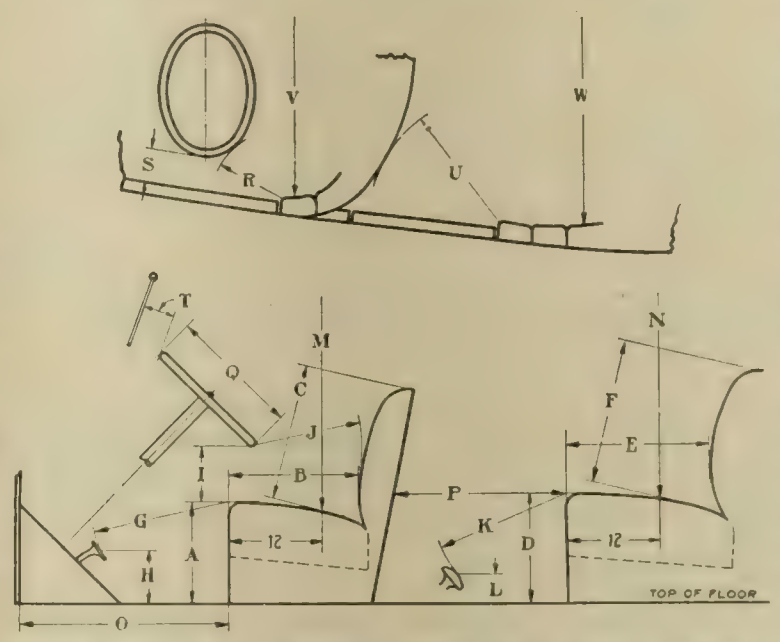


Diagram of body, showing dimensions which influence design and location of seats. See accompanying table for dimensions corresponding to letters used on this cut

Head Room

Head room is a fairly well established dimension. Where the door width is ample and the running board is positioned properly, the entering and leaving of the car is accomplished without assuming even a stooping position. The head room at the front seat can be less than that at the rear, being between axles. The greater range of chassis spring action at the rear makes it advisable to provide slightly more head room over the rear cushion. The minimum to be recommended for the front seat is 37 in. and, for the rear, 38 in., measured vertically at a point 12 in. back of the front edge of the cushion and 8 in. from the side of the body, as indicated by the letters *M* and *N* in cut. Although but 36 in. has been provided in some bodies, this dimension generally is accompanied by an unusually soft cushion.

The entering and leaving of the car has been mentioned in connection with door widths and the like, but the actual clearance between the parts of the structure is the true viewpoint to assume for such considerations. For instance, the distance between the corner of the front seat, or a curved partition, to the rear door hinge pillar must provide a comfortable "hip clearance." A minimum of 17 in. is recommended, as indicated by the letter *U* in the cut. This dimension will provide sufficient shoulder clearance, although more room than this is desirable, particularly if the door is hinged on the front pillar. For entrance to the front seat, "shoulder clearance" should be considered in connection with the slanted windshield or body front. When using the wheel side for entering or leaving the car, ample leg or "body clearance" should be provided between the wheel and the seat arm or front door rear pillar. A minimum of 9 in. is recommended for open bodies, as indicated by the letter *R* in cut. This should be slightly greater on closed bodies and in both open and closed types, where the front door is hung on the rear pillar. Of course, where the body space is limited, this can be accomplished with the aid of a sliding or tilting steering wheel.

Seat Width

The width of seats varies from 37 to 42 in. for front seats, as shown in the tabulation herewith. This dimension is determined more by body design than from the standpoint of proper space for two passengers. While 16 in. of cushion space is sufficient for the average person, a minimum shoulder space of 18 in. should be allowed for passengers. For the driver, I prefer to provide a 21-in. shoulder space to allow ample freedom of arm movement. A front seat width of 40 in. will satisfy these requirements and, with the steering column 10 in. from the center line of the car, the driver will be able to sit directly behind the wheel. It is true that many bodies can be found that are narrower at this point, but too sudden a contraction cramps the left arm movement of the driver. The inside measurement of the body, taken

Table of Dimensions Which Influence the Design and Location of Seats.

O	11	16	17	12	18	18	17	6	6½	14	16	3	36	37	28	21	17	9	4	3	16	38	45	
No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	WB
1	11	16	16¼	14¾	19	18	18½		6¼	15½					31	25					16½	38¼	46	112½
2	12½	17	17½	15	19	18	18		7½	14					31	22					16	38	45	112½
3	15	18	18	16	19½	19	17		7¾	15½					29¼	21						42	47	115½
4	13¼	16	15½	12½	19	17½	17½		7½	13½					32	23						42	46	112
5	15	16	16¼	15	16	19	17		7	14½					28½	21						40	47	115¼
6	14½	18	16	16½	17½	17½	16½		8¼	15					30	25						39	45	118½
7	15	17	15½	16	18	17½	16		7	14½					29	22						40	46	115
8	11	19	16½	14	18½	18	19									23½					15¾	37	38½	113
9	13	17	18½	14	18	17½	18¾		7½	15½					30½	21⅛					17½	40½	43	108
10	13	15½	17¾	14¾	17⅞	19	19		8¼	14					31⅜	21¼					15½	41	46	113 1/16
11	12	16	17	14¾	17⅞	19	20		7⅝	14½					31⅜	23¼					16	41	46	116
12	12½	18	19½	15	21	21	22		8¾	16						19¼					18½	2 Seat 17.5	45	142
Average	13 3/16	16½	16.8	14 9/16	18	18 3/16	17 15/16		7 13/16	14⅝					30½	22½					16¼	39⅞	45	113 11/16
*	12	17	17	14	19	19	19	7	8	15	18	4	37	38	30	24	17	9	5	4	17	40	47	

varies 6 to 9 | varies 17 to 21 | varies 3 to 4½ | varies 36 to 38 | varies 37 to 40 | varies 16 to 20 | varies 8 to 12 | varies 4 to 8 | varies 3 to 10

Dimensions for "Average" do not include No. 12.
O = Minimum practical. } Each dimension in these two lines is given as an individual
* = Minimum recommended. } minimum. Combinations of some dimensions not feasible.

across the center of the steering wheel, should not be less than 45 in. The space *S* will then be but 4 in. when a 17-in. wheel is provided on a column in the location already stated, as shown herewith. I have driven cars that it hardly would have been safe to have driven in congested traffic or in unusually bad going if the front window had not been lowered or the door curtain left off. Cramping at this point should not be encouraged, at least. The hand clearance between the wheel and the windshield should not be less than 3 in., although this depends somewhat on the rake of the steering column of course. The width of rear seats, as shown in the figures for 12 cars tabulated, averages 45 in. for three passengers. It is preferable to provide, as nearly as is possible, a 16-in. cushion space for each passenger.

Depth of Front and Rear Compartments

The distance between the front cushion and the dash, 30 in., usually is ample and does not vary to a great extent, as is shown in the tabulation of the dimensions. The space provided between the rear cushion and the back of the front seat is determined by the use to which it is to be put. With the rear cushion in the compromise position recommended in the first part of this paper, the minimum distance should not be less than 21 in. If ample space for wearing apparel carried on the robe rail or room for a traveling case is desired, it will be necessary to increase this dimension, but 24 in. gives a comfortable compartment.

Knee-room to the front and rear of folding seats in seven-pasenger bodies or bodies having staggered seats should not be less than 26 in., measured from the back upholstery to the part of the structure in front. Therefore, allowing 1 in. for the thickness of the folding seat back, the distance from the back upholstery of the stationary seat to the structure in front should not be less than 53 in.

Standardization of Control Dimensions

In conclusion, I wish to make another plea for the standardization of a range of locations for the control elements as outlined, and also to suggest that a manikin be developed to conform to the average dimensions of the human body, so that it can be used as a standard from which to work. If this accomplished nothing more than the discouraging of such proportions as are found in some of the bodies shown at one of the recent foreign shows, it would be well worth while.

Austria Demands Import Payments in Gold

THE Austrian Government recently enacted an order demanding payment of import duties on certain articles in gold. Included in the list of these articles are the following automotive products:

Tariff Number	Designation of Article	Duty for 100 Kilograms in Kronen
553	Automobiles, also dismantled, and complete chassis with a weight for the piece of:	
	a. Up to 400 kilograms	150
	b. More than 400 up to 1800 kilograms	120
	c. More than 1800 up to 3200 kilograms	100
	d. Over 3200 kilograms	60
	Motorcycles belong to the same tariff number as automobiles.	
320 e.	Pneumatics (tubes and covers)	150

Motor Bus Becomes Vital Transportation Factor in This Country

There are 450 regular bus lines now operating in this country, according to the best available figures. This article traces the growth of bus transportation, gives a picture of the present situation, and points out the part to be played by the truck manufacturer in developing a great potential market. Progress in design an important factor.

By Sinclair Gluck*

JUST as the automobile had reached a high efficiency of design before the motor truck began to develop, so the motor truck had attained a wide variety of design, of model and of use before the motor bus was seriously considered as a nation-wide transportation factor.

The available production capacity of the motor truck industry, together with the experience in design possessed by motor truck engineers, makes the motor truck manufacturer the logical builder of vehicles for bus transportation. The potential possibilities of the bus field are rapidly becoming more widely recognized, and the picture of the wide development in England recently given by Walter Jackson in AUTOMOTIVE INDUSTRIES served to visualize the possibilities of development in a general way.

The truck manufacturer, however, is naturally interested in the domestic market; in the actual sales possibilities, as well as in the long range view of bus development. With this thought in mind, it is pertinent to examine at this time the present status of the motor bus in the United States, the lines along which its development has taken place thus far, and the probable future which lies ahead.

Accurate figures as regards the number of motor buses operating in this country are not available at present. This is due partly to a lack of definition of terms and partly to lack of proper registration facilities. An estimate can be made, however, accurate enough to give some picture of the present scope of bus development.

20,000 Buses in Operation

The N. A. C. C. estimates that there are 20,000 motor buses operating in the United States at the present time. Numerous regular bus lines have been developed in various parts of the country, and the most recent estimate compiled by *The Commercial Vehicle* shows that there are about 450 such lines. These figures do not include jitneys or similar hindrances to sound motor bus development. With these figures as a background the field can be examined more specifically as regards mechanical probabilities and commercial growth.

The original truck was simply a goods body on a passenger car chassis. Later the developments of the truck were, for the most part, developments of passenger car parts with a special eye to truck requirements in the new field of the latter. In the same way, the original bus was and for the most part still is a bus body mounted on a truck chassis. Such changes as have been made up to date are, for the most, developments of truck parts with a special eye to bus requirements.

At present, the special bus chassis is in an experimental stage. With certain exceptions the manufacture of buses has been in the hands of the truck manufacturers and the sale of buses has been a side issue of their business. Naturally, the manufacturer has sold the chassis which he has on hand rather than design a new model for bus use. In some cases the truck chassis has proved serviceable for bus use. In other cases it has not.

To some extent the truck manufacturers have experimented with a wider, lower chassis for bus purposes and with other variations from the truck chassis. But parallel with the manufacture and sale of truck chassis, or slightly modified truck chassis, for bus purposes, has been the development of an ideal bus chassis by the bus interests.

Fifth Avenue Type

The biggest and best known bus company in the United States is the Fifth Avenue Coach Co. Back in 1904 R. W. Meade, who was at that time president of the Fifth Avenue Coach Co., went to Europe and selected the DeDion-Bouton bus chassis. This design was used by the Fifth Avenue Coach Co. until 1915 when the company began building its own buses, for its own use. This model had practically the same design in chassis, gearbox and clutch as the DeDion-Bouton. And quite recently this big bus company has announced the fact that it is now manufacturing buses for sale to other companies.

Although the bus is still closely linked with the truck as to chassis, it has developed more extensively along its own lines as to types of bodies and capacities of bodies.

The different types of motor buses now in use on the streets and highways can be divided roughly into three classes. First, the highly specialized big double-decker for use in big cities, where the traffic justifies a carrying capacity of 50 passengers or more. Second, the smaller, single-deck bus for crosstown runs, for urban and interurban runs, for use as street car line and railway line feeders and for hotel-depot work. And, third, the sightseeing bus.

At present the first type of bus is in use in only three cities in the United States, although it is used much more extensively in England. The Fifth Avenue Coach

*Managing editor, *The Commercial Vehicle*.

Co. operates 265 buses of this type in New York City. These buses accommodate 44 and 47 passengers. The Fifth Avenue Coach Co. has recently installed a new type of bus which is lower built and which accommodates 51 passengers. The Chicago Motor Bus Co. operates 50 double-deckers in Chicago. This company has also added a new type of double-decked bus recently with the upper deck inclosed. The older type accommodates 51 passengers; the newer type, 60. Finally, the Detroit Motor Bus Co. operates 70 double-deck buses in Detroit. These buses accommodate 48 passengers each.

The second class of bus is much the largest. It includes vehicles of capacities ranging from 12 up to about 30 passengers. The bodies of these buses vary in arrangement, some having cross seats like a railway car, some having forward and aft seats like a closed street car and some being equipped with a combination of these two types. In this class of vehicle there are variations of design also. The vast majority of this class of bus for public passenger service are one-man operated vehicles, with the entrance and exit door on the side, near the driver's seat. The fore and aft type of design seems most popular, especially for work in districts where traffic is heavy at certain hours, because this arrangement of seats leaves more standing room.

The third type of bus, the sight-seeing bus, is usually an open vehicle, with the seats running from side to side and with doors on either side for each seat. These are built to accommodate from 20 to 40 passengers. They are used in large numbers in New York City, in Washington, D. C., and in California. But a good deal of jouncing and discomfort to passengers is one of the drawbacks of a motor bus body extending far beyond the rear wheels. And the sight-seeing bus is usually of this type.

The Sphere of Usefulness

The sphere of usefulness of the motor bus is already an extensive and a varied one.

The motor bus has its place in the large city where it can supplement street car and underground transportation and relieve congestion.

It has its place in the small town, where it can supply transportation facilities to passengers too limited in number to justify the installation of a street car line.

There is a big sphere for buses in suburban districts, both as transportation lines to and from the shopping and marketing districts of the nearby city and as a supplement to street car lines. In the latter case the buses act as feeders, bringing the passengers from outlying districts to central points, where their numbers make a street car line a paying proposition.

Finally there is the interurban field, where bus lines connect small towns in a net-work of transportation. This is a peculiarly valuable field for buses, because there are many such towns from and to which there is too little passenger travel to justify the more expensive installation of an interurban trolley line.

Lastly, there is an interurban field for the bus in connection with freight transportation. This is shown by the success of the Tidewater Lines in southern Maryland. This concern operates both buses and trucks, taking care of both passenger and freight transportation throughout a big territory heretofore served by no modern transportation system.

Like the truck, the bus has proved and is proving a national asset. It, too, has made for better roads, because it cannot operate efficiently over very poor roads. And by linking up isolated districts with towns and cities it has increased land values of sites for suburban homes and has brought many shoppers to the towns. This in turn has increased sales and industry generally in small towns and cities, by bringing to the shopping districts outlying settlers and farmers who previously ordered their purchases from big mail-order houses—or went without.

Curiously enough, buses will also have a considerable future influence upon education, an influence which is already making itself felt. In rural districts where there were no transportation facilities, we formerly had tiny rural schools dotted over the countryside, sometimes a school to each village. This meant a multiplicity of teachers, who were poorly paid and accordingly inefficient. But bus transportation has promoted and is still promoting the larger rural school, centrally located, to which school children are brought by bus from all the surrounding districts and villages. This means fewer and better teachers and better education in consequence.

The Bus Will Supplement, Not Supplant, the Street Car

The bus can never replace the street car altogether, for its function is to supplement, not supplant, the street car. But it has had a salubrious effect in several instances in improving street car service through competition. The passenger transportation of the United States, for short haul work, is still in a fluid state. When it solidifies, the street car line and the bus will each have a place and a clearly defined place. In the meantime, there is competition. This has meant a certain amount of confusion, friction and duplication of effort. But the effect of bus competition on street car lines has been good rather than bad in that it caused street car lines to improve their service in many instances in their fight to retain their place in the public regard, and gave the public a new idea of transportation.

In many instances the bus has also relieved congestion and real hardship for the traveling public.

The principal advantages of the bus, in comparison with the street car, are two: Cheapness of installation and flexibility. In certain districts and under certain conditions, these are outweighed by the advantage which the street car possesses, in its ability to carry more passengers. But in other instances the advantages of the bus outweigh those of the street car. And in these last the bus will eventually be established.

This fact has led to an interesting development. The street car lines in certain districts, unwilling to give up their overhead wire installation, but recognizing the advantage of flexibility, are installing trackless trolleys. These are buses mounted on pneumatics but operated by electricity from an overhead trolley.

Overhead Trolley Bus and Flanged Wheel Bus

These installations have been tried out in various parts of the United States and England, notably in Teesside and York in England and in Staten Island, N. Y.; St. Louis, Mo., and Richmond, Va., in the United States. Where the overhead wires and power houses are already installed, these may be cheaper than gasoline buses to operate, although if depreciation on this equipment is taken into consideration, even this is doubtful. But the principal argument against this type of equipment is that, while it permits a certain amount of flexibility in passing other traffic and can drop its passengers at the curb instead of in the middle of the street, it is still tied, by the overhead wires, to a certain route. Thus a parade or a fire can tie it up like the street car. And a shifting or a development of population can leave it high and dry like the street car.

Another interesting development and one which has taken exactly the opposite tack is the flanged wheel bus, designed to operate on tracks. In certain cases this also

has its value, in that it is cheaper to operate than a train of cars and can take care of the passenger and freight traffic on a little used branch line railway with a short run.

In the opinion of the writer, both these developments will be restricted in their use and while they have their value in isolated instances, they will not be of material influence on the transportation problem.

The future of the bus in transportation has already been indicated by its present development. Such further development as there will be will probably be along the lines of better design rather than of different use. The bus will be more extensively used than at present, but it will be used in much the same way as at present. Future changes will be changes in design rather than in application.

In the opinion of the writer, the average truck chassis is not ideal for bus work. The truck chassis is too high. It has too short a wheelbase and too narrow a tread. And a better spring suspension for bus purposes can and will be designed than that with which trucks are now equipped and which is highly suitable to truck work.

It is interesting to note the opinions of automotive manufacturers themselves on this subject, and on the subject of future bus business in general.

A prominent motor truck axle manufacturer writes as follows: "We believe that the volume of motor bus transportation and its possible expansion are tremendous, and will grow with the increase of good roads until we have intertown connections between all of the more important towns and villages in the country.

"We believe there will be, in a general way, three types of buses: One for strictly city use, with low, wide bodies and second stories; larger intercity buses of about 30 to 36 passenger capacity; and smaller buses for intertown or town work in small communities, this last type to have a capacity of from 12 to 16 passengers.

"There are certain changes in chassis design necessary and the present types of motor truck chassis are not satisfactory in their entirety for motor bus work. The motor bus must be built closer to the ground, with a liberal width of body and a better spring suspension. The high speed pneumatic work places a greater strain on all of the units entering into the construction of the bus than is the case in the ordinary motor truck, and in designing motor buses this must be taken into consideration, as well as construction which will enhance the safety of the passengers. For instance, in the axle construction more generous brakes must be provided; and axles of the full floating type should be used so that shaft breakage will not endanger the lives of the passengers."

A letter from the Pierce-Arrow Motor Car Co. may be quoted on the question of speed, etc.: "We are thoroughly convinced that the future of the motor bus is positively assured and this fact is based upon the investigations which we have made concerning the use of buses by the steam and electric railroads and also private transportation companies. In each instance where buses have been installed the results have far exceeded our expectations. The buses which we installed at Albany are in operation 17 hours a day consecutively and each bus handles between 750 and 1000 people at a 6-cent fare.

" . . . We feel that a speed of 25 miles an hour is all that is necessary to handle any city traffic, and if such a speed is used in suburban districts, the same volume of people can be handled at a far less depreciation of the vehicle."

Fuller & Sons Manufacturing Co. make some interesting points: "We believe that in the smaller cities up to 40,000, bus service will predominate, but as cities grow larger there will be both buses and electric service. . . . There is a great future for the motor bus in intercity runs. . . . As the bus lines prove their stability there will be a greater number of city people who will have their homes in the outskirts of the city, as in instances where interurban lines run out from the cities."

On the subject of future bus types, the Walker Axle Co. has this to say: "The future motor bus resolves itself into two general types, according to our estimation: One, the large bus carrying approximately 55 passengers, possibly double-deck, to handle traffic in thickly populated districts where short-haul, frequent-stop business will be found; the other, the general type, will be the light, high-speed bus with possibly 20-28 passenger maximum capacity, equipped with pneumatic tires, to handle express service in the city, rural school service and intercity service. **In both these types of motor bus the equipment will certainly have to be of special design.**

"In the case of the large bus, axles will have to be of such a nature that the center of gravity of the truck unit will be brought as close to the ground as possible. The tread or track of the axle will have to be considerably wider than at present."

According to Walter E. Parker, president of the Commerce Motor Car Co.: "The fast growing use of motor bus transportation gives promise of phenomenal development during the next few years. These years will see the foundation of fortunes laid that will compare with those which accompanied the development of the interurban traction lines."

This general picture of the motor bus situation in the United States, coupled with the recent survey of the British development will visualize for the truck manufacturer the scope of this field. There is an immediate market of limited proportions and a future market of wide proportions. The rate of growth will depend to a large extent upon the progress in bus design, and the marketing methods of the manufacturer.

Motor Fuel from Waste Materials

PROSPECTS of adding materially to the supply of liquid fuel from the manufacture of alcohol from British-grown sources are remote, says a report by the Fuel Research Board of England. Reference, however, is made to experiments in the growing of Jerusalem artichokes, and it is suggested that a scheme of cooperative farming, including dairy farming and pig keeping, combined with the manufacture of alcohol and cellulose, might be a means of relieving the fuel situation, reclaiming waste lands and increasing the food supply.

The report continues that research work for a process, chemical or bacteriological, to produce alcohol commercially from waste vegetable materials has not yet reached a stage where its possible industrial application can be practically considered; the discovery of such a process, however, where locally applicable, probably offers the best chance of a large scale production of power alcohol.

The report is the result of a questionnaire dealing with the possibilities of producing alcohol within the British Empire for use in internal combustion engines.

Economic Problems of Highway Construction

The highway engineer must have a broad knowledge of the various economic factors in order to design efficient roads. Relative proportion of heavy and light loads to the traffic is an important factor. Greater cost of a stronger road must balance against low operating cost of heavy trucks.

By H. S. Fairbanks*

TO one familiar with the history and interested in the future of American highway building there is nothing more reassuring—nothing which seems to give better promise of healthy development—than the general recognition of the existence of numerous problems which remain to be solved. At a time not so remote as to be beyond the span of a young man's experience it would have been almost heresy to doubt that the last word had been spoken on the subject of highway design and construction. Highway builders were sure of themselves then—sure of their principles, at least, and their main efforts were directed to the standardization of practices to conform to this or that method which had been found successful.

Knowing very little of how they did it, road builders of that day were yet able to build to the full satisfaction of the traffic of the time, a horse-drawn traffic that moved on steel-tired wheels. Then came the automobile to jar the universal complacency and later the motor truck to shatter it to bits, with the war's intensified heavy traffic to grind the bits to powder, then for a season hopelessness, when engineers saw their best roads utterly demolished by trains of army trucks without an idea as to how they were to be replaced.

Big Problems to Be Solved

Then came the dawning of the realization that there were some highway problems to be solved, some big problems that go to the very fundamentals of highway engineering. To the Bureau of Public Roads came the first realization of the bigness of these problems, and it set to work immediately to gather the facts necessary to place highway construction upon a more scientific basis. In this work the bureau has been followed by many of the State highway departments and by the laboratories of a number of universities. At first the researches of the various agencies were carried on along the lines which appeared to each as the most desirable, and there is no doubt that some of the ground has been covered by more than one investigator with resulting waste of effort. This condition should now be remedied through the instrumentality of the National Research Council, which is undertaking to correlate and co-ordinate the work of the several agencies, parceling out to each a definite part of the whole, and knitting together the results of their labors to form a complete fabric of scientifically obtained fact.

The researches in which the greatest progress has been made have dealt principally with the physical problems involved in the design of the roads. But even more important than some of the physical problems are those of an economic nature which condition the character of the physical construction. By far the majority of considerations influencing the location and type of the road are economic and not physical considerations.

Character of Traffic

Thus one of the first things that must be known before any highway can be intelligently designed is the character of the traffic it will carry. In this respect the railroad engineer has a comparatively simple problem. The traffic he prepares for is more or less definitely predictable. But for the highway engineer the future is cloaked in uncertainty. This much he can be reasonably sure of, the traffic of the past is no sure index of the traffic of the future. The past use of the road has been governed by its physical condition. When its physical condition is altered the traffic which uses it will change.

For purposes of design the engineer must know both the approximate volume of the future traffic and the weight of the heaviest vehicle. Knowledge of the volume of traffic is needed principally to determine the width of the road, the attrition of the surface, a function of volume being practically negligible when the large majority of vehicles are rubber-tired. The maximum vehicular weight is required to determine the strength of the road's surface. In this determination volume plays an important part. It is possible that the repetition of maximum loads may serve to fatigue the road structure and cause it to break down under a load which it would carry safely if applied only occasionally. But, broadly speaking, the road must be designed to carry the heaviest load that will be applied to it, whether that load is applied few or many times.

If this were all the information required, therefore, the economic problem would not be difficult. We could assume with practical certainty that every road—no matter what its location—would occasionally have to carry the heaviest vehicle manufactured, and, since the policy of vehicle manufacturers is to restrict the weight to a standard maximum, this would not be difficult to determine. As volume of traffic (assuming that it is rubber-tired) has practically no effect upon the design of the surface except as it concerns width, the conclusion would necessarily be that all roads must be constructed of equal strength and that the only permissible variation is in their width.

Such a conclusion, while entirely consistent with the physical requirements of unregulated traffic, fails to take account of all the economic facts. Large, heavy vehicles

*Senior engineer, Bureau of Public Roads. Slightly condensed from an article printed in *The Washington Engineer.*

are used in preference to small, light vehicles because their relative cost of operation is lower. One hundred tons transported in five-ton vehicles will be moved at lower cost than if it is carried in one-ton vehicles; but to operate the heavier vehicles requires a heavier and more expensive road. The economic problem, therefore, is to balance the greater cost of the stronger road against the lower operating cost of the heavier vehicle.

To determine how much more can be economically expended to build a road for traffic of five-ton instead of two-ton vehicles the saving in cost of operation per ton-mile must be multiplied by the number of ton-miles carried during the year, and the result will be an annual saving in operation which, capitalized, is the amount that can be spent to strengthen the road to carry five-ton instead of two-ton vehicles.

It must be evident, therefore, that if only a few of the heavier vehicles use a given road, the saving in operating cost by their use cannot be sufficient to justify the additional expense of the stronger road, while if the traffic of such vehicles is large, the saving may more than offset the greater construction cost. It appears, therefore, that the facts with regard to traffic that must be known before any intelligent decision as to the type and dimensions of the road can be reached are as follows:

1. The maximum weight of vehicle.
2. The volume of traffic.
3. The relative proportion of heavy and light loads in the traffic.

It is this last-named fact that is difficult to determine in advance of construction. In its unimproved condition it is likely that the road has been used by but few heavy vehicles, simply and solely because of its condition. When the condition is improved the chances are that the number of large vehicles that will be operated over it will be increased. How great will be this increase and what expenditure for road improvement will be justified by it is the road builder's problem.

Unfortunately the uncertainty goes deeper than the mere question of first cost. Supposing that it be decided upon purely financial considerations to build 30 miles of a given road outward from a city as a five-ton road. For that distance, let us say, it is anticipated that the road will carry a sufficient number of five-ton vehicles to justify the construction of the five-ton surface. Beyond the 30-mile point such a showing cannot be made, and it is decided to provide for vehicles no heavier than three tons. What, then, is to be done about the occasional five-ton vehicle which it is desired to operate to the town or village 60 miles from the city? Is its operation beyond the 30-mile point to be prevented by police regulation? Then we must take into our financial computations the cost of policing the junctions of heavy and light traffic roads. The strict enforcement of such a regulation will mean one of two things, either of which will add to transportation costs. Either the cargo of the heavy truck must be trans-shipped to a lighter vehicle at the junction of the light traffic road or matter destined for points beyond the junction will have to be shipped all the way in light trucks. Which way does economy lie?

The question will never be definitely answered except in connection with the special conditions surrounding each case, but there are a number of general questions, which will arise in every case, which deserve immediate attention by those who are working to solve the newly recognized highway problems. Such matters as the operating cost of motor vehicles; the economic motor truck haul in competition with steam and electric and waterway transportation, and in the absence of such competition; the highway traffic contributions of the principal industries; the relation of cities and the distance between them to the character of highway traffic—these are matters requiring general study for application to particular cases. In view of their manifest importance it is difficult to understand why they have not already received the careful, scientific study that is being given to the solution of the more important physical problems.

Trucks and Tractors on the American Desert

IN this period of slow movement of tractors and careful buying of motor trucks, a new, and promising field, of an area equivalent to almost one-third of that of the United States, has just been opened to the manufacturer, salesman and demonstrator. This is the American desert, especially that part of it which lies in Nevada, Utah and California. Part of this opening up of the Great American Desert, especially at its northern end, is due to the plans of the new $25,000,000 coal, coke, iron and steel merger, which is combining the raw materials of Utah's mines, with the steel mills on the Pacific Coast. Another important factor in the introduction of motor trucks and tractors to the desert has been the West End Chemical Company of Oakland, Cal. This corporation, which has just discovered a mountain containing 300,000 tons of Colemanite (borate of lime), has been able to develop its property, carry its crystalline ores to the mills and to the railroad, solely through the operation of a fleet of road tractors, tractors and motor trucks. Through its example, other mines in this section, which have been unable to reach maximum production, and, very often, any production at all, by means of mule-drawn transportation, are turning to the truck and the tractor, especially the road tractor, following the example of the West End Chemical Company.

The road tractor, with its steel wagon trailers, has completely driven the 20-mule team and the largest wagons in the world from the trails of the desert, and it remains for the truck and tractor builders and the transportation and distribution engineers to fill this field with their automotive vehicles. Development of this area would also bring transportation to the vast deposits of ores in this desert, which are now dormant because of lack of this very transportation and distribution system and means.

Saving Russia with Tractors

A SIMPLE, though somewhat bold and costly plan to help save Russia was presented recently to the International Labor Conference at Geneva. It involves sending great fleets of tractors into the vast grain districts of that country, with men qualified to teach the Russians how to run them.

Undoubtedly this plan would do a great deal towards restoring the wealth of Russia, for development of her farming lands will accomplish that result. Conditions there are not exactly such at present, however, that the American manufacturer is willing to invest any large sums of money in any industry there, but such conditions cannot last always. There will come a time when Russia will become a factor in world commerce, and when that time appears it would be a good idea for American tractor manufacturers to be ready to step in and do their share in redeveloping the vast farming areas, and incidentally make a profit for themselves.

Chicago Show Indicates Return to Stability

(*Continued from page* 214)

new straight-line flat cowl, flat hood type of line which seems to be rapidly gaining favor. The steel disk wheels blend very harmoniously with this type of line. The car is low so that the driver's eye is about on the same level as if he were walking along the street. The car weighs 2400 lb. and carries a 3⅛ by 4¼ six-cylinder engine. It is mounted on 115 in. wheelbase.

The chassis layout for this new car is very clean. The hand brake is on the front end of the propeller shaft. There is only one universal in the drive, which is a Hotchkiss type with long semi-illiptic springs. The engine is unit powerplant mounted directly in the main frame, the arms on the bell housing acting as a substantial cross member. There is a cross member a little behind the center of length of the chassis, this being a flat inverted U-section heavily gussetted to the main frame. Behind the rear axle there are two rear cross members between which the cylindrical gasoline tank is suspended.

New Hudson Coach

The new Hudson coach which is to sell at $1,795—$50 more than the seven-passenger phaeton and $100 more than the five-passenger—is on exhibition for the first time. It incorporates a number of economy features in closed body construction. Economy has been effected by the elimination of the curved pieces of wood. Substantially all pieces of wood in the body framing are cut on straight lines. This not only materially reduces the cost in preparing the wood framing for assembly, but also in a number of instances has resulted in making the assembly work much easier and far more readily handled on an interchangeable basis. An additional saving has been made in the use of two in place of four doors. This has been made possible by the adoption of individual Pullman type seats in front in place of the usual fixed type. These seats fold out of the way to allow access to the rear seat. The car is a five-passenger design. The rear seat is continuous across the body.

The type of body construction employed is such that it is possible to put it together in a number of sub-assemblies. The body may truly be said to be assembled instead of built up in the usual manner. There is no great amount of tacking to be done from the inside of the body. This can practically all be done before the body is put together. The roof furnishes a good example of this type of construction. The entire roof is practically a sub-assembly. It is a soft type covered with artificial leather. The actual ceiling or roof lining is put on before the roof is put on the body. The roof is then put over the top of this lining as an independent assembly.

Nash Carriole

The Nash Carriole, a five-passenger enclosed car, is entirely new in the Nash line this year and is mounted on the four-cylinder chassis. It is designed as a light enclosed family car. The price is $1,350, f.o.b. factory. The body of the car is an all-metal construction similar to that used on the higher priced sedans and coupes. The front seats are divided and both may be folded forward inasmuch as they are of the parlor car type. The driver's seat folds against the steering wheel and the right hand seat under the cowl when not in use. The front seats are upholstered in genuine leather and the rear seat in wool cloth as well as the interior trimming. There are two doors, one on each side, the left hand door being at the driver's seat and the right hand door directly opposite. Both doors are wide enough to make entrance and exit an easy matter. The front and rear windows may be raised or lowered by the turning of a handle. In the back of the car is a large plate glass window. There is a dome light for interior illumination. List price includes cord tires. It is pointed out by the makers that the low price for this car has been made possible because of the adaptability of its body design to volume production.

Moon Light Six

Moon has added to its line a new six-cylinder car, known as the model Six-40. This is a 115-in. wheelbase car to sell at $1,295. It is built up of such units as Continental engine, Timken axles, Spicer universal joints, Borg & Beck clutch, Delco starting, lighting and ignition, Exide battery, etc. The engine used in this car is the new model Continental 6-Y, having a bore of 3⅛ in. and a stroke of 3¼ in. One of the features of this engine is the use of the Sheppard valve. In this valve the conventional type of L-head layout is used with the exception that the valve spring is placed above the valve and engages with a rod or stem resting on top of the valve head. The engine is said to show 46 hp. on the block test. Camshaft and generator drive are by chain and are so arranged to be easily adjusted. The crankshaft is four bearing.

A new design has been incorporated in the frame in which four cross members are used. A characteristic of Moon frame construction is the molded gusset plate on the rear of the frame to add stiffness and afford protection to the gasoline tank.

One of the features of the Timken axle used in this car is the mounting of the pinion shaft. The shaft bearings are mounted fore and aft of the pinion gear, which reduces the overhang on the pinion shaft and assures a positive method of lubrication to the axle proper. Other details include spiral gears, foot brake on rear axle, emergency brake on transmission. The springs are semi-elliptic, the front being 36 in. long and the rear 54 in. The propeller shaft is of large diameter to prevent whipping at high speeds.

Other features of the chassis include a Gemmer steering gear with an 18 in. wheel. The radiator is a cellular type with a shell made of German silver. The gear shift lever is provided with the Johnson Theft Lock. The fuel tank is placed in the rear and the bracket of the extra tire carrier is fastened to the gusset plate protecting the tank.

The body is built of silver finish steel. Deep one piece stamped fenders of good design are used. The one piece construction makes them rigid and free from rattle.

The tire size is 31 x 4 in. and the tires are cord. Wire and disk wheel equipment includes an extra wheel. The car shown at the Chicago Show was fitted with disk wheels. One of the things noted about this car is its low and rakish appearance. The radiator design is substantially the same as that on the larger Moon car.

A SLIGHT error appeared on page 12 in AUTOMOTIVE INDUSTRIES of January 5, concerning the products of the Midwest Engine Co. The statement was made that "perhaps the most interesting feature of these engines is the use of two-bearing counterbalanced crankshafts. . . ." The following correction of this statement is made by the Midwest company:

"Our largest sizes, that is 4½ x 6-in. and 4⅛ x 5¼-in., are three-bearing jobs. The model 408, which is 3⅝ x 5-in., and model 409, which is 3¼ x 4½-in., are two-bearing jobs. The latter differs from the model 408 only in that the 409 is thermo-syphon cooled, while up to the present time the 408 has had pump circulation."

Exports of Automobiles, Tires and Motorcycles for December, 1921

COUNTRIES	COMMERCIAL				PASSENGER				Parts	TIRES			MOTOR CYCLES	
	Complete Cars		Chassis		Complete Cars		Chassis			Casings	Inner Tubes	Solid Tires		
Europe														
Azores and Madeira Islands	2	$874	1	$495					$2,987	$66			7	$1,945
Belgium			15	6,557	43	$25,100	21	$7,690	6,073	1,987	$768		34	9,639
Bulgaria					1	508			533					
Denmark					4	3,580	11	1,945	9,625	32,243	1,047			
Finland									1,716	907	92			
France					4	7,100			96,291	7,990	8	$700		
Germany									9,660	1,560	7			
Gibraltar									1,685					
Greece					1	725			3,924	22,354	2,708	372		
Hungary									34					
Italy					1	1,000			5,185	11,920			35	9,696
Latvia													8	2,867
Malta, Gozo, and Cyprus Islands					4	3,070			686	1,450				
Netherlands	22	9,615	12	5,245	22	15,440	2	5,600	9,275	6,358	1,214		44	13,471
Norway			2	1,896	3	2,600			16,489	14,372	4,216	113	11	1,666
Poland and Danzig	2	6,939	2	6,939	1	728			1,180	1,885	497			
Portugal									2,322	4,340				
Roumania									950					
Russia in Europe	10	9,700			5	5,700			286					
Spain					25	28,883	2	4,386	20,135	36,240	3,872	1,708	4	1,410
Sweden			5	13,471	19	20,531	2	1,456	20,740	39,292	2,836	1,071	15	2,705
Switzerland					1	1,500			1,871	2,194				
Turkey in Europe									47					
England			4	4,213	116	57,902	143	57,749	907,266	163,438	11,781	5,423	95	27,258
Scotland									201	700	190		1	345
Ireland									2,323				1	325
Jugoslavia, Albania									1,946	12,986				
North and South America														
Bermuda										50				
British Honduras					3	3,633			44	175	50			
Canada	15	15,333	19	28,545	162	199,212	4	8,800	797,465	108,628	11,503	5,866	11	2,717
Costa Rica					3	5,527			1,658	1,405	67	200		
Guatemala					4	3,824			967	3,466	314		1	300
Honduras					5	3,896			4,202	565	[illegible]	564	3	900
Nicaragua					1	750			158					
Panama	12	34,228	19	6,946	18	14,168			1,777	389	97	69	2	850
Salvador									3,033	4,358	853	1,504		
Mexico	31	29,424	34	11,272	426	375,022			86,298	61,805	7,485	3,427	5	1,116
Newfoundland and Labrador									275					
Barbados					3	3,087			1,054	3,397	520	450		
Jamaica	2	1,285			24	17,466	4	7,800	9,611	8,280	1,033	2,417	1	45
Trinidad and Tobago					5	4,046			3,128	5,831	741	1,228	1	300
Other British West Indies			3	1,311	14	9,020			1,808	1,141	234	20		
Cuba	22	16,445	1	1,862	86	113,503			26,665	47,609	3,025	15,782		
Virgin Islands of United States	1	365			2	1,028			2,759	408	40	3,210		
Dutch West Indies					5	2,202			1,141	2,047	58			
French West Indies					1	640			1,366	2,026	271	112		
Haiti					2	1,140			2,403	3,379	472			
Dominican Republic					8	4,713			3,333	6,925	1,475	227		
Argentina					56	68,760			158,967	119,815	10,609	1,630	40	12,410
Bolivia					1	4,000			248	250	25			
Brazil	1	2,000	1	1,607	22	24,487			35,644	10,178		757		
Chile			2	874					4,727	27,074	2,907	2,442		
Colombia	1	933	3	6,462	23	19,664			13,726	6,002	878	315	1	100
Ecuador	2	974	2	404	2	767			240	2,097	317			
British Guiana									973	1,435	171	110		
Dutch Guiana					4	2,573			1,166					
Paraguay									1,835					
Peru					7	5,165			8,848	14,316	1,413	1,275		
Uruguay			10	2,742	8	7,965			11,772	16,542	500		15	5,103
Venezuela	5	2,185			35	28,405			6,015	18,126	909	256	1	320
Asia														
Aden									281					
China	3	8,250	8	4,000	28	36,206			5,821	2,523			1	100
Kwantung, leased territory	1	3,000	1	1,887	1	3,200			165					
Chosen									594				1	350
British India	4	4,569	12	14,764	112	113,106	5	5,328	34,250	8,512	965	8,266	4	927
Straits Settlements									6,212	10,330	108	4,587		
Other British East Indies			2	930	4	55,655			1,043				11	2,970
Dutch East Indies			1	1,458	64	94,533			46,774	43,106	7,089	8,154	40	9,609
French Indo China									238					
Greece in Asia			2	734	6	2,112			21					
Hongkong					3	2,800			415	1,094	556	1,503		
Hajas, Arabia, etc.		5,880							1,236	5,626				
Japan	6	11,000	58	35,790	6	4,395	104	42,477	34,597	12,406	1,049	3,485	76	19,923
Palestine and Syria					57	33,426			12,258	7,741	998		1	250
Persia										391				
Siam									824	530		213		
Australia	5	6,325	102	137,012	109	116,796	572	500,723	100,542	33,303	1,151		[illegible]	[illegible]
New Zealand			4	6,602	51	45,556	2	2,064	27,149	57,451	2,089	15,471	100	33,256
Other British Oceania									1,179			516		
French Oceania					1	800			598	1,091	52	312		
Other Oceania									760	687	66	112		
Philippine Islands			1	2,600	15	155,613			34,214	38,841	5,598	6,045		
Africa														
Belgian Kongo			10	4,371					248					
British West Africa					5	4,219			6,976	24,693	1,632			
British South Africa			7	8,147	100	101,332			24,537	88,465	746		14	3,945
British East Africa					1	343			1,824	7,796	568		1	308
Canary Islands					3	5,985			12,919	4,465	109			
French Africa					4	2,885			3,784					
Morocco											72			
Portuguese Africa			3	1,311	10	4,941			56		208			
Spanish Africa					2	6,950			335					
Egypt	10	4,371	4	1,748	22	9,381			7,098	3,508	231			
Total	161	$173,695	350	$322,195	1,784	$1,759,264	872	$646,018	$2,683,681	$1,193,160	$98,553	$99,912	863	$250,457

Functions of the Dealer in Car Distribution

This article outlines clearly the place of the dealer in the system of car distribution. Mr. Tipper shows the necessity for reducing factory supervision to a minimum, that strong dealers may be developed through individual responsibility. Car reputation bound to its local condition.

By Harry Tipper

THE whole distribution system in the marketing of passenger cars hinges upon the retailer. The position of the retailer, his business acumen, his strength, his ability to conduct properly the various departments required in the automotive business and the service he renders, are things upon which the market of the individual manufacturer depends. They are also the limiting point of the total market for automobiles to a very large degree.

The retail distribution of cars has grown with great rapidity and the retailers have come into this business from all kinds of occupations and in all kinds of ways. Most of them have not been in the business five years. They are still adventurers in what is a new line of endeavor for them. They have been able to erect a large volume of business upon a small capital during the era of rising prices and easy markets. Some of them have developed into strong, capable business men handling the largest concerns in their communities. All of them are important in the business life of their various communities and the influence which they exercise in various ways upon the community reacts upon the automotive business from that community.

At the risk of being wearisome, it is necessary to repeat the statements about the short life of the average dealer in the passenger car field today and the diversity of other occupations from the ranks of which these automotive dealers have been drawn. Without this picture, the manufacturer has no groundwork upon which to draw the possibilities of future development. In one small town seven car dealers represented these original occupations: one had been a successful plumber; one had been in the real estate business; two had been automobile mechanics; one had been a salesman for cars; one had been set up in the automobile business by his father because he had always been tinkering with cars; and one had been a chauffeur.

This picture can be repeated, not in the actual occupations, but in the diversity in almost any fair sized town in the United States. Implement dealers, old bicycle repair shops, salesmen, automobile owners of various kinds, and a host of others who have entered the business of retailing in this field have expanded, in many cases, with great rapidity, so that they have been obliged to meet unknown problems day after day and with but very slight experience.

Under these conditions, there must exist a wide difference in efficiency, a very great difference in the knowledge possessed and the initiative exercised by these various retailers. These, however, are established concerns. As they drop out, new concerns come in from other lines to take their places, although each year a larger number of those entering the business do so with a previous experience in the same field. The automotive manufacturer must work with these established retailers and his business depends upon their efficiency very largely.

We have stated before that the sale of passenger cars possessed many differences from the sale of other products. The passenger car is useful entirely for the service which it renders in its daily transportation of people. The efficiency of that service depends very greatly upon the character, the judgment, and the skill of the local retailer. The reputation of the car is involved in that service, in that locality, at all times. At no time can the reputation of the car be divorced from this local condition. Every man who knows the business has scores of illustrations indicating the strength of this reaction upon the reputation of the car from the character of the local service rendered in connection with its use.

Regardless of the position held by the individual manufacturer concerning the advantage of distributors for his particular purposes, the only possible method of securing a market for passenger cars requires an efficient and stable line of retail establishments located at convenient points all over the country, so that the user of the vehicles can do his buying and secure his service in his ordinary zone of activity.

The functions of the retailer are:

First.—To sell cars within his local area; to obligate himself for a definite number of cars in advance of his sales; and to undertake their distribution in the local zone of his activity.

Second.—To keep in stock such items as may be required for the ordinary service of the user of the car and to provide sufficient storage space for cars while they are being served in this manner.

Third.—To establish the equipment sufficiently to conduct the ordinary necessities of service and repair expected by the user, and to establish these on a reasonably rapid and fair basis.

Fourth.—To maintain the departments of his business so that all the commodities required with the car and for the car can be readily secured by the customer within the reasonable necessities of the locality.

In the course of this rapid growth in the automotive field, the functions involved in retailing and servicing automobiles have not yet arranged themselves in what would be a logical or orderly percentage of development. Because of the lack of efficiency in service in many localities, exclusive repair shops have grown up. There are many exclusive storage places in the larger cities, and

there are still car sales establishments unable to give the proper service to the user of the car. Supplies have not been thoroughly considered, and, in general, the present situation presents many weaknesses and much confusion. This, however, is only the natural result of the growth and the entry of a large number of people into the business of retailing from so wide a diversity of previous occupational background.

In comparison with other lines of retailing covering the small cities and towns of this country, the retailing of passenger cars, the necessary service and repairs, the proper stocking of supplies, etc., represents a large business and a business involving problems foreign to other lines of retailing; more severe and requiring a more effective experience to efficiently work them out. In other words, the efficient distribution of passenger cars requires a higher type of retailing merchant than the ordinary work of retailing goods over this country. To arrive at a decent efficiency, therefore, a longer experience is necessary and much more work must be done in the development of this branch of the field.

In the retailing, as in the wholesaling of a product, the efficiency of the business depends very greatly upon the judgment, initiative, and capacity of the individual concern. Methods of stocking, advertising aids, sales manuals, etc., are of little value unless they are backed by the use of considerable judgment and initiative on the part of the individual retailer. There is, in fact, a degree of danger in the control of the retailing system by the manufacturer too closely in detail, because this produces a tendency on the part of the retailer to lean more and more on the centralized system of the manufacturer until his individual efficiency has finally decreased very materially.

The wide variation in the standards, in the equipment, and in the efficiency of retail establishments selling passenger cars is a difficulty of very great proportions and a difficulty which cannot be overcome merely by a closer supervision of the retailer from the factory. There should be a very much closer co-operation between the retailer and the factory, more open discussion, and more effective understanding of the problems common to both. The supervision itself should be kept at a minimum at all times because the industry needs stronger dealers, larger numbers of stronger dealers, widely distributed throughout the United States, in order that the future problems may be worked out. Strong men are not created by close supervision. They are developed by larger understanding and the necessity for proper decision upon the larger points at issue. The distribution work, particularly in retailing of passenger cars, is not yet a system. There has been no time to create a system in the few years of widespread distribution of passenger cars. The elements of the future system are here—the development into a system depends very greatly upon what the manufacturer does with it during the next five years. If the retailing of passenger cars is standardized with too much uniformity and too close a supervision from the factory, the sale of passenger cars will be limited by the character of the system itself. If the manufacturers arrange matters with the dealers so that the main problems are understood, and the main interests of passenger car sale and service are covered, and if these matters are followed up with a better type of co-operation and discussion, the distribution, as far as retailing is concerned, can be gathered together in the next few years and welded into an actual system out of the diversified elements at present in the field.

In general, the retailing of passenger cars requires an improvement in the selling methods, an understanding of turnover in its relation to capital and profit, better acquaintance with financing, more careful cost consideration, in the extension of service and conduct of repairs, a more definite understanding of the local needs in connection with supplies and accessories, a greater understanding of the manufacturer's policy and position, and a development with the manufacturer of thoroughly understood contractural arrangements with reference to the handling of used cars, the cost and character of service, etc.

This is a work which depends upon the growth of a better understanding between the manufacturing and the retailing branches of the industry and, particularly, between the individual manufacturer and his retail dealers. It calls for a method of square dealing not only, but in addition intensive attempts to develop strong dealers by putting the facilities of the manufacturer's wider experience and information at the service of the dealers for their improvement and development. It is said that there are only eight thousand dealers in the field today, rated at $10,000 or over. Only a comparatively small number of dealers, so-called, are strong business houses. The manufacturer requires, however, a much larger number of dealers than eight thousand for the distribution of cars in this country. The number of worth-while dealers in passenger cars is, however, probably not more than 40% of the total in the field.

THE dealer or retailer is an essential part of the automobile marketing scheme, regardless of the decision between distributers and factory branches. He has four distinct functions, which are outlined here in detail.

The best dealer organization is the one in which the individual dealer assumes a maximum of personal responsibility. Educational activities by the factory are of little value unless backed up by the judgment and initiative of the individual dealer.

It is the business of the manufacturer to see that his own sales possibilities are limited very strictly in accordance with the efficiency, the ability, and, to some extent, the number of his outlets. It is his important interest to see that the dealers are given the opportunity and encouraged to reach higher standards of efficiency so that the business may be stabilized all through, the markets thoroughly canvassed, the local influence of a character that will breed confidence, and the whole atmosphere surrounding the distribution of cars one of development.

In the face of the present confusion, the problems of the manufacturer in connection with his distribution may lead to errors of development just as easily from a desire of speedy solution as they may lead to a lack of development from the tendency to avoid facing the entire issue.

One of the steps the manufacturers could take would be to encourage strong associations of dealers all over the country with their national affiliations through the present National Automobile Dealers Association or some similar body, and with well defined programs of education through their own memberships for the stabilizing of the business. Followed up by the work of the individual manufacturer with his individual dealers, these developments would have a very great effect upon present problems and be of great service in clearing up the present confusion and in clarifying the situation generally.

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A. B. Swetland, General Manager
David Beecroft, Directing Editor
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
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Trucks Can Be Sold

FARMERS at the agricultural conference in Washington were almost unanimous in asserting that the farm market for motor trucks will be open again in the late summer or early fall. The consensus of opinion developed by a number of interviews during the conference revealed almost startling facts. It proved conclusively that the majority of farmers are thoroughly sold on the motor truck as an economic necessity, and that they are eager to buy more trucks as soon as they are financially able to do so.

This paints a brighter picture than has been seen for many months. It is true that farmers in certain grain sections are down and out, but it is equally true that in some sections the farmer is in the market for trucks right now to a limited extent.

It will be necessary to go out and market trucks during the next few years, just as it will be necessary to market other automotive products that have sold themselves up to a year or so ago. There is a market for trucks, and that market will develop the most rapidly for the manufacturer who most thoroughly analyzes his sales possibilities, his merchandising costs and his marketing methods.

Making Standards Effective

THE automotive industry has for a long time been in the van of the standardization movement. Yet many of the standards adopted by the engineers of the industry are still a matter of theory rather than practice. Executives, in certain instances, seem to be unable to visualize the fundamental nature of standards as related to their more general industrial problems.

The Chamber of Commerce of the United States has just issued a statement through its Fabricated Production Department, which emphasizes again the practical financial value of standards, and should strengthen the resolution of the automotive industry to put into immediate widespread use at least all of those standards already adopted by its engineers. The Chamber of Commerce report states in part:

"It takes backbone to tell your sales forces in these times that you will cut your variety. But it is being done not only by individual producers but in entire lines through trade association co-operation. . . . The important rôle which standardization plays in industrial evolution is not generally appreciated. . . . It enables buyer and seller to speak the same language and makes it possible to compel competitive sellers to do likewise. It stabilizes employment by broadening the possible market and by making it safe for the manufacturer to accumulate stock during periods of slack orders to an extent that would not be safe with an unstandardized product."

Many other benefits of standardization are enumerated in this report. Like those noted here, they are not new. They have been stated and restated many times. Yet the difficulty of putting into operation certain standards, the advantages of which would seem almost obvious, indicates that the same thing must still be said many times more. Standardization means financial gain to all those buying and selling within the automotive industry and it means more satisfactory service for the users of automotive products.

Research

A GREAT deal of so-called research work is not research at all, since it does not consist in a seeking for fundamental reasons, but merely in the collection of data. It is not hard to obtain men capable of collecting data, but to get men thoroughly capable of comprehensive and analytical research is a difficult problem.

The development of competent personnel for all kinds of research is one of the pressing problems of the automotive industry. There are already a few great names connected with technical research in our industry. The development of more men capable of and interested in going forward with the work done by these few will have much to do with the progress of the industry during the next decade.

The field of market research is particularly in need of careful study. Production economies have borne the weight of increasing marketing costs for ten years. The limit in this direction has just about been reached. A thorough study of every phase of automotive marketing is essential. And just as in engineering research, there is a necessity for more men capable of thorough, fundamental research.

Servicing Trucks

THE progress of the truck industry rests not only upon the mechanical efficiency of the motor truck, but also upon the ability of users to provide proper operators and to obtain proper service facilities in a majority of cases. A co-ordination of all of these factors is necessary to the economical use of motor transport, and the truck manufacturer is interested, consequently, in the entire field.

Adequate service is essential. And adequate service implies a sufficient supply of capable mechanics. The truck industry might perform a real service for itself and its customers by defining some standard by which the capability of a mechanic might be determined. It was suggested at the recent S. A. E. meeting, for instance, that the S. A. E. set standards as regards the qualities and training necessary for a man who is to properly service the trucks designed by the engineers of the society. The thought behind the suggestion probably was that such standards would ultimately aid in the development of more capable and trained men for truck service work.

Whether or not the suggestion itself is practicable, the idea which it contains is worth consideration. The engineer is undoubtedly hampered in his design by the knowledge that his product will probably be subjected to incompetent operation and service.

Better Brakes

THE inadequacy of the brakes fitted on many American passenger cars has been the subject of much comment which reflects little credit upon those responsible for existing conditions. The problem is of such a serious nature, however, that it should not longer be overlooked. In the case of cars used in hilly country it is difficult to make the brakes, especially of a heavy car, adequate to meet the extreme conditions of service sometimes encountered. Under such conditions experienced drivers invariably use the engine for braking, but there is always danger for, as well as from, inexperienced drivers, so that efforts to provide adequate brakes are most important. It is highly desirable also to make it as convenient as possible to use the engine as a brake, for it is next to impossible to provide adequate brakes for long and difficult grades when these alone are depended upon for the necessary retarding effect.

Braking troubles frequently arise as a result of heat generated by the friction of the brakes. This sometimes results in materially lowering the coefficient of friction of the lining, which decreases brake capacity accordingly. This difficulty is apt to be accentuated when both sets of brakes bear upon a single drum or pair of drums from which the heat is not rapidly radiated. For this reason there is a decided advantage in having independent drums for each set of brakes. There is much to be said in favor of so-called transmission brakes, or brakes located at the axle end of the propeller shaft. On the other hand, such brakes are not always easy to keep cool.

Another fault with many hand brakes is the failure to provide a secure locking ratchet. Some drivers even have to make it a practice to leave the car in gear when it is standing on an incline, for fear the hand brake will release itself and the car start to roll.

These are but a few of the items in connection with braking systems which deserve attention. Cars with defective brakes will still run, even though they may fail in an emergency, and this perhaps is one reason why refinement in braking systems has not kept pace with refinements in other parts of the car. But if skimping must be done it should never be at the expense of safety, hence the subject of improvements in braking systems should be given the thought it deserves and no time should be lost in incorporating those improvements which the safety of the users and others demands.

Now the Tractor

FORD has gone and done it again, this time in connection with the tractor phase of the automotive industry. A tractor at $395 is something new to the tractor industry—and to the farmer. Whether or not there is any connection between this radical price cut and the strong opinions expressed by the farmers at the recent agricultural conference may be open to question. It is certain, at least, that such actions in the tractor industry are in line with demands of tractor buyers.

The farmer is "all hepped up"—to use a current phrase—concerning the relatively low price which he gets for his production and the relatively high price he has to pay for the production of other industries. He does not appear to be interested so much in the reasons for this condition as in the mere fact that he is placed in an unfavorable position. The psychology of the Ford action can scarcely be questioned.

The Statistical Number

THE Statistical Number of AUTOMOTIVE INDUSTRIES will appear this year on Feb. 16. It will contain the same fundamental statistical data concerning every phase of the automotive industry that has characterized past editions. Certain new features have been added, chief of which is the table and analysis of world automobile registrations which has just been completed as a result of a world-wide survey. More detailed information concerning domestic production and sales will be printed, and much of the information will be visualized in chart form.

There has always been a large demand for extra copies of this Statistical Number. In past years the supply has always run short. If you desire any extra copies of this number, order them immediately.

Good Spring Trade Now Appears Sure

Sales Deferred But Chicago Show Exerting Strong Stabilizing Influence

By James Dalton

NEW YORK, Feb. 1.—While uncertainty in regard to prices slowed up materially motor car sales in January, there is evidence throughout the country of a satisfactory deferred spring business. The Chicago show which is now in progress is likely to exert a strong stabilizing influence. Price changes in connection with the display have been less numerous than had been expected, and it is apparent both manufacturers and dealers believe they have been placing too much emphasis on prices and not enough on the value of their product.

Quality Is Stressed

While more stress was laid on prices than on quality at the New York show, the reverse has been true in Chicago. The same deep interest in motor cars displayed at New York is being shown at the present exposition, and it is probable more actual sales will be made.

Managers of shows already held in the smaller cities are unanimous in the statement that the attendances were larger than in 1921. Visitors evidenced more interest in automobiles, but price uncertainty has been an important factor in retarding sales and prospects have held off on that account. There are indications everywhere, however, of a good deferred business in the spring.

Public Is "Motor Wise"

Another reason for delay by prospective purchasers is a desire to familiarize themselves with the merits of the many new models which have been brought out this year. The public is becoming "motor wise" and, while it is interested in price, it is equally interested in quality.

The waiting attitude of prospective purchasers has been reflected in the factories, but January production exceeded that of December by a considerable margin. This was due, in part, to the fact that the final week of December was employed almost universally in the industry for inventory taking, but schedules were increased as soon as manufacturers realized that attendance at the New York show was larger than ever before. This finally convinced them that sales for the first quarter this year would exceed the business done in the same period of 1921.

As a consequence, parts and accessory manufacturers are doing a somewhat better business than they did in December, and many of them have booked substantial orders for February and March. Collections are not quite so good as they were in November, although about on a par with December.

Motor Truck Trade Revived

One of the encouraging factors in the automotive situation at this time is the unmistakable evidence that the motor truck end of the industry is coming to life. Most truck companies are reaching the bottom of their inventories and some of them are giving releases on commitments which have been held up for a year and a half. Companies manufacturing light delivery cars apparently are making more progress than those which confine their operations to heavier vehicles.

Most of the parts makers are getting considerable new business as compared with the past few months, when their operations depended largely on releases on commitments made previously. This is due to the fact that inventories are down and sales are for current production. Sales for January were much better than for January last year.

Overland to Produce New Commercial Car Chassis

DETROIT, Jan. 28—Orders for 500 Overland and Willys-Knight cars were placed by dealers with Simons Sales Co., Michigan distributor, at a meeting and dinner given by Guy O. Simons during show week. Simons said his company would market 7000 Willys cars in Michigan during the year.

The meeting was addressed by Charles B. Wilson, vice president and general manager of the Willys-Overland Co., Toledo, and A. C. Barber, sales manager. Wilson told of economies in manufacture being instituted through the consolidation of operations. Barber said Willys-Overland would produce within sixty days a new commercial car chassis which will be marketed through all Willys dealers.

NATIONAL MOTORS REFINANCED

INDIANAPOLIS, Jan. 29—The National Motor Vehicle Co. of Indianapolis has been refinanced to the extent of $750,000. Bonds will be issued on the mortgage of the plant which was placed by the Fletcher Savings & Trust Co. of this city. The mortgage covers only the plant and equipment and does not affect what stocks of parts and materials there may be on hand at any time, nor the cash resources of the company.

Output Increases As Shows Progress

Response of Public Is Active, Factory Representatives Report at Chicago

CHICAGO, Jan. 30—Production is stepping up at the factories as the show season progresses. Reports of factory representatives at the Chicago show evidence buying responses at the January shows exceeding the expectations of dealers and manufacturers alike and holding out promise of a steady improvement in the automotive situation.

Many of the factory men report their dealers as having devoted a large part of the past few months toward clearing out the bulk of their used car stocks in preparation for active sales campaigns. Now with their used cars down to a working level the dealers are putting additional impetus behind their show efforts and this is bringing the actual sales high.

Responses to the appeal of new models offered by some of the smaller producing companies indicate that the public has not yet bound itself to confine its buying to certain large producing lines. One of these is said to be sold several months ahead as a result of orders placed at the January shows, and several others report themselves as rushed to meet delivery demands.

Addition of units are reported planned by at least one company, which is now at capacity and finds itself nearing the point where it will have to increase its facilities.

Toledo Plants Feel Effects

TOLEDO, Jan. 30—The influence of the automobile shows is already beginning to be felt in the industry as far as Toledo plants are concerned.

The local branch of the Chevrolet Motor Co. is gradually expanding its working force and expects to reach its normal of 2500 men within the next two months.

(*Continued on page* 252)

Brings Service Truck Contract from Poland

WABASH, IND., Jan. 28—R. E. Taylor, representing the Service Motor Truck Co. of Wabash has just returned from Poland with a large contract with that government for trucks, tires, machinery, etc., to be supplied to the Polish War Department.

Other Indiana companies that may receive part of the business of the truck order are the Midwest Engine Co., the Oakes Co. of Indianapolis, the Pressed Steel Products Co., Michigan City; the Ross Gear & Tool Co., Lafayette; the Bimel Auto Wheel & Spoke Co., Portland; Muncie Malleable Iron Co., Muncie; the Muncie Foundry Co., Muncie, and the Fairmount Drop Forge Co., Fairmount.

Dyneto Creditors Aid Reorganization

Announcement of Definite Plan Expected—Majority Stockholder Makes Two Proposals

SYRACUSE, N. Y., Jan. 30—Complete reorganization of the Dyneto Electric Corp. of this city, manufacturer of self-starters, lighting systems and small motor generators, will soon be announced by R. M. Owen, majority stockholder of the concern, which recently went into the hands of a creditors' committee with apparent liabilities of $700,000.

Many of the claims against the company have been rejected by the special master. The readjustment of the company's affairs has been in progress for nearly a year. When the financial difficulties of the company first became known, Carl L. Amos of this city, head of the concern, offered to settle with creditors on a basis of 50 cents on the dollar on deferred payments. The creditors were willing to accept this plan, but it fell through before realization.

Then Owen, who controls the Owen Magnetic patents, offered the creditors 33 1/3 cents on the dollar in cash or the option of helping furnish the cash necessary to meet the cash offer on a pro rata basis, and reinstatement in the reorganized company with full claim credit to be paid on a long term obligation basis without interest. The payments were to extend over a period of five years.

About 95 per cent of the creditors have accepted either one of the two plans, and Owen and the creditors' committee have been making efforts to obtain unanimous consent of the remaining five per cent. It is hoped to meet the cash payments within the next week or ten days.

The definite plans for the new corporation have not been made, nor is the directorate known. The new company will probably carry the name "Dyneto" in some way.

All former heads of the corporation have severed their connection with it, and a complete reorganization is in sight.

When the plant was operating at full capacity it employed between 300 and 400 persons, but for the last year only an office force and a few machine operators have been kept at work.

Rolls-Royce Production Nearly Four Cars Weekly

SPRINGFIELD, MASS., Jan. 28—Rolls-Royce of America, Inc., has added 200 men to its factory force and has brought its production close to four cars a week. Owing to high-class workmanship involving a great deal of hand work, the amount of time given to testing and the large size of car produced, a rapid output of cars is not attempted or desired.

Special attention is now being paid to the development of new body designs. A wage readjustment has been effected at the plant, by which the basic pay rate has been reduced from 57 to 42 cents an hour. The premium plan is continued in force, enabling an employee to receive extra pay when completing work in less than the time alloted for a given task. The regular 48-hour weekly schedule is being maintained.

Franklin Cuts Parts Lists to Within 7 Per Cent of 1914

SYRACUSE, N. Y., Jan. 30—A reduction in prices of parts ranging from 10 per cent to 40 per cent, and effective Feb. 1, is announced by the Franklin Automobile Co. It is pointed out that the greatest reduction is made on those parts which are more generally in use for overhaul or maintenance purposes, as reground crankshafts, rebored cylinders, new pistons, etc.

Improved methods of manufacturing, which were made possible by the establishment of a new plant under separate control, has made much of this reduction possible, according to F. J. Leyerle, service manager. This, he states, combined with economies effective in purchases, labor and operation costs, has made it possible to bring the present prices on parts to within 7 per cent of 1914 prices.

"In revising the prices at this time," Leyerle says, "we are giving the owner the benefit of present cost, regardless of inventories on hand purchased and produced at higher cost."

File Bankruptcy Petition Against Revere Motors

INDIANAPOLIS, Jan. 27—An involuntary petition in bankruptcy has been filed against the Revere Motor Car Corp. in the United States District Court here by three Cleveland concerns. The petition was preferred by the Cleveland Hardware Co. with a claim for $154; the Cleveland Tack Co., $464, and the Cleveland-Akron Bag Co., $213.

John P. Porter, one of the stockholders of the company, who said he represents more than 9000 creditors, came to Indianapolis from Buffalo to aid in filing the petition. Porter claims that the concern was incorporated for $3,000,000 and has liabilities of $5,000,000. The corporation disclaims possession of more than $100,000 in assets, but Porter contends that the assets are really about $2,000,000.

GRINDING COMPANY FORMED

FLINT, MICH., Jan. 30—The Arnold Grinding Attachment Co. has been organized here to manufacture an automatic micrometer gage used on grinding machines, local capital being provided by J. M. Barringer, R. T. Perry and Carl W. Bonbright. The gage is the invention of P. S. Arnold of Detroit.

Price of Fordson Is Reduced $230

Ford Tells Dealers Purpose Is to Help Increase Prosperity of Farmer

DETROIT, Jan. 28—A reduction of $230 in the price of the Fordson tractor was announced personally by Henry Ford by wireless telephone to the Ford dealers assembled at the Fordson Tractor Industrial Show in Cleveland last night. The new price is $395. In his talk Ford said the price revision was to help bring increased prosperity to farmers by permitting use of improved methods.

"It is certainly wonderful to sit here in my office and say a few words of greeting to you Ford dealers of the Cleveland territory," he said. "The radio is on outstanding tribute to man's inventive genius. They say there is nothing new under the sun, but we are constantly inventing new things, every day bringing some big improvement over the previous day's methods."

Continuing, he said:

Manufacturing operations have undergone some wonderful revolutionary changes during the past few years. We are all familiar with the big improvements in transportation methods, but the oldest industry has been the most backward in the acceptance or adoption of the new and up-to-date methods of doing things, and that is the farming industry. Being a farmer, I am vitally interested in all farm inprovements, and with this in mind, I have spent years of time and millions in money in the development of the Fordson.

Must Lower Cost of Production

As a general thing, the farmers have bettered their financial condition during the past 18 months, but the production costs of farm products are still too close to selling prices to allow fair margins of profit. What the farmer must do to put his business on a paying basis is to lower the cost of planting, cultivating and harvesting of his crops. This alone will increase his profits, and with this thought in mind it has been our constant aim to lower the price of the Fordson so that every farmer in the land could afford to own one.

It is a pleasure, therefore, to announce through your Ford dealers that we have to-day decided that the tractor price should again be reduced, and in considering a reduction, naturally my thought has been to make it possible for the largest number of farmers to share in the benefits to be derived through the use of our tractor, and consequently, effective Jan. 27, 1922, the new prices of the Fordson tractor will be $395 f.o.b. Detroit.

This is a cut of $230 off the present price and while in making this big reduction we have taken upon ourselves a gigantic task in the reduction of manufacturing costs, still that task, in my opinion, is not larger than the farmer's problem of to-day, and I am glad to do my part in bringing about a period of increased prosperity for the farmer. Your part is to carry this message to the farmer, thereby enabling him to produce more with less cost and shorter hours.

I am glad to have had this opportunity of talking with you and you have my best wishes.

Court Limits Date for Willys Claims

Must Be Filed Before April 1—Audit of Books Is Ordered

TOLEDO, Jan. 30.—An order fixing the limit date for filing claims against the Willys Corporation was signed by Judge Killits in Federal Court here Saturday. Claims may be filed in any of the district courts where receivers have been appointed on or before April 1, 1922. All will then be reported to the Toledo court.

Colonel Hartwell, representing New Jersey creditors, asked the court for $175,000 of the funds held by New York receivers for meeting city taxes and payroll at the Elizabeth plant. He said the $13,000,000 plant there is 95 per cent completed and that there are liens of $1,700,000 against it. New York attorneys declared there was a heavy demand for portions of their $700,000 now on hand. A Federal tax claim of $200,000 may be presented any day. Judge Killits said he would sign the order requested by Colonel Hartwell provided it was satisfactory to other creditors.

Orders Audit of Books

TOLEDO, Jan. 28—As a step toward untangling the difficulties of the Willys Corp., Judge John M. Killits, in Federal Court here, has ordered the receivers, Frank P. Kennison, Clement O. Miniger and Francis G. Coffey, to proceed with a general audit of the corporation's books. The receivers were also empowered to name the auditors.

The court also authorized the purchase by the receivers of 4315 electric batteries, valued at $495,000, from the Electric Storage Battery Co., Philadelphia. The contract for the batteries was entered into before the receivers were appointed.

The receivers were authorized to accept in settlement of a claim of the Willys Corp. against Earl Motors, Inc., debentures and preferred stock in the amount of $28,035.

Another order was entered requiring the receivers to demand from the Cleveland Trust Co., Cleveland, the Fort Dearborn National Bank, and the Merchants' Loan & Trust Co., Chicago, and the First National Bank, St. Louis, statements of special accounts carried by the Willys corporation in those financial institutions.

Hearing on the intervening petition of the United States Light & Heating Corp. will be held soon before Judge Killits in this city.

ALLEN DEAL NOT CLOSED

COLUMBUS, Jan. 29—Frank P. Shaw of Chicago, who offered $570,000 for the plant and practically all assets of the Allen Motor Co. of Columbus, which has been in the hands of W. C. Willard and George A. Archer as receivers for some time, has not yet closed the deal. The offer was accepted by Judge Sater in the Federal Court.

According to local interests in touch with the situation, no plans for the future operation of the plant have been worked out. H. C. Runyon, who is in charge of the property, has been giving service to owners and selling what completed cars are on the floor.

Franklin Will Seek Hundreds of Dealers

SYRACUSE, N. Y., Jan. 30—"If every automobile dealer would get busy and go after the business it would be a great help toward restoring stability," asserted H. H. Franklin, president of the Franklin Automobile Co., at the annual meeting of stockholders. Franklin at that time announced that the company, to carry out this policy, will start an active campaign at once to obtain at least 250 additional sales representatives throughout the country.

It is understood that this is only the beginning and that the company has in mind a campaign which will enlist several thousand salesmen to handle the new four cylinder Franklin as soon as that car is put on the market in quantity.

At the annual meeting Ralph Murphy was elected to the directorate of the H. H. Franklin Mfg. Co. to succeed H. E. Maney, who became vice-president of the Franklin Automobile Co. and a director of that company. The manufacturing company directors elected are:

H. H. Franklin, Frank A. Barton, Giles H. Stilwell, A. T. Brown, E. H. Dann, Howard L. Franklin and Ralph Murphy. Mr. Franklin is president, John Wilkinson, vice-president, and Mr. Barton, secretary-treasurer.

Wilkinson, Maney, Barton, Franklin and Stilwell are directors of the automobile company with the same officers as for the manufacturing company.

Midcontinent Reorganized by Zenith Tire Receiver

TOLEDO, Jan. 30—E. G. Kirby, receiver for the Zenith Tire & Rubber Co., has returned from Wichita, Kan., where he aided in reorganizing the directorate of the Midcontinent Tire Co., which is practically the only asset of the Zenith company.

Kirby announces that J. A. Curtis, attorney, Cleveland; William Leary, president of the Zenith Tire & Rubber Co., Cleveland, and George W. Ritter, attorney, Toledo, in addition to himself, had been elected directors of the Midcontinent company to represent the 51 per cent stock ownership of the Zenith company.

He said the Midcontinent plant would produce about 800 tires a day for 1922.

ROAD WORK COST DROPS

COLUMBUS, Jan. 29—Cost of road building in Ohio has taken a tremendous drop, according to figures issued by the Ohio Highway Commission following the opening of bids on five highway projects.

Winton Co. Reduces Debts by $500,000

Mails Checks for Second 10 Per Cent Payment on Extension Indebtedness

CLEVELAND, Jan. 30—The Winton Co. has mailed checks for its second 10 per cent payment on its extension indebtedness. This, together with various other payments that have been made within the past sixty days, has reduced the company's debts by practically $500,000.

This is an indication of the thoroughness with which the company is adjusting itself to general market conditions. The newest model of the Winton Six, a 33-hp. car known as Model 40, has been announced to sell at $3,400—a decrease of $1,200 from the price of its previous model.

"This new low price," General Manager McEwen says, "reflects a bona fide result obtained within our own organization. In other words, by submitting every department of the business to critical analysis, we have freed ourselves from the notions and practices growing out of the war, which made manufacturing unduly expensive.

"We have decidedly lessened overhead by a readjustment of wage scales, by careful handling of purchases and the disposition of materials. We have at the same time adhered to rigid production standards both as to quantity and quality."

The Winton Engine Works, a Winton property which manufactures Diesel marine engines, has undergone the same readjustments as the motor car plant, and, in spite of a slow market, is producing 50 per cent of its capacity. New business booked during January is of such volume as to insure steady operation of the engine plant.

Charge Unequaled Rates Due to Insurance War

NEW YORK, Jan. 30—A cut of 20 per cent in automobile truck insurance rates in Boston in a rate war waged by stock casualty insurance companies against mutual companies, and an increase of 19 per cent in the rate in New York, which he intimated was used to recoup the losses in Boston, was revealed by Samuel Untermyer before the Lockwood committee.

The revelation was made during the testimony of Albert W. Whitney, associate general manager of the National Bureau of Casualty and Surety Underwriters, an unincorporated organization of 21 of the leading companies handling casualty insurance in New York state. Jesse S. Philips, former State Superintendent of Insurance, became manager of the bureau a short time ago.

Traveling Tractor School Under Way

Advance Rumely Co. Carries Instruction to Its Dealers—Prepares for Big Year

CHICAGO, Jan. 28.—The Advance Rumely Co. has on the road at present a school for dealers. This school is to make 12 stops ot a week each at the chief branches of this company. The objective is to instruct dealers "in all that the dealer should know about tractors." The company appropriated $100,000 for this work, believing that 1922 was to be a tractor sales year.

In preparation for this school the company prepared an exhibit consisting of 12 carloads of tractors and tractor parts. The exhibit included cutout unit parts and separate crankshafts, disassembled transmission and such fundamental parts. Two of these exhibits were arranged so that the faculty could move from city to city without loss of time.

The faculty includes the service managers, engineers and others from the factory and men loaned by the organizations which make unit parts for this company.

Each of the six days of school work is divided into three sessions, with classes for morning, noon and evening. After the lecture the dealers are taken into a shop or laboratory and shown exactly how each member of the unit part operates. All dealers are required to attend this school and the company paying the expense while there. The roll is called and if the dealer is not present his per diem is not credited to him.

At some time during the school each dealer is required to go into a lot and drive each tractor in the various driving tests. It is believed that any dealer who goes through this course will be able to go on a farm and perform the farming task for the prospect. The instruction is not restricted to driving but includes belt work and other operations that are becoming more popular with tractor owners.

Fenn Finds Truck Outlook Is Bright

CHICAGO, Jan. 30—F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, has been in Chicago visiting several truck manufacturers in this vicinity. His stop here was a part of a trip throughout the West during which he hopes to visit practically all the truck manufacturers. He has just completed a trip through Michigan and after several days in the Chicago vicinity will go through the states of Wisconsin and Minnesota, and will return to New York after visiting several Canadian factories and shows.

Fenn says he has found an excellent spirit in the truck factories he has visited so far. In all of them there are the signs of the awakening of sales and where the sales department is showing any initiative in seeking business, good results are apparent. At no place has he found that truck demands have developed to the point where sales are to be picked up without effort, but he has found that where an effort has been made to adapt truck transportation to specific business needs, sales are being made.

Everywhere that he has visited, Fenn finds there is a strong interest in bus development and in a number of factories special attention has been given to the development of chassis for transportation on railroad tracks.

COLLECTIVE BUYING BEGUN BY FARMERS

PORT BYRON, ILL., Jan 31—The Co-operative Co., composed of farmers, has endorsed a proposal from the Moline Plow & Tractor Co. for collective buying, and seventy-five farmers have agreed to invest in tractors and certain farm implements. The manufacturers will ship directly to the farmers and the latter will remove the implements from the car to the farm. The secretary of the company will serve as agent for the Moline concern. The new system will reduce the cost to the consumer and stimulate dormant buying among the agriculturists.

Americans Operating Bus Lines in China

WASHINGTON, Jan. 30—A report from Vice-Consul Samuel Sokorin at Kalgan says there are at present five American firms engaged in operating automobile passenger service between Kalgan and Urga in China, and by spring it is expected that this number will be doubled. Hitherto only small motor cars carrying four passengers and a driver have been used in this service, and no attempt has been made to carry valuable freight.

Aside from the question of carrying freight, the designing of a large car for Mongolia is important in that it will mean an increased passenger traffic, as the larger cars could carry seven or eight passengers on each trip.

SEIBERLING ON COAST

LOS ANGELES, Jan. 30—Announcement is made by the Seiberling Rubber Co. of Akron, Ohio, that Los Angeles will be headquarters for the Pacific Coast States. George Bellis has been named branch manager here, F. B. Hesse, San Francisco; C. B. Reynolds, Portland; M. H. Anderson, Salt Lake City, and J. M. Watson, Denver. Bellis is a former manager of the Goodyear branch here. J. E. Argus has been named coast manager.

Bank Thinks Prices Nearly Stabilized

Chicago Federal Reserve Says Manufacturers Move Cautiously

CHICAGO, Jan. 30—Discussing automobile production and shipments, the January review of business conditions compiled by the Federal Reserve Bank of Chicago says:

"While the number of visitors at the eastern automobile show indicates increased interest in the motor car, the improvement in actual business looked for with the turn of the year has not yet materialized. The Chicago and other western automobile shows now under way or approaching, are relied upon by manufacturers to give an indication of the probable absorption of cars during the spring months.

"Manufacturers are moving cautiously. Dealers throughout the country are not in a strong financial position. The decline in price of new automobiles has demoralized the second-hand car market, and as a result of the decline in used-car prices, dealers have been compelled to absorb severe losses on cars that have been traded in.

"There is a more widespread feeling among manufacturers than has existed for some time, that prices are now settling to a level on which they are likely to stabilize, for the season at least. Cuts made since Christmas have been fairly general, although prices with few exceptions are not quite down to pre-war levels. These exceptions, however, are offset to some extent by improvements and increased equipment on the car. Inventories show a considerable decrease."

Kansas City Credit Easier

KANSAS CITY, Jan. 30—The following statement in reference to the financial situation in this district is made in the monthly review of conditions prepared by the Federal Reserve Bank of Kansas City.

"The financial situation at the beginning of 1922 may be described as easier than for several months past. Indebtedness is still heavy and there is a considerable volume of frozen loans, though it is noted that there has been continued slow but steady liquidation. Discount rates on short time paper are the lowest in several years and the tendency is toward lower interest rates on long time loans. Lack of an outlet for foreign investments is bringing outside money into the district which is used largely for liquidating industrial loans and giving industries a fresh start, but little is going on in the way of industrial expansion at this time. The agricultural and livestock interests are gradually being helped by loans by banks out of their own funds or borrowings from the Federal Reserve Bank, while the War Finance Corporation is approving loans for agriculture and livestock.

Harvester Truck Plant to Be Built

McCormick States Work at Fort Wayne Will Be Started by March 15

FORT WAYNE, IND., Jan. 30—Work on the construction of the truck plant of the International Harvester Co., in this city, will start on or before March 15. This is the message personally delivered by Cyrus F. McCormick, Jr., president of the Harvester company, at the annual meeting of the stockholders of the Greater Fort Wayne Development Co., which was organized to erect homes to house the workers at the plant. The contracts for the erection of the plant were made in June, 1920, but the construction work was postponed from time to time owing to business conditions.

In making his announcement McCormick said that plans for the plant indicate that in time it will be the largest of its kind in the world, and also declared that action has been taken to make the buildings and grounds a beauty spot in the way of factory construction. Parkways, drives and landscaping of the grounds will be undertaken. The buildings will all be of stucco design.

Operating Within Year

McCormick told the stockholders of the local corporation that while he did not want the action here to be regarded as an indication of great optimism as to future business conditions in the nation, the directors of the Harvester company had decided that all pledges made should be carried out to the letter, even though a wait of a few months more for the starting of the work would be beneficial.

Much of the preliminary work in connection with the big plant has already been done. It is expected that the factory will be in operation and turning out motor trucks within a period of twelve months.

Officers of the Greater Fort Wayne Development Company were re-elected. The development company's assets are now $1,071,869.59.

To Discuss Roads at Tractor Show

MINNEAPOLIS, Jan. 30—A special program treating the application of tractors for road building work has been arranged by the Minneapolis section of the Society of Automotive Engineers for Wednesday afternoon, Feb. 8, in connection with the tractor show in this city.

There will be a technical meeting Thursday at which subjects relating to tractors on the farm will be discussed. A dinner will be given Thursday evening at the Hotel Radisson and the speakers will include E. G. Quamme, president of the Federal Land Bank of St. Paul, and James R. Howard, president of the American Farm Bureau Federation.

The program for the technical session follows:

WED., Feb. 8, 2 p.m.
- Minnesota Road System—C. M. Babcock.
- Road Building Machinery.
- Road Maintenance.
- Motion Pictures of Tractors in Road Construction.

THURS., Feb. 9, 2 p.m.
- Relative Tractor and Plow Reactions of Various Hitches—O. B. Zimmerman and T. G. Sewall.
- The Relation of the Tractor to the Farm Implement—G. Douglas Jones.
- The Possibilities of Standardization in the Tractor Field—P. M. Heldt.

General Motors Has 70,504 Stockholders

NEW YORK, Jan. 31—The number of General Motors Corp. stockholders increased 3367 during the last quarter of 1921. The total now is 70,504, an increase of 21,469 over a year ago. The common stockholders reach a total of 48,348.

The corporation is sending to all its stockholders a pamphlet telling them something of this group of accessory companies which make, market and service essential motor car equipment. The products of this group of companies include electric starting, lighting and ignition systems; warning signals, ball bearings; roller bearings; radiators; rims; cold rolled and also cold drawn steel.

These products are standard equipment upon representative makes of passenger cars, trucks, tractors and engines. Some of them find a wide variety of uses outside the automotive industry. The companies mentioned include the Dayton Engineering Laboratories Co., Remy Electric Co., Hyatt Roller Bearing Co., New Departure Mfg. Co., Harrison Radiator Corp., Jaxon Steel Products Corp., Klaxon Co., United Motors Service Co., Delco Light Co., Lancaster Steel Products Corp. and the Dayton Wright Co.

A. R. Warner Is Dead; Pioneer in Industry

CLEVELAND, Jan. 30—Albert R. Warner, for years an official of the White Co. and known in the motor industry of the country as one of the leaders, was buried in the Lake View Cemetery here after impressive services, in which many of the leaders in the automobile industry of the Forest City participated. Warner died at the age of 54, after a stroke of apoplexy.

For seventeen years he had been with the White company in an official capacity. His service played an important part in the upbuilding of that corporation. Until recently he had been a member of the auxiliary board of the Guardian Savings & Trust Co.; a director of the Cleveland National Bank and of the Universal Crane Co. and the Rubay Co., which builds automobile bodies.

Burke Will Direct Sales for Peerless

Former Sheridan Head Succeeds Cunliffe, Who Becomes Philadelphia Distributor

CLEVELAND, Jan. 30—C. R. Cunliffe has resigned as general sales manager of the Peerless Motor Car Co. to take over control of the Girard Automobile Co., Peerless distributor in Philadelphia. He will be succeeded by D. A. Burke as general sales manager of Peerless.

Burke is one of the veterans of the automotive industry. In 1913 he became branch manager in Cleveland for the Buick Motor Co. and later was transferred to the factory at Flint, where he worked for two years under R. H. Collins, who then was general sales manager and who now is at the head of the Peerless company. Burke was placed in charge of the Buick branch in Chicago in 1916. He remained there until 1919, when he was commissioned by W. C. Durant to design the Sheridan car, in which he embodied many of his own ideas.

Served with Durant

When the Sheridan Motor Car Co. was organized as a division of the General Motors Corp., Burke was made president and general manager. Upon the sale of the Sheridan division to Durant interests, Burke was made general manager of the Durant Motor Car Co. of Indiana. He resigned that position two or three months ago, although he retained a stock interest in the company. His alliance with Collins is another indication of the close relations between the latter and Durant.

Cunliffe retired Aug. 1 as manager of the Chicago branch of the Cadillac Motor Car Co. to become associated with Collins. His appointment as sales manager of the Peerless company was announced a few weeks later. Before going to Chicago Cunliffe was manager of the Cadillac branch in Philadelphia.

Ahlberg Establishes Ten New Branches

CHICAGO, Jan. 30—The Ahlberg Bearing Co., manufacturer and distributor of new high grade ball and roller bearings and manufacturer of Ahlberg ground bearings, announces the opening of ten additional branches, which makes a total of thirty-four branches owned and operated by this company. The new branches are located in the following cities: Baltimore, Buffalo, Columbus, Dallas, Duluth, Indianapolis, Newark, Toledo, Washington, D. C., Youngstown, Ohio.

It is the intention of this company to establish a considerable number of branches in addition to those already in operation, so that customers can avail themselves of its services with very little delay.

Ford Seeking Real Executive Talent

Interviews Big Men of Industry About Lincoln Sales and Production

DETROIT, Jan. 30—Henry Ford's purchase of the Lincoln Motor Co. on Feb. 4, which is considered in this city to be practically a certainty, promises to bring in its train one of the greatest reassemblages of executive talent that the industry has known.

Throughout the deal Ford has acted with the almost certain knowledge that the men he requires to operate the property are willing to join him. Several conferences have been held at which the views of these men on the operation of the plant have been heard and Ford is said to be thoroughly in accord.

The influence of the Lelands in the new control will be nominal, though it is definitely known that they will have a place in the new organization. There will be a new president and general manager and production will be in the hands of an executive of the Ford school. The sales will be under the direction of one of the highest trained specialists in the industry.

That there will be no bid for the property from stockholder interests is gleaned from the fact that the heaviest holders are content to accept a stock loss to realize on their notes.

There are reports, apparently well founded, that Ford is prepared to go to the assistance of at least one other company, producing a high class car, which is said to be in financial difficulties for much the same causes as those which involved the Lelands.

Detroit is gossiping more avidly than ever over the plans of Ford and confidently believes that he will become almost as important a factor in the higher price classes as he now is in the lowest class.

Toronto-Durant Co. Headed by Wallberg

NEW YORK, Jan. 31—Durant Motors of Canada, Ltd., will begin production before March 1 in its plant at Leaside, a suburb of Toronto. Both four and six-cylinder cars will be produced, but the output will be confined for the present to the four-cylinder models.

The Toronto-Durant Co. has been organized with E. A. Wallberg of Toronto as president, to distribute the line in the Toronto territory. Wallberg is a financier and a civil engineer, and is interested in Durant Motors of Canada. The Toronto distributing company will be located in an addition to the King Edward Hotel and will open next week.

FRONT DRIVE MOTORS PRODUCING

KANSAS CITY, Jan. 30—The Front Drive Motor Co., a Missouri corporation, capitalized at $200,000, with main offices in this city, is increasing its capitalization to $1,500,000, with $600,000 paid in. The company is now in production, one car having been delivered in Kansas City, and regular shipments being scheduled, beginning in February, from the Szekely Engineering Co., Moline, Ill. The company is now disposing of territorial distributing agencies. Arrangements are being made for a Kansas City factory.

Broadwell Appoints M. A. M. A. Committees

NEW YORK, Jan. 31—President E. H. Broadwell, president of the Motor and Accessory Manufacturers Association, has announced the following committee appointments for the year:

Executive committee: E. H. Broadwell, Fisk Rubber Co., Chicopee Falls, C. E. Thompson, Steel Products Co., Cleveland; W. O. Rutherford, B. F. Goodrich Co., Akron; G. Brewer Griffin, Westinghouse Electric & Mfg. Co., Springfield, Mass.; C. H. L. Flintermann, Detroit Pressed Steel Co., Detroit.

Finance committee: E. H. Broadwell, chairman, Fisk Rubber Co., Chicopee Falls; C. E. Thompson, Steel Products Co., Cleveland; E. P. Hammond, Gemmer Mfg. Co., Detroit; W. O. Rutherford, B. F. Goodrich Co., Akron; G. Brewer Griffin, Westinghouse Electric & Mfg. Co., Springfield, Mass.; A. W. Copland, Detroit Gear & Machine Co., Detroit; J. M. McComb, Crucible Steel Co. of America, Pittsburgh.

G. M. C. Truck Takes Over Atlanta Branch

PONTIAC, MICH., Jan. 31—A direct factory branch of the General Motors Truck Co. has been opened in Atlanta for the distribution, sale and service of GMC trucks in the Southeastern States. This branch will take the place of the Southeastern GMC Truck Co. and will occupy the same building.

T. K. Johnson, for the last four years general manager of the Southeastern GMC Truck Co., has been appointed manager of the factory branch.

In addition, the General Motors Truck Co. will take over the Charlotte, N. C., branch of the Southeastern GMC Truck Co., and will operate it also as a factory branch under the supervision of the branch in Atlanta.

LOCOMOBILE RECEIVES AWARD

CHICAGO, Jan. 30—A Locomobile steam car built in 1899 and owned by John Barry of Dayton, Ohio, won the first prize offered by the National Automobile Chamber of Commerce for the oldest car in the United States still in running condition. The second prize was awarded to a 1900 Oldsmobile driven by a gasoline engine. There were 200 entries in the contest including twenty-one Oldsmobiles and three Cadillacs. It was brought out that the seventh and ninth Oldsmobiles manufactured still are running.

Finance Men Seek Legislative Reform

Committee Named by National Association—Six Locals Now Organized

NEW YORK, Jan. 30—A legislative committee which will work in harmony with the various companies included in its membership was appointed at the meeting of the directors of the National Association of Automobile Financing companies held in this city. The committee, named by Fred A. Webber, Jr., president of the association, is composed of H. W. Ritter, W. E. Hiller and A. A. Ross. It was contended at the meeting that reforms are needed in the laws of various states or in the interpretation of them. The locals of the association will be expected to co-operate with the national organization in carrying on this work.

It is felt that while many of the problems are peculiar to the individual states, co-operative action would result in amendments to present statutes which would afford all the companies in the automobile financing business greater protection. Most of these companies are doing business in all states and for that reason all of them are vitally interested.

It was reported that locals in Chicago, Pittsburgh, New York, Indianapolis, St. Louis and Rochester now are affiliated with the national organization. John B. Perlee of Chicago was appointed chairman of the membership committee. Each company which is a member of the association will be asked to take three memberships in the local, consisting of an executive, counsel and credit man.

The need for publicity also was considered and a committee headed by C. L. Hemphill of New York was named.

Quarterly meetings will be held by the national association. The next will be in St. Louis in April and the July session will be held in Pittsburgh.

Martin-Parry to Produce Special Bodies for Willys

INDIANAPOLIS, Jan. 25—The Indianapolis plant of the Martin-Parry Corp. of York, Pa., will make the greater part of the order for 40,000 truck bodies of a special type placed by the Willys-Overland Co. The bodies are equipped with new labor and time-saving devices. It is said that the Martin-Parry Company also has working agreements with Chevrolet and Ford companies and is figuring on a contract with Buick.

Chaplin Spahn, general manager of the Indianapolis branch of the corporation, states that plans are now being considered for the construction of a large lumber mill in Louisiana where lumber used for body construction would be cut and trimmed before being sent north. The mill, Spahn says, would probably be large enough to cut and trim four to five million feet annually.

Ball Bearing Stock Is Retained by Nice

Court Orders Voting Trust Certificates Cancelled—Continues As Independent

NEW YORK, Jan. 30—A suit involving a novel question as to the power of the Federal Court to restrain a proceeding in the State courts of Pennsylvania and whether the Nice Ball Bearing Co. of Philadelphia, one of the leading independent manufacturers of ball bearings, was to be absorbed by its leading competitor, was settled here while the case was pending here in the United States Circuit Court of Appeals.

Announcement of the settlement was made by the attorneys, who preferred not to discuss the terms. The plaintiffs in the case were Budd G. Nice, president of the Nice company, and other members of his family, who controlled it. The suit demanded the return of voting trust certificates representing the entire stock of the Nice Ball Bearing Co. from the defendant, Franklin B. Kirkbride, banker, of 7 Wall Street, who during the litigation was president of the S. K. F. Industries, which a few years ago absorbed the Atlas Ball Bearing Co., the Hess Bright Mfg. Co., ball bearing manufacturers of Philadelphia, the S. K. F. Ball Bearing Co. of Hartford, Conn., and the Hubbard Machine Co.

By the settlement, which was effected after months of conferences between counsel for both sides, the Nice family retains all the stock of its company, representing a $2,000,000 plant in Philadelphia. The voting trust certificates held by Kirkbride are cancelled and the Nice company continues as an independent concern. The settlement not only ends the appeals here but several suits pending in Philadelphia and litigation which promised to continue for years, due to the novel questions which would have been carried to the United States Supreme Court.

Kirkbride Wins Victory

While the cases were pending Kirkbride won a victory in the Supreme Court of Pennsylvania, but the plaintiffs obtained an equally important victory here by a decision of Federal Judge Augustus N. Hand.

The history of the case, which is as interesting in its facts as in the legal points involved, is disclosed in the record of the appeal filed in the United States Circuit Court of Appeals here. As shown by the opinion of Judge Rogers, of the Philadelphia Court of Common Pleas, the Nice company desired to extend its plant in 1917 because of war conditions and increased business, and contracted with William Steele & Sons Co. for additional factory buildings on a "cost-plus" basis. The final price charged by the builder was almost double the original estimate. Because of the increased cost, the Nice company could not meet its payments to the contractors, who sued.

Judge Rogers said in his opinion that "Steele & Co. evidently wanted their money and forced a hard bargain." Although the company's prospects for profits from future business were bright and were later fulfilled, the company found itself embarrassed as a result of the Steele action and was forced to avoid the consequences of the suit.

The Nice company agreed to transfer its real estate to the Steele company as security, and to lease it from the contractors for $5,000 a month, which was to be applied on the claim. This arrangement was objected to by certain creditors. A creditors' agreement was made under which the contractors assigned their rights upon payment of the claim. The testimony showed that Prytz, then president of the S. K. F. Industries, was advised of the difficulties of the Nice company and turned the matter over to Kirkbride, who agreed to furnish the necessary capital.

Federal Court Allegations

Allegations in the suit in the Federal Court here were that the necessary capital was then furnished, and voting trust certificates for the stock of the Nice company were delivered to Kirkbride. Kirkbride refused to enter into a reorganization plan to preserve the independence of the Nice company. Suit was then brought for the return of the voting trust certificates, at which time payment of the entire sum due Kirkbride was tendered by the Nice company.

The plaintiffs in the action brought in the United States District Court here included all but two stockholders who had brought a similar suit in Pennsylvania in which they were defeated. While proceedings were pending here, Kirkbride applied in Philadelphia for an order compelling the exchange of the voting trust certificates held by him for all the stock of the company then held by the voting trustees and for an injunction against Budd G. Nice and the other plaintiffs in the suit here. Before this case was heard in Philadelphia the plaintiffs here asked Judge Hand for an order restraining Kirkbride from interfering with the suit here, which Judge Hand granted.

These appeals are now dismissed by the settlement of the case, the receivers have been discharged, and control remains in the hands of Budd G. Nice and members of his family. Nice continues as president.

CADILLAC NEARS 100 DAILY

DETROIT, Jan. 28—Production at the Cadillac Motor Car Co. plant is running close to 100 daily as a result of orders received at the New York and other shows since Jan. 1. Unusual stimulus has been experienced, officials declare, due in large part to the combination of lowered price and improved design of the new models. Four sales were reported in the first two hours of the Detroit show and consistent buying was reported throughout the week.

1000 Membership Is Aim of N.A.D.A.

Sets Out at Annual Meeting on Reorganized Career—Hay Chosen President

CHICAGO, Jan. 31—The National Automobile Dealers Association started today on its reorganized career with membership dues running from $50 to $250 a year, instead of $10, the rate which has prevailed except for a few $100 sustaining members since its organization four years ago. The goal is 1000 members or more and the membership qualifications are such that the appellation "One of a Thousand" is to be applied to dealers earning the right to display the Association emblem.

The new membership plan, approved by the directors several weeks ago, was adopted by the unanimous vote of the annual convention, which was poorly attended but which had a remarkably practical business program. At its close, Thomas J. Hay, Chicago Chandler and Cleveland distributor, was elected president, succeeding Jesse A. Smith, Buick distributor in Milwaukee. The other new officers are William L. Hughson, Ford dealer in San Francisco, first vice-president; John H. Butler, Dodge Brothers distributor in Kansas City, second vice-president; F. W. A. Vesper, Buick distributor in St. Louis, treasurer.

Counter attractions such as the Chicago show and manufacturers' meetings with their dealers kept the attendance down but it was significant that the men present and supporting the new N. A. D. A. plan were largely of the substantial distributor type. The experience suggested that future meetings be held at other times than show week.

Discuss Profits

Frederick Pierce of New York, a sales authority, presented a vivid word and chart picture of the fundamentals of salesmanship, supplementing it with the observations that price should be "forever and eternally secondary." James MacGregor, St. Louis Cadillac distributor, analyzed a dealer's sales from an accounting standpoint, showing how excessive cost of merchandising and paying too much for used cars had cut profits heavily in 1917 and again almost to nothing in 1921.

The general sentiment of the meeting was for "less business and more profits in 1922" to be brought about by refusal to sell new cars at the expense of losses on used cars taken in trade.

HIGHWAY SCHOOL POPULAR

LAFAYETTE, IND., Jan. 30—The eighth annual road school now being held by Purdue University for highway builders of the State of Indiana has attracted a large number of road builders. The registration has passed the 275 mark and it is expected that more than 300 will have taken part or all of the course.

Exclusive Dealer Movement Growing

Factory Sales Managers Busy at Chicago Expanding Organizations

CHICAGO, Feb. 2—Sales and advertising men are prominent at the Chicago show and will put in a busy week. Some of them are actively at work in their exhibits directing sales efforts, but for the most part they are devoting their effort to strengthening the dealer organizations in the territory. The movement toward exclusive dealerships looms up more strongly with the introduction of the lighter models and many realignments of territory are in the making.

The new $1,000 Franklin air-cooled car was shown to dealers in the Mid-West district at the Congress Wednesday noon.

President H. M. Jewett of the Paige-Detroit Motor Car Co. will present to his dealers the new Jewett car at a meeting Thursday evening at the Blackstone. This is the light six which will sell in the $1,000 class.

Velie dealers met at the Drake Wednesday when the new engine and car models were shown. The mechanical improvements were carefully detailed as important to developing volume business.

Jordan dealers were addressed by President Edward S. Jordan and General Sales Manager W. B. Riley at a meeting Thursday noon at the University Club.

The new Chandler line was presented to the dealers of the Mid-West territory at a luncheon meeting Tuesday noon at the Congress.

The Overland dealers' meeting was staged at noon Wednesday in the Congress, with President John N. Willys, Vice-President Walter P. Chrysler and Sales Manager A. C. Barber as speakers. As in New York, the factory organization will be presented to dealers with a view to establishing closer contacts and co-operation.

The Oldsmobile dinner was held at the Congress Wednesday at 7 p. m. President A. B. C. Hardy and a number of General Motors executives spoke.

Gains in California Made by Few Lines

LOS ANGELES, Jan. 30—A recapitulation of the motor car business in southern California during 1921 shows an increase in sales of 8000 new cars over 1920. This was a gain of 18 per cent. In the city of Los Angeles the gain was 21 per cent. The total registration of new cars for the year was 51,226 and the total of all cars of all makes and models was 341,329. The proportion of cars to population will be as 1 to 5. Southern California has ten counties, but some are very sparsely inhabited. Approximately one-third of all the cars in the southern section of the State are owned in Los Angeles.

Dealers have cause for giving serious consideration to the 1921 registration figures. Although a gain of 8000 new cars was made this is more than offset by the increase in the sale of Ford cars alone, which totaled 8019. Of the total of 341,329 cars of all makes registered, 115,123 were Fords. The situation indicates that when all makes of cars, exclusive of Fords, are considered, there was no increase in business over the previous year.

The year's business showed conclusively that the better known makes of cars were the only ones to make material progress. In the main, the less popular makes did not do as well as in 1920. The leaders were: Buick, 3349; Chevrolet, 5306; Studebaker, 4131; Dodge, 3615; Overland, 1345; Oldsmobile, 1122; Nash, 944; Oakland, 710; Maxwell, 856; Hupmobile, 801. Among the higher grade cars, the Cadillac with 562 outstripped the entire field. Among the heavy-duty trucks the Mack led with 276, and among the commercial cars, excluding the Ford, the Dodge was first with 521.

Sales Are Stimulated in Columbus District

COLUMBUS, Jan. 30—A decided improvement in the demand for passenger cars has been noted by Columbus dealers and jobbers since the middle of January. This is attributed partly to the New York show and also by the better industrial conditions which are prevailing. There has been some improvement in the employment situation in Columbus and this is reflected in the demand for motor vehicles.

The bulk of the demand is for cars ranging in price from $800 to $1,500. Yet there is a fair demand for higher priced cars and in fact all classes of vehicles are showing improvement. Recent price declines are given credit for a large part of the improvement and the movement toward stabilization is going on.

TEXAS SALES INCREASE

DALLAS, Jan. 30—There appeared to be a continued improvement in the automobile business in Texas this week. Dallas retailers found sales 5 per cent better than the previous week and Fort Worth dealers were selling 10 per cent more. Houston retailers said the increase was about 5 per cent over the preceding week and Galveston said business was holding its own. Panhandle dealers were selling more cars and trucks and Waco retailers reported slight increases. Retailers in a half dozen small towns in east Texas said business showed a decrease.

BOSTON SALES BETTER

BOSTON, Jan. 30—Boston motor car dealers report that retail business showed a decided turn for the better in January and that they are selling both new and used cars. Wholesale orders also are picking up. With the advent of the 1922 season comes the annual list of changes which occur about this time.

Many Truck Laws Rule California

Patchwork Results Through Each County Adopting Its Own Regulations

LOS ANGELES, Jan. 28.—Defeated in their purpose to reduce the weights allowed motor vehicles on the highways and increase the fees exacted the county supervisors of this State have set about to accomplish their purpose in another way. They are passing separate ordinances in each county lowering the weights from those permitted by State law. The result is that California is fast becoming a crazy quilt proposition when long-distance motor shipping is concerned. Between here and San Francisco it is necessary to traverse ten counties and eight of them have different ordinances affecting weights.

Authorities Hurt Industry

The State law gives supervisors the right to require lower weights on county roads than those permitted on State highways. Every time a truck leaves a State highway it gets on a county road. Some supervisors have assumed jurisdiction over the State highway and a test case now is in the courts to settle the controversy. In other counties the weight allowed on bridges is so low as to interfere seriously with truck operation. Truck shipping is one of the chief transportation assets of California, but under the guise of damage to the roads, urged on by railroad protagonists, the road authorities are throttling the industry.

Hardest Blow Delivered

What is regarded as the hardest blow yet delivered came last week when the supervisors of Los Angeles county passed an ordinance allowing four-wheel vehicles 24,000 lb. gross weight; six-wheel vehicles, 32,000 lb., and any combination of truck and trailer, 40,000 lb. The ordinance stipulates no more than one trailer. The State law allows two trailers. It is estimated by operators that the reduction in weights will result in an increased charge of 30 per cent to truck shippers. Los Angeles county has more trucks engaged in miscellaneous freight operation than any in the State. The county has been governed in the past by the State law which permitted 30,000 lb. on four wheels, 40,000 lb. on six wheels and set no other limit except 700 lb. per inch of tire width. Los Angeles county has reduced the latter figure to 650 lb. per inch.

BODY PLANT COMPLETED

HERMITAGE, ARK., Jan. 31—The Hermitage Body Works plant here has just been completed and will soon be placed in operation. Automobile and truck bodies will be manufactured. The first carload will be shipped to Beaumont, Tex. H. G. Turner of San Antonio, Tex., is manager of the plant.

Justice Officials Probe Bosch Sale

Three Channels of Investigation Indicated—Plant Operations Are Uninterrupted

BOSTON, Jan. 31—The scope of the Department of Justice investigation of the sale of the Bosch Magneto Co. was learned coincident with the arrival here of Thomas W. Miller, Alien Property Custodian, with Government records of the transfer. The documents were discussed at a conference of Federal attorneys held with the view to preparing the information contained in them for presentation to a Federal Grand Jury.

Officials indicated that the investigation would follow three main channels. The first of these is the sale of the Bosch Magneto Co. by A. Mitchell Palmer, as Alien Property Custodian, to Martin E. Kern. In this connection, it was said, the question of Kern's citizenship at the time of the transfer is involved.

Army Contracts Involved

The Government is interested, also, officials said, in looking into the Bosch company's contracts with the army air service, involving $420,000.

The third phase under investigation, it was said, involves income tax returns filed by the company. Internal revenue agents are understood to be checking up these returns now.

The case will come before the Federal Grand Jury here. John E. Joyce, assistant Federal attorney for the southern New York district, will have charge of the investigation of the sale of the company under the direction of District Attorney Harris.

The case is before the Federal Grand Jury of this district at the present time, as it was summoned for the purpose several weeks ago. After a few sessions the jury was dismissed, subject to call at any time. The delay, it is generally understood, was to give the Government authorities time to check and audit the records of the company and of the Alien Property Custodian.

Sold for $4,500,000

The Bosch property at Chicopee, Mass., was seized in April, 1918, by Palmer as Alien Property Custodian, being sold eight months after to Kern for $4,500,000. Allegations that the property transferred, including stock in other concerns and trademarks, was worth a much larger figure and that something was not right about the sale, were made and investigated when Palmer's nomination as United States Attorney General was before the Senate for confirmation.

Soon after his arrival here, Joyce dropped temporarily the Boston end of his investigation and returned to New York after stating that the entire matter would be transferred to that city.

Federal Attorney Harris disagreed with Joyce as to the transfer. He said that the Boston investigation would not be abandoned and that the records which he had subpœnaed would be sent to New York for examination by officials working on the case there, but would not be released from the custody of the Boston office.

Joyce declared that the investigation was ordered transferred to New York for the sake of convenience.

No Interruption at Plant

SPRINGFIELD, MASS., Feb. 3—Arthur T. Murray, president of the American Bosch Magneto Corp., asserts that there will be no interruption of the production program at the plant on account of the Federal Grand Jury inquiry into the company's affairs. Plans have lately been developed for merchandising the concern's new devices that look to a large increase of output.

Popularity of the battery ignition system has brought a decline of the demand for magnetos for passenger car use, and to meet the changed situation the company has brought out ignition and starting devices, etc., ready to be produced in quantities. He stated that since the plant was acquired by its present owners the manufacturing methods as applied to magnetos had been practically revolutionized by the introduction of a flexible system enabling different sizes of magnetos to be provided to meet diverse requirements. In this way, he said, production of magnetos at the plant was expanded from 100,000 to 340,000 yearly.

Factories in Toledo Feel Effects of Shows

(*Continued from page* 244)

Advance orders for Willys-Knight cars for 1922 delivery have caused officials at the Overland plant to increase their production plans for these cars to twice the number manufactured in the two-year period of 1920 and 1921. The general production plans at the Willys-Overland plant are going forward during the month. The working force has been increased considerably.

Electric Auto-Lite, Champion Spark Plug Co., Tillotson Carburetor Co., Mather Spring Co., are among the companies gradually building up their production to normal. The Bock Bearing Co. is going forward with an increased production schedule.

Dealers report that the generally decreased interest rates by bankers and mortgage companies is also helping along sales.

SCHOLARSHIPS AWARDED

FLINT, MICH., Jan. 30—Free scholarships from the various factories of the city were given 24 honor students of the Flint School of Automobile Trades at the conclusion of the first term recently. The students who received these scholarships for the second term of the school are as follows: Buick Motor Car Co., 10; Chevrolet Motor Co., 4; Flint Varnish & Color Works, Flint Motor Axle Co., and Champion Ignition Co., each 1.

February Opening Briskly at Plants

Executives Express Themselves As Well Satisfied with Results of Shows

DETROIT, Jan. 28—Production in Detroit factories in January was small owing to the late resumption of manufacturing following inventories, closings to effect plant changes and other causes. February will start off briskly on orders resulting from the shows. Factory officials declare themselves well satisfied with the results of the shows to date.

Ford production started late in the month, officials declare. Sales were somewhat increased by the lower prices, but there was no rush of business as on occasions where heavy price cuts were made. This condition, officials said, was expected, as the January cut was made to stabilize business.

Dodge and **Maxwell** have run along smoothly during the month, the former on the basis of its anticipated price cut and the latter filling orders.

Durant is building about 40 cars daily at Lansing and will continue this schedule during February.

Production in the medium price field has been late in starting, though **Hudson** and **Essex** have had a steady flow of business, and **Studebaker** and **Buick** have started production on close to normal figures.

Hupp, Reo and **Paige** are ready to enter heavy production.

Rickenbacker has lined up considerable business at the shows but the factory is still being equipped.

Oakland went into production late in January and expects to build 3800 in February.

Oldsmobile reports good show business and steady progress forward.

Cadillac production is running close to 100 cars daily, which is nearly 100 per cent capacity.

Packard has done little in a productive way during the month, but has thoroughly reorganized and retooled its factory departments in anticipation of a heavy manufacturing schedule in February.

Road Builders Await Lower Concrete Price

DAVENPORT, IOWA, Jan. 30—Eight Mississippi Valley State highway commissions have joined in agreement not to build any more hard-surfaced highways until the price of cement is materially lowered. States in the agreement are Iowa, Kansas, Michigan, Missouri, Minnesota, South Dakota and Wisconsin.

The action will tie up proposed highway work representing expenditures of $200,000,000.

Dodge Announces Its Price Revisions

Touring Car Reduced to $880—Cut of $105 Less Than Generally Expected

NEW YORK, Feb. 1—After having been kept a profound secret for two weeks, the new prices of Dodge cars were telegraphed to dealers early to-day. Not even the largest distributors knew them until they went to work this morning. Many Dodge dealers kept vigil in telegraph offices last night in the hope that they might intercept a telegram containing the information, but none came.

The new prices as compared with the old follow:

	Old Price	New Price
Touring Car	$985	$880
Roadster	935	850
Sedan	1,785	1,440
Coupe	1,585	1,280
Screen Delivery	1,035	880
Panel Delivery	1,135	980

See Stabilizing Effect

The reductions were not so sharp as had been expected generally. The commonly accepted report had been that the price of the touring car would be $775 or $785 and a cut of only $105 came as something of a surprise. The new touring car price of $880 compares with $935 for the Buick, $975 for the FB model Chevrolet, $985 for the Dort, $890 for the Durant four, $895 for the Gardner and $885 for the Maxwell.

It is the belief within the industry that the comparatively small cuts made by Dodge Brothers on their models will have a strong tendency to convince the public that motor car prices have reached their lowest level, for several months to come. This impression was driven home first by the insignificant reductions made by Ford.

No Immediate Buick Cut

The new Dodge prices which are retroactive to Jan. 1, will result in exceedingly keen competition in that class. The price of the new Maxwell touring car is exactly $5 more than the Dodge and the Durant is $10 more. While the differential between the Buick and Dodge is considerably higher, it was said at General Motors headquarters here to-day that there was little probability of another Buick reduction at this time. Durant has guaranteed prices until Aug. 1.

Sales results after the New York show, where the greatest emphasis was placed on prices, seem to have jolted the manufacturing end of the industry into a realization that prices must be stabilized if sales are to be made. Price readjustments expected after the Chicago show failed to materialize.

G. M. TRUCK LISTS REVISED

PONTIAC, MICH., Jan. 30—Changes in prices on several of its models are announced by the General Motors Truck Co. The revisions follow:

	Old Price	New Price
2-ton, Model K 41A	$3,000	
2-ton, Model K 41		$2,775
3½-ton, Model K 71A	4,250	3,950
3½-ton, Model K 71B		4,050
5-ton, Model K 101A	4,650	4,350
5-ton, Model K 101B		4,450

VETERAN TRUCK REDUCED

HULL, QUEBEC, Jan. 30—Eastern Canada Motor Truck Co., Ltd., manufacturer of Veteran trucks, has made reductions on its full line as follows:

	Old Price	New Price
1½-ton	$3,500	$2,699
2-ton	4,000	3,699
3-ton	4,400	4,200
4-ton	5,600	5,395

Ruggles Truck Fixes Price on Two Models

DETROIT, Feb. 1—The Ruggles Motor Truck Co. announces prices of its trucks as follows: 1-ton chassis, $1195; 2-ton, $1795. Only two models are to be built for the present. Production which was started in November has been gaining steadily, the company states, and will reach 100 this month. Distribution is increasing, with a wide area covered, the company finding dealers enthusiastic for its product.

In the 1-ton model there are five optional body types all selling at the same price. The equipment includes an electric starter and electric lights, Continental engine, Spicer drive shaft and joint, Brown-Lipe transmission and Columbia rear axle. The model is equipped with pneumatics 34 x 5.

The 2-ton has a Ruggles 4 x 5 engine, Brown-Lipe four speed transmission, Spicer drive shaft and Ruggles double reduction rear axle. Pneumatic tires are fitted in front and an option on solid or pneumatic tires for the rear is given.

MENOMINEE REDUCES PRICES

CLINTONVILLE, WIS., Jan. 31—Effective immediately the following reductions have been made on various models of Menominee trucks by the Menominee Motor Truck Co:

	Old Price	New Price
1—1¼-ton, Model HT	$2,080	$2,000
1½-ton, Model H	2,725	2,475
2—2½-ton, Model D	3,245	2,875
3½-ton, Model G	4,270	3,800
5-ton, Model J-3	5,450	4,850

KELSEY PRODUCES NEW MODEL

NEWARK, N. J., Jan. 30—The Kelsey Motor Co., which will produce a friction drive car, has announced a new four-cylinder model. The touring car and roadster will sell for $985; the coupe at $1,400, and the sedan at $1,450. The prices of the six-cylinder open model have been reduced from $1,800 to $1,525 and of the enclosed model from $2,700 to $2,175.

JACKSON TOURING CUT

JACKSON, MICH., Jan. 28—The price of the Jackson five-passenger touring model has been lowered from $1,635 to $1,485. Other models remain the same.

Truck Trade Poor In Swedish Market

Germans Flood Country With Own Products and Many Remain at Wharves

STOCKHOLM, Jan. 2 (*By Mail*)—The motor truck market in Sweden is not in the most flourishing condition at the present time.

At the end of the war American truck exporters were very keen for the Swedish market in view of the numerous industries in the country and the consequent need of motor trucks of various sizes. Most of the horses had been exported to Germany, money was plentiful and American made machines were in favor.

German trucks of all kinds and sizes flooded the country in 1920. Most of them had been used in the war but when overhauled completely and fitted with tires they gave good service and at the comparatively low price at which they were quoted many hundreds were sold. Yet, there are several thousand of these German trucks still in Swedish ports in the same condition as when received. One hundred dollars buys one of them. either a 3-ton or 4-ton, and the only additional cost to the purchaser is in the overhauling and fitting of new solid tires. The buyer has a selection of Benz. Bergmanns, Duerkopps, Stoewers and Horchs and once in a while he may find a German Daimler.

Ford Sells for $1,000

Ford is filling 90 per cent of the demand for the 1-ton truck with prices lower than ever. One thousand dollars buys a 1-ton Ford complete, which is half the price quoted a year ago.

To-day the American truck dealers are selling out their stock, taking a substantial loss on each sale. American made trucks which appear to have made their land winnings in Sweden, excepting Fords, are GMC, Garford (particularly in Stockholm), Clydesdale (the west coast of the country), Diamond T, Atterbury (the southern part) and Maxwell. A few Republics, Sterlings and Federals and also a few Four Wheel Drives can be found but not in any great numbers. The lower priced trucks, with the exception of Fords and Maxwells, are meeting with an extremely dull demand.

The market is for a good 2-ton truck with a low loading space and equipped with pneumatic tires. If the manufacturer in America can compete in price and quality he may keep on with the single giant pneumatics on the rear wheels.

HARVEY LOWER

HARVEY, ILL., Jan. 30—Harvey Motor Truck Co. announces reductions on two of its models as follows:

	Old Price	New Price
2-ton, Model WOA	$2,950	$2,650
2½-ton, Model WFA	3,200	2,950

Receivers Appointed For Locomobile Co.

Complete Reorganization Will Be Effected—Policy of Company to Be Continued

BRIDGEPORT, CONN., Feb. 1 — Application for a receiver for the Locomobile Co. was filed with Judge Edwin S. Thomas of the Federal District Court here to-day by attorneys representing the company and several creditors. It was asserted that the interests of both bank and merchandise creditors as well as those of stockholders would be served best by a reorganization through a receivership. The application was granted by Judge Thomas, who appointed Edmund S. Wolf, president of the First National Bank, and Elmer H. Stevens receivers under bonds of $100,000 each.

It was asserted that the company was doing a considerable volume of business and has approximately $500,000 in cash deposits. Officers of the company declared that several reorganization plans were under consideration but that, in any event, the policy of the company to build a limited number of high priced cars would be continued.

To Put Plant on Sound Basis

Elmer H. Havens, president of the company, made the following statement in reference to receivership proceedings:

"The banking and merchandise interests and the present officers of the Locomobile Co. are in agreement that a receivership is the best solution to the problems of the company. It is a natural step toward a proper reorganization that should make possible the operation of the Locomobile plant upon a sound financial basis.

"Last fall, when the Locomobile Co. terminated a contract with Hare's Motors, Inc., under which the latter had operated the Locomobile Co.'s business, the plant was heavily obligated in bank loans and merchandise bills. While plans were then under way for a receivership, it was hoped that this step might be averted and a reorganization effected.

"The New York banking interests and other creditors asked me to assume the administration of the plant. My personal interest in the Locomobile as a Bridgeport institution impelled me, at a considerable personal sacrifice, to accept this responsibility.

Several Plans Considered

"Since then we have been able to line up many of the old Locomobile organization in our renewed activities. We have lowered the price of our various models on an average of $1,000 and have been able to get more than our share of business in the quality motor car field. Although, owing to the heavy burdens we have assumed our progress has been slow, it has been steady. We have decided, however, that the best means of preserving the Locomobile as an institution, is the receivership.

"This will enable us to carry out one of several plans, through which a complete reorganization will be effected. I am justified in stating very definitely that whichever proposed alternative is followed the familiar policies of the Locomobile Co. will be preserved.

"Personally, I have great faith in the Locomobile. I believe the prestige it has earned the world over, supported by the enthusiastic specialists who have developed it and the loyal workmen who build it, insure its future. The Locomobile is an institution; the ownership of the plant is merely a detail."

Senate of New Jersey Increases Truck Fees

TRENTON, Jan. 31—The Senate today passed by a 13 to 7 vote the bill of Majority Leader White increasing fees for motor trucks of more than 13,000 lb. gross weight and capacity. The fee graduates from $55 for 13,000 lb. trucks to $270 for trucks of 30,000 lb.

Senator Parry said that there was considerable opposition in Essex to the bill. He said that the motor truck industry claimed such high fees would drive big trucks out of business.

G. M. in Canada Builds 80 Cars Daily for Export

NEW YORK, Feb. 1—A production of about eighty cars per day is being maintained by the Oshawa, Canada, plant of the General Motors Corp. for the account of the General Motors Export Corp., this number of cars going through the factory for current overseas sales.

In outlining the increased foreign business that has come to General Motors within the last few months, J. D. Mooney, vice-president in charge of the export company, stated that present export sales indicated a large increase over 1921, with the cars moving to Australia, Argentina, Brazil, South Africa, Egypt, India, the United Kingdom and other parts of the world. The output of eighty cars daily was entirely for shipments outside of the United States and Canada, it was made clear.

General Motors began making all foreign shipments of Buicks and Chevrolets from Oshawa in November. Shipments of Cadillac cars to export markets are being maintained from the United States.

FORD WANTS CORN ALCOHOL

DETROIT, Feb. 1—A suggestion that Congress enact legislation which would permit the establishment of manufacturing plants to manufacture commercial alcohol from the surplus supply of corn in order that gasoline may be conserved has been made by Henry Ford. It is contended by Ford that farmers have millions of bushels of corn on hand, which there is no prospect to market and that it could be used to advantage in making alcohol which would supply a substitute for shale oil products. Ford has been experimenting for some time on potatoes.

Ford Dealers May Take on Lincoln

Advised Unofficially That Two Sales Organizations Will Be Closely Aligned

CHICAGO, Feb. 1—There has been much speculation among Ford dealers at the Chicago show concerning what part they will play in Henry Ford's plans for the distribution of the Lincoln car. It is understood they have been informed unofficially that the Lincoln sales organization will be made a part of the Ford organization and that in places where there are no Lincoln agencies, Ford dealers will be expected to take on the sale of the car.

W. A. Ryan, general sales manager of the Ford company, denied reports that each Ford dealer would be expected to take one car after Ford gets control of the Lincoln at the receiver's sale Saturday. This would give a production basis of at least 8000 in the operation of the Lincoln factory.

Ford dealers have been led to believe that the Ford Motor Co. will take over the Lincoln plant and run it as a unit of the Ford organization. The belief among these dealers is that the price of the Lincoln will be reduced even more sharply than has been expected. It is said to be the purpose of Ford to revise production methods so that the chassis and bodies can go through the plant as stock jobs rather than as custom jobs, which has been the practice in the past.

Court Restricts Using "Hudson" Name on Tires

NEW YORK, Feb. 1—Judge Leonard Hand of the Federal District Court has granted the Hudson Tire Co., Inc., of Newark, N. J., an injunction restraining the Hudson Tire & Rubber Corp. of Yonkers, N. Y., from using the word "Hudson" on its tires. This injunction makes permanent the temporary order granted in July, 1921.

The plaintiff has been in business since 1911, but the defendant began operations in 1920. It claimed the right to use the name "Hudson" because it was a geographic name, and it also contended the the Hudson Tire Co., Inc., as a New Jersey corporation, could not restrain a New York corporation from using the name under which it had been organized under the laws of New York.

OLD TIMERS MEET IN CHICAGO

CHICAGO, Feb. 1—Six hundred Old Timers attended the annual Chicago banquet last night at the Congress Hotel. Although no speeches were on the program and the meeting was given over to good fellowship, the Old Timers called for speeches from the retiring president, Albert Champion, and Captain Eddie Rickenbacker.

MEN OF THE INDUSTRY

John V. Mowe, general sales manager of the Kelly-Springfield Tire Co., has been elected vice-president of that company. He joined the organization Jan. 1, 1915, as assistant general sales manager and five years later was made general sales manager, when the sales department was moved to New York. Before entering the rubber industry he was in the wholesale wooden ware business in Chicago. He sold his interest in 1906 and joined the Firestone Tire & Rubber Co. at the Chicago branch and later was manager of the Philadelphia and Detroit branches. He went with the Goodyear Tire & Rubber Co. as a special representative in 1913 and remained there two years.

H. J. Edwards who resigned in August as manager of the Elyria branch of the Willys-Overland Co., where all the engines for Willys-Knight cars have been made, is now at work at the plant of the recently reorganized Standard Steel Motor Car Co. Edwards is one of the pioneer designers of the automotive industry. He designed the Stoddard-Dayton car and in 1911 designed the Edwards-Knight engine and established a factory in New Jersey. When his engine rights were purchased by John N. Willys, Edwards went with the Willys-Overland Co.

Ernest N. Culver has been appointed president and general manager of the Willys-Overland Pacific Co. with headquarters at Los Angeles. He has been associated with the Willys-Overland organization for a number of years, latterly as assistant sales manager. Culver succeeds **Frank C. Riggs** who retains his title of vice-president of the Pacific company but will limit his activities to the management of the Portland branch.

Alfred C. Rantsch, formerly with the Doehler Die Casting Co., has been appointed sales manager in charge of the eastern territory for the Soss Mfg. Co., makers of die castings in zinc base and aluminum alloys. **Albert G. Gruss**, formerly superintendent of the Doehler Die Casting Co., has become production manager in the die casting division of the Soss company.

H. A. Neill, for the last five years manager of the Philadelphia branch of the General Motors Truck Co., has been transferred to the factory sales staff. He will be succeeded in Philadelphia by **F. B. Tyler**, who has been connected with the truck industry for several years. Neill was manager of the factory branch at Kansas City for some time.

E. N. Culver, who has been assistant sales manager of Willys-Overland Corporation, left to-night for Los Angeles, where he will make his headquarters as president of the Willys-Overland Pacific Co. Culver will direct Overland business on the coast with branches in San Francisco, Fresno, Portland, Seattle and Spokane.

Harold B. Thorne has been elected a vice-president of the Pierce Oil Corp. and has been assigned the care of its finances. Thorne has had a long experience as a banker. After serving several years as vice-president of the Bankers Trust Co. he was elected vice-president of the Metropolitan Trust Co. of New York.

Ralph S. Wiltrout is general manager of the Ogren Motor Car Co., Milwaukee with **Foster D. Miller** as sales and advertising manager. **M. R. Elliott** is engineer. Wiltrout was formerly with the Stewart-Warner Speedometer Corp., the Crown-Elkhart Motor Corp. and Huffman Bros. Motor Truck Co.

F. M. Root, formerly with B. F. Goodrich Co.'s Chicago branch, has taken over the Chicago branch of the Victor Rubber Co. and will make his headquarters at 1720 South Michigan Avenue. His territory comprises Illinois, Iowa, Wisconsin and parts of Michigan and Indiana.

Harold L. Arnold, who has been distributor of Hudson cars in California, has signed a contract for the distribution, on the Pacific coast, of Woodbury tires to be manufactured in Chicago by a new company which is understood to have very strong financial backing.

N. C. Berrend, for several years identified with the automobile accessory business and most recently sales manager of Jorgenson Manufacturing Co., has joined the Burns-Hall advertising agency, Milwaukee, where he will specialize on automotive accounts.

John N. Willys will leave Saturday for Palm Beach with his family, but after spending a week with them there will start an extended tour of the southwest, Pacific coast and mountain states which will cover about four weeks.

Herman A. Zannoth, who has been in the employ of the Cadillac Motor Car Co. for the last nineteen years, has been appointed plant engineer for the new Cadillac factory in Detroit. Zannoth was previously chief electrician.

C. W. Inches has resigned as purchasing agent of the Northway Motors Corp. Pending announcement of his new business connection, he will be located at 303 Lexington Avenue, New Haven, Conn.

Ralph Leavenworth has returned to the Standard Parts Co., Cleveland, as advertising manager, which position he relinquished some months ago to take up another line of work.

Andrew Scharff has been appointed Chicago branch manager for the Multibestos Co. He formerly was manager of the Minneapolis district for the same company.

C. H. Ritter has been elected treasurer and **E. N. D'Ancona** secretary of the Yellow Cab Co., Inc.

Report Made by British on Alcohol Manufacture

WASHINGTON, Feb. 1—The disappointing general conclusion that "the prospect is remote of adding materially to the supplies of liquid fuel for internal combustion engines in this country by the manufacture of alcohol from home-grown materials" is made in an interim report prepared by the Department of Scientific and Industrial Research which set up a fuel research board some years ago and was charged with the collection of accurate data from the different parts of the British Empire as to the possibility of producing alcohol in bulk from liquid vegetable materials.

The purpose in mind related to the production and utilization of power alcohol for motor transport.

TO TEST ALCOHOL RULING

CINCINNATI, Feb. 1—Legal action to test the ruling of the Attorney General of Ohio to the effect that denatured alcohol for use in automobile radiators can be sold only by registered pharmacists will be instituted by the Cincinnati automotive organizations.

Bad Roads Retard Car Sales in China

First Automobile Show at Shanghai Arouses Interest in Highway Construction

NEW YORK, Jan. 30—China's first automobile show, which was recently held in Shanghai, was a success not only from a strictly business standpoint, but it served to arouse new interest in the importance of road and highway construction in that Republic. American and European manufacturers were quite liberally represented at the show.

Particularly impressive was the number of European cars exhibited. The show emphasized the increasing competition American manufacturers of both large and small-sized cars must meet in the Orient in the future if they are to hold their own.

While China to-day offers by no means a large market for American automobiles, imports during recent years have shown increases. Some very illuminating statistics were compiled during the show which indicate the increasing use of motor vehicles in China. The imports of 1920, the last full year for which official statistics are available, were nearly treble the value of cars brought in during 1918, and more than thirteen times the value of the imports of motor cars in 1912. Shanghai is shown as the largest buyer of cars in the country.

America in First Place

While statistics are not available showing imports of automobiles into China from all countries by units, an analysis of the statistics showing values throws interesting light on the development of the motor car trade in that country. In 1913, the last pre-war year, the British held first position as a supplier of motor cars to China, with exports valued at Hk. Tls 126,642. (The Haikwan tael, Hk. Tl, is now being quoted on New York exchange around 75 cents to the American dollar). Imports of American automobiles by China during 1913 amounted in value to Hk. Tls. 116,891, and Germany's total was Hk. Tls. 105,590. During that year Canada was the fourth largest supplier of motor cars to China, with an aggregate value of Hk. Tls. 38,444; Belgium came next with Hk. Tls. 38,185, with France following with Hk. Tls. 17,201.

In 1914 America obtained first place among suppliers of motor cars to China and she has consistently held the leadership, the aggregate value of her exports in 1920 being nearly four times more than the aggregate value of British exports to China during the same year.

It is easy to visualize the tremendous possibilities for the marketing of motor cars and trucks in China when there is an adequate highway system. China is a country with an area of 1,890,500 square miles, yet there are only about 7000 miles of roadways fit for motor traffic in this vast territory.

Headlight Group For M.A.M.A. Voted

Manufacturers Will Join Association as Result of Action at Chicago Meeting

CHICAGO, Jan. 30—Manufacturers of headlight devices will come into the Motor and Accessory Manufacturers Association as a group as the result of a decision reached at a meeting held in the La Salle Hotel here to-day. The name of the group and a formal definition of its activities were left to the decision of an executive committee which will meet Friday.

The meeting was presided over by Frederick H. Ford of C. A. Shaler Co., who has been chairman of the temporary organization committee, and Hargrave A. Long, manager of the industrial group department of the M. A. M. A., served as secretary. General Manager M. L. Heminway of the association, addressed the meeting on the advantages of the group plan.

Among the activities discussed which will come within the sphere of the organization are:

Educational work for the benefit of public officials, traffic officers, service stations and the general public in the requirements of headlight construction and adjustment to obtain safer and more satisfactory driving light.

A campaign to show drivers that safe lights are as much to their own interest as to other drivers', regardless of whether headlight regulations are enforced.

Co-operation with such organizations as the Society of Illuminating Engineers, National Safety Council and Motor Vehicle Conference Committee to secure uniform regulations.

Establishing closer personal acquaintance and contact between representatives of the different companies in the headlight devices industry.

Elimination of undesirable and unbusinesslike methods by concerted action.

Standardizing equipment used in headlight construction to obtain greater manufacturing and operating efficiency.

Standardizing and improving packages and containers and methods of shipment to reduce breakages and losses.

Spain's Revised Import Duty Becomes Effective

NEW YORK, Feb. 1—An Associated Press dispatch from Madrid, dated Jan. 31, indicates that the revised import duty on automobiles has gone into effect, the new schedule placing an ad valorem tariff of 20 per cent on cars selling at 20,000 pesetas or less and 25 per cent on higher priced cars. This revision is in line with previous reports to the trade that the Spanish tariff would be revised radically some time in January.

The balance of trade between Spain and the United States swung to Spain for 1921, due to increased buying of Spanish products in the United States, and the result has been that the peseta has swung heavily upward until, on to-day's quotations, it was between 20 and 25 per cent of par. Numerous exporters in New York have had car orders on their books from Spain for several months, dependent upon the revision of the duty.

FINANCIAL NOTES

Curtiss Aeroplane & Motor Corp. earned a little more than $100,000 in 1921 after various deductions, as compared with a loss of $1,700,000 in 1920. This result was shown on a much smaller volume of business and was due to rigid economy. Readjustment to a peace time basis has been completed, and there is enough business on the books to justify expectations that operations will continue on a fair basis through 1922. No new financing is contemplated by the company, as working capital is ample for the operations contemplated.

Ajax Rubber Co. stockholders have subscribed to practically all the 200,000 shares of new stock, which recently was offered them at $12.50 a share. The income account from Jan. 1 to Sept. 30, 1921, as submitted to the New York Stock Exchange shows operating losses of $2,446,643, with inventory adjustments of $1,157,431 and interest charges of $362,371, making a total loss of $3,966,445.

B. F. Goodrich Co. reports that sales for the year 1921 approximated $87,000,000, but that there was a loss of about $9,000,000 because of further heavy declines in the market value of raw materials. Current assets as of Dec. 31 approximately $51,500,000 and current liabilities only $3,300,000. There was no bank indebtedness, as against bank loans of $29,000,000 Dec. 31, 1920.

The Keystone Tire & Rubber Co. directors have agreed upon a plan to change its capital stock of $10 par shares to shares of no par. The annual financial statement will be issued about the middle of March. Accounts owed the parent company from subsidiaries will be written down to an actual cash value as of Dec. 31.

Studebaker Corp. directors have declared the regular quarterly dividend of $1.75 each on the common and preferred stocks. The earnings of the quarter ending with December will be announced at the time the annual report is made, sometime within a month.

The Auto Sales Corp. reports gross earnings of $1,330,700 for 1921, as compared with $1,547,236 in 1920. The surplus after preferred dividends was $96,311, against a deficit of $23,577 in 1920.

Truck Associations Merge to Form National Body

CHICAGO, Feb. 1—The National Association of Motor Truck Sales Managers and National Motor Truck Manufacturers have formed a new organization by merging the two old associations into a national association. The present membership is forty-five and will be limited. Functions of both old associations will be continued in the new organization, which will include all branches of the trade industry. Don Whitaker probably will be manager.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During the past week there has been a fairly large supply of call funds and a special feature of the week has been the fact that interior banks were in the market as lenders. The range for call money was 4 per cent to 5 per cent as compared with 3½ per cent to 6 per cent in the previous week. For fixed date funds, 60 days to 6 months, the range was 4½ per cent to 4¾ per cent, the same as in the previous week. The quotation for prime commercial paper also remained unchanged at 4¾ per cent to 5 per cent.

The Federal Reserve statement as of Jan. 25, 1922, reflected a continuation of the movement of liquidation which has been going on almost uninterruptedly for several months. Total reserves increased $7,352,000, of which increased gold holdings constituted $5,556,000. Total earning assets decreased $52,830,000, and total deposits increased $6,098,000. Federal Reserve notes in circulation decreased $45,676,000. The reserve ratio registered an increase from 76 per cent to 77.2 per cent, which is the highest reserve ratio since Sept. 21, 1917.

The New York institution showed an increase of $25,065,000 in total reserves, and a decrease of $25,146,000 in total earning assets. Deposits increased $4,381,000, and Federal Reserve notes in circulation declined $6,710,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 87.6 per cent to 89.6 per cent.

Last week the San Francisco institution reduced its rediscount rate on all classes of paper from 5 per cent to 4½ per cent. The Boston, New York, Philadelphia and San Francisco banks now maintain a 4½ per cent rate on all rediscounts.

On Monday of this week, sterling exchanged reached $4.28¼, which is the highest rate since Aug. 15, 1919. Whatever may be the underlying causes of this remarkable rise, there has been a real improvement in England's economic condition within the last six months. One proof of this is to be found in the figures for the United States trade with England. The surplus of exports over imports in our trade for 1921 with England was $608,000,000 less than in 1920, and $1,265,000,000 less than in 1919.

On Jan. 25, an announcement was made of a new offering of United States Treasury short-term notes to the amount of $400,000,000. These notes will bear interest at 4¾ per cent, will be dated Feb. 1, 1922,

35 ENTRIES FOR GRAND PRIX

PARIS, Jan. 20 (*By Mail*)—With 35 entries made at the time of the preliminary closing date, the success of the French Grand Prix appears assured. Of the entries 19 are in the racing class, the remaining in the touring or stock car class.

INDUSTRIAL NOTES

Electric Storage Battery Co. has consolidated its various New York offices at 23-31 West 43rd Street which hereafter will be the headquarters also of the export sales department. Under the new arrangement, F. L. Kellogg, manager of the north Atlantic district, embracing the New York, Boston and Rochester territories, F. F. Sampson, New York branch manager and J. F. Kelly, Jr., export sales manager, will be located in the West 43rd Street offices.

Greenfield Tap & Die Corp. reports that for the second successive month the volume of incoming orders will show a substantial increase over the same period of a year ago, January, like December, showing a good gain. The developments of the last 60 days are regarded as showing the presence of a positive buying power. The increase in volume has appeared in the export as well as the domestic account.

The American Bosch Magneto Corp. has held a successful convention of distributers from all sections of the country. At the convention the company's engineers exhibited and demonstrated several new Bosch units which will be placed on the market in the near future. These included magnetos, battery ignition parts, starting motors, generators, spark plugs and magneto replacement fittings.

The American Commercial Car Co. of Detroit, manufacturers of Wolverine trucks, which recently purchased the plant of the Southern Valve Car Co. at Knoxville, Tenn., will establish an assembling and manufacturing plant for trucks and truck bodies in that city. It is understood the company proposes to establish a third plant on the Pacific coast.

The Sheldon Axle & Spring Co. of Wilkes-Barre reports that demand for its truck axles was 100 per cent greater in January than in December. Orders for springs for passenger cars and trucks was 500 per cent larger in January than in December, and an extra shift is being added in the spring department.

The Standard Parts Co. has received an order for axles valued at $1,000,000 from the Wills-Sainte Claire Co. Shipments will begin in March and extend throughout the year. With this order Standard Parts reports that the Eaton axle division will be busy all year.

The Martin-Parry Corp. has leased a part of the plant on Duncan Avenue, St. Louis, formerly occupied by the Union Dairy Co. The lease is for a long term of years. The St. Louis plant will be used for assembling and as a distributing base for the south and west.

The Erie Motor Truck Co. of Erie, Pa., at its annual meeting elected E. D. Loose secretary and a director to succeed H. C. Liebeau. Harry Wagner was elected treasurer. It is reported that production is now on a basis of five trucks for twelve days.

White Motor Co. reports that orders received in the final quarter of 1921 showed a 37 per cent gain over the same quarter of 1920, and a 25 per cent gain over the third quarter of 1921. Sales in 1921 were 55 per cent of the 1920 business.

The Batavia Auto Products Co., manufacturers of the Batavia generator, a device for vaporizing low grade fuel, has assigned all territory west of Buffalo to Lonney & Carmichael of Detroit.

Bassic Co. representatives held a four-days' convention at the Drake hotel in Chicago. The convention was devoted to business sessions, at which new sales plans were explained.

The Dominion Asbestos & Rubber Corp. will move its executive offices to 1780 Broadway, New York, but will retain the present store and shipping offices at 67 Murray Street.

Timken Roller Bearing Co., Canton, Ohio, has leased a half floor in the Walker Power Building, which will be occupied as a site for Canadian production.

Kissel Motor Car Co. of Hartford, Wis., reports that it sold five cars at the New York show, nine at the Philadelphia show and six at the Milwaukee show.

National Tire & Rubber Co. at East Palestine, Ohio, has resumed operations with a small force, as the result of orders which have been received.

McKay-Grubb Rubber Co. of Minneapolis, jobbers of automotive supplies, has moved to much larger quarters at 1221 Harmon Place.

Senate Reports Bill for Aeronautic Bureau

WASHINGTON, Jan. 31 — Favorable report was made on the so-called Wadsworth bill from the Commerce Committee of the Senate to-day. The measure provides for the establishment of a bureau of aeronautics in the Department of Commerce and the centralization of all civilian aerial activities in this organization. It has been placed on the Senate calendar and an effort will be made to bring about its enactment at an early date. Considerable opposition exists at the present time to the organization of new agencies but it is expected that sufficient pressure will be exercised to encourage its passage.

A similar bill is now pending in the House, known as the Hicks Bill. Aeronautical organizations are giving support to this measure in an effort to pass the legislation before adjournment.

Chinese Importers Ask More Accessory Stocks

WASHINGTON, Feb. 2—Importers in Tientsin, China, are complaining that there are no distributors of American automobile accessories carrying stocks, especially tires, in China, according to a report received from Consul General Stuart J. Fuller.

The result, it is stated, is that the importers suffer considerable inconvenience and delay in settling difficulties growing out of incomplete deliveries, defective parts, etc. It is declared that any manufacturer who maintains ample stocks at a central distributing point in China and can supply local houses without delay is likely to increase the sale of his products.

RECEIVER FOR DISTRIBUTOR

COLUMBUS, Jan. 31—With liabilities of $187,274, the C. T. Dunkle Motor Corp. has gone into the hands of a receiver. Assets are listed at $100,000. The company distributed Willys-Overlands.

METAL MARKETS

STEEL producers and consumers are fairly well agreed that the next few weeks will usher in a decided improvement in demand. The lethargy which paralyzed the market during January can not continue much longer. In a transition period from a minimum of activity to one in which demand regains more normal proportions there is always danger that the sharp contrast between the two conditions lead to exaggeration of the betterment.

Automotive consumers have been consistent buyers of relatively small tonnages right along but, aside from this source of demand and possibly that for tin plate from container manufacturers, it may be said that the general run of steel consumers failed to give the market any support in January. Orders for a few hundred tons of steel looked quite big in January and, if February brings forth from different sources orders for what are usually looked upon as representative tonnages, 5,000 tons or so, much will undoubtedly be made of this perfectly normal buying.

Prices, on the whole, are plastic. There have been sharp cuts in small products, such as bolts and nuts and chain and concessions are encountered all around, full-finished automobile sheets being still held up as the paragon of steadiness in price. The trade looks for a much broader demand for sheets from the automotive industries in February.

Cold-drawn steel bars are held fairly steady in the Pittsburgh market, thanks to automotive demand, a noteworthy condition when the generally ragged character of the steel bar market is taken into consideration.

On the eve of the reopening of the "Pittsburgh plus" case came reports that one of the United States Steel Corporation's subsidiaries is making sales on a "Cleaveland plus" basis. In the ferroalloy market the leading topic of conversation is a report that a Michigan passenger motor car builder is inquiring for 4,000 lbs. of ferrovanadium but that the order has not yet been placed.

Pig Iron.—Automotive foundries are sounding the market for deferred deliveries but immediate buying is mostly confined to single cars.

Steel.—Skelp and blue-annealed sheet mills are reported to have shaded prices on hot-rolled strip steel to 1.90¢, base Pittsburgh. The market for cold-rolled strip steel is steady at 3.50¢, with producers reporting a fairly satisfactory number of orders which, however, average not more than 100 tons. Alloy steel makers report more inquiries for automotive steels but tonnages involved show that purchasing agents are proceeding with a deal of conservatism.

Aluminum.—Importers are more reserved in their attitude, due to unwillingness on the part of European producers to accept prices below those quoted by them. This is especially true of sheets. Competition between the various importers and the domestic producer continues, however, spirited. The recent advances in foreign exchange, especially in Pound Sterling and Swiss francs are fully reflected in the aluminum situation. Automotive demand is improving daily. Large warehouse stocks of ingots continue, of course, to be a vital market factor.

Copper. — Semi-speculative holders are cutting under producers' quotations. The market is soft.

Calendar

SHOWS

Jan. 28-Feb. 4—Chicago, Automobile Salon, Hotel Drake.

Jan. 28-Feb. 4 — Chicago, National Automobile Show, Coliseum, Auspices of N.A.C.C.

Feb. 6 to 11 — Seventh National Tractor Show and Educational Exposition, Minnesota State Fair Grounds, Minneapolis.

Feb. 6 to 11 — Winnipeg, Can., Automotive Equipment Show, Western Canadian Automotive Association.

FOREIGN SHOWS

Feb. 18-27—Brussels, Belgium, Ninth Exhibition of Agricultural Machines and Implements, Palais de la Cinquantenaire.

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

CONVENTIONS

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Feb. 24, Mar. 24, April 28, May 26.

Minneapolis, Feb. 8-9—Annual Tractor Meeting.

Irish Free State Offers Sales Field

Strong Liking There for American Goods—Country Is Potentially Rich

LONDON, Jan. 20 (*By Mail*)—Present signs point to the British automobile sales season opening late in step with the late Easter, which usually marks the inauguration of the spring sales season. Just now the two items of interest are relatively opposed. The one concerns the poor reports of the trader's prospects at home among users of automobiles for business, the cause being the high taxation on all scores, and the other factor is the prospects of the trade in Ireland following the setting up of the new Irish Free State.

Ireland Stimulated Motoring

The tone in this aspect is optimistic, for Ireland gave a lead to motoring years before the prejudice against it had subsided in England. The Irish, especially in the south and west, have always had a strong liking for American goods. The number of American cars sold in Ireland, apart from Fords, is in the thousands, so that it is not altogether surprising that a section of the irreconcilable minority has put abroad the suggestion that the Irish Government will tax imported automobiles, but concede a strong preferential rate for Americans.

This idea is discounted here for Irishmen recognize that the volume of the trade of their country with Britain will be greater than will be possible with America for many a year.

Big Development Apparent

The Irish automobile trade, when conditions become normal again, will witness a big development, and it behooves American interests not to lose sight of the fact. Ireland being mainly an agricultural country is also potentially correspondingly rich, a fact which is amply proved by the building up of bank deposits among Irish farmers and shopkeepers since the virtual abolition of the Irish landlord class.

As regards the general outlook of the British automobile trade, it should be added that two factors on the right side have marked the incoming of the year. They are: Stocks of materials are mostly exhausted, which means that much high priced materials have been got rid of though no doubt liabilities attaching to it remain as a debt legacy.

Production costs, including bank terms for financing production, are much lower than at the corresponding period of 1921.

Austin Affairs to Be Reviewed

LONDON, Jan. 20 (*By Mail*)—The financial position and outlook of the Austin Motor Co., Northfield, Birmingham, are to be reviewed by the court in a few days with the object of consolidating the company's finances by a creditor's arrangement.

The plan provides for the settlement of the principal debts, offers a prospect of commanding further funds, and insures the dismissal of the winding up petitions.

The Government has the first claim on assets with a mortgage of £240,000 secured on the north and west works, Northfield, Birmingham.

Heavy Loss Is Shown in Dunlop Rubber Report

NEW YORK, Feb. 1—A cable message from London says:

"The Dunlop Rubber Co.'s official report for the year ending August 31 last discloses a net loss of £8,320,000, which is more than one-half of the company's ordinary share capital. The loss, which is said to be the largest, by far, declared by a British company, is attributed by the directors almost entirely to depreciation in the stocks of raw materials, principally rubber and cotton, which were bought on future contracts. The report says nothing regarding the value of the company's capital asset or its American interests."

The London *Times*, discussing the report of the company, says:

"We imagine now that the English company's affairs are straightened out to a considerable extent, it will be possible to make satisfactory arrangements for the participation of American capital in the American undertaking."

A meeting of the shareholders of the company has been fixed for Feb. 10.

Austria Produces More Light Cars

Readier Market Than for Heavier Product Owing to Tax and Operation Cost

WASHINGTON, Feb. 2 — The Austrian factories have recently devoted more attention than formerly, says Trade Commissioner Upson in a report to the Department of Commerce, to the manufacture of light cars, which find a better market than the heavier cars on account of the progressive tax on automobiles and the constantly increasing cost of operation.

The most powerful passenger cars built in Austria are the Graf and Stift, the 6-cylinder 48.60 horsepower and the 4-cylinder 30 horsepower models. Aside from the models mentioned, all other Austrian-made passenger cars are 4-cylinder, ranging from the Daimler, Puch and Graf and Stift models rate at 19.60 horsepower, through the Fiat and Puch of 15.36 and the Steyr of 13.23 horsepower, down to the Perl, which is rated at 7.46 horsepower and is quoted at 2,800,000 crowns.

All But One Car 4-Cylinder

All Austrian-made motor trucks are 4-cylinder, except the Steyr, which makes a 6-cylinder, 2½-ton model. Other manufacturers are the Fross-Buessing, with a 3-ton model estimated at 8,000,000 crowns and a 5-ton model for about 10,000,000 crowns; the Fiat and Perl both make 4-ton trucks; Graf and Stift put out 5-ton trucks and the Saurer has two models, a 3 to 4-ton truck and a 5 to 6-ton truck.

LINCOLN APPROVAL VACATED

WILMINGTON, DEL., Feb. 2 — The U. S. District Court here has vacated its conditional approval of the order issued in the District Court at Detroit for the sale Saturday of the property of the Lincoln Motor Co.

What effect this action will have on the sale is problematical but it is doubtful it will result in any interference with it.

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Many Price Cuts at Minneapolis Tractor Show

McCormick predicts price war. Many large manufacturers absent and attendance is small. Little buying expected until after next harvest. Creeper-type tractors are more prominent. Two-plow type dominates. Cletrac making own implements.

MINNEAPOLIS, MINN., Feb. 7—The National Tractor Show which opened to-day is conspicuous by the small number of exhibitors, twenty-six makes being represented as compared with seventy, two years ago. Many leading makers, including International Harvester, Fordson, Samson, Wallis, Deere, Moline, Emerson-Brantingham and Rock Island, were not present. The exhibition was the smallest on record and the attendance on the opening day was very small. Many concerns who did not favor Minneapolis refused to exhibit. For the first time tractor makers have split on a show.

Parts and accessory exhibitors were very few compared with last year. The show was held in the state fair grounds, which were very inaccessible. It might better have been held in the Overland building with the automobile show, where ample space was available, but the tractor people refused to co-operate.

The big price cuts on Fordson, Samson, Wallis, International Harvester and others are not stimulating sales as farmers are not buying, but reductions are expected to stimulate sales as spring approaches. International Harvester reduced the price of the Titan model $200 and the 8-16 Model $230. Until May 1, next, a two-furrow or three-furrow plow or a tractor disk harrow will be given with each tractor without extra charge.

The Samson tractor has been reduced from $665 to $445, thus meeting the Fordson cut of from $625 to $395. Wallis reduced the Model K from $1,250 to $995 and gives three-bottom plows without extra charge. The price last fall was $1,485.

Harold McCormick, president of the International Harvester Company, expressed the view that a price war appears inevitable. The feeling is that had the reductions now announced been made a year ago, farmers would not have gone on a prolonged buyers' strike. The farmers in the northwest are very short of money and will do little buying of cars, trucks or tractors until after the harvest. Banks refuse to make loans to farmers buying tractors. The farmers have loaned machinery to each other for the past two years and expect to continue to do so for another year or two. It may be said in general that the prospects are that farm purchases may be 20 per cent better than last year when business was not over 20 per cent of 1920. A good crop is needed to make the farmer buy.

The increased use of creeper type tractors for road construction has given impetus to this type. Two makers have creeper attachments to take the place of rear wheels on the Fordson. Avery has added a creeper type. The smaller types of tractors are gaining in popularity and the two-plow type now seems

certain to dominate the field. Fewer large tractors are being shown.

There is a growing sentiment that the National Tractor Shows should be held in Chicago, thus giving a national scope to it. Minneapolis is not central enough. If the show was held at the stock-yards in Chicago the same week as the automobile show, it would be international in scope.

Among the twenty-six makes of tractors exhibited are several new models. Parrett is showing a new cultivator, with an air-cooled V engine. This machine embodies a line drive and is designed to use existing types of implements which are ordinarily horse-drawn.

Cletrac is showing a new small model and has designed a cultivator for use with it, this being the first example of a tractor maker, not previously in implement business, designing implements. The step was necessary because implement makers had no satisfactory cultivators to offer. The extensive use of pressed steel in the cultivator is thought to indicate a new epoch in farm machinery manufacture, since it marks a departure from the old type in which castings were largely employed. The Cletrac cultivator is of the straddle row type, and is universal in character. The frame attaches to the tractor in the same way as the two-row cultivator and can be used as a frame work for planters, seeders, listers, special harrows and cultivators. By this method, it is claimed, a long list of horse-drawn implements already in use on the average farm can be economically converted to use with tractor power.

The straddle-row cultivator will be equipped for potatoes or garden truck with two adjustable gangs of a new type. The spread of the gangs and the distance between the two sets of gangs can be instantly changed from the operator's seat on the tractor.

In order to adapt its new Model F Cletrac tractor to a wider range of farm uses, the Cleveland Tractor Co. has brought out two types in addition to that described and illustrated in AUTOMOTIVE INDUSTRIES of Sept. 8 last. The original type of Model F is only 31 in. wide, which enables it to travel between rows of corn and cotton. The second type of the Model F is like the original in all respects except that it has been widened to 41 in. This change was made to secure greater stability on steep hills and rough ground. In orchards and vineyards this type can be used to advantage for pulling an ordinary disk or to push the new type of Cletrac orchard and vineyard cultivator.

New Types Shown

A third type uses the second or 41-in. type as a base and by means of simple attachments increases the clearance from 8 to 14 in. When making the change it is also necessary to add several track shoes and roller chain links. The primary purpose in developing a "wide and high" type was to fill the need for a practical power cultivating unit in potato and sugar beet sections and for truck gardening, which would straddle the hilled-up rows without injuring the plants or vines. The desired result has been successfully achieved.

A small tractor of the type having wheels in front and tracks in the rear has been added to the line of farm tractors of the Avery company. The machine has a rating of three 14-in. bottoms, the plowing speed being 2.66 m.p.h. The engine is a four-cylinder vertical type of 4-in. bore and 5½-in. stroke. It embodies various features which have come to be recognized as desirable in a tractor engine, such as valve-in-head construction, removable cylinder liners and a very heavy crankshaft (2¼-in. diameter). All cylinders are cast in a block. The engine is of the dual-valve type, there being 16 valves in the cylinder head. Push rods and valve levers are inclosed, and lubrication is by force feed through the hollow crankshaft.

Variety of Fuels May Be Used

A variety of fuels may be used in this tractor, including gasoline, kerosene, distillate and alcohol, but for alcohol it is essential that the compression be increased if the best fuel efficiency is desired. The main fuel tank has a capacity of 30 gal. An air cleaner is fitted, the type being optional with the purchaser. Three types are offered—namely, a dry cleaner, a water cleaner or air washer and an air cleaner comprising oil-saturated bristles. The carbureter is a double Kingston, ignition is by a Dixie double-head magneto and cooling by a centrifugal type of pump and a cellular type of radiator.

THE unsatisfactory attendance at the tractor show now being held in Minneapolis and the fact that many of the prominent tractor manufacturers and parts makers are not exhibiting there makes it more and more evident that the "national" tractor show should be held annually in Chicago, preferably during the same week in which the Chicago automobile show is held. Chicago is well located geographically, so far as the tractor manufacturers are concerned, and a show held there would undoubtedly attract a large attendance.

The clutch is a dry plate, toggle-locked, while the transmission is of the selective sliding gear type with all gears inclosed. This part is of Avery make. Three speeds forward are given by the transmission—namely, 1½, 2 2/3 and 3½ m.p.h. at 1000 r.p.m. of the engine. The track clutches, which are also inclosed in the transmission housing, are of the disk-in-oil type, toggle-locked. All bearings in the transmission are of the roller type. Steering is accomplished by means of the front wheels, assisted by the clutches for the individual tracks.

There is a track on each side, the length of each track developed being 164 in. and the width of the pads 8¼ in., while the length of the tracks assembled is 6 ft. Automatic lubrication is provided for the tracks. For ordinary service 10 x 1½ x 1½-in. traction lugs are recommended, while for use in deep sand or heavy mud 1½x2 or 1½x2½-in. lugs may be used.

The belt pulley, which is 12 in. in diameter by 8½ in. wide, and turns at 1100 r.p.m., is located on the left-hand side, the housing for the bearings extending through the track frame. When the tractor is used for haulage purposes the pulley remains idle. The engine is said to be capable of operating a 24 x 40-in. separator with all attachments. The governor is described as a turbine revolving in oil, which probably means that the pressure of the oil acts against a spring to determine the position of the throttle valve. It is claimed that the speed is maintained within 100 r.p.m. both ways of the standard.

The overall width of the machine is 48 in., the height 58 in. and the length 108 in. With fore-carriage the machine weighs 5000 lb. and without it 4500 lb. The machine can turn practically within its own radius. The front wheels are 26 in. in diameter and their tread is 56 in. They are fitted with anti-friction bearings, as are the steering knuckles. The drawbar swings and has vertical adjustment. The operator's seat is 32 in. wide and is provided with a cushion.

The Bryan steam tractor, which has been seen at a number of successive tractor shows, appears this year with a number of new components and modifications in design. According to the manufacturers, the boiler, which is of the same water tube type as formerly, is now tested under 1200 instead of under 2500 lb. per sq. in. hydrostatic pressure. The condenser, which is really a tractor type of radiator serving a somewhat different purpose, is now of G. & O. make. An automobile type front axle is fitted, with Timken roller bearings in the front wheels. The steering gear is the Wohlrab. All of the gears on the engine, jackshaft and the differential ring are of the heat-treated spur type. The differential is the Allen self-locking type.



Three types of Cletrac model F tractors with varying widths and ground clearance

As a whole the tractor is considerably smaller in appearance, the wheelbase having been shortened from 96 to 88 in., the front wheels reduced from 34 by 6½ to 32 by 5, and the rear wheels from 60 by 12 to 52 by 12. The fuel capacity has been decreased from 35 to 30 gal. and the water capacity increased from 40 to 60 gal.

The belt pulley size, which last year was indefinite, is now fixed at 18 in. diameter by 6⅝ in. width of face. This in conjunction with the governed engine speed gives a belt speed of 3000 instead of 2800 ft. p. m. The ground clearance is now 15 instead of 16 in.; the turning radius is given as 14 instead of 16 ft. and the speed ranges up to 5 instead of 6 m.p.h.

London Motor Plow is a new machine with three plows an integral part of the tractor. A Midwest engine is employed and the plows are raised and lowered by power.

The show was not representative enough to serve as a true indicator of tractor trends of designs, but the four-cylinder type of engine is gaining ground and the creeper type of tractor is increasing. The depression of the last year with sales nearly dormant is eliminating weak tractor makers and several old tractor manufacturers are really giving up tractor manufacture and will produce farm machinery only. During 1921 the sales of creeper tractors to states and counties for road building and contract work has proved big outlet for this type of machine.

Oil Specifications and Other Standards Work in Progress

THE Lubricants Division of the Standards Committee of the Society of Automotive Engineers is formulating definite specifications for lubricating oils for use in internal combustion engines with the exception of aircraft and Diesel engines. The specifications tentatively outlined follow in general the specifications of the American Society for Testing Materials and those given in the Bureau of Mines' Bulletin No. 5 in accordance with recommendations of the Interdepartmental Committee on Standardization of Petroleum Specifications.

At a recent meeting of the Division it was stated that compounded or blended oils are being used by a number of engine builders, due partly to their successful use in Europe, and that acidless tallow and castorated oils are used to some extent. Discussion as to what kinds of oils should be taken into consideration in formulating specifications led to the decision to confine the recommendations to straight mineral oils. It was thought that if specifications for blended oils are desirable, they can be developed after the Division shall have had an opportunity to obtain more information as to their use.

Tank Caps

The following comments in the matter of specifying the minimum size of the filler opening of automobile gasoline tanks have been referred to the members of the Parts and Fittings Division. The present S.A.E. Recommended Practice for Tank and Radiator Caps, page C58, S.A.E. HANDBOOK, does not specify the minimum size of opening, only the diameter of the threaded portion for both internally and externally threaded filler openings having been determined upon.

The demand to-day is for a gasoline pump that will deliver a given amount of gasoline in the shortest possible time. Pumps have therefore been designed for use in service stations with 1¼-in. hose and nozzles.

Complaints are received by pump manufacturers that the nozzles on these pumps are too large to fit into the openings provided in the gasoline tanks on many automobiles. This means that pump manufacturers are obliged to put on a small nozzle, thus restricting the discharge and defeating in a measure the advantages gained from a large pump. If an effort is made to force the delivery with the smaller nozzles, it requires more strength and the gasoline is delivered at considerably higher velocity.

Some automobiles are provided with large openings; 2½ in. is common. This matter should be taken up with the automobile builders as it is to their advantage to provide openings of proper size so that gasoline tanks can be filled quickly.

Sometimes the trouble is due to the connection to the tank being made by a pipe with an offset in it of small diameter. The smallest straight opening that should be used is 2 in. and where the connection is made to the side of the tank by a short pipe with an offset in it, it should be larger with the curve at a greater angle.

Oil Drain Plugs

At a recent meeting of the Engine Division the desirability of providing suitable means for easily draining all engine oil pans was discussed. It was decided that, as the oil drain is a part that is dependent upon individual engine design, no definite type should be standardized, but that a recommendation could be formulated which would indicate that an oil drain device should be provided, having a hole of a minimum size located at the lowest part of the oil pan or crankcase cover. In order that the Engine Division may base its recommendation on the best present-day practice, a questionnaire covering these points has been sent to engine builders and automobile producers who build their own engines.

Service Keynote of Chicago S. A. E. Meeting

Speakers urge engineers to get both the users' and the service man's point of view before designing new cars. Other interesting topics taken up at the meeting included building bodies for commercial cars. Speech of R. H. Grant was the outstanding feature of the annual dinner.

THE Society of Automotive Engineers held one of the most instructive sessions in its history on Monday of Chicago show week. The program was distinguished by the remarkable closeness with which it was adapted to immediate practical problems. The technical sessions were largely devoted to service. The two dinner speakers appealed for a return to bed-rock efficiency in business. After the banquet a great many declared that the speech by R. H. Grant on "How the Engineer Can Help Business at This Time" was one of the greatest that has ever been presented to the S. A. E.

The day's program on service included papers by B. M. Ikert of *Motor Age* on "Some Criticisms of Automotive Engineering by a Service Man," and "Commercial Body Supply and Service" by C. M. Manly and C. B. Veal. J. F. Page, service manager of the Packard company of Chicago spoke on the problems of the service salesman.

H. C. Buffington talked on the subject of special garage tools and automotive repair equipment.

Ikert's paper dealt with the ability of the designing engineer to save the car owner a great amount of money by looking ahead at the problems of maintenance with which the owner is confronted after the car is in service. This paper will be reprinted in full in a later issue of AUTOMOTIVE INDUSTRIES.

Mr. Ikert said in part: "One of the chief difficulties with many of our cars at the present time is that on a comparatively insignificant repair job it requires many hours of labor to remove and replace units before the job itself can be done and the car turned over to the owner. Under such conditions it is extremely difficult for a service station to establish a fixed price that seems commensurate with the nature of a job.

Time Element Important

"The time element in making repairs is important. Very often the parts to be installed cost a dollar or two, but the time required to install them is so great that the price for the work is out of proportion. In analyzing this situation one often finds that the car makers, by spending a few cents more per car, could so materially reduce the time element for service operations on their cars that automobile dealers and service men would not have to resort to all sorts of means in trying to keep customers satisfied with their cars.

"It is realized full well that to change existing constructions on some of our cars it would mean almost a complete retooling of the factory, new jigs, fixtures, dies, etc., therefore any criticisms which might be directed at engines or cars in the following paragraphs is done so with this in view. The major thought is to point out the things of which service station mechanics complain most frequently when they have to tear down or reassemble any of the units.

"We probably never shall have 100 per cent accessibility in our cars. A motor car is made up of just so many necessary units, and if we make one accessible it probably will have been done at the expense of accessibility to another. Also certain units may seem very accessible at the time of assembling the chassis in the factory, but when body and fenders are added the reverse is true. It is this condition with which the service station has to deal. I recently looked at an engine which, when in an engine-stand out of the car, was very accessible, but when in the car was hung so low and had so many accessories heaped around it, with a multitude of wires, control rods, carbureter hot air pipes, etc., to obstruct the movements of the mechanic, that all the efforts of the engine designer to get accessibility were nullified."

Mr. Ikert went on to tell of specific examples in design where parts had been made inaccessible in some 25 makes of American cars, when it would have been possible to make these same units just as good but easier to reach and, consequently, would have saved money on servicing.

Getting the User's Viewpoint

B. B. Bachman, president of the S. A. E., who was presiding at the meeting, opened the discussion on this paper by commenting on the fact that very often there was not the proper contact between the designer, builder, salesman, service man and car user. He stated that if all these branches could be brought together it would result in such an improvement in design that cars would be far better. The builder and designer are, of course, in close contact, but the service man is not so close, while the user is very often quite remote. It is quite apparent that Bachman has fully in mind the fact that the average engineer is not the average user.

The manufacturer has the opportunity to learn much from the user, Bachman added, if he will only analyze the information that comes to him through the sales and service departments. No machine is 100 per cent perfect in any department, and there are improvements that always can be made from any angle. The designers must take all of these angles into consideration and not permit undue influence of certain factors to destroy the all-around utility of his design. More intimate contact between the various phases of design, manufacture, sales, service and use would bring improvement.

Commenting on a question raised by Ikert regarding the proper aging of the cylinder block, Bachman declared this to be more a problem of production than of service.

A. H. Packer stated that he believed it would be possible to make more pieces universal. As an example, he cited the instance of a cam for the breaker box of an ignition device where by clever design the cam could be put on one way for a right-hand instrument and reversed for a left-hand. Since the manufacturer makes

cams for four, six and eight cylinders, by making the universal cam he need only make three types instead of six, and not only is money saved in manufacture but the service man need only carry three types of cam instead of six.

Packer also stated that it is a necessity for the designer to be open minded enough to accept and utilize the criticisms of the service man. He stated that there are many times when a part is theoretically correct, but when installed some practical difficulty comes up. As an example, he mentioned a certain generator which from the electrical standpoint proved to be highly efficient, but when mounted on a car received a stream of oil from the crankcase. The designer took a conceited view of the complaints, with a result that he did not go to the heart of the matter and eliminate the trouble and eventually some other concern got the generator business.

R. B. May urged all of the designers to utilize every possible means for getting information on this subject, so that designs will be made where the proper proportion of a repair charge will go to labor and to material. He suggested that a time study be made for each repair job which is likely to come up, this time study to be made at the factory where the design has been made and the dealers then instructed in the proper methods. It may be very well possible, he pointed out, for these time studies to result in alterations which will make the piece more accessible from the maintenance standpoint. This data will result in manuals to be passed out to the dealers by the manufacturers which will cover all of the essential service operations.

Some little discussion developed regarding the use of standard colors of wire for standard circuits, such as the horn, ignition, starting and lighting. It was pointed out that even if the purchasing agent could save "one-half cent per mile of wire," as one member put it, it might prove to be false economy in view of the fact that much more would be saved in avoiding the confusion which often exists on rewiring jobs.

H. M. Manley predicted that there will be more engineers in the operating end; in other words, the job of service engineer will be developed and his word will carry weight with the designer. Manley also cited efforts to standardize colors of wires and pipes on airplanes. These efforts ceased with the armistice. A. D. T. Libbey stated that the Automotive Electric Association has this matter of standard wire colors under consideration at the present time and will make recommendations to the S. A. E.

J. F. Page, service manager of the Packard company of Chicago, spoke on the problems of the man who faces the car owner when repairs are made. His talk was largely concerned with the neatness of appearance necessary on the part of the salesman and the ability to handle diplomatically the difficult questions which occasionally come up with the (sometimes) unreasonable car owner. Discussion was along this same line, one valuable point being the suggestion of one of the members that service managers bear in mind the three big essentials of having

(1) Trained personnel.
(2) Adequate equipment, space and tools.
(3) A good operating system.

B. B. Bachman closed the discussion by outlining the Autocar system of rebuilding.

Commercial Body Supply and Service

C. B. Veal read the paper on "Commercial Body Supply and Service," of which he is a co-author with C. N. Manley. In this paper there are specified the four general plans that have been followed by chassis builders in securing body equipment, as namely, the building of bodies in their own shop; buying on contract, the body maker adhering to plans and specifications of the chassis builder; buying from a local body maker to the order of the dealer or the owner, and the assembling from stock of standard sectional units recommended by the dealer or selected by the owner. The authors discuss each of these plans in detail.

With regard to the plan of using standardized sectional bodies, the different sizes of chassis used for commercial purposes are separated into four specified groups and the production of a complete standard line, including a number of styles of body for each chassis, is commented upon and illustrated, inclusive of detailed considerations of the all-metal body. The advantages to the dealer and to the user of the factors that are advocated in body building are enumerated, and the standardization of commercial cars and trucks is considered briefly. The authors say:

Four Building Plans

"The whole fabric of body service must be woven around the idea that a commercial motor vehicle has rendered its maximum of profit and usefulness only when the paying operations begin as soon as possible after it is assembled, and continues steadily at a maximum per diem for the longest time with the minimum losses through lay-ups for repairs and renewals. Any attempt to analyze the question of body service, therefore, must bring into consideration all phases of body design, production and distribution, as related to the chassis manufacturer, the dealer and the owner, as well as the body manufacturer or builder.

"Four distinct general plans have been followed by chassis builders in securing body equipment:

(1) Building in their own shop.
(2) Building on contract by body maker to plans and specifications of chassis builder.
(3) Building by local body maker to order of dealer or owner.
(4) Assembling from stock standard sectional units recommended by dealer or selected by owner.

"All four are available to a greater or less extent at present, and to determine the effect of each upon the ultimate question of service we will examine each plan as related to the interests of the chassis builder, the dealer and owner."

Analyzing the first plan, that of building in their own shop, the authors state that the effort expended in trying to build up a permanent business of selling the chassis and body as a unit is, with few exceptions, certain to be entirely out of proportion to the results attained. This is largely due to the need for such a wide variety of bodies except in certain lines where it is possible to get on a large production basis.

The second plan, while it necessitates the chassis builder carrying a body-designing and engineering department, relieves him of the greater investment in shop and tool equipment and body fabricating organization. The body builder, through his ability to furnish other designs of his own for the trade and to take on contracts to supply various chassis producers, is in a much better position than the latter to acquire an adequate volume of body business for efficient and economical production. Here the advantage to all concerned, as compared with the first plan, ceases, however, since the distribution troubles remain the same, with the possible addition of an initial freight shipment of bodies from the body builder to the chassis plant, and the complications arising in repair service with the attendant em-

barrassment to the ultimate user through the interdependence of the chassis producer and the body builder in all matters of responsibility affecting the guarantee, proper functioning and durability of the body. Of the four methods applicable to the supply of bodies for commercial vehicles and trucks having national distribution under existing conditions undoubtedly this plan has the most to recommend it.

The third plan, custom-built bodies, historically has been the accepted method of most motor-vehicle builders upon first entering the commercial-car field and is still the plan generally followed by the majority of truck companies. This practice came into effect not through the application of any special economic theory but rather through the natural working out of conditions as they were and still are to a lamentable degree, especially in connection with heavy-duty trucks.

The successful operation of the fourth plan has been made possible only comparatively recently, owing to a lack of sufficient demand and the continuous evolutionary changes in body requirements as the business developed. Through the adoption of this plan the chassis builder and the dealer derive a great many benefits. Not the least of these for the former is complete relief from the undertaking of body-building. While eliminating the capital investment involved in the first plan, he simultaneously removes from his dealers the burden of body inventories common to the first and second plans. Moreover, he is assured that his chassis will not be abused by being made to carry a poorly proportioned or ill-fitting body of excessive weight or capacity. The dealer is further helped by overcoming the showing up of merchandising while waiting for each body to be built individually under the third plan.

By building the bodies in sections and standardizing these sections it has been found possible to use certain sections for very many different types of these bodies. In some respects the scheme parallels, although in a very different field and with much greater economic possibilities, the flexibility and utility of the sectional bookcase. Standardization has been carried to such an extent that the reduction in the total number of component parts has diminished noticeably the body-builder's investment in raw materials, work in process and finished goods.

Many major parts of bodies and cabs are interchangeable on various types of body. Starting with one platform or base, a choice can be made from several side panels, rear sections and tops, thus making it possible to assemble any one of a dozen body styles on this one design of base. Likewise, doors and windshields used on cabs or vestibules can be assembled interchangeably with a variety of other body units. In fact, windshield, vestibule doors, vestibule side windows, rear doors, toeboards, cushion and lazy-back are worked out readily, each in a single-unit design common to all bodies of whatever model where any one of these items is required. A single end gate can be used to equip several models.

Referring to articles published in AUTOMOTIVE INDUSTRIES on this subject, President Bachman called on J. E. Schipper to open the discussion. Mr. Schipper referred to investigations he had made in connection with these articles which disclosed the facts that body manufacturers are very anxious to see standards in certain chassis dimensions which affect the attachment of bodies, particularly the distance between frame side rails and the distance from the rear end of the cab to the rear end of the chassis frame.

C. M. Manley emphasized this discussion and pointed out the real need for standardization, particularly as it affects foreign trade. Other members brought forward evidence to the effect that considerable money would be saved if standardization were effected in the cab as well as in the dimensions of the chassis which affect body attachments. George S. Cawthorne stated that the standardized cab is just about here and that it will be of great commercial utility from an economic standpoint.

Dinner

The annual Chicago dinner of the society was held at the Drake Hotel and was attended by 350 members and guests. President B. B. Bachman presided, with H. L. Horning as toastmaster. The feature of the evening was a brilliant speech by R. H. Grant, general manager of the Delco Light Company, on the subject of how the engineer can help business at this time. Professor Moulton, economist of the University of Chicago and a noted authority on foreign affairs, spoke on the business situation in relation to the automotive industry.

B. B. Bachman opened the speeches by continuing the picture of the technical session of the afternoon, in which service was the keynote. He spoke of the duty of the engineer to further this idea of so designing his product that it rendered the maximum service at the least expense to the consumer. H. L. Horning, in his inimitable combination of seriousness and humor, pictured our present business situation and struck a note of optimism in his introduction of R. H. Grant.

Mr. Grant delivered what members present say was the most powerful and yet practical speech that the society has ever had presented to it. He made a plea for teamwork in all branches of business and the abandonment of the prima donna attitude on the part of department heads. He pleaded for more anxiety on the part of the manager or engineer to make a better showing on the profit and loss sheet for the entire business, rather than economy in the particular department, which might not mean anywhere near the same economy for the entire business.

He asked that we stop moving machinery, employing armies of sweepers and watchmen and other products of war time and get back to the ground floor in business. His speech will be printed in the near future. The picture he painted was completed by the speech of Professor Moulton, who showed how the situation in this country was related to that of Europe.

Automobile League Is Organized in Madeira

ORGANIZATION of an automobile league in Funchal, Madeira, for the purpose of increasing tourist traffic on the island and thus secure additional revenue for the government and merchants, was announced recently in a report from United States Consul S. E. Wells. The chief objects of the league are to promote legislation for the widening of streets, construction of new highways and better port facilities.

The majority of streets in Funchal are narrow and there are not more than twenty miles of roads that are suitable for motor traffic. More are in process of construction, however. There are in Madeira slightly less than 100 motor-driven vehicles, of which about twenty-six are trucks of 2 tons or less. The law prohibits operation of trucks of more than 2 tons' capacity unless they are equipped with pneumatic tires.

A Modern Electric Passenger Vehicle

New product of Rauch & Lang resembles the gasoline closed car in external appearance and has many similar mechanical features, but retains the desirable characteristics of the electric. Construction details which result in economical use of power are worthy of consideration in gas car design.

By Herbert Chase

AN electric passenger car which in many ways resembles the modern type of closed gasoline car is being produced by Rauch & Lang, Inc., a company formed some two years ago to carry forward the electric vehicle business of the Baker R. & L. Co. The concern is now manufacturing chassis in its new plant in Chicopee Falls, but the bodies used on this chassis are still made by the Baker R. & L. Co. in its Cleveland plant. The chassis, which is shown in one of the accompanying cuts, has a wheelbase of 102 in. and is of fairly light construction for a car weighing, complete with body and battery, approximately 4000 pounds. The mileage which an electric vehicle will make on one charge of the battery depends, to a considerable extent, upon the weight of the vehicle; hence, all parts are made as light as possible, consistent with good practice, proper strength and a good length of life. It is necessary also to make vehicles of this character easy running, since the propulsive ability is limited to that of the battery and an electric motor of relatively small power as compared to the average gasoline car.

In the car under discussion the battery alone weighs approximately 830 lb. There are a total of 42 cells, 22 of which are carried in the front compartment and 20 in the rear. The battery used in this case is either the special thin Exide M.V. 13 plate or the Philadelphia W.T.X.I. 15 plate, both of which have a rating of about 180 ampere-hours. These batteries are said to have a life of from 2 to 4 years, depending upon the care they receive and the amount of use.

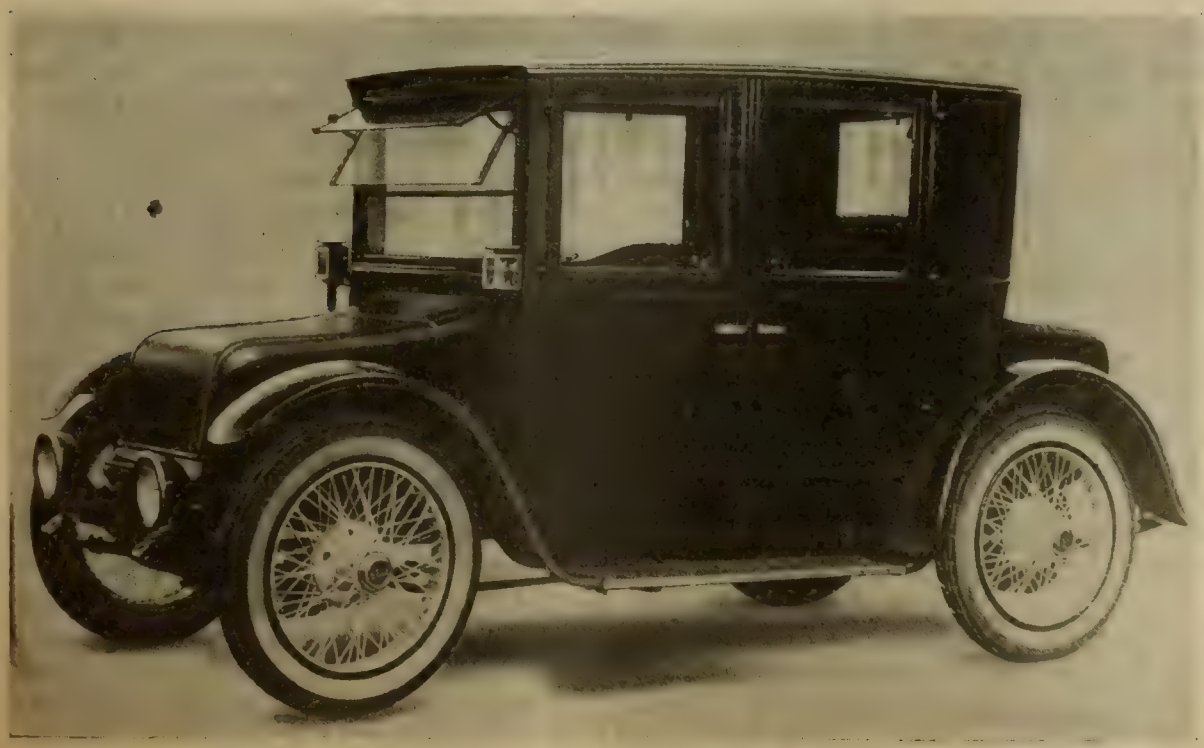
The frame is pressed from 5/32-in. carbon steel and has seven cross members, most of which are required to afford proper support for the battery. The front springs are 40 in. long by 2 in. wide and the rear springs 57 by 2¼ in., both being of the semi-elliptic type. The rear springs are underslung. The spring shackle bolts are of ¾-in. diameter and are drilled out to save weight. The wheels are equipped with 32 x 4½-in. tires all around.

It will be noted that the motor is mounted slightly aft of amidship position and has its axis inclined upward toward the rear to facilitate the drive through the double universal joint shaft to the overhead worm on the rear axle.

The motor is a straight four-pole series type, so far as the first five speeds are concerned, but it has a shunt field which opposes the series field on the sixth or highest speed position of the controllers. The motor is geared 8.6 to 1 on the worm, and is capable of driving the vehicle at a maximum speed of about 28 m.p.h. on level road, in the sixth controller position, and 25 m.p.h. in the fifth.

All the cells of the battery are connected in series, and a resistance is used in the armature circuit in first, second and third speeds. In fourth speed, the battery is coupled direct without resistance. In fifth speed, a resistance is shunted across the field to weaken it, and, in sixth speed, the shunt field opposes the series field. The various controller positions are shown in the accompanying diagram.

The motor has a rating of 2.5 to 3.5 hp., but is capable of withstanding very heavy overloads. The armature shaft is mounted on ball bearings, and carries, at its forward end, a brake drum against which two external shoes, pivoted on the motor frame, bear when the brakes are applied. The motor, formerly built by the Baker R. & L. Co., is now being produced in the Rauch & Lang plant, together with nearly all other parts of the chassis.

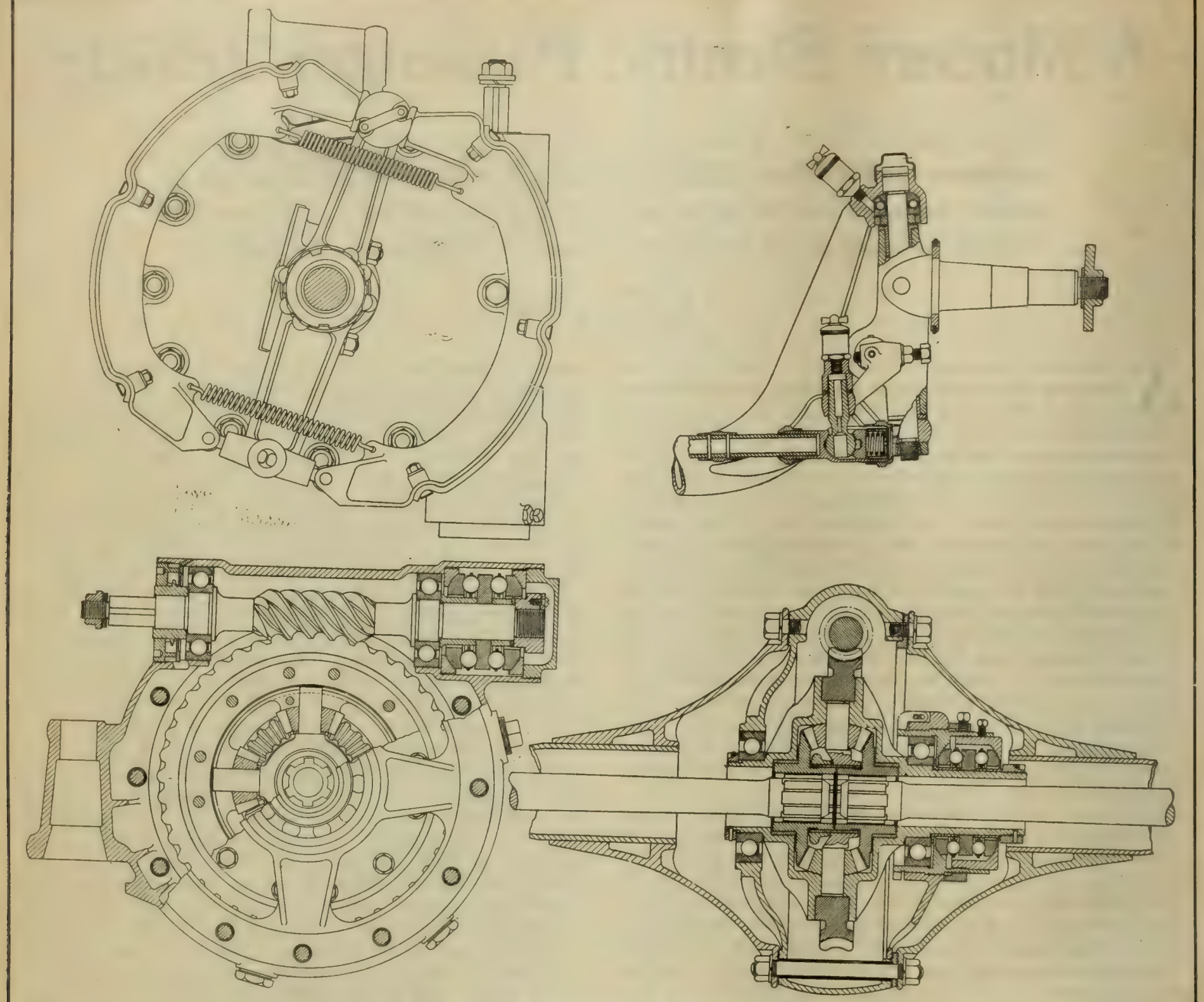


Rauch & Lang Model S66 sedan

The power is conveyed to the worm through a propeller shaft with universal joints of Rauch & Lang construction at either end.

The drive is through the forward half of the rear springs, but torque is taken by a torque arm anchored to the rear end of the motor and pivoted on the rear axle housing.

The rear axle, which is built complete in the Rauch & Lang plant, is of the ¾-floating type, and employs a straight type overhead worm mounted in radial and thrust ball bearings. Timken bearings are used on all wheels. The central housing of the axle is of cast steel and the tubular members or pressed in and riveted with nickel steel rivets. The tubes are swedged to give adequate strength with lightness. The foot brakes are of the internal expanding type and bear on pressed steel drums of



Rauch & Lang foot brake, steering knuckle and rear axle

18-in. diameter mounted on the rear wheels. The shoes are 2½ in. wide and are lined with asbestos fabric held in place by six T-bolts on each shoe. Castor oil is used for lubrication of the worm.

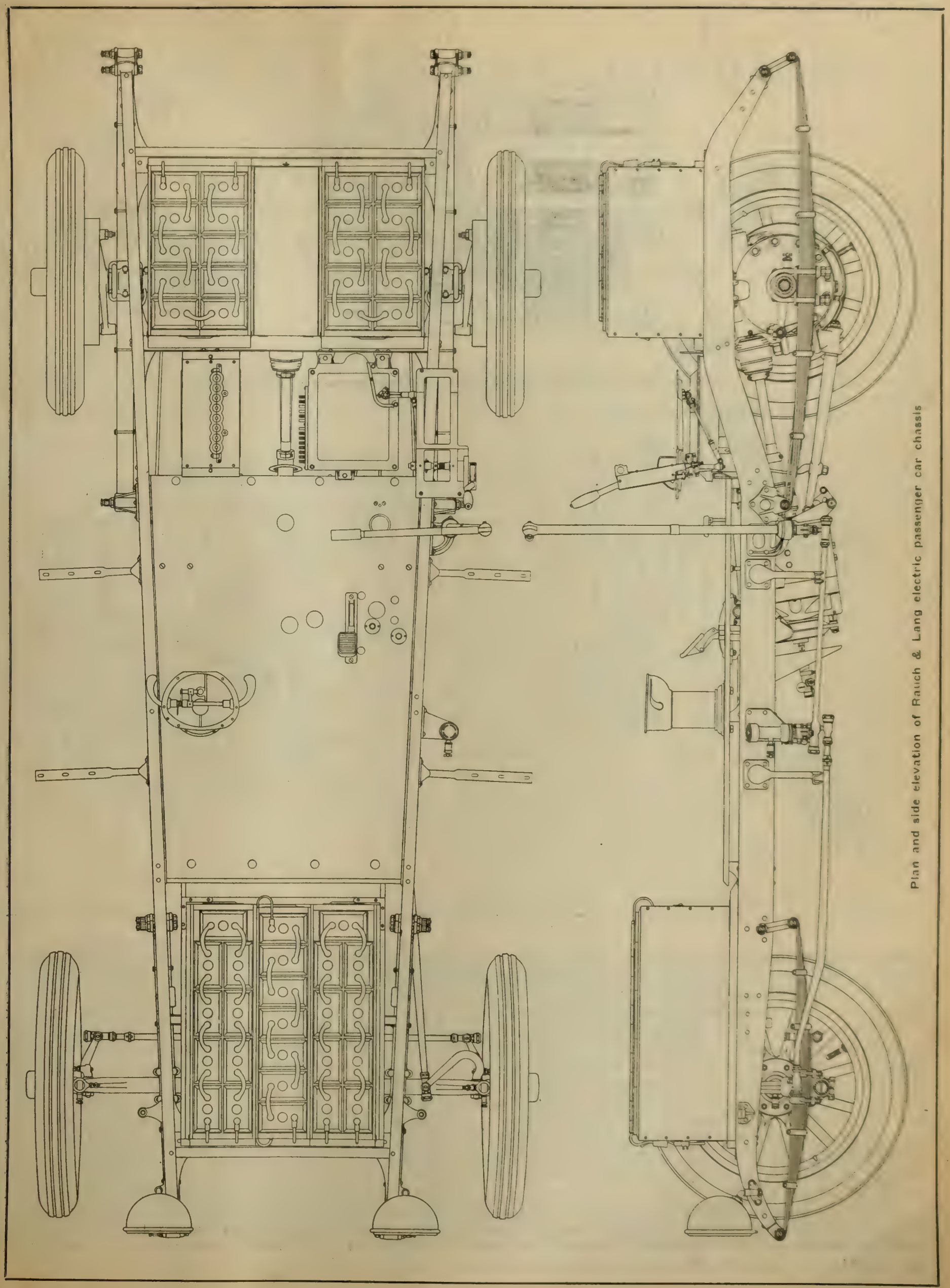
The hand or so-called emergency brake is that mounted on the front end of the motor. It is operated by the controller handle when the latter is drawn into a position back of neutral. At the same time the hand brake is applied, the electric braking effect on the armature exerts a retarding influence. The lining of the hand brake is of metal composition and bears on a steel drum. The foot brake is provided with a ratchet lock, and this is so arranged that the electric horn blows a warning signal if an attempt is made to start the vehicle with the brakes on.

The front axle is of tubular section, but is otherwise of more or less conventional design. It is provided with ball thrust bearings on the steering pivots.

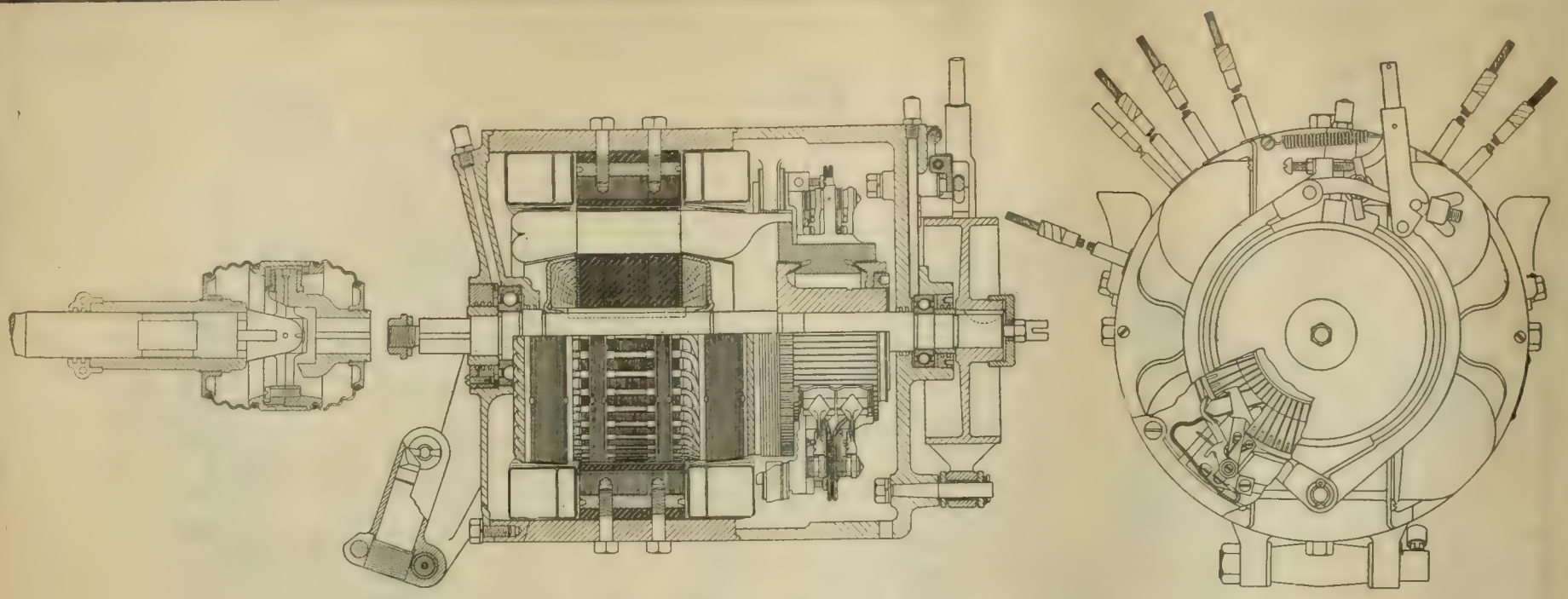
Steering is accomplished by a lever arm which turns a vertical column carrying at its lower end a second lever connected direct to the drag link which is connected in turn to the steering knuckle. This is not an irreversible type of steering gear, but has been used with satisfaction for years on practically all electric passenger vehicles. It will be noted, from the drawing of the chassis, that two positions of the steering column are provided so that steering can be done from either of two seats. There is a disconnecting mechanism which is operated by turning the front seat. When the latter is facing forward, it is occupied by the driver and steering is done by the occupant of this seat, but when the driver is riding on the rear seat, the forward seat is turned toward the rear, thus putting the rear control mechanism into operation and rendering the forward one inoperative.

The controller employed is of the fan type and uses two movable fingers. It is operated by a handle beside the driver's seat. Two such handles are provided and made separately operative. In the controller handle there is a switch lock arranged to open the main battery circuit when the vehicle is not in use. A button for operating the Klaxon horn is fitted conveniently into the end of the controller handle.

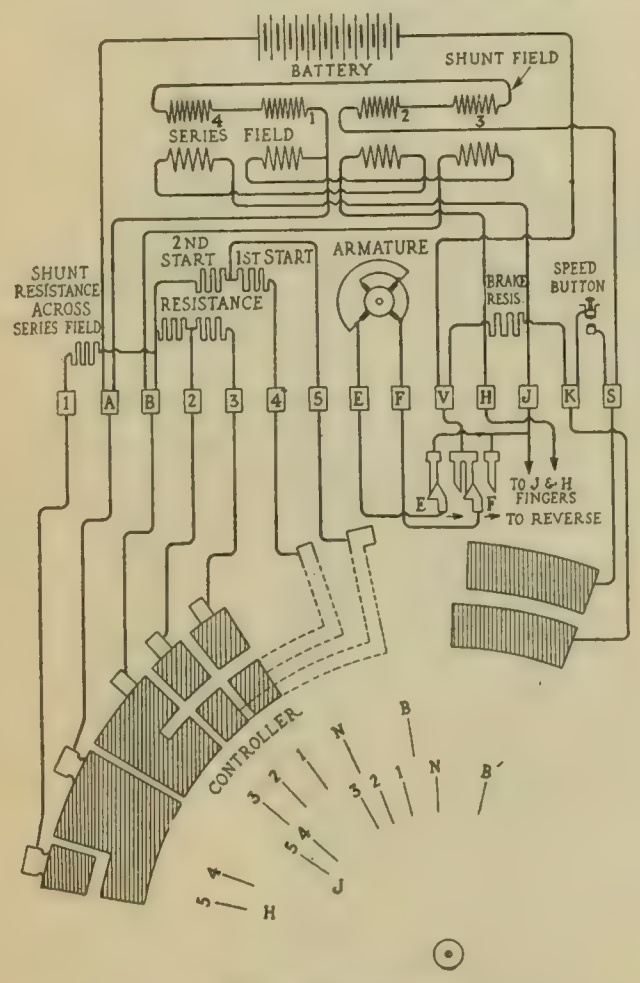
A special composition resistance wire is used in connection with the control of the motor. It is wound on porcelain insulating supports and placed in a ventilated sheet



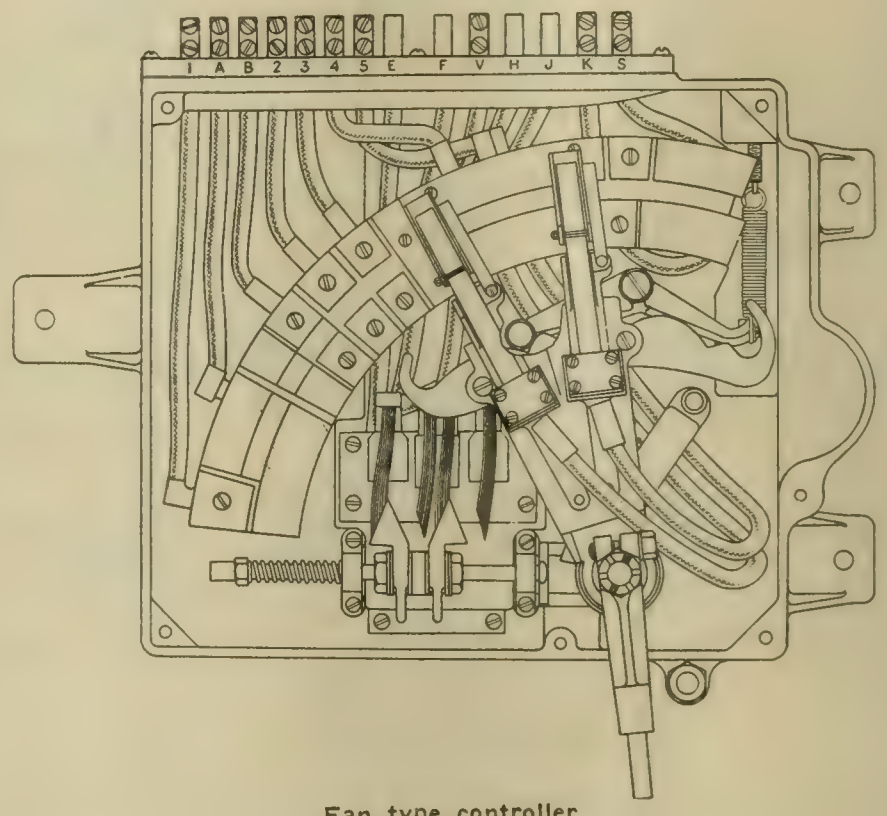
Plan and side elevation of Rauch & Lang electric passenger car chassis



Universal joint and motor showing emergency brake mounted on motor shaft



Wiring diagram



Fan type controller

metal casing, mounted on the chassis frame adjacent to the controller.

The speedometer is driven off the front end of the motor through a worm and wheel, giving reduction of about 5 to 1.

The instruments regularly fitted include a Sangamo ampere-hour meter, Weston ammeter and voltmeter, Waltham speedometer and clock. Other equipment includes Goodyear q.d. rim for straightside tires, headlamps and pillar lamps. Two body models are provided; a coach seating five persons and arranged for driving from the rear seat only, and a four-door coupé-sedan seating five and with provision for driving from the front. These new models are added to that known as the C55 double-drive coach, which is continued.

The Rauch & Lang electric possesses the advantages common to most other electric vehicles, in that it is practically noiseless in operation, is simple to operate and flexible. It has the ability to get away quickly and handles easily in traffic. It can also be turned around readily in restricted places because of its short-turning radius.

IN concluding a paper on "Cracks in Aluminum Alloy Castings." R. J. Anderson of Pittsburgh, Pa., says that the melting temperatures should be low; overheating in the furnace should be avoided. Open-flame furnaces should be run with a non-oxidizing atmosphere in order to avoid the formation of much aluminum oxide and consequently occluded dross in the alloy. Skimming should be adequately and carefully done and the melting practice should be conducted as cleanly as possible. Foundry floor sweepings should not be charged into the furnaces unless sieved, and foreign materials should be kept out of the furnace charges. The pouring temperatures should be as low as is consistent with filling the mold readily with metal; high pouring temperatures should be avoided.

Peugeot To Produce Automotive Injection Engine

New product is said to be capable of using any liquid fuel. It operates on two-stroke cycle, has two working and one scavenging pump cylinders, develops 50 hp. at 1250 r.p.m., weighs 550 lbs. and is reported to use 0.397 lbs. of fuel per hp. hr. at full load and 0.484 lbs. at quarter load.

By W. F. Bradley

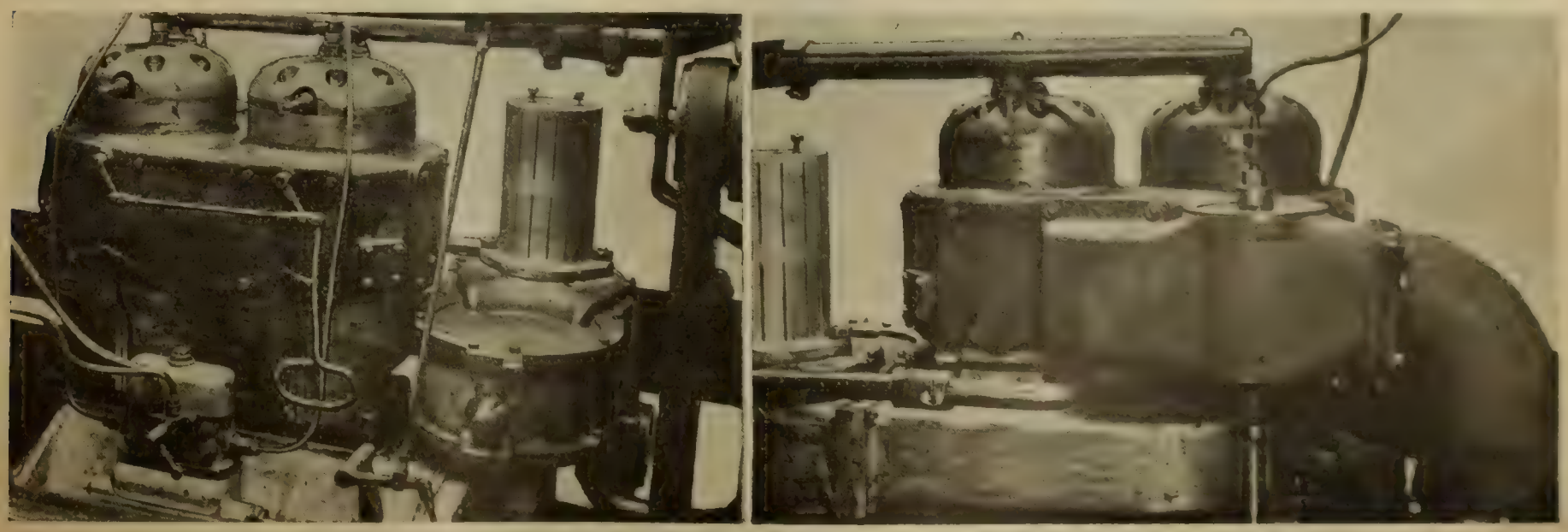
PEUGEOT has decided to go into production on a two-cylinder two-stroke direct injection engine to be used on trucks and passenger cars. The engine, which is built under Tartrais patents, weighs exactly 11 pounds per horsepower, has approximately the same overall dimensions as a normal type four-stroke power plant, consumes 0.397 lb. of fuel per horsepower-hour under full load and less than 0.484 lb. under quarter load, and will run on practically every kind of liquid fuel. After being regulated to run on kerosene, the engine was successively switched over to various types of coal tar and crude oils; it was also run on such vegetable oils as palm, castor, cotton and coco, and also on cod liver oil.

The first series of engines built are twin-cylinder vertical type of 120 by 150 mm. (4.7 by 5.9 in.). This engine, which develops 50 hp. at 1250 revolutions, weighs 550 lb. complete, and was designed with a view to its use either in truck or semi-stationary work. One of the engines was fitted in place of a four-cylinder Schneider on a Paris omnibus chassis and used on the road. With the normal accelerator control only this omnibus possessed a wider range of flexibility than with the engine regularly employed. An engine of this type has a big field of application for stationary or semi-stationary work, but Peugeot intends to use it also for automobile service and will put on the market a series of passenger cars with a 25-hp. twin-cylinder engine for Colonial service.

Among the distinctive features of the Peugeot engine are direct injection of the fuel into the combustion chamber; the use of a scavenging pump and a special type of cylinder head designed to set up turbulence. The most important of the various patents held by the inventor deal with the type of combustion chamber and the provision for securing turbulence of the mixture prior to its explosion.

A normal type aluminum crankcase receives a three-bearing crankshaft with throws at 180 deg., having no other peculiarity than the provision made for driving the air pump off one extremity. The oil pump and the water pump are of normal type. To the shaft of the latter is connected an electric generator which is required only for starting and if desired dry cells or a storage battery can be used instead.

The cast-iron cylinders have annular ports uncovered by the piston at the end of its stroke. The upper ring of ports is for the exhaust, and the lower ring for the intake. A cylinder, with jackets removed, revealing the two rings of ports, is shown in Fig. 1. The cylinder consists of a cast iron barrel in which the piston operates and a special head, of an alloy of chrome and nickel, in which the explosion takes place. The cylinder barrel communicates with the head by a narrow cylindrical passage, the diameter of which is only slightly larger than that of a deflector mounted on the piston head. Fig. 2 shows the cylinder head and the deflector, dismounted from the piston. The cylinder walls are water jacketed but the head is not; instead, it is inclosed by a bronze cover, or external head, bolted to the cylinder barrel, having air pockets which tend to maintain the combustion chamber at the highest temperature which can be employed with the metal used. In Fig. 3 the combustion chamber is shown in place inside the bronze housing.

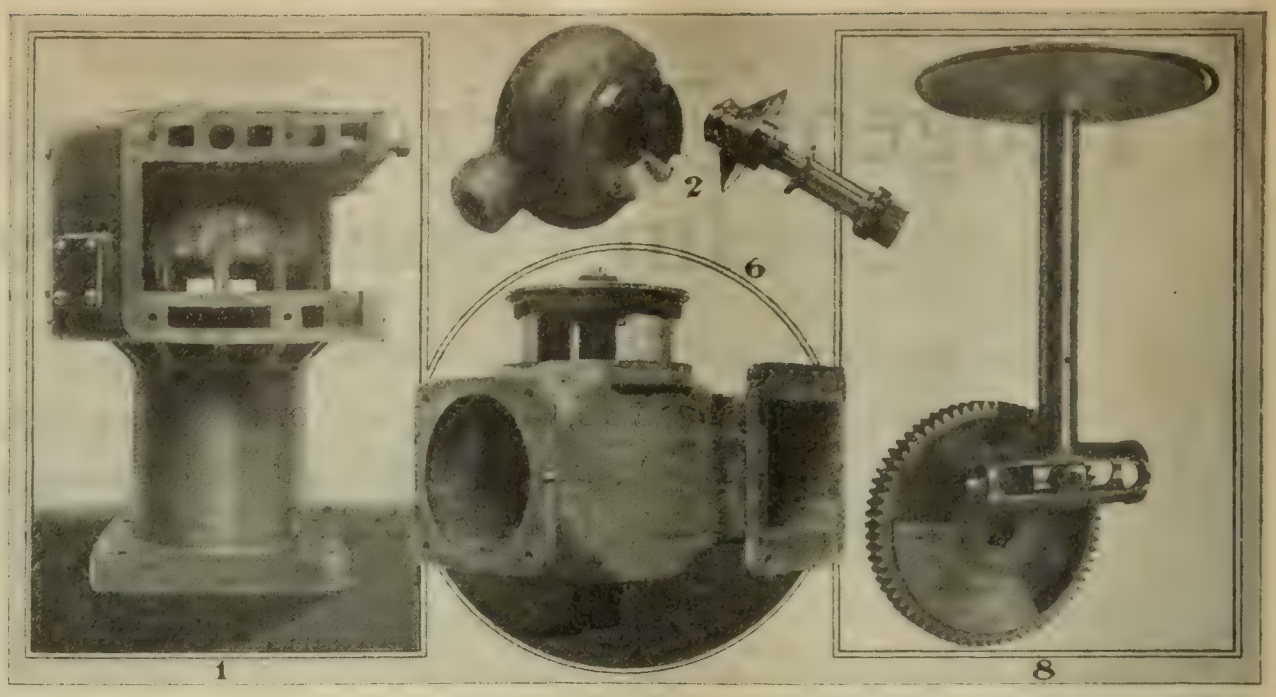


The Peugeot-Tartrais two-stroke fuel injection truck engine showing location of fuel and scavenging pumps, manifolds, etc.

which forms the outer wall of the air jacket. In the center of the combustion chamber is a pulverizer shown in Fig. 4 by means of which fuel is injected into the cylinder at the correct moment.

The piston has an aluminum alloy head and cast iron skirt, the deflector being fastened to the former. The cast iron skirt is employed to overcome expansion difficulties sometimes encountered with all-aluminum alloy pistons. Instead of cast iron rings the piston is fitted with a number of steel compression rings.

At the end of the stroke the deflector on the piston head passes into the mouth of the combustion chamber, driving the compressed air into the chamber at high velocity, and setting up a considerable degree of turbulence. The motion of the air causes the fuel ejected from the pulverizer in a fine spray to be brought into violent contact with the heated walls of the combustion chamber. The deflector in the piston head is cupped and provided with holes, the object of which is to aid pulverization.



Parts of the Peugeot-Tartrais engine. Fig. 1—Working cylinder with jackets removed, showing inlet and exhaust ports. Fig. 2—The inner cylinder head or combustion chamber and the deflector which is attached to the piston head. Fig. 6—Throttle valve used in exhaust manifold. Fig. 8—Piston and Scotch yoke used in scavenging pump

As shown in the drawings, Figs. 3 and 5, an ignition plug is mounted horizontally in the cylinder head. This is required only when starting from cold and is used only for a few moments. By using this device the engine can be started up from cold with the same rapidity and the same degree of assurance as any ordinary gasoline engine. By means of a 4-volt current, which can be obtained from storage batteries or a generator, the central electrode is brought up to a temperature sufficient to ignite the mixture. Within a few minutes the cylinder head attains a sufficiently high temperature to cause self-ignition of the mixture formed in the combustion chamber. Since the plug remains permanently in position it has been necessary to find an insulating material capable of standing up under high temperature and high pressure. The material used is a high-grade steatite known as "Isolantite."

At the end of the power stroke the exhaust gases pass out through the upper ring of ports. Air compressed to about 3 lb. per sq. in. is admitted direct from the scavenging air compressor into the cylinder via the lower ring of ports, without the use of any reserve air tank. The pump is a double-acting, while the distributor which controls the flow of air into the working cylinders is of the barrel type. The compressed air entering the cylinder radially, strikes the central deflector, passes upward into the combustion chamber and then descends, driving the exhaust gases before it. By reason of their inertia there is a danger of the exhaust gases carrying along with them a certain quantity of pure air, thus forming a partial vacuum in the cylinder. To prevent this experience has shown that it is necessary to create a back pressure in the exhaust pipe. This result is obtained by a mechanically operated throttle loosely fitted in the exhaust manifold. This appliance is shown in Fig. 6, the throttle being partially raised out of the manifold.

One of the most difficult problems in connection with this engine has been in securing correct material for the

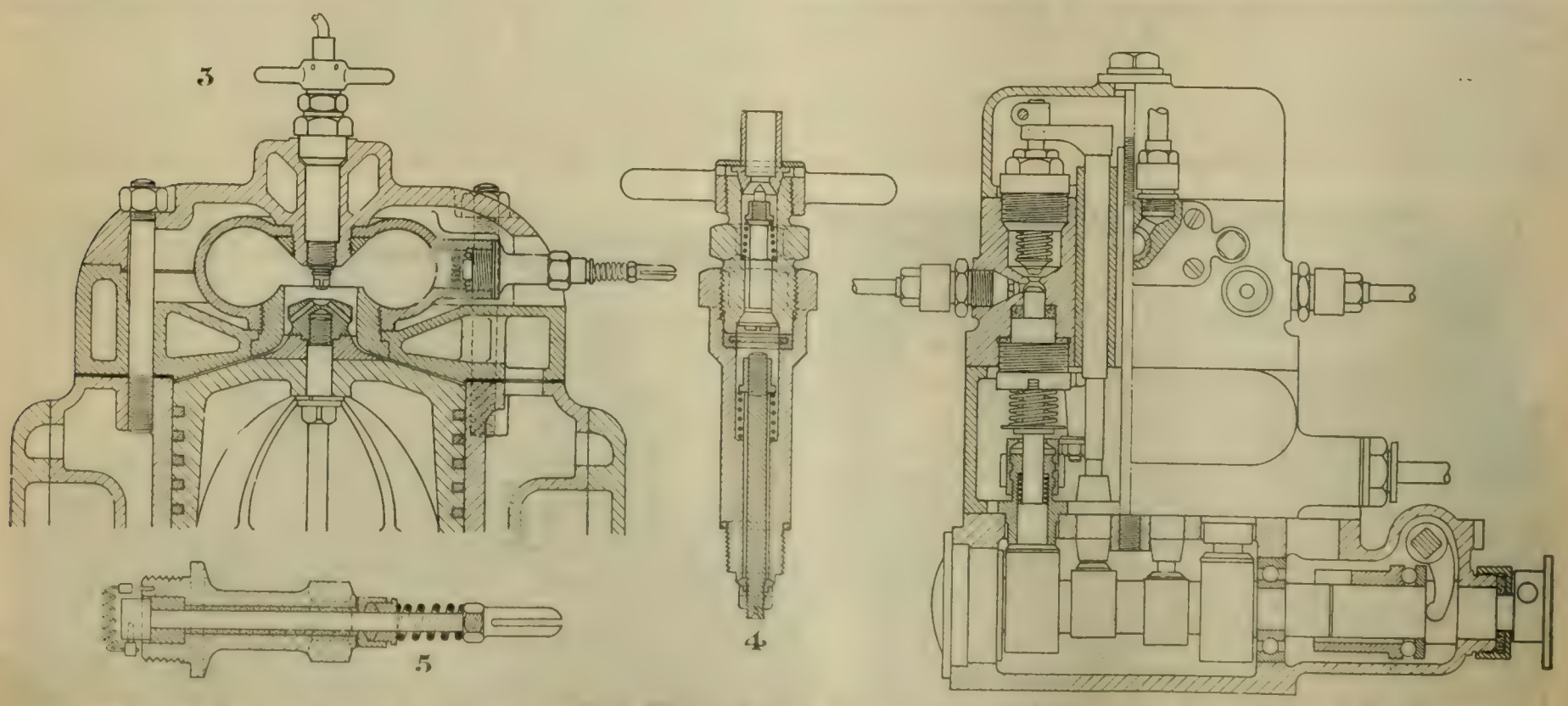
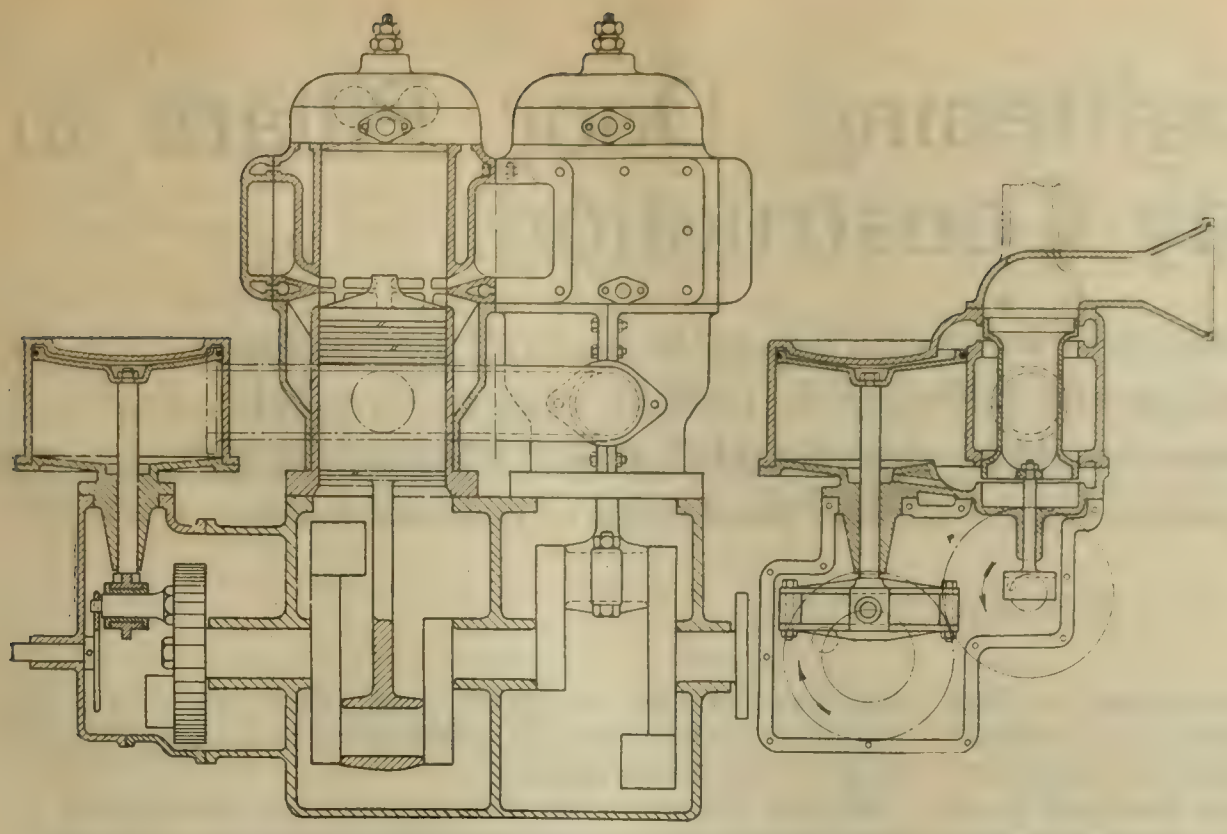


Fig. 3—Sectional view of cylinder head and piston, showing air-jacketed combustion chamber, and location of deflector, igniter and injector. Fig. 4—Section through injection valve. Fig. 5—Section through igniter. Fig. 7—Part sectional view of fuel pump



Diagrammatic views of the Tartrais fuel injection engine showing sections through scavenging pump and working cylinders

combustion chamber and in mounting it on the cylinder barrel so that it would operate satisfactorily. The head has to be maintained at the highest possible temperature, while the barrel must be adequately cooled to avoid lubrication difficulties. The method of assembly is shown in the sectional drawing through the piston and the cylinder head (Fig. 3), from which it will be seen that the combustion chamber is free to expand and contract without affecting the gas tightness of the two joints between the head and the cylinder barrel and between the head and the fuel injector. This feature of the design, which is covered by patents, involved several years of experimental work.

The fuel pump is shown in part section in Fig. 7. When used on trucks two fuels are provided for; kerosene for starting up, and heavier oil for normal running. This explains the presence of two feed pipe connections on the upper portion of the pump housing. There is a separate outlet to the two cylinders of the engine to left and right of the pump housing, for this latter really comprises two distinct pumps in one unit. Variations in the amount of fuel fed to the engine are obtained by altering the stroke of the fuel pumps, this alteration being obtained by pedal control when the engine is used on a truck chassis.

Although this engine has passed out of the experimental stage, as is shown by the fact that Peugeot has put a series of 50-hp. models into production, experiments are being continued. Among these are a series of power and fuel consumption tests with every known kind of liquid fuel.

The most immediate application of an engine of this type is believed to be in Colonial regions where gasoline is costly or unobtainable, but where other liquid fuel is plentiful. It is believed that these tests will show the possibility of using this engine with whatever local fuel happens to be available.

A New Steering Gear for Passenger Cars

THE Ross Gear & Tool Co., which for 15 years has been making steering gears for the motor truck industry, has entered the passenger car field with a steering gear suitable for this type of vehicle. The new gear embodies the same mechanical principles of design as the heavy-duty truck steering gear—namely, a solid nut operated by the steering wheel through the steering tube. In the heavy truck gears the screw turns with the steering nut, and the nut, traveling up or down on the screw, turns the trunnion shaft and swings the steering arm. In the new passenger car gear this operation is reversed, although the principle is the same. The nut rotates with the wheel and the screw moves up or down inside the nut when the nut is rotated. The movement of the screw turns the trunnion shaft and swings the steering arm.

In the new design the connection between the steering tube and the nut is a mechanical four-jaw connection, there being no brazing in this steering gear. The nut, which is made of gray iron, is supported both above and below by ball thrust bearings. Gray iron is used for the nut, because it is always in compression. The nut is a solid piece and gray iron presents the best bearing surface to the screw, which is of case-hardened steel. The threads of the screw are ground. As the nut rotates, the screw travels up and down in the housing and is prevented from rotating by suitable means provided inside the housing.

On the lower end of the screw two swivels are carried, one on either side. The trunnion shaft has two projecting arms, in which cylindrical openings are provided. The swivels on the lower end of the screw operate in the openings of the trunnion shaft, so that as the screw is moved longitudinally by means of the nut, the swivels move longitudinally and rotate the trunnion shaft. The cylindrical openings in the trunnion shaft completely envelope the swivels. The trunnion shaft is hardened and all of the operating surfaces are ground.



Parts of Ross steering gear for passenger cars

The steering arm is secured to the trunnion shaft by means of tapered splines. The gear has been so designed as to use heavy oil, rather than grease, and it is so made as to retain the oil indefinitely under various conditions of service.

The gear is designed for easy operation. It has a compromise degree of irreversibility so that little bumps in the road are not transmitted to the driver's hands, but the car will follow the course for which it is set. This is claimed to be valuable in traveling on dirt roads or on fresh gravel or broken stone.

Means for Lightening Door Pillars in Body Construction

Saving could be accomplished by a reduction of the material used in door pillars. Gain accomplished by following the methods suggested would be slight but the appearance would be considerably lighter. Elimination of unnecessary material a step toward cheaper production of enclosed bodies.

By George J. Mercer

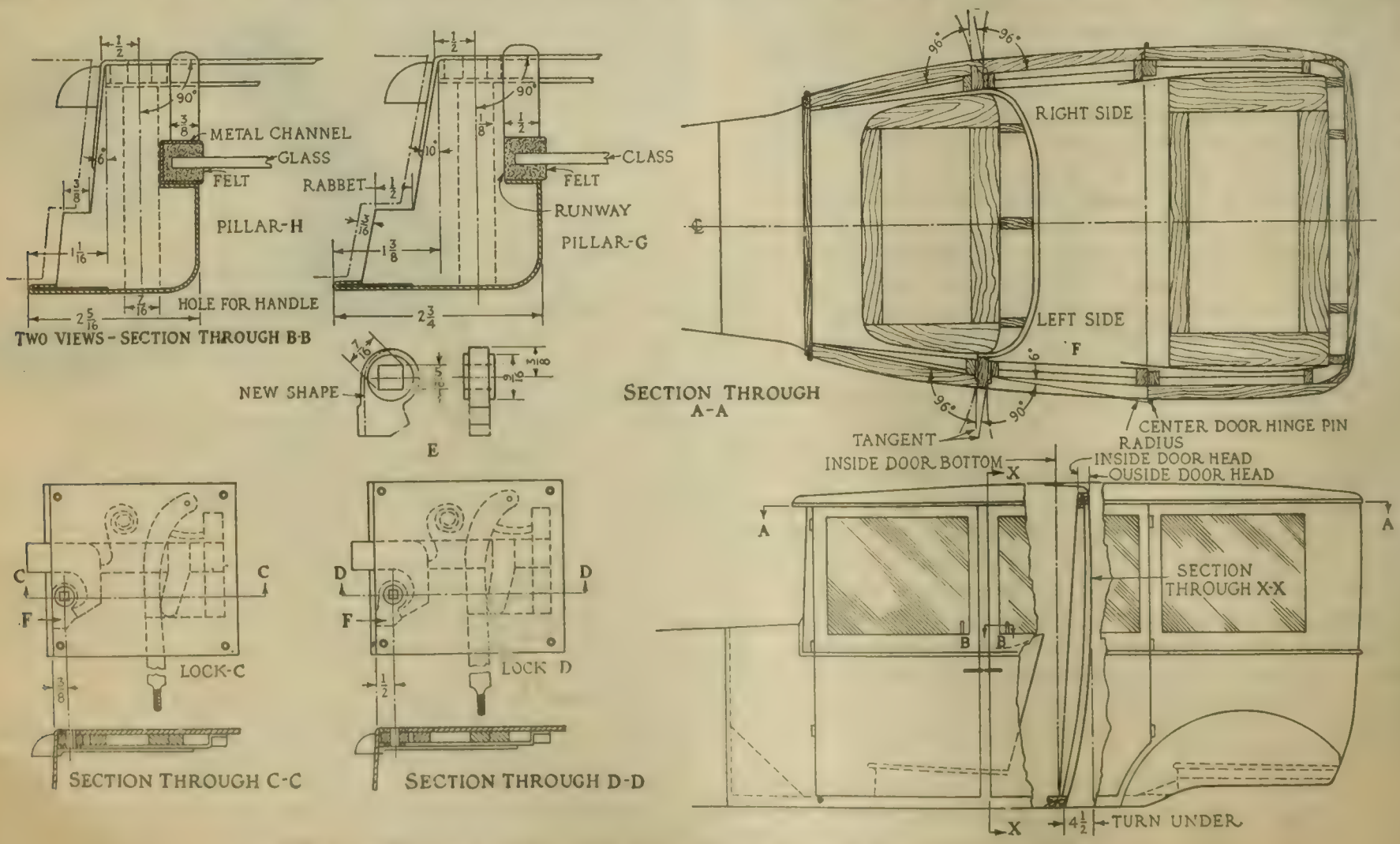
WEIGHT is an important consideration in body construction, yet little has been done toward making that important part of a car materially lighter. This has been largely due to the fact that present practice in wood framing and metal panels does not permit the body builder to leave out any of the members used, or make them much lighter without incurring a risk of shortening the life of the body.

There is one place, however, where a saving in size can be accomplished, namely, in the door pillars. Even the gain accomplished there would be slight, but the effect in giving the appearance of lighter weight would be considerable.

The accompanying illustrations show the side elevation of a sedan body and sectional views of the points emphasized. The two sectional views through B-B show how the saving in size is accomplished. Pillar G is 2¾ in. wide and pillar H is 2 5/16 in. or a saving of 7/16 in. If the body has four doors there will be an additional glass space of ⅞ in. on each side due to the change in dimensions of the lock pillar alone. When the lock pillar is lightened it is always possible to make some reduction on the hinge pillar.

It will be seen that the saving has been made by straightening the pillar face, decreasing the bevel from ½ to ⅜ in., and saving in the space allotted for the glass runway.

In considering the door bevel it should be remembered that some draftsmen are lax in shading the bevel on the door and simply make it to suit the bevel on the lock without further investigation, other than to make sure that the bevel is great enough for easy clearance. The manner in which the minimum permissible bevel is determined is shown at F on Section A-A. In order to make certain that the inner bottom corner of the door will clear in opening the following must be considered. The less turnunder to the door, the less bevel will be required for this purpose. The bevel is determined by drawing a tangent to the circle described by that inside point on the door which is furthest from the hinge axis. The



Side elevation of a sedan body and sectional views of door pillars, locks, etc.

section through X-X gives the turnunder and the inside point of the door bottom is used in determining the correct bevel in this case.

Having determined the bevel and selected a commercial lock that is suitable, the sectional view of pillar H can be drawn. To realize the gain to be made from this correct selection of bevel it is only necessary to compare pillar H with pillar G. On the latter a 10-deg. bevel is used and the result is that the dimension from the inside corner of the pillar to the extreme of the moulding is 1⅜ in. compared to 1 1/16 in. on pillar H at the same place. This is a difference of 5/16 in. less ⅛ in., or an actual gain of 3/16 in. Many times the added thickness is needless as it serves no other purpose than to give the body a heavy appearance.

While the subject is being discussed it might be well to consider the desirability of selecting locks which have the handle hole as near to the face plate as possible. It was customary in carriage days to fasten the handle on the inside with a covered nut and finish washer. These were put on over the trimming and the size of the washer necessitated the hole being placed back from the face in order that the washer would not project over the edge. To-day it is customary to blind fasten the handle and since the screw and washer are small the hole can be close to the front. This can also be used to effect a saving in pillar size. The two views, one lock D and the other lock C, show how it is possible to save ⅛ in. by simply having the tumbler shaped, as shown at E. Lock makers are giving both these points attention on new models, and no doubt would have made earlier changes if body builders had been less lax in their attention to these points.

The second way in which gain in pillar size has been accomplished has been by lessening the size of the door rabbet. On carriages ⅜ in. was used for the rabbet. There is no actual need of more, except when commercial articles are used, which have not been considered in connection with making bodies look light.

The third point of gain has been the runway. There are different methods of providing for the sliding of the glass in the door pillar runways. Sometimes a metal channel, covered with velvet is used, or the channel may be fastened to the glass and then covered. In the latter case the frame works in a wood groove. Another method, as shown on pillar G, is sometimes used. In either case the depth of the runway in the pillar is 7/16 or ½ in. as against the ⅜-in. depth used on carriages. The bottom of the runway, of course, must not interfere with the hole for the lock handles. The shank of this handle is 5/16 in. square, therefore a 7/16-in. hole is the minimum that can be used through the pillar to enable the handle to turn. As a matter of safety ⅛ in. has been allowed between the hole and the bottom of the runway at their crossing.

Going back to the drawing of the locks it will be seen that the handle hole should be toward the front as much as possible. The ⅛ in. gained on lock C over lock D would just furnish the necessary clearance for the runway.

On pillar H the runway is cut up to the line allowed for the handle hole. In order to do this felt is used in a metal channel. By the use of felt the channel will prevent water entering the pillar through the runway. In case the pillar, in process of working up, should give trouble by reason of the hole actually cutting into the runway, about ⅛-in. leeway can be secured by cutting away the back face of the channel and part of the felt.

As mentioned at the outset the gain outlined is not large, but manufacturers are facing the problem of making enclosed bodies for less money than formerly. In bringing out new models all the changes possible that will make them lighter in appearance will prove a distinct advantage. They give also a tangible argument for sales stimulation.

Locks, hinges and window regulators are receiving marked attention by both the manufacturers of these parts and the buyers. The proper working of the doors is an important factor in car selling. For the same reason the correct hinging of the doors on enclosed bodies is important. As shown in the illustration, the front door is hinged at the front and the rear door aft. For safety both doors should be hinged at the front, as this would prevent the door being broken off by hitting an obstruction should it swing open while the car is in motion. The user, however, usually wants the rear door hinged at the back for convenience in entering and leaving the car.

Indiana's Road Maintenance Expenditures Beat Record

INDIANA spent $8,166,121.94 on its roads during the fiscal year ending Sept. 30, according to the annual financial report prepared by John D. Williams, chief clerk of the Indiana Highway Commission, of which Lawrence Lyons is director. The amount spent on the construction of new roads was $3,439,926.12 and on maintenance $4,377,243.84. Other disbursements for the year were, administration, $30,925.64; motor transport, $184,297.54; capital expenditures, $130,655.21; right-of-way, $2,573.59, and liability damages, $500. The total cost of all supervision of all work done by the highway department was $234,855.20, or 2.87 per cent for the total expenditures, or 3.16 per cent of the construction and maintenance costs, a better record than has ever been made by the state before this time.

At the end of the fiscal year of 1920 the commission had a balance of $2,784,605.11. From all other sources the department received this year $6,715,671.99. From the state road tax the amount of $2,213,184.30 was received, and $2,305,312.40 came from the automobile license fees. These two amounts, the principal cash receipts for the year only exceeded the total sum spent on the maintenance of Indiana's state highways by $141,252.86. So it is evident that the roads of the state are eating up the greater part of the annual income in maintenance. The balance of $2,784,605.11 brought forward from the previous year plus $668,939.03 received from inheritance tax, depository interest, sale of non-usable equipment and other miscellaneous items about covered the cost of the new roads constructed. There is a balance of $1,334,155.16 on hand with $419,434.28 of federal aid money earned and to be paid later. Indiana's apportionment of the old federal aid law amounted to $7,415,292, of which only $1,941,621.79 has been received for work completed. Agreements for work that will amount to $6,782,987.88 have been made with the government, leaving an unused and unobligated remainder of the original apportionment of $632,304.70. This does not refer to the approximate two millions of the recently enacted federal aid law, none of which is yet under agreement with the government by accepted projects for federal aid roads.

Variables in Drop Forge Practice

The results of careful experiments in heat treatment of finished forgings are given in this authoritative paper. The author reaches five definite conclusions which are outlined below. He says there are seven possibilities of difference between drop-forgings that are apparently identical.

By J. H. Nelson*

SOME very rapid and stupendous developments have occurred in a large number of industries within the past decade. Chief among these is the automotive industry, which has forged forward from a comparatively inconspicuous beginning to become one of the largest and most highly specialized industries of to-day. One of the principal reasons for this rapid development is the willingness and eagerness with which those in responsible charge seized upon and completely assimilated new ideas and methods that make for better and more rapid production. Many industries have contributed toward this development either directly or indirectly. It is impossible to measure with any degree of accuracy the exact value of each of their contributions. The drop-forging industry, which itself is comparatively young, has contributed in a large measure to this phenomenal advance by successfully forging from steels of various compositions some of the most vital parts that enter into the construction of automotive vehicles. In the early history of the automotive industry, when quantity requirements were small, the cost of drop-forgings was prohibitive to a large extent. The result was that the manufacturer was compelled to resort to castings or hand-forgings to supply his needs. As his requirements increased and designs became more stabilized, he was able to purchase drop-forgings of far superior quality to compete in price with castings and hand-forgings.

Drop-forgings for automotive construction are made to-day in large quantities from a great variety of steels, both plain-carbon and alloy, the particular grade of steel used being dependent upon the part to be forged and the duty required of the part. With the increase in the number of forge-shops that has occurred within the last few years, it is no longer a problem to have a forging made, but rather to secure the necessary quality in the forging when completed; and this matter of satisfactory quality is not something that is apparent on the surface of the forging. Two forgings may be identical in appearance, size, shape, amount of finish and even forged from the same grade of material; yet, from a quality standpoint, they may be decidedly different. This difference may be due to any one or to a combination of the following factors

(1) Method of forging
(2) Method of heating for forging
(3) Inspection and supervision of forging
(4) Inspection of raw stock
(5) Segregation of raw stock
(6) Heat-treatment of the finished forging
(7) Testing of the finished product

It is not the intention to discuss the effects of all of these factors on a finished forging, but rather to confine the discussion to the last four, these having to do with forging materials and their subsequent treatment.

Inspection of raw stock should consist of (*a*) surface inspection to determine the fitness of the material for use in forgings, such as an examination for size, seams, scale, burns and the like, and (*b*) chemical analysis to determine the fitness for use in the various parts, to determine the segregation of the elements in the bars and to determine mixed heats.

Mixed heats are of two kinds, those that are deliberately mixed at the mill and those that are accidentally mixed at the mill. Under deliberately mixed heats, we find steels of the same grade but from different melts that are rolled into bars and furnished to a customer under the same heat number. Such heats are made up from ingots that have the same or nearly the same chemical composition as to the hardening or alloying constituents. Heats of this character are an endless source of trouble to forge-shops that endeavor to keep melts of steel of the same grade segregated. Unintentionally mixed heats are due to a few bars of different grade of steel becoming misplaced. While this is a source of annoyance, it is readily detected chemically and the bars are then rejected.

Segregation of raw stock of the same grade by melts is absolutely essential if quality forgings are to be produced. Many shops and plants fail to recognize this fact and segregate their stock by size and grade only. It not only is necessary to segregate the stock in the yard, but it is equally necessary to segregate the forgings made from this stock until they have been completely heat-treated and are ready to ship to the customer.

The necessity of heat-treating finished forgings can best be demonstrated by our experience on production work. Time and space will not permit of the discussion of the different grades of steels used. The tendency found in the simple carbon-steel summarized in Table 1 holds for all steels, including the more complex alloy-steels. Table 1 gives chemical analyses and physical tests on production work for 107 different melts of a plain carbon-steel purchased under the specification given at the head of the table.

These steels were purchased from a number of different mills and are fairly representative of material selected for our use.

The physical properties given in Table 1 are an average of ten tests selected at random for each melt, the tensile test in every case having been made on a prolongation of a crankshaft that was forged to a diameter equal to the maximum section of the shaft. In our practice this coupon remains attached to the crankshaft throughout the various operations and is used as a check on the heat-treatment operations. One or more such tests are provided for each furnace charge, the number depending upon the number of crankshafts in each charge. The diameters used vary from 2¼ to 2¾ in., according to the particular job that is being forged.

* Chief Metallurgist, Wyman-Gordon Co. Paper presented at the S. A. E. Winter Meeting.

The location of test-specimens was in every case at a point halfway between the outside and the center of the coupon. The axis of the test-specimen was always taken parallel to the axis of the coupon from which it was cut. The test-specimen used conforms to the Society's standard dimensions, 0.505 in. diameter and 2-in. gage-length. The tensile tests were all made on a 100,000-lb. capacity automatic and autographic tensile-testing machine, using the 50,000-lb. counterpoise on the beam. Spherical-seated grips are used in making all tensile tests. The Brinell hardness number recorded was determined on the crankshaft after first grinding and preparing the surface; it does not necessarily indicate the hardness of the test-piece itself.

The crankshafts represented by these tests were all quenched in water from 1525 deg. fahr., and drawn back to the temperature specified. The furnaces used are automatically controlled, use oil for fuel and have a hearth

Table 1—Chemical Analyses and Physical Tests Made on a 0.40 to 0.50 Per-Cent Carbon Steel.

Group A—Drawing Temperature, 980 Deg. Fahr.

No.	C 0.400 to 0.500	Mn 0.600 to 0.800	P 0.045 max.	S 0.050 max.	Yield-Point, lb. per sq. in.	Tensile-Strength, lb. per sq. in.	Elongation in 2 In., per cent	Reduction of Area, per cent	Brinell Hardness No.
1	0.440	0.730	0.010	0.033	77,150	117,600	19.8	50.5	245
2	0.390	0.630	0.015	0.038	72,875	111,550	20.0	52.1	237
3	0.400	0.620	0.016	0.050	72,700	109,300	21.7	53.0	230
4	0.420	0.680	0.015	0.051	73,600	108,400	18.0	50.3	242
5	0.500	0.580	0.008	0.043	72,000	108,475	19.8	50.7	236
6	0.440	0.670	0.010	0.043	76,800	112,000	21.3	54.9	241

Group B—Drawing Temperature, 1,000 Deg. Fahr.

7	0.480	0.800	0.015	0.048	76,350	115,600	21.9	53.0	233
8	0.470	0.650	0.009	0.044	76,950	115,425	20.4	50.6	233
9	0.420	0.680	0.019	0.044	76,300	113,200	20.3	53.3	241
10	0.410	0.660	0.015	0.040	78,350	115,950	20.0	52.7	237
11	0.390	0.690	0.019	0.042	74,700	110,700	21.6	52.9	238
12	0.420	0.740	0.014	0.038	77,775	115,500	21.9	54.1	236
13	0.430	0.700	0.015	0.039	81,350	122,800	19.6	53.0	241
14	0.400	0.620	0.019	0.035	78,300	117,100	20.3	51.2	238
15	0.480	0.680	0.016	0.034	80,200	118,325	19.8	52.4	238
16	0.410	0.780	0.027	0.042	75,150	112,625	22.2	55.4	241

Group C—Drawing Temperature, 1,020 Deg. Fahr.

17	0.460	0.740	0.014	0.034	74,575	110,400	21.2	55.8	234
18	0.430	0.740	0.018	0.032	75,625	114,250	21.5	53.3	236
19	0.470	0.630	0.014	0.046	77,200	116,600	22.2	52.5	230
20	0.470	0.630	0.017	0.053	75,450	115,450	20.4	51.7	238
21	0.480	0.730	0.020	0.043	76,250	114,900	21.5	52.6	238
22	0.540	0.630	0.020	0.039	82,400	122,800	21.1	51.5	238
23	0.470	0.740	0.018	0.058	79,200	118,000	22.4	53.8	240
24	0.430	0.590	0.016	0.031	76,400	113,900	22.8	56.0	241
25	0.510	0.750	0.028	0.034	78,450	117,250	21.7	54.5	239

Group D—Drawing Temperature, 1,040 Deg. Fahr

26	0.500	0.650	0.022	0.048	78,800	117,370	19.5	50.6	239
27	0.490	0.750	0.015	0.040	77,420	114,200	20.7	51.8	236
28	0.480	0.700	0.024	0.042	78,000	119,400	20.9	52.3	239
29	0.520	0.700	0.018	0.046	76,500	115,600	20.1	53.4	241
30	0.500	0.560	0.022	0.046	75,350	114,175	19.8	51.2	238
31	0.500	0.690	0.018	0.042	79,500	116,350	21.2	53.7	241
32	0.500	0.690	0.016	0.041	76,150	116,350	20.0	50.8	238
33	0.480	0.820	0.019	0.053	79,780	118,500	20.3	52.3	241
34	0.470	0.720	0.015	0.042	75,100	113,900	20.3	50.2	235
35	0.420	0.680	0.019	0.044	76,300	113,200	20.3	53.3	241
36	0.480	0.640	0.022	0.012	77,425	116,125	22.8	54.3	238
37	0.440	0.660	0.022	0.039	79,960	118,120	20.8	53.0	241
38	0.520	0.830	0.031	0.041	77,400	112,900	21.0	55.2	243
39	0.510	0.710	0.042	0.045	78,300	116,600	23.4	55.8	240
40	0.480	0.650	0.124	0.046	79,870	118,200	20.3	52.3	236
41	0.480	0.820	0.025	0.056	76,275	114,800	21.0	52.9	239
42	0.490	0.660	0.026	0.052	78,850	116,600	22.0	52.5	237
43	0.460	0.780	0.009	0.053	75,450	113,125	23.2	56.5	233
44	0.470	0.800	0.014	0.045	77,400	115,500	22.6	55.0	233
45	0.400	0.880	0.010	0.048	76,250	112,850	21.8	55.6	237
46	0.450	0.700	0.036	0.043	74,900	114,000	22.3	53.4	235
47	0.400	0.830	0.026	0.046	79,000	117,400	22.8	55.2	241
48	0.460	0.750	0.017	0.043	78,650	116,750	23.0	56.5	234

Group E—Drawing Temperature, 1,060 Deg. Fahr.

No.	C 0.400 to 0.500	Mn 0.600 to 0.800	P 0.045 max.	S 0.050 max.	Yield-Point, lb. per sq. in.	Tensile-Strength, lb. per per cent	Elongation in 2 In., per cent	Reduction of Area, No.	Brinell Hardness
49	0.500	0.700	0.021	0.043	79,850	118,100	20.7	51.0	235
50	0.450	0.680	0.018	0.054	78,150	116,000	20.3	52.1	241
51	0.480	0.630	0.026	0.042	77,925	116,900	21.6	53.9	241
52	0.470	0.700	0.028	0.040	76,325	113,125	21.3	55.6	233
53	0.480	0.820	0.028	0.053	79,550	117,400	20.4	54.9	240
54	0.470	0.780	0.030	0.042	76,850	115,750	22.1	54.0	237
55	0.400	0.890	0.012	0.048	76,250	112,850	21.8	55.6	237
56	0.490	0.610	0.013	0.031	73,500	107,700	22.9	57.5	233
57	0.470	0.700	0.033	0.031	81,200	119,310	20.8	53.0	243
58	0.440	0.780	0.035	0.051	76,870	115,600	22.4	54.5	239
59	0.430	0.650	0.022	0.036	75,950	113,000	23.3	55.5	237
60	0.460	0.690	0.032	0.051	76,600	113,950	22.0	53.6	240

Group F—Drawing Temperature, 1,080 Deg. Fahr.

61	0.460	0.810	0.017	0.043	79,270	118,500	21.0	54.0	238
62	0.520	0.580	0.026	0.049	76,250	115,900	21.2	56.7	237
63	0.480	0.640	0.022	0.054	77,370	117,100	20.8	52.5	239
64	0.480	0.730	0.034	0.046	80,500	119,900	20.3	50.0	238
65	0.480	0.700	0.033	0.056	79,200	116,500	20.0	53.6	233
66	0.450	0.680	0.018	0.054	77,750	117,150	19.7	51.1	242
67	0.490	0.750	0.026	0.055	77,500	115,900	22.3	55.4	235
68	0.480	0.650	0.025	0.042	79,600	117,900	20.9	52.1	238
69	0.450	0.730	0.027	0.043	82,187	121,000	19.7	51.7	241
70	0.440	0.760	0.025	0.049	79,600	119,300	19.9	52.2	242
71	0.450	0.610	0.023	0.040	78,750	114,700	20.7	54.2	245
72	0.460	0.740	0.039	0.040	79,270	115,500	20.5	54.1	242
73	0.480	0.630	0.040	0.043	77,000	113,950	21.1	52.7	247
74	0.460	0.830	0.034	0.047	76,500	113,000	21.4	54.0	246
75	0.490	0.770	0.028	0.041	79,450	118,500	22.4	54.2	237
76	0.430	0.790	0.021	0.043	81,400	120,900	21.6	52.9	241
77	0.470	0.760	0.022	0.046	82,000	121,700	19.5	51.9	242

Group G—Drawing Temperature, 1,100 Deg. Fahr.

78	0.480	0.730	0.014	0.039	78,250	117,625	21.8	55.9	237
79	0.460	0.730	0.015	0.036	78,350	115,300	21.6	56.0	244
80	0.460	0.690	0.041	0.048	75,100	113,900	20.6	52.2	243
81	0.440	0.760	0.023	0.049	77,100	112,500	21.1	56.2	243
82	0.420	0.790	0.034	0.046	75,200	112,160	22.1	54.5	241
83	0.500	0.660	0.030	0.037	76,970	116,100	20.3	52.8	241
84	0.480	0.690	0.039	0.051	76,600	112,950	21.5	57.0	246
85	0.430	0.920	0.038	0.038	76,200	113,900	24.0	57.3	238
86	0.430	0.810	0.027	0.032	77,900	115,000	23.5	57.2	241
87	0.400	0.850	0.035	0.046	78,600	117,120	22.9	54.6	242
88	0.460	0.610	0.034	0.039	75,650	113,600	23.6	57.6	238

Group H—Drawing Temperature, 1,120 Deg. Fahr.

89	0.460	0.740	0.039	0.040	79,300	115,500	20.5	54.1	242
90	0.500	0.780	0.033	0.041	82,250	120,650	19.9	55.0	248
91	0.440	0.820	0.028	0.044	78,950	110,500	22.5	59.7	243
92	0.460	0.690	0.032	0.043	81,000	118,750	21.1	53.5	247
93	0.450	0.880	0.036	0.034	79,450	115,950	21.7	57.5	243
94	0.480	0.740	0.033	0.043	77,750	115,200	22.0	54.8	241
95	0.400	0.700	0.033	0.043	74,700	110,000	22.4	57.1	241
96	0.500	0.800	0.035	0.047	82,150	119,300	20.8	54.3	246
97	0.480	0.680	0.025	0.037	77,750	115,850	21.7	56.6	239
98	0.420	0.850	0.038	0.042	77,750	113,550	22.3	59.7	243
99	0.440	0.860	0.031	0.037	78,500	117,000	21.8	57.2	247
100	0.440	0.950	0.025	0.055	75,500	111,100	21.2	57.1	240
101	0.480	0.710	0.033	0.055	80,200	117,900	21.3	54.4	247
102	0.420	0.870	0.035	0.048	83,000	120,625	21.6	54.1	243
103	0.460	0.790	0.036	0.042	81,000	118,425	21.8	54.2	240
104	0.460	0.700	0.035	0.043	79,000	118,000	21.3	52.5	243
105	0.450	0.690	0.029	0.048	75,250	111,500	23.1	56.0	239
106	0.440	0.630	0.028	0.046	76,250	113,650	23.6	57.8	237
107	0.490	0.750	0.026	0.051	78,200	114,800	21.4	56.4	243

dimension of 66 x 98 in. The temperatures were all measured by an iron-constantin thermocouple pyrometer system, which was checked constantly by a master pyrometer used exclusively for this purpose. The control mechanism, which is very positive in its action, is responsive to changes of 5 deg. in temperature between fire-off and fire-on. The charge of any furnace can be held for any length of time at any predetermined temperature, without danger of over-running as in hand-fired furnaces. This insures accuracy in heat-treating operations.

The values given in Table 1 have been grouped according to the drawing temperature necessary to meet the following specification:

Yield-Point, lb. per sq. in.	70,000
Tensile-Strength, lb. per sq. in.	100,000
Minimum Elongation in 2 in., per cent	18
Minimum Reduction of Area, per cent	50
Brinell Hardness	228 to 248

A study of the results given in Table 1 would lead to the conclusion that the chemical composition of the steel in question is not a complete criterion of the heat-treatment to be specified to meet the requirements of a definite specification. We see that the steels reported require a drawing temperature varying from 980 to 1120 deg. fahr. to bring them within the limits specified. The uniformity of the results obtained in the various groups is exceedingly striking, as is also the uniformity between the various groups.

This latter uniformity is more evident in Table 2, where the averages of the various groups given in Table 1 are summarized. This summary brings out more clearly that the variation in the drawing temperatures necessary to bring these various heats of steel to the common specification cannot be ascribed wholly to the difference in the chemical composition of the heats. The variation in the average carbon and manganese-content of these steels will not account for the large variation in drawing temperatures.

Table 2—Average of Values Given in Table 1.

Group	Drawing Temperature, Deg. Fahr.	C 0.400 to 0.500	Mn 0.600 to 0.800	P 0.045 max.	S 0.050 max.	Yield-Point, Lb. Per Sq. In.	Tensile-Strength, Lb. Per Sq. In.	Elongation in 2 In., Per Cent	Reduction of Area, Per Cent	Brinell Hardness, No.	Number of Tests Averaged
A	980	0.430	0.650	0.012	0.043	74,280	111,220	20.1	51.3	228	60
B	1,000	0.430	0.690	0.016	0.041	77,540	115,900	20.8	52.8	238	110
C	1,020	0.470	0.690	0.018	0.041	77,300	115,950	21.6	53.6	236	90
D	1,040	0.470	0.730	0.021	0.044	77,500	115,750	21.3	52.9	238	230
E	1,060	0.460	0.710	0.024	0.042	77,420	114,980	21.6	54.3	238	120
F	1,080	0.460	0.710	0.028	0.046	79,100	117,200	20.8	53.1	240	170
G	1,100	0.450	0.750	0.021	0.042	76,900	114,600	22.1	55.2	241	110
H	1,120	0.450	0.770	0.032	0.044	78,500	115,750	21.7	56.0	243	190

It does not require much play of the imagination to visualize the condition of a charge of steel made up from each of these groups and treated as a single melt. Such, however, is the condition when stock is kept only by size and grade. This condition can also exist in a heat of steel that is intentionally mixed at the mill. The chemistry of the steel, as has been shown, is not a sufficient criterion to allow any person to prescribe heat-treatments with any degree of accuracy. The only safe way to determine this is by actual experimentation for each melt of steel used.

The test applied to finished forgings is a series of either tensile or Brinell-hardness tests, the latter being more extensively used. For quality forgings, both should be used. It is comparatively easy to treat any heat of steel to meet either of these two tests when used separately but, when both conditions are to be met at the same time, the task becomes somewhat more difficult and with some melts of steel it is impossible. When the Brinell-hardness test only is used to test forgings, nothing short of at least one Brinell test on each forging should be countenanced. If this is not done and the various melts of steel used are not segregated throughout the yard and shop, some poorly treated forgings are sure to be the result.

Summary

(1) Steels of the same grade and of the same chemical composition do not respond in the same way to heat-treatment

(2) To heat-treat with minimum loss, only steels from the same melt should be included in a furnace charge

(3) Stock subjected to heat-treatment should be carefully segregated into piles of the same melt; it should be kept segregated throughout the entire process of fabrication to produce satisfactory forgings of uniform quality

(4) Tensile and hardness tests should be required on all heat-treated forgings to check the thoroughness with which the various heat-treatment operations were performed

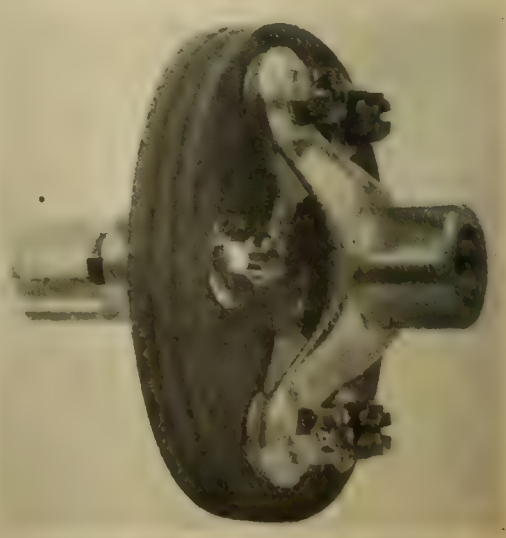
(5) At least one hardness test should be made on all heat-treated forgings to insure that all have responded to the heat-treatment operations in the same manner.

Fabric Universal Joint with Centering Member

A DISK joint has been added to the line of metal universal joints which has been manufactured by the Arvac Mfg. Co. for the last five years. The new disk joint will be manufactured in three sizes, intended to cover the entire passenger car, speed wagon and light truck field and a large percentage of heavier truck installations between clutch and transmission.

As shown in the accompanying illustration, the design includes a centering member which is claimed to keep the propeller shaft concentric and to minimize vibration by supporting the metal parts of the joint in a positive manner, causing them to revolve about a true axis—all of which tends to increase the life of the disks.

The centering member consists of a centering ring carrying a non-metallic, sound deadening, oilless, replaceable bushing supported by three radial arms which securely lock it in a concentric position on the flange-spider bolts. The centering shaft is pressed into the tubular spider and has a spherical surface, providing for both angular and longitudinal movement. The flange spider hubs are turned to S. A. E. standards. Torsional strain is removed from the tube weld by a patented process of swaging the tube back of the weld into slots or keyways milled in the tubular spider hubs.



Arvac disk joint with centering member

The Effect of Impact Forces on Road Pavements

The force of impact blows, as delivered by a road impact machine, can be expressed as an equivalent static load. This offers a means of comparing the resistances of paved sections when subjected to impact. The impact force must be obtained from space time curves. The methods explained.

By C. A. Hogentogler*

IN connection with tests of impact by the wheels of motor trucks on road pavements there is considerable disagreement on such questions as the relation of maximum to average force produced during a blow as well as the connection between static and impact forces. It is true, there are fundamental theoretical formulæ for deriving the force of impact as well as energy work relations for determining average resistance; but when the impact force values are obtained, what do they mean and how do they help us?

What is desired is a knowledge of the effect produced by these forces. In other words, we would like to compare the effects produced by given impact forces with those produced by static loads. To do this, the impact force must be obtained from space time curves by means of theoretical computations, and then a relation must be found between the force and the equivalent static load. For obtaining usable impact values from the curves the following general relations were tried:

1. The maximum force produced by an impact blow is equal to the greatest acceleration times the mass of the moving body.
2. The average force of an impact blow is equal to the average acceleration during time or distance of contact times the mass of the moving body.
3. The average force of an impact blow is equal to the total energy of the blow divided by the distance through which this energy is expended.

The first attempt to secure the force of the impact exerted by a drop of the plunger on a copper testing block was made with autographic curves secured during the first calibration of these blocks. Since all authorities seem to agree that the maximum force of the blow is exerted at or near the point of greatest deformation a position near the lowest point of the curve was selected for the solution. An enlarged typical space time curve and the graphical solution used in this derivation are shown in Fig. 1.

The relation used was:

$$F = Ma.$$

In which,

F = maximum force of blow,
a = maximum acceleration,
M = mass of unsprung weight.

To obtain a, the following formula was used:

$$a = \frac{V_1 - V_2}{t}$$

In which,

t = time in seconds,
V_1 = velocity before the point of maximum deformation,
V_2 = velocity after the point of maximum deformation.

The procedure, as shown in Fig. 1, was first to draw a horizontal line through the curve near its lowest point. Tangents were then drawn to the curve at its intersection with the horizontal line. These tangents or first derivatives gave the values V_1 and V_2, while the time was given by the length of the horizontal line contained between the two sides of the curve. Because of defects in the autographic recording device the results from this set of computations were of value only in so far as they indicated that dependable results could be secured from curves of proper size with correlated accurate time records. While the actual results were not usable, it was strongly suggested that a definite relation existed between the force as computed and the equivalent static load as given by the copper cylinder.

For a further investigation of impact force, several defects were eliminated from the recording apparatus, and the impact machine was loaded with 3050 lb. unsprung and no sprung weight, the plunger being in effect a freely falling body. The sprung weight was eliminated in this calibration in order that the velocity as obtained by the tangent method might be checked by the theoretical velocity of a freely falling body. The procedure in securing deformations of the copper cylinders was the same as that followed in the first calibration described above.

For deriving the impact forces from the curves the method used involved the assumption that the maximum velocity of a falling body which is being stopped by a cushion occurs when the body has penetrated the cushion to such a depth that the resistance of the cushion equals the weight of the body. An inspection of curves, of deformation of rubber tire and copper cylinder under static loads showed that a resistance of 3050 lb. occurs with a deformation of 0.225 of an inch, and it was therefore assumed that the maximum velocity of the plunger occurs at a distance of 0.225 of an inch below the point of first contact and becomes 0 at the lowest tip of the curve. The average acceleration can be expressed in two ways:

1. Ave. $a = \frac{V}{t}$

V = maximum velocity,
t = time required to change from maximum to 0 velocity.

2. Ave. $a = \frac{V^2}{2D}$

V = maximum velocity,
D = distance from point of maximum velocity to lowest or point of zero velocity.

*Highway engineer, Bureau of Public Roads.

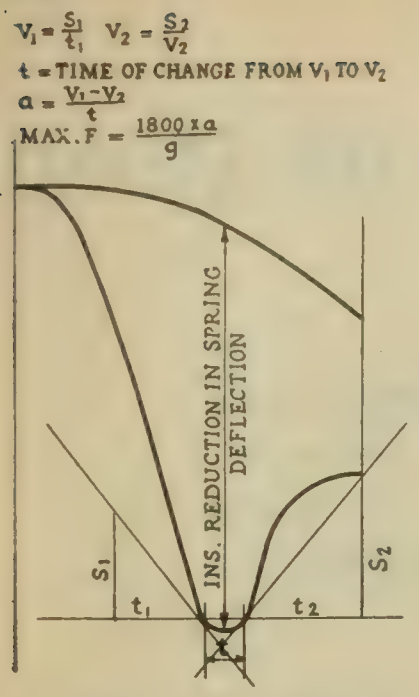


Fig. 1 — Derivation of maximum acceleration from space time curve using the velocity-time relation

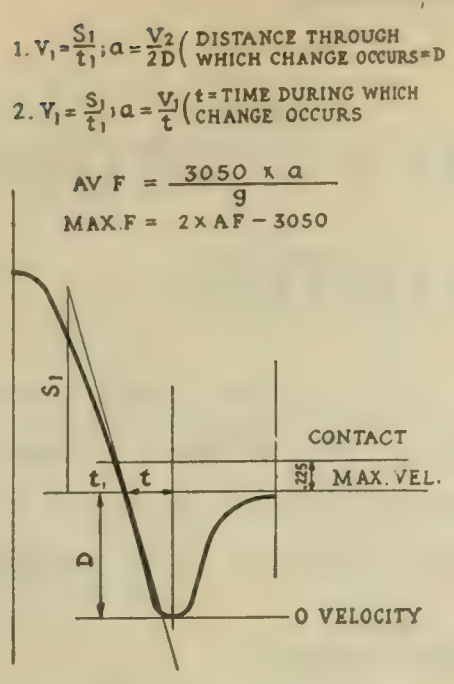


Fig. 2 — Derivation of average acceleration between points of maximum and zero velocity

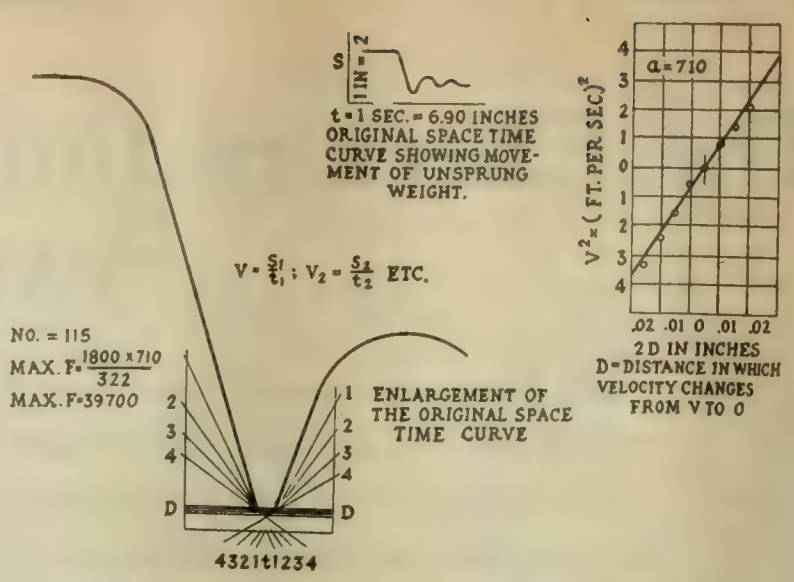


Fig. 3—Derivation of the maximum acceleration from the relation AV2D

Fig. 2 shows how the values are taken from the curve. From the tangent is obtained the maximum velocity; the time, *t*, is the horizontal distance from the point of tangency to the lowest tip of the curve, while *D* is the vertical distance from the point of tangency to the lowest tip of the curve. Having determined the average acceleration from the curves the average force, *R*, is obtained from the relation $R = Ma$. It is noted that *R* is the average force exerted from an initial force of 3050 to a maximum to be determined.

The second assumption is expressed by the relation

Max. $F = 2R - I$,

R = average force,

I = force at point of maximum velocity (in these computations, 3050 lb.).

Table 1—Comparison Between Equivalent Static Load as Indicated by the Copper Cylinder and Impact Force as Computed from Space-Time Curves by Means of Both Velocity Squared-Space and Velocity-Time Relations Between the Points of Maximum and Zero Velocity

No.	Copper cylinder static equivalent.	Approximate computed maximum velocity.	Maximum velocity as obtained from tangent to curve.	Velocity squared-space relation.		Velocity-time relation.	
				Ave. $a = \frac{V^2}{2D}$	F=2R−I.	Ave. $a = \frac{v}{t}$	F=2R−I.
1	22400	3.190	3.254	134.5	23450	143.8	24210
2	24400	3.440	3.700	148.7	25090	145.5	24510
3	26000	3.610	3.885	154.2	26150	183.4	31870
4	28600	4.080	4.150	167.1	28610	183.0	31510
5	30200	4.235	4.287	176.2	30310	178.5	33900
6	21500	3.280	3.360	132.0	21950	151.3	25590
7	20000	3.060	3.140	123.5	20350	154.2	.....
8	16500	2.530	2.700	105.0	16850	103.3	17610
9	15600	2.360	2.590	101.6	16200	110.2	17810
10	11100	1.580	1.746	72.5	10670	72.9	10770
11	8600	1.360	1.343	59.6	8250	60.65	8045

Sprung weight=0. Unsprung weight=3,050 pounds.

The comparison of the forces obtained by this series of drops is shown in Table 1. These results clearly indicate that the equivalent static load as given by the copper cylinder is about the same as the maximum force as computed from the curves by means of the above methods. It will be noted that the tangential velocities are slightly greater than the theoretical and also that the forces as computed from the velocity time relation show more variation than those from the velocity space relation. The reason for the latter condition unquestionably lies in the fact that more accurate measurements can be made on the curves for distance than for time.

There is being developed at present by the Bureau of Public Roads a device which when attached to a motor truck will give space time curves showing the movements of the sprung and unsprung parts of the vehicle when passing over different types and conditions of pavements; and owing to the fact that the curves made by this apparatus can be solved by methods making use of the tip of the curve only, the next step in the development of force derivation involved the securing of the maximum force by means of the maximum acceleration. In the derivation of the maximum acceleration, the velocity distance rather than the velocity time relation was used, since previous study showed that space measurements were more accurate than time measurements. In the study of this method of force derivation the curves obtained during the investigation of the effect of copper cushion reduction were used. It will be noted that these curves represented drops on different sizes of copper cylinders as well as drops in which no cylinders were used. The maximum acceleration was computed from these curves and with this acceleration a maximum force was obtained from the formula:

$$Max.\ F = \frac{1800 \times a}{32.2}\ (\text{lb.})$$

In which,

1800 = unsprung weight (lb.),

a = acceleration (feet per second per second).

The procedure was as follows: Each curve was enlarged 10 times by means of a precise pantograph (see Fig. 3). Four horizontal lines were then drawn through the bottom part of the space time curve, these lines representing distances of one two-hundredth, one one-hundred-and-fiftieth, one one-hundredth, and one-fiftieth of an inch from the lowest point, or point of zero velocity. Tangents to the curve for obtaining the velocities were drawn at the intersections of these horizontal lines. These velocities were squared and plotted as shown in Fig. 3, in which the vertical distances are the squares of the velocities and the horizontal distances are the above noted distances from the point of zero velocity. Through these points as plotted a line is drawn which is the slope of the $\frac{V_2}{2D}$ curve. The slope of this line equals a, the acceleration.

Having found the maximum force, the next step is to determine just what this force means. In other words, what is the actual effect produced by a maximum impact of a given magnitude.

A means of determining this effect is afforded by the copper cylinders. By comparing the maximum impact forces as computed from the space time curves with the static loads which cause equal deformations of copper, a definite relation is found between the two, which is shown

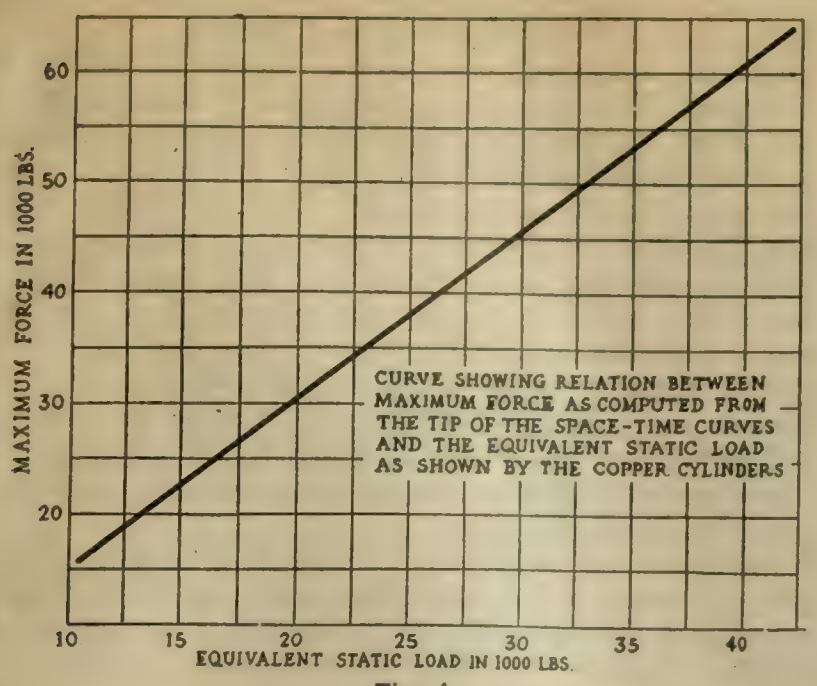


Fig. 4

in Fig. 4. From this curve it will be seen that a maximum force causes the same deformation as would be occasioned by a static load of approximately two-thirds the magnitude. Having determined this relation, an equivalent static load can be found for any maximum impact force, and, knowing the maximum impact force when no cylinder is used, it is a simple matter to find the corresponding equivalent static load.

Table 2—Comparison of Equivalent Static Load as Obtained from Copper Cylinder Deformations with Maximum Force as Computed from Space-Time Curves

$$M = \frac{1800 \times a}{32.2}$$

No.	Maximum acceleration (a).	Maximum force.	Equivalent static load by copper cylinder.	Free fall (H. F.)	Remarks.
		Pounds.	*Pounds.*	*Inches.*	
26	297	16,600	12,500	0.25	½ by ½ cylinder.
25	313	17,500	13,200	.34	¾ by ¾ cylinder.
51	423	23,600	18,600	.40	¾ by ½ cylinder..
4	555	30,740	21,700	1.08	½ by ½ cylinder, 1st blow.
4	582	32,600	23,700	1.07	½ by ½ cylinder, 2d blow.
4	625	34,950	25,300	1.04	½ by ½ cylinder, 3d blow.
62	833	46,700	32,600	1.74	¼ by ½ cylinder.
55	556	31,000	22,000	.63	1 by ½ cylinder.
5	750	42,000	[1]29,800	1.12	No cylinder.
103	608	34,000	[1]24,500	.72	Do.
106	1,019	57,000	[1]39,100	2.91	Do.
101	967	54,100	[1]37,400	2.28	Do.
110	722	40,350	[1]28,700	1.06	Do.
115	705	39,400	[1]28,100	1.08	No cylinder; Time doubtful.
100	324	19,000	[1]14,100	.24	No cylinder.
112	857	47,900	[1]33,500	1.80	Do.
107	1,052	58,800	[1]40,100	3.04	Do.
26	414	23,150	[1]17,100	.28	Do.

[1] Equivalent static load computed.

The values shown in Tables 2 and 3 were obtained by first computing the maximum force and finding the corresponding equivalent static load from the curve. As noted before, it has been known that as the depth of cushion is decreased the impact increases. This effect or increase is shown very clearly in Table 3.

It must be remembered that this investigation of the impact blow was carried on only for the purpose of determining the equivalent static load in the absence of the cushioning effect of the copper cylinder. The close agreement of the above results has been accepted as justification of the use of the no-cylinder curve to represent the values with the effect of copper cushion eliminated. It must be pointed out, however, that these conclusions and the results are neither final nor absolute. They are accepted only because nothing better has been offered. There are several possible sources of error in the curve computations. First, the time cannot be considered as accurate. Autographically, the time intervals are recorded only in seconds, while the computations deal with hundredths of seconds and even smaller intervals. The average time as shown on the graphs in which one second is represented by from 6 to 9 in. horizontally might not be exact for the interval of contact. Again, it is impossible to enlarge the small curves with the degree of accuracy necessary for exact solution of velocities. The slightest variation in the enlargement means a large error in the computed velocity. This explanation and the details of the procedure used are given so that the results can be taken for what they are worth.

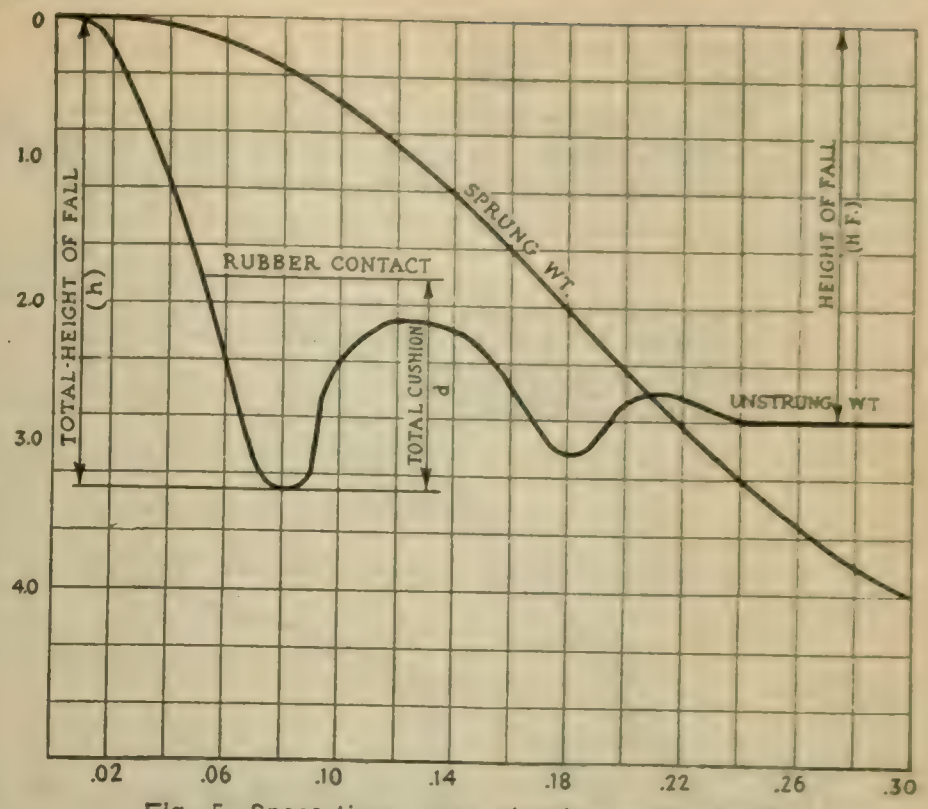


Fig. 5—Space-time curve showing energy-work relation

What can be said then from the above results is that the maximum force at the tip of the curve completed by the mass acceleration method, as shown, produces the same effect upon a copper cylinder as a static load of approximately two-thirds the magnitude. Knowing this, then, these curves become valuable for measurement of force.

By far the simplest solution of the curves secured during the slab tests is that making use of the energy work relation. When the plunger of the impact machine or the wheel of a motor truck falls through any distance,

Table 3—Investigation of Effect of Reduction of Copper Cushion on Force Produced by Same Height of Fall

Percentage of increase of force produced when using rubber alone against that of rubber and ½ by ½ inch copper cylinders

Free fall (H. F.)	Equivalent static load as shown by copper cylinders. ½ by ½	¾ by ¾	¾ by ½	1 by ½	1½ by ½	No. cyl.	Per cen Increase
Inches.							
0.25	**12,500** 0.143	**13,000** 0.070	**13,800** 0.045	**14,500** 0.016	**15,000** 0.007	15,100	20.7
.50	**16,600** .202	**17,600** .114	**19,300** .078	**20,200** .030	**21,600** .014	21,700	30.7
.75	**19,200** .230	**20,200** .140	**22,000** .097	**23,400** .038	**25,700** .019	25,700	33.8
1.00	**21,200** .250	**22,200** .160	**23,800** .109	**25,600** .045	**28,400** .023	28,400	33.9
1.25	**22,900** .265	**23,800** .178	**25,200** .118	**27,100** .050	**30,200** .025	30,300	32.3
1.50	**21,300** .271	**25,200** .193	**26,400** .127	**28,300** .054	**31,500** .027	32,100	32.8
1.75	**25,500** .278	**26,300** .204	**27,300** .133	**29,300** .058	**32,300** .028	33,500	31.3
2.00	**26,400** .283	**27,200** .213	**28,100** .137	**30,100** .060	**33,300** .030	34,900	32.3
2.25	**27,100** .286	**28,000** .222	**28,900** .144	**30,700** .062	**33,900** .030	36,200	33.5
2.50	**28,000** .291	**28,700** .228	**29,500** .148	**31,300** .064	**34,300** .031	37,400	33.6
2.75	**28,600** .293	**29,400** .236	**30,200** .152	**31,800** .065	**34,700** .031	38,500	34.5

a certain amount of energy is developed by the mass acted upon by gravity as well as the spring pressure. This energy must be used up before the wheel can be brought to a stop. In other words, the total energy must be balanced by the resistance of the rubber tire, copper cylinder, slab, etc., acting through the distance of total deformation. Referring to the enlarged space time curve (Fig. 5) showing the movement of the unsprung weight it is noted that the total energy of the blow is equal to total drop (h) times the weight of the plunger plus the average spring pressure exerted on the plunger falling through the distance (h). This energy is expended on an average resistance acting through the distance (d). The average resistance is obtained from

$$R = \frac{(W + f)\ h}{d}$$

In which,

R = average resistance,
W = 1800 = weight of plunger,
f = average spring pressure acting through distance (h), which value is obtained from Fig. 7,
d = total depth of deformation,
h = total height of fall.

In this case as in the preceding one, the average resistance is of value only when its effect can be expressed in static terms. An examination of the results indicated that the equivalent static effect on the copper cylinder was expressed by the relation

$$\text{Equivalent static load} = 2\ R - P$$

P becomes zero when the height of fall (h) is greater than the cushion (d). When $h = d$ (in small drops with rubber in contact with slab) the value for P is taken from the rubber deformation curve and is equal to the static load necessary to deform the rubber the amount it is deformed at the beginning of a particular blow.

The equivalent static load as given by the copper cylinder and the maximum force as obtained from the above formulæ are in very close agreement, the average variation being 2.5 per cent. Results with copper cylinders were obtained with the machine loaded in three different ways, viz. (1) with a sprung weight of 6000 and an unsprung weight of 2000 lb.; (2) with a sprung weight of 6000 and an unsprung weight of 1800 lb. and (3) with a freely falling unsprung weight of 3050 lb.

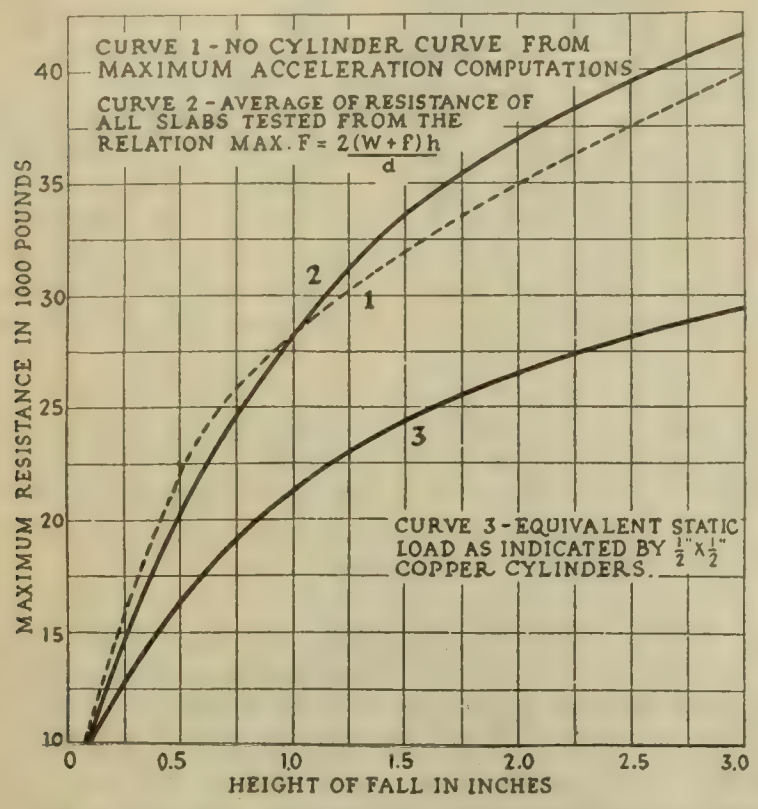


Fig. 6—Curves showing the relation of computed values of static equivalent loads and the static equivalents as measured by copper cylinders

From the foregoing results it is apparent that a definite relation exists between the force of impact as computed from the space time curves and the equivalent static load as indicated by the copper cylinder. It will be noted also that while the impact force, computed by the several methods has different values, a definite relation is shown between each value and the copper cylinder values, thus making the curves of practical use as a means of measurement of force. The indications are that the average force of impact as derived from the curves is one-third the maximum as derived from the tip of the curve, and the static load which produces the same deformation of copper is double the average or two-thirds of the computed maximum.

It will thus be seen that we have been able to express impact in terms of an equivalent static load and through this medium of expression we are enabled to compare the intensity of impact exerted on road slabs tested as already described.

In curve 3, Fig. 6, the equivalent static load is shown as given by the ½ x ½ in. copper cylinder. Curve 2 is the average curve developed from the space time curves taken during the tests of different slabs at Arlington. Curve 1 is the curve worked out by the acceleration method for the equivalent static effect of the blow when no cylinder is used, and while there is no relation between the methods used for curves 1 and 2, they agree within about 5 per cent.

The close agreement of curves 1 and 2 furnishes sufficient proof that a definite relation exists between the effect of impact force and equivalent static load. Curve 1 gives the relation between the equivalent static loads as shown by the copper cylinders while curve No. 2 is twice the average impact forces as computed from theoretical formulæ. The difference between curves 2 and 3 represents the effect of the copper cushion. The ½ x ½ in. copper cylinder values corrected by these differences represent the equivalent static loads which could be expected if no cylinder were used. From the foregoing it can be seen that there is ample evidence to warrant the assertion that the force of impact blows as delivered by the road impact machine can be expressed as an equivalent static load, and thus is secured a means of comparing the resistances of pavement sections when subjected to impact.

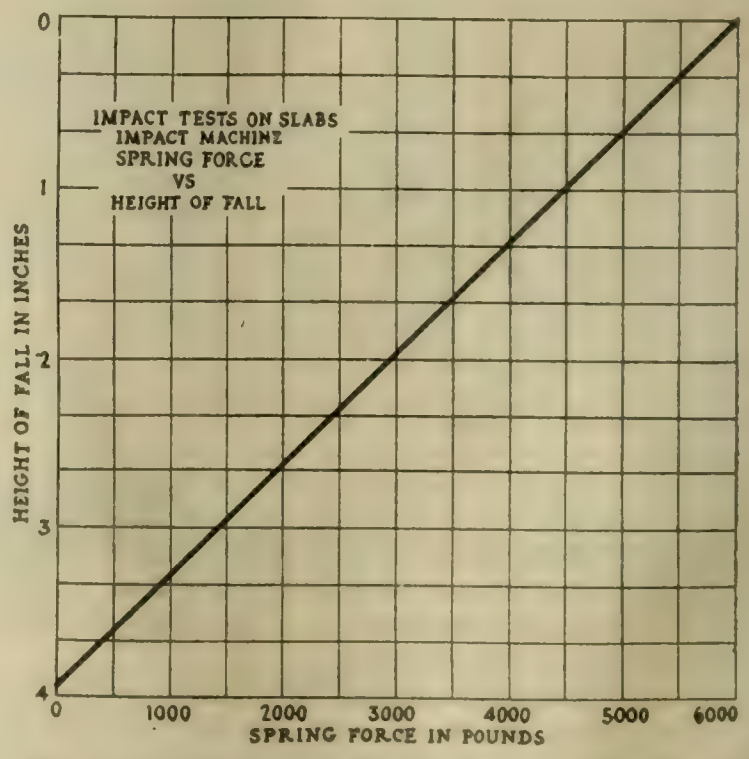


Fig. 7—Average spring pressure for various heights of fall

The Venezuelan Market for Motor Vehicles

An actual need exists in the important cities for omnibus transportation and the cattle areas offer a market for trucks. Road improvement is in a process of rapid development and touring will soon become more popular. Railways are inadequate to take care of increased transportation burdens.

By Harry Chapin Plummer

MOTOR car, omnibus, taxicab, motor truck and tractor opportunities in the Republic of Venezuela are closely linked with the economic vitality and progress of that nearest of all South American nations to the mainland of the United States. Venezuela is vastly more dependent upon motor transportation than is our own country, because the railways and electric trolleys there have been developed in nothing like the ratio to the population and area that the rail and electric lines in the United States have been developed. Even the 1000 miles of superbly constructed, but indifferently maintained, English, German and native railways and the very few urban trolley lines, had accomplished but a feeble and perfunctory advance of the national welfare up to 1910 and 1911. It was in these latter years that the start was made upon the building of the magnificent network of motor highways, now totaling about 2900 kilometers, which in the ensuing decade has well nigh galvanized the social and business life of the natal land of Bolivar.

From the facts as here presented the inference might be drawn that the roads of Venezuela offer an immediate opportunity for the motorist from the North to embark upon a tour of the republic. In theory this is possible; in practice it cannot be counseled. Several reasons, chiefly physical, operate to discourage such an idea at the very outset.

In the first place, the long-bodied, ample-roomed touring car of the de luxe type is, by reason of its length, its breadth and its low structure, ill-suited to the Venezuelan road system, wherein the frequent sharp turns and very steep gradient place such a type of vehicle at a disadvantage—at least until time has been allowed for adjusting its physical conformity to the new conditions confronting it. The Ford, the Hudson-Essex and the Buick five and seven passenger cars, and other similar cars, have proved their adaptability to the peculiar contour of the country traversed by the main trunk line and lateral highways of Venezuela. Nor even can the owner of one of these several makes expect to encounter a free and unrestricted field for operation. Many peculiar local and natural factors are automatically set against him. At certain seasons, the rains; not a deterrent to travel over the central highways before designated, but one to be reckoned with by the motorist unacquainted with the roads and the topography of the country. At other, and almost all times, the mist and fog in the mountains and the startlingly abrupt changes of temperature experienced over relatively short stretches of territory. And always there is the consideration of difficulties arising from travel after dark, which may overtake one in runs, the duration of which, both as to distance and time, may have been underestimated. These details are suggested not to discourage, but rather to encourage, the idea of motor travel in Venezuela, by stressing the need for intelligent preparation and prior understanding. When intelligent preparation marks the initial stage of a motor tour of Venezuela, the maximum of safety, comfort and pleasure is sure to follow.

Motor trucks are brought into the country, as a rule, for purposes specifically different from those that actuate the importation of passenger cars, and usually, too, under a more preconcerted, if not contractual, arrangement. The experience of the road engineers employed by the Venezuelan Ministry of Public Works has proved that the three-quarter to 1 ton, or even 1½ ton truck is the type of commercial vehicle best adapted to the average highway of the republic. It is true that trucks of much larger weight capacity are employed in and about the principal cities, but for interurban traffic and long runs, and especially for use on the roads traversing the mountains, the smaller,



Cement paved thoroughfare with trolley in Caracas

more compact type is conceded to present the greatest measure of utility.

There are few omnibuses owned or operated in Venezuela, but it is no exaggeration to state that the field for that type of vehicle is one of the best in the world. A very few small buses were put into operation some years ago and they have since continued to ply regularly between the Capitolio, in the center of Caracas, and Petare, a populous and picturesque suburb some twelve or thirteen kilometers out. These buses seat not more than fourteen persons—the seats run lengthwise—but during the "rush hours" of early morning and late afternoon traffic and on Sundays and feast days they carry twenty-five passengers within and on the steps and not a few on top and at intervening times a sufficient number on each trip "to keep going." And this despite the fact that the buses operate in competition with a well-equipped railway line which maintains a half-hourly passenger service in each direction between Caracas and Petare and at a lower fare than that charged by the buses.

Buses Needed in Some Cities

There has long been friction between the Federal Government and the monopolies controlling telephone, electric light and trolley services in Caracas. These concerns are owned by British capitalists. Although the city has an almost ideal trolley system, with a five-cent fare and generous transfer privileges and a well-maintained schedule, it is no common secret that the Government is seeking the first pretext to terminate the "stranglehold" it avers the Britons have obtained upon the public utilities of the capital. When the time arrives that any inroads can be made by the Government upon the trolley service, buses, without doubt, will be the medium employed as an entering wedge, since legal and physical limitations—the latter imposed by the narrow streets and a fast-growing automobile traffic—would render impracticable the construction of new and competing trolley lines. Even if a threatened *coup* of this nature does not materialize the degree to which bus lines could serve the newly populated outlying sections of Caracas are many and obvious.

A like condition prevails in Valencia, where an English corporation operates a north-to-south and east-to-west trolley franchise, but leaving large and thickly populated areas within the squares formed by the arms of this traction cross without anything like adequate transportation service. Several important growing suburbs would benefit greatly by bus lines. Another populous center in even greater need of buses is the big port city of Puerto Cabello, where there is always an abundance of money in circulation and which is the seat of the *astillero nacional*, combined naval and military machine shops, shipyards and dry dock, and the British-owned *congelacion de carne*, or refrigerating plant. Great numbers of well paid, skilled workmen are employed in these and other factory establishments in Puerto Cabello and all live considerable distances back from the waterfront, where the factories are located. At present they walk to and from work. That city has long been a "live" trolley prospect; it is an even better potentiality for bus traffic. The railway station in Puerto Cabello is about a mile from the custom house, steamship landing and the several hotels about the waterfront, and nothing but the hired touring car is now available for transportation between these important points. Trains arrive twice daily at Puerto Cabello from Valencia, while there is an average of daily arrivals of trans-Atlantic and coastwise steamers.

The real "bonanza city" for the installation of a motor-bus service, however, is Maracay, capital of the State of Aragua, residential seat of the President-Elect and Dictator, Genera Juan Vicente Gómez, and an industrial center ranking second to Caracas. Many important Government offices and bureaus are located at Maracay, which is virtually the garrison city of the republic for the Venezuelan army. As in Puerto Cabello, the railway station is several blocks distant from the large hotel, which happens to be "Venezuela's least worst" and equally so from the residential section about the hotel.

Taxicabs are an unknown quantity in the Venezuelan cities, yet a condition exists to-day which presages the early advent of these public carriers. The present hired vehicle for getting about Caracas is an old French landau type styled a "coche" and drawn by a single horse and afflicted with a gong which the driver insists upon sounding at every revolution of the wheels. It is obsolete and cannot survive. It was in its hey-day when Caracas, not so many years ago, was an ill-paved, ill-lighted, unsanitary city and something light was needed to negotiate the cobblestones here and the ruts and lakes of mud there. In those days one took a chance with one's life and limb in venturing out of the city proper into the suburbs in any way save on horseback. Now the beautiful Paraiso, a modern boulevard, and any number of admirable avenues and roads tempt the average person to a motor-run at night.

The only alternative for the busy man by day or the pleasure seeker by night is the limousine hired from a public garage. These are availed of to a considerable extent, but their expense and size are such as to render them unsatisfactory.

Possibility of Taxi Installations

Infinitely better than the slow, old *coches*, a taxi of the type familiar to the big American cities could compass the attractive city and suburban drives by day or night and prove to be much swifter and more satisfactory for business uses during bank and office hours.

Maracay, Valencia and Puerto Cabello should prove to be excellent centers for the establishment of taxi services, while La Guaira, the chief seaport, has its bonafide opportunity for this class of vehicle in the fact that two important resort communities—Macuto, "the Newport of Venezuela," and a very attractive seashore place, and Maiquetía, a rendezvous for Caracas' folk of wealth and leisure when cool weather prevails in the capital and, besides, an active industrial center—are within a quick taxi run, in opposite directions, of the steamship dock, custom house, railway station and business section of La Guaira, one of the foremost of Venezuela's commercial centers. A trolley line operates between these three places, but it serves mainly the laboring element and holiday crowds.

Although the English railway extending between Caracas and La Guaira is a never-failing "gold mine" for its shareholders, because of the constantly increasing traffic between the two cities, within a very few years there has been a steadily growing number of travelers between Caracas and American and European centers which have come to make the trip of 36.5 kilometers (it is only about nine kilometers, as the crow flies) by motor car over the magnificently constructed zig-zag road. This because of the stunning views to be obtained, the greater comfort and the time saved. It takes a little more than two hours to accomplish the journey by rail; a little more than an hour by motor-car.

The rate of depreciation of automobiles and motor trucks in the republic is higher than in the larger countries of the North, but it is not greater than in many parts of both the United States and Canada, where road conditions are considered to be good, especially in mountainous and hilly sections of those countries. If a vehicle is maintained and used principally for touring or service in the chief Venezuelan cities and on the main highway

system of he republic, and granted that it receives proper care and attention upon the part of its driver, not only on the road, but in the garage and at times when it is not actually running, and provided, also, that worn mechanism and parts are replaced and cleaning and oiling are constant and regular, it should wear well for almost as long a period as in any but the most highly developed road regions of North America.

The surface of the Venezuelan roads, in and about Caracas and the Federal District, Valencia and Maracay, is generally of cement or macadam, and on the longer stretches of rural roadway a gravel is employed, which, being resilient, exacts no undue strain upon either machine or tires. The grades and the curves, without doubt, are depreciatory factors, yet granted that these are negotiated with no more of the caution and care than are essential to the physical protection of the driver himself and the occupants of the car, they will not prove to be serious deterrents to the maintenance of a car in a satisfactory condition.

Engine over-heating is a common occurrence, due to the intense heat of the sun upon the metal forestructure of the automobile and the fast running over level stretches and downgrades and the friction incident to hill-climbing.

In the cities outside of Caracas the rate of depreciation will depend entirely upon the extent to which a car is run on the streets outside asphalted or otherwise well-paved areas. In Valencia or Puerto Cabella, for instance, it will be found to be possible to maintain a car in admirable condition for almost an indefinite period, provided the poorly paved streets, the number of which is being quickly reduced in those two communities, are avoided. This is true, probably in an even greater degree, of Maracay, and, certainly, it is equally true of La Guaira and Macuto and Maiquetía.

Motor trucks naturally are subject to a greater degree of depreciation in the cities of the interior than are passenger cars, since it is the streets in the "downtown," or business section of each community, having cobbled pavements or being mere dirt roads more or less neglected and subject to furrowing by heavy rains in the season, that they have to negotiate. Nevertheless, Caracas, Maracay and Puerto Cabello, three of the best paved cities in Venezuela, will show any number of trucks, up to five tons capacity, of varying sizes and makes, that have long served their owners and are continuing to do so because of the clean, level, cement or oiled natural dirt thoroughfares over which they are operated.

First of Venezuela's economic problems is cattle raising; the second is cattle transport. Extreme difficulties lie in the way of the successful movement of livestock from the vast, sea-like grazing areas far in the interior to the tidewater outlets at Puerto Cabella and Ocumare de la Costa —the latter a new free port but recently established by the Government.

The grazing lands begin at points within thirty kilometers south of the Caribbean coast-line, on the upland *llanuras* immediately beyond the mighty wall formed by the coastal spur of the Andes Mountains, and extend for hundreds of kilometers over those *llanuras*, over a second and smaller range of mountains, and over the *llanos*, or great plains, to the Orinoco and the Apure, Arauca and other tributaries of that great stream. Of course, by far the majority of cattle are raised on the *llanos* proper, far to the south of the *llanuras*, or highland plains, and the second range of mountains referred to. A fair proportion of cattle find their outlet through Ciudad Bolivar and other Orinoco ports, whence they are transported by steamer to the British Island of Trinidad, off the Venezuelan coast and the Delta of the Orinoco. At Port-of-Spain they are slaughtered in a large British plant. The major number of cattle, however, move northward over the *llanos*, as the dry semestre draws to its close, and converge at a point called "La Boca de los Llanos," (the Mouth of the Llanos), approximately 165 kilometers from the coast. They have come from the *llanos* under an equatorial sun, usually under conditions of drought and dust and the long journey on the hoof has spelled but one thing—depreciation. Thenceforth this is increased, because the benefits of the cooler and more moist climate of the higher altitude are offset by literal climbing of the interior range of mountains. Then they must continue their "run" across the *llanuras*, under trying conditions of temperature and atmosphere, to the great coastal range and thence to Puerto Cabello or Ocumare they encounter a climb, followed by a steep descent, that reduces their qualities as beef pretty nearly to the minimum by the time they enter the run-way to the killing establishment



Many of the best roads parallel railway lines. This will aid rather than hinder truck transportation development, however, since the railways are constantly becoming less capable of handling traffic between major commercial points

at the former city or reach the point of embarkation at either port.

Three splendid lateral motor highways extend from Caracas, Maracay and Valencia, the chief cities of the *llanuras*, to their respective seaboard gateways, La Guaira, Ocumare de la Costa and Puerto Cabello, but the grades, the frequent curves, the marked changes of temperature between the starting point on the *llanuras* and the apex of the watershed and between the watershed and the coast ports, the danger of loss by the falling of animals over the dizzy edges of considerable stretches of the roadways, as, also, from reckless driving of motor cars on the roads, render the movement of cattle on the hoof one of increasing hazard. In fact, there now is relatively little livestock traffic between Caracas and La Guaira, that being no longer an outlet for the industry and automobile and vehicular movement having become so dense as to imperil animals en route. Next in this respect comes the road between Valencia and Puerto Cabello, which is the main artery for cattle to the coast to-day. The Caracas-La Guaira railway and the Valencia-Puerto Cabello railway transport very little livestock.

By reason of a negligible volume of other traffic and the fact that the Maracay-Ocumare highway, but lately completed, was built expressly with the idea of the accommodation of cattle in mind, that road offers much better facilities for their passage on the hoof. However, the refrigerating plant at the port thus far has only been projected, while the volume of stock "run" to Ocumare

for ultimate shipment from that point up to date has been inconsequential.

Extraordinary as it may appear, for some time plans have been seriously considered in Venezuela for the building of an aerial cable line between those two points, by which two or three animals might be taken at a time in cages up the appreciably sharp ascent from Maracay to the *cumbre,* or summit, and then, by a much sharper descent, to the ship's side at Ocumare. The greatest secrecy attended the examination—a secrecy so profound that every man, woman, boy and girl in the republic shared it.

Of course the motor truck will be found to be the solution of this problem, because the cost of adequate railway facilities over the route in question would be prohibitive in these days of soaring material and labor figures.

Spasmodic attempts have been made, always at "long distance," by one or two American motor truck manufacturers to develop this interesting situation, but it is understood that the reason all bids heretofore made from this country have failed is because they have contemplated five-ton trucks. Such a capacity the road, as constructed, would not stand. It is very much to be doubted if the Ministry of Public Works, which is the deciding factor in the case, would sanction the use of trucks greater than 2½ tons, and two-ton trucks probably would come nearer the mark. But between these two figures a vehicle eventually will be evolved and designed that will economically and efficiently realize this vital issue in the Venezuelan livestock industry, which is largely controlled by General Gómez, Dictator and President-Elect.

If the hypothetical question were to be asked by an American manufacturer of passenger or business motor vehicles as to the procedure that should be followed to realize a market in Venezuela, the response would well be: send down to that country a scout, an intelligent American trained in the mechanics, as well as the sales routine, of the business. Give him time and scope to study the situation and to report back. Have him survey the remarkable industrial field in the "motoring area" of the republic—the coffee, sugar, cacao, balata (rubber), wood, cotton and tobacco production, the cattle raising and the fast sprouting manufacturing activities—and try to arrive, in each instance, at the existing type of vehicle most suited to the needs of that industry, considering its peculiar physical operations, its environment, and all related questions of climate, altitude, the topographical formation of the country about the seat of the industry, road structuring and conditions, the nature of labor to be depended upon for the use, the care and the upkeep of the car, and like details of a relevant and pertinent character. After the mechanical specialists and export departments have developed a "program," send down the highest executive of the organization that may be spared to develop a "point of contact" with the business interests in Venezuela to be singled out for service. Big contracts in Venezuela can be underwritten only by a man having the experience and business knowledge, and, even more important, the immediate authority to act without useless cabling and detailed correspondence. That man must be one of standing and prestige and social qualities. It is infinitely better that he speak the language, but that is not imperative. Business has been done in Venezuela by men who scarcely could order their breakfast in Spanish. Good fellowship and a nice regard for the amenities of society are a prime factor in supplanting the specific appeal of a given product and credit considerations.

There are American and native wholesale and retail houses of the highest rating and proved responsibility to which agencies may be allotted by correspondence after the usual investigation. But the most satisfactory and lasting business results are to be secured, even if through the agency, by the visit to the country of an accredited representative of the manufacturer whose executive position at home may be shown to be so exalted as not only to command the respect and attention of the business interests to be invited to trade, but to create a sense of implied recognition and compliment in the delegation of one of the actual principals to the making of connections in that particular and very desirable market, now only in the infant stages of development by the American automotive industries.

Automobile Factories Wanted in Jugoslavia

AMERICAN capital, machinery and executive talent could well be employed in Jugoslavia, according to a report from Consul Thomson at Zagreb. Automobile factories are among the ones specifically mentioned as being industrial plants for which there is an urgent need. American capital is especially desired, the report points out, because no political motives are suspected and confidence is accorded to American business men. Furthermore about 700,000 native workmen from the district have their homes in the United States and the great influx of their money remittances to relatives at home is one of the financial assets of the region.

With regard to labor conditions in Jugoslavia, a government order limits hours of labor to eight a day in plants employing more than five men. The price of labor, at present rates of exchange, runs from 50 cents to $1.50 a day. Strikes are unusual and all strikes having a political or radical socialistic tendency are forbidden by the government. Six months imprisonment may be imposed upon any person who attempts to prevent others from working.

A foreign firm desiring to work in Jugoslavia must first organize itself in the form of a joint-stock company and register before the competent court in the district where the business is to be located; a concession to operate the business must be secured from the Government at Belgrade, Serbia. Relatively high taxes are imposed in connection with these formalities and, in addition, there are local communal taxes. Export restrictions include heavy export duties and taxes upon the volume of business of the exporter. Under existing laws an exporter must give a guaranty that he will bring into Jugoslavia the equivalent, in foreign values obtained abroad, of the goods exported. These various minute regulations, subject to frequent changes without notice, constitute the only serious barrier to American capital in Jugoslavia.

The steady depreciation in local exchange has a tendency to reduce the price of labor and other costs, if such costs are calculated in American or British currency. It also decreases the purchasing power of the local population with respect to purchases of American goods.

Sierra Leone Improving Roads

AT present the number of cars and trucks running about Freetown, Sierra Leone, only totals 100, says a British Colonial report. Outside Freetown, nothing but light vehicles can operate. The Protectorate, equalling South Carolina in size, is gradually extending its road system, and motor highways are receiving special attention. Sierra Leone has many rivers capable of carrying vessels of shallow draught, and motor boats should find a market.

What Some Dealers Are Thinking

All of the speeches during show weeks were not made by factory executives. Some dealers had their own little talk to make. They didn't get up and speak out in meeting, but they told it to one another rather freely. Here is what a few had to say when talking together informally.

IT is sometimes possible and always helpful for car manufacturers to achieve the expressed desire of Bobby Burns:

"Oh wad some power the giftie gie us
To see oursels as ithers see us!
It would frae monie a blunder free us,
And foolish notion."

It is advantageous to know the honest opinion of those with whom we are doing business, even though we feel that there is good reason for disagreeing with that honest opinion in various ways.

There have been many luncheons and dinners tendered by manufacturers to dealers within recent weeks, and at these gatherings many interesting conversations have taken place that were not audible to those at the speakers table. The conversation which took place between a group of some six or seven dealers within speaking range of the writer at one of these functions is worth presenting to the manufacturers as rather typical of the sentiments that were heard elsewhere during show week. For the sake of facility in presentation the words are put into the mouth of a single dealer, although the sentiments were endorsed by the other dealers present. The function was held by a well-known manufacturer of a standard make car; a manufacturer who has been recognized throughout the industry as an intelligent merchandiser and a sound conservative business man. And here is what this typical dealer had to say:

"That was a great meeting we had in the other room, wasn't it? The sales manager gives us a long talk about how to sell cars; he talks about merchandising methods; the proper way to demonstrate the car we are selling.

"Then the chief engineer tells us about the wonderful mechanical developments which have been made in the car; talks about new models and the excellent product which is being given us to sell.

"But, did you hear a word about used cars? Not on your life! The used car is the only thing that is worrying us right now. If they can tell us how to get rid of the stock of used cars we have on hand, we can sell the new ones quick enough. I don't have to use any special selling or demonstration methods to sell the Sennett car. A man comes into my salesroom and says, 'How much will you give me for this old tin can of mine?' If I give him what he wants, the sale is made.

"I can't take any more used cars in trade. I've been bled white, and so has every other dealer I know. We made big profits a year or so ago, but the factories have taken them away from us. We've been cleaned out right.

"The sales manager just announced that the factory had been operated at 70 per cent of capacity during 1921 and thanked us for our help in making the record possible. I'll say we helped. Do you know what that 70 per cent meant to us dealers. It meant that we tied up all our money in used cars and that we are through now. I wonder what they think they are going to do during 1922. They can't bleed us any more; we don't have the money and the banks have shut down on us. And this is the situation with every dealer in my town.

"We had to take the cars they shipped us. And we paid cash for them. The factory is cold-blooded about it. If you don't take them, you lose your dealership.

"This company has the highest type dealers in the business, but I'll bet there isn't $100,000 in real money among the whole crowd.

"Assets? Yes, they have plenty of assets in the form of used cars, but they can't realize on them. I can't possibly afford to take a used car in trade.

"My quota for 1922, given me by the factory, is 100 cars. At the very best I can make thirty sales to people who have not owned cars before. The profit from these sales will not pay my overhead. And I can't afford to trade on any basis, because I can't get rid of my used cars and have to pay cash for the new ones.

"Could I get rid of those used cars and be on a sound basis for going forward if I didn't have to take any cars for six months? Yes, I could. And I could go ahead all-right if, after having a chance to clean out my present stock, I had cars given to me at the rate at which I could reasonably be expected to sell them.

"There is one thing. The dealers in this organization have a real car to sell and if we can ever get over this used car situation, we will be all right. I wish the factory would stop publishing this house organ designed to tell us how to sell cars and give us pep and take that money to help us out on the used car situation. These dinners and things are all right, too, but they aren't doing us any good. The factories have got to give the dealers a chance to get out from under their used car stock. The situation is the same with all the dealers I know. The used car is the only thing that we are interested in just now."

There is another side to this situation, of course, and the sentiments of this dealer are not entirely justified. Nevertheless, the fact that many dealers feel just this way makes an understanding of this viewpoint of vital interest to every automobile manufacturer. It is with this thought that the opinion is presented.

Unfavorable Taxicab Rules in Calcutta

THE use of American motor cars rated at more than 20 hp., and with a turning radius of more than 30 feet, as taxicabs in Calcutta, is endangered by a local rule put into effect as of November 1, by the Municipality of Calcutta.

The American Consul in Calcutta was requested by the Automotive Division of the Bureau of Foreign and Domestic Commerce to protest a rule excluding taxicabs which exceed 20 hp. R. A. C. rating, and 30 feet turning radius, as soon as this proposed legislation was learned of. The American Consul has not been successful in his endeavors as yet.

Common-Sense Methods Mean Automotive Prosperity

This practical timely speech takes its place alongside Norval Hawkins's recent "Service" talk as one of the really significant utterances concerning the automotive industry. Grant says manufacturers must be prepared to operate at a profit and at the same time sell less units if they are to succeed in the next few years. Ways and means are outlined.

By R. H. Grant*

I BELIEVE that we can look forward into the future with optimism. Let us examine the case and see whether we have any grounds for coming to that conclusion. In order to do that we must go back to 1914. This is old stuff; you have read it lots of times; you have thought it lots of times, but in order to make the picture complete and see whether I can build my case it is necessary to get this as an underpinning and a background.

In 1914 this country was having a hard time to sell goods. At that time I happened to be sales manager of the National Cash Register Company. We had a good selling force, a powerful selling force, but we were having a difficult time in disposing of our product in the quantities that we used to, because the retail merchant to whom we sold was in difficulties. The reason that he was in difficult straits at that time was because we had a new tariff law which had just become effective, and this country was being flooded with goods and we could not keep our own factories running. The goods from abroad were taking the place of the goods that we formerly manufactured in 1911, '12 and '13, and those of you who were sales managers at that time may remember that in October of 1913 we began to find a resistance such as we had not found since 1907.

Along in 1915 that condition all changed. Why did it change? Because the war started, because the countries of Europe were engaged in a battle and quit sending any goods to this country. There was a tariff wall set up, the strongest we had ever known—an artificial one because it was caused by the fact that the shops over there were not thinking about turning out things to sell to us; they were thinking about winning the war.

On top of that there was a demand such as we had never known before for our goods, and we began sending them across the ocean as fast as the ships would carry them.

On top of that there came higher wages, a larger purchasing power on the part of domestic consumers. So we stood in a position, from 1915 until after the Armistice, of shutting off the importation of goods that we had previously bought in other countries. We were shipping tremendous quantities of all sorts of goods abroad; we were in such a state of prosperity and wages were so high that the consumption of the people at home was increased very materially over what it had ever been before.

Under such circumstances it was a matter of whether or not we could fill the orders. We were in the strongest sellers' market that we had ever seen.

The Armistice was signed. It should have been evident to all of us that conditions would change. We slowed up, we watched and waited, and we got a little different condition for two or three months, and then all of a sudden we got considerably more business than we did before.

In analyzing the situation we had forgotten that in filling the demands of Europe we had been holding back our domestic filling of orders. Consequently, that wonderful period that came after the first slowing up after the Armistice came on account of the fact that there was a delay in taking care of home consumption. We took care of that home consumption, and economic principles began to act.

We got just as busy as we could to create all the sales activity we could. Most of us were not in shape at that time to do anything with the prices. Most of us had big fixed charges to take care of. We expanded, our properties were bigger, maybe we had some borrowed money. We were just in that condition in many instances where it took that anticipated bunch of sales to carry along these expansive methods and these large organizations so we woke up in January with this in front of us: we have got to cut our overhead. Some people hopped away back in the fall, and if not back in the fall, at least in January, and cut their overhead as low as they could and got their operations on the safest and soundest basis they could, and they took every means at their disposal to decrease their inventories and get down to some kind of a reasonable inventory basis.

They began to do the sound thing, and that was a sounder thing by a great deal, even though it entailed hardship and loss and was one of the most difficult things that the managers of business in this country ever had to do; nevertheless it was a sounder, saner thing than we did in the previous fall, early in the fall when we should have been doing that thing but hoped against hope that this tremendous volume of sales would come. Well, we have been through a year of that liquidation and it has been a hard, tough year in many, many instances, but we have done wonderful jobs, generally speaking.

I want to say that the plant to-day that cannot sell less product before it comes to the turning point between profit and loss is in a very bad way.

*General manager, Delco-Light Co. Condensed from a paper read at the annual Chicago dinner of the S. A. E.

Now as to that optimism business. We have been through a period of liquidation. It started in the basic materials. It hit wool and leather and cotton and copper and such basic things before it hit the articles that we sell. It has been going on and on until in foreign production and in a lot of our basic materials we are practically down to pre-war prices.

As to the consumption abroad of our products, there is one cause for great optimism that exists, and that is that in the consumption of basic raw materials, the shipments to Europe have fallen off in quantity but very, very little.

On farm products, which I happen to know more about than other things, being in the farm business, there was only 6 per cent less of grain that went to Europe in the first nine months of 1921 than in the first nine months of 1920. There was a falling off of values, to be sure, because the stuff didn't cost so much, but there was only 6 per cent less shipped; in other words, Europe has not been hit so hard but what she still has a vast purchasing power for those raw materials that she absolutely has to have.

If we are going to get prosperous conditions in this country we have got to get the farmer back into buying goods, and the farmer is going to come back buying goods for the reason that a great part of the surplus that is produced Europe will take, and every indication is that she will take just as much this year as she did last year.

Did I think that liquidation was going to proceed completely to its ultimate limit, then I would say it would be two or three years before we could get into the same optimistic frame of mind that we can get into now if we understand the situation.

Along about this spring it looks to me like we are going to take the path of least resistance. Already your wholesale prices are showing a tendency upward. They started a few weeks ago; they tumbled back again; they are going to take another start, and we are going to do business again in fair volume—no boom-time basis, none of your inflation stuff, but prices in certain lines that have not been liquidated will still keep on coming down. We used to be on the tenth story in the war. We have hit down about the fourth story now. We are going to stop a while and do a fair volume of business on the fourth story, and after we have done it there for a few months, we are going to have another slowing up period and come down to the third story and finally one of these days we are going to get down to the ground.

That is the thing that has happened in the past in similar situations. Never did liquidation run to a point where everybody was evened up before business resumed itself again. It won't this time, I believe, and I think if you will consult the best authorities on that subject you will find them in agreement with that principle, and that is why I am optimistic on the coming year.

This is the time when the head of a business ought to be surrounded by at least four good business men working hand in glove with it. I think that in the past we have been too highly specialized in our four departments. My idea of running a business is that there should be a head, then there should be a financial man, then there should be a manufacturing man, there should be an engineer and there should be a salesman. I believe that in our past operations great extravagances have often been set up because we had four specialists in that line all working to their own ends and disregarding the interests of the other fellow. To-day we come to a point where those four men should know something about each other's business and they should co-operate and give us the best team play that is in them.

I believe that every business these days should be budgeted. I believe that the comptroller of every business should have passed in to him a statement fifteen days before the month in which the money is going to be spent, showing just exactly what every department head is going to spend. I believe that should be gone over and that the man should not be permitted to spend the money until that budget has been OK.'d and questioned and considered by the comptroller. I don't believe that any man running a business has any right to have a fellow come up to him and say, "I think we need a new floor in here," and reply, "Yes, go on and put it in."

It is my inclination to believe that in the selling end of the business sales are going to be difficult. Sales were difficult in 1911, '12 and '13, but we got a good volume. We were pretty keen as salesmen in those days; we were pretty hard; we were well exercised. We got out of practice during the war; we have got to admit that; things came too easy, and we are pretty much out of practice yet. Some men—I will refer to our own business—absolutely laid down under the conditions and did not try to sell anything; they don't know whether they can or not; they are just overcome, so they are laying on their franchise. Other men were of sterner stuff; they went out and met the conditions and they got results.

What should we be doing in the sales end of the business? First, the management of the business (and, by the way, the chief engineer ought to know something about the selling, and so should the treasurer, as well as other executives) should sit down and analyze what they have got to do. A great mistake that all of us can make this year is trying to do impossible things in selling goods. I can take you to a section of the country where, in our particular business, if you spent $100,000 in sales overhead you would come out at the end of the year with about as many lighting plants as two good-sized fellows could sell under normal conditions. It isn't in the woods in those particular territories. Why should we make the mistake of burning up a lot of money trying to do the impossible thing?

But that is not the general condition. There are thousands of communities where sales can be made. Let us pick them out; let us put the best one at the top and the next one down below and so forth, and get them listed according to their resistance. Let us not burn

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HERE are a few of the major points made by Grant in his outline of necessary steps for automotive manufacturers during 1922:

1. **Be prepared to make a profit, although fewer units are manufactured.**
2. **Promote greater correlation of financial, sales, production and engineering departments. The head of each of these departments should have a good working knowledge of the problems of every other department.**
3. **Budget organization expenditures and stick to the budget.**
4. **Analyze markets, and merchandise the product only where it can be sold at a profit. Study is necessary if this is to be done.**
5. **Make only such production changes as will show an immediate saving. Let those changes wait a while which will take ten years to pay for themselves.**

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up a big advertising appropriation advertising to dead ones. Let's take that money and advertise to live ones. Let's work the spots that are good for all that is in them just as hard as we can work them.

The main danger that I see in an optimistic attitude as far as sales are concerned is through a lack of that proper analysis and spending a lot of money trying to do the impossible thing. Then when the balance is struck at the end of the year you have spent the money in advertising or in sales effort, but you haven't got the results. So I say let's know our territories and let's demand from the territories where the business is the ultimate in that business. Let's put our money in there.

On the manufacturing end of the business it seems to me that every economy that can be practiced and effected should be put into force. I am not very sympathetic this year with this business of saving a half a cent on some operation and getting a $20,000 machine to do it. I am not very sympathetic with this wonderful expert writing down where operation comes in in its proper sequence if we have got to tear our factory up in order to follow out his instructions and get that result. I am not in sympathy with some change that is merely for looks or for some whimsical reason on the part of one fellow who is not a business man, who takes out one row of machinery and substitutes another in its place which is entirely different. I have had the experience of going away for a couple of weeks and when I came back I went down some familiar aisle and saw something was changed. I said, "Where are those grinding machines?"

"Well, you see, on account of doing such and such we had to take those out and put these in."

"What for?"

"Well, on that operation we save a quarter of a cent." And I said, "Yes, and it will take you a million years to get it back again." I don't want to indicate by that that we should not have breadth in our management. I don't want to indicate that we should not look into the future and that we should not get our costs down as low as we can, but instead of doing it in that highly technical way because we want to show Mr. Manufacturer what a wonderful shop we have got, let's do it in a business way and then probably we won't do it in 1922 at all. Let's take those suggestions, make up a 1923 book and begin jotting down the things that we should be planning on for 1923.

I am not in sympathy with these men writing in books that nobody ever looks into. You go through your place and see a fellow with a huge book with little curlicues all over it; four years ago some fellow originated that book and hasn't looked at it for three years. Let's get that all out.

We used to be guarded to death. Great heavens! we had thirty-four of them, I think, protecting the property. You would have thought the place was made of chocolate and all the kids were going to come in and lick it up.

I think that the engineer can do a lot in this business situation. In fact, I think that it is the engineer's period. I think the engineer can take the place of the promoter. As I indicated a few minutes back, you could get away with murder in business, you could make a thing almost any shape and without any appeal and because people couldn't get good stuff they would take bad stuff. That day is over. We have got to give them the values, we have got to give it to them at the right prices, we have got to sell things that really have intrinsic merit in them and we have to rather take the attitude that with this carafe we are buying the other fellow's money; he isn't buying the carafe; we are buying from him if we are selling him the carafe; we are buying dollars from him with it.

I believe the engineer can help in the situation, first by going to the general manager of the concern and saying, "Mr. Man, I want to get to know something about this business. I think I can help you out if I have got a real business understanding of this whole proposition. I would like to meet with the manufacturing man and find out what it is that I can do to help you most." I will guarantee that there are lots of brilliant chief engineers in this country that are running around without any particular business viewpoint that is so crystallized in their minds that it is right in front of them every minute. We need that co-operation and we need it badly, and if that man at the head of the engineering department gets the right attitude he is going to transmit it to every member of the force because he has lots of men in there that can help him arrive at what he wants to do.

One thing that the engineer can do at this time is to take his past accumulated experience, think it out, analyze it and see what he can do with it to make the product better in the coming year.

In addition to that, I think that the engineer can help very materially by studying every known method of getting just as good a product at the very lowest price. I think he can also help out by analyzing the engineering changes that he wants to put into effect. There are two types of engineering changes. There is the engineering change that should be put in immediately because the service department has indicated to us a weakness in that particular feature. It is constantly bobbing up, we are pouring money out in service as the result of a weakness in that place, and the quicker we can cure that the better. There is the engineering change, therefore, that should be put in immediately because the service department has indicated it, as I say. But there is the other type of change that is done more because theoretically or because of some figuring or other it is a highbrow thing that is better than the one we have got now. Let's put that over until 1923. In other words, let's look at it purely from the customer's standpoint. Is he being properly served with the product as it stands? If he is, then leave it alone; if he is not, then put it into effect.

Great economies can be effected (you men who know production know this is absolutely true) by leaving the product alone. If you are eternally fussing it up, it costs the factory an awful lot of money in constantly changing everything over to suit that particular engineering change. It costs money in shifting machinery. and in changing tools.

Here is another thing: When you fixed that one change you didn't take something else into consideration, and lo and behold, when it got out it wasn't in the right relationship to something else and you had another change to make. It is like smallpox. It breeds fast if you don't look out.

I figure the engineer can help us wonderfully by using the very best of business sense in handling those changes that come through. This last thing does not apply so much to this year; it applies all the time. If the engineer is in touch with the selling end of the business he can make things that appeal to the public a great deal better than if he shuts himself up in an office and doesn't know what is going on. So getting out and seeing the product is the thing that counts. I believe that the engi-

neering department, just as much as possible, should be sent out to service the product.

I look forward to this year being a very much better year than last year. I think a wonderful job was done last year in getting back to earth. That will have to still continue in certain lines, but in the main business is going to improve on a sound basis. Don't take it as the final thing; it has to slow up again, come down again, until we finally get to the point where all things are lined up in proper proportion. Let's understand that situation; let's do our part in getting our product so we can make a profit on less sales than we used to get, because all of us cannot get as many sales as we used to get if there isn't as much buying power as there used to be.

That being the case, we have got to operate our property on the amount of sales that we can get, and if we don't there is only one answer: some of us are going to be eliminated in the shuffle. We want to put it across, and the way to put it across is to be lined up in co-operative team play, every man being a business man, every man, though he is a specialist in his own line, seeing to it that his viewpoint and the thing that he does is in the direction of putting the company where it ought to be.

New Bevel Gear Attachment

MACHINING the forged bevel gear blanks as used in the final drives of automobiles has been a rather difficult job, because of the hardness of the alloy steels generally used in this vital part. After considerable preliminary work The Warner & Swasey Co. have brought out an attachment for their No. 3-A universal hollow hexagon turret lathe, for which they claim that it will materially reduce bevel gear costs. The attachment interchanges with the top slide of the regular carriage, so that the machine may be used part of the time on other work or continuously on bevel gears. In construction the attachment is heavy and rigid, so that cuts up to the limit set by the cutter strength may be taken. It may be set for any angle and the machine will take gear blanks up to 14 in. in diameter.

The operation of the machine with the attachment is as follows: The two tool slides are operated by the hexagon turret and saddle. Rack A, which is mounted on the hexagon turret, engages double pinion B. When the turret is moved toward the head of the machine, rack A revolves pinion B in the direction shown. Pinion B engages rack C and transmits to it a sliding motion toward the rear of the machine and rotates two double pinions D, which engage with racks E fastened to the tool slides. The front slide operates on one side of the gear, the rear slide on the other, and both operate at the same time.

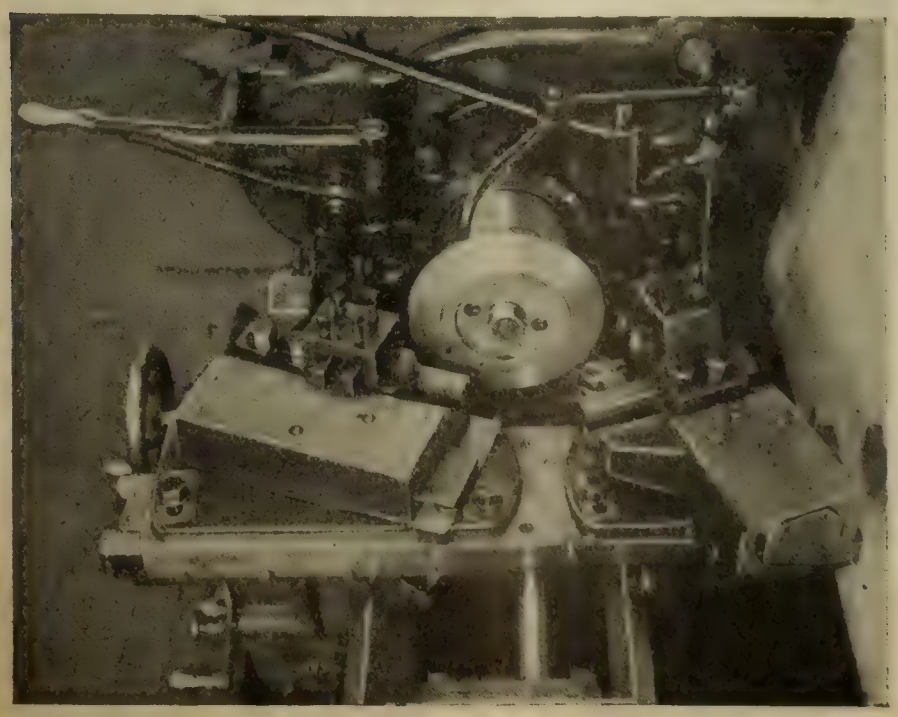
It is believed by the makers that many automobile plants and gear shops can profitably operate a No. 3-A universal hollow hexagon turret lathe with this attachment, either part or full time. A patent on the attachment has been applied for.

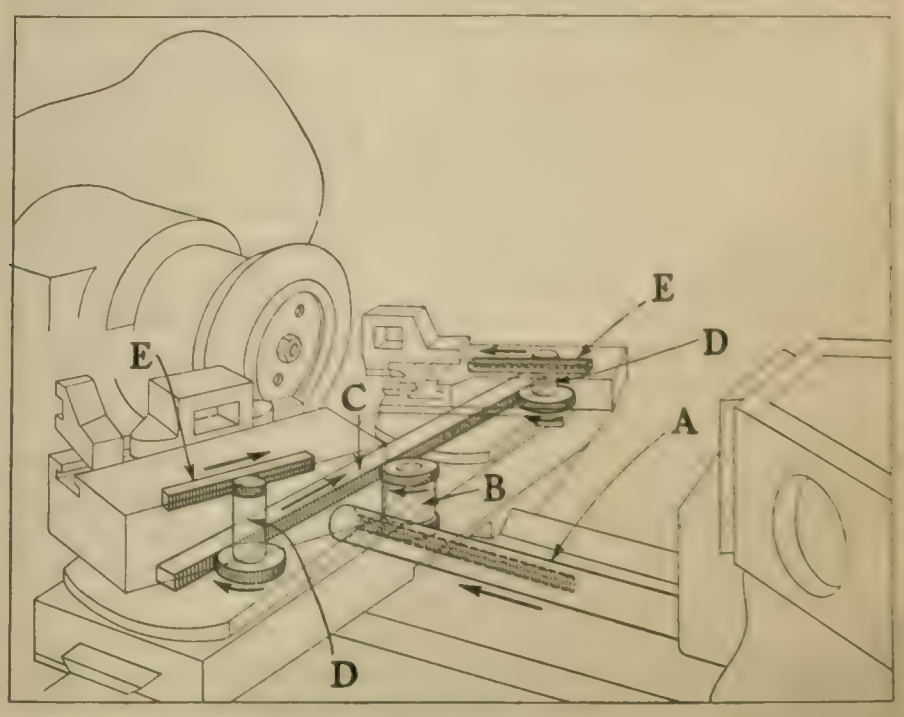
ACCORDING to a statement credited to Captain Guest, head of the British Air Ministry, Germany now has ten commercial air lines in operation, as follows:

	Fare in Marks
Berlin to Danzig and Konisberg	975
Berlin to Bremen and Munster	650
Berlin to Bremen and Wangeroog	650
Berlin to Brunswick and Dortmund	800
Berlin to Dresden	500
Berlin to Leipzig, Nurnberg, Munich and Augsberg	1,725
Hamburg to Magdeburg, Leipzig, and Dresden	700
Munich to Constance	400
Stuttgart to Constance	450
Travemunde to Warnemunde, Sassnitz and Swinemunde	550

Some 6,000 miles are said to be flown daily.

Captain Guest also stated: "The German Government is unquestionably fostering civil aviation, which is, however, at the moment considerably handicapped by the restrictions on the construction of aircraft imposed by the Treaty of Versailles. There are in Germany two main bodies which virtually control all air traffic—the Deutsche Luftreederei and the Nord Deutsche Lloyd. The latter comprises some eight or ten companies—the most important of which are the Rumpler Albatross, Sablatnig and Junker concerns. A large number of societies have been founded throughout the country with the object of stimulating interest in and promoting the development of aviation in all its civil aspects."





Two views of Warner & Swasey turret lathe attachment for manufacture of bevel gear blanks

Experiments in Labor Organization Showing Results

The practical benefits that resulted from establishing personal contact and confidence between management and labor in the days when business was good are shown in times of stress in business circles. Workers, in some cases, voluntarily accepted reduced wages when conditions were explained.

By Harry Tipper

GENERAL discussion concerning labor matters continue to appear in the public press, but these discussions are confined very largely to the question of wage rates and the supposed effect of these rates upon production. Since 1914 many organization experiments have been started with a view to adjusting these matters in the individual organization. These experiments have been in motion for some considerable time now. They are settling down to their practical operation and indicating some of the effects that may be expected therefrom.

Prior to the war for twenty years individual establishments had been conducting business with organizations very different from the usual type and involving some of the changes that were applied more generally during the war. In all cases these organizations had for their object the reduction of "turnover," the settlements of individual grievances, the increased co-operation between employees and employer, and the elimination or reduction of strikes.

In addition to these experiments in individual establishments, plans for the development of improved relations between employers and general bodies of workers were instituted in Rochester, in Cleveland and in other places. These matters have had the attention of general writers occasionally in the magazines and newspapers, and somewhat more frequently ir the general industrial papers. They have not been followed very closely, and their progress is likely to be missed by the casual student because they receive little attention and no particular emphasis in their actual workings.

During 1921 the discussion on such matters was taken up almost entirely by the question of wages, particularly wage rates. The relation between wage rates and production costs entered into the discussion to some extent, but not sufficiently to alter the conclusions. Very little reference has been made to the history of wage rates which show a continuous rise, in general, for about one hundred years, and no conclusions have been drawn from the fact that past history does not show any successful wage reductions other than extremely temporary in character and limited in scope. It is interesting to note also that practically no attempt has been made to determine the influence of these experiments in organization upon the wage rates and production condition in the individual establishments involved. The plans instituted between employers and general bodies of workers have not shown any tendency to a better understanding of the wage question. They have been able to adjust wages in these cases to the immediate requirements without the difficulty and unrest caused in other cases. There are no visible indications of a further examination into the wage question or any attempt to put it into the discussion in its relation to production cost. In so far as these general plans provided machinery for the discussion of pertinent subjects between the representatives of the workers and the employers in the locality, they have prevented considerable loss of time and unrest and have improved the general situation. They have not illuminated the question of increased efficiency per man nor the relation between the pace and the production under any particular wage condition.

An important reason for the absence of discussion upon this point has been the increase in efficiency of the individual worker during this depression, an increase which is to be observed whenever employment becomes less than the number of workers to a sufficient degree to bring the fear of unemployment prominently before the individual.

In order to consider the present position of some of these matters it is necessary to turn to the individual establishments and examine the progress they have made under the organization plans effected previous to or during the war. An examination of these matters shows a very considerable variation in the progress of the different concerns. It was to be expected, of course, that those organizations established before the war under the conditions existing at that time would show a greater degree of progress than those established during the stress of war times. These experiments represent only a small percentage of the total number. It is only possible to find one or perhaps two in any industry. Consequently, it might be argued that their success was due to peculiar conditions and not to the organization change effected. The argument is not valid because the mere fact of local circumstances would not provide immunity from labor unrest and the reduction of turnover enjoyed by some of these concerns. Neither would it wholly answer the voluntary reduction of labor by the workers or the voluntary reduction of working hours and the marked improvement in efficiency over the average secured for the industry in that locality or in general. However, it is perhaps more important to consider the several hundred organization changes undertaken during the war period, involving organizations of all sizes and operating in many lines of industry. Some of the organizations making these changes during the war period employed at that time from 20,000 to 40,000 workers and some of them employed only from 500 to 1000. This wide variation gives the student an opportunity to examine the relative progress of the present conditions

and perhaps the general possibilities a little more closely than the earlier experiments that are confined to a few in number and do not embrace the wider variety in size.

In the largest establishments the progress has been much slower in general. This was to be expected of movements having in view a greater measure of human contact, a more effective consideration of human incentive and knowledge, depending for their progress largely upon the inspiration, patience and understanding of those leading and controlling the work. In the larger organization the labor turnover has been more severe, the fluctuations in the total number of workers greater, and the co-operative feeling much more difficult to establish. Nevertheless, the conditions in these establishments show a very definite and marked progress toward a better spirit than that which existed before they were undertaken, and also a better condition than that which is exhibited in the general industry at this time.

The best that can be said about organization experiments in the larger establishments is that they have made sufficient progress to offer encouragement and hope of their future as business gets back to production capacity and the employment becomes more general in these lines, provided, of course, that the changes in control due to the financial conditions do not destroy the organization developments built up during the last two or three years. It is a question whether some of these organizations will continue along the lines adopted at that time because of the changes in financial control and the widespread changes in the executive personnel and the general leadership under which the experiments were started.

In the medium-sized plants employing from a few hundred to a few thousand workers progress is much more definite and its effect upon production and wages much more important in its significance. The period of depression has afforded an excellent opportunity of observing these conditions. The outstanding features in these cases are:

First—The voluntary reduction of their own wages by the workers upon an explanation of the conditions facing them.

Second—The increase of production of the individual so that the reduction of wages was made unnecessary by the reduction in labor cost.

Third—The absence of any unrest or difficulty in the transfer from abnormal employment to subnormal employment and in the voluntary reduction in the number of hours worked by each individual so that a larger body of workers could remain at work a part of the time.

Not all of these effects have been observed in any one establishment, but one or the other has been observed in most of the establishments concerned.

In one of the small plants in the Middle West, manufacturing parts in the heavy metal trades, the owners of the establishment were able to keep it working at a satisfactory production rate because the workers voluntarily agreed to cut their wages and the owners agreed to cut their profit so that prices could be established to the point required to secure the business.

In another plant in the Middle West the workers increased their production pace so that it was unnecessary to reduce the wage scale, and, at the same time, when the unemployment in other factories in the same district became severe they undertook to share the work with those who were unemployed, so that twice the number of workers could secure some income during the severe period.

Instances of this kind have come to our attention in a number of cases, and in every case they have been a result of three primary causes in the factory organization:

1. The existence of a personal contact and confidence between the executives of the factory and the workers.
2. The existence of some form of machinery previously established, whether formal or informal, for the discussion of problems mutually affecting the management and the workers.
3. The development of a part of the reward in accordance with the increased service.

It is the quiet, daily operation of organization in facing the practical necessity that proves the value and indicates the progress. A great deal of discussion occurred when these changes were being made, but the executive in industry could learn more from watching the present progress than from the discussion of the original changes.

Japan Developing Aviation

INCREASED demand for aerial transportation is becoming apparent in Japan, says a report from H. F. Hawley, American Consul at Nagoya, who declares this situation will probably open up sales opportunities for American air-craft manufacturers.

The establishment of an aerial training school in Nagoya, and the organization of a Lake Aerial Excursion Company is contemplated by a civilian aviator of Kyoto. The latter is planning a visit to the United States for the purpose of purchasing a 400 hp. eight-seater plane.

The reopening of a civilian aviation school at Nagoya, which was temporarily closed, is being planned.

The Mitsubishi Motor Company at Nagoya has made progress in the work of manufacturing the new Mitsubishi type of airplane, and will soon be turning out complete machines. The company's application for permission to establish an aviation field in front of its works at the port, has received official sanction.

A trial flight with an experimental airplane completed by these works, and in which a 300 hp. Hispano-Suiza motor was installed, showed satisfactory results. While the details of the machine's construction are kept secret, it is said to be a high speed fighting plane.

Work has been begun by the Aichi Tokei Denki Kabushiki Kaisha (Aichi Clock & Electric Machinery Company, Limited), on a factory in the neighborhood of Nagoya, to which the works of the company, now at Atsuta, will be moved later on. It is expected that it will be completed by the end of 1922. The present works are capable of turning out one airplane a month, of the Yokosho type; the new factory will have a capacity of 50 planes a month. Special attention will be given to the production of large commercial planes.

The Kawasaki Works of Kobe are contemplating the erection of airplane factories in the Gifu Prefecture. Construction was scheduled to be started in November, 1921, and to be completed in the spring of 1922, when 500 workmen will be detached from Kobe to engage in the manufacture of airplanes.

AN Irish automobile show will be held in February, 1923, under the joint auspices of the Irish Automobile Club and the Irish dealers.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE
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Tariff Export Essentials

THE Automotive Division of the Bureau of Foreign and Domestic Commerce, under the direction of Gordon Lee, has in preparation a series of tariff studies which should prove of considerable value to automotive exporters. The plan is to compile an accurate record of the tariff features in each foreign country, a knowledge of which is essential to the American entering the market.

The industry should follow this work carefully. The survey of essentials, for example, will include such tariff information as: General level and character of tariff; preference; basis of dutiable weight; basis of ad valorem duties; method of duty payment; surcharges; internal taxes on imports; consular and customs regulations; regulations regarding commercial travelers; advertising rules, and trade-mark protection requirements.

This will be kept up to date and the department is to arrange that manufacturers can obtain immediate and accurate information concerning the constantly changing current rates of duty upon specific commodities.

Every department of the manufacturer's organization may save considerable time and money by availing itself of the vast amount of information that is possessed by the Government. Some of this data is not available in convenient form and much of it is simply "born to blush unseen." But an investigation of the various government bureaus will frequently reveal a surprisingly valuable lot of information that the manufacturer might spend considerable time and money to obtain independently.

Too Many Laws

SOMEBODY once said: "Of the making of books there is no end." This was true then and is true now. But the saying might be altered a little to read: "Of the making of *laws* there is no end," without sacrificing the truth at all.

Not only are there too many laws of national application, amplifying or modifying each other, but there are too many laws having a local application only. So that a man may do a thing in one part of the country for which he will find himself locked up in another part of the country.

The motor truck industry—and particularly passenger transportation lines and freight transportation lines over the highways—seem to have been singled out for more than their share of these laws. For example, taxation on trucks and buses of various capacities varies so greatly in the different States that it would be difficult to find two States in which trucks of different capacities are similarly taxed. Moreover, regulations as to the weight of the vehicles, the weight of the loads, the weight per inch of tire width and the percentage of weight on the rear axle are almost innumerable in their variety and complexity.

Not only does this apply to the different States, but it applies in some cases to the different counties and cities within a single State.

A certain motor truck line operates over the highway between San Francisco and San Jose, Cal. In so operating, the line comes under the jurisdiction of three counties and twelve incorporated towns and cities. Each one of these political subdivisions has the power to tax or license the operator of a passenger or freight carrying line, and all of them do so.

For licenses alone, the line has to pay each of these divisions fees running from $7.50 up to $32. These fees average about $16.50. Altogether, they mean an expenditure of about $185 for licenses alone, whereas, if the trucks ran just as often and just as long in a single county, the owner would have a maximum of $32 to pay in license fees, per truck.

But to this figure of $185 must be added the State motor vehicle license, averaging about $30 per year per truck and a personal property tax on assessed valuation of from $200 to $2,000 on various truck units, according to age and size. In the case of this particular line, also, each road truck making a daily call in these communities is liable to a tax (as distinct from the license fees) amounting to about $285 per year

which, based upon an assessed valuation of $2,000, would mean 14½ per cent per year.

Now this tremendous increase in taxation and license fees for operating over long distances instead of operating just as many miles back and forth in the same territory is most unfair.

To assail the operator of trucks who is increasing transportation efficiency is not only unfair and unreasonable, it is exceedingly short-sighted and unprogressive. For the easier and more flexible transportation becomes, the more business and prosperity there will be for everybody.

Four Wheel Brakes

FOR the past decade the question of four-wheel braking has come up at intervals. Such brakes have been tried in this country a number of times and then abandoned temporarily only to spring up here and there on experimental or hand-made cars of small production possibility. In Europe, however, the development of the four-wheel system has gone on steadily and particularly in the cars made where the Alpine region provides a testing ground have they become more prominent.

In America a large per cent of automobiles are never called upon to negotiate a hill which can be called a mountain. Most of our cars operate in country which cannot be characterized by any other title than flat. We have had another influence at work, however, in the increased average speed of travel because of better roads. The braking problem has returned and is more acute than ever both because of this higher speed on the open road and because of the increased speed and congestion on the city streets. Scores of accidents daily testify to the inability of present brake design to cope with the skidding and stopping problems on slippery asphalt. The broken wheel bill of the automobile using public is tremendous.

Does the four wheel brake answer the problem? There is reason to believe that many makers of the higher-priced cars are inclined to think it does. We have had some interesting development in this field. On the other hand, some look to a higher development of the transmission brake and there is much to be said for it, when so designed as to eliminate excessive heating and chatter. The combined internal and external brakes on the rear wheels do not satisfy present-day needs in certain respects, in spite of the fact that under average conditions they are good. It will be interesting to watch brake development in this country during the next three years.

The Ultimate Motor Bus

IT has been the sentiment of engineers throughout the industry for some time that the ultimate motor bus is still to be developed. Minor changes in bus chassis have failed, in most cases, to provide an entirely satisfactory vehicle for bus service. The factors involved in the construction of the 100 per cent motor bus have not yet been thoroughly analyzed and laid out. It would be interesting to develop, on a theoretical basis, an outline of the ultimate motor bus. It would be worth while for a number of competent engineers to do this, each in accordance with his own ideas. A comparison of the results would be illuminating.

Taking the standpoint of the rider, for instance, what factors are most important in the motor bus—comfort, speed, cost. . . .? Dividing these major factors into their component parts, how could the features desirable from the public's viewpoint be co-ordinated with the exigencies of engineering design?

Then also the possibility of operating at a profit must be considered, and this factor is affected to a certain extent, at least, for the original design. In noting the comparatively conservative progress that has been made in this country along the lines of special bus chassis design, it is interesting to note the rumor that one prominent manufacturer has completed the design for a low-priced, specially designed motor bus which will combine comfort and low-cost features. It is expected that this bus will be in production in the near future. The design is such that there is no body frame, the body resting upon cross-members of the underslung chassis frame. There are other distinctive features which render this new job of special interest.

It is mentioned here, however, merely as an example of the work that is going on in some responsible quarters, which indicates the conviction that the market is open for the company which can produce the ultimate motor bus.

"Gone Are the Days"

THE days of the old-fashioned press agent and his product are gone so far as the automotive industry is concerned. The press agent story is finding itself less and less welcome, even in the columns of newspapers which print considerable publicity material in their automobile section. The real reason such stories have lost caste lies in the fact that most sales executives have come to recognize how ineffective they are. Their very flagrancy eliminates the possibility of belief on the part of any intelligent reader.

A few samples of the press agent story, however, still come out now and again to refresh our memories of the days when P. T. Barnum publicity was considered effective in making automobile sales. Such an incident occurred recently, when a long "news" story was sent out by one manufacturer containing statements that simply were not true. This company sent out as facts a series of purely imaginary incidents, and asked the papers to print them as facts. To say the least, this is not ethical or sound business practice.

1922 Statistical Number

THE demand for extra copies of the 1922 Statistical Number, to be published Feb. 16, has already assumed considerable proportions. Those desiring additional copies of the number should place their order at once.

Lincoln Sales Leap as Ford Buys

Reach High Record Under New Control

Executives of Two Plants Confer Relative to Co-ordination of Policies

DETROIT, Feb. 8—Sales of Lincoln cars in the two days since the company passed into the hands of Henry Ford have reached record-breaking proportions. Factory estimates place the total at upwards of $2,000,000, almost $500,000 of which came from New York City alone. All important sales centers are represented in the total.

While the factory force and equipment are being whipped into shape to meet this deluge of business, Henry and Edsel Ford are meeting daily with Henry M. and Wilfred C. Leland for conferences with executives of the two plants to work out a permanent plan under which the company will operate. Every phase of the Lincoln policy is being studied to determine how best the facilities of the Ford Motor Co. can be co-ordinated with them.

Take Up Sales Field Expansion

The expansion of sales territory to include points in which Lincoln is not now represented is one of the questions under consideration. It will be determined at the conferences whether Ford dealers at these points will be authorized to sell the Lincoln car through the present Lincoln distributor organization or direct from the factory. In this connection it is noted that sales for the past two days have been entirely by the old Lincoln sales force.

It is considered unlikely there will be any change in the present system of building the car in the Lincoln plant, although the facilities of the Ford assembly plants will figure largely in the servicing plan.

Executives of the purchasing, production and sales departments of the two plants are meeting with the Fords and Lelands in separate conferences which are practically continuous and take the participants on hurried trips from one factory to the other. It is asserted that no official statement will be forthcoming until the program for the future is definitely formulated.

Immediate Price Reductions

The first announcement made after Ford's bid of $8,000,000 for the Lincoln plant was accepted last Saturday by Federal Judge Tuttle, was of price reductions ranging from $700 to $1,200 on the various Lincoln models. The touring car was cut $1,000 to $3,300, which brings it within $150 of the seven passenger Cadillac, which sells for $3,150. The seven passenger Marmon touring car is priced at $3,700, the six passenger Mercer at $3,950, the six passenger Noma at $3,200, the seven passenger Premier at $3,250, the six passenger Stutz at $2,990 and the seven passenger Winton at $3,400.

Announcement of the fixing of the new Lincoln prices at a level higher than had been expected has had a stabilizing effect on companies in the higher price classes. It had been expected that an even more radical reduction would be made. A

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NEW LINCOLN PRICES SHOW BIG REDUCTION

	Old Price	New Price
7 pass. Touring	$4,300	$3,300
5 pass. Phaeton	4,300	3,300
4 pass. Phaeton	4,600	3,800
Coupe	4,950	3,900
5 pass. Sedan	5,400	4,200
Town Car	6,000	4,800
7 pass. Sedan	6,000	4,900
7 pass. Limousine	6,000	5,100
4 pass. Judkins sedan	5,900	5,200

Northway Back in Old Company as President

BOSTON, Feb. 7—Ralph E. Northway, who recently severed his official connection with the Northway Motors Corp., has returned to that company as president and general manager. His election followed the resignation of James F. Cavanagh as president and general manager and of James F. Finneran as secretary and treasurer. Cavanagh was elected chairman of the board of directors, a new office, and William W. Caswell was elected a director, secretary and treasurer.

Caswell is treasurer of the Arthur D. Little Co., Inc., of Cambridge and vice-president of the International Abrasive Co. He has a high financial standing in Boston.

Northway is the designer of the motor which bears his name and is regarded as one of the most valuable assets of the Northway Motors Corp. After he resigned his official connection with the company he became associated with other interests in the purchase of the Harley Co. from the Hendee Mfg. Co. It is assumed he will retain this interest.

Makers Satisfied with Chicago Show

Encouraging Record of Sales Made—Lessons Given Salesmen Prove Effective

CHICAGO, Feb. 4—The Chicago show has closed with a decidedly encouraging record of retail sales and with a placing of wholesale orders by visiting dealers which seems to be quite satisfactory to a majority of the manufacturers.

Attendance throughout the week was heavy, with mid-week evening crowds that established new records for the Chicago exposition. Buying was more generally spread around than at New York, probably because there was no such disturbing element as the wave of price reductions which accompanied the earlier show. The announcement of the Dodge Brothers reduction, which was smaller than the public had been expecting, seemed to exert a stabilizing influence which was not seriously affected by the mid-week reduction announcements applying to the Nash Four, Dort and National.

Both the manufacturers and the local and visiting dealers watched with interest the experiment inaugurated by the Chicago Automobile Trade Association in training salesmen in the show to tell a unified story about the industry. There were some deviations from the plan and some salesmen violated the rule against criticism of competing cars, but on the whole the men took up the idea enthusiastically and the solicitations in the exhibits were above the average.

There was keen competition among the salesmen to win the $50 daily prize offered for the best solicitations. Business men rather than trained investigators went the rounds as judges and reported much excellent work. One day it was necessary to make a selection out of fourteen names of men whose work was almost on an even basis, and every day decisions were hard to make.

WARFORD ASSISTING LEE

WASHINGTON, Feb. 6—L. E. Warford, formerly field representative of the American Automobile Association, has been assigned to the Automotive Division of the Bureau of Foreign and Domestic Commerce for the purpose of obtaining foreign data and other information of value to the automobile industry. He appears as a special agent of the National Automobile Chamber of Commerce and will assist Gordon Lee, chief of the division. Warford is a resident of Seattle.

Factory Schedules Reflect Optimism

Parts Makers' Business Shows Improvement—Truck Outlook Is Distinctly Encouraging

By James Dalton

NEW YORK, Feb. 7.—Tentative production schedules in the Detroit district for February reflect the confidence inspired in manufacturers by the interest in motor cars displayed by the public at the New York, Chicago and other shows held thus far. This increased activity has resulted in better business for the parts makers.

The industry as a whole believes the corner has been definitely turned and that improvement from now on will be continuous although slow. Prices seem to have slipped somewhat into the background, and the prospect of cutthroat competition is not as menacing as it was a month ago, when so much emphasis was placed on price at the New York show.

Prices Being Stabilized

Reductions made by Dodge Brothers, which were viewed with alarm by many companies when the "mystery announcement" was first made, now are expected to exert a stabilizing influence. The cut was only about half what was generally expected, and is another indication that few more concessions can be expected in the lower price classes until production costs can be scaled down again. There is little present prospect of a further lowering of costs. In fact, the Franklin company has increased by $100 the prices on three of its models.

The most unsettling factor in the higher price field is what Henry Ford will do with the Lincoln Motor Co. As soon as he gained control price reductions running up to $1,200 were announced. An effort is being made to determine how many cars can be absorbed this year with a view to establishing a manufacturing schedule on this basis. It is expected that many Ford dealers will handle the Lincoln.

Truck Conditions Different

Conditions in the truck field are somewhat different because price adjustments have not been so general in that branch of the industry. When it was accepted that there was no demand for trucks and therefore no business to be had, there was no particular incentive to revise prices, but now that the market is showing signs of life there are indications that the course of events in the passenger car field will be duplicated. Several reductions have been made recently and several more are in prospect.

The outlook for trucks is distinctly encouraging. Most of the manufacturers have got down to the bottom of their inventories and are giving releases on materials which have been held up for months. A really good farm market is in prospect within a few months when cash becomes a little more plentiful in the agricultural districts. Farmers are buying even now on a small scale in some sections. Expansion on the co-operative marketing movement inevitably will involve the use of thousands of motor vehicles.

A feeling of greater confidence now pervades all branches of the industry. The year is expected to be one of readjustment, but it is felt that it will be one of progress and stabilization.

NEW PARTS BUSINESS IS BEST IN MONTHS

NEW YORK, Feb. 3—The volume of new business received in the past two weeks by parts makers has been larger than at any time for several months. Not only are substantial orders actually being placed but the large number of inquiries received indicate that a larger business is in prospect for the near future.

Large orders for supplies are being placed by the Gray Motor Corp. and by the Rickenbacker Motor Co. It is understood Gray is buying on the basis of 20,000 cars.

In consequence of the sales which the last fortnight has brought the parts makers are more optimistic than they have been for some time, although they have no expectation of doing anything like a capacity business this year.

Fenn Advises on Proposed Truck Laws in Canada

NEW YORK, Feb. 8.—F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, left Monday night for Montreal, where he conferred yesterday and to-day with the automobile interests of the province in regard to legislation which has been proposed to restrict the use of trucks of more than 3½ tons capacity. Fenn's advice on this subject was asked because of the limited experience Canada has had. Conferences were arranged for him with the heads of large transportation companies, dealers and the Government automobile bureau.

Fenn will deliver addresses to the students of Toronto University to-morrow and Friday on the subject of highway transportation.

White Inaugurates New Bonus System

Jobs Divided According to Skill of Employees, 10 Classifications Resulting

CLEVELAND, Feb. 6.—The White Co. has put into effect a new bonus plan for employees for the purpose of reducing turnover of labor and increasing labor efficiency. The bonus is in addition to all hourly wages paid, is independent of the regular compensation paid and it is not to be confused with the piece work system.

In the plan quality of workmanship is of prime importance, for only good pieces that pass rigid inspection qualify the worker to earn a bonus.

Under the system all jobs in the factory are classified according to the skill required of the worker. Each job is placed in one of ten bonus classifications. Classification charts and standard jobs are in the hands of the superintendents and are posted in the factory so that the workers may ascertain what job and bonus class cover his work.

Standard Table Adopted

A standard table of fatigue and rest allowances, classified according to the job, has been adopted in addition to the standard job and bonus class. From 10 per cent to 22 per cent allowances are made for fatigue and rest, most of which are granted on jobs that put the greatest strain on the worker.

After the job has been studied and classified a bonus chart and instruction card is filled out and given to the worker. This card outlines the method by which the work should be done, giving equipment, set-up, total time for each part of the operation, total net time, time allowance for fatigue and the standard time for doing the job.

In order to arrive at the standard job and bonus classifications, time studies were made by the men who formerly had been practical workmen and foremen and who have from three to five years study experience. Studies were made of each job at least three times so that the chance for error was reduced to a minimum.

Bonus Begins at 60 Per Cent

The bonus chart is set on the standard time of the instruction card for 100 per cent efficiency, but a man begins to earn the bonus when he reaches 60 per cent of the standard and the bonus chart also shows the amount of money which may be earned by increasing the output.

As long as the operation is performed in accordance with the instructions, equipment, method, etc., outlined on the bonus chart and instruction board the bonus will not be lowered nor will the standard classifications, together with the rest and fatigue allowances be altered.

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International Cuts Prices on Tractors

Says Ford Forced It — Reduces Lists of 10-20 Titan Models $200 and 8-16, $230

CHICAGO, Feb. 4—The International Harvester Co. claiming it was forced into a price war on tractors by the $230 reduction on the Fordson has made almost an equal reduction on its two models of Titan. The 10-20 has been reduced from $900 to $700 and the 8-16 from $900 to $670. The new prices include a one or two bottom P & O plow or a tractor disk harrow. This offer holds good until May 1. In the equipment on the Titan is included friction clutch pulley, fenders, platform, throttle, governor, adjustable draw bar angle lugs and brakes. This equipment is valued at $100.

In a statement given out to the public the International Harvester Co. says:

The International Harvester Co. has announced price reductions of $230 on two-plow tractors and $200 on the three-plow tractors, effective immediately.

Until May 1 next, the company will present to every farmer purchasing one of these tractors a two-furrow or three-furrow plow or a tractor disk harrow.

President Harold F. McCormick said:

This reduction is not justified by any present or prospective reduction of manufacturing costs. It is made chiefly to meet competition and to enable our dealers to maintain their position in the trade. The burden of this reduction and the cost of the plows or harrows presented to purchasers will be borne entirely by the company.

Franklin Raises Price $100 on Three Models

SYRACUSE, Feb. 3—An increase of $100 in the prices of three of its models, effective Feb. 1, is announced by the Franklin Automobile Co. The price changes follow:

	New Price	Old Price
Touring car	$2,450	$2,350
Runabout	2,400	2,300
Sedan	3,450	3,350

All prices are f.o.b. Syracuse.

NATIONAL LOWERS PRICES

INDIANAPOLIS, Feb. 4.—The National Motor Car & Vehicle Co. has made reductions in price as follows:

	Old Price	New Price
7-pass. Touring	$2,990	$2,750
4-pass. Touring	2,990	2,750
3-pass. Touring	2,990	2,750
4-pass. Phaeton	3,500	3,250
7-pass. Phaeton	3,600	3,350
Coupe	4,140	3,890
Sedan	4,240	3,990

SAMSON REDUCES $220

JANESVILLE, WIS., Feb. 6—The Samson tractor division of the General Motors Corp. has reduced the price of its model M tractor from $660 to $445. The cut comes a week after the reduction made on the Fordson tractor. The new price is said to be the lowest ever quoted for a tractor of the size and capacity of the Samson.

DORT LISTS REVISED

FLINT, MICH., Feb. 4—The Dort Motor Car Co. has made price reductions, effective at once, as follows:

	Old Price	New Price
Touring	$985	$865
Roadster	985	865
Sedan	1,685	1,445
Coupe	1,535	1,315

Other Revisions on Page 301

Will Direct Foreign Trade of Rubber Association

NEW YORK, Feb. 6—Work of the foreign trade division of the Rubber Association of America will be carried on by a new executive committee headed by F. E. Titus, director of sales for the International B. F. Goodrich Corp. While no statement of detailed plans for the coming year has been made, the general policy of the foreign trade division will be continued. It is designed to promote trade intercourse between the United States and other countries by the dissemination of information regarding trade conditions abroad, credits and local methods of transacting business. One purpose is to make as intelligent and uniform as possible the methods of Americans engaged in foreign trade.

Titus is thoroughly familiar with the export field. He went with the Goodrich company in 1906 and became sales manager of the International corporation when it was organized. He also served as manager of the foreign trade division of the Akron Chamber of Commerce and as a trade advisor at the convention of the National Foreign Trade Council in Cleveland last year.

Caley Is Chosen to Head Show Managers Association

CHICAGO, Feb. 6—Fred H. Caley, secretary of the Cleveland Automobile Manufacturers and Dealers Association, was elected president of the National Association of Automobile Show and Association Managers at the annual meeting here. He succeeds E. E. Peake, secretary of the Kansas City Motor Car Dealers Association, who has been president since the organization was formed. Peake retired because of pressure of work in connection with his private interests.

Robert E. Lee, secretary of the St. Louis Automobile Dealers Association, was elected vice-president, and Neal G. Adair was re-elected secretary-treasurer. Headquarters will continue to be maintained at the office of the secretary-treasurer, 239 West 39th street, New York. The officers, with Price Wells, secretary of the Louisville Automobile Dealers Association, and W. H. Shuart, secretary of the Detroit Automobile Dealers Association, constitute the board of directors.

Bank Creditors Aid Locomobile Plans

Propose Buying Property at Sale —Other Interests Offered Opportunity to Join

NEW YORK, Feb. 6—While no announcement has been made of the plans contemplated for a reorganization of the Locomobile Co., it is understood the bank creditors propose to buy in the property at a receiver's sale and put in some new money, giving stockholders and merchandise creditors an opportunity to join with them. The receivership application filed at Bridgeport was proposed by the bank creditors, but there were no objections from the representatives of the merchandise creditors who have served on the creditors' committee which has had charge of the company's finances since it was separated from Hare's Motors.

Colonel Elmer H. Havens and Edwin A. Travis have been appointed ancillary receivers of the Locomobile Co. in New York by Federal Judge Mack. Their bond has been fixed at $100,000.

The assets of the corporation are estimated at $4,750,000, exclusive of real estate upon which no valuation is placed in the papers. The assets consist of $1,000,000 in cash on hand and in banks; $1,000,000 in plant and equipment; $1,000,000 in raw materials; $800,000 in manufactured cars; $500,000 in parts and accessories; $200,000 in used cars and trucks; $140,000 in trucks; $60,000 in bodies and $50,000 in investments.

No estimate of the liabilities was contained in the papers filed in this jurisdiction, but the original receivership application placed them at $5,000,000.

Will Protect Assets

PHILADELPHIA, Feb. 9—Federal Judge Dickinson has appointed Elmer H. Havens and William S. Horner ancillary receivers for the Locomobile Co. to take charge of the assets in this city pending the proposed reorganization of the company. Homer is general manager of the Philadelphia company.

Oshkosh Tractor Abandons Plan to Absorb La Crosse

MILWAUKEE, Feb. 6—Inability to finance adequately the enterprise has resulted in the abandonment by promoters of the Oshkosh (Wis.) Tractor Co., a Wisconsin corporation with $1,200,000 capital, of the plan to take over the business of the LaCrosse (Wis.) Tractor Co. and erect a new factory in Oshkosh. Foundations for the plant were laid last fall, an investment of $200,000 being contemplated. The new Oshkosh concern had actually taken over the plant, equipment and business of the LaCrosse company, but the contract has now been abrogated by mutual agreement, and liquidation of the Oshkosh business is under way. The liabilities are only $10,000 to $12,000 and are amply covered.

Dunlop Tire Defers American Operation

Company Will Not Seek 1922 Business—Conditions in International Market Blamed

BUFFALO, Feb. 7—Hope for early activity at the big plant of the Dunlop Tire & Rubber Corp. is again deferred by a statement issued with the sanction of Parry D. Saylor, vice-president. Regarding rumors of changes in organization here and of immediate resumption of operations, Saylor said that the whole subject was covered in the statement which reads as follows:

"Prevailing conditions in the international rubber market have prompted the Dunlop Tire & Rubber Corp. to postpone the resumption of activity at its American plant on River Road.

"It has been hoped that operations would get under way during the present winter and spring, but the directors of the company have decided, after a careful survey of conditions, not to seek 1922 business. The construction and equipment work necessary to put the plant into a production sufficient to operate on a profitable basis could not be accomplished before the best of the season's business had already passed.

"Further developments are, therefore, postponed until such date as will permit the company to take such advantages as an early start for 1923 may provide."

It was stated yesterday at the plant that members of the present staff may be called to England for service in the parent company during the interim. Certain of the engineering and factory force will be retained in Buffalo in order to protect the plant and keep all the machinery and equipment in good order.

Dunlop's international organization is now in much better shape. All inventory losses have been written off by the English company, and business for the present fiscal year is in very satisfactory shape.

Seaman Chosen Treasurer of Milwaukee Employers

MILWAUKEE, Feb. 6—H. H. Seaman, president of the Seaman Body Corp., and the W. S. Seaman Co., manufacturing passenger car bodies and specializing in closed types, was elected treasurer of the Milwaukee Employers' Council at the annual meeting. Herman A. Wagner, president Wisconsin Bridge & Iron Co., was elected president; Richard P. Tell, president National Brake & Electric Co., vice-president, and Joseph McC. Bell, secretary and manager.

The council was organized in the fall of 1920 and now has a membership of thirty-one of the major industrial groups in Milwaukee and suburbs. The council did not begin to function until the early part of 1921 and already has become an important factor in industrial relations here. Among the principal groups embraced by the membership is the Automotive Manufacturers' Association, Metal Trades and Founders' Association, Vehicle Manufacturers' Association, Brass Founders and Finishers Division, Sheet Metal Manufacturers Association, etc.

The aims and purposes of the Employers' Council as enunciated in its "Declaration of Principles," are:

1. To promote on a fair and equitable basis, industrial peace and prosperity in the community, and the steady employment of labor.
2. To provide proper safeguards for the health and safety of the employees.
3. To secure for employer and employee alike freedom of contract in the manner of employment.
4. To discourage strikes, lockouts, and unfair demands by either employer or employee.
5. To uphold the principle of the Open Shop.

Two New Chassis for Bus Service Built by Selden

ROCHESTER, N. Y., Feb. 4—The Selden Truck Corp. has brought out two new chassis known as Units 31 and 51, especially designed and constructed for bus transportation service.

The unit 31, rated at 2½-tons, has a wheelbase of 147 in. and a Continental engine 4⅛ x 5¼ in. It can be geared to make either 18 or 25 m.p.h. It has a seating capacity of 18 and a similar standing capacity.

The unit 51 is rated at 3½-tons, has a 177 in. wheelbase and carries 60 passengers, including seated and standing. The engine is a Continental 4½ x 5½. Either 18 or 25 m.p.h. may be had.

Reliance Truck Brings Out New Design of Snow Plow

APPLETON, WIS., Feb. 6—The Reliance Motor Truck Co., manufacturers of Reliance motor trucks, is bringing out a new design of rotary snow plow designed especially for clearing highways. A drum, 8ft. diameter, contains an auger, the whole being mounted on runners and attached to the front axle of a motor truck. Motive power to turn the auger at 400 r.p.m. is derived from the truck power plant. The device also is adapted for attachment to tractors.

Patents have been applied for. Initial models are under experimentation on dirt and concrete roads near Appleton under supervision of the county and state highway authorities.

WILMER BACK FROM BRAZIL

NEW YORK, Feb. 6—Gradual improvement in business conditions in Brazil was found by E. G. Wilmer, president of the Goodyear Tire & Rubber Co., who has returned from a trip to that country. Sales of his own company in Brazil are better than ever, he declared. Wilmer believes the curve of tire business in this country is still headed upward and that the "manufacturer who can keep his costs down and his quality up, may hope for satisfactory business during the coming year."

Moral Hazard Idea Seen in New Plan

Underwriter Divides Policy Holders Into Six Classes to Decide Most Unfavorable

NEW YORK, Feb. 6—One of the largest automobile underwriting companies has decided to divide its automobile policy holders into six classes this year in order to decide just what class of policy holder yields the most unfavorable experience. This plan is a practical application of the contention of the insurance committee of the National Automobile Chamber of Commerce that the moral hazard should be given greater consideration by insurance companies.

The announcement of the company in reference to the classes into which it has divided its policy holders follows:

1—High grade business men with incomes of $5,000 a year or more. Into this class will be placed only substantial, solid business men who are connected with growing concerns and not experimentors or speculators.

2—Laborers, mechanics, and workers of various kinds with an annual income of about $2,500. We will place in this class principally union labor.

3—Those using their cars in their daily work, i.e. doctors, salesmen, etc.

4—Farmers, and ranchers, and dairymen, etc.

5—The young, unmarried men, clerks, and all who have not yet arrived, so far as a permanent business connection is concerned.

6—The undesirables that we are forced to write for one reason or another. All risks that we feel from the start are not good will be placed in this class.

Pierce-Arrow Arranges Loan to Pay Claims

NEW YORK, Feb. 3—It is understood in banking circles here that an arrangement has been made by the Pierce-Arrow Motor Car Co. by which it has obtained $1,000,000 in cash, which will be used to pay all merchandise creditors. These claims, it is stated, will be liquidated within the next two weeks.

Not all the cash will be required for this purpose, and a considerable sum will be left in the hands of the bankers to be drawn upon as required. The business of the company, especially in its truck department, is more satisfactory than it has been for a long time. Orders for a considerable number of trucks now are on the books and more are being received.

MID-WEST RUBBER ELECTS

CHICAGO, Feb. 6—At the regular monthly meeting of the Mid-West Rubber Manufacturers Association officers were elected for the coming year as follows: President, W. W. Wuchter, Nebraska Tire & Rubber Co., Omaha; first vice-president, Thomas Fallen, Lion Tire & Rubber Co., Lafayette, Ind.; second vice-president and treasurer, Samuel J. Turner, Brunswick-Balke-Collender Co.; secretary, C. S. Sutherland.

Value of Tellurium Just "Discovered"

Anti-Knock Compound Hailed by Press as Revolutionary Fuel

NEW YORK, Feb. 7 — Considerable excitement was caused in speculative circles last week by a United Press dispatch from Dayton which said that "discovery of a tellurium gasoline compound which increases automobile mileage 100 per cent over the present gasoline fuel was announced at the research laboratories of the General Motors Co." It was stated that the discovery was made by Thomas Midgley, Jr., and Thomas A. Boyd. As a result of this report, General Motors common stock went up a point or more.

The only trouble with the dispatch was that it was not given out at the General Motors research laboratories, and tellurium is not designed to be a substitute for gasoline.

Midgley and Boyd have been working for many months on the theory that fuel mileage could be materially expanded by redesigning internal combustion engines so that the compression would be increased provided some element were added to the fuel which would take out the cylinder knocks.

There are several anti-knock materials of which di-ethyl telluride is one of the most effective. According to Midgley, road tests have demonstrated that by increasing compression and using di-ethyl telluride an increase of from 80 per cent to 125 per cent in mileage can be obtained. This subject was discussed at the semi-annual meeting of the Society of Automotive Engineers last spring in connection with a paper by Fred C. Ziesenheim on "Developing the High Compression Automotive Engine."

The United Press dispatch naively added that the annual supply of tellurium was only about 60 tons while 1500 tons would be required to meet the annual consumption of gasoline.

Move to Put Tax on Gasoline Grows

NEW YORK, Feb. 6—Indications now are that several additional states will align themselves this year with the fifteen which already have imposed taxes on the sale of gasoline. The present tax is one cent a gallon in all states except Oregon, where it is two cents.

Legislation calling for a gasoline tax already has been taken up by eight more state legislatures. In some instances several bills have been presented covering the same general subject.

A bill which will be offered in Maryland by the administration will call for a gasoline tax to wipe out an old deficit resulting from highway construction. It will not be opposed by the motoring interests because it has been stipulated that this tax will be in lieu of all other automobile taxes. The danger is, however, that the present administration cannot bind later administrations to keep its promises.

Two bills have been presented in Mississippi. One calls for a state tax and the other would authorize counties to impose a tax together with a wheel tax. The state bill would impose a tax of one cent a gallon together with special taxes on distributors and dealers.

Two bills also have been presented in Virginia. One provides for a straight tax of one cent a gallon and the other for a tax of two cents a gallon with an impost of $25 on distributors and $5 on dealers.

Other states which propose an excise tax on gasoline are Massachusetts, Nebraska, New Jersey, New York, Rhode Island and South Carolina.

M. A. M. A. Headlight Group Names Cattell Chairman

NEW YORK, Feb. 7—The following officers have been elected by the headlight device group of the Motor and Accessory Manufacturers Association:

Chairman, J. H. Cattell, secretary-treasurer of the Warner-Patterson Co., Chicago; vice-chairman, Charles Franck, manager of the Holophane Glass Co. of New York; secretary, Frederick H. Ford, manager of the road lighter department of the C. A. Shaler Co., Waupum, Wis.; treasurer, Howard H. Parker, sales manager of the Macbeth-Evans Glass Co., Pittsburgh.

The next meeting of the group will be held at the Hollenden Hotel in Cleveland, April 4 and 5. One of the most important activities which the group is expected to take up is that of standardization.

Rubber Makers Oppose Egyptian Cotton Tariff

NEW YORK, Feb. 6—The legislative committee of the Rubber Association of America will be directed by the board of directors to present strong opposition to the proposal before the Senate finance committee to apply a higher tariff on Egyptian long staple cotton. The purpose presumably is to protect growers in the American Southwest.

Tire manufacturers, who are the principal consumers of Egyptian long staple cotton, do not believe the higher tariff would result in equalizing the price levels of the Egyptian and American product. They feel it is unsound from the standpoint of international trade to impose a high tariff when so little benefit would accrue to the domestic industry.

CHICAGO FRANKLIN LEADS

SYRACUSE, N. Y., Feb. 6.—The Franklin Motor Car Co. of Chicago led the list of Franklin dealers in 1921. Chicago jumped from third place in 1920 to first in 1921. The five Franklin dealers who took the largest number of cars during the past year were in their order: Chicago, New York, Boston, Los Angeles and Pittsburgh.

Lee Finds Better Conditions Exist

Government Official Reports Upward Trend in Industry— Met Dealers at Shows

WASHINGTON, Feb. 6—Analysis of the automotive industry in all of its branches by the Automotive Division, Bureau of Foreign and Domestic Commerce, shows that the industry has been on the upward trend during the last 30 days, due in some measure to price stabilization and the belief among manufacturers that the price war is ended.

Gordon Lee, Chief of the Division, returned today from the Chicago show and expressed the belief that the bottom had been reached in prices and that sales and production will increase steadily during the spring months, especially with renewed confidence on the part of dealers.

Lee contrasted the New York and Chicago shows by saying that the former was characterized by a frenzy of prices, while the Chicago show witnessed actual sales and revival of interest among dealers. Interviews with dealers convinced him that the dealer is becoming more discriminating in the selection of manufacturers. This is explained, he said, by the fact that many dealers have barely made living expenses and others have been forced to the wall during the past few years. Dealers now insist upon obtaining assurance of better terms in service and parts from companies financially sound.

It was found by Lee that many dealers from the South, the Southwest in particular, reported excellent prospects in their territories but had purposely held off purchases for a few weeks until they were convinced that prices had become stabilized. The Federal official believes that the domestic outlook is optimistic in every respect.

First Unit of Kelsey Plant Formally Opened

NEWARK, N. J., Feb. 7—The first unit of the new factory of the Kelsey Motor Co., which will manufacture the friction drive Kelsey car, was formally opened to-day. The building covers 32,000 sq. ft., with a large frontage on Washington Street. In the rear is a side track connecting with the Erie railroad. The siding is so arranged that supplies can be unloaded on the mezzanine factory floor where materials will be stored until needed.

Speakers at the opening exercises were Judge Robert Carey of Jersey City, President E. B. Slade and General Manager C. W. Kelsey of the motor company. There were a large number of guests who inspected the plant.

About 100 six-cylinder Kelsey cars are now in use and the company announces that it will add a four-cylinder line with a touring car selling at $985.

Wages in Industry Higher Than Average

Alexander Says Part Time Work Has Decreased Income of Automobile Employee

DETROIT, Feb. 7—Statistics covering the wages of workers in the automobile industry were presented by Magnus W. Alexander, managing director of the National Industrial Conference Board in an address here. Six important points were made by Alexander:

Automobile wages are higher than the average for industry in general.

Automobile wages were not increased as much over 1914 as were those of industry in general.

The average weekly income of the automobile worker has decreased rapidly because of prevalence of part time work.

Average hourly earnings in the automobile industry are double those of 1914.

Buying power of the average weekly automobile wage is as great as in 1914 in spite of present part time employment.

Buying Power High

Buying power of the average automobile wage is 25 per cent higher than in 1914.

"Whereas the average hourly earnings of wage earners in the automobile industry were 29.3 cents in July 1914, rose to 70.5 cents in September 1920, and then fell to 58.6 cents in June 1921, corresponding earnings for wage earners in all American manufacturing industry were 24.4 cents in July 1914, 62.4 cents in September 1920 and 52.1 cents in June 1921," Alexander said: "There were eighteen other principal industries which, during the last seven year period, showed a greater percentage net increase of hourly earnings than was shown in the automobile industry.

"In respect to weekly earnings, a slightly different picture is presented because of the influence of part time employment during the 1920-1921 period. Average weekly wages in the automobile manufacturing industry rose from $15.71 in July 1914, to $34.34 in July 1920, equal to 119 per cent increase, and then dropped to $25.40 in June 1921, resulting in a net increase of 62 per cent over the 1914 base line. Average hourly wages in all American manufacturing industry rose from $12.40 in July 1914 to $29.81, or by 140 per cent, in July 1920, and then dropped to $22.89 in June 1921, resulting in a net increase of 85 per cent over the 1914 base line."

Employment Decreased

He further stated:

The total employment in the automobile industry decreased 52.3 per cent from June 1920 to July 1921, and in all industry the decrease was only 37.1 per cent. In the automobile industry the volume of employment reached its low point at the beginning of 1921, followed by a marked revival up to May, 1921, and then by a considerable slump in June of that year.

A comparison of employment in the automobile industry with all American industry reflects the enormous growth of the former as compared with the average for the latter.

There is a relationship between the money wages earned and the prevailing cost of living which must be taken into account to secure an adequate measure of the wage purchasing power of the wage-earner or of his economic status at one time as compared with another time. After all, it is not so important to know how much anyone earns as to know how much he can buy in terms of necessaries and comforts of life with the money that he is earning. To ascertain the purchasing power of the money wage, or the real wage, it is therefore necessary to divide the money earnings by the cost of living; and the result will measure the economic status of the worker.

On this basis the automobile manufacturing industry shows that the hourly real earnings of the workers in June 1921, were 24 per cent higher than those in July 1914, while the real weekly earnings were at practically the same level.

For American manufacturing industry as a whole, the economic status of the average wage-earner had increased during the same period by 32 per cent for hourly earnings and by 14.3 per cent for weekly earnings. The results of this comparison check with the previously stated fact, that to begin with the actual money earnings of automobile workers in 1914 had been greater and had also increased to a lesser percentage during the following seven-year period than was the case with the general industrial workers.

Oakland Motor Car Co. of Canada Being Formed

OSHAWA, ONT., Feb. 8—The Oakland Motor Car Co. of Canada, subsidiary of General Motors of Canada, Ltd., is being organized. Operations will begin early in March and this will mean still more production for the Oshawa plants. Four body styles will be manufactured including a touring car, roadster, coupe and sedan. The car is slightly lighter in design than the McLaughlin-Buick six and somewhat lower in price.

The company already has large orders for the new Oakland six for export shipment. Officers of the new company are: President, R. S. McLaughlin; vice-president, G. W. McLaughlin; secretary, T. S. Merrill; treasurer, M. L. Prensky; assistant secretary, G. W. Hezzlewood. R. D. Kerby has been appointed temporary sales manager to perfect a sale and service organization. This work is in addition to his duties as sales manager of the Oldsmobile company.

NEW BENZ TRUCKS SHOWN

NEW YORK, Feb. 6—The latest models of the Benz-Gaggenau truck, just imported from the factory, are being shown by the Benz & Cie United States Distributors, Inc. The line comprises four chassis, ranging from 1-ton to 5-tons. The 4-ton and 5-ton models are chain driven and the others shaft driven. Bodies to suit any purpose are supplied. The company also makes double deck buses, fire apparatus and a tractor. The American agency will maintain a service station.

Truck Tone Better In New York Field

Indications Point to Large Users Preparing to Enter Market in Spring

NEW YORK, Feb. 7—The metropolitan truck market is developing a stronger tone, especially in the heavy duty class. In the past two weeks there have been repeated indications that fleet owners and large users of trucks are preparing to come into the market again this spring after a lull of more than two years.

The demand is not indicated so much at the present time by actual sales as by the apparent desire of prospects and former customers to consider spring installations.

This more favorable attitude is taken to indicate a strengthening of business confidence and holds the promise of translation into actual truck sales in March and April.

Truck Users Change Attitude

The changing attitude of truck users is one that has been closely observed by the metropolitan truck dealers. It is a matter of history now how the large truck users, with, in some cases, only half of their equipment in operation, closed the doors entirely against the addition of new equipment, and how this, together with the competition from reimported units, held the market stagnant for months.

There is another phase of the situation that lends a rosy tinge to the outlook. That is the fact that many of the heavy trucks in use in this territory to-day have been run to junk through the curtailing of replacements, and thus the used truck will not be the factor in its field that the used passenger car has been.

Up to the present time this upward trend has not made itself felt in the light delivery car class. The purchasers in this class to-day, as in the past year, have been principally the small business man who is just changing from horse-drawn to motor-driven equipment, small stores installing delivery service and similar businesses.

Passenger Car Sales Improve

Sales of motor cars in January were considerably better than the same month last year, and in most lines there is indication of a slowly increasing demand extending to the peak of the spring season.

Dealers in all price classes are pointing to the Ford and Dodge Brothers reductions as indications that the bottom has been reached and there are intimations that a few price increases may be announced in the near future.

The used car situation in the metropolitan district is assuming more promising aspects with most dealers in and about New York gradually reducing stocks.

Trade on Upgrade Throughout South

Cotton Belt Particularly Offers Opportunity to Companies Contemplating New Branches

NEW YORK, Feb. 6—An investigation of the automotive market made by AUTOMOTIVE INDUSTRIES in various sections of the middle south indicates that business will remain on the up-grade from now on. This seems to be particularly true in the cotton belt, because mills actually are short of cotton and the present price is likely to go even higher, which will add to the prosperity of the territory and also have an important psychological effect.

Good Time to Open Branches

It seems to be the general belief that any companies which contemplate opening southern branches would be wise to do so at this time in order to establish themselves on a solid footing and be ready for business when conditions improve.

Automobile sales for the last three months in the Atlanta district have been much better than in the three months preceding and were somewhat better than the same months of 1921. Accessory sales, however, remain about stationary, and most of the accessory dealers are rather heavily stocked. They are buying on a hand-to-mouth basis and have been for more than a year.

While no material improvement is expected in Atlanta district for the first half of 1922, all indications are that it will be better than in the same period of 1921. Conditions in other lines are steadily improving, and the second half of the year will be considerably better if there are no crop failures.

Dealers in the St. Louis district report that sales for the last three months have shown a marked improvement in passenger cars, trucks and used cars. By intensive selling methods accessory dealers have been able to bring their stocks down to a satisfactory basis, and few of them are overstocked. As a consequence they are buying liberally for future needs.

St. Louis Cheerful

In general, the feeling in the automotive trade in the St. Louis section is more cheerful than it has been for a year.

Many representative automobile dealers in the Louisville district did a volume of business in 1921 which equalled the record-breaking year of 1920. Profits were not quite so large, however, because of the lower list prices. Sales for the last three months have been much better than in the same period last year. Accessory dealers are not carrying over larger stocks, but are buying only to meet immediate needs.

It is expected that the first half of this year will bring a business equalling the first six months of 1921 in the Louisville territory, while the second half is expected to show a considerable increase over the previous year.

Sales for the last three months in North Carolina have been about on a par with the other two months of the year, but considerably less than 1921. Accessory dealers are carrying small stocks, but they show no disposition to buy liberally. Business for the next few months is expected to be slow, especially for cars selling for more than $1500. No other marked improvement is expected before the latter part of the year. The used car situation is unfavorable.

Sales in the Birmingham territory have fallen off a trifle in the last three months, but have been on about the same basis for a year. Accessory stocks are rather short, but dealers are buying only for their immediate needs. No great increase in business is expected for the first quarter, but sales are expected to increase in the second and third quarters, with a very slight falling off in the fourth quarter. It is believed that cars of southern manufacture will have a slight turn for the better as they are establishing better sales connections.

Business in Dallas Feels Effects of Price Reductions

DALLAS, Feb. 7—While complete reports have not been made, there are indications that the retail automobile business in Dallas and practically all north Texas for the first month of the year showed an increase over the closing month of the last year. From a dozen retailers in Dallas it was indicated the increase would be about 10 per cent. The retailers believe the reduction in prices had considerable to do with the increase in business.

Truck men declare their business was slightly increased and that the outlook is brighter. Tractor dealers reported increased business over the last month, but said their sales are still far from the volume during the banner months of 1920. They believe with the farmers ex-1920.

NEW TIRE WARRANTY APPROVED

NEW YORK, Feb. 6—The standard tire warranty and the accompanying revision of milcage adjustment practices recommended by the Rubber Association of America have been approved by 93 tire manufacturers. The list includes all the larger tire companies.

NO INCREASE IN LOAD WEIGHTS

NEW YORK, Feb. 9—Reports received by the traffic department of the National Automobile Chamber of Commerce indicates strongly that there will be no increase in the minimum car load weights on shipments of passenger cars and trucks to Pacific Coast points.

ACCEPT AMERICAN MOTORS BID

NEW YORK, Feb. 9—Creditors of the American Motors Corp. have agreed to accept an offer of $200,000 for the personal property of the company made by syndicates headed by C. B. Penney of Greenboro, N. C.

No Britain Market for American Parts

Prospects Vanish, Due to Import Duty, Trade Depression and Surplus Stocks

NEW YORK, Feb. 7—The market for American automobile accessories and component parts in Great Britain has practically vanished for the time being, according to a summary of the situation contained in a review of Anglo-American trade covering the outlook for 1922, published by the American Chamber of Commerce in London. In its discussion of the situation, these points are made:

For the time being the trade in American automobile accessories and component parts is dormant, and some time may elapse before it revives to any extent.

Likely to Retain Duty

The import duty of 33⅓ per cent is likely to be retained for two reasons—first, that it brings in revenue; and second, the British manufacturers favor its continuance.

In the opinion of those in touch with the British market, articles of special rather than general design seem to offer the best chances for American manufacturers, as there is less competition in the market for "specialties."

Other causes are the general trade depression and the large quantity of surplus stocks still unsold both in Great Britain and in the various dumps in France, and also in the hands of dealers, while another factor in the situation is the prejudice still existing in the minds of the British public against American component parts. This is, however, a diminishing factor, and some firms have overcome it to the extent of putting out a small car fitted with American back axles.

Yet another factor, the full effect of which has yet to be felt, is the vogue of the small car in Great Britain. American manufacturers build neither small cars nor parts of small cars, and consequently British manufacturers are likely to retain the advantage of this trade.

Transshipment Trade Affected

The trans-shipment trade of American parts and accessories, which used to be very profitable, has also been badly hit by the import duty. It is true that goods can be placed in a bonded warehouse immediately on arrival in Great Britain and re-exported therefrom, and so escape the import duty; but this is expensive, and it is doubtful whether any saving is made by this means.

Another disturbing element is the presence of large surplus stocks still to be absorbed. At Slough, the former government depot, there are reported to be large quantities of American accessories and component parts, as well as British, and in addition government stocks are reported in various parts of France as well as stocks in the hands of dealers.

Tax on Cars Yields Decreased Revenue

In Last Six Months of 1921 Reports Show Collections Fell Off $15,579,309

WASHINGTON, Feb. 7—Collections of excise taxes on automobiles for the last six months of the calendar year of 1921 decreased $15,579,309, as compared with revenues from this source during the same period of 1920. A slump of $1,584,735 was reported to the Bureau of Internal Revenue for December 1921, as compared with the same month of the preceding year. The total receipts from the manufacturers' excise tax on automobiles, motorcycles, accessories, etc., during the last six months of 1921, amounted to $57,308,245, as compared with $72,887,554 during the same period of 1920. The total receipts for the month of December 1921, on these products, amounted to $7,336,008, as against $8,922,744 in December 1920.

Truck Returns Less

A study of these tax returns shows that under section 900 of the Revenue Act of 1918, assessments on motor trucks and wagons for the last six months of 1921 amounted to $4,098,904, as compared with $7,494,029 for the same period in the preceding year, or a decrease of $3,395,125 in revenue from this source. The receipts from automobile trucks and wagon taxes during December 1921 amounted to $473,713, as against $663,594, or a decrease of $189,880. Segregated taxes collected on other automobiles and motorcycles from July 1 to December 31, 1921, amounted to $28,606,522, a decrease of $13,150,826. The returns for December 1921 on these items amounted to $3,999,136, as compared with $4,918,626 for the same period of 1920, representing a decrease of $919,489.

The figures for the latter part of 1921 show an increase in receipts from the sale of automobile accessories and parts, amounting to $966,642. The total revenue from this source amounted to $24,602,818, as against $23,636,176. As compared with December 1920, the taxes for December 1921 declined $475,365, as the yield for the month on automobile accessories and parts aggregated $2,863,158.

Directors Elect Hughson Head of Old Timers' Club

CHICAGO, Feb. 7—At the annual election of officers of the Old Timers' Club held here, the directorate nominated in New York during show week was chosen unanimously, and the directors thereupon chose William L. Hughson, president; F. Ed. Spooner, secretary, and J. Edward Schipper, treasurer.

The newly elected vice presidents who are also the directors consist of Captain E. V. Rickenbacker, vice president, Rickenbacker Motor Car Co.; E. C. Morse, director of sales and advertising, C. H. Wills & Co.; Harry Branstetter, Chicago distributor; Ralph Hamlin, distributor in Los Angeles; George T. Briggs, sales manager, Wheeler & Schebler; Harry W. Anderson, general sales manager, Duesenberg Motors Co.; Chester I. Campbell, manager, Boston automobile shows; Horace W. DeLisser, Ajax Tire & Rubber Co.; George W. Hanson, president, Hanson Motor Car Co.; Louis Block, president, Philadelphia Automobile Trade Association; E. E. Peake, secretary-treasurer, Kansas City Motor Car Dealers' Association.

The following directors hold over: Lloyd Maxwell, Thomas J. Hay, Walter Bermingham, Martin L. Pulcher, Richard Kennerdell, Albert Champion, Gregory Flynn and John Younger.

The club adopted a constitution and by laws which will be distributed to the membership.

Nash Four-Cylinder Line Cut in Price

NEW YORK, Feb. 8—Reductions have been made in the prices of the Nash 4-cylinder chassis and is priced at $1350.

Model	New Price	Old Price
Touring	$985	$1,045
Roadster	965	1,025
Coupe	1,485	1,645
Sedan	1,645	1,835
Cab	1,295	1,395

No change has been made in the prices of the 6-cylinder line. The line of trucks for 1922 will be continued with minor refinements, but the ratings have been changed slightly to conform to the requirements of new state license laws. The new cabriolet, which is a five-passenger enclosed car, is mounted on a four-cylinder chassis and is priced at $1350.

LOWER PRICE FOR WALLIS

RACINE, WIS., Feb. 8—The J. I. Case Plow Works has reduced the price of the Wallis tractor and the J. I. Case three-bottom plow to $995. This combination sold a year ago for $2,023.

MIDWEST UTILITOR REDUCED

INDIANAPOLIS, Feb. 8—The Midwest Engine Co. announces that the price of its model 501 walking type Utilitor has been reduced from $345 to $295, f.o.b. Indianapolis. The riding type of Utilitor has been reduced from $390 to $340.

OLYMPIA TRUCK LOWERED

TACOMA, WASH., Feb. 6—The Olympia Truck Co. has reduced the price of its truck, a 2½-ton model, from $3500 to $3200.

GARFORD MAKES REDUCTIONS

LIMA, OHIO, Feb. 9—The Garford Motor Truck Co. has reduced prices on its three largest models. The list follows:

	New Price	Old Price
3½-ton	$3,750	$4,300
5-ton	4,500	5,200
7½-ton	5,200	5,500

Proposed Bonus Tax Modified by Mellon

House Committee Also Does Not Favor 50-Cent Per Horsepower Levy

WASHINGTON, Feb. 7—Determination of the majority leaders in Congress and officials of the Administration to force bonus legislation brought the suggestions of Secretary of the Treasury Mellon for additional taxes on motor vehicles and gasoline to the fore this week. It is said that certain members of the House Committee on Ways and Means have given serious consideration to the proposal to raise the additional funds through an assessment on gasoline and tobacco. The suggestion to impose a tax of 50 cents per horsepower on owners of motor vehicles finds little active support in Congress, particularly at this time when the Congressional elections are approaching.

Secretary Mellon advised AUTOMOTIVE INDUSTRIES today that he did not recommend the assessments on automobiles, gasoline, etc., but submitted them as suggestions in compliance with the request of the Ways and Means Committee for additional sources of revenue necessary to meet payment of the proposed soldiers' bonus.

In testifying before the Committee, Secretary Mellon suggested a levy of 50 cents per horsepower, but later supplemented it with the proposal that 25 cents per horsepower would be more acceptable in event the Congress decided to enact a bonus bill. He believes that a storm of opposition might develop from a tax as high as 50 cents and might ultimately affect the sale of high-powered cars.

Hare Leaves Manufacturing Field for Merchandising

NEW YORK, Feb. 8—A new company known as E. S. Hare, Inc., has been organized to succeed Hares Motors, Inc. It is headed by Emlen S. Hare and most of his associates will be men who served in the old company. The most important change is in the election of H. B. Lewis, formerly in charge of the advertising, as vice-president to succeed Henry Lansdale The engineering department will be continued with H. D. Church as vice-president in charge of that branch of the business.

The new company will act as manufacturers agents, sales and engineering experts. It will retire altogether from the manufacturing field and devote all its energies to merchandising. The company now has charge of the sales of two truck manufacturing companies.

The identity of E. S. Hare, Inc. will not appear in any of its activities so far as the public is concerned. It is the purpose to take over the sales departments of the companies with which it makes contracts, designing of sales policies and taking over distribution.

Banks Would Keep Overland Control

Will Ask Preferred Stockholders' Consent to Mortgage—Result of Plan in Doubt

NEW YORK, Feb. 8—Bank creditors of the Willys-Overland Co., whose claims aggregate approximately $16,000,000, have virtually agreed upon a plan for funding the bank loans and providing new working capital. This plan, which must be ratified by holders of 75 per cent of the perferred stock, calls for a first mortgage bond issue of $25,000,000 of which about $18,000,000 would be issued.

This would cover the bank loans as well as commissions which would be charged by the bankers. In order to secure working capital, however, the company would be obliged to become a borrower again from the banks. The plan of the bank creditors in this respect provides for the creation of a revolving credit of several million dollars.

Stockholders' Consent Improbable

Whether or not the preferred stockholders will consent to this plan remains to be seen. In some quarters it is considered highly improbable that they will. In that event it is probable the banks will call the loans, which mature March 1. The inevitable result of such a course would be a receivership under which the banks would stand, in the eyes of the court, on an equal basis with all the other interests involved.

If the banks would consent to renew the notes when they come due it is understood the Willys-Overland Co. would be able to make another 10 per cent payment in addition to the 20 per cent which already has been made. After its reduction of the notes the company still would be able to get along without additional working capital. On the other hand, if the plan of the bankers is accepted by the stockholders, the banks would retain a firm grip on the company.

Common Stock Loses Vote

The preferred stock of the Willys-Overland Co., like that of all the other Willys companies, contains a provision that no mortgage or other obligation can be placed upon the property without the consent of the holders of 75 per cent of the stock. It also provides that voting rights in the company revert to the preferred stockholders if four quarterly dividends are passed. The voting rights, therefore, have been lost by the common stock. Under the bankers' financing plan control of the company would pass to a voting trust in which the bank interests would be well represented.

In connection with the present situation it is interesting to recall that when the Willys-Overland Co. acquired control of the Moline Plow Co. in 1918 by purchasing 82 per cent of the common stock from the Stephens interests, it gave in exchange preferred stock in three Willys companies. The proportions of this stock were: Willys-Overland 55 per cent, Electric Auto-Lite Corp. 30 per cent, Curtiss Aeroplane & Motor Co. 15 per cent.

The Moline Plow Co. authorized common stock is $21,000,000 and while the stock books are not available it is understood the Willys-Overland Co. now owns about $17,000,000 of its stock in exchange for which the Stephens family took approximately $9,000,000 in non-convertible cumulative preferred of Willys-Overland. The Willys-Overland preferred stock outstanding amounts to approximately $22,000,000. This would give the Stephens interests control of a little more than 25 per cent. The remainder of the Willys-Overland preferred is held in small lots.

No Changes in Administration

It remains to be seen how much personal interest John N. Willys has with the Stephens interests and whether they will accept the proposal of the bankers. In any event it can be stated there is no foundation for reports that important changes will be made in the administration of the company. Willys will continue as president, devoting much of his time to sales, while Walter P. Chrysler will continue in charge of operations as executive vice-president.

White Inaugurates New Bonus System

(*Continued from page* 295)

The White Company worked out the method on the theory it would pay the men according to their ability. The employee who earns a bonus knows each day just what bonus he earned the day before. The number of pieces he produced is inspected and counted daily, the time checked and the amount of bonus computed. Then a bonus pay slip is made out showing the amount of bonus earned and this slip is handed to the worker the day after that particular bonus is earned. The bonus pay envelope contains the total of all bonus pay slips received by an employee during the preceding pay period.

Quality of Gasoline Marked by Uniformity

WASHINGTON, Feb. 6—Marked uniformity in the average quality of gasoline manufactured for sale during the winter months has been found by the Bureau of Mines, in a semi-annual survey of motor gasoline. The inquiry extended from 1919 to 1921 and was conducted during the winter and summer seasons. It was found that gasoline sold in the summer seems to vary in quality.

A study by cities shows that the average distillation figures for gasolines sampled in New York revealed a slight increase in volatility. Those from Washington showed a decided increase and those from Pittsburgh a decrease when compared with corresponding samples from the same cities a year ago.

Tire and Rim Men to Discuss Valves

Efforts at Standardization on Disk Wheels Will Be Made at Cleveland Meeting

CLEVELAND, Feb. 4.—A meeting of the Tire and Rim Association has been called in the Leader News Bldg. here this week with invitations extended to the members of the Automotive Metal Wheel Association and others interested in this industry.

The subject up for discussion is that of outside inflation for pneumatic tires mounted on disk wheels. The Goodyear Tire and Rubber Co. has brought the matter up for consideration in a bulletin as follows:

"Owing to the increased popularity of the disk wheel, and the various kinds of wheels on the market, it is highly desirable to have the disk wheel manufacturers standardize on one type of valve.

"In order to provide means for inflating tires which are mounted on disk wheels, from the outside of the wheel the different wheel companies are changing the designs of their wheels somewhat.

"At the recent Automobile Show in New York, there were at least four makes of wheels, each providing a different means of inflating the tires.

Tire Inflation Varies

"1st—The ordinary valve stem, which had to be reached on the inside of the wheel.

2nd—The curved valve stem on the Forsythe wheel of the Maxwell, which brings the end of the stem to the outside of the wheel.

"3rd—The slotted disk to which was attached a Schrader extension, on the end of a standard valve.

4th—The dished disk, which allows the standard valve to protrude on the outside of the disk.

"Besides the above, the Dill Manufacturing Co. of Cleveland is making two different kinds of disk wheel valve extensions.

"Last of all, Dodge Brothers has recently designed a curved valve for use on its wheels which is larger than the one in use by the Maxwell.

"In our opinion the fourth named is the most desirable—and we recommend that all disk wheel manufacturers be urged to design their wheels accordingly.

"This will enable the tire manufacturers to carry in their branches only tubes equipped with standard valves, and the automobile manufacturer will not be required to carry tubes with special valves for use on disk wheels.

"The use of an extension should be avoided unless absolutely necessary.

"We trust that this matter will be given attention by the Tire and Rim Association, as their help is needed in order to bring about some standardization of disk wheel valves."

Lincoln Sales Jump Under Ford Regime

Executives of Two Plants Confer Relative to Co-ordination of Policies

(*Continued from page* 294)

statement issued in behalf of the Lincoln company says in reference to prices:

"These new prices are considerably less than are warranted by actual production costs. It is the conviction of Lincoln officials, however, that the expected increase in volume of sales, assisted by Ford's tremendous purchasing power, which will be realized later on, will justify the sacrifice of immediate profits. As the new prices are based upon anticipated rather than upon actual existing advantages, it is asserted that the new prices must necessarily remain for a long time to come."

Prices May Be Scaled Gradually

On the face of it, the statement would seem to set at rest the fear that further price cuts would be made, at least for several months to come. It is the general belief within the industry, however, that the price of the Lincoln car will be scaled down gradually as output increases and production costs are lowered.

There is much speculation here concerning possible changes contemplated by Ford in the management of the Lincoln plant, although the statement made after the sale stated that the management would continue in charge of the Lelands.

The statement issued by the Lelands said in part:

This is believed to be the beginning of what is expected to result in one of the most far-reaching affiliations in the motor car industry; on one end the tremendous Ford institutions turning out a million or more motor vehicles a year, and on the other end the Leland-built Lincoln, which in a comparatively short time has forged its way to the front as probably the finest constructed car the world has ever seen.

Limitless Resources Furnished

It brings to the Lincoln Company Ford's almost limitless resources, and lack of finances was the only handicap the Lincoln Motor Company had ever experienced. It also brings together two men who are recognized as unquestioned leaders in their respective fields, Ford as the master manufacturer in quantity production, and Henry M. Leland as the master of the finest things mechanical.

While the new Lincoln Company becomes affiliated with the Ford Motor Company, the executive personnel of the two concerns will be held separate and distinct, the management of the Lincoln Company continuing with Henry M. and Wilfred C. Leland; in fact, this was one of the conditions insisted on by Mr. Ford at the outset of the negotiations.

An increased manufacturing schedule will be inaugurated immediately there being a large amount of stock in various stages of completion and much which is finished and ready for assembling. The former Lincoln manufacturing organization has largely been held intact and preparations were all made in advance so that everything would be in readiness to go forward as soon as the necessary formalities had been completed.

It is apparent that many persons have been misled into the idea that the Ford connection indicates a revolution in policies, particularly as those policies concern manufacturing practices and selling prices; but it is contended that anyone at all familiar with fine car construction knows the absurdity of any sweeping reduction in prices for a car of the Lincoln's character.

No Changes in Manufacturing

Both Mr. Leland and Mr. Ford have emphasized in the strongest possible terms that any thought of change in the Leland manufacturing standards would be utterly out of all reason.

Another point which is emphasized by the officials is that the company will continue its policy of not having so-called yearly models. This policy, it is claimed, insures the car purchaser against undue depreciation in the re-sale value of his car. It is also asserted that inasmuch as the present eminently fine mechanism of the Lincoln car was thoroughly developed before it was marketed at all, there is nothing in the line of changes under consideration.

The essentials of the merchandising policy, it is said, are also to be continued as before. The Lincoln Company has prided itself upon the exceptional character of its distributors; however the scope of the distributors will be enlarged by the appointment of dealers in the smaller cities.

It is the not uncommon opinion expressed in Detroit that the Leland-Ford affiliation was in no small way encouraged by Edsel Ford who is in full accord with his father's view as to the necessity of saving the Lincoln Company for the good of Detroit, for the good of the industry, and for the benefit of Motordom as a whole. It has also been evidenced for a long time that the younger Ford has a soft spot in his heart for fine cars, that he has held a strong desire to become identified with their manufacture, and that the Lincoln situation provides just such an opportunity. As Mr. Ford himself expressed it, it is a case of extremes meeting—the best low priced car, and the finest car in motordom.

Leland's Position Undefined

Operations were resumed Monday with a factory force of 600 men. Work was started under the same manufacturing and distribution policies as maintained before the receivership.

Where production methods can be improved without sacrifice of quality, changes will be made, W. C. Leland said, but these will be carefully determined. Reports that specialized production men would be introduced into the personnel were denied by him. The probabilities are that Ford engineers will work with the Lelands in an advisory way in determining changes.

No declaration was made as to the position of the Lelands in the new company, aside from their executive positions. It is expected that when the articles of incorporation of the new company are filed, they will be found to hold a considerable share in the stock of the new company, with the control vested in the Ford family.

(*Continued on page* 304)

Minneapolis Shows New Buying Spirit

Dealers Given Object Lesson at Exposition—Conditions in Twin Cities Improve

MINNEAPOLIS, Feb. 8—For a territory in which some distributors have almost no dealers left, that is, dealers who have cars in stock or even demonstrators, while other distributors have only about half their dealer organizations of a year ago, Minneapolis is holding a remarkable show. The crowds are on hand and they are buying a little, which indicates brightening prospects in the city and immediate vicinity, but the real accomplishment of the week is the object lesson to hundreds of dealers in name only, some of whom have not sold a car in a year, that people are still enough interested in automobiles to pay to see them and to buy them.

The distributors and branch managers have had pretty sizable dealer meetings, with attendances running half what they did two or three years ago, but this is something when it is realized that the territory, roughly speaking, runs all the way to the Rocky Mountains, and some dealers have traveled all night or a day and a night to get here.

Dealer Interest Increases

These dealers are not ordering cars by the carload, but some who have been nothing but garagemen for a year and a half are arranging to get a demonstrator, and in some cases an extra car or two to show. This, with the stimulus of the show and the week's meetings, indicates that there will be some lightening of the burden carried in 1921 by the distributors, some of whose businesses have been reversed from a normal of 75 per cent wholesale to 75 per cent retail. The distributors are planning to proceed as they did last year, getting into the territory with their travelers and helping dealers sell.

Local conditions, both in Minneapolis and St. Paul, are improving slowly, with decided gains in retail mercantile business in December and January. The great grain territory, covering six states, is still paying off debts which will be partly liquidated by the 1922 harvest, if it is a good one, and fairly well cleared away in 1923. This prospect, remote as it is, is creating some sales possibilities in the territory, but, though 70 per cent of the farmers have money to spend, they are not spending it with any freedom.

PULLMAN PACKARD OUTPUT

CHICAGO, Feb. 6—Starting March 1 the Pullman Co. will begin a schedule of 600 Packard automobile bodies a month. The company has maintained a Packard department for some time, but its operation has been sluggish for several months.

Lincoln Sales Jump Under Ford Regime

Executives of Two Plants Confer Relative to Co-ordination of Policies

(*Continued from page* 303)

Under the court order accepting the Ford bid of $8,000,000 for the property, the title will be turned over within 10 days, in which time the purchase is to be consummated. The gross liabilities of the company under the financial statement filed by the receiver as of Nov. 8 are $9,073,105.46. With preferred claims disposed of, this will permit a payment to creditors and noteholders of approximately 80 cents on the dollar.

Federal Tax Not Included

The financial statement did not include in the liabilities the $610,000 additional tax demanded by the government, the original filing of a $4,500,000 claim for which was the definite cause of the application for receivership. The tax, with state and local taxes and the $1,882,000 first mortgage bonds, constitute the bulk of the preferred claims against the company. The accounts payable total $1,276,470.59 and the notes payable $4,930,476.79.

The sale of the plant Saturday was witnessed by a large crowd composed largely of employees of the company, but prominent in which were important distributors who came from distant points to witness the formal sale of the company. Henry Ford with Mrs. Ford did not appear until after the sale had been made, but Edsel Ford and the Lelands, with many executives of the two companies, were in attendance.

Only one bid was made, that of Harold H. Emmons, counsel for the Lincoln Motor Co., who represented the Ford interests. The two other men who qualified to bid by depositing $250,000 certified checks with the court shortly after the first official closing time had expired Friday, declined to enter any offers.

Creditors to Get Return

These two were Emanuel T. Berger, a Detroit attorney, and George B. Judson, a vice president of the Bank of Detroit, which is controlled by James Couzens, former treasurer of the Ford company. Both declined later to identify the principals in their bids. Berger said Friday he was acting for persons identified with the industry, but at the sale Saturday said his clients had reconsidered bidding against the Ford interests. It was the impression that the Judson bid was entered in the Ford behalf as a precautionary measure.

During the progress of the sale the Lelands stood directly behind the court officer presiding. Edsel Ford was in a window overlooking the proceedings, which were held on the front steps of the plant. It was all over in a few minutes, and the crowd overran the factory in its desire to congratulate the Lelands and Fords on their success. Notice was given to foremen at once to have former employees to the number of 600 ready for work Monday.

Among the first to extend congratulations were important creditors and distributors. On his arrival Henry Ford met the distributors individually and assured them of the continuance of existing relationships between the company and its sales group.

It is expected general creditors of the company will receive between 60 cents and 75 cents on the dollar, according to estimates based on the sale of the property for $8,000,000. The board of governors of the stock exchange has removed the class A stock from the exchange because the price paid for the property was not sufficient to meet liabilities of the company, and therefore no money would be forthcoming for distribution among the stockholders.

Dodge Production Up; Will Make Own Bodies

DETROIT, Feb. 9—Production at the Dodge plant, which has been running at 550 daily since announcement of its price cut, will be increased to 600 daily before March 1. Preparations are being made by the company to manufacture its own open bodies, and they will be brought out in June or July. Dies and equipment now are being installed in the body unit of the plant. The company previously has manufactured its closed bodies.

The Ford Highland Park plant is operating on a basis averaging four days a week. Some departments are running more and some less. Production in some of the plants manufacturing cars in the Dodge class has fallen off temporarily.

ROOT QUITS WESTCOTT

SPRINGFIELD, Feb. 9—At the close of the annual meeting of the Westcott Motor Car Co. yesterday, announcement was made that H. G. Root had resigned as general manager, effective March 1, to devote his entire time to the H. G. Root Co. and the Automotive Parts Co. He has been general manager of the Westcott Co. since 1914. It also was announced that the Westcott plant would be operated at capacity for several months as a result of business now in sight. Officers elected by the company are: president, B. N. Westcott, vice-president, E. H. Gilcrest; secretary and treasurer, J. N. Reag.

MARKETING BILL PASSES

WASHINGTON, Feb. 9—The Senate yesterday passed the co-operative marketing bill, which authorizes farmers, ranchers, dairymen, planters, nut and fruit growers to act together in associations for collectively preparing, handling and marketing in interstate and foreign commerce the products of their farms, groves and ranches. Enactment of legislation authorizing co-operative marketing will result in greatly extended use of the motor truck by farmers.

Battery Servicing Abroad Emphasized

Government Agent Stresses Need for Carrying Full Stocks of Electrical Parts

WASHINGTON, Feb. 9—The demand for battery equipment service in South Africa has resulted in the organization of a company with service stations in Johannesburg, Capetown and Durban. In a letter received in the automotive division of the Bureau of Foreign and Domestic Commerce, a representative of the company discusses existing conditions in the electrical equipment trade in South Africa, pointing out that service facilities are essential to the continued satisfactory operation of a car with battery ignition, and adding that as American cars are the leaders in battery equipment too great emphasis cannot be placed upon the vital importance of proper servicing if they are to continue to hold their present position in foreign markets.

Some facts in the latter referred to are given below:

The few battery service stations in South Africa to-day are asked to repair any kind of trouble in battery ignition, lighting and starting equipment on any make of car. Service stations, therefore, must frequently call upon representatives of the automobile manufacturers to furnish parts for the specific makes of cars which they represent. Often, however, they do not carry adequate stocks of spare electrical equipment parts, as the turnover is small, and accordingly they represent a comparatively dead investment. In such cases, parts must be imported from abroad, which of course results in a delay of one or two months, thereby greatly inconveniencing the car owners. In order to expedite repairs, service stations should carry a complete line of electrical equipment parts for all makes of cars.

Much Capital Necessary

Considerable tying up of capital is involved in representing an American manufacturer in South Africa. In making agency arrangements, manufacturers should bear in mind the length of time goods are in transit to South Africa, the relatively slow turnover, the large stocks required owing to the distance from the factory, and the fact that very little business in South Africa is done on a cash basis. The consideration of these facts should lead manufacturers to realize the importance of granting liberal credit terms to overseas representatives.

If manufacturers will use care in choosing dealers of good repute and satisfactory credit standing, they will be able to deal direct with their representatives. In this manner the payment of special charges to buyers, shipping and commercial houses and bankers would be avoided, thus making possible price reductions to meet competition from foreign competitors.

MEN OF THE INDUSTRY

George H. Mueller, who during the war served as managing engineer of the Curtiss Aeroplane & Motor Corp., Buffalo, has become associated with the Pawling & Harnischfeger Co., Milwaukee, manufacturer of electric traveling cranes, machine tools, excavating machinery, etc., as general sales manager. He was connected formerly with the Link Belt Co. and the Jeffery Mfg. Co., and following the end of the war with the J. I. Case Plow Works Co., Racine, Wis. More recently he served as receiver of a defunct gas engine and machinery concern at Oshkosh, Wis.

Arthur X. Merz, secretary, Madison-Kipp Co., Madison, Wis., manufacturer of automatic lubricating devices, oil cups, etc., left Feb. 4 from New York on the Empress of Scotland for an extended business and recreation tour. The principal objective is Moscow, where Merz will investigate conditions respecting the possibilities of tractor business, especially with regard to the growing tendency of European manufacturers to build farm power machines to offset lack of imports because of unfavorable exchange rates. Later he will tour the Mediterranean region.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, left Saturday night for Atlanta, where he addressed the dealers association at a meeting Monday. He spoke Tuesday night to the dealers at Jacksonville, and from there went on to Daytona, where he will spend a week. Upon his return trip he will stop off at Camden, S. C., for a conference with Colonel Charles Clifton, president of the N. A. C. C.

J. C. L. Krebs, a pioneer in the industry, has become associated with the organization of the Collier Motor Truck Co., manufacturer of Collier trucks at Bellevue, Ohio. In 1912 Krebs organized what is now the Clydesdale Motor Truck Co. of Clyde, Ohio, and directed its activities up to the time of his resignation to join the Collier organization. His connection with the company will not affect the existing personnel.

Cass G. Selden, until recently an executive of the Scripps-Booth Corp., has been named general manager of Joseph N. Smith Co., builder of automotive body hardware. Before joining Scripps-Booth Selden was connected with the Studebaker Corp. **George Rumford** has resigned as production manager at Maxwell to become production manager at the Smith company plant.

Pitt W. Danforth has become associated with Lewis, Murphy & Co. and will devote his time principally to the business service for the automobile industry. Danforth has been associated with the Packard Motor Car Co. of Boston as treasurer and assistant general manager with the Henshaw Motor Co., Boston, as treasurer.

C. L. Alexander has been appointed assistant sales manager of the Elgin Motor Car Corp., Argo, Ill. He has been with the Elgin company for a little more than a year in charge of sales promotion. Previously he was connected with the Maxwell-Chalmers and Dodge Brothers sales organizations in Detroit.

George L. Willman, formerly assistant sales manager of the Chicago branch of the Studebaker Corp., has purchased an interest in the John G. Wollaeger Co., Milwaukee, distributer of the Studebaker in Wisconsin, and becomes vice-president.

Henry J. Hall, Jr., formerly vice-president and general manager of the New York Lubricating Oil Co., and **C. M. Addis,** formerly service manager of that company, have become associated with the National Lubricants Co., New York.

W. H. Sackman has resigned as chief engineer of the Light Manufacturing & Foundry Co., Pottstown, Pa., effective March 1. He has not decided as to his new connection at this time.

Ben C. Mott of Chicago has been appointed manager of the Milwaukee branch of the Packard Motor Car Co. of Chicago, succeeding Ray C. Chidester, who resigned Jan. 1 to become Durant distributer in Wisconsin and northern Michigan.

J. D. Cole, manager of the Chicago branch of the Pyrene Manufacturing Co. of New York, has been appointed field secretary of the Automotive Equipment Association.

Charles B. Wilson, president of the Wilson Foundry & Machine Co. and vice-president in charge of production for Willys-Overland, Inc., has been elected president of the Willys-Morrow Co. of Elmira.

George Harrison Phelps, director of advertising for Dodge Brothers, will open an advertising agency of his own, in Detroit, April 1. He will continue to handle Dodge Brothers advertising.

William F. Parish, consulting lubrication engineer, announces the opening of a petroleum analytical and experimental laboratory in the Peoples Gas Building, Chicago.

NEW SINGLE SIX PACKARD

DETROIT, Feb. 8—The Packard Motor Car Co. will announce new models in its single six line this month. The feature will be a lengthened wheelbase. It is expected the new line will be ready for early spring deliveries.

COMMERCE TO MAKE NEW BUS

DETROIT, Feb. 8—The Commerce Truck Co. is preparing to go into production on an 11-passenger motor bus built along the lines of a passenger car. This bus will have four seats.

TO BUILD CLETRAC TRUCK

CLEVELAND, Feb. 9—The Cleveland Tractor Co. is preparing to bring out a ¾-ton truck.

TO PRODUCE JEWETT SEDAN

DETROIT, Feb. 9—The Jewett sedan, all metal and with four doors, will be in production within the next 90 days. It is expected to sell for $1,395.

BEDFORD SPEAKS ON TRUCKS

WASHINGTON, Feb. 9—One of the great transportation problems confronting the country at present relates to the development of motor transport and transportation, in the opinion of A. C. Bedford, chairman of the board of the Standard Oil Co. of New Jersey, who addressed the National Council of the Chamber of Commerce of the United States. He declared highway transportation involved the vital problem of coordinating motor trucks for short haul work with steam lines. He asserted that highway transportation was in its infancy.

Nash Eliminates Truck Distributors

Will Handle Sales Through Dealers—Passenger Car Selling System Is Unchanged

KENOSHA, WIS., Feb. 3—The Nash Motors Co. has decided to eliminate distributors in the marketing of its trucks and conduct its business hereafter directly with the dealers. The new plan will have no bearing whatever on the passenger car business which will be carried on through distributors as in the past. In connection with the announcement in relation to the distribution of trucks, it is stated that a marked reduction in prices on the entire truck line will be made in the near future.

Attractive Discounts Offered

Discussing the new truck policy, this explanation was made by C. B. Voorhis, vice-president and general sales manager:

"During the past five years it has been the policy of the Nash company to market both passenger cars and trucks through Nash distributors, but our experience has demonstrated conclusively that the passenger car business and the truck business are entirely separate and distinct. Therefore, while it will continue to be the policy of the Nash Motors Co. to handle passenger cars through distributors in just the way we have done in the past, we have decided that it is wise and necessary to segregate our truck business entirely from the passenger car business and we announce this new Nash policy for the marketing of our trucks."

It is understood that unusually attractive discounts are being offered dealers.

Trend Toward Elimination Spreads

NEW YORK, Feb. 7—Announcement by the Nash Motors Co. that it had decided to eliminate distributors in the sale of its trucks, emphasizes the trend in this direction. It is similar to that in the passenger car field, but more pronounced.

The General Motors Truck Co. recently has established branches in Atlanta and Charlotte, N. C. It is understood the company will establish other factory branches from time to time.

The Republic Motor Truck Co. is supplanting distributors by factory branches and practically all the business of the White Co. and the International Motors Co. is handled through factory branches.

Some of the other truck companies, on the other hand, are strengthening their distributor organizations and signing contracts with some of those who have given up their former connections.

The companies which are expanding their factory branch organizations contend that they are enabled in this way to give better service, and they also can eliminate some of the evils which attend the taking of used trucks on trade-ins at more than their actual value.

Far East Is Still Unexplored Market

America Maintains Supremacy Due to Ability to Undersell Foreign Competitors

CLEVELAND, Feb. 7—Notwithstanding that the United States has outstripped all nations in exporting automobiles to the countries of the Far East, that section is still a great unexplored market for cars of American make, says Brent A. Tozzer, Cleveland sales-manager for the Niles Tool Works Co. of Hamilton and the Pratt & Whitney Co., of Hartford, Conn.

Tozzer has just completed a 14 months tour of the Far East during which he made a survey of business conditions.

American manufacturers will maintain the supremacy they now enjoy for the reason that they can undersell their European competitors. Quantity production is held to be responsible for the great showing made, and nothing has happened in Great Britain or in Europe in recent months to indicate that industry in those countries will approximate American efficiency in production.

Moderately Priced Car Best Seller

The moderately priced automobile sells best in the Far Eastern countries, although the higher priced cars are being sold to the potentates.

One thing that the American maker of automobiles, who seeks to conquer the Far Eastern markets, must bear in mind, Tozzer says, is that in most of the countries, the weather is extremely hot. The temperature gets as high as 150 and 160 degrees in the sun. Lately there have been complaints that the American automobile has not sufficient cooling facilities in the radiator.

Hot countries are dusty also for a greater portion of the year, and the manufacturer who offers additional protection from dust has a strong talking point.

India with a population of 300,000,000 is awakening and it has many good roads. In fact it is possible to travel by automobile from Calcutta to Bombay, a distance of approximately 1000 miles, over a graded road part dirt and part macadam.

Java Dealers Progressive

Burma has very good roads. Siam has no roads with the exception of Bangkok, where there are good streets and many automobiles.

In the cities of Java the automobile dealers are very progressive. Facilities for service and repairs are excellent. There is an abundant taxi service and the cars are driven by chauffeurs, who have with them an extra man, who assumes some of the duties of a porter. Then the weather is so hot that it requires the efforts of two men to change a tire.

Transportation in Shanghai is by means of a trackless trolley, but the company that operates the tramways has projected plans for a motor transportation system in both city and surrounding country roads. Wheelbarrows, which seat as high as 12 persons and are moved by man power, will be replaced in the country by the motor buses and trucks.

There is an industrial development in Canton and adjacent territory that the American automobile maker must keep in touch with. The ancient walls have been torn down and wide boulevards are being built. These have increased the use of the automobile. In the environs streets are being built wider. The use of the motor car in Chinese streets has been limited because of the narrow and congested condition, but with wide boulevards and streets springing up the automobile is in greater demand.

FINANCIAL NOTES

Goodyear Tire & Rubber Co. of Canada, Ltd., shows accounts receivable, according to its comparative balance sheet as of Sept. 30, 1921, of $3,116,418, against $4,817,535 Sept. 30, 1920, and cash of $870,275, against $130,397 on the 1920 date. The notes payable on the date in 1921 were $330,589, against $4,867,612 in 1920; accounts payable of $447,499, against $1,038,355, and surplus of $300,888, as compared with $1,071,725 in 1920.

Bower Roller Bearing Co. comparative balance sheet as of Dec. 31, 1921, shows cash on hand $35,917, as against $39,136 on Dec. 31, 1920; accounts receivable $30,041, compared with $69,871, and notes receivable $62,931, against $74,688. The company's surplus was $222,480 on Dec. 31, 1921, and $252,579 on the same date the year previous.

Yellow Cab Manufacturing Co. stockholders have approved the 100 per cent stock dividend in class B stock, payable early in March to stock of record Feb. 18.

Illinois Tractor Officers Are Sued for Accounting

BLOOMINGTON, ILL., Feb. 6—Stockholders of the Illinois Tractor Co. have filed suits against the officers and directors, demanding an accounting. It is alleged that instead of the surplus of $121,629, which the defendants claimed existed on June 1, 1920, there was a deficit of $695,470, without taking into consideration some $200,000 worth of notes carried on the books as assets. It is asserted that the books show a loss in the first five years of operation of more than $150,000.

The company was organized in 1912 with a capital stock of $100,000. This was later increased to $2,500,000. The original capitalization represented $50,000 in stock and an equal amount in patent rights. It is charged that the officers entered into a contract to pay Dan F. Garber, a director, 25 per cent commission to sell stock, and that later he was authorized to open an office in Philadelphia to sell stock, for which he was to receive 40 per cent commission. A year ago the company suspended operations.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Coincident with the payment of the latest issue of Treasury certificates of indebtedness and the interest and dividend disbursements on Feb. 1, a heavy calling of loans was reported during the past week, and call money consequently advanced to 6 per cent in the local market. During the last half of the week, however, the trend was moderately downward and there appeared to be a fairly liberal supply of funds. The range for call money was 4½ to 6 per cent, as compared with 4 to 5½ per cent of the previous week. The rate for fixed date funds was slightly firmer, the quotations for 60 days to 6 months' maturities being from 4¾ to 5 per cent, as compared with 4½ to 4¾ per cent in the previous week. The rates for prime commercial paper remained unchanged at 4¾ to 5 per cent.

The Federal Reserve statement as of Feb. 1, 1922, showed a decrease in the reserve ratio from 77.2 to 76.2 per cent. Total reserves increased $2,663,000, due to the following changes: an increase of $6,280,000 in gold reserves and a decrease of $4,617,000 in other legal reserves.

The New York institution showed a decrease of $42,807,000 in total reserves and an increase of $9,245,000 in total bills on hand.

The recent offering of 4¾ per cent United States Treasury Certificates was oversubscribed by practically $200,000,000. This fact would indicate that banks have an abundance of funds seeking short-term investment.

The net earnings of the United States Steel Corporation as reported for the fourth quarter of 1921 amounted to $19,612,000, this being $24,000,000 less than in the corresponding quarter of 1920. With the exception of the third quarter of 1921, when earnings were $18,918,000, the net earnings for this last quarter of 1921 were smaller than for any three months since the first quarter of 1915, when the amount stood at $12,458,000.

The rally in sterling exchange has carried it to the highest level since 1919, when the artificial pegging which kept the pound sterling at $4.76 was removed and the market set free.

Bradstreet's total number of failures for January 1922 was 2705, which exceeded the hitherto record total of December 1921 by 11.4 per cent and that for January 1915 by 13.7 per cent. The total amount of liabilities involved was $115,301,371, which marked an increase of 42 per cent over the amount reported for December 1921, and of 76 per cent over January 1920.

CADILLAC EMPLOYS 7000 MEN

DETROIT, Feb. 8—The Cadillac Motor Car Co. reports that it now is employing nearly 7000 men in its factory, and that its production schedule is larger by 20 per cent than is usually the case at this time of year.

INDUSTRIAL NOTES

DuBois Rubber & Tube Co. has formerly opened its new factory at Chattanooga, Tenn., and started production. The plant has 30,000 sq. ft. and a capacity of 500 "Red Giant" compression tubes, 500 "Old Hickory" casings and 1,000 "Old Hickory" tubes. It is reported that 400 dealers are under contract to handle the product nationally. M. N. Whitaker is president of the company; L. H. Lightfoot, first vice-president and sales manager and A. H. Harris, recently vice-president of the Cleveland Rubber Corp., second vice-president and manager.

Ajax Rubber Co. reports that actual orders from dealers covering requirements for the early months of 1922 show an increase of 114.4 per cent over similar months of last year. Ajax tube business on the same basis has increased 117.4 per cent, which does not take into consideration important quantities to automobile manufacturers, which business the company has not hitherto had. The company has contracts with Dodge Brothers, Buick Motor Co., Olds Motor Works, Chevrolet Motor Co., General Motor Truck Co. and Haynes Automobile Co.

American Metal Products Co. of Milwaukee, which recently completed a new factory in that city with electric furnace equipment, is enlarging its line of production, heretofore confined to bronze and brass ingots, castings, bearing metal, etc. One of the latest additions to the line is a poppet valve and stem for car and truck engines, made from Ampco bronze, a patented metal alloy. It is claimed that because of the nature of the metal it is not possible for carbon to form on the valve, which will not carbonize, pit, corrode or warp.

Logansport Machine Co.'s general sales offices have been moved from Chicago to the factory at Logansport, Ind. The Frank G. Payson Co., general sales agent for the company's products, will discontinue business and the corporation dissolved. Frank G. Payson will be located at Logansport as manager of sales for the Logansport Machine Co.

Keystone Tire & Rubber Co. has changed the names of its branch stores to Keystone Tire Sales Co., featuring Keystone products exclusively. Heretofore the stores have been conducted under different corporate names. The company reports that its plant at Kingsbridge is being doubled in size to permit on increased output.

E. A. Johnson has been appointed as service manager of the Auburn Automobile Co. with offices at the factory, Auburn, Ind. Johnson has given extensive study to the relations between manufacturer, dealer and car owner, and through his appointment the company expects to intensify the close relations with Auburn owners.

International Harvester Co. is producing fifty trucks a day at the Springfield, Ohio, works and shipments are going forward about as rapidly as the machines are produced. Within the past week a number of former employees have been added to the force.

Victor Rubber Co. tire production at the Springfield, Ohio, plant has been increased from 500 to 700 a day. The daily output will be increased gradually. It is reported that shipments are satisfactory and the outlook for business is growing more encouraging.

C. E. Mason of Concord, N. H., has been appointed sales engineer by the Kelly-Springfield Motor Truck Co. Mason was formerly with the Abbott-Downing Co. All special installations will be made under his direction.

Nash Motors Co. four-cylinder division at Milwaukee has resumed an eight-hour-a-day schedule, affecting about 400 men on the working force, who for some time have been working mornings only.

E. W. Steinhart Co., Indianapolis, has taken over the business of the Oakland Motor Car Co. branch in that city and will sell Oaklands at retail as well as act as state distributer.

Fafnir Bearing Co. will resume operations in the near future at its plant at New Britain, Conn. The factory has been shut down since September, 1920.

International Motor Truck Corp. reports sales for 1921 approximating $25,000,000 compared with $34,000,000 in the previous year.

Vervoort Ball Bearing Co. has acquired the **Superior Roller Ball Bearing Co.**

MASTER GEAR GAGES LOST BY GOVERNMENT

WASHINGTON, Feb. 6—Federal agencies interested in motor transport and its development have lost master gages and dies designed for the construction of gears and other automotive parts. Samuel H. Cook, Vice-President, Brown-Lipe-Chapin Co., of Syracuse, N. Y., has been called into conference with high Government officials for the purpose of ascertaining replacement costs.

The statement that the master gages and dies could not be found brought the estimate from Cook that it would cost $7,000 to manufacture gears, etc, whereas the cost would be limited to approximately $600 if the Government had in its possession the master gages. This simple inquiry may have a reaction from Congress in view of the enormous expense and great difficulties which attended the establishment of a motor transport corps during the war.

SAXON SHOWS DEFICIT

DETROIT, Feb. 9—The Saxon Motor Car Co. shows an operating deficit of $396,263 for the year ended Dec. 31, 1921. Bank loans were reduced from $500,000 to $100,000, and accounts payable from $249,000 to $190,000. The inventories were valued at $457,000, as against $1,770,000 a year ago. Cash on hand was $72,000, as compared with $476,000.

BUS BILL OFFERED

ALBANY, Feb. 9—Senator Downing of New York has introduced in the state legislature a bill designed to give New York City unlimited authority to issue bonds for the purchase of automobile buses. An initial expenditure of $25,000,000 for this purpose has been appropriated by the Board of Estimate and Apportionment.

METAL MARKETS

Steel orders emanating from the automotive industries are more numerous than representative in tonnage. Buyers, large and small, prefer placing repeat orders to committing themselves for large quantities at one time. Consumers are bent upon avoiding adding to what small reserve stocks of steel they generally have and virtually every ton of metal that leaves steel mills is ordered shipped so as to reach destination on about the day when production schedules call for it. Hence automotive consumers are constantly in the steel market these days and expected to remain so over the next two months, especially builders of medium-priced passenger motor cars and manufacturers of automotive accessories.

The steel industry, especially that of the Mahoning Valley is virtually banking on this demand and on its steady expansion as spring draws nearer. In fact, it is the only bright spot on the steel industry's firmament. There is still no sign of an early improvement in the demand for railroad and structural steel and the light export demand for tin plate and tin plate containers is causing the trade to feel somewhat squeamish about a continuance of the demand for tin plate which together with automotive steels has heretofore constituted its chief sustenance.

In many products prices are not lowered "officially" because the general run of orders is so light in tonnage that the producer feels he is entitled to compensation for the retail character of this business and when any really worth while tonnages are inquired for, quoted prices are shaded $1 to $2 a ton without very much effort on the prospective purchaser's part. As usual, a good many market interests are on the qui vive for the Feb. 10 unfilled tonnage statement of the United States Steel Corp. as a sort of compass to the situation. Aside from the fact that the tonnage of unfilled orders on the corporation's books is always without significance unless read with due regard to the shipments made during the preceding month, the statement to be issued to-morrow will fall short in reflecting conditions in the steel industry in general.

Pig Iron.—The market continues weak. Middle West automotive foundries are buying single carload lots of malleable at as low as $18.50.

Steel.—In the Pittsburgh market there are rumors of non-integrated sheet mills having been able to obtain sheet bars at as low as $28. Youngstown interests maintain that sales were made there at $29. Full-finished automobile sheets are firm at 4.35¢. Plate mills are competing actively with sheet mills in the market for blue annealed sheets and rumors have been current in the Cleveland market of business being accepted on 1.50¢ plate basis, which would make the price of No. 10, 1.80¢. Automotive demand for hot- and cold-rolled strip steel continues to the fore, with some sales of the hot variety reported at as low as 1.80¢. base. Hand-to-mouth buying of cold-drawn steel bars continues. Bolts and nuts are only in slightly better demand.

Aluminum.—Automotive consumers continue to show interest in sheet offerings. Metal for foundry purposes is not over-eagerly sought. The market's tone remains unchanged.

Copper.—Amid dissenting opinions in producers' circles as to the wisdom of resuming production, the market is naturally weak.

Calendar

SHOWS

Feb. 6 to 11 — Seventh National Tractor Show and Educational Exposition, Minnesota State Fair Grounds, Minneapolis.

Feb. 6 to 11 — Winnipeg, Can., Automotive Equipment Show, Western Canadian Automotive Association.

FOREIGN SHOWS

Feb. 18-27—Brussels, Belgium, Ninth Exhibition of Agricultural Machines and Implements, Palais de la Cinquantenaire.

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

CONVENTIONS

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Feb. 24, Mar. 24, April 28, May 26.

New Zealand Duty on Cars Increased

Products of "Foreign Manufacture" Must Pay 25 Per Cent Ad Valorem—Britain Aided

LOS ANGELES, Feb. 6—Chiefly for the purpose of encouraging the placing of orders in Great Britain, the Government of New Zealand has increased the general tariff on automobiles of "foreign manufacture" from a 10 per cent basis to 25 per cent ad valorem. There was considerable opposition to the sharp increase in the customs duties on automobiles, according to information received here, the attack largely centering ing around the government's classification of all motor vehicles as luxuries.

Viewed from a per capita basis, New Zealand has been one of the largest purchasers of American automobiles in the Pacific trade area during recent years. With a population of less than 1,300,000, New Zealand in 1920 imported automobiles valued at approximately $13,000,000. Fully five-sixths of these cars were of American manufacture. The imports of automobiles in 1921 fell off considerably, the total value of motor vehicles brought in aggregating only $5,775,000.

Along with the increase in customs duties on automobiles imported into New Zealand, there is a 25 per cent general duty on tires, which hitherto have been duty free.

Questionnaire Brings Out Conditions with Jobbers

NEW YORK, Feb. 3—A certain group of credit men whose companies deal largely with automotive jobbers recently were asked these four questions in reference to business for November:

1. What was the percentage of your December collections of accounts receivable as compared with November?
2. What percentage of November sales did you make in December?
3. How nearly did your December sales approach normal?
4. What is the percentage of your production for January as compared with December?

The individual replies indicated the following conditions:

Company	Question 1	Question 2	Question 3	Question 4 Inc.	Question 4 Dec.
a	44.8%	134.7%	..	150%	
b	57.31	90	..	no change	
c	..	97	80%	no change	
d	45	120	75	.....	
e	67	100	48	no change	
f	..	320	..	160	
g	60	100	50	50	
h	..	70	50	no change	
i	26	101	..		20%
j	70	80	50		50
k	66	90	..	100	
l	63	80	26	50	
m	49	138	44	increase	
n	42	104	86		40
o	40	54	23	82	
p	87	98	55	no change	
q	75	125	80	50	
r	80	79	60	75	
s	71	80	141		5

Less Red Tape in Service Is Urged by Cobleigh

NEW YORK, Feb. 6—Cheaper service to the car owner through better management, less red tape and more efficient labor was the subject discussed at the February meeting of the Automotive Service Association of New York. H. R. Cobleigh, Service Secretary of the N. A. C. C. made an address on "The Uplook of Service" in which he told briefly what the manufacturers had been doing to make it less expensive to own motor cars.

He recalled that nearly every year the prediction is made that the saturation point in automobiles will soon be reached. This prediction was made when there were less than a million cars, when there were five million and is now made when there are nearly ten million. He took the attitude that the saturation point will never be reached because the automobile is more of a utility than ever before and cars will be bought because they are actually needed.

He said that cheaper and better service was being pushed hard by the manufacturers.

Other speakers brought up various points in shop efficiency and economy. The flat rate system was favorably commented on and was credited with having had much to do with the reduction of service prices.

45 Members in New Truck Association

Two Old Organizations Merge Into National Body — Wide Co-operation Contemplated

CHICAGO, Feb. 7—The National Association of Motor Truck Industries which was organized in Chicago during show week, is the outgrowth of the National Association of Motor Truck Manufacturers and the National Association of Motor Truck Sales Managers. It will be limited in membership, preserving the functions of both the old organizations and seeking in every way to cover every industrial activity, promoting the co-operation and success of makers, dealers and operators of motor trucks.

The formation of the association has been under way for several months under the managership of Don Whittaker, who it is understood will continue as general manager with headquarters in Detroit.

When the idea of uniting the two associations was first conceived a committee of six was appointed representing the sales managers and manufacturers. This committee was authorized to draft a constitution and by-laws and was made up as follows:

Representing the manufacturers—B. A. Gramm of Gramm-Bernstein Motor Truck Co., F. G. Elder of Day-Elder Motors Corp., and Moe Cook of Service Motor Truck Co.; representing sales managers—H. T. Boulden of Selden Truck Corp.; J. E. Tracey of Parker Motor Truck Co., and Homer Hilton of Winther Motors, Inc.

The work of this committee was approved at the Chicago organization meeting.

The motor truck industries association will begin to function at once. It is said that the new association will work hand in hand with all the other national automotive associations in every way that will promote the welfare of the motor truck industry.

Nine directors are to be elected at once.

Fifty per cent of the 45 members of the association are members of the N. A. C. C.

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12,588,949 Motor Vehicles in Use Throughout the World

United States owns 83 per cent of cars and trucks in existence. Europe has 1,110,996. Nearly 250,000 are in Spanish speaking countries. Analysis shows good export market for American automotive products.

By David Beecroft

THE best available statistics show that there are 12,588,949 cars and trucks in the world. This figure has been obtained after a careful and comprehensive investigation, including every country and covering a period of some six months. The results are not perfect but are presented as the most comprehensive and accurate available at the present time.

Outside of the United States there are 2,083,289 cars and trucks. These are distributed through every country and every continent in the world and indicate the widespread progress of automotive development. It is true, however, that a large part of these vehicles are in the English-speaking countries. The United States, Great Britain and Canada have about 91 per cent of the automobiles in the world, while Australia, Newfoundland, etc., add to the predominance of the English-speaking nations from an automotive viewpoint. United States alone, with its 10,505,660 registration in 1921, has over 83 per cent of the world total; Canada a little over 3.5 per cent and Great Britain nearly 4 per cent.

Because the United States includes so large a percentage of total automobile registrations, it is necessary to eliminate its total from most discussions of world statistics, if such discussions are to serve any practical purpose. The United States is in a class by itself so far as automotive selling problems are concerned. Consequently, the United States registration figures are treated as a separate unit in an article on later pages.

Divided into major continental classifications, the world registrations line up as follows:

North and South America	11,162,110
Europe	1,110,996
Asia	134,730
Oceania	125,281
Africa	55,832

From the point of view of the American exporter, the English-speaking countries with the largest registration are not of major interest, since the foreign market for his product lies elsewhere for the most part. It is more interesting from an export standpoint, therefore, to discuss world registration figures in foreign countries other than Canada and Great Britain.

Excluding the motor vehicles in the United States, Great Britain and Canada, the total for the remainder of the world amounts to about 1,122,259. An arbitrary division of these remaining registrations may be made for market study as follows:

Spanish speaking countries	241,584	21.6%
Europe (exclusive of Great Britain, Spain, Portugal, Azores)	570,774	50.8%
Africa (exclusive of Port. East Africa, Madeira Is.)	55,332	4.9%
Oceania (exclusive of Philippine Islands)	112,900	10.1%
Asia	134,730	12.0%
North and South America (exclusive of Spanish speaking countries, U. S. A., Canada)	6,939	.6%
World total (exclusive of U. S. A., Canada, Great Britain)	1,122,259	

The Spanish-speaking countries included in the foregoing total are indicated in an accompanying table. This list brings out certain points of major interest to the American exporter. The basis of computing the per-

lar interest from an export view at the present time due to the generally unsettled economic conditions in those areas.

In certain European countries, moreover, there is active domestic production of motor vehicles, notably in France, Italy, Germany and Belgium. This home competition will always be a large factor of sales resistance to American products.

The countries which already have a considerable number of cars, however, are likely to prove the most accessible to the American exporter, since he is not under so great a necessity of selling the idea of motor transportation.

A detailed analysis of registration distribution is necessary, however, if maximum value is to be derived from these world statistics. The value of the various coun-

World Registration of Cars and Trucks

United States	10,505,660	Algeria	12,000	Jamaica	1,350
Great Britain	497,582	Poland	10,700	British Guiana	1,050
Canada	463,448	Chile	10,000	Barbados	1,000
France	236,146	Uruguay	10,000	Canary Islands	881
Germany	91,384	Roumania	8,500	New Foundland	600
Argentina	75,000	China	8,150	British West Africa	566
Australia	73,900	Federated Malay States	8,000	Ecuador	500
Italy	53,000	Porto Rico	6,500	Guatemala	500
India	45,983	Turkey	5,500	Guadeloupe	500
Dutch East Indies	45,000	Ceylon	5,350	Paraguay	500
Spain	37,560	Egypt	5,084	Salvador	400
New Zealand	37,500	Portugal	5,000	Portuguese East Africa	400
Russia	35,000	Czechoslovakia	4,133	Nicaragua	370
Belgium	33,200	Gold Coast	3,500	Bolivia	300
Union of South Africa	26,468	Peru	3,343	Angola	250
Brazil	25,000	Venezuela	2,500	French West Africa	230
Mexico	25,000	Morocco	2,500	Costa Rica	200
Denmark	22,260	Indo-China	2,300	Honduras	200
Cuba	20,000	Trinidad	2,221	Madagascar	159
Switzerland	18,011	Siam	2,187	Bahama	150
Austria	16,350	Colombia	2,000	Madeira Islands	100
Norway	14,340	Tunis	1,990	Azores	80
Sweden	14,250	Panama	1,950	British Honduras	68
Holland	13,500	Dominican Republic	1,800	Italian Somaliland	66
Philippine Islands	12,381	Mauritius Island	1,600	Reunion Island	35
Japan	12,260	Hawaii	1,500	Monrovia	3
					12,588,949

centages is sound from an export point of view, because those countries outside the United States and Canada are of chief interest as possible markets.

The tabulation indicates that just about half of the remaining total of cars and trucks are owned in European countries. France, Russia, Germany and other smaller European nations, however, are not of particu-

tries as export markets depends partly upon the registration figures, but chiefly upon other economic factors peculiar to the individual territory. While it is impossible within the limits of a brief article to discuss all these factors in detail, a brief survey of each country will serve to bring out clearly the lights and shades in this comprehensive picture of the world automotive situation.

North and South America

NORTH and South America are far in the lead of other continents as regards the total number of motor vehicles in use. There are 11,162,-110 cars and trucks in use in North and South America, the vast majority, of course, being in the United States, which in 1921 has registered a total of 10,505,660.

This leaves a total of 656,450 for these areas outside of continental United States. About 70 per cent of this is included in Canada, where a registration gain of 60,-337 has been attained over 1920. The remaining 193,002

United States	10,505,660	Porto Rico	6,500	British Guiana	1,050	Nicaragua	370
Canada	463,448	Peru	3,343	Barbados	1,000	Bolivia	300
Argentina	75,000	Venezuela	2,500	Newfoundland	600	Honduras	200
Brazil	25,000	Trinidad	2,221	Paraguay	500	Costa Rica	200
Mexico	25,000	Colombia	2,000	Ecuador	500	Bahama	150
Cuba	20,000	Panama	1,950	Guatemala	500	British Honduras	68
Chile	10,000	Dominican Republic	1,800	Guadeloupe	500		
Uruguay	10,000	Jamaica	1,350	Salvador	400	Total	11,162,110

cars and trucks are scattered through the South and Central American countries, Argentina, Brazil and Mexico leading this group with totals of 75,000, 25,000 and 25,000 respectively.

The Dominion of Canada occupies the distinction of ranking third in the countries of the world in motor vehicle population, being led by the United States and Great Britain, the latter made up of England, Scotland, Ireland and Wales. Canada had 463,448 motor vehicles on Dec. 31, 1921, as compared with 403,111 one year ago.

Canada, with its area equal to that of the United States or Brazil, or Australia or the Continent of Europe, has 7,200,000 population; has 1 car for every sixteen persons, as compared to 1 car for every 10 persons in the United States. The Province of Ontario, a rich agricultural and manufacturing province, has nearly one-half the cars of the Dominion. The division of cars among the different provinces as of Dec. 1, 1921, and as of Dec. 31, 1900, are:

Province	December 31, 1921	December 31, 1920
Ontario	200,900	171,500
Saskatchewan	63,370	60,749
Alberta	39,835	38,015
British Columbia	32,724	28,200
Quebec	59,707	43,500
Nova Scotia	13,940	12,198
New Brunswick	12,103	11,421
Prince Edward Island	1,200	1,073
Manitoba	39,669	36,455
	463,448	403,111

The prairie agricultural province of Saskatchewan leads the old province of Quebec by nearly 4000 vehicles. The lack of good roads in western Canada is holding back the sale of motor vehicles.

Quebec has led all the other provinces in good roads with permanent hard surfaces, but in the last three years Ontario has adopted a provincial policy and has been carrying on an extensive highway program.

Argentina has 75,000 cars and trucks. This is an estimate, as total registrations for the country, with its 9,000,000 population, are not available. Argentina ranks sixth among the nations of the world in motor population, being led by the United States, Great Britain, Canada, France and Germany. Buenos Aires, the capital, the largest city in the world south of the equator, has, with its 1,800,000 population, 15,000 cars, of which 6500 are used for taxicab and hire purposes. In the other cities of Argentina, such as Rosario, Cordoba, La Plata, Bahia Blanca, Mendoza, Tucuman and Santa Fe are 10,000 more vehicles, leaving 50,000 in the rural part of the country. Some careful estimates place the total automobiles in Argentina at 80,000.

It is only in recent years that Ford has started assembling in Argentina, so that most of the motor vehicles have been imported. From 1910 to Sept. 30, 1920, a total of 65,275 vehicles were imported. Ford has assembled in Buenos Aires about 25,000 vehicles, although the Fords sold in that country practically double this figure.

During 1921 the imports into Argentina from Jan. 1 to September were: Cars, 414; trucks, 57. These were divided between European and North American manufacturers as follows:

	United States	Europe
Cars	328	86
Trucks	7	50

Of the European trucks 24 were used models.

The imports of cars and trucks into Argentina since 1900 follow:

	Cars		Cars
1900	9	1910	1,581
1901	16	1911	2,461
1902	28	1912	4,281
1903	62	1913	5,115
1904	129	1914	2,185
1905	377	1915	1,847
1906	712	1916	5,929
1907	610	1917	11,031
1908	495	1918	5,926
1909	831	1919	4,594

Ownership of Cars and Trucks by Countries

Algeria	12,000	Egypt	5,084	Nicaragua	370
Angola	250	Federated Malay States	8,000	Norway	14,340
Argentina	75,000	France	236,146	Panama	1,950
Australia	73,900	French West Africa	230	Paraguay	500
Austria	16,350	Germany	91,384	Peru	3,343
Azores	80	Gold Coast	3,500	Philippine Islands	12,381
Bahama	150	Great Britain	497,582	Poland	10.700
Barbados	1,000	Guadeloupe	500	Porto Rico	6,500
Belgium	33,200	Guatemala	500	Portugal	5,000
Bolivia	300	Hawaii	1,500	Portuguese East Africa	400
Brazil	25,000	Holland	13,500	Reunion Island	35
British Guiana	1,050	Honduras	200	Roumania	8,500
British Honduras	68	India	45,983	Russia	35,000
British West Africa	566	Indo China	2,300	Salvador	400
Canada	463,448	Italian Somaliland	66	Siam	2,187
Canary Islands	881	Italy	53,000	Spain	37,560
Ceylon	5,350	Jamaica	1,350	Sweden	14,250
Czechoslovakia	4,133	Japan	12,260	Switzerland	18,011
Chile	10,000	Madagascar	159	Trinidad	2,221
China	8,150	Madeira Islands	100	Tunis	1,990
Colombia	2,000	Mauritius Island	1,600	Turkey	5,500
Costa Rica	200	Mexico	25,000	Union of South Africa	26,468
Cuba	20,000	Monrovia	3	United States	10,505,660
Denmark	22,260	Morocco	2,500	Uruguay	10,000
Dominican Republic	1,800	New Foundland	600	Venezuela	2,500
Dutch East Indies	45,000	New Zealand	37,500		12,588,949
Ecuador	500				

During the first six months of 1920 there were imported 7284 cars and 102 trucks.

Brazil, with an area equal to that of the United States, and a population of 30,000,000, has 25,000 motor vehicles. This is an estimate, as registrations for the many states comprising Brazil are not available. An estimate places trucks at 1000. These vehicles are distributed partially as follows, this distribution being an estimate and not based on registrations:

Rio de Janeiro district	4,000 to 5,000
Sao Paulo district	4,000 to 6,000
Pernambuco	1,000
Southern Brazil	6,000
Central Interior	3,000
Northern Interior	2,000

There were registered in Pernambuco in August, 1920, cars, 851; truck, 127; motorcycles, 8. A year later the registration was: Cars, 633; trucks, 173; motorcycles, 15. The reduction in the number of cars is probably due to late registration.

Ford has established an assembly branch at Sao Paulo, which in recent months has reported extensive improvement in sales.

Mexico's motor population at 25,000 cars and trucks, is based on 8000 vehicles being added in 1921, which was the greatest year for the motor vehicle in Mexico, to the estimate of 18,000 being in the country at the end of 1920. Registration figures for the City of Mexico in August, 1921, gave a total of 9066 vehicles, made up of private cars, 4015; taxicabs, 4166; buses, 363; Government cars, 309; trucks, 214. To this can be added 265 motorcycles. In 1919, there were 20 different makes of automobiles in Mexico, and in 1920 the number had increased to 43. Mexico is the only country that imported more automobiles in 1921 than in 1920, and the most careful estimates show that the automotive registration in Mexico increased from 40 to 50 per cent during last year.

Cuba is estimated to have 20,000 cars and trucks, of which 20 or 25 per cent are motor trucks. This estimate is based on reports from United States consuls for their various districts. The Province of Habana, which includes the city of Havana, in the latter part of 1921, had registrations of 10,216 cars, 2958 trucks and 166 motorcycles. During 1920, approximately 2800 cars were sold in this district, and in the first seven months of 1921 approximately 800 more were sold.

Chile is estimated to have 10,000 cars and trucks. In 1919, the most reliable figures showed 8000 vehicles in the country. In that year the registrations in some of the cities were:

Santiago	3,238	Iquique	86
Valparaiso	575	Valdivia	51
Antofagasta	311	Curico	69
Punta Arenas	311	Talca	80
Concepcion	391		

During 1921, there were imported into Antofogasta 180 cars, 60 trucks, 40 taxicabs and 10 motocycles. The roads within the limits of this city are excellent. In Punta Arenas, 610 cars have been imported, and 93 motor trucks. In the district are 35 motorcycles.

Uruguay, the smallest country in South America, and with but 1,250,000 population, has more good roads than any other country on the continent, which explains why it has 10,000 motor vehicles. In Montevideo are registered 7461 cars, and there were imported into Uruguay from 1903 to May 31, 1921, a total of 13,194 vehicles.

There are 573 motorcycles in Uruguay, of which 500 are in Montevideo. Of the 573 motorcycles, 461 are of North American manufacture. There are not over 100 users of motor trucks in Uruguay.

Porto Rico, with from 6000 to 6500 vehicles, is using the motor vehicle to supply transportation not furnished by railroads. Bus line transportation has reached large proportions on the island. In the last two years the use of motor vehicles has increased rapidly, as at that time there were 4324 cars, 210 trucks and 210 motorcycles in operation.

An estimate of 3343 motor vehicles in Peru is not based on registration figures, as such are not obtainable. Exports from the United States to Peru totaled 3565 cars and 1267 trucks. In 1917 Peru imported 582 vehicles. In 1918 she imported 607 and in 1919 there were 609. The registrations for Lima, the capital, are given as 2229, consisting of 629 cars for hire, 1300 for private use and 300 trucks.

Estimating 2500 motor vehicles in Venezuela is an approximation, and of this number, 10 per cent is trucks. Caracas, the capital, has 505 cars. Different United States consuls have given reports for their districts which estimate the motor vehicles as follows: Peurto Cabello, 500 cars and trucks, and Maracaibo, 325 cars. There are 45 farm tractors in the country.

Colombia is estimated to have 2000 cars and trucks. During the first six months of 1920, approximately 1000 cars were imported through the port of Barranquilla. Not over 12 farm tractors are in use in this district. In Cartagena are 90 cars, 20 trucks and 10 motor buses. In Santa Marta are 42 cars and two trucks. Trade estimates give Barranquilla a total of 332 cars, 24 trucks and 31 motor buses. Total imports in 1920 were 1200 vehicles.

The Dominican Republic on Jan. 1, 1921, had 1644 cars and trucks registered. Of this total 560 cars were imported in 1920 and 211 in 1919. All of the cars are of North American manufacture. There are 50 motorcycles in the country. A dozen farm tractors have been sold in the last two years.

The Republic of Panama and the Canal Zone, but not including the city of Colon, have 1750 cars and trucks. The city of Colon has licensed 200 vehicles, including 50 trucks. There are four tractors and 15 motorcycles in the Republic.

Costa Rica his issued 220 motor car registrations. The imports for 1919 and 1920 have not been published. In the first ten months of 1921 there were sold 33 vehicles. There are 12 motorcycles in Costa Rica and 23 motor trucks.

Car Ownership in Spanish Speaking Countries

Argentina	**75,000**
Spain	**37,560**
Brazil	**25,000**
Mexico	**25,000**
Cuba	**20,000**
Philippine Islands	**12,381**
Chile	**10,000**
Uruguay	**10,000**
Porto Rico	**6,500**
Portugal	**5,000**
Peru	**3,343**
Venezuela	**2,500**
Colombia	**2,000**
Panama	**1,950**
Dominican Republic	**1,800**
Ecuador	**500**
Guatemala	**500**
Paraguay	**500**
Salvador	**400**
Portuguese East Africa	**400**
Nicaragua	**370**
Bolivia	**300**
Costa Rica	**200**
Honduras	**200**
Madeira Islands	**100**
Azores	**80**
	241,584

Nicaragua has 370 motor vehicles made up of 350 cars and 20 trucks. During 1920 there were imported from the United States 184 cars. Not over 25 per cent of this number were imported in 1921. There are 8 farm tractors and 6 motorcycles.

Honduras has 200 motor vehicles, divided among different districts. The Tegucigalpa district has 60 cars, 10 trucks and 5 motorcycles. The Ceiba district has 59 cars, 9 trucks and 5 motorcycles. The Puerto Cortes district has 48 cars and trucks.

Guatemala has 500 motor vehicles, of which 90 per cent are in Guatemala city. This number includes 40 trucks. In 1919 there were imported 126 cars, all from the United States; in 1920 the number was 165 from the United States and 1 from England and 1 from Mexico. There are 50 farm tractors in the country.

Salvador has 400 motor vehicles. The majority of these are of American manufacture. The use of the motor bus is a recent development.

Ecuador has 500 motor vehicles, which includes 6 trucks. There are 8 farm tractors.

Haiti has 726 cars, trucks, tractors and motorcycles, made up as follows: Cars, 650; trucks, 40; motorcycles, 25; tractors, 11. During 1920 there were sold 60 cars and 15 trucks, and during nine months of 1921 sales were 20 cars and 12 trucks.

Bolivia has 300 motor vehicles. The exports from the United States to Bolivia prior to 1920 totaled 379 cars and 67 trucks, a total of 446.

Paraguay has 500 motor vehicles. The United States has exported to Paraguay 186 cars. Most of the cars are in the five cities, Asuncion, Villarica, Concepcion, Pilar and Encarnacion.

Jamaica had registered on Aug. 25, 1921, a total of 1350 automobiles. Trucks in use are estimated at 150. As compared with these figures there were in October, 1920, a total of 2010 vehicles registered, the drop in 1921 apparently indicating vehicles not in use. Not over 25 agricultural tractors are used on the island.

British Guiana, a British possession in South America, has 1050 cars and trucks, of which 159 were imported in 1920. To this can be added 150 motorcycles and 100 farm tractors. Importations of cars and trucks in 1921 were very small.

The British island of Barbados has 1035 cars and trucks, of which 35 are trucks. There are 150 motorcycles on the island. In 1920 Barbados imported 197 cars and in 1921 only 30. There are 12 farm tractors on the island. Barbados is largely given over to sugar plantations and has an excellent system of macadam roads over the entire island.

The island of Guadeloupe, a French possession in the West Indies, has 500 motor vehicles, this including 50 trucks. American makes dominate. Importations in 1921 were very limited, and in 1920 only 71 motor vehicles were imported from the United States and 32 from France.

Trinidad has 1961 motor cars, 200 motor trucks, and 60 motor buses. An analysis of motor importations shows:

1912	67	1917	196
1913	72	1918	114
1914	63	1919	246
1915	111	1920	624
1916	174		

Probably not over 100 vehicles were imported into Trinidad in 1921. There are 200 motorcycles on the island. Very few farm tractors have been imported.

British Honduras in October, 1921, had 56 cars and 12 trucks. Five farm tractors are used in the lumber industry. Lack of roads is responsible for the small number of vehicles, 75 per cent of which are for hire. Practically all cars and trucks imported have come from the United States.

Europe

MORE than a million cars are now in use throughout Europe, the total being 1,110,996, according to the figures obtained in this survey. The European countries best known as automobile producers lead the list in registrations. Great Britain is found at the top, while France, Germany and Italy follow in the order named.

Figures for many of the European countries have been difficult to obtain, since registration of motor vehicles is not carried out to the extent that it is in this country. Figures for Russia have been particularly hard to get because of the unsettled economic and political situation in that country. The figure for Russia used in the following tabulation is little more than an intelligent guess, since there is probably nobody in the world who can give a refinite figure as to how many cars and trucks are in that country.

Great Britain	497,582	Denmark	22,260	Roumania	8,500
France	236,146	Switzerland	18,011	Portugal	5,000
Germany	91,384	Austria	16,350	Czechoslovakia	4,133
Italy	53,000	Norway	14,340	Azores	80
Spain	37,560	Sweden	14,250		
Russia	35,000	Holland	13,500	Total	1,110,996
Belgium	33,200	Poland	10,700		

Great Britain, consisting of England, Scotland, Wales and Ireland, had on Aug. 31, 1921, a motor vehicle registration of 497,582. This was made up as follows:

Cars	242,500
Trucks	128,200
Hackneys	82,800
Farm Tractors	14,520
Road Locomotives	2,650
Ambulances	312
Motorcycles	173,200

When 373,200 motorcycles are added to the other motor vehicles it gives a grand total of 870,782 motor vehicles of all classifications. The 2650 road locomotives undoubtedly referred to steam vehicles, generally designated traction engines. Under motor hackney undoubtedly is included all taxicabs, and we are not certain if motor buses come under this classification. These figures from the Ministry of Transport are for the registration of the first nine months of the year. Figures are not available for the last three months. Great Britain has always been a great motorcycle country, and is one of the few in which more motorcycles are used than motor cars.

Basing calculations on 497,582 vehicles, and with a population of 48,000,000, there is one vehicle for approximately every 96 persons. The total area of the British Isles is approximately the same as the State of New Mex-

ico. The country is served with a network of improved highways, it being questionable if there is any other country that compares with England in the uniform character of its highways.

France for the first time in history has accurate statistics on its motor population, and the following figures are as of July 1, 1921: On that date there were 236,146 automobiles of all kinds, which included cars, trucks, and buses, but did not include cyclecars, motorcycles with side cars, or motorcycles. This total gives one motor vehicle for every 152 of population. It represents an increase of 100 per cent as compared with the vehicles in France prior to the war. A further analysis of this total is:

Private cars	135,266
Private trucks	72,649
Motor buses	21,038
Municipal trucks	6,418
State subsidy trucks	777

These figures do not take into account army automobiles of any character.

The division of motor vehicles in France in the different departments shows that by far the greatest number is in the Paris zone. Paris with its suburbs has the following vehicles:

Private cars	22,665
Private trucks	17,482
Buses	16,397

The other French departments are a long distance behind Paris in the registration of motor vehicles. The department of Rhone, which includes the city of Marseilles, has only 8657. The Nord, comprising one of the wealthiest regions of France, has but the same number. An analysis of French registration shows that in many of the agricultural regions a large amount of work remains to be done in selling automobiles.

Germany had registered on July 1, 1921, motor vehicles to a total of 91,678, this including cars, trucks, buses, and tractors, and army vehicles as well as civilian vehicles. A rather complete analysis of this total is as follows:

Motor cars	59,588
Trucks	30,424
Buses	1,372
Tractors	292

To this total may be added motorcycles, 26,729. Germany is the only country in its registration dividing its vehicles into internal combustion, steam, and electric classifications. This analysis shows 385 electric passenger vehicles.

French Motor Vehicle Registrations by Departments

DEPARTEMENTS	State Subsidized Trucks and Buses	Public Service Automobiles		Privately Owned Automobiles		Total			DEPARTEMENTS	State Subsidized Trucks and Buses	Public Service Automobiles		Privately Owned Automobiles		Total		
		Buses	Trucks	Pass. Cars	Trucks	Pass. Cars	Trucks	All kinds Automobiles			Buses	Trucks	Pass Cars	Trucks	Pass. Cars	Trucks	All kinds Automobile
Ain	10	60	18	790	388	860	406	1,266	Loiret	1	60	25	1,657	459	1,718	484	2,202
Aisne	10	35	34	744	2,750	779	2,784	3,563	Lot	16	38	14	255	70	309	84	393
Allier	2	143	14	1,313	441	1,458	455	1,913	Lot-et-Garonne	9	34	6	877	330	920	336	1,256
Alpes (Basses)	12	33	12	163	112	208	124	332	Lozère	5	16	4	79	24	100	28	128
Alpes (Hautes)	12	20	5	103	70	135	75	210	Maine-et-Loire	1	119	7	2,037	712	2,157	719	2,876
Alpes-Maritimes	12	694	29	1,329	457	2,035	486	2,521	Manche	5	96	19	1,051	475	1,152	494	1,646
Ardèche	13	78	22	656	250	747	272	1,019	Marne	...	149	83	1,503	876	1,652	959	2,611
Ardennes	...	34	43	795	613	829	656	1,485	Marne (Haute)	10	17	6	735	430	762	436	1,198
Ariège	13	22	10	271	108	306	118	424	Mayenne	2	75	21	1,006	285	1,083	306	1,389
Aube	8	55	28	1,122	480	1,185	508	1,693	Meurthe-et-Moselle	...	127	81	1,195	837	1,322	918	2,240
Aude	14	52	65	794	339	860	404	1,264	Meuse	...	42	2	1,112	348	1,154	350	1,504
Aveyron	44	66	50	551	276	661	326	987	Morbihan	2	38	3	772	291	812	294	1,106
Bouches-du-Rhône	3	249	418	4,506	3,481	4,758	3,899	8,657	Nièvre	7	126	30	1,079	404	1,212	434	1,646
Calvados	...	93	14	1,901	673	1,994	687	2,681	Nord	2	158	63	4,848	3,345	5,008	3,408	8,416
Cantal	20	67	23	319	108	406	131	537	Oise	...	.....	.....	2,192	1,094	2,192	1,094	3,286
Charente	...	75	37	1,163	360	1,238	397	1,635	Orne	5	84	14	1,251	439	1,340	453	1,793
Charente Inférieure	...	110	27	1,423	679	1,533	706	2,239	Pas-de-Calais	...	165	90	2,018	1,235	2,183	1,325	3,508
Cher	...	69	9	715	463	784	472	1,256	Puy-de-Dôme	37	69	21	899	597	1,005	618	1,623
Corrèze	1	66	24	391	217	458	241	699	Pyrénées (Basses)	1	279	25	1,302	288	1,582	313	1,895
Côte d'Or	6	79	25	1,181	725	1,266	750	2,016	Pyrénées (Hautes)	7	24	5	275	95	306	100	406
Côtes-du-Nord	4	50	15	1,077	398	1,131	413	1,544	Pyrénées (Orientales)	5	50	32	616	494	671	226	897
Creuse	13	20	9	[illegible]	204	457	213	670	Rhône	4	176	366	3,872	2,656	1,052	3,022	7,074
Dordogne	17	45	12	1,029	173	1,091	185	1,276	Saône (Haute)	...	38	7	1,050	471	4,088	478	1,566
Doubs	19	58	21	955	658	1,032	679	1,711	Saône-et-Loire	4	112	59	1,739	762	1,855	821	2,676
Drôme	9	66	17	1,297	339	1,372	356	1,728	Sarthe	...	55	8	1,482	556	1,537	564	2,101
Eure	4	122	39	2,198	813	2,324	852	3,176	Savoie	8	19	10	437	232	464	242	706
Eure-et-Loir	...	68	8	1,702	494	1,770	502	2,272	Savoie (Haute)	14	94	14	468	275	576	289	865
Finistère	12	167	32	1,068	538	1,247	570	1,817	Seine	222	13,395	2,780	22,665	17,482	26,282	20,262	56,544
Gard	2	72	79	1,156	412	1,230	491	1,721	Seine Inférieure	...	274	128	4,869	1,890	5,143	2,018	7,161
Garonne (Haute)	23	48	7	1,170	323	1,241	330	1,571	Seine-et-Marne	6	79	28	2,260	985	2,345	1,013	3,358
Gers	7	30	14	395	296	432	310	742	Seine-et-Oise	17	156	117	3,578	2,555	3,751	2,672	6,423
Gironde	11	168	98	1,375	1,[illegible]39	1,554	1,537	3,091	Deux-Sèvres	...	65	11	1,006	447	1,071	458	1,529
Hérault	26	96	37	2,647	[illegible]35	2,769	872	3,641	Somme	...	132	461	2,074	990	2,206	1,451	3,657
Ille-et-Vilaine	...	67	32	1,385	[illegible]4	1,452	516	1,968	Tarn	1	60	23	995	253	1,056	276	1,332
Indre	...	49	1	1,975	299	2,024	300	2,324	Tarn-et-Garonne	5	36	6	413	152	454	158	612
Indre-et-Loire	4	315	77	4,982	2,173	5,301	2,250	7,551	Var	9	75	32	797	338	881	370	1,251
Isère	20	116	51	1,433	873	1,569	924	2,943	Vaucluse	12	114	30	1,393	380	1,519	410	1,929
Jura	2	71	26	654	344	727	370	1,097	Vendée	..	72	10	1,066	288	1,138	298	1,436
Landes	...	45	13	796	159	841	152	993	Vienne	1	30	4	1,063	374	1,094	378	1,472
Loir-et-Cher	...	56	22	1,084	491	1,140	513	1,653	Vienne (Haute)	...	53	29	931	471	984	500	1,484
Loire	3	96	134	2,971	1,320	3,070	1,454	4,524	Vosges	4	110	16	1,212	611	1,326	627	1,953
Loire (Haute)	...	29	13	239	397	268	410	678	Yonne	3	78	19	1,282	520	1,363	539	1,902
Loire-Inférieure	6	95	45	1,613	710	1,714	746	2,460									
									Total	777	21,038	6,418	135,266	72,649	157,081	79,067	236,148

Classification of the 30,424 trucks shows 858 electrics and 30 steam. A classification of the private cars shows:

Privately owned	48,963
Government owned	3,321
Taxicabs	7,574

The 292 tractors are made up of electric, 73; steam, 84, and internal combustion engine, 135. There are 540 fire department vehicles registered, and 264 street cleaning vehicles.

A comparison of the passenger cars registered in Germany on Jan. 1, 1914, and February, 1920, shows a heavy decrease. The figures for 1914 were 60,876, and for February, 1920, 32,450. A comparison of the truck registrations on those dates showed in 1914, 9639, and in 1920, more than double that number, namely, 19,742. The registration of motorcycles in 1914 was 22,557, and in 1920, 9369.

Holland, with an area one-half greater than Massachusetts, and a population close to 7,000,000, has an estimated motor vehicle census of 13,000 motor cars, 500 trucks, 15,000 motorcycles, and 100 tractors. This estimate is as of July 1. It has been impossible to get accurate figures, and even the figures of 1920 to which could be added the imports of 1921, are not correct in that we do not know how many of the vehicles imported remain in the country and how many are merely in transit, destined to other countries. The imports for 1920 totals 7603 vehicles from the following countries:

Country	Number
Germany	3,790
United States	2,968
Belgium	402
France	236
Great Britain	207
Total	7,603

Spain on July 1, 1921, had 37,560 motor vehicles of all kinds in operation. Unfortunately these figures do not show the division between cars and trucks. This total is made up from official figures from the different provinces of Spain showing the widespread distribution of the motor vehicle in that country. As in most European countries, a pretty heavy percentage of the vehicles are in the large cities; thus Madrid, the capital, and Barcelona, a great manufacturing city, each with a population of 650,000, have 7500 cars and trucks each. A total of 37,560 is a small motor vehicle population for a country like Spain, which is one-fifth larger than California in area, and a little larger than all of Germany. Being largely an agricultural area, the prospects for a wide use of vehicles among the agricultural classes is good. Its population is 20,500,000. Ford has established an assembly branch at Cadiz.

Czecho-Slovakia has a total motor population of 4133, which is divided among the city of Prague and the four provinces comprising Czecho-Slovakia as follows:

	Cars	Trucks
Bohemia	1,297	532
Prague	1,121	360
Moravia	326	131
Silesia	97	38
Slovakia	174	57

During 1921 there were sold up to September 1 a total of 555 automobiles. No sales statistics for the remainder of the country for this year are available.

Austrian Conditions

Austria has been designated as the head without the body, remnant of former Austria-Hungary. Vienna, a city of 1,800,000, and one of the beautiful cities of the world, and the former center of Austria-Hungary, is now the major part of what is left of this former empire. Austria is to-day an area scarcely the size of Indiana. It is a great city with a tourist country but none of the manufacturing and agricultural areas to support it, which did support it previous to the war. Notwithstanding that the body, which, so to speak, supported the head, has been amputated, the city of Vienna remains a great city, and one to which the Near East comes to make its purchases. Vienna will have to buy largely her manufacturing and agricultural products from the adjoining countries. The motor population of present Austria, with 6,000,000 people, is approximately 16,350 cars and trucks. These are divided, cars, 13,000; trucks, 3500. To this can be added 4000 motorcycles. The number of motor vehicles in a resort area such as Austria is certain to exceed, by some quantity, the numbers registered by its citizens.

Swiss Registration

Statistics on the number of motor vehicles in Switzerland, the great resort area of Europe, are no indication of the number of motor vehicles in use in the country at certain seasons. This country, which in area is twice the size of Massachusetts, and with 4,000,000 population, had on Aug. 31, 1921, a total car and truck registration of 18,011. The segregated registration figures as of that date are:

Cars	13,172	Motorcycles	9,500
Trucks	4,839	Tractors	160

These figures give Switzerland a motor vehicle, that is, a car or truck for every 200 population. Included in the passenger car figures are 196 passenger buses registered.

Registrations for Italy during 1921 have not been obtainable, but registrations at the close of 1920 showed a total of 53,000 cars, trucks and motor buses. To this should be added 15,000 motorcycles. The detailed figures are:

Cars	25,000	Motorcycles	15,000
Trucks	25,000	Motorbuses	3,000

Estimates on the sales in Italy during 1921 have been placed as follows: Trucks 5000; motorcycles, 5000. No estimate has been obtainable on the number of cars sold last year. Italy as a country in area is twice that of Iowa, and its population of 40,000,000 is twenty times as great as that of Iowa.

Poland on the new map of Europe almost equals California in area, and with its population of 24,000,000 offers one of the fields worth watching and developing for motor vehicles in Europe. The total number of vehicles in use is a composite estimate, and is placed at 10,700, composed as follows: Cars, 6800; trucks, 2000; motorcycles, 1900. A goodly percentage of these are found in the three important cities, Warsaw, Lodz and Posen. Warsaw, with almost a million population, has 2600 vehicles that have been operated during the past year; Lodz, a city of half the size, has 200; and Posen, with 150,000 population, has 300 vehicles. Poland, being largely an agricultural country, is certain when conditions become settled to be a useful market.

There are approximately 980 cars, 120 trucks, and 210 motorcycles in the Free City of Danzig, many of which have been brought in during the past year by the various missions, commissions, Polish officials, and representatives of the League of Nations. In 1920 there were registered in the city 302 cars and 62 trucks, a total of 364. Toward the end of 1921 there were registered cars, 683; trucks, 123; motorcycles, 115.

Bulgaria, whose railroad and other methods of transportation was seriously wrecked during the war, is still as badly handicapped in transportation as practically any country in Europe. For an area as large as Tennessee,

and with 5,000,000 population, the number of cars and trucks, 1140, is hopelessly inadequate. The best available figures obtained from Sofia, the capital, are: Cars, 700; trucks, 400; buses, 40; motorcycles, 100. These figures apply to the entire country. In the past two years the number of motor vehicles has increased 35 per cent, largely by importations of Italian makes. During the war German vehicles were purchased. The present condition of roads in Bulgaria is not conducive to increased use of vehicles, but the inefficient condition of the railroads and the greatly increased production in agriculture, timber and tobacco, augur favorably for an increased use of motor vehicles.

Belgium at the end of 1921 had 33,200 motor cars, trucks, and tractors, according to Government officials as of that date. It might be more conservative to say that there were really in use in Belgium 32,000 vehicles in order to take care of dual registrations. The detailed figures are:

Cars .....28,160 Trucks 3,840

The number of motorcycles in use is 20,000, compared with 11,000 in 1914, immediately previous to the war. The growth of automobiles since 1914 has been nearly 100 per cent. There were, when the war opened, 16,000 automobiles, as compared with 28,160 to-day. Belgium is a small country, only one-half larger than Massachusetts in area and with a population of 7,600,000, and has approximately one automobile for every 230 population.

In considering ratio of population to automobiles, it must be kept in mind that Belgium is a manufacturing country rather than an agricultural one.

Roumania, one of the Balkan countries, which in area equals New Mexico, with 17,000,000 population, has an estimated total of 8500 vehicles of all classes. The Roumanian army operates 1500 vehicles in all parts of the country, the majority of which are in Bucharest, the capital, a city of 350,000 population. In this city are 1960 privately owned vehicles, thus leaving 5100 vehicles of all classes in the remainder of the country. The imports in 1920 were 711 vehicles of all classes. Due to the breaking up of many of the large estates among small land owners, it is not expected that for some time the development of the farm tractor industry will be very rapid.

Portugal, about the size of Indiana, but with nearly 6,000,000 population, had in 1919 about 4400 cars and trucks. To this may be added 200 motorcycles.

Asia

ASIA has a total of 134,730 cars and trucks. More than half of these are located in three countries—India, Japan, and the Dutch East Indies. Despite its enormous population, China stands fourth in the list of registrations. There are many parts of Asia which offer little immediate chance for automotive development.

India	45,983	Federated Malay States	8,000	Siam	2,187
Dutch East Indies	45,000	Turkey	5,500		
Japan	12,260	Ceylon	5,350	Total	134,730
China	8,150	Indo-China	2,300		

China, with its 400,000,000 population and area nearly one-half greater than that of the United States, has a total motor registration of 8150 vehicles, made up as follows: Cars, 6866; trucks, 437; buses, 55; trailers, 50; motorcycles, 792. There is no other country in which greater difficulty lies in the way of accurate registrations than in China. There are several areas that are under the government of other nations, and motor vehicle registrations in such areas are under these respective governments. The most of the vehicles are in the cities. It is estimated that there are 4000 in Shanghai.

China has 60,000 miles of well-constructed courier roads which radiate out of the chief centers and connect with provincial capitals, but unfortunately the use of the telegraph and railroad have let these highways go into disuse. Of these 10,000 miles radiate from the national capital and 50,000 from provincial capitals. China has total railroad mileage of 7000 miles.

The passenger cars and trucks in some of the divisions of China are:

City	Number	City	Number
Canton	152	Changchun	41
Changsha	3	Dairien	240
Foo Chaw	17	Hankow	252
Hongkong	617	Kalgan	35
Mukden	81	Nanking	53
Nantungchow	23	Newchwang	9
Peking	1,127	Shanghai	4,670
Tientsin	646	Tsinan	41
Tsingtao	45	Elsewhere	70

British India, on March 31, 1921, had registered 45,983 motor vehicles, of which the division among cars, motorcycles and trucks follows: Cars, 31,934; motorcycles, 11,399; trucks, 2660. These figures cover the fourteen provinces which make up British India. The greater numbers of the cars are located in the larger cities, and immediate provinces. Bombay has 10,288 cars; Calcutta, 7650, and Madras, 5595. The number of motor trucks in these cities is relatively few: Bombay, 544; Calcutta, 600, and Madras, 59. In the Rangoon province there are 5000 cars and trucks.

The total vehicles in the different provinces of India are:

Province	Number	Province	Number
Bengal	9,757	Bombay	13,290
Burma	5,018	Delhi	603
Madras	3,527	Karachi	899
Central Province	1,170	United Provinces	4,590
Northwest Province	481	Bihar	1,829
Punjab	3,975	Assam	772
Ajmer-Merwara	72		

There were 12,260 automobiles and motor trucks in the Japanese Empire about the middle of 1921, and of this number approximately 7000 were in the city of Tokyo. Roads in Japan are very poor and have restricted the sale of motor vehicles. In spite of this the total of 12,260 scarcely represents the exact number, as many parts are imported into Japan and assembled there. During 1920 there were imported 1745 automobiles valued at $2,425,000, and parts to the value of $2,798,000. A number of companies are building automobiles in small production in different parts of Japan, but the manufacturer is scarcely out of the experimental stage. The building of automobile bodies has developed to a much greater extent.

Ceylon, a British insular possession off the southern end of India, and noted for its exports of tea, spices, rubber, etc., is a good motor car center because of its system of highways, embracing 4000 miles of well surfaced main roads and 4200 miles of minor roads. The island is about the same size as the State of Maine and its population of 4,500,000 equals that of Iowa. On July 1, 1921, its total motor population was 5350 vehicles, made up as follows:

Cars	3,200	Trucks	200
Motorcycles	1,850	Buses	100

During the first five months of 1921 only 394 vehicles were imported. The European population, all British, is approximately 7000. The purchasing power of the natives is low.

The Federated Malay States, with Singapore as capitol, has approximately 8,000 motor cars, of which nearly 4,000 are in Singapore, the most attractive city of that portion of the Orient, and located on an island approximately 30 miles in length and 14 miles wide. The wealth of the Federated Malay States is due to rubber and tin, perhaps 80 per cent of the world's crude rubber coming from this area.

The Dutch East Indies composed of the Islands of Java, Sumatra, Celebes, and other islands, is one of the large motor fields of the east, and it is estimated there are 45,000 motor vehicles in this group of islands, which have been developed by the Dutch. Java, an island 700 miles in length, and 100 miles in width, has literally a net work of good macadam roads, which carry the motorist everywhere. Road building on the other islands has not progressed. With its population of 35,000,000, Java gives promise of being one of the best centers for motor vehicles. Its industries are sugar, coffee, tea, rubber and spices. The Island of Sumatra has some of the largest rubber plantations of the east. Petroleum is a product of Borneo and Sumatra.

Siam, while having a population of 9,000,000 has little more than 2,187 motor vehicles, most of which are in Bangkok, the capital. This total is made up of cars, 1,483; motorcycles, 541; and trucks, 163. While there are approximately 300 miles of good highways in the vicinity of Bangkok the automobiles are mostly in the hands of Chinese merchants and Siamese nobles and officials. A few months ago motor car dealers in Bangkok had a fairly heavy supply of unsold cars on hand. There is a very limited demand for motor trucks. The government operates 1,200 miles of railroad. Rice is the big crop but most of this is transported on the rivers, there not being much of a field for the motor truck in this industry.

French Indo-China one year ago had approximately 2,300 motor cars and trucks, of which number not more than 50 are motor trucks. Practically all of these are European cars, the majority being small French types. There are good roads in the vicinity of Saigon, the capital, in fact the country boasts of 5,600 miles of good macadam roads which are kept in a good state of maintenance. The large rice estates are mostly in the hands of the French. This country does not offer special prospects for the American manufacturer.

Arabia with its 5,000,000 population, and its area nearly one-half that of the United States is one of the many poor motor car areas in Asia. With the exception of Aden there is scarcely any other town in Arabia where motor cars are in use, so that the 300 cars in Aden largely represent the motor population of the country. While there are only 100 motorcycles, there exists a fair demand for them. In the vicinity of Aden there are perhaps 20 miles of roadway suitable for motor cars, and in the remainder of Arabia there are no roads.

In no country are statistics more difficult than in Turkey, largely because of the disturbed condition of the country, and its population of 20,000,000 gives no indication of the number of motor vehicles. It is estimated that including army vehicles, there are 5,500 motor vehicles in the country. These may be divided up as follows: Constantinople has 1,800 of which 1,500 are cars and 300 trucks. In the remainder of Turkey there are 800 cars and 400 trucks, estimated. To this should be added 2,500 army vehicles, giving a total of 5,500. The motorcycle has made very little progress. The estimate for the country being 100. The armies of occupation have sold quite a number of cars and trucks to the public.

Syria, with its 4,000,000 people has not more than 1,500 motor vehicles, practically all of which are in such cities as Damascus, Beirut, and Aleppo. All of these were brought into the country after the fall of 1919. In the Damascus area there are not more than 50 motor cars, most of which are of American manufacture. At Beirut, which is 75 miles from Damascus there are 950 cars and 25 trucks. Aleppo has 65 motor cars and a few trucks.

In several Asiastic countries it is impossible to get any estimate on the motor vehicles in use and it is questionable if there are a score of vehicles in some of these countries. In this list are included Tibet, north of India with 2,000,000 population; Turkestan in the Caspian Sea area, with 2,500,000 population; Afghanistan 6,000,000 population; Baluchistan 1,000,000 and Persia with 10,000,000. There are many army vehicles in Persia, the British government having built military roads of over 600 miles in length leading to Teheran, the capital. The condition of the country makes purchasing almost impossible.

Oceania

IN this group have been included Australia, New Zealand, Hawaii, and the Philippine Islands. Australia and New Zealand have always been of interest to American automotive exporters. The registration for this group is 125,281, Australia alone having 59 per cent of the total number.

Australia	73,900	New Zealand	37,500	Philippine Islands	12,381	Hawaii	1,500

Total 125,281

Australia and New Zealand have a total of 111,400 cars and trucks divided as follows:

	Cars	Trucks
Australia	70,000	3,900
New Zealand	35,000	2,500
	105,000	6,400

To these figures may be added 25,000 motorcycles in New Zealand. the number in Australia not being known.

Australia with an area equalling that of the United States or Canada or Brazil or Europe, has 5,000,000 population, nearly all being white. The Commonwealth of Australia is divided into seven states with a motor population as follows:

	Cars	Trucks	Motorcycles
New South Wales....	25,000	2,502	10,609
Victoria	19,000	.....	11,985
Queensland	11,000	700	2,000
S. Australia	11,004	695	7,504
W. Australia	2,600	505	1,774
Tasmania	2,500	79	1,700

The Island of New Zealand, constituting some of the most fertile agricultural areas of the world have a very creditable motor population:

Cars	25,000
Trucks	2,500
Motorcycles	25,000
Car sales 1921	2,500
Truck sales 1921	250
Car sales 1920	10,000
Truck sales 1920	1,000

Figures on the Philippine Islands on December 31, 1920, gave a total of 12,381 cars and trucks registered. Of this number 9,692 being cars, and 2,689 trucks. The last registration figures from the Director of Public Works, as of Aug. 12, 1921, showed only 11,653 vehicles registered, or a decline on the previous year, largely due to a number of vehicles not having been registered because of the condition of the times. On Aug. 12, the figures of registration were: Cars 9,134; trucks 2,519. These figures will not include army vehicles. The development of highways through the Philippines will stimulate the sale of motor vehicles.

Africa

THE total of 55,583 cars and trucks in the continent of Africa scarcely represents all of the motor vehicles there, although most of the important countries are included. Abyssinia has been left out, however, as well as many areas in the Soudan. The Union of South Africa leads all the other African countries with practically half of the total number of motor vehicles on the continent. The other British possessions, including Egypt, and the French areas of Morocco, Algeria, etc., contain the great majority of cars and trucks.

Union of South Africa....	26,468	Mauritius Island.....	1,600	Madeira Islands.....	100
Algeria	12,000	Canary Islands.....	881	Italian Somaliland.....	66
Egypt	5,084	British West Africa.....	566	Reunion Island.....	35
Gold Coast.....	3,500	Angola	250	Monrovia	3
Morocco	2,500	French West Africa.....	230		
Tunis	1,990	Portuguese East Africa..	400	Total.....	55,832
		Madagascar	159		

The Union of South Africa at the end of 1920 had 25,084 motor vehicles, made up of cars and trucks, and to arrive at a rational estimate of the number in the Union at the end of 1921 we must add 1438 vehicles imported in the first nine months of the year. This gives a total of 26,468 cars and trucks. An analysis shows the following classification of these vehicles:

Passenger cars	22,957
Taxicabs	1,107
Buses	115
Motor trucks	682
Motor delivery vehicles	223
	25,084

An analysis of the 1438 vehicles imported in the first nine months of 1921 shows the great majority from the U. S. A. and Canada. Here are the figures:

U. S. A.	658	France	20
Canada	608	Belgium	10
United Kingdom	114	Italy	4
Germany	23	Holland	1

The heavy imports from Canada are doubtless made up of Fords, and from those other Canadian factories, representing General Motors group, Studebaker, etc.

Egypt, in area over one-half greater than Texas, with 12,000,000 population, or one-third more than New York State, had a total of 5084 cars, buses, trucks, and motorcycles on January 1, a year ago.

An analysis of the 630 vehicles imported in the first eight months of 1921 shows United States, Italy, and France the leading nations in furnishing cars:

U. S. A.	174	Holland	44
Italy	148	Belgium	8
France	130	Switzerland	2
United Kingdom	69	Austria	1
Germany	52	Elsewhere	2

Egypt is sadly lacking in roads, and with the exception of a usable road between Alexandria and Cairo, the vehicles are used only in cities and suburbs. Cairo is a city of 800,000 and Alexandria 450,000 population. Of the 4337 vehicles in use Jan. 1, 1921, almost 3000 were in Cairo. In Alexandria there were in use 1024 automobiles, 150 taxis, 203 motorcycles and 67 motor trucks.

Algeria, about the size of the State of Kansas and with 5,500,000 population, is largely dominated by French automobiles and motor trucks, chiefly because it is a French colony and only thirty hours by boat from France. In Algeria are 12,000 motor vehicles, of which 741 were imported in the first six months of 1921. Imports in other years were:

1919 .....595 1920 3,360

Motor vehicles from France enter free of duty. Railroad mileage is very limited, and the use of motor trucks between seaports and inland cities has developed rapidly, France taking the lead in this field. Many excellent vehicle roads exist and the use of motor buses has been a recent development in inter-city travel.

Since the Armistice fortunes made during the war by business men and wine growers were generally used to purchase motor cars. Motorcyles are used very little, as distances are generally too great for their effective use.

There are 2800 miles of improved highways.

An analysis of cars in Algeria in 1920 showed thirty different makes of French cars and nine makes of United States, totaling 1580.

Morocco, a French protectorate in North Africa bordering on the Mediterranean, is a little smaller than Texas, and with 6,000,000 population has not over 2500 motor vehicles. The country has 2000 miles of improved roads, and has a few narrow gage military railroads that are not very useful for commerce. It is an agricultural area that should use a goodly quota of trucks, but only 272 were in use July, 1921, this not including army vehicles. American automobiles have a good hold in Morocco, with French machines holding the majority. In Morocco is

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AUTOMOTIVE INDUSTRIES
February 16, 1922

WORLD REGISTRATION OF CARS AND TRUCKS



what is known as the International Zone of Tangier, an area of 140 square miles, with 75 passenger automobiles.

Tunis, equal in area to Wisconsin and with 2,000,000 population, borders on the Mediterranean, and on June 30, 1921, had 1990 cars and trucks. To this can be added 600 farm tractors and 246 motorcycles. An automobile summary of Tunisia is:

Cars	1,803	Motorcycles	246
Trucks	187	Tractors	600

The Gold Coast Colony, a British possession, has 3500 motor vehicles of all types in use, to which can be added 240 used by the Government, about 60 cars, 4 buses, 20 mail trucks and 160 trucks. Two or three farm tractors are being used by the agricultural department of the Government.

In the Province of Cameroon only 4 motorcycles are in use and no cars or trucks.

In Angola, an estimate by the United States consul places the motor population at 250 cars, trucks, motorcycles, and tractors. In all of Belgian Congo there are not over 200 motor vehicles.

The Republic of Monrovia, the only republic in Africa. has 3 motor vehicles, two Fords and a Reo, according to the United States consul. The republic lacks roads.

French West Africa has 150 cars, 80 trucks and 15 motorcycles, these being in Senegal, Ivory Coast, Upper Senegal, and Niger.

British West Africa has vehicles as follows: Gambia, 60; Sierra Leone, 65; and Nigeria, 441.

The Canary Islands, with 500,000 population and 372 miles of crushed stone roads, has 720 cars, 161 trucks, and 40 motorcycles, a total of 921 vehicles. In 1914 there were 185 cars on the seven islands. As there are no railroads on the islands, travel is largely by car and motor bus, the latter seating twenty to thirty passengers. Fruits and other agricultural products are largely transported to seaport by motor truck.

Madeira Islands imported 15 cars in 1920 and 4 in 1919. Motorcycles have grown in popularity in the last two years and there are 100 on the islands.

Africa's largest island, Madagascar, is nearly as large as Texas, is as long as from New York to Chicago, and, with a little over 2,000,000 people, largely natives, has 1300 miles of macadam roads, 400 miles of other good roads, and 130 miles of macadam streets in cities and towns. Madagascar is a French possession and French motor vehicles are favored by the Government. The railroad mileage is very limited, not over 450 miles of track being built. There are 132 cars and 27 trucks in use in the island, and of these the Government operates 53 cars, 12 trucks, 17 buses for mail and passenger service. In Tananarine, the capital, 103 of the cars are used. Of the 159 cars in use 116 are French and 38 United States. Three farm tractors are in use.

Portuguese East Africa, or the Province of Mozambique, has 400 motor vehicles, of which a majority are in the city of Lourenco Marques. The three farm tractors in the Province are being used for demonstration purposes. In 1920 there were 68 cars imported, of which 40 came from America. In the same year 46 motorcycles were imported, 11 coming from the United States. Lourenco Marques has 50 miles of paved streets, some leading to the suburbs. A fairly good road leads from the city to Goba, 54 miles.

Italian Somaliland has 16 cars, 50 motor trucks, 4 motorcycles and 18 tractors. Most of these vehicles are in and around Magadozo.

The island of Mauritius, with an area of 720 square miles and 365,000 population, mostly Indians. has 1600 automobiles.

The island of Reunion has 35 automobiles and a population of 175,000, according to the United States consul at Tananarivo.

Palestine, the cradle of Christianity, which passed from the control of Mohammed to Christianity in the final year of the great war, has 536 cars and trucks. To be accurate, the United States consul reports 494 cars, 42 trucks and 83 motorcycles. With the occupation of the British Army the old Turkish roads were converted into motoring highways, and now this historic land, no larger than the State of Maryland, and with a population of 647,000. has 500 miles of first class motor roads. To this add 1500 miles of second class roads that can be used by motor cars at favorable seasons. You can motor from Jerusalem to Damascus. The motor statistics given do not include army vehicles.

In certain instances it has been impossible to obtain acceptable data concerning car and truck registrations. The following list of countries is appended in the hope that some reader may be able to give us additional information regarding them. The list is as follows:

Iceland, Jugoslavia, Latvia, Lithuania, Esthonia, Armenia, Abyssinia, Alaska, Liberia, Hedjaz, Ukrania.

South Africa Offers Market for Tires

WITH the increasing imports of motor cars and motor cycles into the Union of South Africa there has been a corresponding demand for tires, according to a report to the Department of Commerce by Trade Commissioner Stevenson at Johannesburg. As with most other lines, imports of tires during 1920 can not be taken as a true indication of the market's normal purchasing power, as prices were inflated and the volume of imports exceeded the demand. In 1920, however, American tires predominated for the first time, with £517,692 ($2,578,460), as against British imports valued at £464,008 ($2,320,040), French at £145,096 ($725,480), and Canadian at £117,844 ($589,220).

The import figures for the first eight months of 1921 do not give separate statistics for tires, but, judging from the fact that in previous years tires have been about 80 to 90 per cent of the total under the classification of "India rubber, raw and manufactures of," 85 per cent of the total of £192,705, or £163,800, may be approximately reckoned as tires. The total value for the first eight months of 1920 was £982,184, of which about £831,850 represents tires. It is only natural that tire imports should react from the record figures of 1920. Stocks and deliveries were very heavy in 1920, which curtailed new imports during the early part of 1921. At the present time the situation in South Africa has been largely righted and the demand for tires is fairly good, although there is considerable room for improvement. At this time stocks in the country have been appreciably reduced. While in the early part of 1921 stocks were often estimated as sufficient for a year or eighteen months, to-day many firms are short of the better lessing lines.

As to sales methods employed the large American companies work on the same general lines as in the United States. Service has been the keynote of their policies. Stocks have been carried in the country; expensive advertising campaigns have been carried out; and technical and sales help given to the dealers.

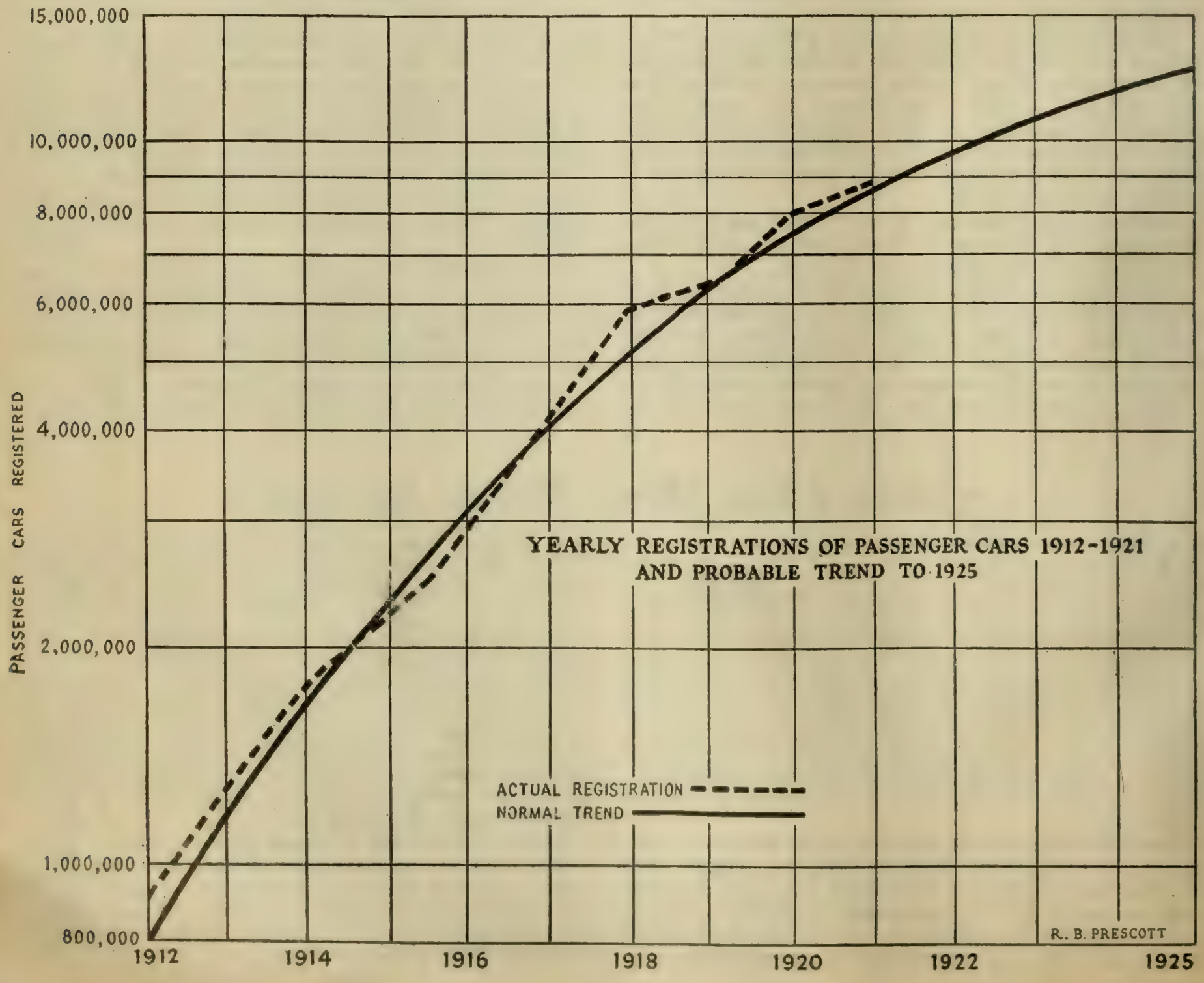
Revised Figures Show U. S. Car and Truck Registration of 10,505,660

Gain of 1,573,202 recorded over 1920. Increase of 17.6 per cent. One motor vehicle for every 10.2 persons in the United States. Total fees amount to $122,038,613. Motorcycle registrations drop 27,024. Grain state registrations increase despite year of general agricultural depression.

FINAL revised figures show that there were 10,505,660 cars and trucks registered in the United States during 1921. This is an actual gain of 1,573,202 over 1920; a percentage gain of 17.6 per cent. There is now one car for every 10.2 persons in the country; $122,038,613 in fees were collected from car owners.

It should be noted at once that a little over 200,000 of this gain in registration is merely an apparent statistical gain, due to the fact that proper figures for the State of Minnesota and for the District of Columbia are now available for the first time. Even though this is the case, however, the gain for 1921 equals that of 1920, a distinctly encouraging result in view of the depressed condition of business during the last year.

Since motor vehicles have come to be used so largely for utility purposes it is interesting to discuss the registration figures in relation to the various industrial activities of the several states. For this purpose an arbitrary division may be made as follows, a State being classified according to the type of industrial activity which predominates within its borders:



1—**Manufacturing States:**
Massachusetts, New York, Pennsylvania, Michigan, Indiana, Delaware, Connecticut, Rhode Island, New Jersey and Wisconsin.
2—**Agricultural States:**
Arkansas, North Dakota, South Dakota, Kansas, Minnesota, Nebraska, Oregon, Oklahoma, Texas, Washington and Iowa.
3—**Mining States:**
Wyoming, Nevada, Utah, Montana, Colorado, Arizona, Idaho and New Mexico.
4—**Southern States:**
Florida, Georgia, Virginia, North Carolina, South Carolina, Kentucky, Tennessee, Louisiana, Mississippi, Alabama, West Virginia.

The population and registration of these four groups line up in this way:

Group	Population	Registration
Manufacturing	38,350,503	3,568,462
Agricultural	20,100,362	2,591,205
Mining	3,445,116	400,531
Southern	22,902,405	1,175,281

It may be noted here that the population figures used in making the calculations throughout this article are those estimated by the Federal Bureau of Census for July 1, 1921. Using these as a basis, it appears that the agricultural states have the most dense automobile population, followed by the mining, manufacturing and southern groups in the order named. This order is the same as last year, but a comparison of the persons per car in these groups in 1920 and 1921 shows one or two interesting features. The figures for these two years are as follows:

Group	Persons Per Motor Vehicle 1920	1921
Agricultural States	8.10	7.76
Mining States	8.90	8.61
Manufacturing States	12.00	10.72
Southern States	20.08	19.50

This comparison indicates that the potential development possibilities of the group of southern states has not been realized to any great extent during the past year. This is true despite the fact that a large percentage of the population in these states is colored and that a large percentage of the colored population does not comprise a market.

Registration of Motor Vehicles

State	Total Net Registration	Non-Resident Registrations and Transfers	Passenger Cars	Commercial Cars	Motorcycles	Total Fees
Alabama	82,343	.....	73,233	9,110	805	$1,147,265
Arizona	35,049	.....	31,069	3,980	440	195,970
Arkansas	67,446	509	66,480	966	192	678,984
California	673,830	202,562	638,922	34,908	17,603	6,790,981
Colorado	145,739	.....	136,336	9,403	2,868	906,059
Connecticut	137,526	.....	110,316	27,210	5,589	2,033,838
Delaware	21,413	.....	.....	.....	541	375,469
District of Columbia	71 645	.....	54,147	6,976	2,487	383,289
Florida	97,837	.....	82,992	14,845	1,296	750,000
Georgia	131,942	2,511	.....	.....	1,338	1,703,913
Idaho	51,294	930	46,935	4,359	744	843,951
Illinois	670,434	.....	590,527	79,907	7,104	6,803,456
Indiana	400,342	.....	357,025	43,317	7,524	2,422,171
Iowa	460,528	99	430,003	30,525	3,897	7,718,926
Kansas	291,309	4,205	269,661	21,648	2,271	3,000,000
Kentucky	126,371	.....	111,227	15,144	1,185	1,771,887
Louisiana	80,500	.....	70,000	10,500	498	453,276
Maine	77,527	7,241	67,591	9,936	1,525	1,004,914
Maryland	140,572	.....	128,042	12,530	7,847	2,460,162
Massachusetts	360,732	44,000	305,471	55,261	12,048	4,717,389
Michigan	477,037	.....	426,984	50,053	6,195	6,751,925
Minnesota	328,700	.....	301,900	26,800	3,500	5,616,114
Mississippi	65,139	.....	58,429	6,710	375	537,462
Missouri	346,437	17,850	.....	.....	3,609	2,505,354
Montana	58,785	650	.....	.....	472	594,521
Nebraska	238,704	.....	219,781	18,923	1,866	2,819,629
Nevada	10,819	.....	.....	.....	130	102,800
New Hampshire	42,039	8,131	36,994	5,045	2,358	876,322
New Jersey	272,994	52,849	248,477	24,517	9,724	4,106,269
New Mexico	24,703	.....	.....	.....	214	255,000
New York	812,031	.....	630,791	181,240	26,998	10,000,000
North Carolina	148,684	.....	134,884	13,800	1,276	2,250,000
North Dakota	92,644	6,261	90,221	2,423	810	683,052
Ohio	720,632	32,878	622,044	98,588	23,026	6,886,205
Oklahoma	221,300	.....	.....	.....	1,013	2,592,195
Oregon	118,325	.....	103,735	14,590	3,164	2,334,782
Pennsylvania	689,589	75,559	632,541	57,048	21,111	9,460,895
Rhode Island	54,957	7,636	45,059	9,898	1,780	847,083
South Carolina	90,546	1,394	83,349	7,197	756	733,820
South Dakota	119,274	.....	110,997	8,277	682	720,587
Tennessee	117,025	6,309	102,795	14,230	1,043	1,387,374
Texas	467,616	113,809	.....	.....	3,905	2,146,873
Utah	47,523	.....	40,587	6,936	909	441,359
Vermont	36,965	4,495	33,478	3,487	965	668,289
Virginia	141,000	.....	125,000	16,000	2,200	2,100,000
Washington	185,359	12,727	156,693	28,666	3,763	2,925,731
West Virginia	93,894	.....	89,397	4,497	1,539	1,600,000
Wisconsin	341,841	.....	320,577	21,264	6,423	3,644,950
Wyoming	26,619	247	.....	.....	322	288,122
TOTALS	10,505,660	602,852	8,184,690	1,010,714	207,930	$122,038,613

Persons Per Motor Vehicle, Dec. 31, 1921

Iowa	5.28
South Dakota	5.38
Nebraska	5.49
California	5.78
Kansas	6.14
Colorado	6.61
Oregon	6.76
Nevada	7.07
North Dakota	7.09
Dist. of Col.	7.35
Indiana	7.41
Minnesota	7.41
Washington	7.47
Wyoming	7.55
Wisconsin	7.84
Michigan	7.97
Ohio	8.20
Idaho	8.75
Oklahoma	9.09
Utah	9.69
Vermont	9.77
Montana	9.83
Illinois	9.87
Missouri	9.92
Maine	9.95
Arizona	10.10
Maryland	10.21
Texas	10.21
Florida	10.22
Connecticut	10.35
Delaware	10.53
New Hampshire	10.59
Massachusetts	10.89
Rhode Island	11.21
New Jersey	11.94
Pennsylvania	12.90
New York	12.99
New Mexico	14.78
West Virginia	16.04
Virginia	16.68
North Carolina	17.55
South Carolina	18.85
Kentucky	19.23
Tennessee	20.09
Georgia	22.35
Louisiana	22.61
Arkansas	26.39
Mississippi	27.40
Alabama	29.50

Cars and Trucks in the United States December 31, 1921

New York	812,031
Ohio	720,632
Pennsylvania	689,589
California	673,830
Illinois	670,434
Michigan	477,037
Texas	467,616
Iowa	460,528
Indiana	400,342
Massachusetts	360,732
Missouri	346,437
Wisconsin	341,841
Minnesota	328,700
Kansas	291,309
New Jersey	272,994
Nebraska	238,704
Oklahoma	221,300
Washington	185,359
North Carolina	148,684
Colorado	145,739
Virginia	141,000
Maryland	140,572
Connecticut	137,526
Georgia	131,942
Kentucky	126,371
South Dakota	119,274
Oregon	118,325
Tennessee	117,025
Florida	97,837
West Virginia	93,894
North Dakota	92,644
South Carolina	90,546
Alabama	82,343
Louisiana	80,500
Maine	77,527
Arkansas	67,446
Mississippi	65,139
District of Columbia	61,745
Montana	58,785
Rhode Island	54,957
Idaho	51,294
Utah	47,523
New Hampshire	42,039
Vermont	36,965
Arizona	35,049
Wyoming	26,619
New Mexico	24,703
Delaware	21,413
Nevada	10,819
Total	10,505,660

Percentage Gain in Registration Dec. 31, 1920 to Dec. 31, 1921

Florida	32.40
Maine	23.28
Louisiana	22.00
New York	21.35
New Hampshire	21.23
Pennsylvania	20.91
Maryland	20.81
Indiana	20.22
New Jersey	19.92
West Virginia	19.16
Massachusetts	18.47
California	18.41
Illinois	17.91
Delaware	17.11
Ohio	17.10
Vermont	16.84
Missouri	16.71
Wisconsin	16.61
Michigan	15.59
Connecticut	15.41
Tennessee	14.91
Arkansas	14.18
Oregon	14.04
Colorado	13.02
Kentucky	12.12
New Mexico	11.71
Utah	11.58
Wyoming	11.23
Alabama	10.31
Kansas	9.78
Texas	9.35
Rhode Island	9.10
Oklahoma	8.30
Nebraska	7.05
Washington	6.60
North Carolina	5.58
Iowa	5.33
Virginia	5.23
Nevada	3.39
Mississippi	2.62
North Dakota	1.98
Arizona	1.42
Idaho	.83
Losses	
Georgia	8.65
Montana	3.07
South Carolina	2.44
South Dakota	.93

Average gain—17.6 per cent.

It is interesting to note that as regards persons per car the manufacturing states, which in 1920 already had but half as many persons per car as the southern states, reduced their number of persons per car by 1.28 during the past year, while the southern states reduced only .58.

The figures for the great grain-growing states, as well, indicate a healthy condition as regards cars and trucks, despite the fact that the value of the grain crop in 1921 decreased 48 per cent, while the volume decreased only 1½ per cent compared, with the five-year average (1914-1918) production and value.

In the midst of this unfavorable condition registrations increased 75,296 during 1921 in the group of grain states comprising South Dakota, North Dakota, Minnesota and Kansas. In making this calculation the number of cars in Minnesota for 1920 has been estimated at 280,000, since exact figures will never be available. This means that the number of persons per car in this group of states has been reduced during the period of business depression, using the 1920 and 1921 population figures respectively in making the calculation. For these four states the numbers of persons per car were as follows:

1920.....7.23 persons per vehicle
1921.....6.64 persons per vehicle

These figures show a favorable condition from an automotive standpoint when taken in conjunction with the fact that Iowa, the great corn State, showed an increased registration of 23,228. The Iowa figures shown in the preliminary report gave that State a loss in registration for the year, but the final figures indicate the material gain recorded above. This constitutes the only major change from the preliminary compilation, although New York and one or two other states have materially increased totals.

New York Still on Top

New York still leads in total registrations. There is no change, in fact, in the first five states. Iowa, however, has dropped behind Michigan and Texas and now stands eighth instead of sixth.

New York also leads in actual registration gain for the year, while Pennsylvania is also ahead of Ohio, the State which had the largest numerical gain last year. Five states gained more than 100,000 in registrations during 1921. These states were as follows:

New York	142,741
Pennsylvania	119,425
Ohio	105.235
California	104,938
Illinois	101,675

The final figures show registration losses in four states, Georgia having lost 12,480; South Carolina, 2272; Montana, 1861, and South Dakota, 1121. This is the first time that losses have been recorded in any state, but the character of the losses is such as to eliminate a possibility of the assumption that they are due to "saturation" of the states involved.

South Carolina has 18 persons per motor vehicle, Georgia has 22 and Montana about 10. South Dakota has 5.38, but its drop is obviously to be attributed to the peculiarly unfavorable economic position in which that State has been during the last year.

Florida Has Large Percentage Gain

The largest percentage gain in registration was made by Florida, which has 32.40 per cent more motor vehicles

Gain Made in Car and Truck Registration 1920-1921

New York	142,741	New Hampshire	7,359
Pennsylvania	119,425	Virginia	7,000
Ohio	105,235	Vermont	5,340
California	104,938	Utah	4,945
Illinois	101,675	Rhode Island	4,582
Indiana	67,635	Delaware	3,113
Michigan	64,320	Wyoming	2,693
Massachusetts	56,101	New Mexico	2,594
Missouri	49,518	North Dakota	1,804
Wisconsin	48,543	Mississippi	1,655
New Jersey	45,257	Arizona	490
Texas	39,923	Idaho	421
Kansas	25,913	Nevada	355
Maryland	24,231	District of Columbia	52,033
Florida	23,923	Minnesota	263,183
Iowa	23,228		1,590,936
Connecticut	18,392		
Oklahoma	17,000		
Colorado	16,788		
Nebraska	15,704	DECREASES IN CAR AND TRUCK REGISTRATION	
Tennessee	15,173		
West Virginia	15,032		
Maine	14,620	Georgia	12,480
Oregon	14,535	South Carolina	2,272
Louisiana	14,500	Montana	1,861
Kentucky	13,686	South Dakota	1,121
Washington	11,439		17,734
Arkansas	8,364		
North Carolina	7,824		
Alabama	7,706	Net Gain	1,573,202

than last year. Louisiana is the only other southern State that has gained more than 20 per cent. Although it has always lead in total registrations, New York is still to be found near the top of percentage gain. It stands in fourth place this year with a gain of 21.35 per cent, despite its already large gross total.

Idaho has the smallest gain, its increase over 1920 being only .83 per cent. Minnesota and the District of Columbia are not included in the list of percentage gains, because their gains, as noted before, are chiefly statistical rather than actual.

To use the accompanying tables intelligently it is necessary to take into account certain variables which are involved in the registration methods of the various states.

To begin with, there is little possibilty of determining accurately, under present conditions, the division between car and truck registrations. In AUTOMOTIVE INDUSTRIES of Nov. 17 a detailed explanation was given as regards the possibility of getting this segregation accurately. The result of this analysis showed that by extensive research it is possible to get passenger car figures which will be accurate for all practical purposes, involving an error of only about 1 per cent, but that no such accuracy is possible in regard to truck figures, as the error may run anywhere from 25 per cent to 40 per cent. Even such figures cannot be determined merely from the results published by the various states, but must be obtained in most cases by an actual examination and compilation from the registration books.

Many states do not segregate car and truck registrations at all. Even in those cases where they do, however, there is a wide variation in definition of what is a car and what is a truck.

Some states register tractors with trucks and do not register trailers; others register trailers with trucks and do not register tractors; others register both tractors and trailers with trucks, and still others register neither trailers nor tractors in any way. These facts should be borne in mind when any calculations are being made on the basis of apparently segregated registrations.

It is the practice in some states, as well, to classify vehicles on the basis of use rather than construction.

Detailed and useful segregation of motor vehicle registrations is being made in several states at present, notably Oregon, New York and Michigan. But even in these cases the practice is not uniform among the three.

Motor Vehicle Registration 1912 to 1921

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Alabama	3,385	5,435	8,078	11,925	21,636	32,873	46,171	58,898	74,637	82,343
Arizona	1,624	3,098	5,040	7,318	12,124	19,890	23,905	28,979	34,559	35,049
Arkansas	2,250	3,000	5,642	8,021	15,000	28,693	41,458	49,450	59,082	67,446
California	88,699	60,000	123,516	163,795	232,440	306,916	364,800	477,450	568,892	673,830
Colorado	8,950	13,135	17,756	27,568	43,296	66,850	83,630	104,865	128,951	145,739
Connecticut	24,101	27,189	33,009	43,985	61,855	85,724	92,605	109,651	119,134	137,526
Delaware	1,732	2,350	3,050	4,657	7,102	10,700	12,955	16,152	18,300	21,413
Dist. of Columbia	1,732	2,373	4,833	8,009	13,118	15,493	30,490	35,400	9,712	61,745
Florida	1,749	2,372	3,368	10,850	20,718	27,000	54,186	55,400	73,914	97,837
Georgia	19,120	18,500	20,916	25,671	47,579	70,357	99,800	127,326	144,422	131,942
Idaho	2,500	2,173	3,346	7,071	12,999	24,731	32,289	42,220	50,873	51,294
Illinois	68,073	94,656	131,140	180,832	248,429	340,292	389,620	478,438	568,759	670,434
Indiana	54,334	47,000	66,400	96,915	139,317	192,192	227,160	277,255	332,707	400,342
Iowa	47,188	75,088	112,134	152,134	198,602	254,317	278,213	363,857	437,300	460,528
Kansas	22,000	34,366	49,374	72,520	112,122	159,343	189,163	227,752	265,396	291,309
Kentucky	5,147	7,210	11,746	19,500	31,700	47,416	65,870	90,641	112,685	126,371
Louisiana	7,000	7,200	12,000	11,380	17,000	28,394	40,000	51,000	66,000	80,500
Maine	7,743	10,570	15,700	21,545	30,972	41,499	40,372	53,425	62,907	77,527
Maryland	10,487	14,254	20,213	31,047	44,245	60,943	74,666	95,634	116,341	140,572
Massachusetts	50,132	62,660	77,246	102,633	136,809	174,274	193,497	247,183	304,631	360,732
Michigan	39,579	54,366	76,389	114,845	160,052	247,006	262,125	325,813	412,717	477,037
Minnesota	29,000	37,800	67,862	93,269	46,000	54,009	204,458	259,743	65,517	328,700
Mississippi	2,895	3,000	5,964	9,669	25,000	36,600	48,400	45,030	63,484	65,139
Missouri	24,379	38,140	54,468	76,462	103,587	147,528	188,040	244,363	296,919	346,437
Montana	2,000	5,686	10,172	14,499	24,440	42,696	51,037	59,325	60,646	58,785
Nebraska	33,861	25,617	40,929	59,140	100,534	148,101	175,409	192,000	223,000	238,704
Nevada	900	1,131	1,487	2,009	4,919	7,160	8,159	9,305	10,464	10,819
New Hampshire	5,764	7,420	9,571	13,499	17,508	22,267	24,817	31,625	34,680	42,039
New Jersey	43,056	48,892	60,247	78,232	104,341	134,964	155,519	190,873	227,737	272,994
New Mexico	911	1,721	2,945	5,100	8,228	8,457	15,000	18,077	22,109	24,703
New York	107,262	134,405	169,966	234,032	317,866	411,567	463,758	571,662	669,290	812,031
North Carolina	6,178	10,000	14,677	21,000	33,904	55,950	72,313	109,017	140,860	148,684
North Dakota	8,997	13,075	15,701	24,908	40,446	62,993	71,627	82,885	90,840	92,644
Ohio	63,066	86,054	122,504	181,332	252,431	346,772	412,775	511,031	615,397	720,632
Oklahoma	6,524	7,934	13,500	25,032	52,718	100,199	121,500	144,500	204,300	221,300
Oregon	10,165	13,957	16,447	23,585	33,917	48,632	63,324	83,332	103,790	118,325
Pennsylvania	59,357	76,178	112,854	160,137	230,578	325,153	394,186	482,117	570,164	689,589
Rhode Island	8,565	10,294	12,331	16,362	21,406	37,046	36,218	44,833	50,375	54,957
South Carolina	10,000	11,500	14,500	15,000	19,000	39,527	55,492	70,143	92,818	90,546
South Dakota	14,481	14,578	20,929	28,784	44,271	67,158	90,521	104,628	120,395	119,274
Tennessee	35,187	54,362	19,769	7,618	30,000	48,000	63,000	80,422	101,852	117,025
Texas	35,187	54,362	64,732	90,000	197 687	213,334	251,118	331,310	427,693	467,616
Utah	2,576	4,021	2,253	9,177	13,507	24,076	32,273	35,236	42,578	47,423
Vermont	4,283	5,918	8,256	11,499	15,671	20,369	22,655	26,807	31,625	36,965
Virginia	5,760	9,022	14,002	21,357	35,426	55,000	72,228	94,120	134,000	141,000
Washington	13,990	24,178	30,253	38,823	60,734	91,337	117,278	148,775	*173,920	185,359
W. Virginia	5,349	5,088	6,159	13,279	20,571	31,300	38,750	50,203	78,862	93,894
Wisconsin	24,578	34,646	53,161	79,791	115,637	164,531	196,844	236,981	293,298	341,841
Wyoming	1,300	1,584	2,428	3,976	7,125	12,523	16,200	21,371	23,926	26,619
Totals	1,033,096	1,287,558	1,768,720	2,479,742	3,584,567	4,992,152	6,105,974	7,596,503	8,932,458	10,505,660

*Estimated.

Motorcycle Registrations 1918-1921

	1918	1919	1920	1921		1918	1919	1920	1921
Ala.	1,180	1,103	1,035	805	N. H.	2,452	2,632	2,542	2,358
Ariz.	685	596	542	440	N. J.	12,517	11,416	11,041	9,724
Ark.	**	**	**	192	N. Mex.	300	200	219	214
Cal.	27,887	28,028	20,047	17,603	N. Y.	28,597	28,561	29,453	26,998
Colo.	3,909	3,636	3,364	2,868	N. C.	1,333*	1,459	1,418	1,276
Conn.	4,246	4,495	6,543	5,589	N. Dak.	1,659	901	898	810
Del.	707	699	674	541	Ohio	20,717	20,444	26,956	23,026
D. C.	2,353	2,412	519	2,487	Okla.	1,622	1,310	1,320	1,013
Fla.	1,629	1,412	1,275	1,296	Ore.	3,501	3,570	3,516	3,164
Ga.	1,681	1,722	1,688	1,338	Pa.	26,621	25,760	23,981	21,111
Idaho	707	731	764	744	R. I.	1,464	2,301	2,225	1,780
Ill.	10,834	10,920	10,597	7,104	S. C.	1,147	869	908	756
Ind.	9,112	8,995	8,823	7,524	S. Dak.	1,323	888	777	682
Iowa	2,529	3,035	4,000*	3,897	Tenn.	800	1,133	1,151	1,043
Kans	4,173	3,589	2,972	2,271	Texas	2,496	3,990	4,293	3,905
Ky.	1,479	1,503	1,543	1,185	Utah	1,298	1,185	1,114	909
La.	399	490*	500	498	Vt.	734	800	946	965
Me.	1,497	1,608	1,566	1,525	Va.	2,414	2.520	2,233	2.200
Md.	5,351	5,872	7,332	7,847	Wash.	6,317	5,050	4,915	3,763
Mass.	12,862	13,698	15,143	12,048	W. Va.	847	994	1,659	1,539
Mich.	7,818	7,875	8,011	6,195	Wis.	7,238	7,223	8,002	6.423
Minn.	5,021	6,389	1,158	3,500	Wyo.	313	353	327	322
Miss.	100*	120*	194	375					
Mo.	3,980	4,131	3,954	3,609	Total	233,665	233,386	234,954	207,930
Mont.	852	847	675	472					
Nebr.	2,900	2,500	2,000	1,866					
Nev.	121	125	141	130					

*Estimated **Not segregated

The industry will never be able to obtain the maximum benefit from registration figures until there is a uniform registration law throughout the country. There are already samples of valuable and sound practice, but such practice is not at all universal. Moreover, uniformity is necessary as well as essential soundness. A detailed outline for the best method of segregating and compiling motor vehicle registrations would be a worthwhile addition to the Uniform Motor Vehicle Law, which many automotive interests throughout the country are now supporting.

The foregoing explanation indicates the reason for compiling a table of persons per motor vehicle rather than two tables of persons per car and persons per truck. It can't be done with any degree of accuracy at the present time. The tables used, however, do give a comparative evaluation from year to year.

In the major table, "total net registration" includes only cars and trucks. It does not include motorcycles.

Motorcycles Drop

Motorcycle registration took a decided fall during 1921, when 27,024 less machines were registered than in 1920. The motorcycle total for 1921 was 207,930, a drop of 11.54 per cent as compared with the previous year.

Persons Per Car

Iowa has taken the lead in having the lowest number of persons per car. Its superiority over South Dakota in this respect, however, is so small as to be almost negligible. Iowa, South Dakota, Nebraska and California, in fact, are all very closely bunched, the difference being extremely slight.

Indiana is the first of the manufacturing states to appear in this list, followed by Wisconsin and Michigan. The first five manufacturing states rank as follows:

Indiana	7.41
Wisconsin	7.84
Michigan	7.97
Ohio	8.20
Illinois	9.87

There are no manufacturing states included in the first ten of this list, nor are there any of the southern states in this charmed circle of ten. There are six agricultural states, two mining states and two—California and District of Columbia—not included in the arbitrary classification used here.

In certain instances this persons per car was higher in 1921 than in 1920. This is due to the fact that the population has increased at a greater rate than has registration during the last year.

Motor Buses Increase in Number

THE motor bus has become a real factor in transportation during the last few years. All the available statistics indicate that the use of buses has increased materially during 1921. This has been true both in the United States and in Great Britain, although in England the bus has taken a greater proportionate part in transportation than it has over here up to the present time.

The best available conservative estimates indicate that there are nearly 1000 motor bus lines in the United States, as against about half that number a year ago. It is difficult to estimate the number of buses actually in operation since no provision for segregated registration of such vehicles is made in the various states. *The Commercial Vehicle* estimates that something over 5000 buses are now in operation, while the N. A. C. C. gives the figure as 20,000. The former figure is a more conservative estimate.

Eight thousand six hundred motor buses are being used in England, according to the best figures available over there. Of this number nearly 50 per cent are being operated in the London area.

No Government figures are available or taken showing the number of such vehicles in use. The existing system of registration in England includes motor buses with all other forms of "hackney carriages," as they are officially described, and these consist of taxicabs, motor coaches, private hire cars, carriers' vehicles licensed to accommodate a proportion of passengers as well as motor buses.

Information was obtained from individual makers of this type of vehicle as to the number of their chassis known to be in use for such a purpose. While admittedly this indirect method cannot give anything but an approximate figure, there is reason to believe it has at least the merit of affording a conservative estimate, for it does not and cannot take into consideration the number of surplus Government trucks the chassis of which have been fitted with bus bodies by their purchasers without the knowledge of the chassis manufacturers. The number of chassis thus applied is, however, not believed to be large; none of the big bus undertakings have used them and those that have been fitted up for public passenger work have been so treated in ones, twos and threes for isolated services in country districts; 500 would probably be a fair estimate of the total in this class of use exclusively.

True, if there are taken into consideration the number of "surplus" truck chassis with public passenger bodies of the motor coach type, the total would probably amount to 2000 or 3000. But these vehicles are not run to time-table or on regular services, being mostly in use only during the summer months on pleasure trips from their headquarters.

Production

Automotive Production Statistics Show Industrial Stability

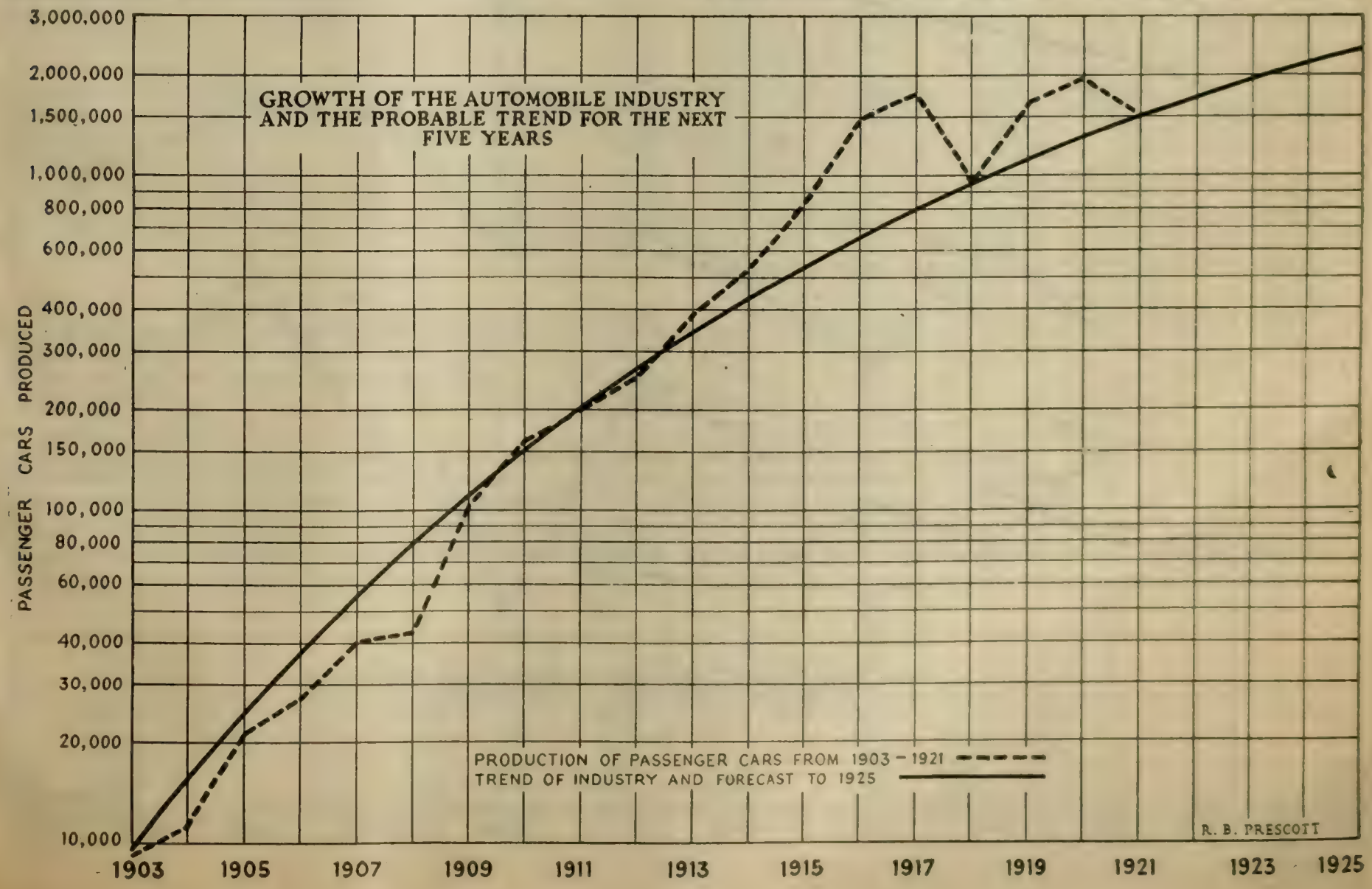
1,457,000 passenger cars were produced in 1921. Truck production was about 150,000, while 50,000 tractors and 25,000 motorcycles were made. Passenger car plants operated at 60 per cent of capacity. 25 per cent of 1921 cars were closed jobs. One ton trucks predominate.

By Raymond B. Prescott

PASSENGER car manufacturing plants fared better than the other units of the automotive industry during 1921, although the industry as a whole operated on a better basis than did many others. The following figures indicate in a general way the proportion of production capacity utilized by the various units of the automotive industry in getting out their 1921 production. It will be recognized, of course, that the term "production" capacity is subject to some variation in definition and that the capacity figures used are, consequently, approximations:

Product	1921 Production	Approximate Capacity	Per Cent of Capacity, 1921
Passenger Cars ..	1,457,000	2,500,000	60
Trucks	150,000	350,000	43
Tractors	50,000	200,000	25
Motorcycles	25,000	100,000	25
Tires	.....	.....	..
Casings	20,000,000	30,000,000	67
Inner Tubes	25,000,000	35,000,000	70

The figures for passenger cars are accurate, while the truck figures contain a small percentage of error. This slight error is due to the fact that the production figures



Analysis of Passenger Car Sales by Number and Per Cent.

Year	Under $1,000	$1,000-$1,999	$2,000-$2,999	$3,000-$3,999	$4,000 and Over
1905	8,023	10,650	1,253	664	941
	.372	.495	.058	.031	.044
1906	6,858	13,854	2,611	1,119	2,256
	.257	.519	.098	.044	.082
1907	13,321	18,148	4,109	497	4,483
	.328	.447	.101	.012	.112
1908	19,322	15,801	2,902	559	4,654
	.447	.366	.067	.013	.107
1909	41,191	44,440	4,131	6,151	6,785
	.400	.434	.040	.060	.066
1910	53,320	81,658	8,221	5,854	9,050
	.337	.516	.052	.037	.058
1911	No figures available.				
1912	128,704	87,274	13,360	5,352	9,055
	.528	.357	.055	.022	.038
1913	236,092	111,253	18,219	5,233	9,947
	.620	.292	.048	.014	.026
1914	352,397	128,950	35,480	7,435	5,208
	.665	.244	.067	.014	.010
1915	638,333	155,592	16,010	3,407	6,765
	.778	.190	.020	.004	.008
1916	1,129,393	197,144	26,877	11,087	3,984
	.825	.144	.020	.007	.003
1917	1,418,351	247,058	35,728	12,947	4,392
	.826	.144	.020	.007	.003
1918	735,346	153,667	33,635	3,290	5,238
	.789	.165	.036	.004	.006
1919	1,040,750	499,924	75,502	25,280	9,616
	.630	.303	.046	.015	.006
1920	1,185,407	590,780	86,201	23,841	29,758
	.622	.310	.045	.012	.016
1921	1,071,553	291,432	62,144	18,308	13,311
	.735	.200	.042	.013	.01
1922*	1,326,000	306,000	42,500	17,000	8,500
	.78	.18	.025	.01	.005

*Estimated.

Fig. 2—Passenger car production by price classes 1905-1921 inclusive, with prediction for 1922

of the entire truck industry are not collected and exact figures are available for only about 80 per cent of the industry.

Motorcycle figures are very nearly accurate, although not exact, while tractor figures comprise an intelligent estimate. Tire figures are those of the *Tire Rate Book.*

The completeness and accuracy of the passenger car figures make it possible to analyze passenger car produc-

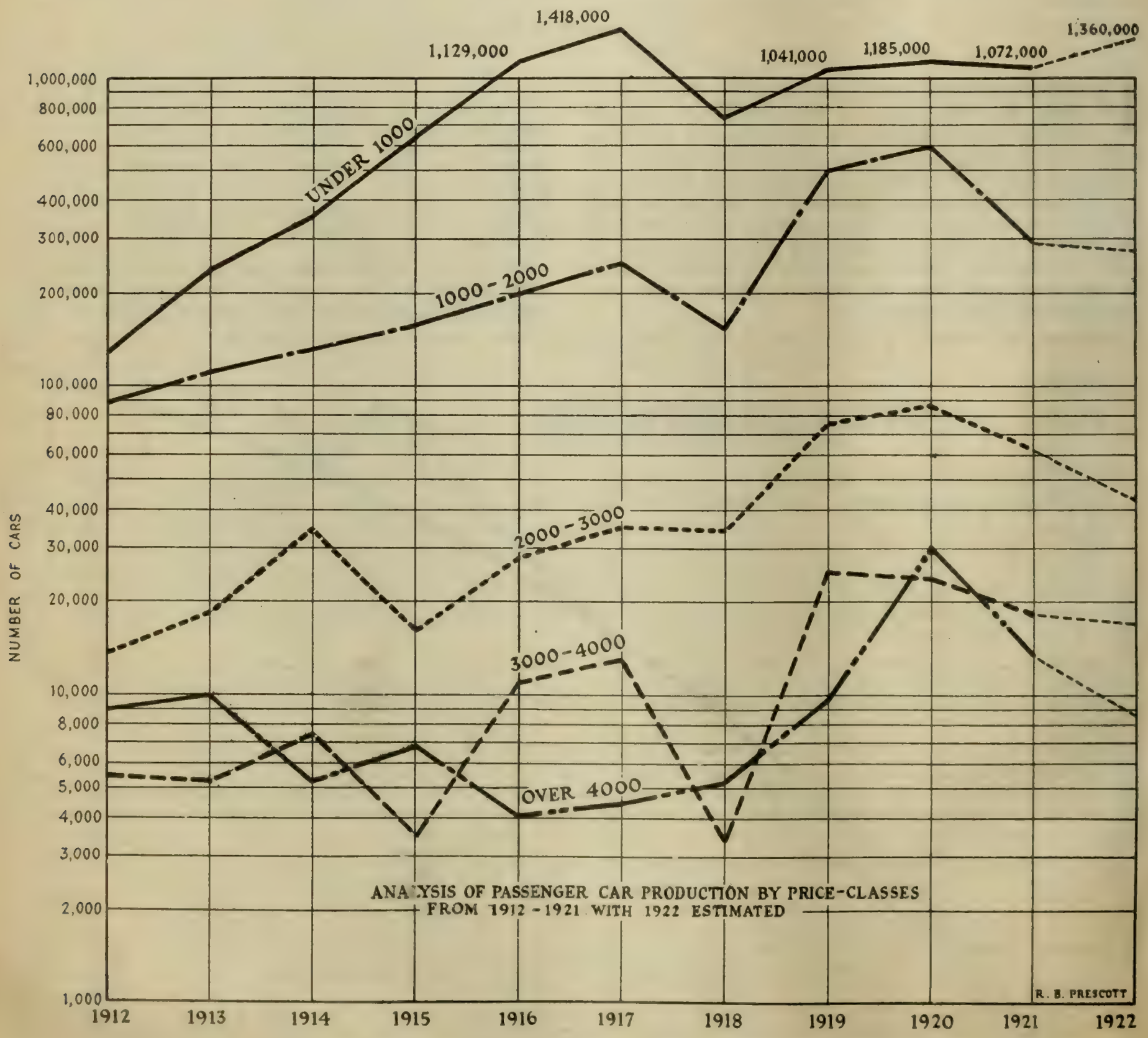


Fig. 3

	1915	1916	1917	1918	1919	1920	1921
Under 1,000.....	.014	.014	.03	.06	.09	.16	.21
1-2,000	.03	.04	.05	.06	.08	.12	.18
2-3,000	.07	.10	.24	.22	.24	.22	.36
3-4,000	.08	.10	.10	.20	.27	.43	.41
Over 4,000.....	.27	.37	.33	.25	.27	.30	.47
Total.....	.015	.015	.04	.07	.10	.18	.25

Fig. 4—Closed car production by years and price classes 1915-1921

tion in considerable detail. The chart shown in Fig. 1 indicates the actual as compared with the normal passenger car production since 1903, the normal curve being extended to 1925. A thorough analysis of this normal curve, together with a complete explanation of the sound basis upon which it was built up, was published in AUTOMOTIVE INDUSTRIES of Nov. 17. Fig. 1 is identical with the chart shown in the previous article, except that the actual production figures for 1921 have been inserted.

1921 Meets Normal Curve

A detailed discussion of the chart is not necessary in the present article. It is interesting to note, however, that the 1921 production figures just meet the normal curve. This indicates that the 1921 car production would have been just what it was had there been no war and had industry not been inflated as a result. The difference in actual conditions, however, would have rested in the fact that production capacity and actual production would have very nearly coincided had war inflation not taken place.

Thus it would appear that we are already back to normal in the sense that passenger car production has been adjusted to the normal demand. The chart shows, however, that not until 1923 will we be back to normal as regards the proper balance of production and production capacity; this is assuming production capacity to be about equal to the peak production in 1920.

Production by Price Classes

Fig. 2 gives the passenger car production by price classes from 1905 to 1921 inclusive, together with a prediction for 1922. The 1921 figures bring out an interesting point as regards the 1922 prediction. In AUTOMOTIVE INDUSTRIES of Dec. 22 these figures were presented up to 1920, and a prediction for 1921 was made without the use of any figures except those previous to and including 1920. At that time the percentage of total production comprised in

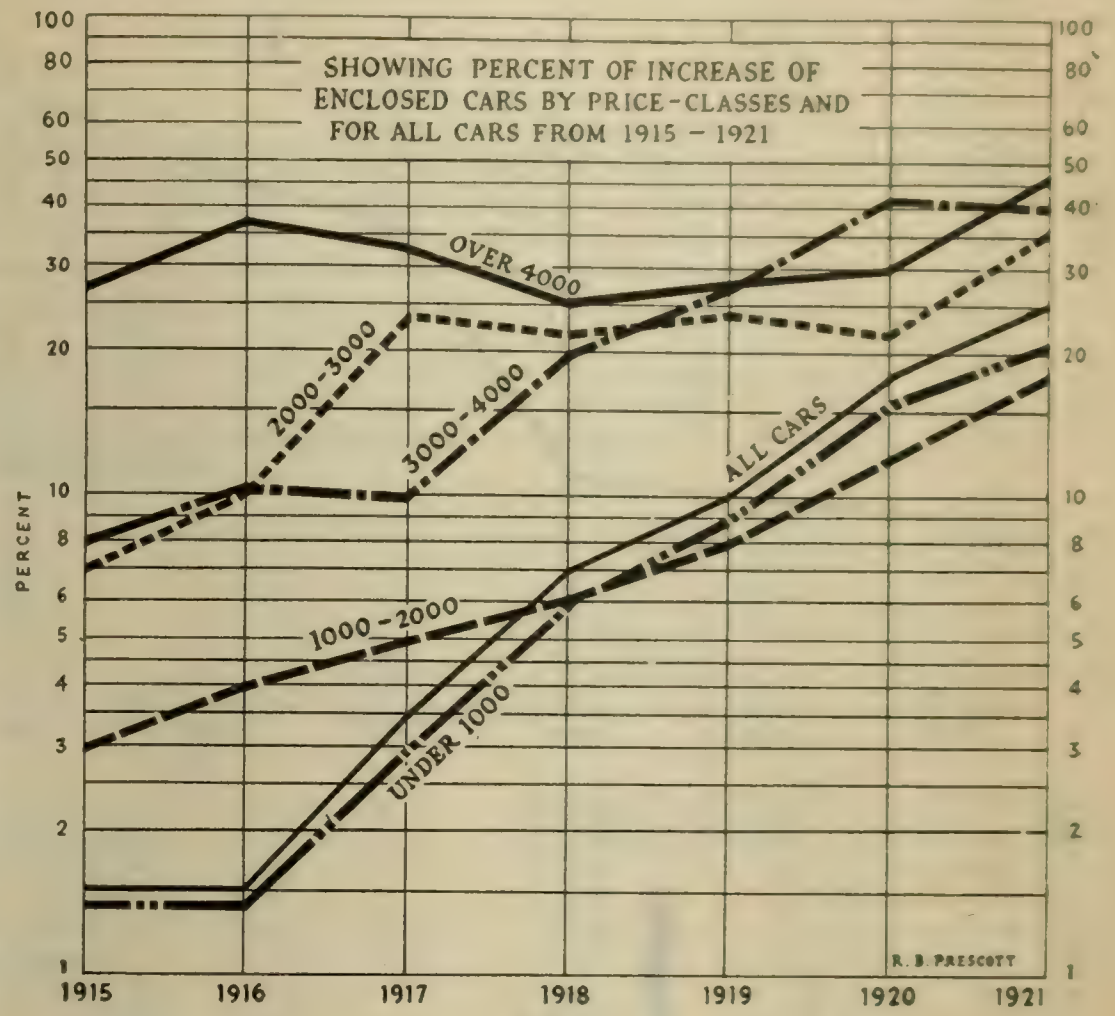


Fig. 5

each price class was calculated. The closeness with which this prediction came true is strikingly revealed by the following comparison:

	Under $1000	$1000-$2000	$2000-$3000	$3000-$4000	Over $4000
Calculated 75%	19%	4%	1%	1%
Actual 73.5	20	4.2	1.3	1

This merely furnishes another indication of the soundness of the basis upon which the normal curves have been built up and the degree of accuracy which can be expected in future predictions for 1922 and other years.

Fig. 3 shows in graphic form passenger car production by price classes for the years 1912 to 1921 inclusive, the 1922 prediction being included as well. This shows that there will be about 1,326,000 passenger cars produced in the "Under $1,000" class during the coming year, a larger number than was produced during 1921 in this class. The number produced in each of the other price groups will probably drop slightly, the sharpest decline probably occurring in the "Over $4,000" class.

A comprehensive survey of closed car production figures has just been completed by AUTOMOTIVE INDUSTRIES and the compiled results are presented here for the first

PERCENTAGE OF PRODUCTION BY QUARTERS FROM 1912 TO 1921

	1st	2nd	3rd	4th
1912.....	.243	.317	.175	.264
1913.....	.204	.338	.213	.250
1914.....	.246	.306	.248	.206
1915.....	.189	.244	.290	.278
1916.....	.240	.288	.256	.216
1917.....	.272	.296	.232	.201
1918.....	.272	.260	.238	.130
1919.....	.192	.258	.260	.290
1920.....	.303	.316	.268	.113
1921.....	.147	.300	.323	.224

FIG. 6

PASSENGER CARS MANUFACTURED BY STATES FROM 1912-1921

	Mich.	Ind.	Ohio	N. Y.	Ill.	Wis.	Conn.	Mass.	Mo.	N. J.	Pa.	Va.	Ga.	Kan.	So. Car.
1912...	193,307	5,305	32,914	9,653	1,218	11,482	2,016	851	894	375	724				
1913...	296,877	8,188	42,901	6,385	3,100	13,541	2,018	721	1,205	573	582	113			
1914...	432,156	7,990	51,637	5,826	2,108	15,551	1,230	591	1,454	502	388	106			
1915...	636,721	17,329	102,562	6,550	3,099	22,795	943		1,015	527	4,300	22			
1916...	1,041,971	29,083	156,586	7,153	7,092	41,477	895		2,632	740	5,364	119			
1917...	1,341,857	37,918	150,225	12,653	10,975	32,016	762		2,067	685	1,574	205			
1918...	671,943	21,561	97,343	8,066	10,111	24,234	370		1,464	360	415	191			
1919...	1,344,346	34,557	94,661	11,659	14,292	49,150	484		1,930	583	875	269		249	751
1920...	1,488,707	39,837	142,015	13,034	22,021	52,165	785	33	2,813	968	1,464	195	32	188	1,180
1921...	1,315,366	22,128	66,692	10,504	9,463	24,663	327	158	5,797	495	543	145	375		481

FIG. 7

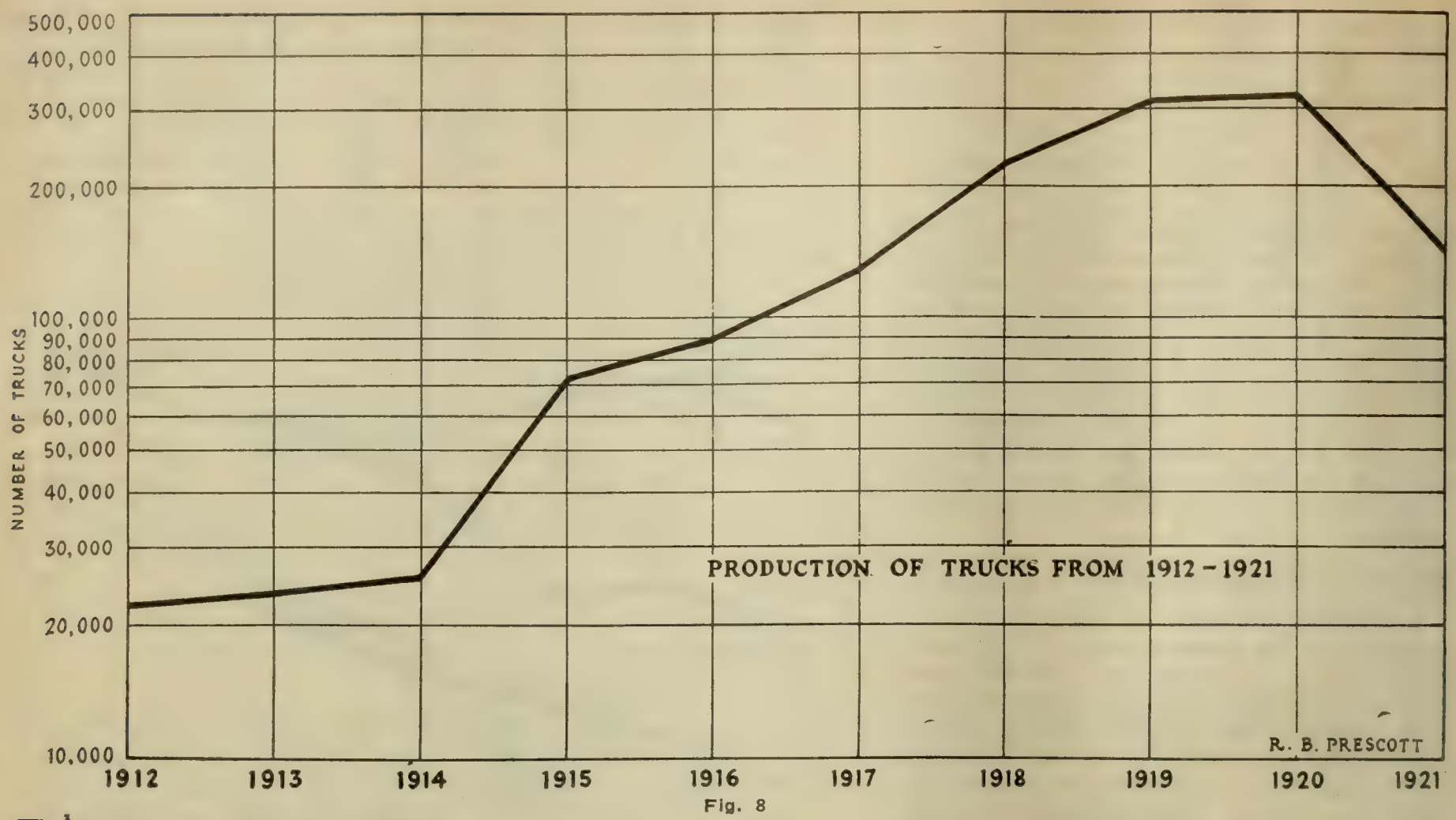


Fig. 8

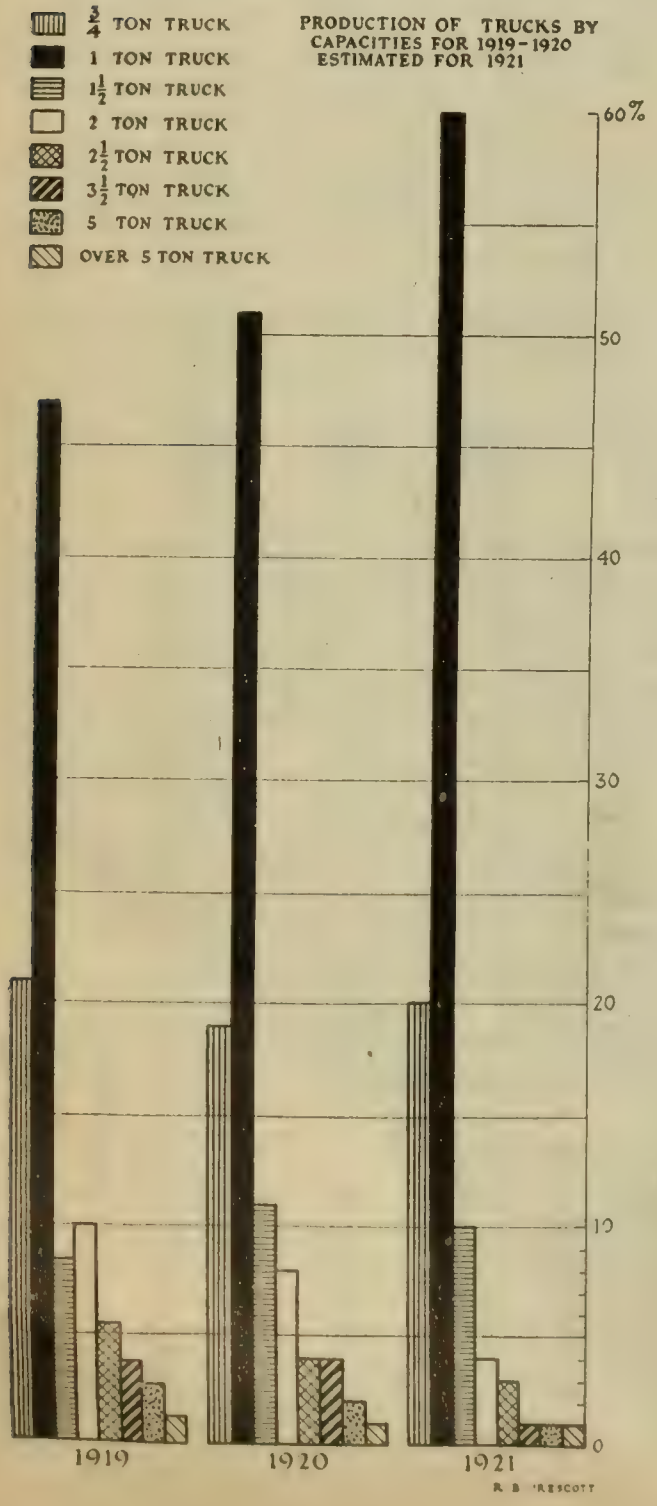


Fig. 9

time. This constitutes probably the most accurate survey of this kind that has ever been made and is especially timely in view of the greatly increased interest in closed car construction throughout the industry.

The percentage of total production comprised of closed cars is shown in tabular form in Fig. 4 and in graphic form in Fig. 5. The results of the survey are shown thus in percentages because in this way the relative importance of the closed car can best be visualized.

The figures show that there has been an increase in closed car production in every price class in practically every year since 1915. The only variation is in the $2,000-$3,000 class in the years 1917 and 1918. In a general way it would appear that the proportion of closed cars varies directly as the price rises, although this proportion is inverted in the case of the two lower price classes. The percentage variation in this case, however, is so small as to be negligible.

Taking all price classes together, the percentage of closed cars has steadily increased until, in 1921, 25 per cent of the total production was comprised of closed jobs. Over 40 per cent of the high-priced cars were closed jobs in 1921. It will be interesting to note the effect in the various price class percentages of the development of utility closed cars.

Production by quarters is shown in Fig. 6. The striking thing about this table is the revelation that there is very little variation in the percentage of total output produced during each of the four quarters. A survey of the ten years shown indicates that in any given year the variation between quarters is not more than 10 per cent. This holds true throughout, except for the last quarter of 1920 and the first quarter of 1921, where greater variations are noted. Since these are the only ones for ten years, however, it is reasonable to say that they are probably the result of a temporary and peculiar economic condition rather than any indication of a trend.

The slight variations shown are rather startling when analyzed in connection with the general conception of the passenger car industry as a seasonable one. These

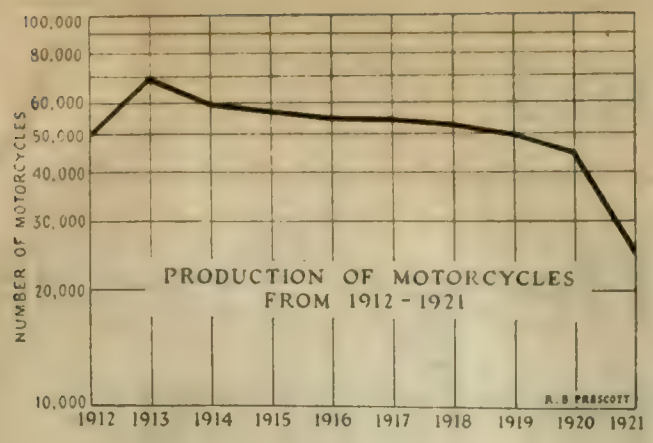


Fig. 10

figures indicate a comparatively constant production throughout the year.

Passenger car production by states is shown in Fig. 7. Michigan has led in car production ever since 1912, while Ohio has followed each year. The table is interesting in many ways and serves to show something of the scope of the car manufacturing industry alone. In 1921 the five leading states in order of production stood as follows:

Michigan	1,315,366
Ohio	66,692
Wisconsin	24,663
Indiana	22,128
New York	10,504

Truck production from 1912 to 1921 inclusive is shown in Fig. 8. It will be noted that the curve is not nearly so uniform as that for passenger cars. This indicates that the truck has not yet found its exact niche in transportation and that further development will be necessary before it attains its maximum possibilities. Truck production, moreover, was affected to a greater relative degree by war inflation than was the case with passenger cars.

Truck production by tonnage groups is shown in the interesting chart, Fig. 9. Only three years' figures are available for this chart, so that a definite trend can hardly be determined. The chart does appear to show the predominance of the 1-ton truck, occasioned chiefly by the numerical predominance of Ford production. There appears to be a tendency for the 1-ton truck predominance to increase. With minor exceptions, the expected results are shown from this analysis, in that greater numbers of small trucks and fewer large trucks are produced. These figures do not, of course, take any account of values.

The trend of motorcycle production is shown in Fig. 10. This chart indicates a steadily falling production since 1913 and quite a heavy drop during 1921. The figures are presented here without any special critical analysis, as such discussion would involve the consideration of many outside factors.

FIFTEEN MILLION DOLLARS has been apportioned by the Secretary of Agriculture among twenty-seven States, Alaska, and Porto Rico for the construction of national forest roads and trails. Of this sum, $9,500,000, known as the "National Forest Highway Funds," is set aside for roads of primary importance to States, counties, and national forest communities; $5,500,000, constituting the "National Forest Development Fund," will be used for the construction of roads and trails needed for the administration and utilization of the forests themselves.

The distribution by States of the National Forest development and National Forest highway funds is as follows:

State	National Forest Highway Fund	National Forest Development Funds	Totals
Alabama	4,880	5,799	10,679
Alaska	970,271	50,222	1,020,493
Arizona	598,189	280,722	878,911
Arkansas	70,365	72,573	142,938
California	1,460,871	703,822	2,164,693
Colorado	717,058	336,360	1,053,418
Florida	25,118	8,730	33,848
Georgia	13,355	20,347	33,702
Idaho	1,097,894	1,088,656	2,186,550
Maine	2,760	4,754	7,514
Michigan	3,638	6,220	9,858
Minnesota	60,929	65,621	126,550
Montana	878,886	574,615	1,453,501
Nebraska	11,065	11,159	22,224
Nevada	207,984	55,377	263,361
New Hampshire	35,294	24,276	59,570
New Mexico	458,258	219,652	677,910
North Carolina	27,856	46,984	74,840
Oklahoma	5,645	8,764	14,409
Oregon	1,157,109	718,555	1,875,664
Porto Rico	1,454	5,344	6,798
South Carolina	1,572	8,704	10,276
South Dakota	77,553	64,139	141,692
Tennessee	20,896	23,243	44,139
Utah	371,776	164,258	536,034
Virginia	26,140	46,512	72,652
Washington	708,133	602,889	1,311,022
West Virginia	6.051	14,602	20,653
Wyoming	479,000	267,101	746,101
Totals	9,500,000	5,500,000	15,000,000

FRENCH aerial navigation companies numbered 4 in 1919, 10 in 1920 and 8 in 1921. Two companies ceased operation in 1921. Nearly all the machines are war types or modified war types, and have not been specially designed for commercial service. Services began in 1919 on a very small scale, but the increase has been progressive. The average commercial speed realized on the various lines (all stops included) is 37 miles for Toulouse-Casablanca; 62 miles for Paris, Brussels, Rotterdam, Amsterdam; 70 miles for Paris-Warsaw and 70 to 90 miles for Paris-London.

Up to Sept. 1, 1921, the distance covered in regular service was 1,744,810 miles, with 10 deaths and 14 cases of injury, this including both passenger and crew. This gives one death per 174,481 miles and one injury per 124,630 miles. The time saved through the use of these various aerial routes is 5 hr. to London and Amsterdam, 13 hr. to Warsaw and 70 hr. between Toulouse and Casablanca.

On the attached table the rate of fares on the various lines radiating from Paris are given in francs, also freight charges in francs and rate per kilometre for mail, freight and passengers.

FRENCH AERIAL LINES

ROUTE	Distance Miles	Mail Rates Per ⅜ Oz. Francs	FREIGHT CHARGES		PASSENGER FARES	
			Per Kilo-Francs	Per Kilometre	Francs	Per Kilometre
Paris-London	232	0.50	5 to 7.50	.0133	300	.80
Paris-Brussels	155	0.30	3 to 4	.013	175	.67
Paris-Amsterdam	273	0.50	5 to 6.50	.013	300	.68
Paris-Strasbourg	248	0.75	2.50	.006	150	.375
Paris-Prague	559	1.25	7.00	.0077	500	.55
Paris-Warsaw	870	1.75	9.00	.0064	800	.37
Toulouse-Casablanca	1149	0.50	9.00	.0048	1560	.86
Bagaure-Santanda	124	0.25	2.50	.0012	150	.75
Paris-Settano	186	.....	3.50	.0116	200	.66
Bordeaux-Montpellier	261	.....	6.60	.0157	176	.40
Nimes-Nice	217	.....	4.50	.013	240	.68

Specifications

American Passenger Car Design Trends as Revealed by 1922 Specifications

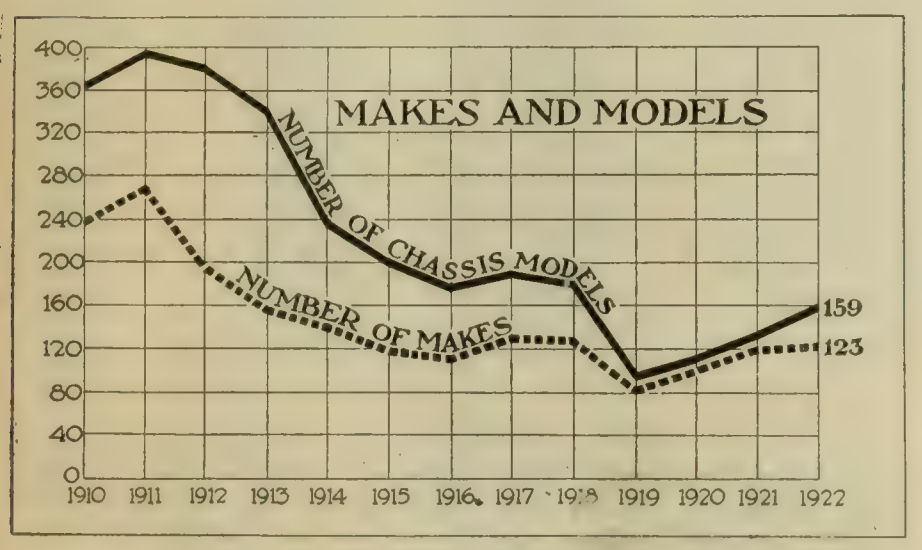
Slight increase in percentage of six and eight-cylinder engines with corresponding decrease in fours and twelves. More chassis models and more makes are listed this year. Plate and multiple-disk clutches predominate. Spiral bevel final drive now almost universally employed.

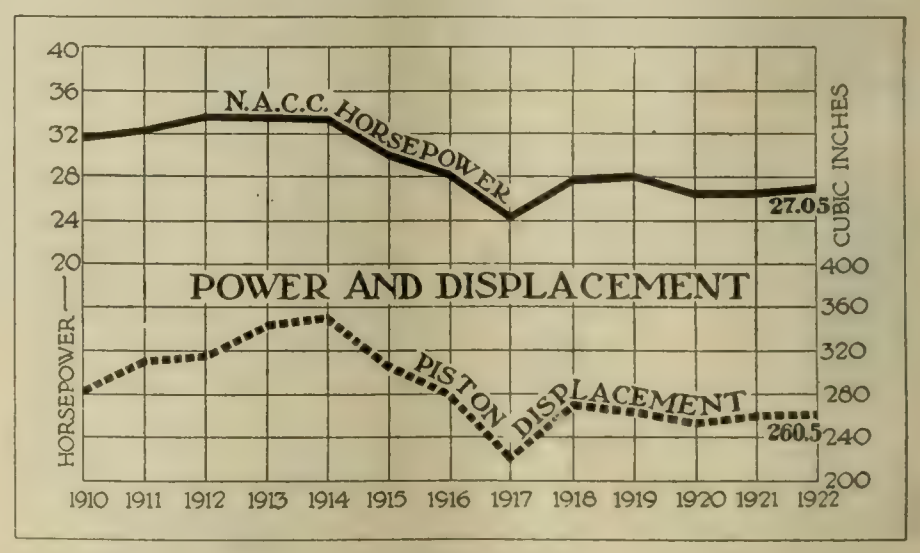
By Herbert Chase

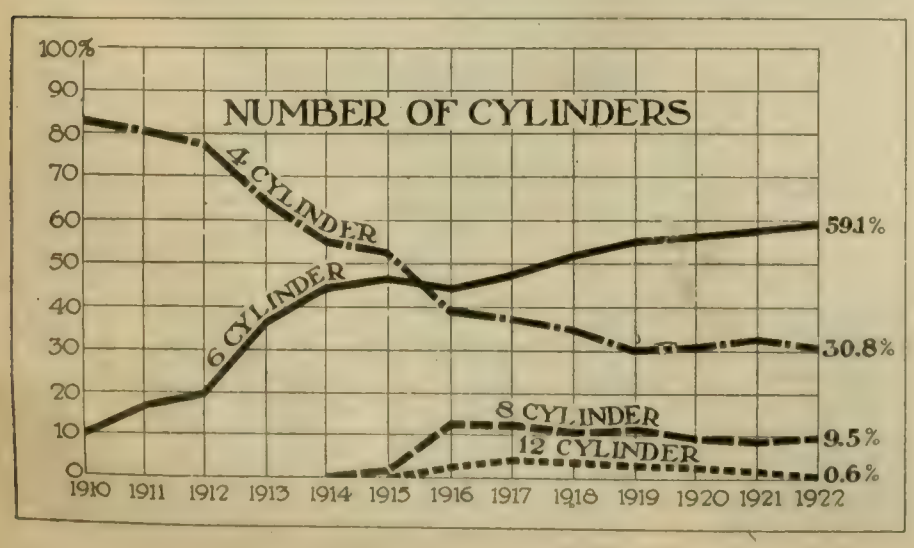
IT was not to be expected that the 1922 specifications for American passenger car chassis would show any marked deviation from what has come to be regarded as "standard practice" for the industry has become too stable and too much involved in the business of economical quantity production to be stampeded into making many radical changes from year to year. It is a well recognized fact that the companies which turn out substantially the same chassis year after year are in general those which have the reputation for making the most dependable and satisfactory products in their respective price classes, and which have therefore been most successful from a commercial standpoint. This may not be a policy which favors the development of the most perfect design from a purely engineering standpoint, but so long as conditions, such for example as those imposed by the character and quantity of the fuel supply, do not change it is doubtless the most satisfactory from the user's standpoint as well as the most profitable for the manufacturer. For this reason it is probable that even if a simple change in engine design could be made to-day which would result in doubling the mileage per gallon of fuel (and such a thing is quite possible, not to say probable), such change would not be incorporated in any considerable percentage of cars for several years to come.

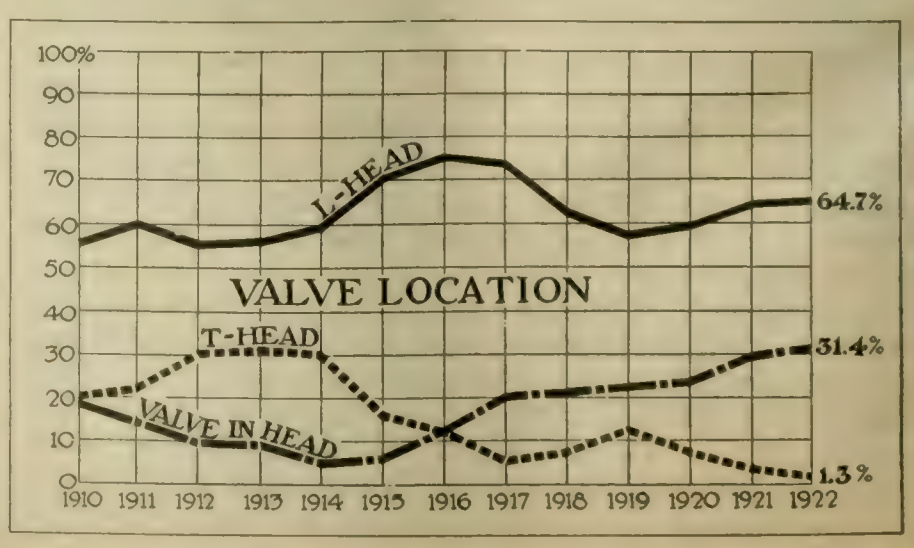
Trends in design are best illustrated by reference to the accompanying charts on which are plotted curves

(*Continued on page* 336)

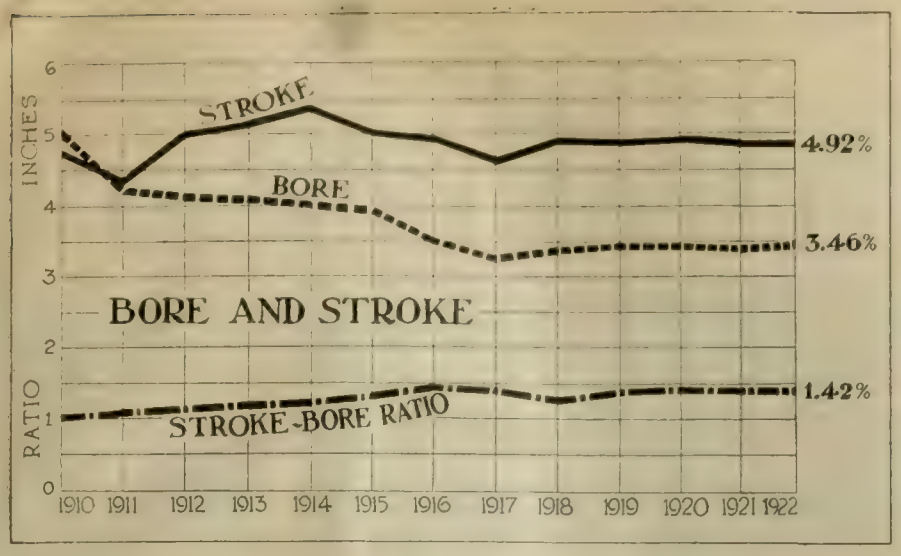


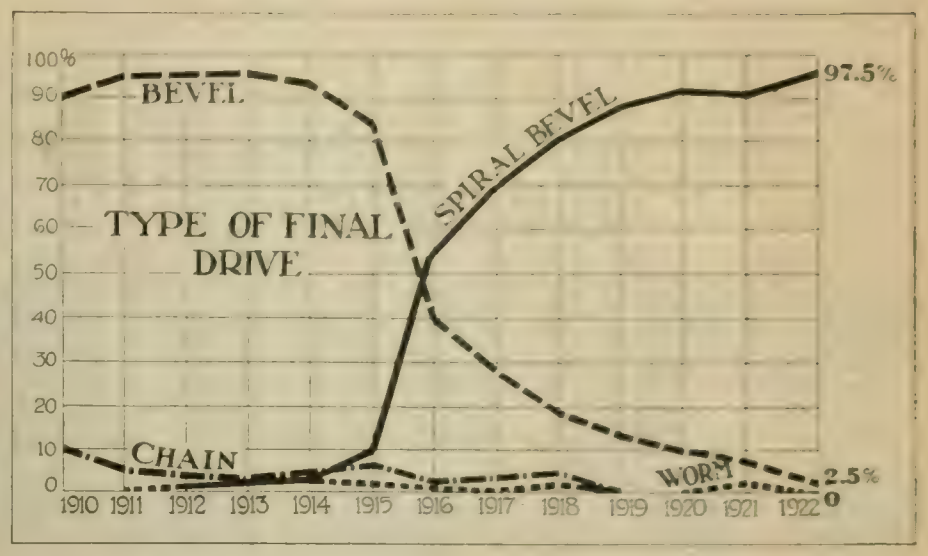


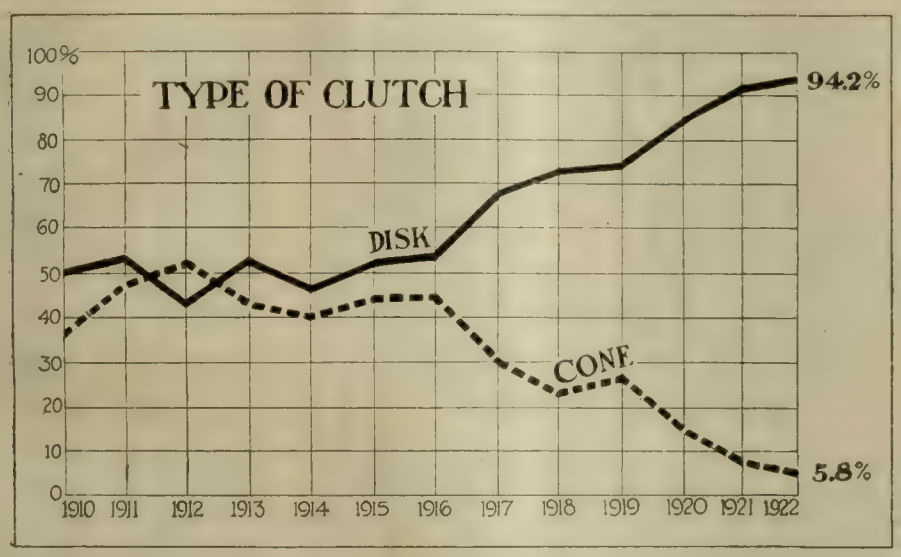


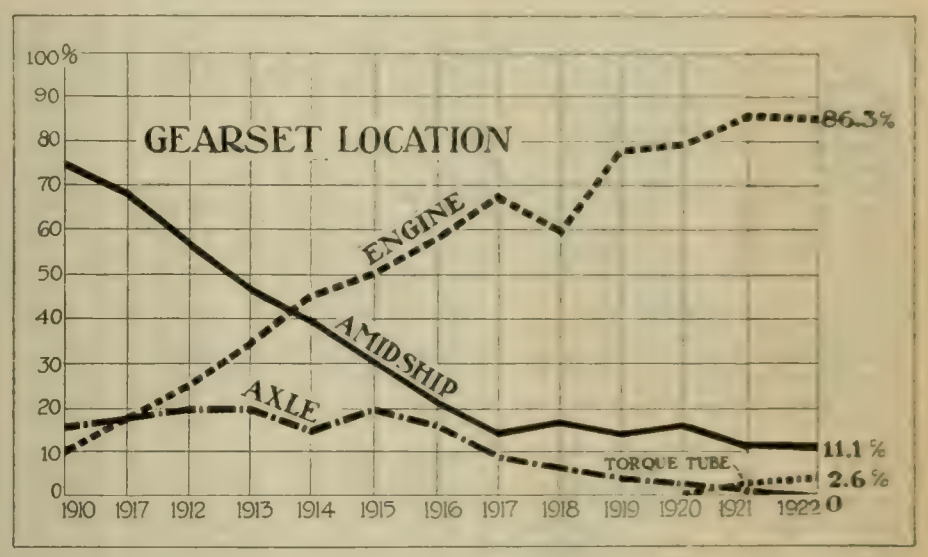


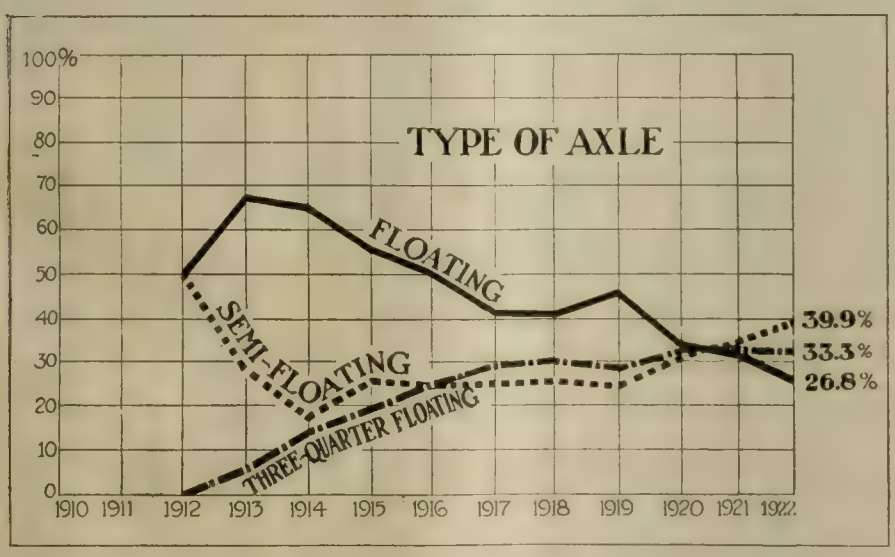
Tendencies in Passenger Car Design, 1910-1922

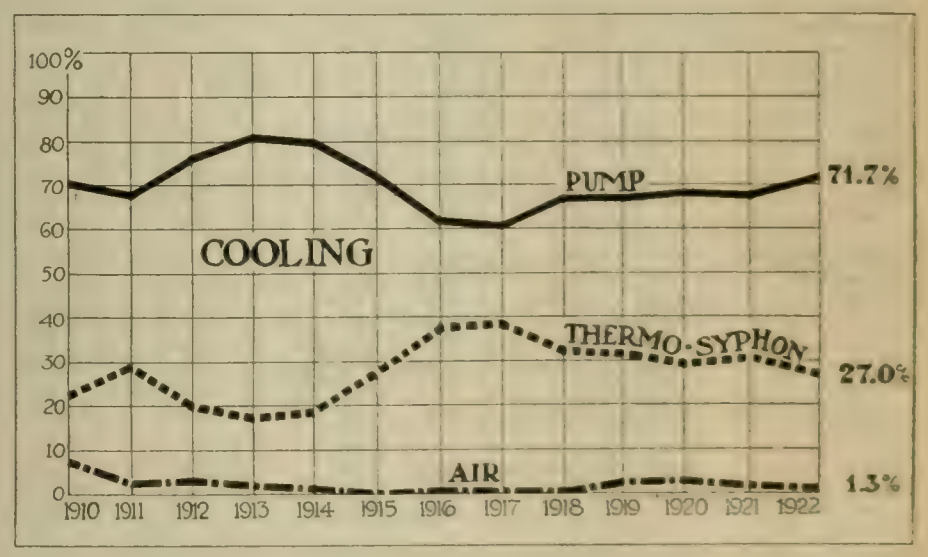


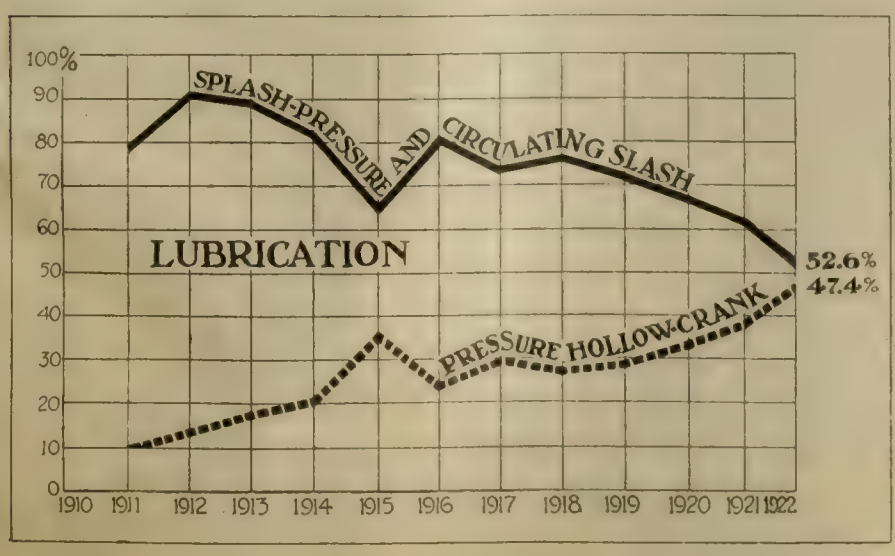


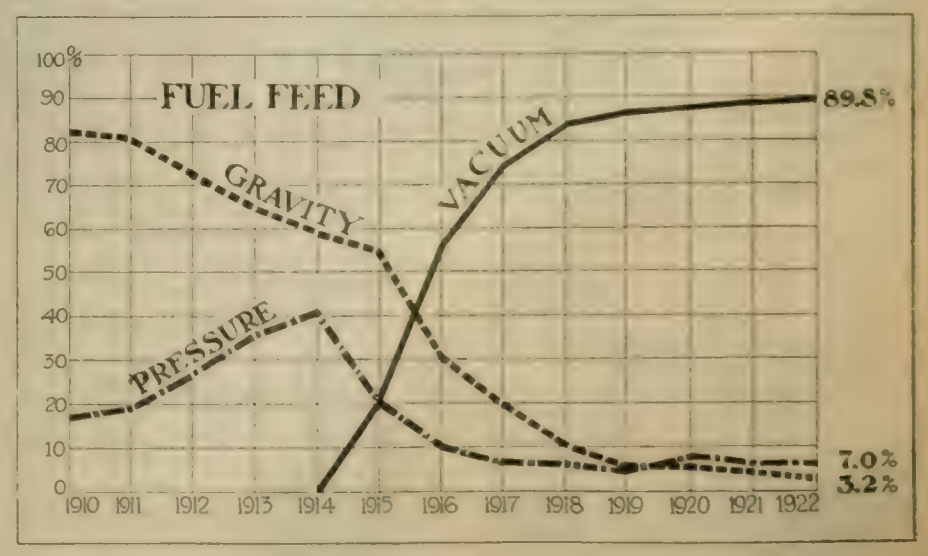












Passenger Car

Make and Model	Wheelbase	ENGINE: Make	Number Cylinders, Bore and Stroke	Piston Displacement Cu. In.	Point Suspension	Cylinder Type	Cylinder Head	Cylinders Cast	Piston Material	Camshaft Drive	Cooling	Cooling Control	LUBRICATION: System	LUBRICATION: Type of Pump	FUEL SYSTEM: Carbureter Make	FUEL SYSTEM: Fuel Feed	IGNITION SYSTEM: Type	IGNITION SYSTEM: Make	IGNITION SYSTEM: Control	IGNITION SYSTEM: Generator Make	IGNITION SYSTEM: Voltage
Ambassador R	136	Con	6-3⅝x5¼	356.1	3	H	Det.	6	Cl	Chain	Pump.	None.	Hol-Crk	Gear	Stromb	Vac	Cl-Cir	Bosch	Hand	West	6
American C	127	H-S	6-3¼x5	248.9	3	L	Det.	6	Cl	Met-Gear	Pump.	None.	Cir-Spl		Stromb	Vac	Cl-Cir	At-K	Hand	G&D	6
Anderson Series 40	120	Con	6-3¼x4½	224.0	3	L	Det.	6	Cl	Met-Gear	Pump.	None.	Hol-Crk	Gear	Rayfld	Vac	Op-Cir*	Remy	Hand	Remy	6
Apperson Eight	130	Own	8-3¼x5	331.8		T	Det.	4	Cl	Met-Gear	Ther.	None.	Hol-Crk	Gear	Johnsn	Vac	Cl-Cir*	Remy	Hand	Bijur	6
Auburn, Beauty Six 6-51	121	Con	6-3¼x4½	224.0	3	L	Det.	6	Cl	Met-Gear	Pump.	None.	Hol-Crk	Gear	Rayfld	Vac	Op-Cir	Remy	Hand	Remy	6
Beggs 20-T	120	Con	6-3¼x4½	224.0	3	L	Det.	6	Cl	Met-Gear	Pump.	None.	Hol-Crk	Gear	Stromb	Vac		Conn	Hand		
Biddle B-1, B-5	121	Buda	4-3⅜x5⅛	226.4	3	H	Int.	4	Al	Met-Gear	Ther.	None.	Cir-Spl	Gear	Zenith	Vac	Cl-Cir	Simms	Hand	G&D	
Brewster 02	125	Own	4-4x5½	276.5	4	S	Det.	4	Cl	Chain	Pump.	None.	Hol-Crk	Gear	Zenith	Vac		Bosch	Hand	USL	12
Buick Four 22-34-37	109	Own	4-3⅜x4¾	170.0	3	H	Det.	4	Cl	Met-Gear	Pump.	None.	Cir-Spl	Gear	Marvel	Vac	S-pt	Delco	Hand	Delco	6
Buick Six 22-44-47	118	Own	6-3⅜x4½	241.6	3	H	Int.	6	Cl	Non-Met-G	Pump.	None.	Cir-Spl	Gear	Marvel	Vac	S-pt	Delco	Hand††	Delco	6
Buick Six 22-48-50	124	Own	6-3⅜x4½	241.6	3	H	Int.	6	Cl	Non-Met-G	Pump.	None.	Cir-Spl	Gear	Marvel	Vac	S-pt	Delco	Hand††	Delco	6
Cadillac 61	132	Own	8-3⅛x5⅛	314.4	3	L	Det.	4	Cl	Chain	Pump.	Ther.	Hol-Crk	Gear	Own	Pr	D-pt	Delco	Auto	Delco	6
Case X	122	Con	6-3⅜x4½	224.0	3	L	Det.	6	Cl	Met-Gear	Pump.	Ther.	Hol-Crk	Gear	Rayfld	Vac	Cl-Cir*	Delco	Hand	Bijur	6
Chalmers 6-30	117	Own	6-3¼x4½	224.0	4	L	Det.	6	Al	Chain	Ther.	None.	Cir-Spl	Gear	Stromb	Vac	Cl-Cir	Remy	Hand	Aut-L	6
Chalmers 6-30	122	Own	6-3¼x4½	224.0	4	L	Det.	6	Al	Chain	Ther.	None.	Cir-Spl	Gear	Stromb	Vac	Cl-Cir	Remy	Hand	Aut-L	6
Champion Tourist	113	Lyc	4-3½x5	192.4		L		4			Ther.				Zenith			Dynet	Hand	Dynet	
Champion Special	118	H-S	4-3½x5	192.4		L		4			Ther.				Zenith			Dynet	Hand	Dynet	
Chandler Six	123	Own	6-3½x5	288.6		L		6		Chain	Pump.		Cir-Spl	Pist	Rayfld	Vac		Bosch	Hand	Bosch	6
Chevrolet 490	102	Own	4-3 1/16x4	170.9	4	H	Det.	4	Cl	Met-Gear	Pump.	None.	Cir-Spl	Gear	Zenith	Gra	Cl-Cir	Remy	Hand	Aut-L	6
Chevrolet FB	110	Own	4-3 1/16x5¼	224.3		L		4			Pump.	None.	Cir-Spl	Gear	Zenith	Vac		Remy		Aut-L	
Cleveland 40	112	Own	6-3x4½	190.8	4	H	Det.	6	Cl	Chain	Pump.	None.	Cir-Spl	Gear	Stromb	Vac	Op-Cir*	Bosch	Hand	Bosch	6
Climber Four K	117	H-S	4-3½x5	192.4	3	H	Det.	4	Cl	Com-Gear	Ther.	None.	Cir-Spl		Stromb	Vac	D-pt	At-K	Hand	West	6
Climber Six S	126	H-S	6-3¼x5	248.9		H	Int.	6	Cl	Met-Gear	Pump.	None.	Cir-Spl		Stromb	Vac	D-pt	Bosch	Hand	West	6
Cole 890	127	Nor	8-3½x4½	346.3	3	L	Det.	4	Al	Com-Gear	Pump.	Ther.	Cir-Spl	Gear	Johnsn	Vac	D-pt	Delco	Hand	Delco	6
Columbia CC	115	Con	6-3¼x4½	224.0	3	L	Det.	6	Cl	Met-Gear	Pump.	Ther.	Cir-Spl	Gear	Stromb	Vac	Cl-Cir*	At-K	Hand	Aut-L	6
Comet 6-C53-2	125	Con	6-3½x5¼	303.1	3	H	Det.	3		Met-Gear	Pump.	None.	Cir-Spl	Pist	Stromb	Vac	Op-Cir	Wagnr	Hand		
Crawford 22-6-49	122	Con	6-3½x5¼	303.1		L		6		Chain	Pump.		Cir-Spl		Stromb	Vac		At-K	Hand	West	6
Crow-Elkhart L	117	Lyc	4-3½x5	192.4	3	L	Det.	4	Cl		Ther.	None.	Cir-Spl	Gear	Zenith	Vac		Conn	Hand	Dynet	
Crow-Elkhart S	117	H-S	6-3¼x5	248.9	3	L	Det.	6	Cl		Pump.	None.	Cir-Spl	Gear	Stromb	Vac		Conn		Dynet	
Cunningham V-4	132	Own	8-3¾x5	441.7	4	L	Det.	4	Al	Non-Met-G	Pump.	Ther.	Hol-Crk	Gear	Stromb	Vac	D-pt	Delco	Hand††	Delco	6
Cunningham	142	Own	8-3¾x5	441.7	4	L	Det.	4	Al	Non-Met-G	Pump.	Ther.	Hol-Crk	Gear	Stromb	Vac	D-pt	Delco	Hand	Delco	6
Daniels D-19	132	Own	8-3½x5¼	404.1	3	L	Det.	4	Cl	Met-Gear	Pump.	None.		Gear	Zenith	Pr	D-pt		Hand††	Delco	6
Davis 61-67	120	Con	6-3¼x4½	224.0	3	L	Det.	6	Cl	Met-Gear	Pump.	None.	Hol-Crk	Gear	Stromb	Vac		Delco	Hand	Delco	
Dixie Flyer H	112	H-S	4-3½x5	192.4	3	L	Det.	4	Cl	Met-Gear	Ther.	None.	Cir-Spl	Gear	Stromb	Vac	S-pt	Eisem	Hand	Dynet	6
Dodge Brothers	114	Own	4-3⅞x4½	212.3	3	L	Det.	4	Cl	Met-Gear	Pump.	None.	Cir-Spl	Gear	Stewart	Vac	Cl-Cir*	N.E.	Auto	N.E.	12
Dorris 6-80	132	Own	6-4x5	377.0	4	H	Det.	3	Cl	Met-Gear	Pump.	None.		Gear	Stromb	Vac	S-pt	Bosch	Hand	West	6
Dort 19	108	D-Lyc	4-3½x5	192.4	3	L	Det.	4	Cl	Met-Gear	Ther.	None.	Cir-Spl	Pist	Carter	Vac	Cl-Cir	Conn	Hand	Bosch	6
Driggs 1922	104	Own	4-2⅝x4½	97.4	3	L	Det.	4	Cl	Met-Gear	Ther.	None.	Cir-Spl	Gear	Zenith	Vac	Cl-Cir	Bosch	Hand	Bosch	6
Duesenberg Straight 8	134	Own	8-2⅞x5	259.7	3	H	Det.	8	Al	Met-Gear	Pump.	None.	Hol-Crk	Gear		Vac	Cl-Cir**	Delco	Hand	Delco	6
Du Pont A	124	Own	4-3 1/16x5⅛	249.6		L					Pump.		Cir-Spl	Gear	Yale&T	Vac	S-pt	Eisem	Hand	West	6
Durant Four A-22	109	Own	4-3⅞x4¼	200.4	4	H	Det.	4	Cl	Met-Gear	Pump.	None.	Cir-Spl	Gear	Tillot	Vac	Cl-Cir	Aut-L	Hand	Aut-L	
Durant Six B-22	123½	Ans	6-3¼x4½	224.0		L					Pump.					Vac		Aut-L			
Earl 40	112	Own	4-3 1/16x5¼	194.9	4	L	Det.	4	Cl	Non-Met-G	Ther.	None.	Cir-Spl	Pist	Scoe	Vac	S-pt	Conn	Hand	Aut-L	6
Elcar K-4	118	Lyc	4-3½x5	192.4	3	L	Det.	4	Cl	Met-Gear	Ther.	None.	Cir-Spl	Pist	Stromb	Vac	Op-Cir	Delco	Hand	Delco	6
Elcar 7-R	118	Con	6-3¼x4½	224.0	3	L	Det.	6	Cl	Com-Gear	Pump.	None.	Hol-Crk	Gear	Stromb	Vac	Op-Cir	Delco	Hand	Delco	6
Elgin K-1	118	Falls	6-3⅛x4¼	195.6	3	H	Det.	6	Cl	Met-Gear	Ther.	None.		Eccn	Stromb	Vac	Cl-Cir	Wagnr	Hand	West	6
Essex	108½	Own	4-3⅜x5	178.9	4		Det.	4	Al	Met-Gear	Ther.	Shut	Cir-Spl	Pist	Own	Vac	Cl-Cir*	Bosch	Hand††	Bosch	6
Falcon Light Four	115	Own	4-3½x5	192.4	3	L	Det.	4	Cl	Com-Gear	Ther.	None.	Hol-Crk	Gear	Stromb	Vac	Op-Cir	At-K	Hand	West	6
Falcon Six	115	Own	6-3⅛x5	230.1	3	L	Det.	6	Cl	Com-Gear	Pump.	None.	Cir-Spl	Eccn	Stromb	Vac	Op-Cir	At-K	Hand	West	6
Falcon 12-D-22	100	Own	4-2¾x4	95.0	3	L	Det.	4	Al	Chain	Ther.	None.	Cir-Spl	Gear	Zenith	Vac			Hand	Bosch	6
Ferris 60	130	Con	6-3½x5¼	303.1	3	L	Int.	6	Cl	Non-Met-G	Pump.	None.	Cir-Spl	Pist	Zenith	Vac		Split	Hand	L-Nev	6
Ferris 70	130	Con	6-3⅝x5¼	325.1	3	L	Det.	6	Cl	Chain	Pump.	None.	Hol-Crk	Gear		Vac	Cl-Cir	Split	Hand††	L-Nev	6
Ford T	100	Own	4-3¾x4	176.7	3	L	Det.	4	Cl	Met-Gear	Ther.	None.	Cir-Spl		Own	Gra	Op-Cir	Own	Hand	Own	6
Fox	132		6-3¼x5	248.9		H	Int.								Zenith	Vac		Bosch		West	
Franklin 9-B	115	Own	6-3¼x4	199.1	3	H	Int.	1	Al	Non-Met-G	Air	None.	Hol-Crk	Gear	Own	Vac	Cl-Cir*	At-K	Auto	N.E.	12
Frontenac			4-3⅝x5½	196.8		L					Ther.							Delco			
Gardner R.T.S.	112	Lyc	4-3½x5	192.4	3	L	Det.	4	Cl	Met-Gear	Ther.	None.	Cir-Spl	Pist	Carter	Vac	Cl-Cir**	West	Hand	West	6
Grant	116	Wal	6-3 1/16x4½	207.1	3	H	Det.	6	Cl	Non-Met-G	Ther.	None.	Cir-Spl	Gear	Stromb	Vac	Cl-Cir	At-K	Hand	Bijur	6
Goodspeed	124	Own	4-3¾x5½	226.4	3		Det.	4	Cl	Chain	Pump.	Ther.	Hol-Crk		Rayfld	Pr	Op-Cir	Split	Auto	West	6
H. C. S. Series 3	120	Wei	4-3⅝x5 1/12	210.6	4	H	Det.	4	Cl	Met-Gear	Pump.	None.	Hol-Crk	Gear	Stromb	Pr		Delco	Hand	Delco	
Handley-Knight B	125	Knt	4-4 1/16x4½	240	3	S	Det.	4	Al	Chain	Ther.	None.	Hol-Crk	Eccn	Tillot	Vac	Cl-Cir	Aut-L	Auto	Aut-L	
Hanson 60	121	Con	6-3¼x4½	224.0	3	L	Det.	6	Cl	Met-Gear	Pump.	None.	Hol-Crk	Gear	Marvel	Vac		Delco	Hand	Delco	6
Hatfield A-42	115	H-S	4-3½x5	192.4	3	L	Det.	4	Cl	Met-Gear	Ther.	None.	Cir-Spl	Gear	Zenith	Vac	Op-Cir*	Conn	Hand	Dynet	6
Haynes 75	132	Own	6-3 1/16x5 1/16	289.0	3	L	Det.	6	Cl	Chain	Pump.	Ther.	Hol-Crk	Gear	Stromb	Vac	Cl-Cir*	King	Hand	L-Nev	6
Haynes 55	121	Own	6-3½x5	288.6	3	L	Int.	6	Cl	Met-Gear	Pump.	None.	Cir-Spl	Pist	Rayfld	Vac	Cl-Cir*	King	Hand	L-Nev	6
Holmes Series 4	126	Own	6-3½x4½	259.8	3	H	Det.	1	Al	Non-Met-G	Air		Cir-Spl	Gear	Stromb	Vac		Eisem	Auto	Dynet	12
Hudson Super-Six	126	Own	6-3½x5	288.6	4	L	Det.	6	Cl	Met-Gear	Pump.	Shut	Cir-Spl	Pist	Own	Vac	Cl-Cir*	Bosch	Hand††	Bosch	6
Hupmobile R	112	Own	4-3¼x5½	182.5	3	L	Det.	4	Cl	Chain	Ther.	None.	Hol-Crk	Gear	Stromb	Vac	Cl-Cir	At-K	Hand	West	6

ABBREVIATIONS—ENGINE

Engine Make:
Ans—Ansted.
Ben—Beaver.
Con—Continental.
Due—Duesenberg.
D-Lyc—Dort-Lycoming.
H-S—Herschell-Spillman.
Knt—Knight.
Lyc—Lycoming.
Nor—Northway.
R-D—Rochester-Duesenberg.
Wal—Walker
Wei—Weidely.

Ignition Make:
At-K—Atwater-Kent.
Ant-L—Auto-Lite.
Berlg—Berling.
Conn—Connecticut.
Dynet—Dyneto.
Eisem—Eisemann.
N. E.—North East.
Philb—Philbrin.
Split—Splitdorf.
West—Westinghouse.
Wagnr—Wagner.

Ignition Type:
Ci-Cir—Closed Circuit.
D-pt—Double Point.
Op-Cir—Open Circuit.
S-pt—Single Point.
**—Also Double Point.
*—Also Single Point.

Cylinder Type:
D—Dual
H—Head.
Ho—Horizontal.
L—At Side.
L†—At Side and Head.
S—Sleeve.
T—Opposite.

Camshaft Drive:
Com-Gear—Combination Gear.
Met-Gear—Metal Gear.
Non-Met-G—Non-Metal Gear.

Cooling Control:
Shut—Shutter.
Ther—Thermostat.
T & S—Thermostat and Shutter.

Oil Pump Type:
Eccn—Eccentric.
Pist—Piston.

Fuel Feed:
Gra—Gravity.
Pr—Pressure.
Vac—Vacuum.

Ignition Control:
Auto—Automatic.
††—Also Automatic.

Generator Make:
Same as IGNITION MAKE including:
G & D—Gray & Davis.
L-Nev—Leece-Neville.

Cylinder Head:
Det—Detachable.
Int—Integral.

Piston Material:
Al—Aluminum Alloy.
Cl—Cast Iron.

Cooling:
Ther—Thermo-Siphon.

Lubricaton System:
Cir-Spl—Circulating Splash.
Hol-Crk—Hollow Crankshaft.

Carbureter Make:
B&B—Ball & Ball
Claudl—Claudel.
Johnsn—Johnson.
Rayfld—Rayfield.
Stromb—Stromberg.
Schebl—Schebler.
Tillot—Tillotson.
Yale & T—Yale & Towne.

TRANSMISSION

Clutch Type:
D-M—Disk Multiple.
Pla—Plate.

Rear Axle Make:
Ad—Adams.
Col—Columbia.
Fli—Flint.
Per—Peru.
Sal—Salisbury.
S-P—Sian-Par.
St-P—Standard Parts.

Chassis Specifications

TRANSMISSION													TIRES						BRAKES			BEARINGS				
CLUTCH		GEARSET				REAR AXLE													TYPE							
Make	Type	Make	Location	Number Forward Speeds	Universal Joints Type	Rear Axle Make	Final Drive	Rear Axle Type	Direct Gear Ratio	Torque Taken By	Propulsion Taken By	Front	Rear	Wheels, Type	Type Rear Springs	Steering Gear Make	Speedometer Make	Service	Emergency	Location	Gearset	Rear Wheels	Front Wheels, Outer	Front Wheels, Inner	Make and Model
B-L...	D-M..	B-L...	UnWE..	3	Fab...	Tim...	S-B...	F...	4.45	TA.	Sp..	32x4½	32x4½	.....	½E...	Jac...	S-W..	Ext...	Int...	R-W..	R.....	R.....	R...	R...	Ambassador R
B&B..	Pla...	War..	UnWE..	3	Met...	Sal...	S-B...	F...	4.50	Sp..	Sp..	32x4	32x4	.....	½E...	War..	Van...	Ext...	Int...						American C
B&B..	Pla...	Dur...	UnWE..	3	Fab...	Sal...	S-B...	¾	4.50	Sp..	Sp..	33x4	33x4	.....	½E...	Gem..	.....	Ext...	Int...	R-W..	B.....	B.....	R...	R...	Anderson Series 40
Own..	D-M..	Own..	SepUn..	3	Met...	Own..	S-B...	½	4.25	Sp..	Sp..	34x4½	34x4½	.....	¾E...	Own..	Van...	Ext...	Int...	R-W..	R.....	R.....	R..,	R...	Apperson Eight
B&B..	Pla...	G-L...	UnWE..	3	Met...	Sal...	S-B...	F...	5.00	TA.	Sp..	32x4	32x4	Art...	½E...	Jac...	S-W..	Ext...	Int...	.....	B.....	B.....	R...	R...	Auburn, Beauty Six 6-51
B&B..	Pla...	Dt....	UnWE..	3	Met...	S-P...	S-B...	¾	4.75	Sp..	Sp..	33x4	33x4	Dis...	½E...	Dit...	S-W..	Ext...	Int...						Beggs 20-T
War..	D-M..	War..	UnWE..	4	Met...	S-P...	S-B...	½	4.50	Sp..	Sp..	32x4	32x4	Art...	½E...	Gem..	S-W..	Ext...	Int...	R-W..	R.....	R.....	R...	R...	Biddle B-1, B-5
Own..	Cone..	Own..	UnTT...	3	Lea...	Own..	S-B...	F...	....	TT.	TT.	32x4½	32x4½	Art...	FC...	Own..	S-W..	Int...	Int...	R-W..					Brewster 62
Own..	D-M..	Own..	UnWE..	3	Met...	Own..	S-B...	¾	4.66	TT.	TT.	31x4	31x4	Art...	½E...	Jac...	S-W..	Ext...	Int...	R-W..	B.....	R.....	B...	B...	Buick Four 22-34-37
Own..	D-M..	Own..	UnWE..	3	Met...	Own..	S-B...	¾	4.60	TT.	TT.	33x4	33x4	Art...	FC...	Jac...	S-W..	Ext...	Int...	R-W..	B.....	B.....	B...	B...	Buick Six 22-44-47
Own..	D-M..	Own..	UnWE..	3	Met...	Own..	S-B...	¾	4.90	TT.	TT.	33x4½	33x4½	Art...	FC...	Jac...	S-W..	Ext...	Int...	R-W..	B.....	B.....	B...	B...	Buick Six 33-48-50
Own..	D-M..	Own..	UnWE..	3	Met...	Tim...	S-B...	F...	....	TA.	Sp..	33x5	33x5	.....	Pl....	Own..	.....	Ext...	Int...						Cadillac 61
Own..	D-M..	Own..	UnWE..	3	Fab...	Col...	S-B...	½	4.66	Sp..	Sp..	32x4½	32x4½	Art...	½E...	Jac...	S-W..	Ext...	Int...	R-W..	R.....	R.....	R...	R...	Case X
Own..	D-M..	Own..	UnWE..	3	Met...	Ad....	S-B...	½	5.12	Sp..	Sp..	32x4	32x4	Art...	½E...	Own..	S-W..	Ext...	Int...	R-W..					Chalmers 6-30
Own..	D-M..	Own..	UnWE..	3	Met...	Ad....	S-B...	½	5.12	Sp..	Sp..	32x4	32x4	Art...	½E...	Own..	S-W..	Ext...	Int...	R-W..					Chalmers 6-30
B&B..	Pla...	G-L...	.....	3	.....	Col...	Bev...	F...	....	....	....	32x3½	32x3½	Art...	½E...	.....	.....	.....	.....	.....	.....	R.....	.....	.....	Champion Tourist
B&B..	Pla...	G-L...	.....	3	.....	Col...	Bev...	F...	....	....	....	32x4	32x4	Art...	½E...	.....	.....	.....	.....	.....	.....	.....	R...	R...	Champion Special
B&B..	Pla...	Own..	UnWE..	3	.....	Own..	S-B...	F...	4.40	Sp..	....	33x4..	33x4	Art...	½E...	CAS..	S-W..	.....	.....	.....	B.....	B.....	R...	R...	Chandler Six
Own..	Cone..	Own..	UnWE..	3	Met...	Own..	S-B...	½	3.66	TT.	Sp..	30x3½	30x3½	Art...	¼E...	Own..	S-W..	.....	Int...	.....	B.....	R.....	R...	R...	Chevrolet 490
.....	Cone..	.....	.....	3	.....	.....	.....	¾	....	....	....	33x4	33x4	Art...	½E...	.....	.....	.....	.....	.....	.....	R.....	B...	B...	Chevrolet FB
B&B..	Pla...	Mec..	UnWE..	3	Met...	Own..	S-B...	½	4.45	Sp..	Sp..	32x4	32x4	.....	½E...	CAS..	Van...	Ext...	Ext...	R&D..	R.....	B&R..	R...	R...	Cleveland 40
B&B..	Pla...	Mun..	UnWE..	3	Met...	Ad....	S-B...	F...	4.00	Sp..	Sp..	33x4	33x4	.....	½E...	CAS..	S-W..	Ext...	Int...	R-W..	.....	R.....	R...	R...	Climber Four K
Mun..	D-M..	Mun..	UnWE..	3	.....	Ad....	S-B...	.....	4.75	Sp..	Sp..	32x4½	32x4½	.....	½E...	CAS..	Van...	Ext...	Int...	R-W..	.....	R.....	R...	R...	Climber Six S
Nor...	Cone..	Nor...	UnWE..	3	Met...	Col...	S-B...	F...	....	Sp..	Sp..	33x5	33x5	Art...	½E...	Gem..	S-W..	Ext...	Int...	R-W..	B.....	R.....	R...	R...	Cole 890
B&B..	Pla...	Dur...	UnWE..	3	Met...	Tim...	S-B...	½	....	TA.	Sp..	32x4	32x4	.....	Ca....	Gem..	S-W..	Ext...	Int...	R-W..	.....	.....	.....	.....	Columbia CC
B&B..	Pla...	Mun..	UnWE..	3	Met...	Col...	S-B...	¾	....	Sp..	Sp..	33x4½	33x4½	Art...	½E...	Gem..	S-W..	Ext...	Int...	R-W..	.....	.....	.....	.....	Comet 6-C53-2
B-L..	D-M..	B-L...	UnWE..	3	.....	Tim...	S-B...	½	....	Sp..	....	32x4	32x4	Art...	½E...	Lav...	S-W..	.....	.....	.....	R.....	.R.....	R...	R...	Crawford 22-6-40
B&B..	Pla...	Mun..	UnWE..	.....	Fab...	Per...	S-B...	F...	4.25	....	Sp..	33x4	33x4	Art...	.....	Dit...	S-W..	Ext...	Int...	R-W..	.....	.....	.....	.....	Crow-Elkhart L
B&B..	Pla...	Mun..	.....	3	Fab...	Per...	S-B...	F...	4.25	....	Sp..	33x4	33x4	Art...	.....	Dit...	S-W..	Ext...	Int...	.....	.....	.....	.....	.....	Crow-Elkhart S
B&B..	Pla...	Own..	UnWE..	4	Fab...	Tim...	S-B...	F...	4.22	TA.	Sp..	33x5	33x5	.....	¾E...	Gem..	Wal...	Ext...	Int...	.....	.....	.....	.....	.....	Cunningham V-4
B&B..	Pla...	Own..	UnWE..	4	Fab...	Tim...	S-B...	F...	4.22	TA.	Sp..	33x5	33x5	.....	¾E...	Gem..	Wal...	Ext...	Int...	.....	.....	.....	.....	.....	Cunningham
Own..	D-M..	Own..	UnWE..	.....	Met...	Tim...	S-B...	F...	....	TA.	....	33x5	33x5	.....	½E...	Gem..	Wal...	Ext...	Int...	R-W..	.....	R.....	R...	R...	Daniels D-19
B&B..	Pla...	War..	UnWE..	3	Met...	Tim...	S-B...	¾	5.99	Sp..	Sp..	32x4	32x4	.....	½E...	War..	S-W..	Ext...	Int...	.....	.....	.....	.....	.....	Davis 61-67
B&B..	Pla...	G-L...	UnWE..	3	Fab...	Per...	S-B...	F...	4.75	TT.	TT.	32x4	32x4	Art...	¾E...	CAS..	Van...	Ext...	Int...	R-W..	B.....	R.....	R...	R...	Dixie Flyer H
Own..	D-M..	Own..	UnWE..	3	Met...	Own..	S-B...	F...	4.16	TT.	Sp..	32x4	32x4	.....	¾E...	Own..	J-M...	Ext...	Int...	R-W..	.....	.....	.....	.....	Dodge Brothers
Own..	D-M..	War..	UnWE..	3	Met...	Tim...	S-B...	¾	....	Sp..	Sp..	33x5	33x5	Art...	½E...	Ross..	Van...	Ext...	.....	R-W..	B.....	R.....	R...	R...	Dorris 6-80
Det...	D-M..	Own..	UnWE..	3	Met...	Fli....	S-B...	¾	4.45	TT.	Sp..	31x4	31x4	.....	FC...	Jac..	S-W..	Ext...	Int...	R-W..	B.....	R.....	R...	R...	Dort 19
Hoo...	Pla...	Mec..	UnWE..	3	Met...	Own..	S-B...	¾	4.75	TT.	TT.	30x3½	30x3½	Wir...	FC...	CAS..	S-W..	Ext...	Int...	R-W..	.....	.....	.....	.....	Driggs 1922
B-L...	D-M..	Own..	UnWE..	3	Fab...	Own..	S-B...	½	4.60	TT.	....	33x5	33x5	Wir...	½E...	Ross..	S-W..	Int...	Ext...	FRD..	.....	.....	.....	.....	Duesenberg Straight 8
B-L...	D-M..	B-L...	UnWE..	4	.....	Col...	S-B...	F...	.....	Sp..	....	32x4½	32x4½	.....	½E...	Jac..	S-W..	.....	.....	.....	R.....	R.....	R...	R...	Du Pont A
Own..	Pla...	.....	SepUn..	3	.....	Ad....	S-B...	¾	4.30	Sp..	Sp..	31x4	31x4	Art...	½E...	War..	S-W..	Ext...	Int...	R-W..	.....	.....	.....	.....	Durant Four A-22
.....	Pla...	.....	SepUn..	3	.....	Tim...	S-B...	½	....	....	....	32x4½	32x4½	Art...	½E...	.....	.....	Ext...	Int...	R-W..	R.....	R.....	R...	R...	Durant Six B-22
B&B..	Pla...	Own..	UnWE..	3	Fab...	Own..	S-B...	½	3.66	Sp..	Sp..	32x4	32x4	Art...	½E...	CAS..	S-W..	Ext...	.....	.....	B.....	R.....	R...	R...	Earl 40
B&B..	Pla...	Mun..	UnWE..	3	Met...	Sal...	S-B...	¾	4.75	Sp..	Sp..	33x4	33x4	.....	½E...	Fos...	S-W..	Ext...	Int...	R-W..	B.....	B.....	R...	R...	Elcar K-4
War..	D-M..	War..	UnWE..	3	Met...	Sal...	S-B...	¾	4.50	Sp..	Sp..	32x4	32x4	.....	½E...	Gem..	S-W..	Ext...	Int...	R-W..	R.....	B.....	R...	R...	Elcar 7-R
.....	Pla...	.....	UnWE..	3	Met...	Col...	S-B...	¾	....	TA.	Sp..	33x4	33x4	.....	Ca....	CAS..	Van...	Ext...	Int...	R-W..	B.....	B.....	R...	R...	Elgin K-1
Own..	DM...	Own..	UnWE..	3	Met...	Tim...	S-B...	½	4.66	Sp..	Sp..	32x4	32x4	Art...	½E...	Gem..	S-W..	Ext...	Int...	R-W..	R.....	R.....	R...	R...	Essex
B&B..	Pla...	G-L...	UnWE..	3	Met...	Fli....	S-B...	½	4.88	Sp..	Sp..	32x4	32x4	.....	½E...	CAS..	S-W..	Ext...	Int...	.....	.....	.....	.....	.....	Falcon Light Four
B&B..	Pla...	G-L...	UnWE..	3	Met...	Fli....	S-B...	½	4.88	Sp..	Sp..	32x4	32x4	.....	½E...	CAS..	S-W..	Ext...	Int...	.....	.....	.....	.....	.....	Falcon Six
Own..	D-M..	Own..	SepUn..	3	.....	Own..	S-B...	¾	....	Sp..	Sp..	27x3½	27x3½	Wir...	½E...	Own..	S-W..	Int...	Int...	.....	.....	.....	.....	.....	Falcon 12-D-22
.....	.....	.....	UnWE..	.....	Met...	Col...	S-B...	¾	....	TA.	Sp..	32x4½	32x4½	Dis...	½E...	Gem..	S-W..	Ext...	Int...	R-W..	.....	.....	.....	.....	Ferris 60
.....	.....	.....	UnWE..	.....	Met...	Col...	S-B...	¾	....	TA.	Sp..	32x4½	32x4½	St....	½E...	Gem..	S-W..	Ext...	Int...	R-W..	.....	.....	.....	.....	Ferris 70
Own..	D-M..	Own..	UnWE..	2	Met...	Own..	StB...	½	3.63	TT.	....	30x3½	30x3½	Art...	T½..	Own..	.....	.....	.....	D&R..	.....	R.....	R...	R...	Ford T
B&B..	Pla...	.....	.....	3	.....	Own..	.....	.....	.....	.....	.....	32x4½	32x4½	.....	½E...	Ross..	.....	.....	Int...	R-W..	.....	.....	.....	.....	Fox
B&B..	Pla...	Own..	SepUn..	3	Met...	Own..	S-B...	½	4.33	Sp..	Sp..	32x4	32x4	Art...	El....	Own..	S-W..	Ext...	Ext...	D&R..	B.....	B.....	B...	B...	Franklin 9-B
.....	Pla...	.....	.....	.....	.....	Own..	.....	¾	....	....	....	32x4	32x4	.....	½E...	.....	.....	.....	.....	.....	.....	.....	.....	.....	Frontenac
B&B..	Pla...	Mec..	UnWE..	3	Met...	Fli....	S-B...	¾	4.44	Sp..	Sp..	32x3½	32x3½	Art...	½E...	Dit...	S-W..	Ext...	Int...	R-W..	B.....	R.....	R...	R...	Gardner R.T.S.
B&B..	Pla...	Dur...	UnWE..	.....	Met...	Col...	S-B...	¾	4.60	Sp..	Sp..	32x4	32x4	Art...	½E...	Jac...	Van...	Ext...	Int...	R-W..	B.....	B.....	R...	R...	Grant
G-L...	Pla...	G-L...	UnWE..	3	Fab...	Col...	S-B...	....	4.00	TT.	Sp..	32x4½	32x4½	Wir...	FC...	Jon...	Wal...	Ext...	Int...	R-W..	....	.....	.....	.....	Goodspeed
War..	D-M..	.....	UnWE..	3	Met...	Own..	S-B...	¾	....	TT.	TT.	32x4½	32x4½	Wir...	½E...	.....	S-W..	Int...	Ext...	R-W..	.....	.....	.....	.....	H. C. S. Series 3
War..	D-M..	War..	UnWE..	3	Met...	Tim...	S-B...	½	4.90	Sp..	Sp..	32x4½	32x4½	.....	½E...	Gem..	Van...	Ext...	Int...	.....	.....	.....	.....	.....	Handley-Knight B
B&B..	Pla...	Dt....	UnWE..	.....	.....	Tim...	S-B...	¾	4.66	Sp..	Sp..	32x4	32x4	.....	½E...	Gem..	S-W..	Ext...	Int...	.....	.....	.....	.....	.....	Hanson 60
B&B..	Pla...	G-L...	UnWE..	3	Met...	Col...	S-B...	¾	4.63	Sp..	Sp..	32x4	32x4	Art...	½E...	Gem..	S-W..	Ext...	Int...	R-W..	.....	.....	.....	.....	Hatfield A-42
B&B..	Pla...	Own..	UnWE..	3	Met...	Own..	S-B...	¾	4.60	TA.	Sp..	34x4½	34x4½	Art...	½E...	Jac..	S-W..	Ext...	Int...	R-W..	B.....	B.....	R...	R...	Haynes 75
B&B..	Pla...	Own..	UnWE..	3	Met...	Own..	S-B...	¾	4.11	Sp..	Sp..	33x4	33x4	Art...	½E...	Jac..	S-W..	Int...	Int...	R-W..	B.....	B.....	R...	R...	Haynes 55
B-L...	D-M..	B-L...	UnWE..	3	Met...	Tim...	S-B...	½	....	Sp..	Sp..	34x4½	34x4½	Art...	El....	Gem..	S-W..	Ext...	Int...	D&R..	B&R..	R.....	R...	R...	Holmes Series 4
Own..	D-M..	Own..	UnWE..	3	Met...	Tim...	S-B...	½	4.81	Sp..	Sp..	34x4½	34x4½	Art...	½E...	Gem..	S-W..	Ext...	Int...	R-W..	R.....	R.....	R...	R...	Hudson Super-Six
Own..	D-M..	Own..	UnWE..	3	Met...	Own..	S-B...	¾	4.87	Sp..	Sp..	32x4	32x4	Art...	½E...	Jac...	S-W..	Ext...	Int...	R-W..	.....	R.....	R...	R...	Hupmobile R

Spa—Spacke.
Tim—Timken.
U. S.—U. S. Axle Co.
W-M—Weston-Mott.

Clutch Make:
Ans—Ansted.
B & B—Borg & Beck.
B-L—Brown-Lipe.
Det—Detlaff.
Dt—Detroit.
Doo—Dooley.
Ful—Fuller.
G-L—Grant-Lees.
Hoo—Hoosier.
Mun—Muncie.
M & E—Merchant & Evans.
Nor—Northway.
War—Warner.

Gearset Make:
B-L—Brown-Lipe.
Cov—Covert.
Dun—Dundore.
Dur—Durston.
Dt—Detroit.
Ful—Fuller.
G-L—Grant-Lees.
Hoo—Hoosier.
Mec—Mechanics.
Mun—Muncie.
Nor—Northway.
War—Warner.

Final Drive:
Bev—Bevel.
S-B—Spiral Bevel.
StB—Straight Bevel.

Propulsion Taken:
R R—Radius Rods.
Sp—Springs.
TT—Torque Tube.

Gearset Location:
Amid—Amidships.
Sep-Un—Separate Unit.
Un-W-E—Unit with Engine.
Un-TT—Unit with Torque Tube.

Universal Joints:
Fab—Fabric.
Lea—Leather.
Met—Metal.

Rear Axle Type:
F—Floating.
¾—¾ Floating.
½—Semi-Floating.

Torque Taken:
Sp—Springs.
TA—Torque Arm.
TT—Torque Tube.

RUNNING GEAR

Wheels:
Art—Artillery.
Dis—Disk.
St—Steel.
Wir—Wire.

Speedometer Make:
J-M—Johns-Manville.
S-W—Stewart-Warner.
Van—Van Sicklen.
Wal—Waltham.

Rear Springs:
Ca—Cantilever.
El—Elliptic.
½ E—Semi-Elliptic.
¾ E—Three-quarter Elliptic.
FuC—Full Cantilever.
FC—Floating Cantilever.
Pl—Platform.
T ½—Transverse Semi-Elliptic.

Steering Gear Make.
Day—Dayton.
Dit—Ditweiler.
Fos—Foster.
Gem—Gemmer.
Jac—Jacox.
Jon—Jones.
Lav—Lavine.
War—Warner.
Woh—Wohlrab.

BRAKES

Type:
Ext—External.
Int—Internal.

Location:
D & R—Service on Drive Shaft, Emergency on Rear Wheels.
FRD—Service on Front and Rear Wheels, Emergency on Driveshaft.
R & D—Service on Rear Wheel, Emergency on Driveshaft.
R-W—Both Sets on Rear Wheel.

BEARINGS

B—Ball.
B & R—Ball and Roller.
R—Roller.

Passenger Car Chassis

Make and Model	Wheelbase	ENGINE: Make	Number Cylinders, Bore and Stroke	Piston Displacement Cu. In.	Point Suspension	Cylinder Type	Cylinder Head	Cylinders Cast	Piston Material	Camshaft Drive	Cooling	Cooling Control	LUBRICATION: System	LUBRICATION: Type of Pump	FUEL SYSTEM: Carbureter Make	FUEL SYSTEM: Fuel Feed	IGNITION SYSTEM: Type	IGNITION SYSTEM: Make	IGNITION SYSTEM: Control	IGNITION SYSTEM: Generator Make	IGNITION SYSTEM: Voltage
Jackson 6-38	121	Con	6-3¼x4½	224.0		L					Pump		Hol-Crk	Gear	Stromb	Vac	S-pt	Remy	Hand	Aut-L	6
Jordan MK	120	Own	6-3 5/16x4¾	245.6	3	L	Det.	6	CI	Chain	Pump	None	Hol-Crk	Gear	Stromb	Vac	Op-Cir	Delco	Hand	Delco	6
Jordan F	127	Con	6-3½x5¼	303.1	3	L	Int	6	CI	Non-Met-G	Pump	None	Hol-Crk	Pist	Stromb	Vac	Op-Cir	Delco	Hand	Delco	6
King K	120	Own	8-3x5	282.7	3	L	Int	4	CI	Chain	Ther	None	Hol-Crk	Gear	B&B	Vac	Cl-Cir	At-K	Auto	West	6
Kissel 45	124	Own	6-3 5/16x5½	284.4	3	L	Det.	6	CI	Non-Met-G	Pump	Ther	Cir-Spl	Gear	Stromb	Vac	Op-Cir*	Remy	Hand††	Remy	6
Kline Kar 6-55-K	121	Con	6-3¼x4½	224.0	3	L	Det.	6	CI	Met-Gear	Pump	None	Hol-Crk	Gear	Rayfld	Vac	Cl-Cir**	Conn	Hand	Wagnr	6
Kurtz Automatic A	122	H-S	6-3¼x5	248.9	3	L	Det.	6	CI	Com-Gear	Pump	None		Gear	Zenith	Vac		West	Hand	West	
Lafayette 134	132	Own	8-3¼x5¼	261.3	4	L	Det.	4	CI	Chain	Pump	T&S	Hol-Crk	Gear	Johnsn	Pr	D-pt	Delco	Hand††	Delco	6
Leach 999	134	Own	6-3¾x5¼	347.9	3	H	Det.	6	CI		Pump	None	Hol-Crk	Gear	Rayfld	Vac	Op-Cir*	Delco	Hand	Delco	
Lexington T-22	128	Ans	6-3¼x4½	224.0	3	H	Det.	6	CI	Non-Met-G	Pump	Ther	Hol-Crk	Gear	Rayfld	Vac	Op-Cir	Conn	Hand	G&D	6
Lexington ST-22	122	Ans	6-3¼x4½	224.0	3	H	Det.	6	CI	Non-Met-G	Pump	Ther	Hol-Crk	Gear	Rayfld	Vac	Op-Cir	Conn	Hand	G&D	6
Liberty 10-D	117	Own	6-3½x5	230.1	3	L	Det.	6	CI	Met-Gear	Ther		Hol-Crk	Gear	Stromb	Vac	Op-Cir	Wagnr	Hand	Wagnr	6
Lincoln	136	Own	8-3⅜x5	357.8	3	L	Det.	4	CI	Chain	Pump	T&S	Hol-Crk	Gear	Stromb	Vac	Cl-Cir	Delco	Hand††	Delco	6
Locomobile 48	142	Own	6-4½x5½	524.8	4	L	Int	2	CI	Non-Met-G	Pump	None		Gear	B&B	Pr	D-pt	Berlg	Hand	West	6
Maibohm B	116	Falls	6-3⅛x4¼	195.6	3	H	Det.	6	CI	Met-Gear	Ther	None	Cir-Spl	Pist	Tillot	Vac	Op-Cir*	At-K	Hand	Bijur	6
Marmon 34	136	Own	6-3¾x5⅛	339.7	4	H	Det.	3	CI	Non-Met-G	Pump	None	Hol-Crk	Gear	Stromb	Gra		Delco	Hand††	Delco	6
Maxwell	109	Own	4-3⅝x4½	185.8			Det.	4	Al		Ther	None	Cir-Spl		Eagle	Gra					6
McFarlan TV	140	Own	6-4½x6	572.5	4	T	Det.	3	CI	Met-Gear	Pump	None	Hol-Crk	Gear	Rayfld	Vac		West	Hand	West	6
Mercer Series 5	132	Own	4-3¾x6¾	298.2	4	L	Int	4	CI	Chain	Pump	None		Gear		Vac	S-pt	Eisem	Hand	West	6
Merit BC	119	Con	6-3¼x4½	224.0	3	L	Det.	6	CI	Met-Gear	Pump	None		Gear	Stromb	Vac	Cl-Cir	Delco	Hand	Delco	
Meteor 22-80	129	Due	4-4½x6	340.4	3	H	Int	4	Al	Chain	Pump	None	Hol-Crk	Gear	Zenith	Vac	S-pt		Hand	West	
Mitchell F-50	120	Own	6-3½x5	288.6	3	L	Det.	6	CI	Met-Gear	Pump	Ther	Cir-Spl	Pist	Stromb	Vac	S-pt	Remy	Hand	Remy	6
Mitchell F-50	127	Own	6-3½x5	288.6	3	L	Det.	6	CI	Met-Gear	Pump	Ther	Cir-Spl	Pist	Stromb	Vac	S-pt	Remy	Hand	Remy	6
Monroe S-9-10-11-12	115	Own	4-3¼x4½	149.3	3	H	Det.	4	Al	Met-Gear	Ther	None	Hol-Crk	Gear	Zenith	Vac	S-pt	Conn	Hand	Aut-L	6
Moon 6-48	122	Con	6-3¼x4½	224.0	3	L	Det.	6	CI	Met-Gear	Pump	None	Hol-Crk	Gear	Rayfld	Vac	Op-Cir*	Delco	Auto	Delco	6
Moon 6-75	135	Con	6-3⅝x5¼	325.1	3	L	Det.	6	CI	Chain	Pump	None	Hol-Crk	Gear	Rayfld	Vac	Op-Cir*	Delco	Auto	Delco	6
Murray-Mac 70-T	131	Bea	6-3½x5¼	303.1	3	H	Det.	6	CI	Non-Met-G	Pump	Ther		Gear	Stromb	Vac		Dixie	Hand	Bijur	6
Nash 681-7	121	Own	6-3¼x5	248.9		H					Pump		Cir-Spl	Gear	Marvel	Vac		Wagnr	Hand††	Wagnr	6
Nash 682	127	Own	6-3¼x5	248.9		H					Pump		Cir-Spl	Gear	Marvel	Vac		Wagnr	Hand††	Wagnr	6
Nash 41-4	112	Own	4-3⅜x5	178.9		H		4			Pump		Cir-Spl	Gear	Schebl	Vac		Delco	Hand	Delco	6
National Series BB	130	Own	6-3½x5¼	303.1	3	H	Det.	6	CI	Chain	Pump	None	Hol-Crk	Gear	Rayfld	Vac	Cl-Cir	Delco	Auto	West	6
Noma 3-C	128	Con	6-3¼x4½	224.0	3	L	Det.	6	CI	Met-Gear	Pump	None	Hol-Crk	Pist	Claudl	Vac	Op-Cir*	Delco	Hand	Delco	6
Noma 1-D	128	Bea	6-3¾x5½	364.5	3	H	Det.	6	CI	Chain	Pump	None	Hol-Crk	Pist	Zenith	Vac	Op-Cir		Hand		6
Norwalk 4-30 KS	116	Lyc	4-3½x5	192.4	3	H	Det.	4	CI	Met-Gear	Ther	None	Cir-Spl	Pist	Zenith	Vac	Op-Cir	Delco	Hand	Dynet	6
Oakland 6-44	115	Own	6-2 13/16x4¾	177.0	3	H	Det.	6	Al	Chain	Pump	None	Hol-Crk	Gear	Marvel	Vac	Op-Cir	Remy	Hand††	Remy	6
Ogren Six	134	Con	6-3⅝x5¼	325.1	3	L	Det.	6	CI	Chain	Pump	None	Cir-Spl	Gear	Rayfld	Vac	Op-Cir	Bosch	Hand	Bosch	6
Oldsmobile 43-A	115	Own	4-3 11/16x5¼	224.3	4	H	Det.	4	Al	Met-Gear	Pump	None	Cir-Spl	Gear	Zenith	Vac	S-pt	Remy	Hand	Aut-L	6
Oldsmobile 46	122	Own	8-2⅞x4¾	246.7	3	L	Det.	4	CI	Com-Gear	Pump	None	Hol-Crk	Gear	B&B	Vac	D-pt	Delco	Auto	Delco	6
Oldsmobile 47	115	Own	8-2⅞x4½	233.7	3	L	Det.	4	CI	Non-Met-G	Pump	None	Hol-Crk	Gear	Johnsn	Vac	D-pt	Delco	Auto	Delco	6
Overland 4	100	Own	4-3⅜x4	143.1		L					Ther		Cir-Spl		Tillot	Gra	S-pt	Conn	Hand	Aut-L	
Packard Single-Six	116	Own	6-3⅜x4½	241.6	3	L	Det.	6	CI	Chain	Pump	Ther	Hol-Crk	Gear	Own	Vac	D-pt	Delco	Hand††	At-K	6
Packard Twin-Six	136	Own	12-3x5	424.1	4	L	Det.	6	CI	Chain	Pump	Ther	Hol-Crk	Gear	Own	Pr	D-pt	Delco	Hand††	Bijur	6
Paige 6-44	119	Own	6-3¼x5	248.9	3	L	Det.	6	CI	Non-Met-G	Pump	None	Cir-Spl	Pist	Stromb	Vac	Cl-Cir*	At-K	Hand	Remy	6
Paige 6-66	131	Con	6-3¾x5	331.4	3	L	Det.	6	CI	Met-Gear	Pump	Ther	Hol-Crk	Gear	Rayfld	Vac	Cl-Cir*	At-K	Hand	Remy	6
Pan American 6-55	121	H-S	6-3¼x5	248.9	3	L	Det.	6	CI	Met-Gear	Pump	None	Cir-Spl	Gear	Rayfld	Vac	Op-Cir	West	Hand	West	
Paterson 22-6-52	120	Con	6-3¾x4½	298.2	3	L	Det.	6	CI	Met-Gear	Pump	None	Hol-Crk	Gear	Stromb	Vac	Cl-Cir	Delco	Hand	Delco	6
Peerless 56 Series 7	125	Own	8-3¼x5	331.8	3	L	Int	4	CI	Non-Met-G	Pump	None	Hol-Crk	Gear	B&B	Vac	Cl-Cir	At-K	Hand	Aut-L	6
Piedmont 4-30	116	Lyc	4-3½x5	192.4	3	L	Det.	4	CI	Met-Gear	Ther	None	Cir-Spl	Pist	Carter	Vac	Op-Cir*	Delco	Hand	Dynet	6
Piedmont 6-40	122	Con	6-3¼x4½	224.0	3	L	Det.	6	CI	Com-Gear	Pump	None	Cir-Spl		Stromb	Vac	Op-Cir*	Remy	Hand	Remy	6
Pierce-Arrow 33	138	Own	6-4x5½	414.7	4	D	Det.	6	Al	Met-Gear	Pump	Ther	Hol-Crk	Gear	Own	Pr		Delco	Hand	Delco	6
Pilot 6-50	126	H-S	6-3¼x5	248.9	3	L	Det.	6	CI	Met-Gear	Pump	None	Cir-Spl	Gear	Tillot	Vac	Cl-Cir	Conn	Hand	Bijur	6
Porter 46	142	Own	4-4 3/16x6¾	478.4		H		4			Pump			Gear	Zenith	Pr		Berlg	Hand	West	12
Premier 6-D	126¾	Own	6-3⅜x5½	295.3	4	H	Det.	6	Al	Com-Gear	Pump	Ther	Hol-Crk	Gear	Johnsn	Vac		Delco	Hand	Delco	6
Premocar 6-40	117	Falls	6-3⅛x4¼	195.6	3	H	Det.	6	CI	Met-Gear	Ther	None	Cir-Spl	Gear	Stromb	Vac	Op-Cir	Wagnr	Hand	Wagnr	
Ranger A-22-4	116	Own	4-3⅜x5	178.9		L	Det.	4			Pump				Zenith	Vac		West		Bijur	
Ranger A-22-6	123	Own	6-3⅝x5¼	325.1		H	Det.	6		Chain	Pump				Stromb	Vac		Philb		Bijur	
R. & V. Knight R	116	Own	4-3¾x5	220.9	3	S	Det.	4	CI	Chain	Ther	None	Hol-Crk	Gear	Stromb	Vac	S-pt	Wagnr	Hand	Wagnr	6
R. & V. Knight J	127	Own	6-3½x4½	259.8	3	S	Det.	6	CI	Chain	Ther	None	Hol-Crk	Gear	Stromb	Vac	S-pt	Wagnr	Hand	Wagnr	6
Reo T-6-B	120	Own	6-3 3/16x5	239.4	4	L†	Det.	6	Al	Met-Gear	Pump	None	Cir-Spl	Pist	Rayfld	Vac	Op-Cir*		Hand	N.E	6
ReVere	131	Due	4-4¼x6	283.7	3	H	Det.	4	Al	Chain	Pump	None		Gear	Stromb	Vac		Bosch	Hand	West	6
Rickenbacker A	117	Own	6-3⅛x4¾	218.6	3	L	Det.	6	CI	Chain	Pump	None	Hol-Crk	Gear	Stromb	Vac	Cl-Cir	Aut-L	Auto	Simms	6
Roamer 4-75-E	128	R-D	4-4¼x6	340.4		Ho	Int	3	Al	Chain	Pump	None		Pist		Vac	Cl-Cir	Split	Hand	West	6
Roamer 6-54-E	128	Con	6-3½x5¼	303.1		L	Int	6	CI	Met-Gear	Pump	None		Pist	Stromb	Vac	Cl-Cir	Bosch	Hand	Bijur	6
Rock Falls 14	132	Con	6-3¾x5	331.4	3	L	Det.	6	CI	Met-Gear	Pump	None	Hol-Crk	Gear	Rayfld	Vac		Bosch	Hand	West	6
Rolls-Royce	143½	Own	6-4½x4¾	453.3		L	Int	3	Al	Met-Gear	Pump		Hol-Crk	Gear	Own	Pr	Cl-Cir**	Own	Hand	Bijur	12
Romer A-22	120	Con	6-3¼x4½	298.2	3	L	Det.	6	CI	Met-Gear	Pump	None	Cir-Spl	Gear	Zenith	Vac		Conn	Hand	West	6
Saxon 125-G	112	Gray	4-3½x5	192.3	3	H	Det.	4	CI	Chain	Ther	None		Gear	Stromb	Vac	Cl-Cir*	Wagnr	Hand	Wagnr	6
Sayers Six	119	Con	6-3¼x4½	224.0	3	L	Det.	6	CI	Met-Gear	Pump	None	Hol-Crk	Gear	Stromb	Vac	Op-Cir	Delco	Hand	Delco	6
Seneca 50	112	Lyc	4-3½x5	192.4	3	L	Det.	4	CI	Met-Gear	Ther	None	Cir-Spl	Pist	Zenith	Vac	Op-Cir*	Aut-L	Hand	Aut-L	6
Standard Eight 11	127	Own	8-3¼x5	441.9	3	L	Int	4	CI	Non-Met-G	Pump	None	Hol-Crk	Gear	Zenith	Vac	S-pt	Split	Hand	West	6
Stanwood A-22	118	Con	6-3¼x4½	224.0	3	L	Det.	6	CI	Met-Gear	Pump	None	Cir-Spl	Gear	Stromb	Vac	Cl-Cir	At-K	Hand	West	6
Stearns-Knight SKL4	125	Own	4-3¾x5⅝	248.5	4	S	Det.	4	CI	Chain	Pump	None	Hol-Crk	Gear	Rayfld	Vac	Cl-Cir	At-K	Hand	West	12
Stephens 90	122	Own	6-3¼x4½	224.0	3	H	Det.	6	CI	Non-Met-G	Ther	None	Hol-Crk	Gear	Tillot	Vac	Op-Cir	Conn	Hand	Aut-L	6
Stevens-Duryea E	138	Own	6-4 7/16x5½	510.4	3	L	Int	2	CI	Non-Met-G	Pump	Ther	Cir-Spl	Gear	Stromb	Vac	Cl-Cir	Berlg	Hand	West	6
Studebaker Light Six	112	Own	6-3⅛x4½	207.1	3	L	Det.	6	CI	Chain	Pump	None	Cir-Spl	Gear	Stromb	Vac			Auto		
Studebaker Special Six	119	Own	6-3½x5	288.6	3	L	Det.	6	CI	Met-Gear	Pump	None	Cir-Spl	Gear	Stromb	Vac			Hand		
Studebaker Big Six	126	Own	6-3⅞x5	353.8	3	L	Det.	6	CI	Met-Gear	Pump	None	Cir-Spl	Gear	B&B	Vac			Hand		
Stutz K	130	Own	4-4⅜x6	360.8	4		Int	4	CI	Met-Gear	Pump	None	Cir-Spl	Pist	Stromb	Pr	S-pt	Delco	Hand	Remy	6
Templar 445	118	Own	4-3⅜x5½	196.8	4	H	Det.	4	CI	Chain	Pump	None	Hol-Crk	Gear	Stromb	Vac		Simms	Hand	Bijur	6
Tulsa E-1-2-3	117	H-S	4-3½x5	192.4	3	L	Det.	4	CI	Met-Gear	Ther	None	Cir-Spl	Gear	Zenith	Vac	D-pt	Conn	Hand	Dynet	6
Velie 58	115	Own	6-3⅛x4¼	195.6	3	H	Det.	6	CI	Non-Met-G	Ther	None	Hol-Crk	Gear	Stromb	Vac	Cl-Cir	At-K	Hand	Bijur	
Velie 48	115	Con	6-3¼x4½	224.0		L					Pump		Cir-Spl	Gear	Stromb	Vac		At-K	Hand††	Biur	6
Velie 34	112	Falls	6-3⅛x4¼	195.6		H					Ther		Cir-Spl	Gear	Stromb	Vac		At-K	Hand††	West	6
Vogue 6-55	124	H-S	6-3¼x5	248.9	3	L	Det.	6	CI	Met-Gear	Pump	None		Gear	Schebl	Vac	Cl-Cir**	Conn	Hand	Aut-L	
Vogue 6-66	124	Con	6-3½x5¼	303.1	3	L	Int	6	CI	Met-Gear	Pump	None	Cir-Spl	Ecen	Schebl	Vac	Cl-Cir**	Conn	Hand	Aut-L	
Westcott A-44	120	Con	6-3¼x4½	224.0	3	L	Det.	6	CI	Non-Met-G	Pump	None	Hol-Crk	Gear		Vac	Op-Cir*	Delco	Hand††	Delco	6
Westcott C-48	125	Con	6-3½x5¼	303.1		L					Pump		Cir-Spl	Gear	Rayfld	Vac	S-pt	Delco	Hand††	Delco	6
Wills-Sainte Claire A-68	121	Own	8-3¼x4	205.4	4	H	Int	4	CI	Met-Gear	Ther	None	Hol-Crk	Gear	Zenith	Vac	Op-Cir**	Delco	Hand††	Delco	6
Willys-Knight 20	118	Own	4-3⅝x4½	185.8	4	S	Det.	4	Al	Chain	Ther	None	Cir-Spl	Gear	Tillot	Vac	S-pt	Conn	Hand	Aut-L	6
Winther Six 61	120	H-S	6-3¼x5	248.9	3	L	Det.	6	CI	Met-Gear	Pump	None	Cir-Spl	Gear	Stromb	Vac	Op-Cir	West	Hand	West	6
Winton Six 25	132	Own	6-3¾x5¼	347.9				2			Pump	None			Stromb	Vac		Bosch	Hand	Bijur	6

For abbreviations, see pages 332 and 333.

Specifications—Continued

TRANSMISSION												TIRES					BRAKES			BEARINGS				Make and Model
CLUTCH		GEARSET				REAR AXLE											TYPE							
Make	Type	Make	Location	Number Forward Speeds	Universal Joints Type	Rear Axle Make	Final Drive	Rear Axle Type	Direct Gear Ratio	Torque Taken By	Propulsion Taken By	Front	Rear	Wheels, Type	Type Rear Springs	Steering Gear Make	Speedometer Make	Service	Emergency	Location	Gearset	Rear Wheels	Front Wheels, Outer	Front Wheels, Inner	
B&B	Pla	Cov	UnWE	3		Sal	S-B	¾	4.75	Sp		32x4½	32x4½	St	½E	Own					B	R	R	R	Jackson 6-38
Dt	Pla	Dt	UnWE	3	Met	Tim	S-B	½	4.42	Sp	Sp	32x4	32x4		½E	Gem	S-W	Ext	Int	R-W	B	R	R	R	Jordan MX
Dt	Pla	Dt	UnWE	3	Met	Tim	StB	½	4.80	Sp	Sp	32x4½	32x4½		½E	Gem	S-W	Ext	Int	R-W	B	R	R	R	Jordan F
Dt	Pla	Own	UnWE	3	Fab	Col	S-B	F		TA	Sp	32x4½	32x4½		FC	Jac	Van	Ext	Int		R	R	R	R	King K
War	D-M	War	UnWE	3	Met		S-B	F		Sp	Sp	32x4½	32x4½	Wir	½E	Jac	S-W	Ext	Ext	R-W					Kissel 45
B&B	Pla	G-L	UnWE	3	Fab	S-P	S-B	½	4.75	Sp	Sp	33x4	33x4	Art	¾E	Woh	S-W	Ext	Int	R-W	B	R	R	R	Kline Kar 6-55-K
B&B	Pla	G-L	UnWE	3	Fab	Sal	S-B	¾	4.50	Sp	Sp	32x4	32x4	Art	½E	Gem	S-W	Ext	Int	R-W					Kurtz Automatic A
Own	D-M	Own	UnWE	3	Met	Own	S-B	F		TT	TT	33x5	33x5	Art	½E	Own	Wal	Ext	Int		R	R	R	R	Lafayette 134
		Own	UnWE	3		Tim	S-B			TA	TT	32x4½	32x4½	Dis	½E	Gem		Int	Ext	R-W					Leach 999
Ans	D-M	War	UnWE	3	Fab	Own	S-B	¾	5.10	Sp	Sp	32x4½	32x4½	Art	½E	CAS	S-W	Ext	Ext						Lexington T-22
Ans	D-M	War	UnWE	3	Fab	Own	S-B	¾	5.10	Sp	Sp	32x4	32x4	Art	½E	CAS		Ext	Ext						Lexington ST-22
B&B	Pla	Dt	SepUn		Met	Tim	S-B	½	4.66	Sp	Sp	31x4	31x4	Art	El	Gem		Ext	Ext						Liberty 10-D
Own	D-M	Own	UnWE	3	Met	Tim	S-B	F		TT	TT	33x5	33x5	Art	½E	Own		Ext	Int	R-W					Lincoln
Own	D-M	Own	SepUn	4	Met	Own	S-B	F		TA	RR	35x5	35x5	Art	¾E	Own	S-W	Ext	Int	R-W	B	R	R	R	Locomobile 48
B&B	Pla	Mun	UnWE	3	Fab	Col	S-B	¾	5.00	Sp	Sp	32x4	32x4		½E	Dit	S-W	Ext	Int		B		R	R	Maibohm B
Own	D-M	Own	UnTT	3	Met	Own	S-B	¾		TT	TT	32x4½	32x4½	Wir	T½	Own	Van	Ext	Int		R	B	R	R	Marmon 34
Own	Cone	Own	UnWE	3		Own		¾	4.56	Sp	RR	31x4	31x4		½E	Own	S-W	Ext	Int	R-W					Maxwell
B&B	Pla	B-L	SepUn	3	Met	Tim	S-B	F	3.50	TA	Sp	33x5	33x5		½E		S-W	Ext	Int	R-W					McFarlan TV
Own	D-M	Own	SepUn	4	Met	Own	S-B	F	3.87	Sp	Sp	32x4½	32x4½		½E	Gem	S-W	Int	Int	D&R			R	R	Mercer Series 5
B&B	Pla	Mun	UnWE	3	Fab	Col	S-B	F	4.60	Sp	Sp	32x4	32x4		½E	Gem	S-W	Ext	Int	R-W			R	R	Merit BC
B&B	Pla	Dun	SepUn	4	Met	St-P	S-B	¾		Sp	Sp	32x4½	32x4½	Wir	½E	Gem	S-W	Int	Int	R&D	B&R	R	R	R	Meteor 22-80
B&B	Pla	Own	UnTT	3	Met	Own	S-B	F	4.42	TT	Sp	33x4	33x4	Art	FC	Own	S-W	Ext	Int	R-W	B&R	R	R	R	Mitchell F-50
B&B	Pla	Own	UnTT	3	Met	Own	S-B	F	4.42	TT	Sp	33x4	33x4	Art	FC	Own	S-W	Ext	Int	R-W	B&R	R	R	R	Mitchell F-50
Own	D-M	Mec	UnWE	3	Met	Own	S-B	¾	5.30	TA		32x3½	32x3½	Art		CAS	S-W	Ext	Int	R-W		R	R	R	Monroe S-8-10-11-12
B&B	Pla	B-L	UnWE		Met	Tim	S-B	½	4.66	Sp	Sp	32x4	32x4	Art	½E	Gem	S-W	Ext	Int	R-W					Moon 6-48
B&B	Pla	B-L			Met	Tim	S-B	½	4.45	TA	Sp	32x4½	32x4½	Art	½E	Gem	S-W	Ext	Int	R-W					Moon 6-75
B-L	D-M	B-L	UnWE	4	Met	Tim	S-B	F	4.80			33x5	33x5	Art	¾E	Gem	S-W	Ext	Ext	R-W					Murray-Mac 70-T
B&B	Pla	Own	UnWE	3			S-B	½	4.50	Sp		33x4	33x4	Art	½E	Gem	S-W				R	R	R	R	Nash 681-7
B&B	Pla	Own	UnWE	3			S-B	½	4.50	Sp		34x4½	34x4½	Art	½E	Gem	S-W				R	R	R	R	Nash 682
B&B	Pla	Own	UnWE	3		Own	S-B	½	4.50	Sp		33x4	33x4	Art	½E	Gem	S-W				R	R	R	R	Nash 41-4
B&B	Pla	B-L	UnWE	3	Met	Col	S-B	F	4.08	TA	Sp	32x4½	32x4½	Art	½E	War	S-W	Ext	Int	R-W	B&R	R	R	R	National Series BB
B&B	Pla	Dt	UnWE	3	Met	Tim	S-B	½	4.45	Sp	Sp	32x4½	32x4½	Wir	½E	Lav	S-W	Ext	Int						Noma 3-C
B&B	Pla	Dt	UnWE	3	Fab	Tim	S-B	½		Sp	Sp	32x4½	32x4½	Wir	½E	Lav	S-W	Ext	Int						Noma 1-D
B&B	Pla	G-L	UnWE	3	Met	Col	S-B	¾	5.00	Sp	Sp	32x3½	32x3½		½E	Dit	S-W	Ext	Int	R-W					Norwalk 4-30 KS
Own	Cone	Hoo	UnWE	3	Met	W-M	S-B		4.66	Sp	Sp	32x4	32x4	Art	½E	Jac	S-W	Ext	Int	R-W					
B-L	D-M	B-L	UnWE	3	Met	Col	S-B	F	4.00	Sp	Sp	33x5	33x5		½E	Gem	S-W	Ext	Int	R-W	B&R	R	R	R	Oakland 6-44
B&B	Pla	War	UnWE	3	Met	Own	S-B	¾	4.66	TT	Sp	32x4	32x4	Art	½E	Jac	S-W	Ext	Int	R-W	B&R	R	B	B	Ogren Six
Own	Cone	War	UnWE	3	Met	W-M	S-B	F	4.93	Sp	Sp	32x3½	33x4½		½E	Jac	S-W	Ext	Int	R-W	B&R	R	B	B	Oldsmobile 43-A
B&B	Pla	War	UnWE	3	Met	Own	S-B	¾	5.10	TT	Sp	32x4	32x4	Art	½E	Jac	S-W	Ext	Int	R-W	B&R	R	B	B	Oldsmobile 46
Own	Pla	Own	UnWE	3		Own	S-B	¾	4.50	Sp		30x3½	30x3½	Art	Ca	Own	S-W				B&R	B	R	R	Oldsmobile 47
Own	D-M	Own	UnWE	3	Fab	Own	S-B	½	4.30	TA		33x4½	33x4½	Art	½E	Own	S-W	Ext	Int	R-W	B&R	B	R	R	Overland 4
Own	D-M	Own	UnWE	3	Met	Own	S-B	½	4.36	TA		35x5	35x5	Art	½E	Own	Wal	Ext	Int	R-W	B	B	R	R	Packard Single-Six
B&B	Pla	Own	UnWE	3	Met	Sal	S-B	¾	4.75	Sp	Sp	32x4	32x4		½E	Jac	S-W	Ext	Int	R-W	B	B	R	R	Packard Twin-Six
B&B	Pla	Own	UnWE	3	Met	Sal	S-B	¾	4.55	Sp	Sp	32x4½	32x4½		½E	Jac	S-W	Ext	Int	R-W	R	B	R	R	Paige 6-44
B&B	Pla	Dt	UnWE	3	Met	Tim	S-B	½	4.90	Sp	Sp	33x4	33x4		½E	Jac	S-W	Ext	Int	R-W	R	B	R	R	Paige 6-66
B&B	Pla	Dur	UnWE	3	Met	StP	S-B	½	4.50	Sp	Sp	32x4½	32x4½	Art	½E	Jac	S-W			R-W	B	R	R	R	Pan American 6-55
Own	D-M	Own	UnWE	3	Met	Own	S-B	¾	4.90	Sp	Sp	33x4½	34x4½	Art	Pl	Gem	Van	Ext	Int		B	B	R	R	Paterson 22-6-52
B&B	Pla	G-L	UnWE	3	Fab	Tim	S-B	½		Sp	Sp	32x3½	32x3½	Art	½E	Dit	S-W	Ext	Int		B&R	B&R	R	R	Peerless 56 Series 7
B&B	Pla	G-L	UnWE		Fab	Spa	S-B	½	4.25	Sp	Sp	32x4	32x4	Art	½E	Lav	S-W	Ext	Ext	R&D					Piedmont 4-30
Own	D-M	Own	SepUn	3	Met	Own	S-B	½		TA	Sp	33x5	33x5	Art	½E	Own	Wal	Ext	Int	R-W	B	B	R	R	Piedmont 6-40
B&B	Pla	Mun	UnWE	3	Met	Col	S-B	¾	5.00	Sp	Sp	32x4½	32x4½		½E	Dit	S-W	Ext	Int	R-W	B	B&R	R	R	Pierce-Arrow 33
Own	Pla	Own	Amid	4		Own	S-B	F	3.25	TA		35x5	35x5	Art	El	Own	S-W				B	B	B	B	Pilot 6-50
B&B	Pla	Own	UnWE	3	Met		S-B	½		Sp	Sp	32x4½	32x4½	Art	½E	Own	S-W	Ext	Int	R-W	B				Porter 46
B&B	Pla	Mec	UnWE		Met		S-B	½		Sp	Sp	32x4	32x4		½E	Dit		Ext	Int						Premier 6-D
																									Premocar 6-40
B&B	Pla	Dt	UnWE	3		Col	S-B	¾				32x4	32x4	Art	½E	Jac	S-W								Ranger A-22-4
M&E	D-M	Dt	UnWE	3		Tim	S-B	¾				33x4½	33x4½	Wir	½E	Day	Wal								Ranger A-22-6
B&B	Pla	B-L	UnWE	3	Met	Sal	S-B	F	4.70	Sp	Sp	32x4	32x4	Art	½E	Jac	S-W	Ext	Int	R-W	B&R	B	R	R	R. & V. Knight R
B&B	Pla	B-L	UnWE	3	Met	Tim	S-B	½	4.90	Sp	Sp	32x4½	32x4½	Art	½E	Jac	S-W	Ext	Int	R-W	B&R	R	R	R	R. & V. Knight J
Own	D-M	Own	SepUn	3		Own	S-B	½	4.70	Sp	Sp	33x4	33x4	Art	½E	Own		Ext	Int		R	R	R	R	Reo T-6-B
B-L	D-M	B-L	UnWE	4	Met	StP	S-B	¾	3.40	TT	TT	32x4½	32x4½	Wir	¾E	Gem	S-W	Ext	Int	R-W	R	R	R	R	ReVere
Own	Cone	Own	UnWE	3	Met	Own	S-B	¾	4.63	Sp	Sp	32x4	32x4	Art	½E	Gem	S-W	Ext	Ext	R&D					Rickenbacker A
B-L	D-M	B-L	UnWE	4	Fab	Tim	S-B	½	3.77	TT	Sp	32x4½	32x4½	Wir	FuC	Jac	S-W	Ext	Int	R-W					Roamer 4-75-E
B&B	Pla	G-L	UnWE	3	Fab	Tim	S-B		4.80	Sp	Sp	32x4½	32x4½	Wir	FuC	Jac	S-W	Ext	Int	R-W					Roamer 6-54-E
B&B	Pla	Dt	UnWE	3	Met	Tim	S-B	F	4.90	TA	Sp	35x5	35x5	Art	¾E	Gem	S-W	Ext	Int				R	R	Rock Falls 14
Own	Cone	Own	SepUn	4	Met	Own	S-B	F	3.25	TT	TT	33x5	33x5	Wir	FC	Own	Wal	Int	Int	R-W	B	B	B	B	Rolls-Royce
Ful	D-M	Ful	UnWE	3	Met	Col	StB	F	4.67	Sp	Sp	32x4	32x4	Art	½E	Gem	S-W	Ext	Int						Romer A-22
Det	Pla	Cov	UnWE	3	Met		S-B	¾	4.75	TA		32x4	32x4			CAS	S-W	Ext	Int	R-W	B&R		R	R	Saxon 125-G
B&B	Pla	G-L	UnWE	3	Met	S-P	S-B	½	4.75	Sp	Sp	33x4	33x4	Art	½E	Lav	S-W	Ext	Int	R-W	B&R	R	R	R	Sayers Six
B&B	Pla	G-L	UnWE	3			S-B	F	4.75	Sp	Sp	31x4	31x4	Art	El	Dit	S-W	Ext	Int	R-W					Seneca 50
B&B	Pla	G-L	UnWE	3	Met	Tim	S-B	½	4.45	Sp	Sp	34x4½	34x4½	Art	½E	Own	S-W	Ext	Int	R-W		R	R	R	Standard Eight 11
B&B	Pla	G-L	UnWE	3	Met	StP	S-B	½	4.50	Sp	Sp	33x4	33x4	Art	½E	Gem	S-W	Ext	Int	R-W		R	R	R	Stanwood A-22
Own	D-M	Own	UnWE	3	Fab	Own	S-B	½	4.50	TA	Sp	34x4½	34x4½	Art	FC	Own	Van	Ext	Int		B&R	R	R	R	Stearns-Knight SKL4
B&B	Pla	Mec	UnWE	3	Met	Tim	S-B	½		Sp	Sp	33x4½	33x4½		½E	CAS	S-W	Ext	Int	R-W	B		R	R	Stephens 90
Own	D-M	Own	UnWE	3	Met	Own	S-B	F	3.94	TT	Sp	35x5	35x5	Art	¾E	Own	Wal	Ext	Int	R-W					Stevens-Duryea E
Own	D-M	Own	Amid	3	Fab	Own	S-B	½		Sp	Sp	32x4	32x4	Art	½E	Own		Int	Ext						Studebaker Light Six
Own	D-M	Own	Amid	3	Met	Own	S-B	½		Sp	Sp	32x4	32x4	Art	½E	Own		Int	Ext						Studebaker Special Six
Own	D-M	Own	Amid	3	Met	Own	S-B	½		Sp	Sp	33x4½	33x4½	Art	½E	Own		Int	Ext						Studebaker Big Six
War	D-M	Own	UnWE	3	Met	Own	S-B	½		TT	TT	32x4½	32x4½		½E	Gem	S-W	Int	Int	R-W	B	B	R	R	Stutz K
B&B	Pla	Dt	UnWE	3	Fab	U.S	S-B	½	4.40	Sp	Sp	32x4	32x4		½E	CAS	S-W	Int	Int						Templar 445
B&B	Pla	Mun	UnWE		Met	Sal	S-B	F	4.50	Sp	Sp	33x4	33x4		½E	CAS	S-W	Ext	Int						Tulsa E-1-2-3
Doo	Pla	Dur	UnWE	3	Met	Tim	S-B	½	4.66	Sp	Sp	32x4	32x4		½E	Gem	S-W	Ext	Int	R-W	B		R	R	Velie 58
B&B	Pla	Dur	UnWE	3		Tim	S-B	½	4.60	Sp		33x4½	33x4½	Art	¾E	Gem	S-W				B&R	R	R	R	Velie 48
B&B	Pla	Dur	UnWE	3		Col	S-B	¾	4.63	Sp		33x4	33x4	Art	½E	Gem	S-W				B	B&R	R	R	Velie 34
B&B	Pla	G-L	UnWE	3	Fab	Sal	S-B	¾	4.50	Sp	Sp	32x4	32x4		½E	Dit	S-W	Ext	Int						Vogue 6-55
B&B	Pla	G-L	UnWE		Fab	Sal	S-B	¾	4.50	Sp	Sp	32x4½	32x4½		½E	Dit	S-W	Ext	Int						Vogue 6-66
B&B	Pla	War	UnWE	3		Tim	S-B	½	4.66	Sp	Sp	32x4	32x4	Art	½E	Gem	S-W			R&D	B&R	R	R	R	Westcott A-44
War	D-M	War	UnWE	3		Tim	S-B	½	4.45	Sp		32x4½	32x4½	Art	½E	Gem	Van				B&R	R	R	R	Westcott C-48
Own	D-M	Own	UnWE	3	Met	Own	S-B	½		TT	Sp	32x4½	32x4½		½E	Own	Wal	Ext	Int	R-W					Wills Sainte Claire A-68
B&B	Pla	Own	UnWE	3	Fab	Own	S-B	½	5.00	Sp		33x4	33x4	Art	½E	Own	S-W	Ext	Int	R-W	B&R	R	R	R	Willys-Knight 20
War	D-M	War	UnWE	3	Met	Tim	S-B	½	4.45	Sp	Sp	32x4½	32x4½	Art	½E	Lav	S.W	Ext	Ext	R&D	B&R	R	R	R	Winther Six 61
B-L	D-M			4			S-B	F		TA		35x5	35x5	Art	½E						R	R	R	R	Winton Six 25

For abbreviations, see pages 332 and 333.

American Passenger Car Design Trends

(*Continued from page* 330)

showing the variation from year to year in certain important elements of design. It should be understood that the figures used are arrived at by computing the percentage of chassis models which, according to the statistics given in the corresponding tabulation, employ the particular type of construction in question. These figures do not bear any relation to the quantity of cars produced which employ a given type of design. For example they show that nearly 90 per cent of the models listed employ the vacuum type of fuel feed, but Ford and some other large producers who together make much more than half of the total number of cars built each year use gravity feed fuel systems. The figures given do express in a sense the "votes" of the manufacturers in favor of a given construction, each maker being given one "vote" for each chassis model produced. When information is not furnished under a given head, the calculation covering this item is made on a basis which assumes that those not reporting are divided in the same proportion as those which report. In other words the figures express the percentage of "votes" cast which favor that construction.

The data on engine design factors show but little variation from the trend followed for several years past. The average bore and stroke, and consequently the bore-stroke ratio, have varied almost none since 1918. The percentage of four-cylinder models has decreased slightly this year, while the proportion of sixes has increased slightly as it has done for several years. The percentage of eights shows a slight increase after having fallen off steadily from a peak in 1916. Only one twelve remains.

There is a small gain in the percentage of L-head engines, which are used in 64.7 per cent of all models, and a somewhat larger gain in the proportion of valve-in-head types, while the proportion using the T-head type has decreased to less than one per cent.

So-called "full pressure" lubrication, in which oil is fed under pressure to the main bearings and thence through holes drilled in the crank cheeks to the crankpin bearings, continues to meet with favor and is now used on over 47 per cent of all models, as against 38.6 per cent last year. 52.6 per cent of models still use the ordinary circulating splash system, or a combination of pressure to main bearings and splash for all other parts.

Advocates of thermo-siphon cooling appear to have lost some ground this year in the passenger car as in some other fields, while pump circulation has gained accordingly. The more positive action of the pump is favored by some while the smaller radiator and water space required partly or wholly offset the extra cost of the pump. This trend, if it can be called such, is in keeping with a similar trend in truck and tractor construction.

Turning now to units for transmission of power to the wheels of the car we find that the trend away from the cone and toward the disk type continues. 94.2 per cent of models now have either single plate or multiple-disk types, nearly all of these being of the dry variety, while the cone clutch is now used on only 5.8 per cent of chassis models. In general the larger and more expensive cars use the multiple-disk type while the lighter and less expensive cars use the single plate type but there are exceptions in both classes. The models using the single plate type number 90, the multiple-disk type 57 and the cone type only 9.

Mounting the gearset as a unit with the engine, which last year was employed by 86.1 per cent of models, is used by a slightly larger proportion this year but the gain is much less than for many years past. This type of construction possesses certain advantages from a manufacturing and some other standpoints, but it is used in some cases at the expense of accessibility, especially as regards the clutch. Whether the lower rate of increase in this type is due to an appreciation of this fact remains to be seen. There is a slight decrease in the proportion of models in which a separate amidship mounting is used and a gain in the small number which use a mounting in unit with the torque tube, but the practice of mounting the gearset as a unit with the axle, where it increased unsprung weight, which was once done on 20 per cent of models is now entirely abandoned.

Spiral bevel final drives are rapidly approaching the point of universal application, having superseded all other types except the straight bevel, still used on 2.5 per cent of models. It was interesting to note how this distinctively American contribution to motor car construction has gained in favor even in England and continental Europe where it was once considered as more or less of a "freak." Its recognition is a tribute to American manufacturing methods as well as to our inventive genius, for both have contributed to its success.

Last year there was scarcely any difference in the relative popularity of full floating, three-quarter floating and semi-floating rear axles. The three-quarter floating type, which gained rapidly for five years after its introduction in 1912 has held second place since 1916. The relative standing this year is as follows: full floating 26.8 per cent, semi-floating 39.9 per cent, ¾ floating 33.3 per cent.

Fuel feed systems of the gravity and pressure type which once held the field alone, have now been nearly displaced by the vacuum type which shows a small gain over last year and is now used on about 90 per cent of all chassis models, 3.2 per cent still use gravity fuel feed, and 7.0 per cent employ the pressure type.

The small increase in average rated horsepower and in piston displacement, both of which are a function of the square of the bore and of the number of cylinders, is due largely to the increase in number of cylinders, for the average bore is about the same as it has been for several years.

Last year 133 models and 119 makes were listed. This year there are 159 models and 123 makes listed. The increase in number of manufacturers is somewhat surprising in view of the business depression and the excess capacity for car production. The greater number of models is due largely to the fact that many new chassis have been developed during the dull months while several older models are still listed. Many of the latter will doubtless be retained until obsolete, because of the investment in tools for making them is large and they must be used so long as the market can absorb the product.

The percentage of chain driven camshafts has increased from about 19 per cent last year to nearly 28 per cent this year, this gain being in line with efforts to render cars more quiet than formerly. Better methods for taking up slack due to chain wear or stretch are now used.

About 90 per cent of the chassis in which particulars concerning brake location have been furnished have both sets of brakes on the rear wheels, one set, usually the foot brakes, being of the contracting band type in most cases, and the other set internal expanding on the same drum. The remaining 10 per cent have one set of brakes on the rear wheels, these being foot operated, as a general rule, and the other set on the drive shaft, usually adjacent to the gearset. One car is now fitted with brakes on both front and rear wheels as well as on the drive shaft. Comparative figures for last year are not at hand, but there is thought to be a trend toward the use of drive shaft brakes. The average gear ratio is 4.53 and the average wheelbase 122 in., both figures being substantially the same as last year.

Export Specifications American Passenger Cars

NAME AND MODEL	Boxing Charge	Cubic Contents—Chassis Boxed	Cubic Feet—Complete Car Boxed	Magneto: Make	Magneto: Extra Charge	Drive: Right-Hand	Drive: Extra Charge	Wheel Option: Wire	Wheel Option: Extra Charge	Wheel Option: Disc	Wheel Option: Extra Charge	Color Options	Extra Charge	Tire Sizes	Rim Type	Tire Type
American, 6	$80	...	359	Bosch	75	Yes	$30	Yes	$100	Yes	$160	3 colors	None	610x105	S.S.	Cord.
Anderson, "Coach-Bilt" 6	75	...	450	Bosch	35	Yes	...	Yes	100	Yes	150	Yes	None	33x4	S.S.	Cord
Apperson, Beverly	100	370	415	...	...	Yes	50	Yes	125	Yes	125	Yes	75	34x4½	S.S.	Cord
Auburn Beauty, 6-51	100	290	364	Bosch	55	Yes	None	Yes	100	No	None	Yes	50	33x3½	S.S.	Cord.
Beggs	85	...	375	...	50	Yes	...	Yes	150	Yes	150	3 colors	None	880x120		Fabric
Buick, 22-35	55	152	314	Bosch	Yes	Yes	18	Yes	55	No	...	Black	...	31x4	S.S.	Cord.
Buick, 22-49	70	169	314	Bosch	Yes	Yes	20	Yes	75	No	...	Blue or gray	No	880x120	C.	Fabric
Buick, 22-45	65	163	334	Bosch	Yes	Yes	20	Yes	75	No	...	Green or gray	No	34x4½	S.S.	Cord.
Cadillac, 61	125	250	418	None	...	Yes	90	Yes	Yes	Yes	Yes	Optional	Yes	33x5	S.S.	Cord
Champion Four	60	...	...	Optional	40	Yes	5	Yes	150	No	...	No	...	32x3½	S.S.	Fabric
Champion Special	60	...	...	Optional	40	Yes	5	Yes	150	No	...	No	...	32x3½	S.S.	Fabric
Chandler	75	338½	382	Bosch	None	Yes	None	Yes	Yes	...	...	Blue or green	No	33x4	S.S.	Cord.
Chevrolet, 490	10	95	192	Berling	Yes	Yes	7	Yes	75	No	...	Black or green	Yes	30x3½	S.S.	Fabric
Chevrolet, F.B.	10	148	313	Simms	Yes	Yes	7	Yes	75	No	...	Black or green	Yes	33x4	C.	Fabric
Climber Four	100	246	333	...	60	Yes	75	Yes	75	Yes	100	Any color	None	33x4	S.S.	Fabric
Climber Six	125	249	347	Bosch	None	Yes	75	Yes	75	Yes	100	Any color	None	32x4½	S.S.	Fabric
Cole 890	100	336	462	...	...	Yes	None	Yes	75	Yes	100	Any color	75	33x5	S.S.	Fabric
Columbia 6	70	225	340	Bosch	55	Yes	None	Yes	75	Yes	150	Any color	...	815x105	Opt.	Cord.
Crow-Elkhart, 63-65	.....	...	335	Eisemann	85	Yes	...	Yes	100	Yes	150	0 color	None	32x3½	S.S.	Fabric
Crow-Elkhart, L63-65	.....	...	335	Eisemann	85	Yes	...	Yes	100	Yes	150	0 color	...	33x4	S.S.	Fabric
Cunningham	Yes	...	640	None	85	No	...	Yes	None	Yes	75	Optional	None			Cord.
Davis, 61-67	100	...	390	...	...	Yes	None	Yes	125	Yes	125	3 colors	None	610x105	S.S.	Cord.
Dixie-Flyer	63.91	210	304	Eisemann	...	Opt.	...	Yes	120	Yes	165	3 colors	No	32x4	S.S.	Cord.
Dodge Brothers	34	...	...	Simms	25	Yes	25	...	...	Yes	50	No	...	32x4	S.S.	Cord.
Dorris, 6-80	125	...	...	Bosch	...	No	...	Yes	225	Yes	140	Yes	Yes	33x5	S.S.	Cord.
Dort 19-14	.....	...	...	Bosch	...	Yes	None	Yes	Yes	...	...	No	...	31x4	S.S. or C.	Fabric
Durant, 22	70	168	266	Simms	45	Yes	20	Yes	None	...	...	3 colors	None	31x4	S.S.	Fabric
Earl	50	...	350	Splitdorf	35	Yes	None	Yes	Yes	...	...	Green lake	...	32x4	S.S.	Cord.
Elgin 6-K1	75	245	324	Bosch	50	Yes	35	Yes	50	Yes	50	Yes	50	33x4	S.S.	Fabric
Essex	Yes	318	318	...	50	Yes	...	Yes	Yes	...	...	2 colors	...	815x105	S.S.	Fabric
Ford	Yes	129	262	...	None	No	...	No	...	No	...	...	...	30x3½	C.	Fabric
Franklin	85	...	389½	No	...	No	...	Yes	60	Yes	150	Yes	75	32x4	S.S.	Cord.
Gardner	60	121	308	Bosch	40	Yes	35	No	...	Yes	35	No	...	32x3½	S.S.	Cord.
Grant Six	80	290	344	Bosch	50	Yes	None	Yes	100	...	...	...	...	...		Cord.
H. C. S.	None	...	330	...	...	No	...	Yes	...	No	None	5 colors	Yes	32x4½	S.S.	Fabric
Haynes 55	100	350	447	Simms	80	Yes	25	Yes	150	Yes	250	Yes	100	33x4	S.S.	Fabric
Haynes 75	100	380	486	Simms	80	Yes	25	Yes	150	Yes	250	Yes	100	34x4½	S.S.	Cord.
Holmes 4	100	400	...	Eisemann	None	No	...	Yes	...	No	...	Blue	...	34x4½	S.S.	Cord.
Hudson Super-6	Yes	370	393	...	...	Yes	...	Yes	Yes	...	...	2 colors	...	880x120	S.S.	Fabric
Huffman	70	322	373	...	...	Yes	None	Yes	135	No	...	3 colors	None		S.S.	Fabric
Hupmobile "R"	70	...	322	Splitdorf	...	Yes	...	Yes	100	...	...	2 colors	...	32x4	S.S.	Fabric
Jackson, 6	80	...	390	Bosch	35	Yes	25	Yes	100	Yes	100	5 colors	...	33x4	S.S.	Fabric
Jordan, MX	100	295	372	Bosch	50	Yes	50	Yes	90	Yes	115	3 colors	...	32x4	S.S.	Cord.
Jordan, F	100	340	400	Bosch	50	No	...	Yes	90	Yes	115	2 colors	None	32x4½	S.S.	Cord.
Kissel	110	404	466	Bosch	50	Yes	None	Yes	125	Yes	200	Green	100	32x4½	S.S.	Cord.
Kline-Kar	90	250	350	Bosch	70	Yes	30	Yes	125	Yes	125	Yes	...	...	S.S.	Fabric
Lexington U	90	...	348	Liberty	50	Yes	None	Yes	75	Yes	75	3 colors	...	32x4½	S.S.	Cord.
Liberty 6	75	246	280	Berling	65	Yes	35	Yes	100	Yes	100	5 colors	None	32x4	S.S.	Cord.
Locomobile	125	...	485	Berling	None	No	...	Yes	275	Yes	300	18 colors	None	35x5	S.S.	Cord.
Maibohm	110	181	314	Bosch	50	Yes	25	Yes	100	No	...	4 colors	...	815x120	S.S.	Cord.
Marmom, 34	110	433	526	Simms	None	Yes	None	Yes	None	Yes	Yes	Any color	...	32x4½	S.S.	Cord.
McFarlan	135	...	575	Berling	None	Yes	None	Yes	None	Yes	None	Any color	None	35x5	S.S.	Cord.
Mercer	70	365	365	Eisemann	None	None	...	Yes	150	No	...	4 colors	None	32x4½	S.S.	Cord.
Mitchell, F5-50	65	215	374	Bosch	75	Opt.	No	Yes	80	No	...	2 colors	None	815x105	Opt.	Fabric
Mitchell, F7-50	70	264	396	Bosch	75	Opt.	No	Yes	80	No	...	2 colors	None	815x120	Opt.	Fabric
Moller	.....	140	...	Eisemann	None	Yes	None	Yes	No	No	...	...	...	27x3½	C.	Fabric
Moon 6-48	65	300	365	Bosch	35	Yes	None	Yes	75	Yes	90	2 colors	None	32x4	S.S.	Cord.
Moon 6-40	60	275	315	...	...	Opt.	None	Yes	75	No	75	Red or blue	None	31x4	Opt.	Cord.
Nash, 691-7	60	...	...	Bosch	40	Opt.	25	Yes	100	No	...	Gray or blue	...	875x105	Opt.	Cord.
Nash, 692	60	...	...	Bosch	40	Opt.	25	Yes	100	No	...	Gray or blue	...	880x120	Opt.	Cord.
National BB	100	449	539	Bosch	...	No	...	Yes	...	Yes	...	No	...	32x4½	S.S.	Cord.
Noma, 3C	.....	...	...	...	...	Opt.	...	Yes	...	No	...	Any color	50	880x120	S.S.	Cord.
Oakland, 34-D	Yes	124	298	Liberty	Yes	Yes	Yes	Yes	Yes	No	...	Green or gray	No	32x4	S.S.	Fabric
Oldsmobile, 43-A	10	205	351	...	Yes	Yes	10	Yes	65	No	...	Blue or red	No	32x4	C.	Fabric
Overland, 4	.....	108	272	Bosch	50	No	...	Yes	Yes	No	Yes	Green or blue	Yes	30x3½	C.	Cord.
Packard-Single-6	90	400	457	None	...	No	...	Yes	Yes	No	None	Any color	Yes	33x4½	S.S.	Cord.
Packard-Twin-6	100	447	558	None	...	No	None	Yes	170	Yes	140	Any color	Yes	35x5	S.S.	
Paige 6-44	75	166	358	Bosch	45	Yes	None	Yes	94	Yes	116	Any color	35	32x4	S.S.	Cord.
Paterson, 22-6-52	100	...	393	...	...	Yes	...	Yes	100	Yes	110	3 colors	No	32x4½	S.S.	Cord.
Piedmont, 4-30	60	180	288	Splitdorf	50	Yes	10	Yes	100	No	None	Any color	25	32x3½	C.	Fabric
Pierce-Artow	130	437	527	...	...	No	None	Yes	115	Yes	90	Any color	No	33x5	S.S.	Cord.
Pilot 6-65	90	...	406	None	...	Yes	None	Yes	105	Yes	...	...	...	32x4	S.S.	Fabric
Porter, 46	.....	...	...	Berling	None	Yes	None	Yes	280	No	...	Any color	None	35x5	S.S.	Cord.
Premier, 6-D	90	325	396	None	...	Yes	150	Yes	125	Yes	170	3 colors	None	32x4½	S.S.	Cord.
Reo, B-T6 & U-6	75	...	338	...	...	No	...	No	...	No	...	2 colors	None	33x4	S.S.	Cord.
ReVere	85	..	384	Bosch	None	No	...	Yes	None	No	...	Any color	None	32x4½	S.S.	Cord.
Roamer, 6-54-1	90	...	...	Bosch	None	Yes	25	Yes	None	Yes	75	Any color	None	820x120	S.S.	Opt.
Rock Falls	250	...	...	Bosch	...	No	...	...	...	Yes	150	Any color	...	35x5	S.S.	Cord.
Saxon-Duplex	75	277	276	...	45	...	25	...	...	...	...	...	...	32x4		
Sayers D.P.	90	...	350	Bosch	75	Yes	55	Yes	125	Yes	150	3 colors	30	33x4	S.S.	Fabric
Seneca, L & O	55	148	280	Simms	35	Yes	10	Yes	85	Yes	75	5 colors	...	30x3½	S.S.	Opt.
Stephens, 90	90	...	410	Bosch	60	Yes	30	Yes	150	...	...	Red or blue	...	33x4½	S.S.	Cord.
Stevens-Duryea, E	Yes	...	...	Berling	...	No	...	Yes	230	...	200	Opt	...	35x5	S.S.	Cord.
Studebaker, L6 Light Six	Yes	...	268	Bosch	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Gray or black	None	815x105	S.S.	Cord.
Studebaker, B6 Big Six	Yes	...	347	Dixie	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Green	None	880x180	S.S.	Cord.
Studebaker, S6 Special Six	Yes	...	331	Dixie	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Blue	None	815x105	S.S.	Cord.
Stutz-Seis	125	...	444	Delco	...	Opt.	...	Yes	None	No	...	Maroon, blue	...	32x4½	S.S.	Cord.
Templar A-445	80	308	336	Simms	...	Yes	None	Yes	125	No	...	Black or red	...	660x115	S.S.	Cord.
Velie, 58	65	185	376	Dixie	35	Opt.	None	Yes	50	No	80	2 colors	None	32x4	S.S.	Cord.
Vogue	100	...	360	Bosch	55	Yes	100	Yes	100	Yes	150	Green	...	32x4	S.S.	Fabric
Willys-Knight 20	51	315	331	Bosch	50	Yes	None	Yes	50	Yes	...	...	...	33x4	S.S.	Fabric
Wescott, C-38	110	...	388	Bosch	100	Yes	None	Yes	125	Yes	50	2 colors	50	33x4	S.S.	Cord.
Westcott, C-48	110	...	413	...	...	No	...	Yes	175	No	200	2 colors	50	32x4½	S.S.	Cord.
Winther-Seis	75	...	350	Bosch	...	Opt.	150	Yes	...	...	...	Any dolor	...	33x4	S.S.	Cord.
Winton 25.k	.....	425	520	Bosch	75	Yes	75	Yes	100	Yes	200	6 colors	Yes	35x5	S.S.	C od.

Abbreviations—S.S.—Straight side. **C**—Clincher.

Design Tendencies in British Chassis

Light cars increase despite lack of public demand. Overhead valves gaining. Unit engine and gearset construction makes no headway, but unit torque tube and gearset shows gain. The percentage of four-cylinder engines is much greater than in American passenger car practice.

By M. W. Bourdon

AS will be gathered from the accompanying specification tables, an outstanding feature of the products of the British passenger car industry is the large number of chassis with four-cylinder engines termed 10 to 12 hp. and having a cylinder capacity of under 100 cu. in. The popularity of this type of chassis, which first gained force in 1919, has increased remarkably during the past twelve months.

Over 50 British manufacturers are interested in light cars of one size or another, and, although originally this type was almost monopolized by quite small manufacturers, some of the largest concerns have now entered the field.

British light cars are by no means cheap as regards first cost, for with a two-seated body and 10 hp. engine the average price is in the neighborhood of £400, or approximately $1,600 at normal rate of exchange. The average price of the 12 hp. type, which signifies an engine of 90 to 100 cu. in. capacity, is £600 (or $2,400) with a small four-passenger body. The popularity of the light car is therefore not due to its catalogue price, but rather to its low cost of running and upkeep in respect of fuel, tires, insurance and taxation, though there are not a few critics among British motorists who, as users of American cars of the Overland, Dodge and similar types, maintain that the difference in running costs between the low-priced American car and its small British contemporary does not justify the drawbacks attached to the lower powered and smaller vehicle. Be that as it may, there can be no question but that the light car in its various forms and sizes has secured a firm hold, and its introduction and development have created a demand but for which the British industry would at present be in a decidedly parlous state.

The full-sized four- and five-passenger car selling at a popular price has a very meager representation among the products of British automobile plants.

Chassis Design Features

Dealing with the features of chassis design of normally constituted passenger cars of all sizes, the four-cylinder engine maintains its popularity and is represented on 77 per cent of chassis, which is practically the same as 12 months ago. The actual number of six-cylinder engines has slightly increased, though in percentage of the total this type shows a falling off of 3 per cent due to the far larger number of two and four-cylinder models now in production. Eight per cent of the total have two-cylinder engines and 13 per cent six cylinders. Block cast cylinders comprise 72 per cent of the total, but include only two six-cylinder engines—the A. C. and the 40-hp. Napier—both having unit water jackets and top half of crankcase in aluminum with steel cylinder liners.

As regards valve arrangement, L-head cylinders are by far the most popular, occurring in 69 per cent of chassis, but overhead valves have gained slightly during the year and are now represented on 24 per cent of engines. The push-rod system of operation for valves in the head now has favor over the top camshaft, the positions as compared with last year being approximately reversed with push-rods now on 56 per cent. In a few cases the push-rods pass up through a passage formed in the cylinder block, but the majority of push-rods are exposed. With both overhead camshaft and push-rod operation it is usual to provide pressure lubrication for the overhead details, but in certain new models the simpler if less efficient system is embodied, namely, that of using the hollow rocker shaft to form an oil reservoir replenished by hand.

In water-cooled engines the pump and thermo-siphon circulation systems have approximately equal favor, but in 17 per cent of pump systems the pump is driven by belt and in such cases is usually located at the front end of the cylinder water jacket, the rotor being mounted on a rearward extension of the fan shaft.

Frame Suspension

Eighty-two per cent of British passenger car engines are supported directly in the main frame and 65 per cent of these have a 4-point suspension. Where sub frames occur, the majority (68 per cent) also have a 4-point support from the main frame, and in very few cases—either when the engine is suspended directly from the main frame or from a sub frame—is there any attempt to provide flexibility for the anchorages. The engine is, therefore, in the majority of cases called upon to assist in resisting frame distortion.

While the unit construction of engine and gearset has increased slightly, this feature occurs on only 28 per cent of cars, the majority (55 per cent) having the gearset amidships. There has, moreover, been a distinct increase in the number of gearsets mounted at the front end of the torque tube and a slight increase in the number arranged as a unit with the rear axle.

Reverting to the details of engine design, aluminum pistons have gained slightly, being now represented on 37 per cent of cars. Steel pistons appear in 2 per cent, the remainder being cast iron. Taking those of all materials, the straight-sided type of piston occurs in 88 per cent of cases, the slipper piston with segmental skirt having failed to increase in favor even when aluminum is used, in which event it would appear to have the greatest theoretical advantage.

In respect of engine lubrication, the pressure system in one form or another appears on 65 per cent of engines, which represents a small increase as compared with twelve months ago. Actually, however, the full pressure

system, in which the oil is conveyed by leads to the connecting rod small end, occurs in only 4 per cent of cases, while in 17 per cent the pressure feed is carried only to the main crankshaft journals, troughs occurring beneath the connecting rods to serve for the big-ends and splash to other interior details. The simple trough or circulating splash system with catch pits over the journals has decreased perceptibly in favor, now being used in only 23 per cent of engines.

British manufacturers generally do not favor the plunger type of oil pump, and it is used in only 19 per cent of cars, the gear type accounting for 76 per cent, while among the remainder the flywheel is used to lift the oil to gutters in one case and a disk on the crankshaft in another. Seventy-three per cent of pumps are located in the crankcase sump, 21 per cent at the rear end of the camshaft, and only 6 per cent at the side of the latter. It will be seen, therefore, that even when cam-operated plunger pumps are used the pump is generally located in the sump, despite the somewhat lengthy connecting rod which this arrangement implies. There is no improvement to record in regard to facilities for cleaning the oil filter, this operation in the majority of engines still involving the draining of the crankcase and the removal of the pump, for the filter usually consists of a dome or cylinder of gauze surrounding the pump intake.

The Zenith carbureter is by far the most popular device and actually appears on 55 per cent of British cars.

Gravity feed for the fuel is the most popular (53 per cent) and the vacuum system has made but slight headway during the past twelve months. It now appears on just over one-third the total number of British cars. Magneto ignition is still almost universal, appearing on 92 per cent of cars, on 6 per cent of which it is supplemented by a battery system, this combination being provided by some of the makers of super-grade chassis. It will thus be seen that the battery system as the sole means of ignition has by no means gained the favor of British manufacturers.

Three-bearing crankshafts predominate, this number being fitted to quite a good proportion of the smallest four-cylinder engines; but 27 per cent have only two bearings. There are very few examples of ball or roller journals or big-ends, and those that occur are mostly on two-cylinder engines. Three bearings are used for the majority of camshafts and half the total, irrespective of the number per shaft, are bronze bushes; white, metal-lined bushes are next in favor, but the practice of running the white metal into the crankcase housing is not in evidence; 7 per cent of camshaft bearings are of cast iron, either separate bushes or integral with a cast iron crankcase. For gearsets ball bearings are used in over 80 per cent on both shafts, with plain bushes occur for the pilot in 60 per cent, ball in 31 per cent and roller the remainder. Wheel bearings and those supporting the differential case are also mostly of the ball type (front wheels 60 per cent, rear 76 per cent, differential 86 per cent); where rollers occur they are usually of the Timken pattern.

Clutch Types

Cone clutches are still in the majority, being represented on 52 per cent of cars; the dry, single-plate type has, nevertheless, continued to gain slightly during the past year and is now found on 34 per cent, a gain of 6 per cent. Four out of ten cone clutches are of the inverted variety, usually with an internal central spring unprovided with adjustment. It need hardly be said that fabric friction material is generally used in cone and plate clutches, though 20 per cent of the former are leather-faced and two examples are metal-to-metal (aluminum cone to cast-iron flywheel) running in oil. Multi-plate clutches have slightly increased (12 to 14 per cent), but there is little doubt, however, that they will in the near future be displaced almost entirely by the dry, single-plate pattern.

As already mentioned, 55 per cent of gearsets are located amidships, separate from the engine. It may be added, however, that instead of three and four speeds being equally favored as last year, fours are now in the minority, represented by 46 per cent. On a percentage basis the central control lever has lost ground owing to the large number of new models having the lever on the right. Numerically, however, the central lever has gained and appears on 26 per cent of British cars.

The popularity of the fabric disk universal joint continues to increase, but it does not by any means show signs of entirely displacing metallic joints; it is used on the majority of clutch shafts, but one or other of the metallic types are still more usual on propeller shafts, the star type being favored at the front end and the pot or sliding block pattern at the rear in the case of open shafts.

Spiral Bevel Increases

Spiral bevel final drive has increased appreciably, now appearing on 63 per cent of cars, but it has displaced the straight bevel rather than the worm. Straight bevels have decreased from 28 per cent to 11.5 per cent, while worm drives above and below the axle to an almost equal extent appear on 21.5 per cent of chassis. Brakes on wheels only have also increased slightly in both number and percentage (61 to 64 per cent), but no four-wheeled British car in production has front wheel brakes.

Hollow pressed steel wheels with integral rims and formed of two pressings welded together continue to receive most favor, though they have receded from 56 to 51 per cent. Disk wheels have increased slightly (20 to 26 per cent), while wire-spoked remain as they were, being fitted to approximately 20 per cent of standard models. All wheels are detachable.

No British maker has yet adopted straight-side tires for a model in production, though at least two prominent firms will fit them in place of the beaded-edge or clincher variety before the next Olympia show. Of rear axles 50 per cent are full floating, the semi-floating variety occurring on 43 per cent of cars.

For 1922 a few makers have adopted the Marles cam steering gear as standard, but 54 per cent of cars have worm and worm wheel steering gears, 24 per cent worm and segment and 8 per cent worm and nut. The rest of the manufacturers use the epicyclic, rack and pinion or bevel patterns.

Assembled cars remain few and far between among the productions of British plants. Only some of the smallest concerns use stock engines and even they, in approximately 40 per cent of cases, make their own. Stock gearsets and back axles are quite exceptional. Even steering gears (apart from the Marles) are nearly always made by the car manufacturer—invariably so in other than quite the smallest of plants.

In regard to bodywork, the most favored type is still the open two, four or five passenger, though a dozen or so of makers now provide a modified folding top with side panels or curtains that open with the doors. There is but a very small demand for sedan bodies and coupes; both figure among the range of approximately 30 per cent of makers, but no maker looks upon any kind of body except the open type as the standard fitted to his chassis.

British Passenger Car

No.	Car	MAKE AND MODEL	ENGINE AND COOLING SYSTEM: Nominal H. P.	Piston Displacement Cubic Inches	No. of Cyls.	Bore and Stroke, Ins.	Cylinder Head	Cylinders Cast	Cylinder Type	Overhead Valve Operation	Camshaft Drive	Cooling	Radiator Type	Point Suspension	PISTONS: Material	PISTONS: Type	LUBRICATION: System	LUBRICATION: Type of Pump	FUEL SYSTEM: Make of Carbureter	FUEL SYSTEM: Fuel Feed	ELECTRICAL SYSTEM: Ignition	ELECTRICAL SYSTEM: Generator Drive	ELECTRICAL SYSTEM: Volts
1		A.B.C.	12	71.0	2	3 9/16x3 9/16	Det.	1	H	P R	St. Pin.	A.C.		4	C.I.	SS	Trough	Plun.	Zenith	Gr.	Mag.	Belt	6
2		A.C.	11	93.7	4	2 3/4x3 5/16	Det.	4	L		Ch.	Ther.	Tub.	3	Al.	SS	Hol-Crk.	Gear		Gr.	Mag.	Belt	6
3		A.C.	12	121.8	6	2 9/16x3 5/16	Det.	6	H	C	Ch.	Pump.	Tub.	3	Al.	SS	Hol-Crk.	Gear		Gr.	Mag.	Belt	6
4		Albert	12	90.8	4	2 5/16x4	Det.	4	H	P.R.	Ch.	Ther.	Cel.	4	Al.	Spec.	Hol-Crk.	Gear	Claudl.	Gr.	Mag.	Pos.	12
5		Alvis	10	89.0	4	2 9/16x4 5/16	Int.	4	L		Sk. Pin.	Ther.	Cel.	4	Al.	SS	Hol-Crk.	Gear	Solex.	Gr.	Mag.	Belt	6
6		Angus Sanderson	14	141.4	4	3 x5	Det.	4	L		Sk. Pin	Ther.			C.I.	SS	Hol-Crk.	Plun.	Zenith	Gr.	Mag.	Belt	12
7		Argyll	15	157.2	4	3 1/8x5 1/8	Det.	4	S		Ch.	Pump.	Cel.	3	C.I.	SS	Hol-Crk.	Plun.	Zenith	Vac.	Mag.	Belt	12
8		Armstrong Siddeley.	18	147.0	6	2 3/4x4 1/8	Int.	3	H	P.R.	Ch.	Pump.	Cel.	4	C.I.	SS	Hol-Crk.	Gear	Claudl.	Gr.	Mag.	Belt	12
9		Armstrong Siddeley.	30	303.1	6	3 1/2x5 1/4	Int.	3	H	P.R.	Ch.	Pump.	Cel.	4	C.I.	SS	Hol-Crk.	Gear	Claudl.	Gr.	Mag.	Belt	12
10		Anol Johnston	16	157.2	4	3 1/8x5 1/8	Det.	4	L		Ch.	Ther.	Cel.	4	C.I.	SS	Hol-Crk.	Gear	Zenith	Vac.	Mag.	Pos.	6
11		Ashton Evans	11	72.5	4	2 5/8x4 5/16	Int.	4	L		Ch.	Ther.	Cel.	4	C.I.	SS	Hol-Crk.	Gear		Gr.	Mag.	Belt	6
12		Aston Martin	11	70.3	4	2 5/8x4 3/16	Int.	4	L		Sk. Pin.	Pump.	Cel.	4	St.	Hr. Gl.	Hol-Crk.	Gear	W. & P.	Vac.	Mag.	Belt	12
13		Austin	12	99.4	4	2 9/16x4	Det.	4	L		Ch.	Pump.	Cel.	3	Al.	SS	Hol-Crk.	Gear		Vac	Mag.	Pos.	6
14		Austin	20	220.9	4	3 3/4x5	Det.	4	L		Ch.	Pump.	Cel.	3	Al.	SS	Hol-Crk.	Gear	Zenith	Vac	Mag.	Belt	12
15		Bayliss Thomas	10	72.5	4	2 5/8x4 5/16	Int.	4	L		Ch.	Ther.	Cel.	4	C.I.	SS		Gear	Cox	Gr.	Mag.	Pos.	6
16		Bean	12	112.9	4	2 3/4x4 3/4	Int.	4	L		Sk. Pin	Ther.	Cel.	4	Al.	SS	Hol-Crk.	Gear		Gr.	Mag.	Belt	12
17		Beardmore [1]	11	102.1	4	2 11/16x4 1/2	Det.	4	H	C	Sk. Pin	Ther.	Tub.	3	C.I.	SS	Tr. & Pres	Gear	Zenith	Gr.	Mag.	Pos.	12
18		Belsize[3]	9	80.5	2	3 3/8x4 1/2	Det.	1	L		Ch.	A.C.		4	C.I.	SS	Hol-Crk.	Gear	Zenith	Gr.	Mag.	Belt	6
19		Belsize	16	165.8	4	3 1/2x4 5/16	Int.	4	L		Ch.	Pump.	Cel.	3	C.I.	SS	Hol-Crk.	Gear	Zenith	Vac.	Mag.	Belt	12
20		Bentley[2]	16	180.2	4	3 1/8x5 7/8	Int.	4	H	C	Sp. Bev.	Pump.	Cel.	3	Al.	Hr. Gl.	Hol-Crk.	Gear	Smith	Vac.	Mag.	Pos.	12
21		Blackburn	20	192.4	4	3 1/2x5	Det.	4	L		Ch.	Pump.	Cel.	4	C.I.	SS	Hol-Crk.	Plun.	Zenith	Vac	Mag.	Belt	
22		Briton	9	84.6	4	2 1/2x4 5/16	Int.	4	L		Ch.	Ther.	Cel.	4	C.I.	SS	Hol-Crk.	Ecce.	Zenith	Gr.	Mag.	Belt	12
23		Briton	11	107.8	4	2 9/16x4 3/4	Int.	2	L		Ch.	Ther.	Cel.	4	C.I.	SS	Trough	Ecce.	Zenith	Gr.	Mag.	Belt	12
24		B. S. A.	9	64.9	2	3 1/2x3 3/8	Int.	1	H	P.R.	St. Pin.	A.C.		4	Al.	SS	Splash	Gear	Zenith	Gr.	Mag.	Pos.	
25		Calcott	10	89.0	4	2 9/16x4 5/16	Int.	4	L		Ch.	Ther.	Cel.	4	C.I.	SS	Trough	Gear	Zenith	Gr.	Mag.	Pos.	8
26		Calcott	12	102.5	4	2 3/4x4 5/16	Int.	4	L		Ch.	Ther.	Cel.	4	C.I.	SS	Trough	Gear	Zenith	Gr.	Mag.	Pos.	12
27		Calthorpe	10	77.4	4	2 9/16x3 3/4	Int.	4	L		Ch.	Ther.	Cel.	4	Al.	Slip	Tr. & Pres.	Plun.	Zenith	Gr.	Mag.	Belt	12
28		Charron Laycock	10	89.0	4	2 9/16x4 5/16	Det.	4	L		Sk. Pin.	Ther.	Cel.	4	C.I.	SS	Hol-Crk.	Gear	Zenith	Vac	Mag.	Belt	6
29		Cluley	10	89.0	4	2 9/16x4 5/16	Int.	4	L		St. Pin.	Ther.	Cel.	4	C.I.	SS	Hol-Crk.	Gear	Zenith	Gr.	Mag.	Pos.	12
30		Cluley	12	102.5	4	2 3/4x4 5/16	Int.	4	L		St. Pin.	Ther.	Cel.	4	C.I.	SS	Hol-Crk.	Gear	Zenith	Gr.	Mag.	Pos.	12
31		Crossley	20	226.1	4	3 1/2x5 7/8	Det.	4	L		Ch.	Pump.	Tub.	4	Al.	Hr. Gl.	Hol-Crk.	Gear	Smith	Vac	Mag.	Belt	12
32		Crossley	30	276.5	4	4 x5 1/2	Int.	2	L		Ch.	Pump.	Tub.	3	C.I.	SS	Hol-Crk.	Gear	Smith	Vac	Mag.	Belt	12
33		Crouch	8	77.2	2	3 3/8x4 5/16	Det.	1	H	P.R.	St. Pin.	Ther.	Tub.	3	Al.	SS	Hol-Crk.	Plun.	Cox	Gr.	Mag.	Belt	6
34		Cubitt	16	168.7	4	3 1/8x5 1/2	Det.	4	L		Sk. Pin	Ther.	Cel.	4	C.I.	SS	Hol-Crk.	Plun.	Smith	Gr.	Bat.	Pos.	12
35		Daimler[1]	20	197.2	4	3 1/2x5 1/8	Det.	2	S		Ch.	Pump.	Tub.	4	C.I.	SS	Tr. & Pres.	Plun.	Own	Vac	Mag.	Belt	12
36		Daimler[1]	30	295.9	6	3 1/2x5 1/8	Det.	2	S		Ch.	Pump.	Cel.	4	C.I.	SS	Tr. & Pres.	Plun.	Own	Pr.	Mag.	Belt	12
37		Daimler[1]	45	449.2	6	4 5/16x5 1/8	Det.	2	S		Ch.	Pump.	Tub	4	C.I.	SS	Tr. & Pres.	Plun.	Own	Pr.	Mag.	Belt	12
38		Deemster	10	65.3	4	2 7/16x3 1/2	Int.	4	L		St. Pin.	Ther.	Cel.	4	C.I.	SS	Trough	Gear	Clandl	Gr.	Mag.	Belt	12
39		Enfield Allday	10	90.8	4	2 1/2x4 5/8	Int.	4	L		Ch.	Ther.	Cel.	3	C.I.	SS	Hol-Crk.	Gear	Zenith	Vac	Mag.	Pos.	12
40		Ensign	38	414.7	6	4 x5 1/2	Det.	2	H	C	Worm	Pump.	Cel.	3	Al.	SS	Hol-Crk.	Gear	Zenith	Pr.	M & C.	Pos.	12
41		Galloway	10	89.0	4	2 9/16x4 5/16	Det.	4	L		St. Pin.	Ther.	Cel.	3	C.I.	SS	Hol-Crk.	Gear	Zenith	Gr.	Mag.	Pos.	6
42		Guy	12	106.9	4	2 3/4x4 1/2	Det.	4	L		St. Pin.	Ther.	Tub.	3	C.I.	SS	Trough	Gear	Zenith	Gr.	Mag.	Belt	12
43		Guy	16	138.1	4	3 1/8x4 1/2	Det.	4	L		St. Pin.	Ther.	Tub.	3	C.I.	SS	Trough	Gear	Zenith	Gr.	Mag.	Belt	12
44		Guy	20	245.2	8	2 5/16x4 5/16	Det.	2	L		Ch.	Pump.	Tub.	4	Al.	SS	Hol-Crk.	Gear	Smith	Vac	Mag.	Pos.	12
45		G.W.K.	11	72.5	4	2 5/8x4 5/16	Det.	4	L		Ch.	Ther.	Tub.	3	C.I.	Hr. Gl.	Trough	Plun		Gr.	Mag.	Belt	6
46		Hampton	12	112.9	4	2 3/4x4 3/4	Det.	4	H	P.R.	Ch.	Ther.	Cel.	3	C.I.	SS	Tr. & Pres.	Gear	Zenith	Vac.	Mag.	Belt	12
47		H.E.	14	128.8	4	2 9/16x4 3/4	Det.	4	L		Ch.	Pump.	Cel.	4	C.I.	SS	Trough	Gear	Zenith	Vac.	Mag.	Pos.	6
48		Hillman	11	98.0	4	2 9/16x4 3/4	Int.	4	L		Sk. Pin	Ther.	Cel.	4	Al.	SS	Trough	Gear	Zenith	Gr.	Mag.	Pos.	12
49		Horstmann	11	72.5	4	2 5/8x4 5/16	Int.	4	L		Ch.	Ther.	Tub.	4	C.I.	SS	Hol-Crk.	Gear		Gr.	Mag.	Belt	
50		Humber	12	107.8	4	2 11/16x4 3/4	Det.	4	L		Ch.	Ther.	Cel.	4	Al.	SS	Tr. & Pres.	Gear	Cox	Gr.	Mag.	Pos.	12
51		Humber	16	168.7	4	3 1/8x5 1/2	Int.	4	L		Ch.	Pump.	Cel.	4	Al.	SS	Hol-Crk.	Gear	Cox	Vac.	Mag.	Belt	12
52		Jowett	7	56.5	2	3 x4	Int.	1	L		St. Pin.	Ther.	Tub.	3	C.I.	SS	Hol-Crk.	Gear.	Zenith	Gr.	Mag.	Pos.	6
53		Lagonda	11	89.1	4	2 3/4x3 3/4	Int.	4	L.H.		Ch.	Ther.	Cel.	4	Al.	SS	Tr. & Pres.	Plun.	Zenith	Gr.	Mag.	Belt	6
54		Lanchester	40	377.0	6	4 x5	Int.	3	H	C	Worm	Pump.	Cel.	4	Al.	SS	Full Pres.	Gear	S.U.	Vac.	M & B.	Pos.	12
55		Leyland		423.3	8	3 1/2x5 1/2	Det.	4	H	C	Ecce.	Pump.	Cel.	3	Al.	Slip	Full Pres.	Gear	Smith	Vac.	Bat.	Pos.	12
56		Marlborough	11	93.7	4	2 3/4x3 5/16	Int.	4	L		Ch.	Ther.	Cel.	4	C.I.	SS	Trough	Gear	Solex	Gr.	Bat.	Belt	12
57		McKenzie	10	50.0	4	2 5/8x2 5/8	Int.	4	L		Ch.	Ther.		4	C.I.	SS	Hol-Crk.	Gear	Cox	Gr.	Mag.	Belt	12
58		Morris	12	95.0	4	2 3/4x4	Det.	4	L		Sk. Pin	Ther.	Tub.	4	C.I.	SS	Tr. & Pres.	Plun.		Gr.	Mag.	Pos.	12
59		Napier	40	377.0	6	4 x5	Det.	6	H	C	Worm	Pump.	Cel.	4	Al.	SS	Hol-Crk.	Gear	Own	Pr.	M & B.	Pos.	12
60		New Orleans	10	77.2	4	2 1/2x3 5/16	Int.	4	L		Sk. Pin	Ther.	Cel.	4	C.I.	SS	Tr. & Pres.	Gear	Own	Gr.	Mag.	Belt	6
61		New Orleans	15	112.9	4	2 3/4x4 3/4	Det.	4	L		Sk. Pin	Pump.	Cel.	4	C.I.	SS	Hol-Crk.	Gear	Own	Vac.	Mag.	Pos.	12
62		Orpington	10	93.3	4	2 5/8x4 5/16	Int.	4	L		Ch.	Ther.	Cel.	4	C.I.	SS	Hol-Crk.	Gear	Zenith	Gr.	Mag.	Belt	6
63		Owen	30	318.5	8	2 11/16x5 7/8	Det.	4	L		Sk. Pin	Pump.	Cel.	3	St.	SS	Full Pres.	Plun.	Own	Vac.	M & B.	Pos.	12

ABBREVIATIONS:

Cylinder Head: Det—Detachable; **Int**—Integral.
Cylinder Type: H—Valves in Head; **S**—Sleeve; **T**—At Opposite Sides; **L**—Valves at Side; **LH**—Valves at Side, Exhaust Over Inlet.
Overhead Valve Operation: P R—Push Rods; **C**—Overhead Camshaft.
Camshaft Drive: St Pin—Straight Toothed Pinions; **Sk Pin**—Skew Toothed Pinions; **Ch-silent**—(inverted tooth) Chain; **Sp Bev**—Spiral Bevel; **Eccen**—Triple Eccentric Rods; **Sk & Wm**—Skew and Worm Gears; **Bev & Ch**—Bevel Gears and Silent Chain.
Cooling: A-C—Air-Cooled; **Ther**—Thermo Syphon.
Radiator Type: Cel—Cellular; **Tub**—Tubular.
Piston, Material: C I—Cast Iron; **Al**—Aluminum Alloy; **St**—Steel.
Piston, Type: S S—Straight Sided; **Hr Gl**—Hour Glass; **Slip**—Slipper (Segmental Skirt); **Spec**—Special.
Lubrication System: Trough—Troughs Under Connecting Rods and Catch Pits Over Main Bearings; **Tr & Pres**—Trough and Pressure, i.e. Troughs Under Connecting Rods and Direct Leads to Main Bearings; **Hol-Crk**—Drilled Crankshaft with Pressure Feed to Big-End and Main Bearings.
Type of Oil Pump: Plun—Plunger, Operated from Camshaft; **Gear**—Twin Gear Wheels; **Ecce**—Rotating Eccentric with Vane; **Flywh**—Flywheel Lifts Oil to Galleries and Troughs; **Disk**—Disk on Crankshaft Lifts Oil to Galleries and Troughs.
Carbureter Make: Claudl—Claudel, W & P, S.U.
Fuel Feed: Gr—Gravity; **Vac**—Vacuum; **Pr**—Pressure.
Ignition: Mag—Magneto; **M & B**—Magneto and Battery; **Bat**—Battery.
Generator Drive: Pos—Positive.
Bearings: B & P—Ball and Plain; **Pl**—Plain; **B & R**—Ball and Roller; **Bl**—Ball; **Rol**—Roller.

Chassis Specifications

TRANSMISSION AND OTHER CHASSIS PARTS																					CHASSIS DIMENSIONS				MAKE AND MODEL	No. Car
BEARINGS				Clutch	Gear Set				REAR AXLE					BRAKES						TIRES						
Gear Set														Hand		Foot										
Mainshaft	Lay Shaft	Front Wheels	Rear Axle	Type	Location	No. Forward Speeds	Steering Gear Type	Universal Joints, Type	Final Drive	Propulsion Taken By	Torque Taken By	Direct Gear Ratio	Type	Type	Location	Type	Location	Rear Springs, Type	Wheels, Type	Type	Size, Ins. or M.M.	Wheel Base, Ins.	Track, Ins.	Ground Clearance, Ins.	Weight of Chassis, Lbs.		
Bl....	Bl....	Bl....	Bl....	D-P....	Amid..	4	W & Nut	Fab...	SB....	TT...	TT...	.....	½...	Int...	RW...	Ext..	RW...	¼E...	Pr. St....	Cl..	710x90	100	47	8½	960	A.B.C.	1
Bl....	Bl....	Bl....	Bl....	D-P....	UA...	3	W & Wh.	Star...	WO...	TT...	TT...	4.5	Full..	Dsk..	PS....	Int...	RW...	¼E...	Disk....	Cl..	710x90	106	46	9	....	A.C.	2
Bl....	Bl....	Bl....	Bl....	D-P....	UA...	3	W & Wh.	Star...	WO...	TT...	TT...	4.5	Full..	Dsk..	PS....	Int...	RW...	¼E...	Disk....	Cl..	710x90	106	46	9	....	A.C.	3
Bl....	Pl....	Rol...	Bl....	D-P....	Amid..	4	W & Wh.	Fab...	StB...	TT...	TT...	4.5	Full..	Int...	RW...	Int...	RW...	Cant..	Pr. St....	Cl..	760x90	114	49	8½	1460	Albert	4
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	4	W & Wh	Fab...	SB....	Sp....	Sp....	4.3	Full..	Int...	RW...	Int...	RW...	½E...	Pr. St....	Cl..	760x90	110	49	9	1350	Alvis	5
Bl....	Bl....	.....	.....	Con....	UE...	3	W & Wh	Star...	SB....	TT...	TT...	4.2	½...	Int...	RW...	Int...	RW...	Cant..	Pr. St....	Cl..	810x90	120	52	9	1900	Angus Sanderson	6
Bl....	Bl....	Rol...	Bl....	D-P....	UE...	4	W & Wh	Star...	SB....	TT...	TT...	4.3	Full..	Int..	RW...	Int..	RW...	ant..	Disk....	Cl..	820x120	120	53	8	2100	Argyll	7
Rol...	Pl....	Bl....	Bl....	D-M....	UT...	3	W & Wh	Star...	SB....	TT...	TT...	4.7	½...	Int..	RW...	Int..	RW...	ant..	Disk....	Cl..	815x105	120	51	8	2100	Armstrong Siddeley	8
Rol...	Pl....	Bl....	Bl....	D-M....	UT...	3	W & Wh	Star...	SB....	TT...	TT...	3.75	½...	Int...	RW...	Int..	RW...	Cant..	Disk....	Cl..	820x120	135	56	8½	2660	Armstrong Siddeley	9
Bl....	Bl....	Bl....	Bl....	D-P....	UE...	4	W & Seg	Ex. Pn	SB....	TT...	TT...	4.25	½...	Int..	RW...	Int..	RW...	½E...	Disk....	Cl..	815x105	120	56	8½	2490	Anol Johnston	10
Rol...	Bl....	B & R.	B & R.	Con....	Amid..	3	.....	Fab...	SB....	RR...	TA...	4	Full..	Int..	RW...	Int..	RW...	Trans.	Pr. St....	Cl..	650x65	96	48	8½	1000	Ashton Evans	11
Rol...	Rol...	Rol...	B & R.	MDO...	Amid..	4	Marles..	Star...	SB....	TT...	TT...	Opt..	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	710x90	103	48	8½	1140	Aston Martin	12
Bl....	Bl....	Bl....	Bl....	D-P....	UE...	4	W & Wh.	F & M	SB....	Sp....	Sp....	5.2	½...	Ext...	DS...	Int..	RW...	½E...	Wood...	Cl..	.....	112	48	9	1400	Austin	13
Bl....	Bl....	Rol...	B & R.	D-P....	UE...	4	W & Wh.	Pot...	SB....	Sp....	Sp....	3.9	½...	Ext...	DS...	Int...	RW...	½E...	Wood...	Cl..	820x120	130	56	9	2240	Austin	14
Pl....	Pl....	Rol...	Bl....	D-P....	Amid..	3	W & Seg.	Fab...	SB....	RR...	TA...	4.5	Full..	Int...	RW...	Int...	RW...	¼E...	Disk....	Cl..	700x80	99	55	9	....	Bayliss Thomas	15
Bl....	Pl....	Rol...	Bl....	Con....	Amid..	3	W & Seg.	S. & P.	SB....	Sp....	Sp....	4	½...	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	760x90	102	49	9	1450	Bean	16
Bl....	Bl....	Rol...	Rol...	D-P....	UE...	4	W & Nut	Pot...	SB....	Sp....	Sp....	4.5	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	760x90	107	50	7½	1460	Beardmore[1]	17
Bl....	Pl....	Bl....	Bl....	MDO...	UE...	3	W & Nut	S & L.	SB....	Sp....	Sp....	4.25	N....	Int..	PS....	Int..	RW...	¼E...	Disk....	Cl..	700x80	99	46	8	1000	Belsize[2]	18
Bl....	Bl....	Bl....	Bl....	Con....	UE...	4	W & Wh.	Lea...	SB....	Sp....	Sp....	3.6	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	815x105	116	54	10	2350	Belsize	19
Bl....	Bl....	Rol...	B & R.	Con....	Amid..	4	W & Wh.	S & P..	SB....	Sp....	Sp....	3.7	½...	Int...	RW...	Int..	RW...	½E...	Wire....	Cl..	820x120	117	56	....	2300	Bentley[2]	20
Bl....	Bl....	Bl....	Bl....	Con....	UT...	4	W & Wh.	Star...	SB....	TT...	TT...	3.8	.....	Int..	RW...	Int..	RW...	Cant..	Pr. St....	Cl..	815x120	129	56	8	2300	Blackburn	21
Bl....	Bl....	Bl....	Bl....	DM....	UE...	3	W & Wh.	Fab...	WO...	Sp....	Sp....	4.4	½...	Int...	RW...	Ext...	DS...	½E...	Disk....	Cl..	700x85	98	46	8½	1000	Briton	22
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	3	W & Wh.	Fab...	SB....	Sp....	Sp....	4.4	½...	Int...	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	760x90	109	53	8	1220	Briton	23
Bl....	Bl....	Bl....	Bl....	D-P....	UE...	3	Rk & Pin	Star...	WU...	TT...	TT...	4.8	N....	Int..	RW...	Int..	RW...	¼E...	Disk....	Cl..	710x90	96	48	7½	....	B. S. A.	24
Bl....	Bl....	B & P.	B & P.	Con....	Amid..	3	W & Seg.	Fab...	SB....	Sp....	Sp....	4	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	700x80	93	45	9	1170	Calcott	25
Bl....	Bl....	B & P.	B & P.	Con....	Amid..	3	W & Seg.	Fab...	SB....	Sp....	Sp....	4	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	710x90	102	45	9	1570	Calcott	26
B & R.	Bl....	Bl....	Bl....	D-P....	Amid..	3	W & Seg.	Fab...	SB....	Sp....	Sp....	4.3	Full..	Int..	DS...	Int..	RW...	½E...	Pr. St....	Cl..	710x85	99	45	8½	930	Calthorpe	27
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	3	W & Wh.	Fab...	SB....	Sp....	Sp....	4.5	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	710x90	98	45	9	1350	Charron Laycock	28
.....	.....	Bl....	Bl....	Con....	UE...	3	W & Seg.	F & M	StB...	Sp....	Sp....	4.4	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	28x3½	96	45	7½	....	Cluley	29
.....	.....	Bl....	Bl....	Con....	Amid..	3	W & Seg.	F & M	StB...	Sp....	Sp....	4.4	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	28x3½	105	45	7½	....	Cluley	30
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	4	W & Wh.	S & P..	SB....	Sp....	Sp....	3.57	½...	Int..	RW...	Ext...	DS...	½E...	Pr. St....	Cl..	820x120	124	55	9	2160	Crossley	31
Bl....	Bl....	Rol...	B. & R.	Con....	Amid..	4	W & Wh.	Star...	SB....	TT...	TT...	4	Full..	Int..	RW...	Int...	DS...	¾E...	Wire....	Cl..	920x120	135	54	10¾	....	Crossley	32
Bl....	Bl....	Bl....	Bl....	Con....	UT...	3	Rk & Pin	.....	SB....	TT...	TT...	4.5	N....	Int...	RW...	Int..	RW...	¼E...	Wire....	Cl..	710x90	114	45	6½	900	Crouch	33
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	4	W & Wh.	Fab...	WO...	Sp....	Sp....	4.17	Full..	Int..	RW...	Ext...	DS...	½E...	Pr. St....	Cl..	815x105	126	54	10	2240	Cabitt	34
Bl....	Bl....	Bl....	Bl....	D-P....	Amid..	4	W & Wh.	Star...	WU...	Sp....	Sp....	3.37	½...	Ext...	DS...	Int..	RW...	¾E...	Wire....	Cl..	880x120	132	57	9	2350	Daimler[1]	35
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	4	W & Wh.	Star...	WU...	Sp....	Sp....	3.5	½...	Ext..	DS....	Ext..	RW...	¾E...	Wire....	Cl..	880x120	Var..	57	9	2890	Daimler[1]	36
Bl....	Bl....	Bl....	Bl....	D-P....	Amid..	4	W & Wh.	Star...	WU...	Sp....	Sp....	3.5	½...	Ext..	DS...	Int..	RW...	¾E...	Wire....	Cl..	895x150	146	57	9	3320	Daimler[1]	37
Bl....	Bl....	Rol...	B.&R.	Con....	Amid..	3	W & Nut	Star...	StB...	TT...	TT...	4.5	Full..	Int..	RW...	Int..	RW...	¼E...	Pr. St....	Cl..	700x80	91	46	7½	750	Deemster	38
B.&R.	Rol...	Bl....	Bl....	Con....	Amid..	3	W & Wh.	Star...	SB....	TT...	TT...	4.75	½...	Ext..	DS...	Int..	RW...	Cant..	Pr. St....	Cl..	30x3½	108	48	9½	1620	Enfield Allday	39
Bl....	Bl....	Rol...	B.&R.	DM....	UE...	3	W & Wh.	Star...	SB....	TT...	TT...	3.6	Full..	Int..	RW...	Int..	RW...	Cant..	Wire....	Opt.	895x150	147	56	8½	3360	Ensign	40
Bl....	Bl....	Rol...	G.&R.	Con....	UE...	3	W & Seg.	Fab...	SB....	TT...	TT...	4.2	½...	Int..	RW...	Int..	RW...	¼E...	Disk....	Cl..	710x90	112	49	....	1350	Galloway	41
Bl....	Bl....	Rol...	B.&R.	Con....	UE...	3	W & Wh.	Fab...	SB....	Sp....	Sp....	.....	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	760x90	110	48	7½	....	Guy	42
Bl....	Bl....	Rol...	G.&R.	Con....	UE...	3	W & Wh.	Fab...	SB....	Sp....	Sp....	.....	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	815x105	114	54	9	....	Guy	43
Bl....	Bl....	Rol...	B.&R.	Con....	Amid..	4	W.&Wh.	S.&P..	SB....	Sp....	Sp....	4.01	Full..	Int..	RW...	Int..	RW...	½E...	Wire....	Cl..	820x120	130	56	9	2880	Guy	44
Bl....	Bl....	Bl....	Bl....	.....	FD...	F	Epicy...	.....	IG....	Sp....	Sp....	.....	.....	Int..	RW...	Int..	RW...	¼E...	Wire....	Cl..	700x 80	106	48	8	950	G.W.K.	45
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	3	W.&Seg.	Fab...	SB....	Sp....	TA...	4	Full..	Int..	RW...	Int..	RW...	¾E...	Pr. St....	Cl..	710x 90	108	48	9	1300	Hampton	46
Bl....	G.&R.	B.&R.	B.&R.	DM....	Amid..	4	W.&Nut	Star...	WO...	TT...	TT...	4.2	Full..	Int..	RW...	Int..	RW...	¾E...	Pr. St....	Cl..	815x105	114	50	10	2100	H.E.	47
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	3	W.&Seg.	Spec...	WO...	Sp....	Sp....	.....	½...	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	700x 85	102	48	9	1570	Hillman	48
Bl....	Pl....	Rol...	Rol...	D-P....	UA...	3	Bev.....	Star...	St. B..	TT...	TT...	4	½...	Int..	RW...	Int..	RW...	Cant..	.....	Cl..	700x 85	....	....	....	....	Horstmann	49
Bl....	Bl....	Bl....	Bl....	Con. ...	UE...	4	W.&Wh.	Fab...	St. B..	Sp....	Sp....	4.33	Full..	Ext..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	760x 90	105	55	8½	1280	Humber	50
Bl....	Bl....	Bl....	Bl....	Con....	Amid..	4	W.&Wh.	F.&M.	St. B..	Sp....	Sp....	4.33	Full..	Int..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	815x105	123	57	9	1770	Humber	51
Bl....	Bl....	Bl....	Bl....	Con....	UE...	3	Epic.....	Fab...	SB....	Sp....	Sp....	4.5	½...	Ext..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	26x 3	84	45	8	670	Jowett	52
B.&P..	Pl....	Bl....	Bl....	Con....	UE...	3	W.&Seg.	Fab...	WO...	TT...	TT...	4.4	½...	Int..	RW...	Ext..	DS...	¼E...	Pr. St....	Cl..	700x 80	108	46	7	....	Lagonda	53
.....	.....	B &R.	B.&R.	D-P....	UE...	3	W.&Nut	Star...	WU...	TT...	TT...	.....	Full..	Int..	RW...	Int..	DS...	Cant..	Wire....	....	895x135	141	58	11	....	Lanchester	54
Rol...	Rol...	B &R.	B.&R.	D-P....	Amid..	4	Marles..	MD...	SB....	TT....	TT...	3.2	Full..	Int..	RW...	Int..	RW...	¼E...	Disk....	Cl..	895x135	141	56	....	....	Leyland	55
Bl....	Bl....	Bl....	Bl....	MDO...	Amid..	4	W.&Seg.	Pot...	SB....	Sp....	Sp....	4	½...	Int..	RW...	Int..	RW...	½E...	Disk....	Cl..	710x 90	108	48	9	1120	Marlborough	56
.....	.....	Bl....	Bl....	Con....	Amid..	3	W.&Wh.	Fab...	SB....	Sp....	Sp....	4.2	Full..	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	700x 80	102	48	8	1120	McKenzie	57
Bl....	Pl....	Bl....	Bl....	MD....	UE...	3	W.&Wh.	Pot...	SB....	TT...	TT...	4.75	½...	Int..	RW...	Int..	RW...	¾E...	Pr. St....	Cl..	710x 90	102	48	....	1220	Morris	58
Rol...	Rol...	Rol...	Rol...	D-P....	Amid..	4	W.&Seg.	Star...	SB....	Sp....	TT...	3.7	½...	Int..	RW...	Ext..	DS...	Cant..	Wire....	Cl..	895x150	137	56	....	2890	Napier	59
Bl....	Bl....	Bl....	Bl....	D-P....	UA...	2	W.&Wh.	Fab...	SB....	TT...	TT...	4	Full..	Int..	RW...	Int..	RW...	½E...	Disk....	Cl..	710x 90	102	50	8¼	1000	New Orleans	60
Bl....	Bl....	Bl....	Bl....	D-P....	UE...	4	W.&Wh.	Star...	SB....	TT...	TT...	3.25	Full..	Int..	RW...	Int..	RW...	½E...	Disk....	Cl..	820x120	129	56	9	1280	New Orleans	61
Bl....	Bl....	Rol...	Rol...	Con....	Amid..	3	W.&Wh.	Fab...	St. B..	Sp....	Sp....	4.2	N....	Int..	RW...	Ext..	DS...	¼E...	Pr. St....	Cl.	710x 90	96	50	7½	1460	Orpington	62
Bl....	Bl....	Rol...	Rol...	Con....	UA...	6	W.&Wh.	Star...	SB....	TT...	TT...	3	Full..	Int..	RW...	Int..	RW...	Cant..	Pr. St....	Cl..	895x135	160	60	9	2460	Owen	63

Clutch Type: **D P**—Dry Single Plate; **O P**—Single Plate in Oil; **Con**—Cone; **M D O**—Multiple Disk in Oil; **D M**—Dry Multiple Disk.

Gearset Location: **Amid**—Amidship; **U E**—Unit with Engine; **U A**—Unit with Axle; **U T**—Unit with Torque Tube; **F D**—Friction Drive.

Steering Gear Type: **W & Wh**—Worm and Full Worm Wheel; **W & Seg**—Worm and Worm Wheel Segment; **W & Nut**—Worm and Nut; **Rk & Pin**—Rack and Pinion; **Epicy**—Epicyclic; **Marles**—Marles Cam Gear.

Universal Joints: **Fab**—Fabric Disk; **S & P**—Star and Pot Type; **F & M**—Fabric Disk and Metal; **Pot**—Pot Type (metal); **Star**—Star Type (metal); **Lea**—Leather Disk; **S & L**—Star and Leather Disk; **M D**—Metal Disk.

Final Drive: **Wo**—Worm Over Axle; **Wu**—Worm Under Axle; **S B**—Spiral Bevel; **St B**—Straight Toothed Bevel; **I G**—Internal Gear.

Drive and Torque: **TT**—Torque Tube; **Sp**—Springs; **RR**—Radius Rods; **T A**—Torque Arm.

Rear Axle: **Full**—Full Floating; **½**—Semi-floating; **N**—Non-floating.

Brakes: **Int**—Internal Expanding Shoes; **Dsk**—Disk; **Ext**—External Contracting Shoes or Band; **R W**—On Rear Wheels; **P S**—On Pinion or Worm, Shaft, Front or Back or Axle Casing; **D S**—On Drive Shaft at Rear of Gearset.

Springs: **¼ E**—Quarter Elliptic; **½ E**—Semi-Elliptic; **¾ E**—Three-quarter Elliptic; **Trans**—Transverse Inverted Semi-Elliptic; **Cant**—Cantilever; **¼ Dul**—Two Super-imposed Quarter Elliptic; **C & ½ E**—Cantilever Fore and Aft Anchored to Semi-Elliptic Amidships, at Each Side of Chassis.

Wheels: **Pr St**—Hollow Spoked Pressed Steel with Integral Rim.

Tires: **Cl**—Clincher; **S S**—Straight Sided.

[1]Troughs Connected to Throttle.
[2]Four Valves Per Cyl.
[3]Oil Cooled Cylinders.

British Passenger Car Chassis

No. Car	MAKE AND MODEL	ENGINE AND COOLING SYSTEM											PISTONS		LUBRICATION		FUEL SYSTEM		ELECTRICAL SYSTEM		
		Nominal H.P.	Piston Displacement Cubic Inches	No. of Cyls.	Bore and Stroke, Ins.	Cylinder Head	Cylinders Cast	Cylinder Type	Overhead Valve Operation	Camshaft Drive	Cooling	Radiator Type	Point Suspension	Material	Type	System	Type of Pump	Make of Carbureter	Fuel Feed	Ignition	Generator Drive	Volts
64	Palladium	12	93.3	4	2¾x3½	Det.	4	L.		Sk. Pin	Ther.	Cel.	3	C.I.	SS.	Trough.	Plun.	Zenith.	Gr.	Mag.	Belt	6
65	Phoenix	12	93.3	4	2¾x3½	Int.	4	L.		Sk. Pin	Ther.	Tub.	4	C.I.	SS.	Tr. & Pres.	Gear.	S.U.	Gr.	Mag.	Belt	6
66	Phoenix	18	190.1	4	3⅜x5½	Det.	4	H.	C.	Sk. Pin	Pump.	Tub.		C.I.	Slip.	Tr. & Pres.	Gear.	Zenith.	Vac.	Mag.	Belt	12
67	Rhode	9	65.3	4	2⅞x3½	Det.	4	H.	C.	Bev.	Ther.	Cel.	3	C.I.	SS.	Trough.	Flywh.	Cox	Gr.	Mag.	Pos.	6
68	Riley	11	72.5	4	2⅝x4⅛	Det.	4	L.		Ch.	Ther.	Cel.	4	Al.	Slip.	Tr. & Pres.	Gear.	Zephyr.	Gr.	Mag.	Belt	12
69	Rolls Royce	40	453.3	6	4½x4¾	Int.	3	L.		Sk. Pin	Pump.	Cel.	3	Al.	SS.	Full Pres.	Gear.	Own.	Pr.	M & B.	Belt	12
70	Rover	8	61.5	2	3⅜x3⅞	Det.	1	L.		St. Pin.	A.C.		3	C.I.	SS.	Trough.	Ecce.	Smith.	Gr.	Mag.	Belt	6
71	Rover	12	138.9	4	2⅝x5⅛	Det.	4	L.		Ch.	Pump.	Cel.	4	C.I.	SS.	Trough.	Gear.	Solex.	Vac.	Mag.	Belt	12
72	Ruston Hornsby	16	157.2	4	3⅛x5⅛	Det.	4	L.		Sk. Pin	Pump.	Cel.	3	C.I.	SS.	Tr. & Pres.	Gear.	Zenith.	Gr.	Mag.	Belt	12
73	Ruston Hornsby	20	226.4	4	3¾x5⅛	Int.	4	L.		Sk. Pin	Pump.	Cel.	3	C.I.	SS.	Tr. & Pres.	Gear.	Zenith.	Gr.	Mag.	Belt	12
74	Sheffield Simplex	50	477.1	6	4½x5	Int.	1	L.		Ch.	Pump.	Tub.		Al.	Trnk.	Hol-Crk.	Gear.	Own.	Pr.	M & B.		12
75	Singer	10	67.4	4	2½x3⅞	Int.	2	L.		St. Pin.	Ther.	Cel.	4	C.I.	SS.	Tr. & Pres.	Gear.	Claudl.	Gr.	Mag.	Pos.	
76	Singer	15	122.0	6	2⅝x3⅝	Det.	6	L.		Ch.	Ther.	Cel.	4	C.I.	SS.	Tr. & Pres.	Plun.		Vac.	Mag.	Pos.	
77	Sizaire Berwick	25	275.2	4	3¾x6⅝	Int.	4	L.		Sk. Pin.	Pump.	Cel.	4	Al.	SS.	Hol-Crk.	Gear.	Smith.	Vac.	Mag.	Pos.	12
78	Standard	8	65.3	4	2⅞x3½	Det.	4	H.	PR.	St. Pin.	Ther.	Tub.	4	Al.	SS.	Trough.	Disk.	Zenith.	Gr.	Bat.	Belt	6
79	Standard	11	117.0	4	2⅝x4⅛	Det.	4	H.	PR.	Ch.	Ther.	Tub.	4	Al.	Slip.	Hol-Crk.	Gear.	Zenith.	Vac.	Mag.	Pos.	12
80	Star	12	112.9	4	2¾x4¾	Det.	4	L.		St. Pin.	Ther.	Cel.	4	C.I.	SS.	Trough.	Plun.	Zenith.	Gr.	Mag.	Pos.	12
81	Star	16	180.2	4	3⅛x5⅞	Int.	2	L.		Ch.	Pump.	Cel.	4	C.I.	Hr. Gl.	Hol-Crk.	Gear.	Zenith.	Vac.	Mag.	Belt	12
82	Star	20	226.1	4	3½x5⅞	Int.	2	L.		Ch.	Pump.	Cel.	4	C.I.	Hr. Gl.	Hol-Crk.	Gear.	Zenith.	Vac.	Mag.	Belt	12
83	Stroker Squire	15	182.8	4	3½x4¾	Int.	4	L.		Sk. Pin	Pump.	Cel.	4	Al.	SS.	Trough.	Gear.		Vac.	Mag.	Belt	12
84	Stroker Squire	25	235.9	6	3⅛x5⅛	Int.	1	H.	C.	Bev.	Pump.	Cel.	4	Al.	SS.	Hol-Crk.	Gear.		Vac.	Mag.	Pos.	12
85	Sunbeam	14	118.0	4	2⅝x4¾	Det.	4	H.	PR.	Ch.	Pump.	Cel.	4	Al.	SS.	Hol-Crk.	Gear.	Claudl.	Vac.	Bat.	Belt	12
86	Sunbeam	16	180.2	4	3⅛x5⅞	Det.	4	H.	PR.	Ch.	Pump.	Cel.	4	Al.	SS.	Hol-Crk.	Gear.	Claudl.	Vac.	Mag.	Belt	12
87	Sunbeam	24	270.4	6	3⅛x5⅞	Det.	6	H.	PR.	Ch.	Pump.	Cel.	4	Al.	SS.	Hol-Crk.	Gear.	Claudl.	Vac.	Mag.	Pos.	12
88	Swift	10	68.7	4	2½x3½	Int.	4	L.		Ch.	Ther.	Tub.	4	C.I.	SS.	Hol-Crk.	Gear.	Zenith.	Gr.	Mag.	Belt	12
89	Swift	12	121.8	4	2¾x5⅛	Int.	4	L.		Ch.	Ther.	Tub.	4	C.I.	SS.	Hol-Crk.	Gear.	Zenith.	Gr.	Mag.	Belt	12
90	Talbot	14	118.0	4	2⅝x4¾	Det.	4	H.	PR.	Ch.	Pump.	Cel.	4	Al.	SS.	Hol-Crk.	Gear.	Claudl.	Vac.	Bat.	Belt	12
91	Talbot	16	157.2	4	3⅛x5⅛	Int.	2	L.		Ch.	Pump.	Cel.	4	C.I.	SS.	Hol-Crk.	Gear.	Zenith.	Vac.	Mag.	Belt	6
92	Talbot	25	276.5	4	4 x5½	Int.	2	L.		Ch.	Pump.	Cei.	4	C.I.	SS.	Hol-Crk.	Gear.	Zenith.	Vac.	Mag.	Belt	12
93	Talbot	36	235.9	6	3⅛x5⅛	Int.	2	L.		Ch.	Pump.	Cel.	4	C.I.	SS.	Hol-Crk.	Gear.	Zenith.	Vac.	Mag.	Belt	12
94	Vauxhall	14	138.9	4	2⅝x5⅛	Det.	4	L.		St. Pin.	Pump.	Cel.	3	Al.	SS.	Hol-Crk.	Plun.	Zenith.	Vac.	Mag.	Belt	
95	Vauxhall	25	243.0	4	3¾x5½	Int.	4	L.		Ch.	Pump.	Cel.	4	C.I.	SS.	Hol-Crk.	Plun.	Zenith.	Pr.	Mag.	Belt	12
96	Vauxhall	30	277.1	4	3⅞x5⅞	Int.	4	L.		Ch.	Pump.	Cel.	4	Al.		Hol-Crk.	Plun.	Zenith.	Pr.	Mag.	Belt	12
97	Vulcan	9	125.3	2	3⅜x3½	Det.	1	S.		Sk.&wm.	Pump.	Cel.	4	Al.	SS.	Hol-Crk.	Gear.	Zenith.	Gr.	Mag.	Pos.	6
98	Vulcan	16	157.2	4	3⅛x5⅛	Det.	4	L.		Sk. Pin	Pump.	Cel.	4	C.I.	SS.	Trough.	Gear.	Zenith.	Gr.	Mag.	Belt	12
99	Vulcan	20	197.2	4	3½x5⅛	Det.	4	L.		Sp. Pin	Pump.	Cel.	4	C.I.	SS.	Trough.	Gear.	Zenith.	Gr.	Mag.	Belt	12
100	Vulcan	20	211.7	4	3½x5½	Det.	4	S.		Sk & wm	Pump	Cel.	4	Al.	SS.	Hol-Crk.	Gear.	Zenith.	Vac.	Mag.	Pos.	12
101	Warren Lambert	10	93.3	4	2¾x3⅝	Det.	4	L.		Ch.	Ther.	Cel.	3	C.I	SS.	Tr. & Pres.	Gear.		Gr.	Mag.	Belt	
102	Waverley	15	141.4	4	3 x5	Det.	4	L.		Sk. Pin	Ther.	Cel.	4	C.I.	SS.	Hol-Crk.	Plun.	Zenith.	Gr.	Mag.	Belt	12
103	Westwood	12	112.9	4	2¾x4¾	Det.	4	H.	PR.	Ch.	Pump.	Tub.	3	C.I.	SS.	Tr. & Pres.	Gear.	Zenith.	Vac.	Mag.	Belt	12
104	Wolseley	7	60.1	2	3¼x3⅝	Int.	1	L		St. Pin	Ther.	Cel.	3	Al.	SS.	Trough.	Gear.	Own.	Gr.	Bat.	Belt	6
105	Wolseley	10	77.4	4	2⅝x3¾	Det.	4	H.	C.	Bev&Ch.	Ther.	Cel.	4	C.I.	SS.	Trough.	Gear.	Own.	Gr.	Bat.	Pos.	6
106	Wolseley	15	157.2	4	3⅛x5⅛	Det.	4	H.	C.	Bev&Ch.	Pump.	Cel.	4	Al.	SS.	Trough.	Gear.	Own.	Vac.	Bat.	Pos.	12
107	Wolseley	20	235.9	6	3⅛x5⅛	Int.	2	L.		Ch.	Pump.	Cel.	4	Al.	SS.	Trough.	Gear.	Own.	Vac.	Mag.	Pos.	12

ABBREVIATIONS:

Cylinder Head: Det—Detachable; **Int**—Integral.
Cylinder Type: H—Valves in Head; **S**—Sleeve; **T**—At Opposite Sides; **L**—Valves at Side; **LH**—Valves at Side, Exhaust Over Inlet.
Overhead Valve Operation: P R—Push Rods; **C**—Overhead Camshaft.
Camshaft Drive: St Pin—Straight Toothed Pinions; **Sk Pin**—Skew Toothed Pinions; **Ch-silent**—(inverted tooth) Chain; **Sp Bev**—Spiral Bevel; **Eccen**—Triple Eccentric Rods; **Sk & Wm**—Skew and Worm Gears; **Bev & Ch**—Bevel Gears and Silent Chain.
Cooling: A-C—Air-Cooled; **Ther**—Thermo Syphon.
Radiator Type: Cel—Cellular; **Tub**—Tubular.
Piston, Material: C I—Cast Iron; **Al**—Aluminum Alloy; **St**—Steel.
Piston, Type: S S—Straight Sided; **Hr Gl**—Hour Glass; **Slip**—Slipper (Segmental Skirt); **Spec**—Special.
Lubrication System: Trough—Troughs Under Connecting Rods and Catch Pits Over Main Bearings; **Tr & Pres**—Trough and Pressure, i.e. Troughs Under Connecting Rods and Direct Leads to Main Bearings; **Hol-Crk**—Drilled Crankshaft with Pressure Feed to Big-End and Main Bearings.
Type of Oil Pump: Plun—Plunger, Operated from Camshaft; **Gear**—Twin Gear Wheels; **Ecce**—Rotating Eccentric with Vane; **Flywh**—Flywheel Lifts Oil to Galleries and Troughs; **Disk**—Disk on Crankshaft Lifts Oil to Galleries and Troughs.
Carbureter Make: Claudl—Claudel, W & P, S.U.
Fuel Feed: Gr—Gravity; **Vac**—Vacuum; **Pr**—Pressure.
Ignition: Mag—Magneto; **M & B**—Magneto and Battery; **Bat**—Battery.
Generator Drive: Pos—Positive.
Bearings: B & P—Ball and Plain; **Pl**—Plain; **B & R**—Ball and Roller; **Bl**—Ball; **Rol**—Roller.

Percentages of Design Features in British Passenger Cars, 1922

Cylinder Head

Detachable	54 per cent
Integral	46 per cent

Cylinders Cast

Block	72 per cent
Pairs	13 per cent
Singly	9 per cent
Threes	4 per cent
Fours	2 per cent

Cylinders Separate or Unit with Top Half of Crankcase

Separate	82 per cent
Unit	18 per cent

Valve Arrangement

L head	69 per cent
I head (overhead valves)	24 per cent
Sleeve	6 per cent
F head (inlet over exhaust)	1 per cent

Overhead Valve Operation

Push rods	54 per cent
Overhead camshaft	46 per cent

Overhead Camshaft Drive

Worm	25 per cent
Skew pinions	17 per cent
Straight bevels	17 per cent
Bevels and chain	17 per cent
Chain	8 per cent
Spiral bevels	8 per cent
Eccentric rods	8 per cent

Interior Camshaft Drive

Chain	59 per cent
Skew pinions	22 per cent
Straight pinions	17 per cent
Skew and worm	2 per cent

Water Circulation

Pump	49 per cent
Thermo	47 per cent
Air-cooled	4 per cent

Water Pump Drive

Positive	83 per cent
Belt	17 per cent

Radiator Type

Cellular	77 per cent
Tubular	23 per cent

Specifications (Continued)

TRANSMISSION AND OTHER CHASSIS PARTS																						CHASSIS DIMENSIONS					
BEARINGS				Clutch	Gear Set				REAR AXLE					BRAKES						TIRES							
Gear Set														Hand		Foot											
Mainshaft	Lay Shaft	Front Wheels	Rear Axle	Type	Location	No. Forward Speeds	Steering Gear, Type	Universal Joints, Type	Final Drive	Propulsion Taken By	Torque Ta'en By	Direct Gear Ratio	Type	Type	Location	Type	Location	Rear Springs, Type	Wheels, Type	Type	Size, Ins. or M.M.	Wheel Base, Ins.	Track, Ins.	Ground Clearance, Ins.	Weight of Chassis, Lbs.	MAKE AND MODEL	No. Car
Bl....	Bl....	Bl....	Bl....	D-P....	UE...	4	W.&Wh.	Fab...	SB....	Sp....	Sp....	4.66	Full..	Int..	RW...	Int..	RW...	½E...	Disk....	Cl..	760x 90	111	48	10	1350	Palladium	64
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	3	W.&Wh.	Star...	WO...	TT...	TT...	4.14	Full..	Ext..	RW...	Ext..	DS...	½E...	Wood...	Cl..	760x 90	96	50	9	1220	Phoenix	65
Bl....	Bl....	Bl....	Bl....	Con.....	UE...	3	W.&Wh.	Star...	SB....	Sp....	TT...	4.2	Full..	Int..	RW...	Int..	RW...	Cant..	Wood...	Cl..	815x105	126	56	10	1850	Phoenix	66
Bl....	Bl....	Bl....	Bl....	D-P....	UE...	3	Epicy....	Fab...	SB....	Sp....	TT...	4.2	N...	Ext..	DS...	Int..	RW...	½E...	Pr. St....	Cl..	700x 80	102	46	8	....	Rhode	67
Bl....	Bl....	Rol...	B.&R.	Con.....	Amid..	4	W.&Wh.	Fab...	SB....	Sp....	Sp....	4	½...	Int..	RW...	Int..	RW...	½E...	Disk....	Cl..	710x 90	108	48	9	1120	Riley	68
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	4	W.&Nut	S. & P.	SB....	TT...	TT...	3.46	Full..	Int..	RW...	Int..	RW...	Cant..	Wire....	Cl..	895x135	144	56	10	3360	Rolls Royce	69
Bl....	Bl....	Rol...	Bl....	D-P....	UE...	3	R.&Pin.	F.&M.	WU...	Sp....	TA...	4.8	½...	Int..	RW...	Int..	RW...	¼E...	Disk....	Cl..	28x 3	88	46	8	670	Rover	70
Bl....	Bl....	Rol...	Bl....	OP.....	Amid..	3	W.&Seg.	S. & P.	WU...	Sp....	TA...	4.37	½...	Int..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	815x105	116	50	7	1680	Rover	71
Bl....	Bl....	Bl....	Bl....	Con.....	UA...	3	Marles..	Fab...	SB....	TT...	TT...	4.23	½...	Int..	RW...	Int..	RW...	¾E...	Disk....	Cl..	815x105	117	56	9	2240	Ruston Hornsby	72
Bl....	Bl....	Bl....	Bl....	Con.....	UA...	3	Marles..	Fab...	SB....	TT...	TT...	4.23	.....	Int..	RW...	Int..	RW...	¾E...	Disk....	Cl..	820x120	126	56	10	....	Ruston Hornsby	73
.....	.....	.....	.....	DM....	UT...	4	.....	Star...	SB....	TT...	TT...	.....	.....	Int..	RW...	Int..	RW...	Cant..	Wire....	Cl..	895x150	150	56	10	2800	Sheffield Simplex	74
Bl....	Bl....	B.&R.	Bl....	Con.....	UT...	3	W.&Seg.	Star...	SB....	TT...	TT...	4.5	½...	Int..	RW...	Int..	RW...	¼E...	Disk....	Cl..	26x 3	96	48	8	....	Singer	75
Bl....	Bl....	B.&R.	Bl....	Con.....	UT...	3	W.&Seg.	Star...	SB....	TT...	TT...	4	½...	Int..	RW...	Int..	RW...	Cant..	Disk....	Cl..	815x105	117	52	9	....	Singer	76
Bl....	Bl....	Bl....	Bl....	D-P....	Amid..	4	W.&Nut	S. & P.	SB....	Sp....	Sp....	4	½...	Int..	DS...	Int..	RW...	½E...	Wire....	Cl..	895x135	141	53	8½	....	Sizaire Berwick	77
Bl....	Pl....	.....	Bl....	D-P....	UT...	3	W.&Wh.	Fab...	WU...	TT...	TT...	5.1	½...	Int..	RW...	Int..	RW...	¼E...	Pr. St....	Cl..	26x 3	102	....	....	....	Standard	78
Bl....	Bl....	.....	Bl....	D-P....	Amid..	4	W.&Wh.	Fab...	WO...	Sp....	Sp....	4.2	½...	Int..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	30x3½	....	54	....	....	Standard	79
Bl....	Bl....	B.&R.	Bl....	D-P....	UE...	3	W.&Wh.	Fab...	SB....	Sp....	Sp....	4.3	N...	Int..	RW...	Ext..	RW...	½E...	Disk....	Cl..	30x3½	108	48	10	1570	Star	80
Bl....	Bl....	Bl....	Bl....	D-P....	Amid..	4	W.&Wh.	S.&P..	SB....	Sp....	Sp....	3.9	Full..	Int..	RW...	Ext..	DS...	¾E...	Pr. St....	Cl..	820x120	129	56	9	2300	Star	81
Bl....	Bl....	Bl....	Bl....	D-P....	Amid..	4	W.&Wh.	S.&P..	SB....	Sp....	Sp....	3.9	Full..	Int..	RW...	Ext..	DS...	¾E...	Pr. St....	Cl..	820x120	129	56	9	2410	Star	82
Bl....	Bl....	Bl....	Bl....	D-P....	Amid..	4	W.&Wh.	S.&P..	SB....	Sp....	Sp....	4.15	½...	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	815x105	117	52	8	2110	Stroker Squire	83
Bl....	Bl....	Bl....	Bl....	D-P....	Amid..	4	W.&Wh.	Star...	SB....	TT...	TT...	4.15	½...	Int..	RW...	Int..	RW...	Cant..	Wire....	Cl..	880x120	127	56	9	1900	Stroker Sqnire	84
Bl....	Bl....	Bl....	Bl....	D-P....	UE...	3	W.&Seg.	Star...	SB....	TT...	TT...	4.15	Full..	Int..	RW...	Int..	RW...	Cant..	Pr. St....	Cl..	815x105	118	51	....	....	Sunbeam	85
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	4	W.&Seg.	S.&P..	SB....	Sp....	Sp....	4	Full..	Int..	RW...	Int..	DS...	½E...	Pr. St....	Cl..	820x120	124	57	....	....	Sunbeam	86
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	4	W.&Seg.	S.&P..	SB....	Sp....	Sp....	4	Full..	Int..	RW...	Int..	DS...	½E...	Pr. St....	Cl..	820x120	136	57	....	....	Suubeam	87
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	3	W.&Wh.	F.&M.	SB....	Sp....	Sp....	4.5	½...	Int..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	700x 80	90	45	7½	1230	Swift	88
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	4	W.&Wh.	S.&P..	SB....	Sp....	Sp....	4.26	½...	Int..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	760x 90	108	48	8½	1570	Swift	89
Bl....	Bl....	Bl....	Bl....	D-P....	UE...	3	W.&Seg.	Star...	SB....	TT...	TT...	4.15	Full..	Int..	RW...	Int..	RW...	Cant..	Pr. St....	Cl..	815x105	118	49	....	....	Talbot	90
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	4	W.&Seg.	Star...	SB....	TT...	TT...	4.3	Full..	Int..	RW...	Int..	RW...	Cant..	Wire....	Cl..	815x105	121	53	9	1680	Talbot	91
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	4	W.&Seg.	Star...	SB....	TT...	TT...	3.5	Full..	Int..	RW...	Int..	RW...	Cant..	Pr. St....	Cl..	895x135	133	56	10	2890	Talbot	92
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	4	W.&Seg.	Star...	SB....	TT...	TT...	4	Full..	Int..	RW...	Int..	RW...	½E...	Wire....	Cl..	880x120	139	56	10	3000	Talbot	93
.....	.....	.....	.....	D-P....	UE...	3	Marles..	.....	St. B..	Sp....	TT...	4	.....	Int..	RW...	Int..	RW...	Cant..	Disk....	Cl..	815x105	116	50	....	....	Vauxhall	94
Bl....	Bl....	Bl....	Bl....	MDO...	Amid..	4	W.&Wh.	S.&P..	SB....	Sp....	TA...	3.6	Full..	Int..	RW...	Int..	DS...	½E...	Wire....	Cl..	880x120	120	56	9	3000	Vauxhall	95
Bl....	Bl....	Bl....	Bl....	MDO...	Amid..	4	W.&Wh.	S.&P..	St. B..	Sp....	TA...	3	½...	Int..	RW...	Int..	DS...	½E...	Wire....	Cl..	820x120	114	54	8	2680	Vauxhall	96
Bl....	Bl....	.....	Bl....	Con.....	UT...	3	W.&Seg.	Star...	St. B..	TT...	TT...	4	.....	Int..	RW...	Int..	RW...	C&½E	Disk....	Cl..	710x 90	108	48	8½	....	Vulcan	97
Bl....	Bl....	.....	Bl....	Con.....	Amid..	4	W.&Wh.	S.&P..	WO...	Sp....	Sp....	4	.....	Int..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	815x105	123	56	7½	....	Vulcan	98
Bl....	Bl....	.....	Bl....	Con.....	Amid..	4	W.&Wh.	S.&P.	WO...	Sp....	Sp....	4	.....	Int..	RW...	Ext..	DS...	½E...	Pr. St....	Cl..	820x120	123	56	7	....	Vulcan	99
Bl....	Bl....	.....	Bl....	Con.....	Amid..	4	W.&Wh.	Star...	WO...	TT...	TT...	4	.....	Int..	RW...	Int..	RW...	½E...	Pr. St....	Cl..	820x120	128	56	9½	....	Vulcan	100
Bl....	Bl....	Bl....	Bl....	D-P....	UT...	3	Epicy...	Fab...	St. B..	TT...	TT...	4.3	½...	Int..	RW...	Int..	RW...	¼E...	Disk....	Cl..	700x 80	96	44	7½	950	Warren Lambert	101
Bl....	Bl....	Rol...	Bl....	Con.....	Amid..	3	Bev....	Fab...	SB....	Sp....	Sp....	4.27	½...	Int..	RW...	Int..	RW...	¼Dul.	Disk....	Cl..	.....	120	50	9	1680	Waverley	102
Bl....	Bl....	Bl....	Bl....	Con.....	Amid..	3	W.&Wh.	Fab...	SB....	Sp....	TA...	4.7	Full..	Int..	RW...	Int..	RW...	½E...	Disk....	Cl..	760x 90	110	49	7½	2060	Westwood	103
Bl....	Pl....	Rol...	Rol...	Con.....	UE...	3	W.&Wh.	Fab...	SB....	Sp....	Sp....	5.1	N...	Int..	RW...	Int..	RW...	¼E...	Pr. St....	Cl..	26x 3	97	44	7	784	Wolseley	104
Rol...	Pl....	Rol...	Rol...	MDO...	UA...	3	W.&Wh.	Star...	WU...	Sp....	TT...	5.25	½...	Int..	RW...	Int..	RW...	¼E...	Pr. St....	Cl..	710x 90	99	46	7	1000	Wolseley	105
Rol...	Rol...	Rol...	Rol...	MDO...	Amid..	3	W.&Wh.	Fab...	WU...	Sp....	TT...	4.8	½...	Int..	RW...	Int..	RW...	¼E...	Pr. St....	Cl..	815x105	118	52	7½	1680	Wolseley	106
B.&R.	Rol...	Rol...	B.&R.	MDO...	Amid..	4	W.&Seg.	S.&P..	WU...	Sp....	TA...	4.6	Full..	Int..	RW...	Ext..	DS...	Cant..	Wire....	Cl..	820x120	137	54	6½	2140	Wolseley	107

Clutch Type: **D P**—Dry Single Plate; **O P**—Single Plate in Oil; **Con**—Cone; **M D O**—Multiple Disk in Oil; **D M**—Dry Multiple Disk.

Gearset Location: **Amid**—Amidship; **U E**—Unit with Engine; **U A**—Unit with Axle; **U T**—Unit with Torque Tube; **F D**—Friction Drive.

Steering Gear Type: **W & Wh**—Worm and Full Worm Wheel; **W & Seg**—Worm and Worm Wheel Segment; **W & Nut**—Worm and Nut; **Rk & Pin**—Rack and Pinion; **Epicy**—Epicyclic; **Marles**—Marles Cam Gear.

Universal Joints: **Fab**—Fabric Disk; **S & P**—Star and Pot Type; **F & M**—Fabric Disk and Metal; **Pot**—Pot Type (metal); **Star**—Star Type (metal); **Lea**—Leather Disk; **S & L**—Star and Leather Disk; **M D**—Metal Disk.

Final Drive: **W O**—Worm Over Axle; **W U**—Worm Under Axle; **S B**—Spiral Bevel; **St B**—Straight Toothed Bevel; **I G**—Internal Gear.

Drive and Torque: **TT**—Torque Tube; **Sp**—Springs; **RR**—Radius Rods; **T A**—Torque Arm.

Rear Axle: **Full**—Full Floating; **½**—Semi-floating; **N**—Non-floating.

Brakes: **Int**—Internal Expanding Shoes; **Dsk**—Disk; **Ext**—External Contracting Shoes or Band; **R W**—On Rear Wheels; **P S**—On Pinion or Worm, Shaft, Front or Back or Axle Casing; **D S**—On Drive Shaft at Rear of Gearset.

Springs: **¼ E**—Quarter Elliptic; **½ E**—Semi-Elliptic; **¾ E**—Three-quarter Elliptic; **Trans**—Transverse Inverted Semi-Elliptic; **Cant**—Cantilever; **¼ Dul**—Two Super-imposed Quarter Elliptic; **C & ½ E**—Cantilever Fore and Aft Anchored to Semi-Elliptic Amidships, at Each Side of Chassis.

Wheels: **Pr St**—Hollow Spoked Pressed Steel with Integral Rim.

Tires: **Cl**—Clincher; **S S**—Straight Sided.

[1]Troughs Connected to Throttle.
[2]Four Valves Per Cyl.
[3]Oil Cooled Cylinders.

Radiator Casing Material

Sheet brass .....60 per cent
White metal .....32 per cent
Cast aluminum ..... 6 per cent
Sheet steel casing..... 2 per cent

Engine Mounting

In main frame.....82 per cent
In sub frame.....18 per cent

Suspension in Main Frame

4 point .....65 per cent
3 point .....35 per cent

Suspension in Sub Frame

4 point .....100 per cent

Sub Frame Support

4 point. .....68 per cent
6 point. .....16 per cent
3 point .....10 per cent
8 point ..... 6 per cent

Pistons, Material

Cast iron .....61 per cent
Aluminum .....37 per cent
Steel ..... 2 per cent

Type

Straight side .....88 per cent
Hour-glass ..... 6 per cent
Slipper ..... 5 per cent
Ricardo trunk ..... 1 per cent

Scraper Ring

None .....56 per cent
In skirt .....28 per cent
Above pin .....16 per cent

No. of Rings

3 .....63 per cent
2 .....29 per cent
4 ..... 6 per cent
5 ..... 1 per cent
6 ..... 1 per cent

Wrist Pin Fixing

Floating .....34 per cent
In piston bosses.....41 per cent
In connecting rod.....25 per cent

Engine Lubrication

Pressure .....54 per cent
Trough .....23 per cent
Trough and pressure.....17 per cent
Full pressure ..... 4 per cent
Splash ..... 2 per cent

(*Continued on page* 388)

Specifications of Continental European Passenger Car Chassis

(Compiled for Automotive Industries by W. F. Bradley.)

Nationality and Make	Wheelbase (In.)	Track (In.)	No. of Cylinders	Valve Location	Camshaft Location	Cylinder Head	BORE AND STROKE			Piston Displacement (Cu. In.)	H.P. (Nominal)	Cooling	Lubricating System	Carbureter Make	Fuel Feed	Ignition	Starting and Lighting	Clutch	Speeds	Gearset Location	Position of Levers	Final Drive	Tires Size (Mm.)	Wheels	Rear Springs	Brake Location
							Mm.	In.	Ratio																	
FRENCH																										
Alba	114	49	4	L...	C'case...	Fix.	65x130	2.56x5.12	2	105	9	Ther...	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Cone...	3	Amid..	R.....	Bev.....	760x90	Wood..	¼-El...	Fr.-R.....
Alva	118	51	4	I...	C'case...	Det.	75x130	2.95x5.12	1.7	139	11	Pump...	Press....	Solex.....	Vac...	De'co ...	Delco.....	Cone...	4	Unit E..	C.....	Bev.....	765x105	Wire....	½-El...	Fr.-R.....
Ariès	99	49	4	I...	Head...	Det.	60x85	2.36x3.85	1.4	59	5	Ther....	Circ.....	Claudel..	Vac..	Mag.....	2-Unit.....	Disk....	3	Amid...	C.....	Sp. Bev...	650x65	Disk....	¾-El...	R.....
Ariès	114	49	4	L...	C'case...	Fix.	72x120	2.83x4.73	1.7	119	10	Ther....	Press ...	Zenith....	Vac..	Mag.....	2-Unit.....	Disk....	4	Unit E..	R.....	Sp. Bev...	815x105	Disk....	½-El...	Fr.-R.....
Ariès	118	56	4	L...	C'case...	Fix.	80x140	3.15x5.52	1.7	172	15	Ther....	Press ...	Zenith....	Vac..	Mag.....	2-Unit.....	Disk....	4	Amid...	R.....	Sp. Bev...	880x120	Disk....	½-El...	R.....
Ballot	115	54	4	I...	C'case...	Det.	70x130	2.75x5.12	1.8	120	15	Pump...	Press....	Zenith....	Vac..	Delco....	Delco.....	Disk....	4	Unit E..	R.....	Bev.....	820x120	Wire....	Cant....	Fr.-R.....
Ballot	110	51	4	I...	Head...	Fix.	69.9x130	2.75x5.12	1.8	120	16	Pump...	Circ....	Zenith....	Vac..	Mag.....	2-Unit.....	Disk....	4	Amid...	R.....	Bev.....	820x120	Wire....	½-El...	Fr.-R.....
Beck	105	52	4	I...	Head...	Det.	65x113	2.56x4.12	1.7	92	10	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit.....	Disk....	3	Unit E..	C.....	Bev.....	765x105	Disk....	Coil....	Tr.-R.....
Bazelaire	110	55	4	L...	C'case...	Fix.	70x130	2.75x5.12	1.8	120	12	Pump...	Press....	Zenith....	Vac..	Delco....	2-Unit.....	Disk....	4	Unit E..	R.....	Bev.....	765x105	Disk....	½ El...	Tr.-R.....
Bazelaire	122	55	4	L...	C'case...	Fix.	80x140	3.15x5.52	1.7	172	12	Pump...	Press....	Zenith....	Vac ..	Mag.....	2 Unit.....	Disk....	4	Unit E..	R.....	Bev.....	820x120	Wire....	½ El...	Tr.-R.....
Bedelia	110	40	2	L...	C'case...	Fix.	80x99	3.15x3.90	1.2	61	6	Air.....	Splash...	Zenith....	Grav..	Mag.....	None.....	Plate....	3	Amid...	R.....	Belt.....	650x65	Wire....	¼ El...	R.....
Bellanger	103	57	4	I...	C'case...	Fix.	90x125	3.54x4.92	1.3	193	17	Pump...	Press....	Zenith....	Press.	Bat.....	2-Unit.....	Disk....	3	Unit E..	C.....	Sp. Bev...	810x90	Wood...	Cant....	F.-Tr.-R...
Bellanger	114	56	4	L...	C'case...	Det.	88x127	3.46x5.00	1.4	188	15	Ther....	Circ....	Jackson...	Grav..	Bat.....	2 Unit West..	Disk....	3	Unit E..	R.....	Sp. Bev...	820x105	Wood...	½ El...	R.....
Bellanger	147	57	8	I...	C'case,..	Fix.	90x125	3.54x4.92	1.3	386	50	Pump...	Press....	Zenith....	Press.	Bat.....	2-Unit.....	Disk....	3	Unit E..	R.....	Sp. Bev...	935x135	Steel....	Cant....	F.-Tr.-R...
Benjamin	89	34	4	L...	C'case...	Fix.	54x82	2.12x3.19	1.5	46	5	Ther....	Press....	Zenith....	Grav..	Mag.....	None.....	Disk....	3	Unit E..	R.....	Bev.....	650x65	Disk....	¾ El...	R.....
Berliet	123	56	4	L...	C'case...	Det.	90x130	3.54x5.12	1.4	200	16	Pump...	Circ....	Own.....	Vac..	Mag.....	1 Unit.....	Disk....	3	Unit E..	R.....	Sp. Bev...	820x120	Disk....	Cant....	Tr.-R.....
Berliet	135	57	4	L...	C'case...	Det.	100x140	3.94x5.52	1.4	267	25	Pump...	Press....	Own.....	Vac..	Mag.....	1 Unit.....	Disk....	4	Amid...	R.....	Sp. Bev...	895x150	Disk....	Cant....	Tr.-R.....
Bignan	102	41	4	I...	C'case...	Det.	62x90	2.44x3.54	1.4	66	8	Ther....	Circ....	Zenith....	Grav..	Mag.....	None.....	Disk....	3	Unit E..	R.....	Sp Bev...	650x65	Wire....	¾ El ...	R.....
Bignan	112	52	4	L...	C'case...	Fix.	92x130	3.62x5.12	1.4	210	18	Pump...	Press....	Zenith....	Vac..	Mag.....	2 Unit.....	Plate....	4	Unit E..	R.....	Sp. Bev...	820x120	Wire....	½ El ...	F. Tr. R...
Bollée, Léon	126	55	4	L...	C'case...	Fix.	85x130	3.35x5.12	1.5	179	15	Ther....	Press....	Zenith....	Vac..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Disk....	½-El...	Tr.-R.....
Bollée, Léon	130	55	6	I...	Head...	Det.	83x110	3.27x4.33	1.3	159	18	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Bev.....	820x120	Wood...	½-El...	Tr.-R.....
Brasier	129	55	4	L...	C'case...	Fix.	85x150	3.35x5.91	1.7	207	18	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit S.E.V..	Cone....	4	Amid...	R.....	Sp. Bev...	880x120	Wire....	½-El...	Tr.-R.....
Bugatti	95	44	4	I...	Head...	Fix.	65x100	2.56x3.94	1.5	81	6	Pump...	Press....	Zenith....	Press.	Mag.....	None.....	Disk....	4	Amid...	R.....	Bev.....	710x90	Wire....	¼-El...	Tr.-R.....
Bugatti	118	52	8	I...	Head...	Fix.	69x100	2.72x3.94	1.4	183	14	Pump...	Press....	Own.....	Grav..	Mag.....	1-Unit.....	Disk....	2	Unit A..	R.....	Bev.....	820x120	Wire....	¼-El...	Fr.-R.....
Buchet	105	48	4	L...	C'case...	Fix.	65x110	2.56x4.33	1.7	89	8	Ther....	Press....	Solex.....	Grav..	Mag.....	2-Unit.....	Cone....	4	Unit E..	C.....	Bev.....	760x90	Disk....	½-El...	Tr.-R.....
Charron	90	41	4	L...	C'case...	Fix.	58x100	2.28x3.94	1.7	64	6	Ther....	Circ....	Zenith....	Grav..	Mag.....	1-Unit.....	Cone....	3	Unit E..	C.....	Bev.....	710x90	Disk....	½-El...	Tr.-R.....
Charron	134	56	4	L...	C'case...	Fix.	85x150	3.35x5.91	1.7	208	15	Pump...	Circ....	Zenith....	Vac..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	880x120	Wire....	½-El...	Tr.-R.....
Chenard & Walcker	110	47	4	L...	C'case...	Fix.	69x100	2.72x3.94	1.4	91	8	Ther....	Press....	Solex.....	Grav..	Mag.....	2-Unit.....	Cone....	3	Amid...	R.....	Int. Gear.	710x90	Disk....	½-El...	Tr.-R.....
Chenard & Walcker	112	52	4	L...	C'case...	Fix.	70x130	2.75x5.12	1.8	120	10	Ther....	Press....	Solex.....	Vac..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Int. Gear.	760x90	Disk	½-El...	Tr.-R.....
Chenard & Walcker	130	55	4	L...	C'case...	Fix.	80x150	3.15x5.91	1.8	184	15	Ther....	Press....	Solex.....	Vac..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Int. Gear.	880x120	Wire....	½-El...	Tr.-R.....
Chenard & Walcker	120	55	4	I...	C'case...	Fix.	80x150	3.15x5.91	1.8	184	15	Ther....	Press....	Solex.....	Vac..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Int. Gear.	880x120	Wire....	½-El...	F.-Tr.-R...
Citroen	90	47	4	L...	C'case...	Det.	55x90	2.16x3.54	1.6	52	5	Ther....	Pump...	Solex.....	Grav.	Delco....	Delco.....	Plate....	3	Unit E..	C.....	Chev.....	650x65	Disk....	¼-El...	R.....
Citroen	114	48	4	L...	C'case...	Det.	65x100	2.56x3.94	1.5	81	10	Ther....	Press....	Solex.....	Grav..	Mag.....	2-Unit.....	Plate....	3	Unit E..	C.....	Chev.....	710x90	Disk....	¼-El...	Tr.-R.....
Colda	107	50	4	L...	C'case...	Fix.	70x120	2.75x4.73	1.7	111	10	Ther....	Circ....	Zenith....	Vac..	Mag.....	2-Unit.....	Plate....	3	Unit E..	C.....	Bev.....	760x90	Wire	½-El...	Fr.-R.....
Corre-la-Licorne	102	49	4	L...	C'case...	Fix.	65x100	2.56x3.94	1.5	81	10	Ther....	Press....	Zenith....	Grav..	Mag.....	Lights only....	Cone....	4	Amid...	R.....	Bev.....	710x90	Disk ..	½-El...	Tr.-R.....
Corre-la-Licorne	110	49	4	L...	C'case...	Fix.	65x120	2.56x4.72	1.8	97	11	Ther....	Press....	Zenith....	Grav..	Mag.....	Lights only....	Cone....	4	Amid...	R.....	Bev.....	760x90	Disk ...	½-El...	Tr.-R.....
Cottin-Desgouttes	133	55	4	L...	C'case...	Fix.	80x160	3.15x6.30	2	196	14	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit S.E.V..	Cone....	4	Unit E..	R.....	Sp. Bev...	880x120	Disk	Cant	Tr.-R.....
Cottin-Desgouttes	133	55	4	L...	C'case...	Fix.	90x160	3.54x6.30	1.7	247	18	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit S.E.V..	Cone....	4	Unit E..	R.....	Sp. Bev	880x120	Disk	Cant....	Tr.-R.....
Cottin-Desgouttes	133	55	4	L...	C'case...	Fix.	100x160	3.94x6.30	1.6	305	23	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit S.E.V..	Cone....	4	Unit E	R ...	Sp. Bev...	880x120	Wire....	Cant....	Tr.-R.....
Crespelle	135	55	4	L...	C'case...	Fix.	80x120	3.15x4.73	1.5	147	14	Pump...	Circ....	Zenith....	Vac..	Mag.....	2-Unit.....	Disk....	4	Amid	R.....	Bev.....	820x120	Disk....	½-El...	Tr.-R.....
De Dion-Bouton	114	48	4	L...	C'case...	Fix.	70x120	2.75x4.72	1.7	111	12	Pump...	Press....	Zenith....	Grav..	Mag.....	2-Unit own....	Plate....	4	Unit E	R.....	Sp. Bev...	760x90	Disk....	Cant....	Tr.-R.....
De Dion-Bouton	133	52	4	L...	C'case...	Fix.	85x130	3.35x5.12	1.5	180	15	Pump...	Press....	Solex.....	Vac..	Mag.....	1-Unit.....	Plate....	4	Unit E	R.....	Sp. Bev...	880x120	Disk....	Cant....	R.....
De Dion-Bouton	125	49	8	L...	C'case..	Fix.	65x100	2.56x3.94	1.5	162	18	Pump...	Press....	Solex.....	Vac..	Mag.....	1-Unit.....	Plate....	4	Unit E..	R.....	Sp. Bev...	815x105	Disk....	Cant....	R.....
De Dion-Bouton	133	52	8	L...	C'case..	Int.	70x120	2.75x4.72	1.7	222	20	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit own ..	Plate....	4	Unit E..	R.....	Sp. Bev...	880x120	Disk....	Cant....	Tr-R.....
Delage	116	52	4	L...	C'case..	Det.	72x130	2.83x5.12	1.8	129	11	Ther....	Circ....	Zenith....	Vac..	Mag.....	1-Unit.....	Disk....	4	Unit E..	C.....	Sp. Bev...	765x105	Wire....	½-El...	Fr.-R.....
Delage	135	56	4	L...	C'case..	Fix.	80x150	3.15x5.91	1.8	184	16	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit S.E.V..	Disk....	4	Unit E..	R.....	Sp. Bev...	880x120	Wire....	¾-El...	F.-Tr.-R...
Delage	135	56	6	I...	C'case..	Fix.	80x150	3.15x5.91	1.8	276	25	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit S.E V..	Disk....	4	Unit E..	R.....	Sp. Bev...	895x135	Wire....	¾-El...	F.-Tr.-R...
Delage	135	56	6	L...	C'case..	Fix.	80x150	3.15x5.91	1.8	276	25	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit S.E.V..	Disk....	4	Unit E..	R.....	Sp. Bev...	895x135	Wire....	¾-El...	F.-Tr.-R...
Delahaye	118	51	4	L...	C'case..	Fix.	70x120	2.75x4.72	1.7	111	10	Pump...	Circ....	Solex.....	Vac..	Mag.....	1-Unit.....	Cone....	4	Unit E..	C.....	Sp. Bev...	765x105	Disk....	½-El...	Tr.-R.....
Delahaye	129	54	4	L...	C'case..	Fix.	85x130	3.35x5.12	1.5	179	18	Pump...	Circ....	Claudel..	Vac..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Wire....	½-El...	Tr.-R.....
Delahaye	136	54	6	L...	C'case..	Fix.	85x130	3.35x5.12	1.5	269	18	Pump...	Circ....	Cozette..	Vac..	Mag.....	2-Unit.....	Cone....	4	Unit E..	R.....	Sp. Bev...	895x135	Wire....	½-El...	Fr -R.....
Delaugère-Clayette	116	56	4	I...	C'case..	Det.	70x140	2.75x5.51	2	131	10	Pump...	Circ....	Zenith....	Vac..	Mag.....	1-Unit S.E.V..	Cone....	4	Unit E..	R.....	Bev.....	815x105	Disk....	½-El...	Tr.-R.....
Delaugère-Clayette	125	56	4	L...	C'case..	Fix.	85x140	3.35x5.51	1.6	194	15	Pump...	Circ....	Zenith....	Vac..	Mag.....	1-Unit.....	Cone....	4	Unit E..	R.....	Sp. Bev...	880x120	Disk....	½-El...	R.....
Delaunay-Belleville	120	56	4	L...	C'case..	Det.	72x120	2.83x4.72	1.7	119	10	Pump...	Press....	Solex.....	Vac..	Mag.....	1-Unit.....	Disk....	4	Unit E..	R.....	Sp. Bev...	765x105	Disk....	½-El...	Tr.-R.....
Delaunay-Belleville	133	56	6	L...	C'case..	Fix.	78x140	3.07x5.51	1.8	215	20	Pump...	Press....	Own.....	Vac..	Mag.....	2-Unit.....	Disk....	4	Amid...	R.....	Sp. Bev...	895x135	Wire....	Plat....	Tr.-R.....
Delaunay-Belleville	142	59	6	L...	C'case..	Fix.	88x150	3.46x5.91	1.7	333	30	Pump...	Press....	Own.....	Vac..	Mag.....	2-Unit.....	Disk....	4	Amid...	R.....	Sp. Bev...	895x135	Wire....	Plat....	Tr.-R.....
Delaunay-Belleville	145	56	6	I...	C'case..	Det.	103x160	4.06x6.30	1.5	488	45	Pump...	Press....	Own.....	Vac..	Mag.....	2-Unit	Disk....	4	Amid...	R.....	Sp. Bev...	935x135	Wire....	Plat....	Tr.-R.....
Doriot-Flandrin & Parant	110	47	4	L...	C'case...	Det.	65x120	2.16x4.72	1.8	97	10	Ther....	Press....	Zenith....	Vac..	Delco....	1-Unit.....	Cone....	3	Unit E..	R.....	Sp. Bev...	760x90	Disk....	½-El...	R.....
Doriot-Flandrin & Parant	119	50	4	L...	C'case...	Fix.	70x130	2.75x5.12	1.8	122	12	Pump...	Circ....	Zenith....	Vac..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	765x105	Disk....	Cant....	Fr.-R.....
Farman	142	56	6	I...	Head...	Fix.	100x140	3.94x5.51	1.4	401	40	Pump...	Press....	Zenith....	Vac..	Mag.....	2-Unit.....	Disk....	4	Unit E..	C.....	Sp. Bev...	895x135	Wire....	Cant....	Tr.-R.....
Fonck	122	55	4	I...	Head...	Det.	80x130	3.15x5.12	1.6	160	15	Pump...	Press ..	Cozette..	Vac..	Mag.....	2-Unit.....	Disk....	3	Unit E..	R.....	Sp. Bev...	820x120	Wire....	½-El...	F.-Tr.-R..
Fonck	143	55	8	I...	Head...	Det.	80x130	3.15x5.12	1.6	319	30	Pump...	Press ...	Cozette...	Vac..	2 Mags...	2-Unit.....	Disk....	3	Unit E..	R.....	Sp. Bev...	895x135	Wire....	½-El...	F-Tr.-R...
Gobron	145	56	6	Sl...	C'case...	Fix.	85x220	3.35x8.66	2.6	458	40	Pump...	Press....	Zenith....	Vac..	Delco....	Delco.....	Disk....	3	Unit E..	R.....	Bev.....	895x135	Wire....	Cant....	Fr.-R.....

Nationality and Make	Wheelbase (In.)	Track (In.)	No. of Cylinders	Valve Location	Camshaft Location	Cylinder Head	BORE AND STROKE Mm.	In.	Ratio	Piston Displacement (Cu. In.)	H.P. (Nominal)	Water Circulation	Lubricating System	Carbureter Make	Fuel Feed	Ignition	Starting and Lighting	Clutch	Speeds	Gearset Location	Position of Levers	Final Drive	Tires (Mm.)	Wheels	Rear Springs	Brake Location
FRENCH (Contin.)																										
Gregoire	118	51	4	L...	C'case...	Fix.	70x130	2.75x5.12	1.8	120	11	Pump...	Press....	Zenith....	Vac...	Delco.....	Delco.....	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Wire....	½-El...	Tr.-R.....
Gregoire	118	51	4	I...	C'case...	Det.	75x130	2.95x5.12	1.7	139	16	Pump...	Press....	Zenith....	Vac...	Db. Delco.	Db. Delco	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Wire....	½-El...	Tr.-R.....
Hispano-Suiza	145	56	6	I...	Head...	Fix.	100x140	3.94x5.52	1.4	401	40	Pump...	Press....	Own.....	Press..	Delco.....	2-Unit Delco...	Disk....	3	Unit E..	R.....	Sp. Bev...	895x135	Wire....	½-El...	Tr.-R.....
Hotchkiss	132	55	4	I...	Head...	Det.	95x140	3.74x5.52	1.4	242	18	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	895x135	Wire....	½-El...	Tr.-R.....
Hotchkiss	147	57	6	I...	Head...	Det.	100x140	3.94x5.51	1.4	401	30	Pump...	Press....	Zenith....	Vac...	M. Delco..	2-Unit.....	Disk....	4	Unit E..	C.....	Sp. Bev...	895x135	Wire....	Cant....	Tr.-R.....
Hurtu	118	51	4	L...	C'case...	Fix.	76x130	2.99x5.12	1.7	144	14	Ther....	Press....	Solex.....	Grav..	Mag.....	1-Unit.....	Cone....	4	Unit E..	C.....	Sp. Bev...	895x135	Wire....	Cant....	F.-Tr.-R...
Irat	110	51	4	I...	C'case...	Det.	70x130	2.75x5.12	1.7	122	10	Ther....	Press....	Zenith....	Vac...	Mag.....	1-Unit.....	Cone....	4	Unit E..	R.....	Bev.....	810x90	Wood...	Cant....	Tr.-R.....
La Buire	117	52	4	L...	C'case...	Fix.	75x150	2.95x5.90	2	161	12	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	C.....	Sp. Bev...	760x90	Disk....	½-El...	Fr.-R.....
Lorraine-Dietrich	114	56	6	I...	C'case...	Fix.	75x130	2.95x5.12	1.7	209	16	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Unit E..	R.....	Bev.....	820x120	Disk....	Cant....	Fr.-R.....
Lorraine-Dietrich	131	56	6	L...	C'case...	Fix.	90x160	3.54x6.30	1.7	370	30	Pump...	Press....	Zenith....	Vac...	Delco.....	Delco.....	Plate....	3	Unit E..	C.....	Sp. Bev...	815x105	Steel....	Cant....	R.....
Majola	91	40	4	I...	C'case...	Fix.	59x90	2.32x3.54	1.5	59	12	Ther....	Press....	Claudel...	Grav..	Mag.....	Lights only....	Cone....	3	Amid...	R.....	Bev.....	710x90	Wire....	¾-El...	Tr.-R.....
Majola	110	40	4	I...	C'case...	Fix.	65x105	2.56x4.13	1.6	84	20	Ther....	Press....	Claudel...	Grav..	Mag.....	Lights only....	Cone....	3	Amid...	R.....	Bev.....	760x90	Disk....	½-El...	Tr.-R.....
Mathis	92	43	4	L...	C'case...	Fix.	55x80	2.16x3.15	1.4	46	5	Ther....	Circ....	Solex.....	Grav..	Mag.....	Lights only....	Cone....	3	Amid...	R.....	Bev.....	760x90	Disk....	¼-El...	R.....
Mathis	94	43	4	L...	C'case...	Fix.	60x100	2.36x3.94	1.7	68	10	Ther....	Press....	Solex.....	Grav..	Mag.....	1-Unit.....	Disk....	4	Unit E..	C.....	Sp. Bev...	760x80	Disk....	½-El...	R.....
Mors	125	54	4	Sl...	C'case...	Det.	80x140	3.15x5.51	1.7	172	15	Pump...	Circ....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	3	Unit E..	C.....	Bev.....	710x90	Disk....	½-El...	R.....
Motobloc	128	52	4	L...	C'case...	Fix.	80x120	3.15x4.72	1.5	147	12	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Band...	4	Amid...	R.....	Chev.....	820x120	Disk....	½-El...	Fr.-Tr.-R..
Motobloc	128	52	4	L...	C'case...	Fix.	80x148	3.15x5.83	1.8	181	15	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	R.....	Bev.....	820x120	Disk....	¾-El...	Tr.-R.....
Mourre	86	40	2	L...	C'case...	Fix.	75x120	2.95x4.72	1.6	65	8	Ther....	Splash...	Zenith....	Grav.	Mag.....	None	Frict....	Frict.	Chain...	R.....	Chain....	650x65	Wire....	¼-El...	R.....
Panhard & Levassor	107	51	4	L...	C'case...	Kngt	60x105	2.36x4.13	1.7	73	10	Pump...	Circ....	Own.....	Vac...	Mag.....	1-Unit.....	Plate....	4	Unit E..	C.....	Sp. Bev...	760x90	Wood...	¼-El...	R.....
Panhard & Levassor	114	56	4	L...	C'case...	Fix.	72x140	2.83x5.51	1.9	139	12	Pump...	Circ....	Own.....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R.....	Sp. Bev...	820x120	Wire....	½-El...	R.....
Panhard & Levassor	129	56	4	Sl...	C'case...	Det.	85x140	3.35x5.51	1.6	193	16	Pump...	Circ....	Own.....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R.....	Sp. Bev...	820x120	Wire....	½-El...	R.....
Panhard & Levassor	136	55	4	Sl...	C'case...	Det.	105x140	4.13x5.51	1.3	296	20	Pump...	Circ....	Own.....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R.....	Sp. Bev...	880x120	Wood...	½-El...	R.....
Panhard & Levassor	148	58	8	Sl...	C'case...	Kn.	85x140	3.35x5.51	1.6	388	40	Pump...	Circ....	Own.....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R.....	Sp. Bev...	895x135	Wood...	½-El...	R.....
Paquis	100	47	4	L...	C'case...	Fix.	65x120	2.56x4.72	1.8	97	10	Ther....	Circ....	Zenith....	Grav..	Mag.....	Light.....	Cone....	4	Amid...	R.....	Bev.....	760x90	Disk....	½-El...	Fr.-R.....
Paulet	126	56	6	I...	C'case...	Det.	75x130	2.95x5.12	1.7	210	30	Pump...	Press....	Zenith....	Delco.	Delco.....	2-Unit.....	Disk....	3	Unit E..	C.....	Sp. Bev...	895x135	Wire....	½-El...	R.....
Peugeot	90	36	4	L...	C'case...	Fix.	50x85	1.98x3.35	1.7	39	8	Ther....	Press....	Zenith....	Grav..	Mag.....	None.....	Cone....	3	Unit A..	R.....	Worm.....	650x65	Wire....	¼-El...	R.....
Peugeot	98	47	4	L...	C'case...	Fix.	66x105	2.60x4.13	1.6	88	10	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	C.....	Worm.....	710x90	Wood...	Cant....	R.....
Peugeot	122	54	4	L...	C'case...	Fix.	82x130	3.23x5.12	1.5	167	14	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Amid...	R.....	Sp. Bev...	820x120	Wire....	Cant....	R.....
Peugeot	144	57	6	Sl...	C'case...	Fix.	95x140	3.74x5.51	1.4	424	25	Pump...	Press....	2-Zenith..	Vac...	Mag.....	2-Unit.....	Disk....	4	Amid...	R.....	Sp. Bev...	820x120	Wood...	½-El...	R.....
Philos	117	49	4	L...	C'case...	Fix.	65x120	2.56x4.72	1.8	97	10	Ther....	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Amid...	R.....	Sp. Bev...	880x120	Wire....	Cant....	R.....
Renault	103	56	4	L...	C'case...	Fix.	75x120	2.95x4.72	1.6	129	10	Ther....	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Disk....	3	Unit E..	R.....	Bev.....	760x90	Disk....	½-El...	Tr.-R.....
Renault	120	56	4	L...	C'case...	Fix.	80x140	3.15x5.51	1.7	172	12	Ther....	Circ....	Own.....	Grav..	Mag.....	1-Unit.....	Cone....	3	Amid...	R.....	Sp. Bev...	760x90	Disk....	Transv..	Tr.-R.....
Renault	130	56	4	L...	C'case...	Fix.	95x160	3.74x6.30	1.7	330	18	Ther....	Circ....	Own.....	Grav..	Mag.....	2-Unit S.E.V...	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Wood...	½-El...	Tr.-R.....
Renault	145	56	6	L...	C'case...	Fix.	80x140	3.15x5.51	1.7	257	40	Ther....	Circ....	Own.....	Press.	Mag.....	2-Unit S.E.V...	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Wood...	½-El...	Tr.-R.....
Rochet-Schneider	129	53	4	L...	C'case...	Fix.	80x130	3.15x5.12	1.6	160	12	Ther....	Press....	Zenith....	Grav..	Mag.....	1-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Wood...	½-El...	Tr.-R.....
Rochet-Schneider	133	56	4	L...	C'case...	Fix.	95x140	3.74x5.51	1.4	242	18	Ther....	Press....	Zenith....	Press.	Mag.....	2-Unit.....	Cone....	4	Unit E..	R.....	Sp. Bev...	815x105	Disk....	Cant....	Tr.-R.....
Rochet-Schneider	141	57	6	L...	C'case...	Fix.	100x130	3.94x5.12	1.3	374	30	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	880x120	Disk....	Cant....	Fr.-Tr.-R..
Rolland-Pilain	111	51	4	L...	C'case...	Fix.	70x125	2.75x4.92	1.7	115	10	Ther....	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	880x120	Disk....	Cant....	Fr.-Tr.-R..
Rolland-Pilain	118	52	4	L...	C'case...	Fix.	74x130	2.91x5.12	1.7	136	12	Ther....	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Unit E..	R.....	Bev.....	765x105	Disk....	½-El...	Tr.-R.....
Rolland-Pilain	133	54	4	I...	C'case...	Det.	95x140	3.74x5.51	1.4	242	18	Ther....	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Unit E..	R.....	Sp. Bev...	815x105	Disk....	½-El...	Fr.-R.....
Roy	110	44	4	L...	C'case...	Fix.	70x100	2.75x3.94	1.4	94	10	Ther....	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Unit E..	R.....	Sp. Bev...	880x120	Disk....	½-El...	Fr.-R.....
Roy	128	53	4	L...	C'case...	Fix.	85x130	3.35x5.12	1.5	179	14	Pump...	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Cone....	3	Amid...	R.....	Bev.....	760x90	Disk....	½-El...	R.....
Salmson	102	40	4	I...	C'case...	Det.	62x90	2.44x3.54	1.4	66	8	Ther....	Circ....	Zenith....	Grav..	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Bev.....	815x105	Disk....	½-El...	Tr.-R.....
S. C. A. P.	118	52	4	L...	C'case...	Fix.	76x130	2.99x5.12	1.7	144	12	Pump...	Press....	Claudel...	Vac...	Mag.....	None.....	Plate....	3	Unit E..	R.....	Bev.....	650x65	Wire....	½-El...	Tr.-R.....
Schneider, Th.	125	55	4	L...	C'case...	Det.	82.5x140	3.25x5.52	1.7	183	14	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	815x105	Disk....	Platef...	Tr.-R.....
Schneider, Th.	136	55	6	L...	C'case...	Det.	82.5x140	3.25x5.52	1.7	275	30	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Amid...	R.....	Sp. Bev...	875x105	Steel....	½-El...	Tr.-R.....
Secq. Hoyau	114	54	4	L...	C'case...	Fix.	60x110	2.36x4.33	1.8	75	10	Ther....	Press....	Claudel...	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R.....	Sp. Bev...	880x120	Steel....	Cant....	Tr.-R.....
Sidéa	107	43	4	L...	C'case...	Fix.	69x100	2.72x3.94	1.4	91	9	Ther....	Circ....	Zenith....	Grav..	Mag.....	1-Unit.....	Disk....	4	Amid...	R.....	Sp. Bev...	710x90	Wire....	½-El...	Tr.-R.....
Sigma	113	45	4	L...	C'case...	Fix.	65x120	2.56x4.72	1.8	97	10	Ther....	Circ....	Zenith....	Grav..	Mag.....	.....	Cone....	4	Amid...	R.....	Bev.....	760x90	Disk....	½-El...	R.....
Sizaire Berwick	135	55	4	L...	C'case...	Fix.	95x160	3.74x6.30	1.7	277	20	Pump...	Press....	Cozette...	Vac...	Mag.....	2-Unit.....	Plate....	4	Amid...	R.....	Bev.....	760x90	Disk....	½-El...	Tr.-R.....
Slim	109	54	4	I...	C'case...	Det.	65x130	2.56x5.12	2	105	12	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Amid...	R.....	Bev.....	.....	Wire....	½-El...	Tr.-R.....
Soriano-Pedroso	100	44	4	L...	C'case...	Fix.	65x120	2.56x4.72	1.8	97	8	Ther....	Press....	Zenith....	Vac...	Mag.....	1-Unit.....	Cone....	4	Unit A..	R.....	Bev.....	765x105	Disk....	¾-El...	Fr.-R.....
Suère	112	48	4	L...	C'case...	Det.	70x120	2.75x4.72	1.7	122	10	Ther....	Press....	Zenith....	Grav..	Mag.....	Lighting.....	Cone....	4	Amid...	R.....	Bev.....	710x90	Wire....	¼-El...	R.....
Talbot-Darracq	118	49	4	I...	C'case...	Det.	66x120	2.60x4.72	1.8	100	10	Pump...	Press....	Lachar....	Grav..	Mag.....	1-Unit.....	Cone....	3	Unit E..	C.....	Sp. Bev...	760x90	Disk....	½-El...	R.....
Talbot-Darracq	124	51	4	L...	C'case...	Fix.	85x130	3.35x5.12	1.5	179	14	Pump...	Press....	Claudel...	Vac...	Delco.....	3-Unit.....	Plate....	3	Unit E..	C.....	Sp. Bev...	765x105	Wood....	Cant....	R.....
Talbot-Darracq	138	34	8	L...	C'case...	Det.	75x130	2.95x5.12	1.7	278	20	Pump...	Press....	Smith.....	Vac...	Mag.....	2-Unit.....	Plate....	4	Amid...	R.....	Worm.....	820x120	Wood....	Cant....	Tr.-R.....
Turcat-Méry	129	56	4	L...	C'case...	Fix.	80x150	3.15x5.90	1.8	183	25	Pump...	Press....	Smith.....	Vac...	Delco.....	2-Unit Delco...	Plate....	4	Unit E..	C.....	Sp. Bev...	835x135	Disk....	Cant....	Fr.-R.....
Unic	106	53	4	L...	C'case...	Fix.	65x110	2.56x4.33	1.6	89	10	Ther....	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Cone....	4	Unit E..	R.....	Sp. Bev...	820x120	Disk....	½-El...	Tr.-R.....
Unic	125	54	4	L...	C'case...	Fix.	80x130	3.15x5.12	1.6	160	15	Pump...	Press....	Own.....	Grav..	Mag.....	None.....	Cone....	4	Amid...	R.....	Sp. Bev...	815x105	Disk....	¼-El...	Tr.-R.....
Vermorel	112	51	4	L...	C'case...	Fix.	70x110	2.75x4.33	1.6	103	8	Ther....	Press....	Own.....	Vac...	Mag.....	S.E.V.....	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Wire....	Db.Cant	Tr.-R.....
Vermorel	122	55	4	L...	C'case...	Fix.	74x130	2.91x5.12	1.7	135	12	Ther....	Press....	Zenith....	Vac...	Mag.....	1-Unit.....	Cone....	4	Unit E..	C.....	Sp. Bev...	765x105	Disk....	½-El...	Tr.-R.....
Vinot-Deguingand	118	51	4	I...	C'case...	Fix.	70x120	2.75x4.72	1.7	113	12	Pump...	Circ....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Unit E..	C.....	Bev.....	815x105	Steel....	Cant. & ¼-El	Fr.-Tr.-R
Vinot-Deguingand	117	53	4	L...	C'case...	Fix.	80x130	3.15x5.12	1.6	159	14	Pump...	Press....	Zenith....	Vac...	Mag.....	1-Unit.....	Cone....	4	Amid...	R.....	Bev.....	765x105	Disk....	½-El...	Tr.-R.....
Vinot-Deguingand	117	53	4	I...	C'case...	Fix.	80x130	3.15x5.12	1.6	159	14	Pump...	Press....	Zenith....	Vac...	Mag.....	1-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Disk....	½-El...	Tr.-R.....
Voisin	111	41	4	Sl...	C'case...	Det.	60x110	2.36x4.33	1.8	76	10	Ther....	Circ....	Zenith....	Grav..	Mag.....	1-Unit.....	Cone....	4	Amid...	R.....	Sp. Bev...	820x120	Disk....	½-El...	Tr.-R.....
Voisin	136	56	4	Sl...	C'case...	Det.	95x140	3.74x5.51	1.5	242	18	Pump...	Press....	Zenith....	Grav..	Mag.....	1-Unit.....	Disk....	3	Unit E	C	Sp. Bev	765x105	Disk....	½-El	R
Voisin	136	56	4	Sl...	C'case...	Det.	95x140	3.74x5.51	1.5	242	18	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E	R	Sp. Bev	880x120	Disk....	Cant	R
Voisin	150	56	12	Sl...	C'case...	Det.	80x120	3.15x4.72	1.5	442	40	Pump...	Circ....	Zenith....	Vac...	Delco.....	Delco.....	Plate....	3	Unit E	C	Sp. Bev	895x135	Disk....	½-El	Fr.-Tr.-R
Zebre	80	39	1	L...	C'case.	Fix.	88x106	3.46x4.13	1.2	39	6	Ther....	Circ....	Zenith....	Grav..	Mag.....	None.....	Plate....	3	Amid	R	Bev	700x80	Wire....	½-El	Tr.-R
Zebre	99	44	4	L...	C'case.	Fix.	55x105	2.16x4.13	1.9	61	8	Ther....	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Plate....	4	Unit E	C	Bev	710x90	Wire....	Cant	Tr.-R
Zedel	113	51	4	L...	C'case.	Fix	70x120	2.75x4.72	1.7	113	10	Ther....	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	...	Unit E	R	Sp. Bev	760x90	Wood....	½-El	Tr.-R.....
Zedel	117	48	4	L...	C'case.	Fix	82x130	3.23x5.12	1.5	167	13	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E	R	Bev	820x120	Steel....	½-El	Tr.-R.....

Abbreviations—Valve Location: **L,** valves both on one side; **I,** valves in head; **Sl,** sleeve valves. **Camshaft location: Cc,** in base chamber, with valve operation by pushrods; **H,** overhead. **Lubricating system: Press.,** full pressure with hollow Crankshaft; **Circ.,** pump circulating type, without hollow crankshaft; **Fuel Feed: Vac.,** Vacuum; **Press.,** Pressure; **Grav.,** Gravity. **Gearset location: Amid.,** gearbox mounted independently of engine; **Unit E,** gearbox unit with engine; **Unit A,** gears in rear axle. **Ignition: Mag.,** Magneto; **Bat.,** Battery. **Wheels: Steel,** steel spoke wheels. **Brake location: Fr.,** on front wheels; **Tr.** on transmission; **R,** on rear wheels.

Specifications of Continental European Passenger Car Chassis—1922

Nationality / Make and Model	Wheelbase, Ins.	No. of Cylinders	Revolutions Per Minute	Brake Horse Power	BORE AND STROKE			Piston Displacement (Cu In.)	Camshaft Drive	Valve Location	Cooling	Type of Lubricating System	Make of Carbureter	Fuel Feed	Ignition Make	Electric System	Clutch Type	No. Forward Speeds	Gearset Location	Final Drive	Torque Taken By	Type of Steering Gear	Tire Size (Mm.)	Type of Wheels	Type of Rear Springs	BRAKE LOCATION		Chasis Weight (Lbs.)
					Mm.	Ins.	Ratio																			Hand	Foot	
GERMAN																												
Adler 6-18	104	4	2000	18	67x110	2.64x4.33	1.49	95	Chan..	L...	Ther....	Pres..	Zenith....	P.....	Eise....	Bosch...	Cone....	3	Amid...	Bevl.....	T-T..	Worm..	760x100	Wire....	½-E....	R...	Tr..	1320
Adler 9-24	119	4	2000	25	79x118	3.11x4.65	1.49	141	Chan..	L...	Pump...	Pres..	Zenith....	P.....	Bosch...	Bosch...	Cone....	4	Unit E..	Bevl.....	T-T..	Scrw...	820x120	Wire....	½-E....	R...	Tr..	2160
Adler 12-34	134	4	1800	42	86x135	3.38x5.32	1.57	191	Spur..	L...	Pump...	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Cone....	4	Unit E..	S-B.....	T-T..	Scrw...	880x125	Wire....	½-E....	R...	Tr..	2650
Adler 18-48	134	4	1800	60	100x150	3.94x5.91	1.50	287	Spur..	L...	Pump...	Pres..	Pallas.....	V.....	Bosch...	Eise....	Cone....	4	Unit E..	S-B.....	T-T..	Scrw...	930x135	Wire....	½-E....	R...	Tr..	2770
Aga 6-20	101	4	2800	20	64x110	2.52x4.33	1.72	86	Spur..	L...	Ther....	Spl...	Own.....	V.....	Bosch...	Bosch...	Cone....	3	Unit E..	S-B.....	Spr...	Worm..	760x100	Opt.....	½-E....	R...	Tr..	1150
Apollo 4-14	80	4	2000	14	60x92	2.36x3.62	1.53	64	Spur..	I...	Ther....	Spl...	Opt.....	G.....	Eise....	Bosch...	Cone....	3	Amid...	Bevl.....	Spr...	Rack...	660x 75	Wood...	Cant....	R...	Tr..	993
Apollo 10-30	91	4	2000	30	82x116	3.23x4.56	1.41	149	Spur..	L...	Ther....	Spl...	Opt.....	P.....	Eise....	Eise....	Cone....	4	Amid...	Bevl.....	.....	Worm..	820x120	Steel....	Cant....	R...	Tr..	1980
Apollo 12-45	91	8	2000	45	70x100	2.75x3.94	1.43	188	Spur..	I...	Ther....	Pres..	Opt.....	P.....	Eise....	Fenag...	Cone....	4	Amid...	Bevl.....	.....	Worm..	820x120	Wire....	Cant....	R...	Tr..	1980
Audi K	139	4	2200	50	90x140	3.54x5.51	1.56	217	Heli..	I...	Ther....	Pres..	Zenith....	P.....	Bosch...	Bosch...	Cone....	4	Unit E..	S-B.....	T-T..	Scrw...	895x135	Opt.....	½-E....	R...	Tr..	2650
Beckmann 8-24	122	4	1800	24	76x110	2.99x4.33	1.45	122	Spur..	I...	Ther....	Pres..	Zenith....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	.....	Worm..	815x105	Wood...	½-E....	R...	Tr..	1760
Beckmann 10-30	132	4	1800	30	82x120	3.23x4.73	1.46	155	Spur..	I...	Ther....	Pres..	Zenith....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	.....	Worm..	820x120	Wood...	½-E....	R...	Tr..	1980
Benz 8-20	112	4	2000	20	74.5x120	2.93x4.73	1.61	171	Chan..	L...	Ther....	Pres..	Zenith....	P.....	Eise....	Bosch...	Cone....	4	Amid...	Bevl.....	T-T ..	Scrw..	815x105	Opt.....	½-E....	R..	Tr..	1720
Benz 10-30	123	4	2200	30	80x130	3.15x5.12	1.62	159	Chan..	L...	Ther....	Pres..	Zenith....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	820x120	Opt.....	½-E....	R...	Tr..	1980
Benz 14-30	134	4	1850	30	90x140	3.54x5.51	1.56	217	Chan..	L...	Pump...	Pres..	Zenith....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	880x120	Opt.....	½-E....	R...	Tr..	2210
Benz 16-50	137	6	1950	50	80x138	3.13x5.43	1.72	254	Chan..	L...	Pump...	Pres..	Zenith....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	880x135	Opt.....	½-E....	R...	Tr..	2430
Benz 27-70	144	6	1550	70	100x150	3.94x5.91	1.50	432	Chan..	L...	Pump...	Pres..	Zenith....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	935x135	Opt.....	Cant....	R...	Tr..	3200
Benz Soehne 8-25	120	4	2000	20	75x120	2.95x4.73	1.60	129	Chan..	L...	Ther....	Pres..	Zenith....	V.....	Bosch...	Opt.....	Cone....	4	Amid...	Bevl.....	Spr...	Scrw...	815x105	Wood...	¾-E....	R...	Tr..	1670
Benz Soehne 14-42	127	4	1800	42	90x140	3.54x5.51	1.56	217	Heli...	L...	Ther....	Pres..	Zenith....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	.....	Scrw...	880x135	Wood ..	½-E....	R...	Tr..	2160
Bergmann 10-30	118	4	.....	30	80x130	3.15x5.12	1.62	159	Chan..	L...	Ther....	Pres..	Favorit....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Worm..	.....	Opt.....	½-E....	R...	Tr..	2050
Bergmann 19-55	140	4	.....	55	102x150	4.02x5.91	1.47	300	Chan..	L...	Ther....	Pres..	Favorit....	P.....	Bosch...	Bosch...	Exp....	4	Amid...	Bevl.....	T-A..	Worm..	.....	Opt.....	½-E....	R...	Tr..	2710
Bob 4-10	89	4	1600	10	60x90	2.36x3.54	1.50	62	Spur..	L...	Ther....	Pres..	Pallas.....	G.....	Sieme...	Opt.....	Cone....	3	Amid...	Bevl.....	T-T..	Worm..	710x 90	Wire. ..	¾-E....	R...	Tr..	772
Brennabor P-IV	125	4	2000	24	80x104	3.15x4.09	1.30	128	Spur..	L...	Ther....	Pres..	Opt.....	P.....	Opt.....	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Worm..	815x105	Wood...	½-E....	R...	Tr..	2430
Brennabor S	102	4	2000	20	70x102	2.75x4.02	1.46	96	Heli...	I...	Pump...	Spl...	Pallas.....	G.....	Bosch...	Bosch...	Plate....	3	Unit E..	Bevl.....	T-T..	Scrw...	700x 90	Wood...	Cant....	R...	R..	1540
Daimler-Mercedes 6-20	108	4	.....	20	68x108	2.68x4.25	1.59	96	.....	I...	Pump...	Spl...	Own.....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	D-B.....	T-T..	Scrw...	760x100	Opt	½-E....	R...	Tr..	.....
Daimler-Mercedes 10-35	120	4	.....	35	80x130	3.15x5.12	1.62	159	.....	I...	Pump...	Spl...	Own.....	P.....	Bosch...	Bosch...	D-Cone..	4	Amid...	D-B.....	T-T..	Scrw...	820x120	Opt.....	½-E....	R...	Tr..	.....
Daimler-Mercedes 16-45	127	4	.....	45	100x130	3.94x5.12	1.30	249	.....	S...	Pump...	Spl...	Own.....	P.....	Bosch...	Bosch ..	D-Cone..	4	Amid...	D-B.....	T-T..	Scrw...	820x135	Opt.. ..	½-E....	R...	Tr..	.....
Daimler-Mercedes 28-95	133	6	.....	95	105x140	4.13x5.51	1.33	443	.....	I...	Pump...	Pres..	Own.....	P.....	Bosch...	Bosch...	D-Cone..	4	Amid...	D-B.....	T-T..	Scrw...	895x135	Opt.....	½-E....	R...	Tr..	.....
Dinos 8-35	115	4	2500	35	78x108	3.07x4.25	1.38	126	Bevl..	I...	Pump...	Pres..	Pallas.....	V.....	Tria....	Tria....	Cone....	4	Unit E..	Bevl.....	T-T..	Scrw...	815x105	Wire....	½-E....	R...	Tr..	1650
Dixi 6-18	112	4	2200	18	70x102	2.75x4.02	1.46	96	Chan..	L...	Ther....	Pres..	Opt.....	G.....	Bosch...	Opt.....	Cone....	4	Amid...	Bevl.....	T-T..	Scrw..	710x100	Wire....	Cant....	R...	Tr..	1210
Dixi 8-24	112	4	1800	24	75x120	2.95x4.73	1.60	123	Spur..	L...	Pump...	Pres..	Opt.....	P.....	Bosch...	Opt.....	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	815x105	Wood ..	½-E....	R..	Tr..	1760
Dixi 13-39	126	4	1500	39	95x120	3.74x4.73	1.26	124	Spur..	L...	Pump...	Pres..	Opt.....	P.....	Bosch...	Opt.....	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	820x120	Wood...	¾-E....	R...	Tr..	2210
Dixi 20-55	144	4	1800	55	100x165	3.94x6.49	1.65	316	Chan..	L...	Pump...	Pres..	Opt.....	P.....	Bosch...	Opt.....	Cone....	4	Amid...	Bevl.....	T-T..	Worm..	935x120	Opt.....	¾-E....	R...	Tr..	3200
Duerkopp P8	112	4	2000	24	82x100	3.23x3.94	1.22	129	Spur..	L...	Ther....	Spl...	Opt.....	P.....	Bosch...	Opt.....	Cone....	4	Amid...	S-B.....	T-T..	Worm..	815x105	Wood...	½-E....	R...	Tr..	1540
Duerkopp P10	129	4	2000	30	91x100	3.58x3.94	1.10	175	Spur..	L...	Ther....	Spl...	Opt.....	P.....	Bosch...	Opt.....	Cone....	4	Amid...	S-B.....	T-T..	Worm..	820x120	Wood...	½-E....	R...	Tr..	1980
Duerkopp P16	137	4	1800	45	101x130	3.97x5.12	1.29	254	Spur..	L...	Pump...	Spl...	Opt.....	V.....	Bosch...	Opt.....	Cone....	4	Amid...	S-B.....	T-T..	Worm..	880x125	S-Disk..	½-E....	R...	Tr..	2860
Duerkopp P24	146	6	1800	70	101x130	3.97x5.12	1.29	381	Spur..	L...	Pump...	Spl...	Opt.....	V.....	Bosch...	Opt.....	Cone....	4	Amid...	S-B.....	T-T..	Worm..	935x135	S-Disk..	½-E....	R...	Tr..	3300
Dux S	138	4	1800	50	100x140	3.94x5.51	1.40	268	Chan..	L...	Pump...	Pres..	Zenith....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-T..	Scrw...	895x135	Wood...	½-E....	R...	Tr..	3040
Ehrhardt L40	131	4	1800	40	80x130	3.15x5.12	1.62	159	Heli...	I...	Pump...	Pres..	Pallas.....	V.....	Bosch...	Fenag..	Disk....	4	Amid...	S-B.....	T-A..	Worm..	820x120	Wire....	Cant....	R...	Tr..	1980
Ehrhardt L50	143	6	1800	50	80x130	3.15x5.12	1.62	239	Heli...	I...	Pump...	Pres..	Pallas.....	V.....	Bosch...	Fenag..	Disk....	4	Amid...	S-B.....	T-A..	Worm..	880x120	Wire....	Cant....	R...	Tr..	2430
Elite S55	144	6	1950	55	85x140	3.45x5.51	1.65	290	Chan..	L...	Pump...	Pres..	Zenith....	V.....	Bosch...	Bosch..	Disk....	4	Amid...	S-B.....	T-T..	Scrw...	880x135	Opt.....	Cant....	R...	Tr..	2780
Elite E12	125	4	2000	42	85x140	3.45x5.51	1.65	194	Chan..	L...	Pump...	Pres..	Zenith....	V.....	Bosch...	Bosch...	Disk....	4	Amid...	S-B.....	T-T..	Scrw...	820x120	Opt.....	Cant....	R...	Tr..	2540
Fafnir 476	117	4	1700	28	76x125	2.99x4.92	1.64	138	Chan..	L...	Ther....	Pres..	Pallas.....	G.....	Bosch...	Eise....	Cone....	4	Unit E..	Bevl.....	T-T..	Worm..	815x105	Steel....	Cant....	R...	Tr..	1650
Falcon 6-20	99	4	2200	20	65x110	2.56x4.33	1.69	89	Heli...	L...	Ther....	Spl...	Solex.....	G.....	Eise....	Eise....	Disk....	4	Unit E..	Bevl.....	.....	Worm..	710x 90	Wood...	Cant....	R...	R...	1490
Faun 6-22	114	4	1800	22	64x110	2.52x4.33	1.72	86	Heli...	I...	Ther....	Pres..	Pallas.....	G.....	Bosch...	Own....	Disk....	3	Unit E..	Bevl.....	Spr...	Worm..	760x 90	S-Disk..	Cant....	R...	R...	1210
Fulmina 10-30	118	4	2200	30	80x125	3.15x4.92	1.56	153	Chan..	L...	Ther....	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Disk....	4	Amid...	Bevl.....	T-A..	Scrw...	820x120	Wood...	D-Can..	R...	Tr..	1650
Fulmina 16-45	134	4	1850	47	100x130	3.94x5.12	1.30	249	Chan..	L...	Ther....	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Disk....	4	Amid...	Bevl.....	T-A..	Scrw...	880x135	Wood...	D-Can..	R...	Tr..	2430
Grade 4-12	110	1	1600	12	95x120	3.74x4.73	1.26	518	.....	2...	Air.....	Spl...	Own.....	G.....	Bosch ..	.....	Fr.....	.....	.....	Chn.....	Spr...	Dret...	710x 90	S-Disk..	¼-E....	R...	R...	772
Hansa-Lloyd H50	150	4	2200	50	100x130	3.94x5.12	1.30	249	Chan..	L...	Ther....	Pres..	Pallas.....	V.....	Mea....	Bosch...	Disk....	4	Amid...	Bevl.....	T-T..	Scrw...	935x135	Steel....	½-E....	R...	Tr..	3090
Hansa-Varel F32	134	4	2500	34	88x104	3.46x4.09	1.18	154	Chan..	L...	Ther....	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Disk....	4	Amid...	Worm.....	T-T..	Scrw...	820x135	Steel....	Plat....	R...	Tr..	2870
Hansa-Varel P26	117	4	2400	28	78x110	3.07x4.33	1.41	128	Chan..	L...	Ther....	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Disk....	4	Amid...	Worm.....	T-T..	Scrw...	765x105	Steel....	Plat....	R...	Tr..	2090
Heim 6-20	114	4	2600	26	71x100	2.79x3.94	1.41	97	Chan..	L...	Ther....	Pres..	Pallas.....	G.....	Bosch...	Bosch...	Cone....	3	Amid...	Bevl.....	Spr...	Scrw...	765x105	Wire....	¾-E....	R...	Tr..	1540
Heim 8-30	118	4	2600	31	80x100	3.15x3.94	1.25	123	Chan..	L...	Ther....	Pres..	Pallas.....	G.....	Bosch...	Bosch...	Cone....	3	Amid...	Bevl.....	Spr...	Scrw...	765x105	Wire....	¾-E....	R...	Tr..	1650
Horch 10-30	127	4	2000	30	80x130	3.15x5.12	1.62	159	Heli...	L...	Pump...	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Disk....	4	Unit E..	S-B.....	T-T..	Worm..	820x120	Steel....	Di-Ca..	R...	R...	2090
Horch 15-50	146	6	2000	50	80x130	3.15x5.12	1.62	239	Heli...	I...	Pump...	Pres..	Zenith....	V.....	Bosch...	Bosch...	Disk....	4	Unit E..	S-B.....	T-T..	Worm..	880x135	Steel....	Di-Ca..	R...	R...	2870
Horch 18-50	139	4	1800	50	100x150	3.94x5.91	1.50	287	Chan..	L...	Pump...	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-R..	Scrw...	935x135	Steel....	½-E....	R...	Tr..	2430
Horch 25-60	139	4	1600	60	115x155	4.53x6.11	1.35	393	Chan..	L...	Pump...	Pres..	Zenith....	V.....	Bosch...	Bosch...	Cone.. .	4	Amid...	S-B.....	T-R..	Scrw...	935x135	Wood...	½-E....	R...	Tr..	2650
Jerwin 25-75	145	6	1400	75	99x140	3.89x5.51	1.42	394	.....	I...	Pump...	Pres..	Zenith....	V.....	Bosch...	Fenag...	Disk....	4	Amid...	Bevl.....	T-T..	Scrw...	935x150	Wire....	½-E....	R...	Tr..	3970
Kleinautobau Greiz S5	79	4	2500	14	64x100	2.52x3.94	1.56	78	Spur..	L...	Ther....	Spl...	Solex.....	G.....	Bosch...	Eise....	Cone....	3	Amid...	Bevl.....	T-T..	Worm..	710x 90	Wire....	½-E....	R...	Tr..	772
Koco IV	.....	2	1800	12	85x90	3.45x3.54	1.06	62	Spur..	H...	Ther....	Spl...	Pallas.....	G.....	Bosch...	.....	Cone....	2	Plntr....	Chn.....	.....	Worm..	700x 80	Wire. ..	2-Spi....	R...	R...	840
Ley S12	136	6	2200	40	80x104	3.15x4.09	1.30	191	Heli...	L...	Pump...	Pres..	Zenith....	V.....	Bosch...	Bosch..	Disk....	4	Unit E..	S-B.....	T-T..	Worm..	820x125	Wire....	½-E....	R...	Tr..	2320
Ley T6	105	4	2200	16	70x100	2.75x3.94	1.43	94	Heli...	L...	Ther....	Spl...	Zenith....	G.....	Eise....	Eise....	Disk....	3	Unit E..	Bevl.....	T-T..	Scrw...	760x 90	Wire....	Cant....	R...	Tr..	1210
Ley U12	125	4	2200	32	87x130	3.43x5.12	1.49	188	Heli...	L...	Pump...	Pres..	Zenith....	G.....	Bosch...	Bosch...	Disk....	4	Unit E..	S-B.....	T-T..	Worm..	880x125	Wire....	Cant....	R...	Tr..	2090
M. A. F G6	104	4	1700	18	72x96	2.84x3.78	1.33	95	Spur..	F...	Air.....	Spl...	Pallas.....	G.....	Bosch...	.....	Cone ...	4	Amid...	Bevl.....	Spr...	Worm..	760x100	Wood...	½-E....	R...	Tr..	1320
M. A. F G8	114	4	1700	25	78x110	3.07x4.33	1.41	128	Spur..	F...	Air.....	Pres..	Pallas.....	G.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	Spr...	Worm..	765x105	Wood...	½-E....	R...	Tr..	1650
Maybach 22-70	144	6	2200	70	95x135	3.74x5.32	1.42	350	Spur..	L...	Pump...	Pres..	Own.....	V.....	Bosch...	Bosch...	Cone....	1	Unit E..	S-B.....	T-T..	Scrw...	895x135	S-Disk..	½-E....	FR.	FR.	2850
N. A. G 10-30	126	4	2300	35	83x118	3.27x4.65	1.42	156	Chan..	L...	Ther....	Pres..	Pallas.....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-T..	Scrw...	820x120	Wood...	½-E....	R...	Tr..	2230
N. A. G 11-45	130	4	2300	48	83x132	3.27x5.19	1.59	174	Chan..	I...	Pump...	Pres..	Zenith....	V.....	Bosch...	Bosch...	Plat....	4	Amid...	S-B.....	T-R..	Scrw...	820x135	Steel....	Cant....	R...	R...	2110
N. S. U 5-15	99	4	1600	15	66x90	2.59x3.54	1.36	75	Spur..	L...	Ther....	Pres..	Zenith....	P.....	Bosch...	Eise	Cone....	3	Amid...	Bevl.....	Spr...	Scrw...	700x 85	Wood...	½-E....	R...	Tr.	1230
N. S. U 8-24	118	4	1500	24	78x110	3.07x4.33	1.41	128	Spur..	L...	Ther....	Pres..	Zenith....	P.....	Bosch...	Bosch...	Disk....	4	Amid...	Bevl.....	Spr...	Scrw...	815x105	Wood...	Cant....	R...	Tr..	1760
N. S. U 14-40	126	4	1400	40	84x130	3.01x5.12	1.55	176	Spur..	L...	Ther....	Pres..	Zenith....	P.....	Bosch...	Bosch...	Disk....	4	Amid...	Bevl.....	Spr...	Scrw...	880x120	Wood...	Cant....	R...	Tr..	2430

N. U. G.	3. 8-15	87	4	2400	15	60x 90	2.36x3.54	1.50	62	Spur..	F...	Ther....	Spl...	Pallas.....	G....	Sieme...	.....	Plat....	3	Unit A..	Bevl.....	T-T...	Worm..	710x100	S-Disk..	¼-E....	R...	R...	1100
Opel	30-75	148	6	1400	75	105x150	4.13x5.91	1.43	476	Heli...	L...	Pump...	Pres..	Own.....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-T..	Scrw...	935x135	Steel....	Cant....	R...	Tr..	....
Opel	21-50	138	6	1400	50	96x130	3.78x5.12	1.35	344	Heli...	L...	Pump...	Pres..	Own.....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-T..	Scrw...	895x135	Steel....	Cant....	R...	Tr..	....
Opel	14-38	131	4	1800	38	90x135	3.54x5.32	1.50	210	Heli...	L...	Pump...	Pres..	Own.....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-T..	Worm..	880x120	Steel....	½-E....	R...	Tr..	....
Opel	9-25	124	4	1800	25	78x122	3.07x4.81	1.56	142	Heli...	L...	Pump...	Pres..	Own.....	P.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-T..	Worm..	820x120	Steel....	½-E....	R...	Tr..	....
Phaenomen	10-30	128	4	1800	30	80x130	3.15x5.12	1.62	159	Chan..	L...	Ther....	Spl...	Pallas.....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	820x120	Wood....	½-E....	R...	Tr..	2540
Phaenomen	16-45	128	4	1800	45	97x140	3.82x5.51	1.44	252	Chan..	L...	Pump...	Spl...	Pallas.....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	820x125	Wire....	½-E....	R...	Tr..	2780
Presto	D	122	4	2000	30	78x123	3.07x4.84	1.58	143	Spur..	L...	Ther....	Spl...	Opt.....	P.....	Bosch...	Bosch...	Disk....	4	Amid...	S-B.....	T-T..	Scrw...	820x120	Wire....	½-E....	R...	Tr..	1980
Protos	C10-30	126	4	2200	30	80x130	3.15x5.12	1.62	159	Chan..	L...	Ther....	Pres..	Zenith.....	P.....	Sieme...	Bosch...	Disk....	4	Amid...	S-B.....	T-T..	Worm..	820x135	Steel....	½-E....	R...	Tr..	2430
Richard & Hering	10-28	127	4	1400	28	77x140	3.03x5.51	1.82	159	Heli...	L...	Pump...	Pres..	Zenith.....	V.....	Bosch...	Bosch...	Cone....	4	Unit E..	Bevl.....	T-T..	Scrw...	820x120	Wood....	½-E....	R...	Tr..	2210
Richard & Hering	13-35	127	4	1400	35	85x140	3.35x5.51	1.65	194	Heli...	L...	Pump...	Pres..	Zenith.....	V.....	Bosch...	Bosch...	Cone....	4	Unit E..	Bevl.....	T-T..	Scrw...	820x120	Wire....	½-E....	R...	Tr..	2210
Rumpler	CA104	114	6	2200	36	74x100	2.92x3.94	1.35	157	Heli...	I...	Pump...	Pres..	Pallas.....	G.....	Bosch...	Bosch...	Disk....	3	Unit A..	Bevl.....	.....	Scrw...	880x120	S-Disk..	Cant....	R...	Tr..	1870
Selve	SL6	118	4	2500	28	71x100	2.79x3.94	1.41	97	Chan..	L...	Ther....	Pres..	Pallas.....	G.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-T..	Worm..	765x105	Wire....	Cant....	R...	Tr..	1870
Selve	SL8	118	4	2500	36	82x100	3.23x3.94	1.22	129	Chan..	L...	Ther....	Pres..	Zefan.....	G.....	Bosch...	Bosch...	Cone....	4	Amid...	S-B.....	T-T..	Worm..	820x120	Wire....	Cant....	R...	Tr..	1980
Simson	B	104	4	1500	18	70x102	2.75x4.02	1.46	95	Chan..	L...	Ther....	Spl...	Zenith.....	O.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Worm..	765x105	Opt.....	½-E....	R...	Tr..	1590
Simson	C	122	4	1800	30	80x130	3.15x5.12	1.62	159	Chan..	L...	Ther....	Spl...	Zenith.....	O.....	Bosch...	Bosch...	Disk....	4	Amid...	Bevl.....	T-T..	Worm..	815x120	Opt.....	½-E....	R...	Tr..	2090
Simson	D	122	4	1800	45	90x140	3.54x5.51	1.56	217	Chan..	L...	Pump...	Spl...	Zenith.....	O.....	Bosch...	Bosch...	Disk....	4	Amid...	Bevl.....	T-T..	Worm..	820x135	Opt.....	½-E....	R...	Tr..	2320
Steiger	P.A.	118	4	2200	45	72x160	2.84x6.29	2.22	154	Bevl..	J...	Pump...	Spl...	Zenith.....	V.....	Bosch...	Bosch...	Plat.....	4	Unit E..	S-B.....	T-T..	Scrw...	820x120	Wire....	Cant....	R...	Tr..	2320
Stoewer	D3	116	4	2000	24	75x120	2.95x4.73	1.60	129	Chan..	L...	Pump...	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	815x105	Wood....	½-E....	R...	Tr..	1980
Stoewer	D5	131	6	2000	36	75x118	2.95x4.65	1.57	191	Chan..	L...	Pump...	Pres..	Pallas.....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	820x125	Wood....	½-E....	R...	Tr..	2320
Stoewer	D7	140	6	1400	120	130x140	5.12x5.51	1.08	680	Bevl..	I...	Pump...	Pres..	Zenith.....	V.....	Bosch...	Bosch...	Cone....	4	Amid...	Bevl.....	T-T..	Scrw...	935x150	S-Disk..	½-E....	R...	Tr..	3970
Szawe	10-50	137	6	2400	50	62x140	2.44x5.51	2.26	159	Bevl..	I...	Pump...	Pres..	Zenith.....	V.....	Eise....	Eise....	Plat....	4	Unit E..	S-B.....	T-T..	Scrw...	880x120	Wire....	Cant....	R...	Tr..	1870
Wanderer	W8	95	4	2000	15	65x100	2.56x3.94	1.54	81	Chan..	I...	Pump...	Spl...	Own.....	G.....	Bosch...	Bosch...	Cone....	3	Unit E..	S-B.....	T-T..	Scrw...	710x 90	Wire....	Cant....	R...	Tr..	927
Wanderer	W6	108	4	1800	18	67x110	2.64x4.33	1.64	95	Chan..	F...	Pump...	Spl...	Zenith.....	V.....	Bosch...	Bosch...	Cone....	4	Unit E..	S-B.....	T-T..	Scrw...	760x100	Wire....	½-E....	R...	Tr..	1590

For abbreviations see page 345.

Nationality and Make	Wheelbase (In.)	Track (In.)	No. of Cylinders	Valve Location	Camshaft Location	Cylinder Head	BORE AND STROKE Mm.	In.	Ratio	Piston Displacement (Cu. In.)	H.P. (Nominal)	Cooling	Lubricating System	Carburetor Make	Fuel Feed	Ignition	Starting and Lighting	Clutch	Speeds	Gearset Location	Position of Levers	Final Drive	Tires Size (Mm.)	Wheels	Rear Springs	Brake Location
BELGIAN																										
Belga	108	49	4	L...	C'Case..	Fix.	65x120	2.5x4.7	1.8	97	10	Ther....	Press...	Zenith....	Grav..	Mag.....	None.....	Cone....	5	Fric.....	R....	Bevel.....	760x90	Disk....	½-El...	R.....
d'Aoust	106	49	4	L...	C'Case..	Fix.	65x140	2.5x5.5	2.1	113	10	Ther....	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	R....	Bevel.....	760x90	Wire....	½-El...	Tr.-R.....
d'Aoust	126	55	4	I...	Head...	Det.	89x120	3.5x4.7	1.4	182	20	Pump...	Press....	Zenith....	Vac...	2-Mag....	2-Unit.....	Disk....	4	Unit E..	R....	Bevel.....	880x120	Wire....	½-El...	Fr.-R.....
Dasse	118	49	4	L...	C'Case..	Fix.	75x120	2.9x4.7	1.5	129	12	Pump...	Circ....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	3	Unit E..	C....	Spiral.....	760x90	Disk....	Cant....	R.....
Dasse	137	55	4	I...	Head...	Det.	90x140	3.5x5.5	1.5	218	30	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	3	Unit E..	C....	Spiral.....	895x135	Disk....	½-El...	Tr.-R.....
Excelsior	150	56	6	L...	C'Case..	Fix.	85x140	3.3x5.5	1.6	291	.....	Pump...	Press....	2-Claud...	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	C....	Spiral.....	895x135	Wire....	Cant....	Fr.-R.....
F. N.	108	49	4	L...	C'Case..	Fix.	62x110	2.4x4.3	1.6	81	10	Ther....	Circ....	Own.....	Vac...	Mag.....	1-Unit.....	Cone....	3	Unit E..	R....	Bevel.....	760x90	Wood....	½-El...	R.....
F. N.	123	55	4	L...	C'Case..	Fix.	85x120	3.3x4.7	1.4	166	16	Ther....	Press....	Own.....	Vac...	Mag.....	2-Unit.....	Disk....	4	Amid...	R....	Spiral.....	820x120	Wood....	½-El...	Tr.-R.....
F. N.	134	55	4	L...	C'Case..	Fix.	90x150	3.5x5.9	1.7	233	30	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	R....	Spiral.....	895x150	Wood....	½-El...	R.....
Imporia	130	52	4	L...	C'Case..	Fix.	80x180	3.1x7.0	2.2	214	20	Pump...	Press....	.....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	R....	Bevel.....	820x120	Wire....	½-El...	Tr.-R.....
Abadal	142	56	8	I...	Head...	Det.	80x140	3.1x5.5	1.7	344	40	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	C....	Bevel.....	895x135	Wire....	½-El...	Fr.-Tr.-R..
Metallurgique	126	52	4	L...	C'Case..	Fix.	80x130	3.1x5.1	1.6	160	14	Ther....	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R....	Spiral.....	820x120	Wire....	½-El...	Tr.-R.....
Metallurgique	137	56	4	L...	C'Case..	Fix.	90x140	3.5x5.5	1.5	216	18	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R....	Spiral.....	880x120	Wire....	½-El...	Tr.-R.....
Metallurgique	146	56	4	L...	C'Case..	Fix.	100x160	3.9x6.3	1.6	305	30	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	C....	Spiral.....	895x135	Wire....	½-El...	Fr.-Tr.-R..
Miesse	118	55	4	I...	Head...	Det.	69x130	2.7x5.1	1.8	119	12	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	3	Unit E..	C....	Spiral.....	815x105	Wire....	½-El...	R.....
Miesse	133	55	8	I...	Head...	Det.	69x130	2.7x5.1	1.8	237	25	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	3	Unit E..	C....	Spiral.....	895x135	Wire....	½-El...	R.....
Minerva	118	52	4	Sl..	C'Case..	Det.	75x112	2.9x4.4	1.5	121	15	Pump...	Circ....	Sthenos...	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	C....	Spiral.....	820x120	Wire....	Cant....	R.....
Minerva	134	55	4	Sl..	C'Case..	Det.	90x140	3.5x5.5	1.5	217	20	Pump...	Circ....	Sthenos...	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R....	Spiral.....	895x135	Wire....	Cant....	Tr.-R.....
Minerva	142	55	6	Sl..	C'Case..	Det.	90x140	3.5x5.5	1.5	326	30	Pump...	Circ....	Sthenos...	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	R....	Spiral.....	895x135	Wire....	Cant....	Tr.-R.....
Nagant	114	51	4	I...	C'Case..	Det.	72x120	2.8x4.7	1.6	119	10	Ther....	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Plate....	4	Unit E..	C....	Spiral.....	765x105	Wood....	Cant....	Fr.-R.....
Nagant	130	52	4	I...	C'Case..	Fix.	80x150	3.1x5.9	1.9	184	16	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	R....	Spiral.....	880x120	Wood....	½-El...	Tr.-R.....
Pipe	130	54	4	L...	C'Case..	Fix.	80x150	3.1x5.9	1.9	184	20	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	R....	Bevel.....	820x120	Wire....	½-El...	Tr.-R.....
Pipe	140	54	4	L...	C'Case..	Fix.	100x180	3.9x7.1	1.8	345	30	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	R....	Bevel.....	880x120	Wire....	½-El...	Tr.-R.....
Pipe	152	54	4	L...	C'Case..	Fix.	120x200	4.7x7.8	1.7	552	40	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Cone....	4	Amid...	R....	Bevel.....	895x135	Wire....	½-El...	Tr.-R.....
P. M.	114	51	4	L...	C'Case..	Fix.	69.5x120	2.7x4.7	1.7	108	10	Ther....	Circ....	Claudel...	Grav..	Mag.....	2-Unit.....	Plate....	4	Unit E..	R....	Spiral.....	765x90	Disk....	½-El...	R.....
Somea	118	48	4	I...	Head...	Det.	69x133	2.7x5.2	1.9	121	12	Pump...	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Plate....	4	Unit E..	R....	Spiral.....	820x120	Wire....	½-El...	R.....
ITALIAN																										
Alfa-Romeo	114	56	4	L...	C'Case..	Fix.	102x130	4 x5.1	1.27	259	20	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Amid...	R....	Bevel.....	820x120	Steel....	½-El...	Tr.-R.....
Alfa-Romeo	133	56	6	L...	C'Case..	Fix.	94x140	3. 7x5.5	1.48	356	35	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Amid...	R....	Bevel.....	895x135	Steel....	Dbl. Ct..	Tr.-R.....
Alfa-Romeo	129	56	6	I...	Head...	Det.	75x110	2.95x4.3	1.4	178	20	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	C....	Bevel.....	820x120	Steel....	½-El...	Tr.-R.....
Ansaldo	108	51	4	I...	C'Case..	Det.	70x120	2.75x4.7	1.7	113	10	Pump...	Press....	Zenith....	Grav..	Mag.....	1-Unit.....	Disk....	3	Unit E..	C....	Sp. Bevel..	760x90	Steel....	½-El...	R.....
Bianchi	108	49	4	L...	C'Case..	Fix.	70x110	2.75x4.3	1.5	103	10	Ther....	Press....	Zenith....	Vac...	Mag.....	1-Unit.....	Plate....	4	Amid...	R....	Sp. Bevel..	765x105	Wood....	½-El...	R.....
Chiribiri	102	49	4	L...	C'Case..	Fix.	65x113	2.55x4.4	1.7	91	10	Ther....	Circ....	Zenith....	Grav..	Mag.....	1-Unit.....	Plate....	4	Unit A..	C....	Bevel.....	710x90	Disk....	½-El...	R.....
Diatto	98	43	4	L...	C'Case..	Fix.	60x90	2.36x3.5	1.5	62	10	Pump...	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Plate....	3	Amid...	C....	Bevel.....	710x90	Disk....	½-El...	R.....
Diatto	118	55	4	L...	C'Case..	Fix.	85x120	3.34x4.7	1.4	166	25	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disks...	4	Amid...	R....	Bevel.....	820x120	Wire....	½-El...	Tr.-R.....
Diatto	118	55	4	I...	Head...	Det.	80x100	3.14x3.9	1.25	123	20	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Plate....	4	Unit E..	C....	Sp. Bevel..	820x120	Steel....	Cant....	Tr.-R.....
Fiat	104	49	4	L...	C'Case..	Det.	65x110	2.56x4.33	1.7	89	10	Pump...	Press....	Own.....	Grav..	Mag.....	Own 2-Unit....	Disk....	4	Unit E..	R....	Sp. Bevel..	760x90	Steel....	½-El...	R.....
Fiat	120	55	4	L...	C'Case..	Det.	75x130	2.95x5.12	1.73	140	15	Pump...	Press....	Own.....	Press..	Mag.....	Own 2-Unit....	Disk....	4	Unit E..	R....	Sp. Bevel..	820x120	Steel....	½-El...	R.....
Fiat	134	55	6	L...	C'Case..	Det.	75x130	2.95x5.12	1.73	210	20	Pump...	Press....	Own.....	Press..	Mag.....	Own 2-Unit....	Disk....	4	Unit E..	R....	Sp. Bevel..	895x135	Steel....	½-El...	R.....
Fiat	152	59	12	I...	C'Case..	Det.	85x110	3.35x4.33	1.29	457	80	Pump...	Press....	Own.....	Press..	Bat.....	Own 1-Unit....	Disk....	3	Unit E..	R....	Sp. Bevel..	895x135	Steel....	Cant....	Fr.-R.....
Isotta-Fraschini	146	55	8	I...	C'Case..	Det.	85x130	3.35x5.12	1.5	360	80	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	3	Unit E..	R....	Sp. Bevel..	895x135	Wire....	½-El...	Fr.-R.....
Itala	126	55	4	L...	C'Case..	Fix.	83x130	3.27x5.12	1.5	172	25	Pump...	Press....	Own.....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	R....	Sp. Bevel..	820x120	Steel....	½-El...	Tr.-R.....
Itala	142	55	6	Sl..	C'Case..	Fix.	85x130	3.35x5.12	1.5	270	60	Pump...	Press....	Zenith....	Vac...	Bat.....	2-Unit.....	Disk....	3	Unit E..	R....	Sp. Bevel..	895x135	Wire....	½-El...	Fr.-R.....
Lancia	133	52	4	L...	C'Case..	Det.	110x130	4.3x5.1	1.18	302	30	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	R....	Sp. Bevel..	895x135	Disk....	½-El...	Tr.-R.....
Lancia	133	52	4	I...	C'Case..	Det.	110x130	4.3x5.1	1.18	302	35	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	R....	Sp. Bevel..	895x135	Disk....	½-El...	Tr.-R.....
Lancia	133	52	8	I...	C'Case..	Det.	75x130	2.95x5.1	1.7	280	40	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Amid...	R....	Sp. Bevel..	895x135	Wire....	½-El...	Tr.-R.....
Nazzaro	124	55	4	I...	Head...	Det.	90x140	3.5x5.5	1.55	217	30	Pump...	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Disk....	4	Unit E..	R....	Bevel.....	820x135	Steel....	½-El...	R.....
Scat	114	52	4	L...	C'Case..	Fix.	75x120	2.95x4.7	1.6	129	12	Pump...	Press....	Zenith....	Vac...	Mag.....	2-Unit.....	Disk....	4	Unit E..	R....	Sp. Bevel..	760x105	Steel....	½-El...	Tr.-R.....
Spa	126	55	4	L...	C'Case..	Det.	85x120	3.3x4.7	1.41	166	20	Pump...	Press....	Zenith....	Grav..	Mag.....	2-Unit.....	Plate....	4	Unit E..	R....	Sp. Bevel..	820x120	Steel....	½-El...	Tr.-R.....
Spa	146	57	4	I...	Head...	Det.	85x130	3.3x5.1	1.53	180	40	Pump...	Press....	Zenith....	Grav..	Mag. & Bat	2-Unit.....	Plate....	4	Unit E..	R....	Sp. Bevel..	895x135	Steel....	Cant....	Fr.-Tr.-R..

For abbreviations see page 345

The Trend in French Passenger Car Design

Four cylinder models predominate. Vacuum fuel feed used on all except small cars. Four speed transmissions on 73 per cent of models. Four wheel brakes on one-fourth of cars. Specifications show design details

By W. F. Bradley

THE French passenger car specifications show 69 makers producing 135 models, this comprising the entire French industry with the exception of cycle car manufacturers of comparatively small importance. One model only is produced by 30 makers; two models are built by 24 firms; 8 firms have three models, and 7 have four or more different types. This enumeration only covers French passenger cars.

The battle of the cylinders has been won by the "four." Out of 135 models comprised in the list 106, or 78.5 per cent, have an engine with four cylinders. It should be noted, too, that these comprise all the big production jobs, there being only one maker in France who attempts to supply a medium priced car with more than four cylinders. The six-cylinder engine comes next on the list, with 13.33 per cent, practically all these being high grade jobs produced in limited quantities. There has been a revival in the eight-cylinder engine of the line-ahead type, these now representing by 5.18 per cent. It should be noted that there has been no increase in the number of eight-cylinder V engine, the only makers being De Dion Bouton, with two models, and Talbot-Darracq with one model. Both these firms also produce four-cylinder cars. There is only one twelve-cylinder car on the list, this being the high grade Voisin. The single-cylinder has also a single representative if cycle cars are ignored, and there are only two cases of twin-cylinder engines. It is worth noting that even for very small cars there is a tendency to use a small four-cylinder in preference to a twin.

The L-head engine is at the top of the list with 68.1 per cent, followed by the I-head with 24.44 per cent; of these latter 63.6 per cent have the camshaft in the base chamber, the valves being operated by concealed push rods in the cylinder block, and 36.4 per cent have an overhead camshaft.

Poppet Valves Dominate

Sleeve valve engines are represented by 7.4 per cent. These comprise the Knight engine and other types of sleeves. The poppet valve engine dominates the field.

Water circulation by means of a pump is found on 59.25 per cent of French cars, with thermo-siphon cooling on 40 per cent. Only one car is air cooled.

Few automobile makers now fit their own carbureter. Vacuum fuel feed holds the field, the gravity type being found only on small cars which can carry the tank on the dash. Pressure tanks are very little used.

An important fight is in progress between magneto and battery ignition. The former has been designated on the list as Delco, for in every case where the magneto has been abandoned this move has been made in favor of Delco apparatus. Under this count there is a percentage of 85.2 engines with magneto ignition and 14.8 per cent with Delco ignition.

Unit construction of engine and gear box has made remarkable progress, if it is remembered that in 1914 it was very rarely employed and is now to be found on 55.5 per cent of French cars. The midship position of the gearbox, which constitutes a separate unit from the engine, is represented by 42.2 per cent. There are only three cars with the change speed mechanism in the rear axle, the proportion being 2.2 per cent.

Transmission Trends

Four-speed transmissions retain the enormous majority of 73.3 per cent, compared with 25.9 per cent for three-speed transmissions. There is only one car, representing 0.8 per cent, with a two-speed transmission.

Spiral bevel drive has almost driven out all other systems, for it is represented by 60 per cent, compared with 32.5 per cent for straight bevel. Worm driven rear axles are only 2.2 per cent; internal gear drive is represented by 2.9 per cent, these being four cars from the same maker. Other types of gear are the "chevron" or herringbone, used by Cirtoen and Mors. The spiral bevel would have a still greater following were it not that several of the smaller makers do not possess the plant necessary for cutting these gears.

The old-established system of a brake on the transmission and a pair on the rear wheels still heads the list with 51.1 per cent of the whole. In practically all these cases the transmission brake is foot operated and the rear wheel brakes are applied by hand. The great change, however, is the adoption of brakes on both front and rear wheels for 24.4 per cent of French models. Some of these cars also have a hand operated transmission brake, but this is merely to comply with the law calling for two independent braking systems. Otners meet this requirement by a foot control for the four brakes and an independent lever control for the rear wheel brakes only. Brakes on the rear wheels only, the great majority of these being side by side, are also 24.4 per cent of the whole. This braking system has grown in popularity since the adoption of unit construction of engine and gearbox.

Although gaining ground, the detachable head is still in a minority compared with the fixed head, the percentages being 68.8 for the fixed and 31.2 for the detachable. Delahaye, who took up the detachable head with valve caps two years ago has abandoned it in favor of a fixed head, and one of the Talbot-Darracq models has been changed from detachable to fixed head. On the other hand a new type brought out by this firm has detachable head.

The figures covering wheels should be examined with a certain amount of circumspection, for while the big makers standardize, many of the smaller firms have no settled policy and will furnish the type of wheel requested by the client.

Trend in Truck Design as Revealed by Specifications for 1922 Models

Out of 494 models listed, 138 are of 1 to 1½ tons capacity, 145 are 2 to 2½ tonners and 95 are 3 to 3½ tonners. Wide use of more or less standardized components is reflected in great uniformity of specifications. Tendency to four-speed gearset. Worm drive still most popular type.

TRUCKS of 1½ tons capacity are still the most popular size, but the number of 2½-ton models listed this year is nearly as great, the figures being 82 and 81 respectively. Twenty-eight per cent of the 494 models listed are of 1 to 1½ tons capacity, 29 per cent 2 to 2½ tons, and 19 per cent 3 to 3½ tons. The remaining 24 per cent are divided as follows: 4 and 5 ton, 16 per cent; 6 to 15 ton, 4 per cent; ½ and ¾ ton, 4 per cent.

There are few pronounced changes to be noted in connection with the detailed specifications. This would seem to indicate that truck design is becoming more and more nearly standardized. It is, of course, a well known fact that a very large percentage of makes of American built trucks are assembled from more or less standard parts which can be made in sufficiently large quantities to make it possible for the parts maker to sell them as a rule for a lower price than that at which individual truck manufacturers can make them. Since the standardized units themselves are quite similar in many cases, it is obvious that when a comparison is made on a basis of the total number of models listed the satus of the parts market will be reflected. If a comparison could readily be made on a basis of the number of trucks in use employing a given type of construction produced, some quite different comparisons would be obtained. For example, the Autocar Co. and the International Motor Co., who build the Mack truck, use types of final drive which have proved highly successful but which are not very generally marketed if made at all by parts makers, and are therefore seldom seen in trucks assembled from standard component parts. The companies mentioned, however, are among the largest producers of trucks, so that a comparison which takes volume production into consideration would be quite different from the comparison here given.

The percentage figures which follow have been computed by dividing by the number of models on which questionnaire returns were received, the number which reported the use of a certain type of construction. For example, of the 494 truck models listed, 401 reported the use of a pump for water circulation, 77 reported the use of thermo-siphon circulation, and 16 failed to give data under this heading, leaving 478 on which returns were complete, so far as this item is concerned. Of this number, the 401 which employ pump circulation are 83.9 per cent of the total reporting under this heading, while 77 compose the remaining 16.1 per cent of the total reported.

The statistics here given indicate relatively little change in engine design; 76.5 per cent employ block cast cylinders, this proportion being exactly the same as last year. There is a slight gain in the number using pair-cast cylinders, while the separately cast cylinder has disappeared entirely on all engines except the two-cylinder Autocar, which is the only American truck listed which does not use a four-cylinder engine.

In respect to clutch design the trend away from the cone and toward the disk type continues. Only 2 per cent of the models listed use cone clutches, while 98 per cent use either the multiple disk or single plate type. Of the 483 in which specific information regarding the clutch is given, 376 use the dry multiple disk type, 8 the multiple disk in oil, 89 the single plate type and 10 the cone clutch.

The number of models using gravity fuel feed are still in the majority, but the advocates of this system continue to lose ground, while the use of vacuum feed is increasing. There are still a few makers who employ pressure feed, but the percentage is slightly less than last year.

For several years there has been but slight change in the percentage of cooling systems using pump and thermo-siphon circulation, and there is less change this year than last. About one-sixth of the models listed have thermo-siphon systems, and the bulk of these are in the light higher speed class of chassis.

The trend toward the use of gearsets with a greater number of speed changes continues. Over 62 per cent of models have four speeds, as against 57.4 per cent last year. The percentage using three-speed gearsets has reduced from 40 to 34.3. 12 trucks have 5 or more speeds.

There is a slight increase in the proportion of trucks using unit powerplants, due, no doubt, to the fewer number of parts and consequent simplicity. This construction is sometimes used at the expense of accessibility, an argument which accounts in part for the continued use of amidship gearset mounting on nearly half the models.

In respect to the type of final drive the figures show a further increase in the percentage of models using the worm, but it is worthy of note that at least three of the oldest and largest truck manufacturers who make their own rear axles prefer other types of final drive. The gain in the percentage of models using the worm type of final drive appears to have been made at the expense of all other types except the bevel gear, which is quite generally used on the lightest trucks. The percentage of models using this type of gear is still small but is slightly larger than last year.

Metal wheels are still gaining slightly in popularity, although the rate of increase is much less than in other years, but nearly 63 per cent of all models are still equipped with wood wheels. Of the metal wheels about 90 per cent are cast steel.

For three years past over 70 per cent of models have been equipped with pressed steel frames, the percentage increasing slightly each year. This year 69.5 per cent of models have pressed steel frames as against 73.6 per cent last year. The percentage using rolled section frames has shown a corresponding increase from 26.4 to 30.3.

*See charts of page 362 for graphical presentation of design trends.

Specifications of

Make and Model	Tons Capacity	Wheel-Base, Ins.	TIRE SIZE Front, Ins.	TIRE SIZE Rear, Ins.	ENGINE Make	Number Cylinders, Bore and Stroke	Cylinders, Cast	Camshaft Drive Type	Radiator Core Make	Radiator Core Type	Water Circulation	OILING SYSTEM Type	OILING SYSTEM Oil Pump Type	FUEL SYSTEM Carbureter Make	FUEL SYSTEM Carbureter Size, Ins.	FUEL SYSTEM Fuel Feed	GOVERNOR Make	GOVERNOR Type	SPEED Motor in R.P.M.	SPEED Truck in M.P.H.	ELECTRICAL SYSTEM Generator Make	ELECTRICAL SYSTEM Ignition System, Make	ELECTRICAL SYSTEM Ignition System, Type
Acason.....H	2½	150	36x4	36x4d	Wau....	4-4⅜x5¾	2	.....	Natl....	Cel...	Pump.	.....	.....	Schebl...	....	Vac...	Wau....	Cent...	1200	18	.....	Eis....	S-P...
Acason.....L	3½	180	36x5	36x5d	Wau....	4-4⅜x5¾	2	.....	Natl....	Cel...	Pump.	.....	.....	Sch b ..	....	Vac...	Wau....	Cent...	1200	14	.....	Eis....	S-P...
Ace.....C	1½	144	34x3½	34x5d	Buda...	4-3¾x5⅛	4	Met-Gear..	Mod....	Cel...	Ther..	Cir-Spl..	Gear..	Zenith...	1	Vac...	.....	.....	1250	18	West...	At-K...	O-C...
Ace.....A	2½	156	36x4	36x4d	Buda...	4-4¼x5½	4	Met-Gear..	.....	Cel...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Vac...	.....	.....	1250	16	West...	Eis....	.....
Acme.....G	¾	130	35x5*	35x5*	Cont....	4-3¾x5	4	Met-Gear..	G&O....	Cel...	Ther..	.....	Gear..	Rayfld..	1	Vac...	.....	.....	1700	28	Eis....	E s....	S&C...
Acme.....B	1	130	34x3½	34x5	Cont....	4-3¼x5	4	Met-Gear..	G&O....	Cel...	Ther..	Cir-Spl..	.....	Rayfld..	1	Vac...	Dup....	Cent..	1700	23	Eis....	Eis....	S&C...
Acme.....F	1½	141	34x3½	34x5	Cont...	4-3¾x5	4	Met-Gear..	G&O....	Fin...	Pump.	Cir-Spl..	Gear..	Zenith...	1	Vac...	Dup....	Cent..	1600	18½	Dayt...	Eis....	S&C...
Acme.....A	2	148	36x4	36x7	Cont....	4-4⅛x5½	4	Met-Gear..	G&O....	Fin...	Pump.	Cir-Spl..	Gear..	Rayfid..	1¼	Vac...	Dup....	Cent..	1500	17½	Dayt...	Eis....	S&C...
Acme.....AC	2½	156	36x4	36x7	Cont....	4-4½x5½	4	Met-Gear..	Bre.....	Fin...	Pump.	Cir-Spl..	Gear..	Zenith...	1¼	Vac...	Dup....	Cent..	1300	30	Dayt...	Eis....	S&C...
Acme.....C	3½	168	36x5	40x5d	Cont....	4-4½x5½	4	Met-Gear..	G&O....	Fin...	Pump.	Cir-Spl..	Gear..	Zenith...	1¼	Vac...	Dup....	Cent..	1300	13½	Dayt...	Eis....	S&C...
Acme.....E	5	180	36x6	40x6d	Cont....	4-4¾x6	2	Met-Gear..	G&O....	Fin...	Pump.	Cir-Spl..	Gear..	Rayfid..	1½	Vac...	Cont....	Cent..	1250	12½	Dayt...	Eis....	S&C...
Akron Multi-Truck...20	1¼	133½	34x5*	34x5*	Hink....	4-4 5¼	4	Met-Gear..	Fed.....	Cel...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra....	.....	.....	1800	35	West...	West...	S&O...
American.....25	2½	158	36x4	36x4d	Wis.....	4-4x6	4	Met-Gear..	G&O....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Own....	Cent..	1600	18	West...	Apollo..	S-P...
American.....40	4	158	36x5	36x5d	Wis.....	4-4½x6	4	Met-Gear..	G&O....	F n...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Gra...	Own....	Cent..	1600	15	West...	Apollo..	S-P...
American.....50	5	174	36x5	36x5d	Wis.....	4-4½x6	4	Met-Gear..	G&O....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Own....	Cent..	1600	15	West...	Apollo..	S-P...
Armleder.....20	1	148	34x3½	34x5*	Buda....	4-3¾x5½	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1	Vac....	.....	.....	1400	....	West...	Bosch..	S&C...
Armleder.....HW	2½	148	36x4*	36x7*	BorC....	4-4⅛x5¼	2	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Gear..	Zenith...	1¼	Gra...	Pharo...	Hyd..	1350	....	Vesta..	Bosch..	S&C...
Armleder.....KW	3½	156	36x5*	36x5d*	BorC....	4-4½x5½	2	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Gear..	Zenith...	1¼	Gra...	Pharo...	Hyd..	1250	12	Vesta..	Bosch..	S&C...
Atco.....B	1½	132	34x5*	36x6*	Buda....	4-3¾x5½	4	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1	Vac....	.....	.....	.....	.....	West...	Eis....	.....
Atco.....A	2½	150	36x4*	36x8*	Buda....	4-4¼x5½	4	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb.	1¼	Vac...	Pier....	Cent..	....	18	Eis....	Eis....	.....
Atlas.....MD	1	130	32x4½p	32x4½p	Lyc.....	4-3½x5	4	.....	.....	Fin...	.....	.....	.....	Marvel..	....	Gra...	.....	.....	.....	....	Bijur...	At-K...	.....
Atterbury.....20R	1½	144	34x3½	34x5	Cont....	4-3¾x5	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1	Vac...	Simp....	Cent..	1525	20	Delco..	Berlg...	.....
Atterbury.....7CX	2½	153½	36x5	36x4d	Cont....	4-4⅛x5½	4	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Pist...	Zenith...	1¼	Gra...	Mon....	Suc...	1300	15	.....	Eis....	.....
Atterbury.....7DX	3½	167½	36x5	40x5d	Cont....	4-4½x5½	2	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Pist...	Zenith...	1¼	Gra...	Mon....	Suc...	1200	14	.....	Eis....	.....
Atterbury.....8E	5	167½	36x5	40x6	Cont....	4-4¾x6	2	Met-Gear .	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Vac...	Cont....	Cent..	1100	11	Delco..	Eis....	.....
Autocar.....21F	1½	97	34x4	34x6	Own....	2-4¾x4½	1	Met-Gear..	Own....	Fin...	Pump.	Cir-Spl..	Pist...	Stromb.	1¼	Gra...	.....	.....	.....	.....	.....	.....	.....
Autocar.....27H	2	114	34x5	34x7	Own....	4-4x5½	4	Com-Gear.	.....	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1¼	Gra...	Pharo...	Oil....	.....	.....	.....	.....	.....
Autocar.....26B	5	156	34x6	36x12	Own....	4-4¼x5½	4	Com-Gear.	.....	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1¼	Gra...	Pharo...	Oil....	.....	.....	.....	.....	.....
Available.....H1½	1½	147	36x3½	36x5	Her.....	4-4x5½	4	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1	Gra...	McCan..	Suc...	1176	18	Bosch..	Bosch..	S&O...
Available.....H2½	2½	152	36x4	36x8	Her.....	4-4x5⅛	4	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1	Vac...	Pier.....	Cent..	1270	16	Bosch..	Bosch..	O-C...
Available.....H3½	3½	176	36x5	40x5d	Her.....	4-4½x5½	4	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Pier.....	Cent..	1215	14	Bosch..	Bosch..	O-C...
Available.....H5	5	190	36x6	40x12	Her.....	4-5x6	2	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Vac...	Pier.....	Cent..	1180	12	Bosch..	Bosch..	O-C...
Avery.....	1	129	34x5p	34x5p	Own....	4-3x4	..	.....	.....	Cel...	Ther..	.....	.....	Stromb..	....	Vac...	Own....	.....	....	20	West...	KW...	.....
Belmont.....D	2	144	34x3½*	34x6*	Buda...	4-4¼x5½	4	.....	Rome-T	Fin...	Pump.	.....	Gear..	Zenith...	1¼	Gra...	Pier.....	Cent..	1600	....	Dynet..	.....	.....
Bessemer.....G	1	124	34x3*	34x4*	Cont....	4-3½x5	4	Met-Gear..	Stan....	Cel...	Ther..	Cir-Spl..	Pist...	Stromb..	1	Gra...	.....	.....	.....	....	Bijur...	Bosch..	S-P...
Bessemer.....H2	1½	144	36x3½	36x5	Cont....	4-3¾x5	4	Met-Gear..	Stan....	Cel...	Ther..	Cir-Spl..	Pist...	Stromb..	1	Gra...	.....	.....	.....	....	Bijur...	Bosch..	S-P...
Bessemer.....J2	2½	158	36x4	36x4d	Cont....	4-4⅛x5½	4	Met-Gear..	Stan....	Cel...	Pump.	Cir-Spl..	Pist...	Stromb..	1¼	Gra...	Pier.....	Cent..	.....	....	Eis....	Eis....	S-P...
Bessemer.....K2	4	175	36x5	36x5d	Cont....	4-4½x5½	2	Met-Gear..	.....	Cel...	Pump.	Cir-Spl..	Pist...	Stromb..	1¼	Gra...	Pier.....	Cent..	.....	....	.....	.....	S-P...
Big Four.....K	4	124	36x7	36x10	Buda...	4-4¼x6	4	Met-Gear..	.....	Cel...	Pump.	Hol-Crk.	Gear..	Zenith...	....	Vac...	.....	Cent..	.....	....	.....	.....	.....
Brinton.....F2½	2½	156	36x4	36x7	Cont....	4-4⅜x5½	4	Met-Gear..	Chic....	Fin...	Pump.	Cir-Spl..	.....	Stromb..	1¼	Gra...	Pier	Cent..	.....	....	.....	.....	C-C...
Brockway.....E	1	135	35x5p	35x5p	Buda...	4-4¾x5¾	4	Met-Gear..	Long....	Fin...	Ther..	Cir-Spl..	.....	Stromb..	1	Vac...	.....	.....	.....	....	Remy..	Remy..	O-C...
Brockway.....SK	1½	145	36x4	36x6	Cont....	4-4⅜x5½	4	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Pharo...	Hyd..	1300	22	NE....	Eis....	O-C...
Brockway.....K5	2½	153	36x4	36x8	Cont....	4-4⅜x5½	4	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Pharo...	Hyd..	1300	18	NE....	Eis....	O-C...
Brockway.....R4	3½	164	36x5	36x10	Cont....	4-4½x5½	2	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Pharo...	Hyd..	1200	14½	NE	Eis....	O-C...
Brockway.....T4	5	174	36x6	40x6d	Cont....	4-4¾x6	2	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Vac...	Cont....	Cent..	1100	13	NE....	Eis....	O-C...
Bridgeport.....A	1½	146	34x3½	34x6	Buda...	4-3¾x5½	4	Met-Gear..	G&O....	Fin...	Pump.	.....	Gear..	Stromb..	1¼	Vac...	Pier.....	Cent..	1250	25	G&D...	.....	.....
Bridgeport.....B	2½	156	36x4	36x4d	Buda...	4-4¼x5½	4	Met-Gear..	G&O....	Fin...	Pump.	.....	Gear..	Stromb..	1½	Vac...	Pier.....	Cent..	1200	15	Opt....	Eis....	.....
Bridgeport.....C	3½	170	36x5	36x10	Buda...	4-4½x6	4	Met-Gear..	G&O....	Fin...	Pump.	.....	Gear..	Stromb..	1½	Vac...	Pier.....	Cent..	1250	13	Opt....	Opt....	.....
Case.....JI	2	144	36x6p	38x7	Own....	4-4½x5¾	4	.....	Mod....	Cel...	Cent..	Cir-Spl..	.....	Bennet..	....	Gra...	Own....	Hyd..	1400	20	Eis....	Eis....	.....
Chevrolet.....G	¾	120	31x4p	34x4½	Own....	4-3 1/16x4	4	Met-Gear..	Har.....	Cel...	Pump.	Cir-Spl..	Gear..	Zenith...	1	Gra...	.....	.....	.....	....	Aut-L..	Remy..	C-C...
Chicago.....C1½	1½	144	36x3½	36x5	Her.....	4-3¾x5⅛	4	Met-Gear..	Bre.....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1	Gra...	.....	.....	1300	18	.....	Bosch..	.....
Chicago.....C2½	2½	156	36x4	36x7	Her.....	4-4x5½	4	Met-Gear..	Bre.....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Simp....	Cent..	1350	16	.....	Bosch..	.....
Chicago.....C3½	3½	156	36x5	36x10	Her.....	4-4½x5½	4	Met-Gear..	Bre.....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Simp....	Cent..	1250	12½	.....	Bosch..	.....
Chicago.....D5	5	156	36x6	40x12	Her.....	4-4½x5½	4	Met-Gear..	Bre.....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Simp....	Cent..	1250	10	.....	Bosch..	.....
Climber.....A	1½	146	36x6*	38x7*	H-S.....	4-3½x5	4	.....	Chic....	Fin...	Ther..	.....	.....	Stromb..	....	.....	.....	.....	1500	20	West...	At-K...	.....
Clydesdale.....18	¾	136	34x5	34x5p	Cont....	4-3¾x5	4	Met-Gear..	Own....	PT...	Ther..	Cir-Spl..	Pist...	Zenith...	1	Vac...	Own....	Cent..	1600	33	Eis....	Eis....	.....
Clydesdale.....20	1	136	34x5p	34x5p	Cont....	4-3¾x5	4	Met-Gear..	Own....	PT...	Ther..	Cir-Spl..	Pist...	Zenith..	1	Vac...	Own....	Cent..	1570	40	Eis....	Eis....	.....
Clydesdale.....42	1½	146	36x3½*	36x6*	Cont....	4-3¾x5	4	Met-Gear..	Own....	PT...	Ther..	Cir-Spl..	Pist...	Zenith..	1	Gra ..	Own....	Cent..	1200	18	Eis.. .	Bosch..	.....
Clydesdale.....65X	2½	163	36x4	36x4d	Cont....	4-4⅛x5½	4	Met-Gear..	Own....	PT...	Pump.	Cir-Spl..	Pist...	Zenith..	1¼	Gra...	Own....	Cent..	1370	17	Eis....	Bosch..	.....
Clydesdale.....90	3½	170	36x5	40x5d	Cont....	4-4½x5½	2	Met-Gear..	Own....	PT...	Pump.	Cir-Spl..	Pist...	Zenith...	1½	Gra...	Own....	Cent..	1400	16	Eis....	Bosch..	S&O...
Clydesdale.....120B	5	176	36x6	40x6d	Cont....	4-4¾x6	2	Met-Gear..	Own....	PT...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Vac...	Own....	Cent..	1400	14	West...	Bosch..	S&O...

TRUCK ABBREVIATIONS

Tires:
C—Cushion
D—Dual
P—Pneumatic
*—Other Options

Engine Make:
B or C—Buda or Continental
Cont—Continental Motors Corp.
D-Lyc—Dort-Lycoming Motor Corp.
Dodge—Dodge Bros.
Gray B—Gray Beall Motor Corp.
H-S—Herschell-Spillman Motor Co.
Her—Hercules Motor Mfg. Co.
High—Highway Engine Co.
Hink—Hinkley Motors Corp.
Lyc—Lycoming Motors Corp.
Mid—Midwest Engine Co.
Wau—Waukesha Motor Co.
Wei—Weidely Motors Co.
Wis—Wisconsin Motor Mfg. Co.

Camshaft Drive:
Com-Gear—Combination Gear
Met-Gear—Metal Gear
N-M-G—Non-Metallic Gear

Radiator Core Make:
AM C—American Can Co.
B&W—B&W Mfg. Co.
Bre—Bremer Mfg. Co.
Chic—Chicago Mfg. Co.
E & M—English & Mersick Co.
Fed—Fedders Mfg. Co.
Flex—Flexo Mfg. Co.
G&O—G&O Mfg. Co.
Gor—Gordon Radiator Co.
Har—Harrison Radiator Corp.
Hoo—Hoover
Liv—Livingston Radiator Corp.
M P Co.—Motor Products Co.
McCo—McCord Mfg. Co.
Mod—Modine Mfg. Co.
Natl—National Can Co.
Perf—Perfex Radiator Co.
Rome-T—Rome-Turney Radiator Co.
Stan—Standard
W R Co.—Wheeler Radiator & Mfg. Co.

Radiator Core Type:
Cel—Cellular
Fin—Finned Tube
P T—Plain Tube

Water Circulation:
Ther—Thermo-Siphon

Oiling System Type:
Cir-Spl — Circulating Splash (includes systems with pressure to main bearings, but not to connecting rod bearings)
Hol-Crk—Hollow Crankshaft

Oil Pump Type:
Ecc—Eccentric
Pist—Piston

Carbureter Make:
Johsn—Johnson Co.
King—(Kingston)—Bryne, Kingston Co.
Rayfld—(Rayfield)—Beneke & Kropf Mfg. Co.
Schebl—Wheeler-Schebler Carburetor Co.
Stromb—Stromberg Motor Devices Co.
Tillot—Tillotson Mfg. Co.

Fuel Feed:
Gra—Gravity
Pr—Pressure
Vac—Vacuum

Governor Make:
Cont—Continental
Dup—Duplex Engine Governor Co.
Hink—Hinkley
McCan—McCanna
Mon—Monarch Governor Co.
Muel—Mueller
Opt—Optional
Pier—Pierce Governor Co.
Simp—(Simplex)—Duplex Engine Governor Co.
Wau—Waukesha Motor Co.

Governor Type:
Cent—Centrifugal
Hyd—Hydraulic
O-O—Oil Operated
Suc—Suction

Generator and Ignition Make:
Ant-L—Electric Auto-Lite Corp.
Eis—Eisemann
Dayt—Dayton
Dyn—Dyneto
G & D—Gray & Davis
Lee-N—Leece-Neville Co.
N E—North East Electric Co.
Opt—Optional
West—Westinghouse Electric & Mfg. Co.

Ignition Make:
At-K—Atwater-Kent Mfg. Co.
Bend—Bendix
Berlg—Berling
Conn—Connecticut Telephone & Electric Co.
K W—K W Ignition Co.
Splitd—Splitdorf

Ignition Type:
C-C—Closed Circuit
C-D—Closed Circuit Double Point
D-P—Double Point
O-C—Open Circuit
S & C—Single Point and Closed Circuit
S & O—Single Point and Open Circuit
S-P—Single Point

Clutch Make:
B & B—Borg & Beck Co.
B-L—Brown-Lipe
Cov—Covert Gear Co.
Det—Detlaff Co.
Dt—Detroit Gear and Machinery Co.
Dodge—Dodge Bros.
Ful—Fuller & Sons Mfg. Co.
Hele—Hele-Shaw (Merchant & Evans Co.
Mech—Mechanics Machine Co.
M & E—Merchant & Evans Co.
Twin—Twin Disc Clutch Co.
Uni—Universal

American Trucks

CLUTCH		TRANSMISSION												SPRINGS		BRAKES		STEERING		WHEELS			
		GEARSET				UNIVERSAL JOINTS		AXLES															
Make	Type	Make	Type	Location	Forward Speeds	Make	Type	Front Make	Rear Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Final Drive Type	Front	Rear	Service	Emergency	Steering Gear Make	Steering Gear Type	Make	Type	Frame Material	Make and Model
Det	D-M	Cotta	Ind	Sep-Un	4	Blood	Met		Tim	7.75	Sp	Sp	Worm					Ross		Smith		P-S	Acason H
Det	D-M	Cotta	Ind	Sep-Un	4	Blood	Met		Tim	8.75	Sp	Sp	Worm					Ross		Smith		P-S	Acason L
Ful	D-M	Ful	SG	Sep-Un	3	Spi	Met	Tim	Tim	7.00	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Sch	Art	P-S	Ace C
Ful	D-M	Ful	SG	Sep-Un	4	Spi	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W		Ross	S&N	Sch	Art	P-S	Ace A
B&B	Pla	Cotta	CM	Un-WE	3	Blood	Met	Tim	Tim	6.25	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Bimel		P-S	Acme G
B&B	Pla	Cotta	CM	Un-WE	3	Blood	Met	Tim	Tim	7.20	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Bimel	Art	P-S	Acme B
B&B	Pla	Cotta	CM	Un-WE	3	Blood	Met	Tim	Tim	8.75	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Bimel	Art	P-S	Acme F
B&B	Pla	Cotta	CM	UN-WE	4	Blood	Met	Tim	Tim	9.25	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Bimel	Art	P-S	Acme A
B&B	Pla	Cotta	CM	Un-WE	4	Blood	Met	Tim	Tim	6.00	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Bimel	Art	P-S	Acme AC
B&B	Pla	Cotta	CM	Sep-Un	4	Blood	Met	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Bimel	Art	P-S	Acme C
B&B	Pla	Cotta	CM	Sep-Un	4	Blood	Met	Tim	Tim	11.66	RR	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Smith	C-S	P-S	Acme E
War	D-M	War	SG	Un-WE	3		Fab	Eat	Eat	5.12	Sp	Sp	S-B	½E	½E	Int	Int	Jac	S&N	Bimel	Art	P-S	Akron Multi-Truck 20
Det	D-M	Cotta	CM	Un-WE	4	Arvac	Met	Sav	Tho	8.66	Sp	Sp	Worm	½E	½E			Ross		Indes	P-S	P-S	American 25
Det	D-M	Cotta	CM	Sep-Un	4	Arvac	Met	Sav	Wis	10.00	Sp	Sp	Worm	½E	½E	Int	Int	Lav	W&S	Indes	P-S	P-S	American 40
Det	D-M	Cotta	CM	Sep-Un	4	Arvac	Met	Sav	Tho	10.00	Sp	Sp	Worm	½E	½E	Int	Int	Ross	W&S	Indes	P-S	P-S	American 50
Ful	D-M	Ful	SG	Un-WE	3	Spi	Met	Shu	Tim	7.25	RR	Sp	Worm	½E	½E	IntR-W	IntRW-	Ross	S&N	StM	Art	P-S	Armleder 20
Ful	D-M	Ful	SG	Un-WE	4	Spi	Met	Tim	Tim	9.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	StM		P-S	Armleder HW
Ful	D-M	Ful	SG	Un-WE	4	Spi	Met	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	SM		R-S	Armleder KW
Ful	D-M	Ful	SG	Un-WE	3	Hart	Met		Wis	7.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	Iron	R-S	Atco B
Ful	D-M	Ful	SG	Sep-Un	4	Hart	Met	She	Wis	8.67	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	Iron	P-S	Atco A
B&B	Pla	Own			3				Own				Worm	½E	½E	ExtR-W	Dr	CAS		E&O	Art	P-S	Atlas MD
Ful	D-M	Ful	SG	Un-WE	3	Spi	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Arch	Art	P-S	Atterbury 20R
B-L	D-M	B&L	SG	Un-WE	4	Spi	Met	Tim	Tim	9.25	Sp	Sp	Worm	½E	½E	Int	Int	Gem	W&S	Arch	Art	P-S	Atterbury 7CX
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Tim	Tim	10.33	Sp	Sp	Worm	½E	½E	Int	Int	Gem	W&S	Arch	Art	P-S	Atterbury 7DX
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	11.60	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&S	Stan	C-S	P-S	Atterbury 8E
Own	Pla	Own	SG	Sep-Un	3	Spi	Met	Own	Own	8.30	Sp	Sp	B-S	½E	Pl	ExtR-W	IntR-W	Ross	S&N		Art	P-S	Autocar 21F
Own	Pla	Own	SG	Sep-Un	4		Met	Own	Own	6.43	Sp	Sp	B-S	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	P-S	Autocar 27H
Own	Pla	Own	SG	Sep-Un	4	Spi	Met	Own	Own	8.70	Sp	Sp	B-S	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	P-S	Autocar 26B
B-L	D-M	B-L	SG	Un-WE	3	M&E	Met	Tim	Tim	7.00	RR	Sp	Worm	½E	½E	Int	Int	Ross	S&N	StM	Art	R-S	Available H1½
B-L	D-M	B-L	SG	Sep-Un	4	M&E	Met	Tim	Tim	8.50	RR	Sp	Worm	½E	½E	Int	Int	Ross	S&N	StM	Art	R-S	Available H2½
B-L	D-M	B-L	SG	Sep-Un	4	M&E	Met	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	Int	Int	Ross	S&N	StM	Art	R-S	Available H3½
B-L	D-M	B-L	SG	Sep-Un	4	M&E	Met	Tim	Tim	11.66	RR	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Smith	C-S	R-S	Available H5
Own	D-D								Tor				Int					Ross		Own	Art	P-S	Avery
Ful	D-M	Ful	SG	Un-WE		Uni	Met	Shu	Rus		Sp	Sp	Int	½E	El	Ext		Lav	S&N	Own	Art	P-S	Belmont D
Ful	D-M	Ful	SG	Un-WE	3	Arvac	Met	Shu	Tor	7.00	Sp	Sp	Int	½E	½E	ExtR-W	IntR-W	Ross	S&N	Sch	Art	P-S	Bessemer G
B&B	Pla	B-L	SG	Sep-Un	3	Arvac	Met	Shu	Tor	8.00	RR	Sp	Int	½E	½E	ExtR-W	IntR-W	Ross	S&N	Sch	Art	P-S	Bessemer H2
B&B	Pla	B-L	SG	Sep-Un	4	Arvac	Met	Shu	Tor	8.00	RR	Sp	Int	½E	½E	ExtR-W	IntR-W	Ross	S&N	Sch	Art	P-S	Bessemer J2
B&B	Pla	B-L	SG	Sep-Un	4	Spi	Met	Shu	Tor	10.25	RR	Sp	Int	½E	½E	ExtR-W	Dr	Ross	S&N	Smith	C-S	P-S	Bessemer K2
B-L	D-M	Own	SG	Sep-Un	6	Spi	Met	Own	Own	7.50	Sp	Sp	Worm	½E	½E	Ext	Int	Ross	S&N	Smith	C-S	R-S	Big Four K
B-L	D-M	B-L	SG	Un-WE	3	Spi	Met	Tim	Tim		RR	Sp	Worm	½E	½E	I&ER-W	I&ER-W	Ross	W&W	Smith	C-S	R-S	Brinton F2½
War	D-M	War	SG	Un-WE	3	Spi	Met	Col	Col	5.85	Sp	Sp	S-B	½E	½E	Ext	Int	Lav	S&N		Art	P-S	Brockway E
B-L	D-M	B-L	SG	Un-WE	3	Spi	Met	Tim	Tim	6.50	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W		Art	P-S	Brockway SK
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	7.75	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W		Art	P-S	Brockway K5
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	8.75	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W	Smith	C-S	P-S	Brockway R4
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.25	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W	Smith	C-S	P-S	Brockway T4
	Pla	B-L	SG	Un-WE	3	Hart	Met	Shu	Wis	7.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	W&W	Jones	Art	R-S	Bridgeport A
B&B	Pla	B-L	SG	Un-WE	4	Hart	Met	Shu	Eat	7.25	Sp	Sp	Worm	½E	½E	Int	Int	Ross	W&W	Jones	Art	R-S	Bridgeport B
B&B	Pla	B-L	SG	Sep-Un	4	Hart	Met	Shu	Eat	10.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	W&W		Art	R-S	Bridgeport C
Twin	Pla	Own	SG	Un-WE	3	Spi	Met	Tor	Tor		Sp	Sp	I-G	½E	½E			Ross					Case JI
Own	Cone	Own	SG	Un-WE	3	Own	Met	Own	Cen	5.50	Sp	TT	S-B	¼E	½E	ExtR-W	IntR-W	Own	Plan	Hayes	Art	P-S	Chevrolet G
B-L	D-M	B-L	SG	Un-WE		Pet	Met	Tim	Tim	7.00	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Opt		R-S	Chicago C1½
B-L	D-M	B-L	SG	Un-WE	4	Pet	Met	Tim	Tim	8.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Opt		R-S	Chicago C2½
B-L	D-M	B-L	SG	Sep-Un	4	Pet	Met	Tim	Tim	10.33	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem		Opt		R-S	Chicago C3½
B-L	D-M	B-L	SG	Sep-Un	4	Pet	Met	Tim	Tim	13.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Opt		R-S	Chicago D5
		Mun	SG	Un-WE	3	Hart	Met	Tor	Tor		Sp	Sp	I-G	½E	½E			Ross		Roy	Art	P-S	Climer A
B-L	D-M	B-L	SG	Un-WE		Spi	Met	Tim	Tim	5.00	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	Art	P-S	Clydesdale 18
B-L	D-M	B-L	SG	Un-WE		Spi	Met			6.20	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	P-S	Clydesdale 20
B-L	D-M	B-L	SG	Un-WE	3	Spi	Met	Tim	Tim	7.00	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	P-S	Clydesdale 42
B-L	D-M	B-L	SG	Sep-Un	4	Spi		Tim	Tim	8.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Clydesdale 65X
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Clydesdale 90
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	11.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Clydesdale 120B

War—Warner Gear Co.

Clutch Type:
Con—Cone
D-O—Disk in Oil
D-M—Dry Multiple Disk
Pla—Plate (with multiplying levers)

Gearset Make:
B-L—Brown-Lipe
Chev—Chevrolet Motor Co.
Cov—Covert Gear Co.
Dt—Detroit Gear & Machinery Co.
Dodge—Dodge Bros.
Dur—Durston Gear Corp.
Ful——Fuller & Sons Mfg. Co.
G-L—Grant-Lees Gear Co.
Mech—Mechanics Machine Co.
Mun—Muncie Gear Works
War—Warner Gear Co.

Gearset Type:
C M—Constant Mesh
Ind—Individual Jaw Clutches
Plan—Planetary
S G—Sliding Gear

Gearset Location:
Sep Un—Separate Unit
Un W E—Unit with Engine
Un W J—Unit with Jackshaft

Universal Joint Make:
B Co.—Bearings Co. of America
Blood—Blood Brothers Machine Co.
East—Easton Machine Co.
Hart—Hartford Automotive Parts Co.
M & E—Merchant & Evans Co.
Mech—Mechanics Machine Co.
Nor—Norwalk Auto Parts Co.
Pet—Peters Machine & Mfg. Co.
Spi—Spicer Mfg. Corp.
Therm—Thermoid Rubber Co.
Uni—(Detroit) Universal Products
U M Co.—Universal Machine Co.

Universal Joint Type:
Fab—Fabric
Met—Metal

Front and Rear Axle Make:
Cen—Central Products Co.
Col—Columbia Axle Co.
Dodge—Dodge Brothers
Dun—Dunkirk Axle Corp.
Eat—Eaton (Standard Parts Co.)
Emp—Empire
I-M—Iron Mountain Co.
Olds—Olds Motor Works
Opt—Optional
Med—Medway Sales Corp.
Mid—Midwest Wheel & Axle Co.
Rus—Russel Motor Axle Co.
Sal—Salisbury Axle Co.
Sav—Savage
She—Sheldon Axle & Spring Co.
Shu—Shuler Axle Mfg. Co.
S-P—Standard Parts Co.
Tho—Thomson Press Co.
Tim—Timkin-Detroit Axle Co.
Tor—Torbensen Axle Co.
Vul—Vulcan Motor Axle Corp.
Wal—Walker Axle Co.
Wis—Wisconsin Gear & Axle Co.

Propulsion and Torque Taken by:
R R—Radius Rods
Sp—Springs
T A—Torque Arm
T T—Torque Tube

Final Drive Type:
B-S—Bevel-spur (double reduction)
B-S & Ch—Bevel-spur (double reduction) and Chain
Ch—Chain
I-G—Internal Gear
S-B—Spiral Bevel
St B—Straight Bevel

Front and Rear Springs Type:
El—Elliptic
½ E—Half Elliptic
¼ E—Quarter Elliptic
F C—Floating Cantilever
Pl—Platform
½ T—Transverse Half Elliptic

Brake Type and Location:
Dr—Driveshaft
Ext—External
Int—Internal
I & E—Internal & External
R & F—Rear and Front Wheels
R W—Rear Wheels

Steering Gear Make:
Dit—Ditweiler Mfg. Co.
Dodge—Dodge Bros.
Gem—Gemmer Mfg. Co.
Jac—Jacox (Saginaw Products Co.)
Lav—Lavine Gear Co.
Woh—Wohlrab Gear Co.

Steering Gear Type:
B P & S—Bevel Pinion and Sector
Plan—Planetary
S & N—Screw and Nut
W & S—Worm and Sector
W & W—Worm and Wheel

Wheels:
Arch—Archibald Wheel Co.
A-W—Auto-Wheel
Day—Dayton Automotive Wheel Co.
Dom—Dominion Wheel Co.
E & O—Eberly & Orris Mfg. Co.
Hoop—Hoopes Bros. & Darlington
Imp W Co.—Imperial Wheel Co.
Indes—Indestructible Wheel Co.
Med—Medway Sales Corp.
M W Co.—Motor Wheel Corp.
Mut—Mutual Wheel Co.
North—Northern Wheel Co.
Opt—Optional
Prud—Prudden
Roy—Royer Wheel Co.
San F—San Francisco Wheel Co.
St M—Saint Marys
Sch—Schwarz Wheel Co.
Smith—Smith & Co.
Stan—Standard Wheel Co.

Wheels Type:
Art—Artillery
C S—Cast Steel
P S—Pressed Steel

Frame Material:
P S—Pressed Steel
R S—Rolled Section

Specifications of American

Make and Model	Tons Capacity	Wheel-Base, Ins.	TIRE SIZE		ENGINE																ELECTRICAL SYSTEM		
												OILING SYSTEM		FUEL SYSTEM			GOVERNOR		SPEED				
			Front, Ins.	Rear, Ins.	Make	Number Cylinders, Bore and Stroke	Cylinders, Cast	Camshaft Drive Type	Radiator Core Make	Radiator Core Type	Water Circulation	Type	Oil Pump Type	Carbureter Make	Carbureter Size, Ins.	Fuel Feed	Make	Type	Motor in R.P.M.	Truck in M.P.H.	Generator Make	Ignition System, Make	Ignition System, Type
Collier	23	½–1¼	129	34x4½p	34x4½p	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Pump	Cir-Spl	Pist	Zenith	1	Vac					Eis	Eis	C-C
Collier	18	1	132	34x4	34x5	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Pump	Cir-Spl	Pist	Zenith	1	Vac	Mon	Suc			Eis	Eis	C-C
Collier	19	1½	144	36x4	36x6	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Pump	Cir-Spl	Pist	Zenith	1	Vac	Mon	Suc			Eis	Eis	C-C
Collier	22	2½	165	36x4	36x4d	Cont	4–4⅛x5¼	4	Met-Gear	Long	Fin	Pump	Cir-Spl	Pist	Zenith	1¼	Vac	Pier	Suc			Eis	Eis	C-C
Columbia	G	2½	148	36x4	36x7	Hink	4–4x5½	4	Met-Gear	Long	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac	Hink	Cent	1200	14	West	Dixie	
Commerce	T	¾	127	34x4½p	34x4½p	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl	Pist	Zenith	1	Vac			2200	40	Bijur	Eis	
Commerce	12	1½	130	35x5*	35x5*	Cont	4–3¾x5	3	Met-Gear	Long	Fin	Ther	Cir-Spl	Pist	Zenith	1	Vac			2200	40	Bijur	Eis	
Commerce	16	2	137	35x5p	36x6p	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl	Pist	Zenith	1	Vac			2200	30	Bijur	Eis	
Commerce	18	2½	149	36x6p	38x7p	Cont	4–4¼x5½	4	Met-Gear	Long	Fin	Pump	Cir-Spl	Pist	Zenith	1¼	Vac				30	Eis	Eis	
Cook	51	2½	....	36x6p	40x8p	Her	4–4½x5⅛	4	Met-Gear	Chic	Fin	Pump	Hol-Crk	Gear			Vac			2000	35	West	Splitd	
Corbitt	H-22	1	130	34x3½	34x4	Cont	4–3¾x5	4	Met-Gear	McCo	Fin	Ther	Cir-Spl	Gear	Stromb	1	Vac	Simp	Cent		18	Bijur	Eis	
Corbitt	E-22	1½	144	34x3½	34x5	Cont	4–3¾x5	4	Met-Gear	McCo	PT	Ther	Cir-Spl	Gear	Stromb	1	Vac	Simp	Cent	1200	18	Bijur	Eis	
Corbitt	C-22	2	148	36x3½	36x7	Cont	4–4¼x5¼	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Vac	Simp	Cent		16	Eis	Eis	
Corbitt	B-22	2½	152	36x4	36x7	Cont	4–4½x5½	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Vac	Simp	Cent		16	Eis	Eis	
Corbitt	R-22	3	158	36x4	36x8	Cont	4–4¾x5½	2	Met-Gear	McCo	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Vac	Pier	Cent		15	Eis	Eis	
Corbitt	A-22	3½–4	178	36x5	36x10	Cont	4–4½x5½	2	Met-Gear	McCo	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Vac	Pier	Cent		14	Eis	Eis	
Corbitt	AA-22	5	178	36x6	40x6d	Cont	4–4¾x6	2	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Stromb	1½	Vac	Cont	Cent	950	12	Eis	Eis	
Day-Elder	A	1	128	35x5p	35x5p	Cont	4–3¾x5	4	Met-Gear	Bush	Fin	Ther	Cir-Spl	Pist	Zenith	1¼	Gra			1800	30	Eis	Eis	C-D
Day-Elder	B	1½–2	144	34x3½	34x5	Cont	4–3¾x5	4	Met-Gear	Bush	Fin	Ther	Cir-Spl	Pist	Zenith	1¼	Gra			1385	15	Eis	Eis	C-D
Day-Elder	D	2–2½	144	36x4	36x7	Cont	4–4¼x5¼	4	Met-Gear	Bush	Fin	Pump	Cir-Spl	Pist	Zenith	1¼	Gra	Mon	Suc	1140	14	Eis	Eis	C-D
Day-Elder	C	2½–3	150	36x4	36x7	Buda	4–4¼x5¼	4	Met-Gear	Bush	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Mon	Suc	1140	14	Eis	Eis	C-D
Day-Elder	F	3½–4	165	36x5	36x5d	Cont	4–4½x5½	2	Met-Gear	Bush	Fin	Pump	Cir-Spl	Gear	Zenith	1½	Gra	Mon	Suc	1150	12	Eis	Eis	C-D
Day-Elder	E	5–6	162	36x5	40x6d	Buda	4–4½x6	4	Met-Gear	Bush	Fin	Pump	Hol-Crk	Gear	Zenith	1½	Gra	Mon	Suc	860	10	Eis	Eis	C-D
Dearborn	E	1	132	35x5p	35x5p	Buda	4–3⅜x5½	4	N-M-G	Chic	Fin	Pump	Hol-Crk	Gear	Stromb	1	Vac			3500	45	West	Conn	C-C
Dearborn	F	1½	126	34x4	34x5	Buda	4–3¾x5¼	4	Met-Gear	Chic	Fin	Ther	Cir-Spl	Gear	Stromb	1	Vac			2600	28	West		O-C
Dearborn	48	2	141	34x4½p	34x7	Buda	4–3¾x5½	4	Met-Gear	Chic	Fin	Ther	Cir-Spl	Gear	Stromb	1	Vac			2600	22½	West	Bosch	
Defiance	G	1	128	35x5p	35x5p	High	4–3¾x5	4	Met-Gear	Perf	Cel	Pump	Hol-Crk	Gear	Stromb	1	Vac			2600		Aut-L	Eis	
Defiance	D	1½	140	35x5p	36x6p	High	4–3¾x5	4	Met-Gear	Perf	Cel	Pump	Hol-Crk	Gear	Stromb	1	Vac					Aut-L	Eis	
Defiance	E	2	140	35x5p	38x7p	High	4–3¾x5	4	Met-Gear	Perf	Cel	Pump	Hol-Crk	Gear	Stromb	1	Vac					Aut-L	Eis	
DeMartini	1½	1½	....	34x3½	34x6	Buda	4–3½x5¼	4	Met-Gear	Flex	Cel	Ther	Cir-Spl	Gear	Zenith	1½	Vac			2500		Bosch	Bosch	
DeMartini	2	2	162	36x4	36x7	Buda	4–4½x5½	4	Met-Gear	Flex	Cel	Pump	Hol-Crk	Gear	Zenith	1¼	Vac			1800		Bosch	Bosch	
DeMartini	3	3	168	36x5	36x10	Buda	4–4¼x5½	4	Met-Gear	Flex	Cel	Pump	Hol-Crk	Gear	Zenith	1½	Vac			1200		Bosch	Bosch	
DeMartini	4	4	188	36x6	36x6d	Buda	4–4½x6	4	Met-Gear	Flex	Cel	Pump	Hol-Crk	Gear	Zenith	1½	Vac			1950		Bosch	Bosch	
Denby	31	¾	130	35x5p	35x5p	Cont	4–3¼x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl		Stromb	1	Gra			1900	25	Remy	Eis	S-P
Denby	33	1½	136	35x5p	38x7p	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl		Stromb	1	Gra			1600	26½	Remy	Eis	S-P
Denby	134	2	144	36x3½	36x6	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl		Stromb	1	Gra	Mon	Suc	1330	22½		Eis	S-P
Denby	25	3	150	36x4	37x7	Cont	4–4¼x5¼	4	Met-Gear	Long	Fin		Cir-Spl		Stromb	1½	Gra	Mon	Suc	1145	27		Eis	S-P
Denby	27	4	170	36x5	36x10	Cont	4–4½x5¼	4	Met-Gear	Long	Fin		Cir-Spl		Stromb	1½	Gra	Dup	Cent	1090	32		Eis	S-P
Denby	210	5	170	36x6	40x12	Cont	4–4½x5½	4	Met-Gear	Long	Fin	Pump	Cir-Spl		Stromb	1½	Gra	Dup	Cent	1090	32		Eis	S-P
Dependable	C	1½	150	34x4	34x6	Buda	4–3¾x5¼	4	Com-Gear	Long	Fin	Pump	Hol-Crk	Gear	Zenith	1	Vac	Mon	Suc	1800			Splitd	S&O
Dependable	E	2½	165	36x4	36x7	Buda	4–4¼x5½	4	Com-Gear	Long	Fin	Pump	Hol-Crk	Gear	Zenith	1½	Vac	Mon	Suc	1850			Splitd	S&O
Diamond T	03	1–1½	132	36x3½	36x4	Hink	4–3¾x5¼	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Stromb	1	Vac	Hink	Cent	1425	28	Bosch	Bosch	
Diamond T	FS	1½	144	36x3½	36x5	Hink	4–3¾x5¼	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Stromb	1	Vac	Hink	Cent	1425	18	Bosch	Bosch	
Diamond T	U	2	160	36x4	36x7	Hink	4–4x5½	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac	Hink	Cent	1425	16	Bosch	Bosch	
Diamond T	K	3½	170	36x5	36x5d	Hink	4–4¼x5½	2	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac	Hink	Cent	1250	13	Bosch	Bosch	
Diamond T	EL	5	180	36x6	40x6d	Hink	4–4½x5½	2	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac	Hink	Cent	1250	12	Bosch	Bosch	
Diehl	B	1½	125	34x4½p	35x5*	H-S	4–3½x5	4	Met-Gear	Stan	Cel	Ther	Cir-Spl	Gear	Zenith	1¾	Gra							
Dodge Brothers		½	114	32x4p	32x4p	Own	4–3⅞x4½	4	Met-Gear	McCo	PT	Pump	Cir-Spl	Gear	Stewart	1	Vac			2000		NE	NE	S&C
Dorris	K-4	2½	144	36x4	36x7	Own	4–4¼x5½	4		McCo	Cel	Pump		Gear	Stromb		Vac	Own	Cent	1190	15	West	Bosch	S-P
Dorris	K-7	3½	154	36x5	36x10	Own	4–4¼x5½	4		McCo	Cel	Pump		Gear	Stromb	1½	Vac	Own	Cent	1190	15		Bosch	S-P
Dort	103	½	105½	31x4p	31x4p	D-Lyc	4–3½x5	4	Met-Gear	Fed	Cel	Ther	Cir-Spl	Pist	Carter	1	Vac			2100	45	Bosch	Conn	C-C
Duplex	A	1½–2	145	35x5p	38x7p	Hink	4–4x5¼	4	Met-Gear	Mod		Pump	Cir-Spl	Gear	Stromb	1¼	Gra			2200	35	West	West	C-D
Duplex	E	3½	130	36x8	36x8	Buda	4–4½x5½	4	Met-Gear	Long	PT	Pump	Cir-Spl	Gear	Schebl	1¼	Vac	Dup	Cent	1400	15			C-C
Duty		2	134	34x3½*	34x5*	Gray-B	4–3⅛x5	4			Cel	Ther		Gear	Zenith					2000	34			
F. W. D.	B	3	124	36x6	36x6	Wis	4–4¾x5½	2	Met-Gear			Pump	Hol-Crk	Gear	Stromb	1½	Gra	Pier	Cent	1350	16	NE	Vend	S & C
Facto		2½	155	36x4*	36x8*	Buda	4–4½x5½	4	Met-Gear	Bush	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Pier	Cent	1300		West		O-C
Fageol	2	2	136	34x3½*	34x6*	Wau	4–3¾x5½	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Gear	Zenith	1	Vac	Wau	Cent	1250	26	Splitd	Dixie	
Fageol	3	3	144	34x4*	36x7*	Wau	4–4½x5½	2	Met-Gear	McCo	Fin	Pump	Cir-Spl	Gear	Zenith	1½	Gra	Wau	Cent	1100	21	Splitd	Dixie	
Fageol	4	4	172	36x5*	36x5d*	Wau	4–4½x6½	2	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Zenith	1½	Vac	Wau	Cent	1000	17	Splitd	Dixie	
Fageol	6	6	172	36x6	40x6d	Wau	4–4½x6½	2	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Vac	Wau	Cent	1000	14	Splitd	Dixie	
Fargo	R	2	144	36x4	36x6	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl		Rayfld	1	Gra							
Federal	SD	1–1½	132	35x5p	36x6p	Cont	4–3¾x5	4	Met-Gear		Fin	Pump	Hol-Crk	Gear	Zenith	1	Vac	Pharo	Hyd	1450	25	Aut-L	Eis	C-C
Federal	TE	1½–2	144	36x3½	36x5	Cont	4–4⅛x5¼	4	Met-Gear		Fin	Pump	Cir-Spl	Gear	Zenith	1¼	Gra	Pharo	Hyd	1190	15	Aut-L	Eis	C-C
Federal	UE	2–2½	156	36x4	36x4d	Cont	4–4⅛x5¼	4	Met-Gear		Fin	Pump	Cir-Spl	Gear	Zenith	1¼	Gra	Pharo	Hyd	1120	13	Aut-L	Eis	C-C
Federal	WE	3½–4	154	36x5	36x5d	Cont	4–4½x5½	2	Met-Gear	Long	Fin	Pump	Cir-Spl	Gear	Zenith	1¼	Gra	Pharo		1150	12		Eis	S-P
Federal	X-2	5–6	163	36x6	40x6d	Cont	4–4¾x6	2	Met-Gear	Long	Fin	Pump	Hol-Crk	Gear	Zenith	1½	Vac	Pharo	Hyd	1100	12	Aut-L	Eis	S-P
Ford	TT	1	123	30x3½p	32x4½p	Own	4–3¾x4	4	Met-Gear	Own	Fin	Ther	Cir-Spl		Own	1	Gra					Own	Own	O-C
Fulton	A	1	130	35x5p	35x5p	H-S	4–3⅜x5	4	Met-Gear	Liv	Cel	Ther	Cir-Spl		Carter	1	Gra					West	Mag	
Fulton	C	2	177	34x4	34x6	H-S	4–2½x5	4	Met-Gear	G&O	Cel	Ther	Cir-Spl	Gear	Carter	1	Gra			1700	18			
G. M. C.	K-16	1	132	34x5p	34x5p	Own	4–3⅜x5½	4	Met-Gear	McCo	Fin		Hol-Crk	Gear	Marvel	1¼	Gra	Own	Cent	1485	25	Remy	Eis	
G. M. C.	K-41-A	2	146	36x4	36x7	Own	4–4x5½	4	Met-Gear	McCo	Fin		Hol-Crk	Gear	Marvel	1¼	Gra	Own	Cent			Remy	Eis	
G. M. C.	K-71	3½	163	36x5	40x5d	Own	4–4½x6	4	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Marvel	1¼	Gra	Own	Cent	1250		Remy	Eis	
G. M. C.	K-101	5	167	36x5	40x6d	Own	4–4½x6	4	Met-Gear	McCo	Fin		Hol-Crk	Gear	Marvel	1¼	Gra	Own	Cent	1260	15	Remy	Eis	
G. W. W.	Farm-Special	1½	142	35x5p	35x5p	Wei	4–3¾x5½	4		Own	Fin	Pump	Hol-Crk	Gear	Schebl	1¼	Gra				40	Delco	Delco	C-C
Garford	15	¾	132	34x5p	34x5p	Buda	4–3¾x5½	4		Long	Fin	Cent			Stromb		Gra			1800	30			
Garford	25	1¼	135	36x3½	36x4	Buda	4–3¾x5½	4			Fin	Cent	Cir-Spl		Stromb		Gra					West	Splitd	
Garford	70-H	2	144	36x4	36x7	Buda	4–4½x5½	4			Fin	Cent			Stromb		Gra	Sim	Cent	1085	15	West	Splitd	
Garford	77-D	3½	162	36x5	36x5d	Buda	4–4½x6	4			Fin	Cent			Stromb		Gra	Sim	Cent	1144	14	West	Splitd	
Garford	68-D	5	128	36x6	40x6d	Wis	4–4¾x5½	2				Cent			Rayfld		Gra	Sim	Cent	1057	11			
Gary	F	1	130	36x3½	36x4	Buda	4–3¾x5	4	Met-Gear		Fin	Ther	Hol-Crk	Gear	Master	1	Vac	McCan	Suc	1050	20	Opt	Eis	D-P
Gary	I	1½	144	36x3½	36x5	Buda	4–4x5½	4	Met-Gear		Fin		Hol-Crk	Gear	Master	1½	Vac	McCan	Suc	980	18			D-P
Gary	J	2½	148	36x4	36x7	Buda	4–4½x5½	4	Met-Gear		Fin	Pump	Hol-Crk	Gear	Master	1½	Vac	McCan	Suc	1350	15		Eis	D-P
Gary	K	3½	162	36x5	40x5d	Buda	4–4½x6	4	Met-Gear		Fin	Pump	Hol-Crk	Gear	Master	1½	Vac	McCan	Suc		12			D-P
Gary	M	5	182	36x6	40x6d	Buda	4–5½x6½	4	Met-Gear		Fin	Pump	Hol-Crk	Gear	Master	1½	Vac	McCan	Suc	1200	10			D-P
Gersix	K	2½	150	36x4*	36x8	Buda	4–4½x5½	4	Met-Gear	Ideal	Cel	Pump	Hol-Crk	Gear	Stromb	1¼	Vac	Mon	Suc	1320	15	G&D	Bosch	S & C
Graham Brothers		1	140	33x4½p	34x5p	Dodge	4–3⅞x4½	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Ecc	Stewart		Vac					NE	NE	S & D
Gramm-Pioneer	10	1	129	33x5p	33x5p	Lyc	4–3½x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl		Stromb	1	Gra			2400	50	Aut-L	Conn	C-C
Gramm-Pioneer	15	1½	138	36x3½	36x5	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl	Pist	Stromb	1	Gra			1600	25	NE	NE	C-C
Hahn	J-4	1	132	34x5*	34x5*	Cont	4–3¾x5	...		Chic	Fin	Pump	Hol-Crk					Pharo		1200		Delco	Delco	
Hahn	CD	1½	155	36x3½*	36x5*	Cont	4–4¼x5½	...		Chic	Fin	Pump	Hol-Crk	Gear		1¼	Gra	Pharo		1400		Delco		
Hahn	DE	2	158	36x4*	36x7*	Cont	4–4¼x5½	...		Chic	Fin	Pump	Hol-Crk	Gear		1¼	Gra	Pharo		1400		Delco		
Hahn	EE	2½	162	36x4*	36x8*	Cont	4–4½x5½	2		Chic	Fin	Pump	Hol-Crk	Gear		1¼	Gra	Pharo		1400		Delco		
Hahn	F	3½	191	36x5*	36x10*	Cont	4–4½x5½	...		Chic	Fin	Pump	Hol-Crk	Gear		1¼	Gra	Pharo	Cent	1400		Delco		

For abbreviations, see pages 350 and 351.

Trucks (Continued)

CLUTCH		TRANSMISSION												SPRINGS		BRAKES		STEERING		WHEELS			
		GEARSET				UNIVERSAL JOINTS		AXLES															
Make	Type	Make	Type	Location	Forward Speeds	Make	Type	Front Make	Rear Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Final Drive Type	Front	Rear	Service	Emergency	Steering Gear Make	Steering Gear Type	Make	Type	Frame Material	Make and Model
Ful	D-M	Ful	SG	Un-WE		Uni	Met	Sal	Sal	5.50	Sp	Sp	S-B	½E	½E	ExtR-W	IntR-W	Ross	S&N	Bimel	Art	P-S	Collier 23
Ful	D-M	Ful	SG	Un-WE	3	Uni	Met	Tim	Tim	7.50	Sp	Sp	Worm	½E	½E	Ext	Int	Ross	S&N	Bimel	Art	P-S	Collier 18
Ful	D-M	Ful	SG	Un-WE		Uni	Met	Tim	Tim	7.50	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Bimel	Art	R-S	Collier 19
Ful	D-M	Ful	SG	Un-WE	3	Uni	Met	Tim	Tim		Sp	Sp	Worm	½E	½E	Ext	Int	Ross	S&N	Bimel	Art	R-S	Collier 22
M&E	D-M	Cotta	CM	Sep-Un	4	Spi	Met	Shu	Rus	9.45	Sp	Sp	Int	½E	½E	ExtR-W	IntR-W	Own	W&W	Detroit	Art	R-S	Columbia G
DG&M	Con	DG&M	SG	Un-WE	3	Spi	Met	Sal	Sal	5.70	Sp	Sp	S-B	½E	½E	ExtR-W	IntR-W	Jac	S&N			P-S	Commerce T
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Sal	Tor	8.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N		Art	P-S	Commerce 12
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Sal	Tor	9.00	Sp	Sp	I-G	½E	½E	Ext	Int	Jac			Art	P-S	Commerce 16
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Tor	Tor	9.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N		Art	P-S	Commerce 18
B&B	Pla	B-L	SG	Un-WE	4	Own	Fab	Tim	Opt	7.00	Sp	Sp		½E	½E	R-W	R-W	Woh	S&N		C-S	P-S	Cook 51
B-L	D-M	B-L	SG	Un-WE	3	Hart	Met	She	She	5.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	R-S	Corbitt H22
B-L	D-M	B-L	SG	Un-WE	3	Hart	Met	She	She	6.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	R-S	Corbitt E22
B-L	D-M	B-L	SG	Un-WE	3	Hart	Met	She	She	8.67	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	R-S	Corbitt C22
B-L	D-M	B-L	SG	Un-WE	4	Hart	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	R-S	Corbitt B22
B-L	D-M	B-L	SG	Un-WE	4	Hart	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	R-S	Corbitt R22
B-L	D-M	B-L	SG	Un-WE	4	Hart	Met	She	She	11.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Corbitt A22
Det	D-M	B-L	SG	Sep-Un	4	Hart	Met	She	She	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Corbitt AA22
Cov	D-M	Cov	SG	Un-WE	3	Hart	Met	She	She	6.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Jones	Art	P-S	Day-Elder A
Cov	D-M	Cov	SG	Un-WE	3	Hart	Met	Col	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Jones	Art	P-S	Day-Elder B
Cov	D-M	Cov	SG	Un-WE	4	Hart	Met	Col	She	8.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Jones	Art	P-S	Day-Elder D
Cov	D-M	Cov	SG	Un-WE	4	Hart	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Jones	Art	P-S	Day-Elder C
B-L	D-M	B-L	SG	Un-WE	4	Hart	Met	Col	She	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Jones	Art	P-S	Day-Elder F
B-L	D-M	B-L	SG	Sep-Un	4	Hart	Met	She	She	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Jones	Art	P-S	Day-Elder E
Ful	D-M	Ful	SG	Un-WE	3	Hart	Met	Tor	Wis	6.20	Sp	Sp	Worm	½E	½E	Int	Int	Dit	W&W	Own	Art	R-S	Dearborn E
Ful	D-M	Ful	SG	Un-WE		Hart	Met	Tor	Wis	7.50	Sp	Sp	Worm	½E	½E	Int	Int	Dit	W&W	Own	Art	P-S	Dearborn F
Ful	D-M	Ful	SG	Un-WE		Hart	Met	Tor	Wis	9.60	Sp	Sp	Worm	½E	½E	Int	Int	Dit	W&W	Own	Art	R-S	Dearborn 48
B&B	Pla	G-L	SG	Un-WE	3	Arvac	Met	Eat	Eat	5.25	Sp	Sp	S-B	½E	½E	IntR-W	IntR-W	Own	W&W	StM	Art	P-S	Defiance G
B&B	Pla	G-L	SG	Un-WE	3	Arvac	Met	Col	Tor	7.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntRM-	Own	W&W	StM	Art	P-S	Defiance D
B&B	Pla	G-L	SG	Un-WE	3	Arvac	Met	Col	Tor	8.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Own	W&W	StM	Art	P-S	Defiance E
B-L	D-M	B-L	SG	Un-WE			Spi	Met	She	She		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	R-S	DeMartini 1½
B-L	D-M	B-L	SG	Un-WE			Spi	Met	She	She		RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-C	R-S	DeMartini 2
B-L	D-M	B-L	SG	Un-WE	4		Spi		She	She		RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	DeMartini 3
B-L	D-M	B-L	SG	Un-WE	4		Spi	Met	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	DeMartini 4
Ful	D-M	Ful	SG	Un-WE	3	Uni	Met	She	Col	5.85	Sp	Sp	S-B	½E	½E	ExtR-W	IntR-W	Ross	S&N	MWC	Art	P-S	Denby 31
Ful	D-M	Ful	SG	Un-WE	3	Uni	Met	Tim	Clark	6.83	Sp	Sp	I-G	½E	½E	ExtDr	ExrR-W	Gem	W&W	MWC	Art	P-S	Denby 33
Ful	D-M	Ful	SG	Un-WE	4	Uni	Met	Tim	Rus	10.20	Sp	Sp	I-G	½E	½E	ExtDr	ExtR-W	Gem	W&W	MWC	Art	P-S	Denby 134
Ful	D-M	Ful	SG	Un-WE	4	Uni	Met	S-P	Rus	9.45	Sp	Sp	I-G	½E	½E	ExtDr	ExtR-W	Gem	W&W	Smith	C-S	P-S	Denby 25
Own	D-M	War	SG	Sep-Un	4	Uni	Met	S-P	Clark	10.00	SP	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Denby 27
Own	D-M	War	SG		4	Pet	Met	S-P	Clark	12.55	Sp	Sp	I-G	½E	½E	ExtDr	IntR-W	Ross	S&N	Clark	C-S	P-S	Denby 210
Ful	D-M	Ful	SG	Un-WE	3	Arvac	Met	Shu	Wis	8.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	P-S	Dependable C
Ful	D-M	Ful	SG	Sep-Un	4	Arvac	Met	Shu	Wis	8.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	P-S	Dependable E
Cov	D-M	Cov	SG	Un-WE			Spi	Met	Tim	Own	6.20	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Sch	Art	P-S	Diamond T 03
Cov	D-M	Cov	SG	Un-WE	4		Spi	Met	Tim	Wis	8.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Sch	Art	P-S	Diamond T FS
Cov	D-M	Cov	SG	Un-WE				Met	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Sch	Art	P-S	Diamond T U
Cov	D-M	Cov	SG	Sep-Un	4		Spi	Met	Tim	Tim		Sp	Sp	Worm	½E	½El	IntR-W	IntR-W	Gem	W&W	Smith	C-S	P-S	Diamond T K
Cov	D-M	Cov	SG	Sep-Un	4		Spi	Met	Tim	Tim	11.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Smith	C-C	P-S	Diamond T EL
M&E	D-M	Dur	SG	Un-WE	3	M&E	Met	Sal	Tor	6.33	Sp	Sp	I-G	½E	½E	Ext	Int	Ross	S&N	Wayne	Art	P-S	Diehl B
Own	D-M	Own	SG	Un-WE	3	Own	Met	Own	Own	4.16	Sp	TT	S-B	½E	¾E	Ext	Int	Own	W&W	Kelsey	Art	P-S	Dodge Brothers
Own	D-M	War	SG	Un-WE	3	Spi	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Smith	C-S	P-S	Dorris K4
Own	D-M			Un-WE	3	Spi	Met	Tim	Tim		Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Smith	C-S	P-S	Dorris K7
Det	D-M	Own	SG	Un-WE	3	Mec	Met	Flint	Flint	4.45	Sp	TT	S-B	½E	FC	Ext	Int	Jac	S&N	ImpWC	Art	P-S	Dort 103
Cov	D-M	Cov	SG	Un-WE	3	Pet	Met	She	She	6.50	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	MWC	Art	P-S	Duplex A
B-L	D-M	B-L	SG	Un-WE	4	Pet	Met	Own	Own	8.00	RR	Sp	I-G	½E	½E	ExtDr	R-W	Woh	S&N	MWC	Art	P-S	Duplex E
Cov	D-M																						Duty
Hele	D-M	Cotta	CM	Sep-Un	3	Blood	Met	Own	Own	8.90	Sp	TA	StB	½E	Pl	ExtR&F	ExtR-W	Ross	S&N	Sch	Art	P-S	F. W. D. B
Ful	D-M	Ful	SG	Sep-Un	4	Spi	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	Smith	C-S	P-S	Facto
Det	D-M	Own	SG	Un-WE	5			Eat	Eat	7.80	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Prud		R-S	Fageol 2
Det	D-M	Own	SG	Sep-Un	5			Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Prud		R-S	Fageol 3
Det	D-M	Own	SG	Sep-Un	5			Tim	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Prud		P-S	Fageol 4
Det	D-M	Own	SG	Sep-Un	5			Tim	Tim	11.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Prud		P-S	Fageol 6
Ful	D-M	Ful	SG	Un-WE			Spi		Shu	Rus	9.40	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N		Art	R-S	Fargo R
B&B	Pla	Own	SG	Sep-Un	3	Pet	Met	Own	Tim	7.20	RR	Sp	Worm	½E	½E	R-W	R-W	Gem	W&W	Dist	P-S	P-S	Federal SD
B&B	Pla	DG&M	SG	Sep-Un	4	Spi	Met	Own	Tim	8.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Sch	Art	Wd	Federal TE
B&B	Pla	DG&M	SG	Sep-Un	4	Spi	Met	Own	Tim	9.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Sch	Art	P-S	Federal UE
B&B	Pla	War	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Smith	C-S	P-S	Federal WE
B&B	Pla	War	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Smitn	C-S	P-S	Federal X2
Own	D-M	Own	Plan	Un-WE	2	Own	Met	Own	Own	7.25	TT	TT	Worm	½E	¼E	Dr	R-W	Own	Plan		Art	P-S	Ford TT
B&B	Pla	Dur	SG	Un-WE		Spi	Met	Col	Col	6.80	Sp	Sp	S-B	½E	½E	R-W	R-W	Lav	S&N	Hoopes	Art	P-S	Fulton A
Cov	D-M	Cov	SG	Un-WE		Uni	Met	Col	Rus	10.80	Sp	Sp	I-G	½E	½E	ExtR-W	Dr	Lav	S&N	Hoopes	Art	P-S	Fulton C
Own	D-M	Own	SG	Un-WE	3	Uni	Met	Own	Own	6.00	RR	Sp	StB	½E	½E	Ext	Int	Own	S&N	Kelsey	Art	P-S	G. M. C. K16
Own		Own	SG	Un-WE	7	Own	Met	Tim	Tim	7.25	RR	Sp	Worm	½E	½E	Int	Int	Own	S&N	Own	C-S	P-S	G. M. C. K41A
Own	D-M	Own	SG	Sep-Un	7	Own	Met	Tim	Tim	8.75	RR	Sp	Worm	½E	½E	Int	Int	Own	S&N	Own	C-S	P-S	G. M. C. K71
Own	D-M	Own	SG	Sep-Un	7	Own	Met	Tim	Tim	10.00	RR	Sp	Worm	½E	½E	Int	Int	Own	S&N	Own	C-S	P-S	G. M. C. K101
Ful	D-M	Ful	SG	Un-WE	3	Acme	Met	Shu	Clark	7.00	Sp	Sp	I-G	½E	½E	Ext	Int	Woh	W&S	Roy	Art	R-S	G. W. W. Farm Special
B&B	Pla	Own	SG	Un-WE	3	Spi	Met	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W				Art	P-S	Garford 15
B-L	D-M	Own	SG	Sep-Un	3			Own	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross			Art	P-S	Garford 25
B-L	D-M	Own	SG	Sep-Un	4	Spi	Met	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross			Art	P-S	Garford 70H
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross		Smith	C-S	P-S	Garford 77D
B-L	D-M	Own	SG	Un-WJ	4	Spi	Met	Tim	Own		RR	Sp	Ch	½E	½E	IntR-W	ExtDr	Ross		Smith	C-S	P-S	Garford 68D
Ful	D-M	Ful	SG	Un-WE				Met	Tim	Tim	7.20	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N		Art	P-S	Gary F
Ful	D-M	Ful	SG	Un-WE	3			Met	Tim	Tim	7.25	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N		Art	P-S	Gary I
Ful	D-M	Ful	SG	Un-WE	4	Spi	Met	Tim	Tim	8.50	RR	Sp	Worm	½E	½E	Int	Int	Ross	S&N		Art	P-S	Gary J
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.30	RR		Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Gary K
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	11.70	RR		Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Gary M
B&B	Pla	Cotta	CM	Un-WE	3	Blood	Met	She	Own	9.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Jones	Art	R-S	Gersix K
Dodge	D-M	Dodge	SG	Un-WE	3		Met	Dodge	Own	6.28	Sp	Sp	S-B	½E	½E	ExtR-W	IntR-W	Dodge	W&W		Art	P-S	Graham Brothers
B&B	Pla	Warren	SG	Un-WE	3	Nor	Fab	Sal	Sal	5.75	Sp	Sp	S-B	½E	½E	ExtR-W	ExtDr		S&N			P-S	Gramm-Pioneer 10
Ful	D-M	Ful	SG	Un-WE	3	Snead	Fab	Col	Clark	7.80	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N	Bimel	Art	P-S	Gramm-Pioneer 15
B-L	D-M	B-L	SG	Un-WE		Spi	Met	She	She		Sp	Sp	Worm	½E	½E	Int	Int	Ross				P-S	Hahn J4
B-L	D-M	B-L	SG	Un-WE	3	Spi	Met	Tim	Tim	7.00	RR		Worm	½E	½E	IntR-W	IntR-W	Ross				P-S	Hahn CD
B-L	D-M	B-L	SG	Un-WE	3	Spi	Met	Tim	Tim	9.00			Worm	½E	½E	IntR-W	IntR-W	Ross				P-S	Hahn DE
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Tim	Tim	7.75			Worm	½E	½E	IntR-W	IntR-W	Ross				P-S	Hahn EE
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.25			Worm	½E	½E	IntR-W	IntR-W	Ross				P-S	Hahn F

For abbreviations, see pages 350 and 351.

Specifications of American

Make and Model	Tons Capacity	Wheel-Base, Ins.	TIRE SIZE Front, Ins.	TIRE SIZE Rear, Ins.	ENGINE Make	Number Cylinders, Bore and Stroke	Cylinders, Cast	Camshaft Drive Type	Radiator Core Make	Radiator Core Type	Water Circulation	OILING SYSTEM Type	OILING SYSTEM Oil Pump Type	FUEL SYSTEM Carbureter Make	FUEL SYSTEM Carbureter Size, Ins.	FUEL SYSTEM Fuel Feed	GOVERNOR Make	GOVERNOR Type	SPEED Motor in R.P.M.	SPEED Truck in M.P.H.	ELECTRICAL SYSTEM Generator Make	ELECTRICAL SYSTEM Ignition System, Make	ELECTRICAL SYSTEM Ignition System, Type
Hal-Fur....D	1½	144	34x5*	38x7*	Hink....	4–4x5½	4	Met-Gear..	G&O....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Hink....	Cent..	1350	45	West...	Bosch..	S-P...
Hal-Fur....B	2½	168	36x6p	36x10	Hink....	4–4¼x5½	4	Met-Gear..	G&O....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Vac...	Hink....	Cent..	1350	30	West...	Bosch..	S-P...
Hal-Fur....F	3½	180	36x6	40x12	Hink....	4–4½x5½	4	Met-Gear..	G&O....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Vac...	Hink....	Cent..	1350	25	West...	Bosch..	S-P...
Hall....2½	2½	156	36x4	36x4d	Cont....	4–4 1/16x5¼	4	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Pist...	Zenith...	1½	Gra...	Dup....	Cent..	1400	22	Eis....	.....	O-C...
Hall....3½	3½	144	36x5*	36x5d*	Cont....	4–4½x5½	2	Met-Gear..	.....	.....	Pump.	Cir-Spl..	Pist...	Zenith...	1½	Gra...	Dup....	Cent..	1300	18	.....	Eis....	O-C...
Hall....5	5	144	36x5	40x6d	Cont....	4–4½x5½	2	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Pist...	Zenith...	1½	Gra...	Dup....	Cent..	1300	15	Eis....	Eis....	O-C...
Hall....7 Chain	7	144	36x5	40x6	Cont....	4–4½x5½	2	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Pist...	Zenith...	1½	Gra...	Dup....	Cent..	1300	15	Eis....	.....	.....
Harvey....WOA	2	160	34x4	34x7	Buda...	4–4½ 5½	4	Met-Gear..	Chic....	Fin...	Pump.	Cir-Spl..	Ecc...	Stromb..	1¼	Gra...	Mec....	Suc...	1200	16	.....	.....	.....
Harvey....WFA	2½	150	36x4	36x7	Buda...	4–4¼x5½	4	Met-Gear..	.....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Mec....	Suc...	1200	16	.....	.....	.....
Harvey....WHA	3½	160	36x5	36x5d	Buda...	4–4½x6	4	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Gra...	Mec....	Suc...	1000	13	.....	.....	.....
Hawkeye....K	1½	148	34x3½*	34x5*	Buda...	4–3¾x5¼	4	Met-Gear..	Ideal....	Cel...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Simp....	Cent..	1400	17	.....	.....	.....
Hawkeye....M	2	148	36x4*	36x6*	Buda...	4–4¼x5½	4	Met-Gear..	Bre.....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Simp....	Cent..	1200	15	Eis....	Eis....	.....
Hawkeye....N	3½	170	36x5	36x10	Buda...	4–4½x6	4	Met-Gear..	Ideal....	Cel...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Simp....	Cent..	1200	12	Eis....	Eis....	.....
Hendrickson....	1½	130	36x4p	36x5p	Buda...	4–3⅜x5½	...	.....	.....	.....	Pump.	.....	.....	Stromb..	....	.....	.....	Suc...	....	....	.....	Splitd..	.....
Hendrickson....	2½	140	36x4	36x7	Buda...	4—4½x5½	...	.....	.....	.....	Pump.	.....	.....	Stromb..	....	.....	.....	Suc...	....	....	.....	Splitd..	.....
Hendrickson....	3½	165	36x5	36x5	Buda...	4–4¼x5½	...	.....	.....	.....	Pump.	.....	.....	Stromb..	....	.....	.....	Suc...	....	....	.....	Splitd..	.....
Hendrickson....	5	170	36x6	40x6d	Wau...	4–5x6½	...	.....	.....	.....	Pump.	.....	.....	Stromb..	....	.....	.....	.....	....	....	.....	Splitd..	.....
Huron, Erie....	1½–2	144	35x5p	38x7p	Buda...	4–3¾x5½	4	Met-Gear..	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1	Vac...	Pier....	Cent..	1400	25	NE....	Bosch..	.....
Huron....Mich.	2½–3	156	36x6p	40x8p	Buda...	4–4¼x5½	4	Met-Gear..	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Vac...	Pier....	Cent..	1400	22	NE....	Bosch..	.....
Indiana....12	1½	134	34x3½	34x5	Wau....	4–3¾x5¼	4	Met-Gear..	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1	Gra...	Wau....	Cent..	1300	20	West...	Eis....	.....
Indiana....20	2	150	36x4	36x7	Own....	4–4⅛x5½	2	Com-Gear.	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Gra...	Pier....	Cent..	1160	15	West...	Eis....	.....
Indiana....25	2½	156	36x4	36x8	Own....	4–4⅛x5½	2	Com-Gear.	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Pier....	Cent..	1600	15	West...	Eis....	.....
Indiana....35	3½	160	36x5	36x5d	Own....	4–4⅜x5½	2	Com-Gear.	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Pr....	Pier....	Cent..	1150	12	West...	Eis....	.....
Indiana....51	5	170	36x5	40x6d	Wau....	4–5x6¼	2	Met-Gear..	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Gra...	Wau....	Cent..	1000	12	West...	Eis....	.....
International....S	¾	124½	34x5p	34x5p	Lyc.....	4–3½x5	4	Met-Gear..	Long....	Fin...	Ther..	Cir-Spl..	Pist...	Ensign..	1¼	Gra...	.....	.....	2000	35	Aut-L..	Conn...	S&C..
International....21	1	115	36x3½	36x3½	Own....	4–3½x5¼	4	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Pist...	Ensign..	1¼	Gra...	Own....	Cent..	1450	22	NE....	Bosch..	S&C..
International....31	1½	129	36x3½	36x4	Own....	4–3½x5¼	4	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Pist...	Ensign..	1¼	Gra...	Own....	Cent..	1450	19	NE....	Bosch..	S&C..
International....41	2	129	36x3½	36x5	Own....	4–3½x5¼	4	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Pist...	Ensign..	1¼	Gra...	Own....	Cent..	1450	15	NE....	Bosch..	S&C..
International....51	3	138½	36x4	36x6	Own....	4–4¼x5	4	Met-Gear..	Long....	Fin...	Ther..	Cir-Spl..	Pist...	Ensign..	1¼	Gra...	Own....	Cent..	1275	15	NE....	Dixie...	S&C..
International....101	5	160	36x5	40x10	Own....	4–4¼x5	4	Met-Gear..	Long....	Fin...	Ther..	Cir-Spl..	Pist...	Ensign..	1¼	Gra...	Own....	Cent..	1275	14	NE....	Dixie...	S&C..
K-Z....1	1	134	34x3½	34x5	Cont....	4–3½x5	4	Met-Gear..	Chic....	Fin...	Ther..	Cir-Spl..	.....	Stromb..	1	Gra...	McCan..	Suc...	....	....	.....	.....	.....
K-Z....1½	1½	134	36x4	36x6	Cont....	4–3⅜x5	4	Met-Gear..	Chic....	Fin...	Ther..	Cir-Spl..	.....	Stromb..	1	Gra...	McCan..	Suc...	....	....	.....	.....	.....
K-Z....2½	2½	150	36x6	36x8	Cont....	4–4⅛x5¼	4	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Mec....	Suc...	....	....	.....	.....	.....
K-Z....3½	3½	156	36x5	36x10	Cont....	4–4½x5½	2	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	McCan..	Suc...	....	....	.....	.....	.....
K-Z....5	5	156	36x6	40x12	Cont....	4–4¾x6	2	Met-Gear..	Chic....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Gra...	McCan..	Suc...	....	....	.....	.....	.....
Kalamazoo....G1	1½	144	34x4	34x5	Cont....	4–3¾x5	4	Met-Gear..	Hoo....	Cel...	Ther..	Cir-Spl..	Pist...	Stromb..	1¼	Vac...	Pier....	Cent..	1300	20	Dyn...	Conn...	S-P...
Kalamazoo....H	2½	160	36x4	36x8	Wis.....	4–4x6	4	Met-Gear..	G&O....	Fin...	Pump.	Hol-Crk.	Fear..	Stromb..	1¼	Vac...	Pier....	Cent..	1300	15	Dyn...	Bosch..	S-P...
Kalamazoo....K	3½	160	36x5	36x10	Wis.....	4–4½x6	4	Met-Gear..	.....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Pier....	Cent..	1300	12	Dyn...	Bosch..	S-P...
Kalamazoo....K5	5	160	36x6	36x6d	Wis.....	4–4½x6	4	Met-Gear..	G&O....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Vac...	Pier....	Cent..	1300	12	Dyn...	Bosch..	S-P...
Kearns....H	1	118	32x4½p	32x4½p	H-S.....	4–3½x4½	4	.....	.....	Cel...	Ther..	Cir-Spl..	.....	Zenith...	1¼	Vac...	.....	.....	2000	40	Dyn...	Berlg...	S-P...
Kearns....N	2	136	34x3½	34x6	H-S.....	4–3½x5	4	.....	.....	Fin...	Ther..	Cir-Spl..	.....	Zenith...	....	Vac...	.....	.....	1800	20	Dyn...	.....	.....
Kelly-Springfield....K34	1½	144	36x3½	36x6	Own....	4–3¾x5½	4	.....	.....	Fin...	Pump.	.....	Gear..	Zenith...	....	.....	.....	.....	1600	....	Eis....	.....	.....
Kelly-Springfield....K38	2½	150	36x4	36x4d	Own....	4–3¾x5½	4	.....	.....	Fin...	Pump.	.....	Gear..	Zenith...	....	.....	.....	.....	1600	16	Eis....	.....	.....
Kelly-Springfield....K41	3½	156	36x5	40x5d	Own....	4–4½x6½	2	.....	.....	Fin...	Pump.	.....	.....	Zenith..	....	.....	.....	Cent..	1300	15	Eis....	.....	.....
Kelly-Springfield....K50	5	158	36x6	40x6d	Own....	4–4½x6½	2	.....	.....	Fin...	Pump.	.....	.....	Zenith..	....	.....	.....	Cent..	1300	13	Eis....	.....	.....
Kelly-Springfield....K60	6	158	36x6	40x7d	Own....	4–4½x6½	2	.....	.....	Fin...	Pump.	.....	.....	Zenith..	....	.....	.....	Cent..	1300	13	Eis....	.....	.....
Keystone....	2	144	34x5*	38x7*	Buda...	4–3¾x5½	4	Met-Gear..	McCo...	PT...	Ther..	Cir-Spl..	Gear..	Zenith...	1	Gra...	Pier....	Cent..	1350	17	G&D...	Berlg...	C-C...
Kimball....AB	2	136	36x4	36x7	Wis.....	4–4x6	4	Met-Gear..	Eagle...	PT...	Pump.	Hol-Crk.	Gear..	Master..	1¼	Vac...	.....	.....	1600	17	West...	Eis....	.....
Kimball....AK	3	172	36x5	36x10	Wis.....	4–4½x6	4	Met-Gear..	Eagle...	PT...	Pump.	Hol-Crk.	Gear..	Master..	1¼	Vac...	.....	.....	....	16	West...	Splitd..	.....
Kimball....AE	4	164	36x5	40x6d	Wis.....	4–4¾x6	2	Met-Gear..	Eagle...	PT...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Vac...	.....	.....	....	....	West...	Splitd..	.....
Kimball....AF	5	164	36x6	40x7d	Wis.....	4–5x6	2	Met-Gear..	Eagle...	PT...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Vac...	.....	.....	....	12	West...	Splitd..	.....
Kissel....Express	1	140	34x5p	34x5p	Own....	4–3⅞x5½	4	Met-Gear..	McCo...	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1¼	Vac...	.....	.....	....	....	Remy..	Remy..	S&O..
Kissel....General Utility	1½	152	36x3½	36x5	Own....	4–3⅞x5½	4	Met-Gear..	McCo...	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1¼	Vac...	Pier....	Cent..	1400	12	.....	.....	.....
Kissel....Freighter	2½	168	36x4	36x7	Own....	4–4½x5½	4	Met-Gear..	McCo...	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1¼	Vac...	Pier....	Cent..	1400	12	.....	.....	.....
Kissel....Heavy Duty	3½	168	36x5	36x5d	Own....	4–4½x5½	4	Met-Gear..	McCo...	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1¼	Vac...	Pier....	Cent..	1400	12	.....	.....	.....
Kleiber....	1	140	34x3½	34x5	Cont....	4–4⅛x5¼	4	Met-Gear..	Rome-T.	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1¼	Gra..	Simp....	Cent..	....	....	.....	.....	.....
Kleiber....	1½	147	36x3½	36x6	Cont....	4–4¼x5½	4	Met-Gear..	Rome-T.	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1½	Gra...	Simp....	Cent..	....	....	.....	.....	.....
Kleiber....	2	156	36x4	36x7	Cont....	4–4⅛x5¼	4	Met-Gear..	Rome-T.	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1½	Gra...	Simp....	Cent..	....	....	.....	.....	.....
Kleiber....	2½	160	36x5	36x8	Cont....	4–4½x5½	2	Met-Gear..	Rome-T.	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1¼	Gra...	Simp....	Cent..	....	....	.....	.....	.....
Kleiber....	3½	167	36x5	36x10	Cont....	4–4½x5½	2	Met-Gear..	Rome-T.	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1¼	Gra...	Simp....	Cent..	....	....	.....	.....	.....
Kleiber....	5	180	36x6	40x12	Buda...	4–5x6½	4	Met-Gear..	Rome-T.	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1½	Gra...	Simp....	Cent..	....	....	.....	.....	.....
Koehler....D	1½	137	34x3½	34x5	H-S.....	4–3½x5	4	Met-Gear..	Gor.....	Cel...	Ther..	.....	Gear..	Zenith...	1	Gra...	Simp....	Cent..	1275	18	West...	Splitd..	C-C...
Koehler....M	2½	165	36x4	36x7	Her.....	4–4x5½	4	Met-Gear..	Gor.....	Cel...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Simp....	Cent..	1375	16	West...	Splitd..	C-C...
Koehler....F	3½	162	36x5	36x5d	Her.....	4–4½x5½	4	Met-Gear..	Gor.....	Cel...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Vac...	Pier. ...	Cent..	1350	14	West...	Splitd..	C-C...
Lange....EA	2½	153	36x4*	36x7*	Cont....	4–4⅛x5½	4	Met-Gear..	Mod....	Cel...	Pump.	Hol-Crk.	Gear..	Stromb..	....	Vac...	Simp....	Cent..	1300	15	.....	Bosch..	O-C...
Larrabee....X2	1	138	34x5p	34x5p	Cont....	6–3½x4½	6	Met-Gear..	Fed.....	Cel...	Pump.	Hol-Crk.	Gear..	Zenith...	1	Gra...	.....	.....	....	....	Bosch..	Bosch..	O-C...
Larrabee....J4	1½	138	34x3½	34x5	Cont....	4–3¾x5	4	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1	Cra...	Pharo...	Hyd..	....	18	Bosch..	Bosch..	.....
Larrabee....K4	2½	158	36x4	36x8	Cont....	4–4⅛x5½	4	Met-Gear..	Rome-T.	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Pharo...	Hyd..	1225	15	Bosch..	Bosch..	.....
Larrabee....L4	3½	160	36x5d.	36x5d	Cont....	4–4½x5½	2	Met-Gear.	Rome-T.	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Pharo...	Hyd..	1260	13	Bosch..	Bosch..	.....
Larrabee....W	5	185	36x6	40x6d	Cont....	4–4¼x6	2	Met-Gear.	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Gra...	Pharo...	Hyd..	1100	10	Bosch..	Bosch..	.....
Luedinghaus....C	1	130	35x5p	35x5p	H-S.....	4–3½x5	4	Met-Gear.	Bre.....	Fin...	Pump.	Cir-Spl..	Gear..	Schebl...	1	Gra...	.....	.....	....	35	Dyn...	At-K...	O-C...
Luedinghaus....W	1½	144	34x3½*	34x5*	Wau....	4–3⅞x4¼	4	Met-Gear..	Bre.....	Fin...	Pump.	Cir-Spl..	Gear..	Schebl...	1	Gra...	Wau....	Cent..	....	....	.....	.....	O-C...
Luedinghaus....K	2–2½	145	36x4*	36x7*	Wau....	4–4½x5½	2	Met-Gear..	Bre.....	Fin...	Pump.	Cir-Spl..	Gear..	Schebl...	1½	Gra...	Wau....	Cent..	....	....	.....	.....	.....
Maccar....L2	1½	150	36x4	36x6	Cont....	4–4¼x5½	4	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Gra...	Muel....	Suc...	1350	19	Bosch..	Eis....	S&O..
Maccar....HA	2	162	36x4	36x4d	Cont....	4–4¼x5½	4	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Gra...	Muel....	Suc...	1350	19	Bosch..	Eis....	S&O..
Maccar....H2	3	162	36x4	36x4d	Cont....	4–4½x5½	2	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Gra...	Muel....	Suc...	1300	20	Bosch..	Eis....	S&O..
Maccar....MA	4	185	36x5	36x5d	Cont....	4–4½x6	2	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Gra...	Muel....	Suc...	1150	16	Bosch..	Eis....	S&O..
Maccar....G	5	186	36x5	40x6d	Cont....	4–4½x6	2	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Gra...	Muel....	Suc...	1150	13	Bosch..	Eis....	S&O..
MacDonald....A	7½	180	40x7	40x14	Buda...	4–4½x6	4	Met-Gear..	Mod....	PT...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Gra...	Simp....	Cent..	1300	10	.....	.....	.....
Mack....AB	1½	144	36x4	36x3½d	Own....	4–4x5	2	Met-Gear..	Own....	Cel...	Pump.	Cir-Spl..	Gear..	Schebl...	1¼	Vac...	Own....	Cent..	1275	17	Lee-N..	Teagle..	S-P...
Mack....AB	2	144	36x4	36x4d	Own....	4–4x5	2	Met-Gear..	Own....	Cel...	Pump.	Cir-Spl..	Gear..	Schebl...	1¼	Gra...	Own....	Cent..	1275	17	Lee-N..	Teagle..	S-P...
Mack....AB	2½	144	36x4	36x4d	Own....	4–4x5	2	Met-Gear..	Own....	Cel...	Pump.	Cir-Spl..	Gear..	Schebl...	1¼	Gra...	Own....	Cent..	1275	19	Lee-N..	Teagle..	S-P...
Mack....AC	3½	168	36x5	40x5d	Own....	4–5x6	2	Met-Gear..	Own....	PT...	Pump.	Cir-Spl..	Gear..	Schebl...	1½	Gra...	Own....	Cent..	1000	14	Lee-N..	Teagle..	S-P...
Mack....AC	5	168	36x6	40x6d	Own....	4–5x6	2	Met-Gear..	Own....	PT...	Pump.	Cir-Spl..	Gear..	Schebl...	1½	Gra...	Own....	Cent..	1000	13	Lee-N..	Teagle..	S-P...
Mack....AB Tractor	5	120	36x4	36x4d	Own....	4–4x5	2	Met-Gear..	Own....	Cel...	Pump.	Cir-Spl..	Gear..	Schebl...	1¼	Gra...	Own....	Cent..	1275	12	Lee-N..	Teagle..	S-P...
Mack....AC	6½	168	36x6	40x12	Own....	4–5x6	2	Met-Gear..	Own....	PT...	Pump.	Cir-Spl..	Gear..	Schebl...	1½	Gra...	Own....	Cent..	1000	11	Lee-N..	Lee-N..	S-P...
Mack....AC Tractor	7	119	36x5	40x5d	Own....	4–5x6	2	Met-Gear..	Own....	PT...	Pump.	.....	Gear..	Schebl...	1½	Gra...	Own....	Cent..	1000	11	Lee-N..	Teagle..	S-P...
Mack....AC	7½	168	36x7	40x7d	Own....	4–5x6	2	Met-Gear.	Own....	PT...	Pump.	Cir-Spl..	Gear..	Schebl...	1½	Gra...	Own....	Cent..	1000	10	Lee-N..	Lee-N..	S-P...
Mack....AC Tractor	10	119	36x6	40x6d	Own....	4–5x6	2	Met-Gear..	Own....	PT...	Pump.	Cir-Spl..	Gear..	Schebl...	1½	Gra...	Own....	Cent..	1000	10	Lee-N..	Teagle..	S-P...
Mack....AC Tractor	13	119	36x6	40x12	Own....	4–5x6	2	Met-Gear..	Own....	PT...	Pump	Cir-Spl..	Gear..	Schebl...	1½	Gra...	Own....	Cent..	1000	9	Lee-N..	Lee-N..	S-P...
Mack....AC Tractor	15	119	36x7	40x7d	Own....	4–5x6	2	Met-Gear.	Own....	PT...	Pump.	Cir-Spl..	Gear..	Schebl...	1½	Gra...	Own....	Cent..	1000	8	Lee-N..	Lee-N..	S-P...
Mapleleaf....AA	2	144	36x4	36x7	Hink....	4–4x5½	4	Met-Gear..	McCo...	PT...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Hink....	Cent..	1200	18	West...	Eis....	S&C..
Mapleleaf....BB	3	150	36x4	36x4d	Hink....	4–4½x5½	4	Met-Gear..	McCo...	PT...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Hink....	Cent..	1200	16	West...	Eis....	S&C..

For abbreviations, see pages 350 and 351.

Trucks (Continued)

CLUTCH		TRANSMISSION												SPRINGS		BRAKES		STEERING		WHEELS			Make and Model
		GEARSET				UNIVERSAL JOINTS		AXLES															
Make	Type	Make	Type	Location	Forward Speeds	Make	Type	Front Make	Rear Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Final Drive Type	Front	Rear	Service	Emergency	Steering Gear Make	Steering Gear Type	Make	Type	Frame Material	
B&B	Pla	Own	SG	Sep-Un	4	Pet	Met	Tim	Tim	6.40	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Day	C-S	P-S	Hal-Fur D
B&B	Pla	Own	SG	Sep-Un	4	Pet	Met	Tim	Tim	8.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Day	C-S	P-S	Hal-Fur B
B&B	Pla	Own	SG	Sep-Un	4	Pet	Met	Tim	Tim	12.00	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Day	C-S	P-S	Hal-Fur F
B-L	D-M	B-L	SG	Un-WE	.....	.....	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	El	Int	Int	Gem	W&W	Smith	C-S	R-S	Hall 2½
B-L	D-M	B-L	.....	Sep-Un	4	Spi	Met	Tim	Tim	10.33	Sp	Sp	Worm	½E	½E	Int	Int	Gem	W&S	Smith	C-S	R-S	Hall 3½
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	15.00	Sp	Sp	Worm	½E	½E	Int	Int	Gem	W&S	Smith	C-S	R-S	Hall 5
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	14.70	RR	TA	Ch	½E	½E	Int	Int	Gem	W&S	Smith	C-S	R-S	Hall 7 Chain
Ful	D-M	Ful	SG	Un-WE	3	Spi	Met	She	She	7.75	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	StM	Art	R-S	Harvey WOA
Ful	D-M	B-L	SG	Sep-Un	4	Spi	Met	She	She	7.75	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	StM	Art	R-S	Harvey WFA
Ful	D-M	B-L	SG	Sep-Un	.....	Spi	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	Int	Int	Ross	S&N	StM	Art	R-S	Harvey WHA
Ful	D-M	Ful	SG	Un-WE	.....	Hart	Met	Col	Clark	7.60	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N	Bimel'	Art	R-S	Hawkeye K
Ful	D-M	Ful	SG	Un-WE	4	Hart	Met	Col	Clark	8.00	Sp	Sp	I-G	½E	½E	ExtDr	IntR-W	Ross	S&N	Bimel	Art	R-S	Hawkeye M
Ful	D-M	Cotta	CM	Sep-Un	4	Hart	Met	Shu	Clark	10.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N	Clark	C-S	R-S	Hawkeye N
Ful	D-M	.....	.....	.....	3	.....	.....	Tim	Tim	.....	.....	.....	Worm	½E	½E	.....	.....	Ross	.....	.....	.....	C-S	Hendrickson
Ful	D-M	.....	.....	.....	4	.....	.....	Tim	Tim	.....	.....	.....	Worm	½E	½E	.....	.....	Ross	.....	.....	.....	C-S	Hendrickson
Ful	D-M	.....	.....	.....	4	.....	.....	Tim	Tim	.....	.....	.....	Worm	½E	½E	.....	.....	Ross	.....	.....	.....	C-S	Hendrickson
Ful	D-M	.....	.....	.....	4	.....	.....	Tim	Tim	.....	.....	.....	Worm	½E	½E	.....	.....	Ross	.....	.....	.....	C-S	Hendrickson
B&B	Pla	Cotta	CM	Un-WE	4	Un	Met	Col	Clark	7.00	RR	Sp	I-G	½E	½E	Ext	Int	Jac	S&N	A-W	Art	R-S	Huron Erie
B&B	Pla	Cotta	CM	Un-WE	4	Un	Met	Col	Clark	8.00	RR	Sp	I-G	½E	½E	Ext	Int	Jac	S&N	A-W	Art	R-S	Huron Mich.
B&B	Pla	B-L	SG	Sep-Un	3	.....	.....	She	She	7.80	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Bimel	Art	R-S	Indiana 12
B&B	Pla	B-L	SG	Sep-Un	4	.....	.....	She	She	7.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Day	C-S	R-S	Indiana 20
B&B	Pla	B-L	SG	.....	4	.....	.....	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Day	C-S	R-S	Indiana 25
B&B	Pla	B-L	SG	Sep-Un	4	.....	.....	She	She	.....	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Day	C-S	R-S	Indiana 35
B&B	Pla	B-L	SG	Sep-Un	4	.....	.....	She	She	10.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Smith	C-S	R-S	Indiana 51
Mun	D-M	Mun	SG	Un-WE	3	Snead	Fab	Tor	Tor	6.30	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	CAS	W&W	Own	Art	P-S	International S
Own	D-M	Own	SG	Sep-Un	3	Own	Met	Own	Own	7.00	Sp	Sp	I-G	½E	½E	IntR-W	IntR-W	Own	W&W	Own	Art	P-S	International 21
Own	D-M	Own	SG	Sep-Un	3	Own	Met	Own	Own	8.00	Sp	Sp	I-G	½E	½E	IntR-W	IntR-W	Own	W&W	Own	Art	P-S	International 31
Own	D-M	B-L	SG	Sep-Un	4	Own	Met	Own	Own	9.00	Sp	Sp	I-G	½E	½E	IntR-W	IntR-W	Own	W&W	Own	Art	P-S	International 41
Own	D-M	B-L	SG	Sep-Un	4	Own	Met	Own	Own	9.00	Sp	Sp	I-G	½E	½E	IntR-W	IntR-W	Own	W&W	Own	Art	P-S	International 61
Own	D-M	B-L	SG	Sep-Un	4	Own	Met	Own	Own	11.00	Sp	Sp	I-G	½E	½E	IntR-W	IntR-W	Own	W&W	Own	Art	P-S	International 101
B-L	D-M	B-L	SG	Un-WE	3	Therm	Fab	Tim	Tim	7.75	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W	StM	Art	R-S	K-Z 1
B-L	D-M	B-L	SG	Un-WE	3	Snead	Fab	Tim	Tim	8.50	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W	StM	Art	R-S	K-Z 1½
B-L	D-M	B-L	SG	Sep-Un	4	Snead	Fab	Tim	Tim	9.25	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W	StM	Art	R-S	K-Z 2½
B-L	D-M	B-L	SG	Sep-Un	4	Snead	Fab	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W	StM	Art	R-S	K-Z 3½
B-L	D-M	B-L	SG	Sep-Un	4	Snead	Fab	Tim	Tim	12.33	RR	Sp	Worm	½E	½E	Int	Int	Gem	W&W	StM	Art	R-S	K-Z 6
Ful	D-M	Ful	SG	Sep-Un	4	Acme	Met	Shu	Wis	8.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	W&S	Bimel	Art	R-S	Kalamazoo G1
Ful	D-M	Ful	SG	Sep-Un	4	Acme	Met	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	.....	Smith	C-S	R-S	Kalamazoo H
Ful	D-M	Ful	SG	Sep-Un	4	Acme	Met	She	She	10.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	W&S	Smith	C-S	R-S	Kalamazoo K
Ful	D-M	Ful	SG	Sep-Un	4	Spi	Met	She	She	13.00	RR	Sp	Worm	½E	½E	IntR-W	.....	Ross	W&S	Smith	C-S	R-S	Kalamazoo K5
B&B	Pla	G-L	SG	Un-WE	.....	M&E	Met	Tor	Tor	6.50	.....	Sp	I-G	½E	½E	Int	Ext	Lav	W&S	Wayne	Art	P-S	Kearns H
B&B	Pla	G-L	SG	Un-WE	.....	M&E	Met	Tor	Tor	8.00	Sp	Sp	I-G	½E	½E	Int	Ext	Lav	W&S	Wayne	Art	P-S	Kearns N
.....	D-D	.....	SG	.....	3	.....	Met	Own	She	8.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&S	.....	Art	P-S	Kelly-Springfield K34
.....	D-D	.....	SG	.....	3	.....	Met	Own	She	8.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&S	.....	Art	P-S	Kelly-Springfield K38
.....	.....	.....	SG	.....	.....	.....	.....	.....	Clark	10.00	RR	.....	I-G	½E	½E	IntR-W	IntR-W	.....	W&S	.....	P-S	P-S	Kelly-Springfield K41
.....	.....	.....	SG	.....	.....	.....	.....	Own	Own	12.24	RR	Sp	Ch	½E	½E	IntR-W	IntR-W	.....	W&S	.....	Art	P-S	Kelly-Springfield K50
.....	.....	.....	.....	.....	.....	.....	.....	Own	Own	12.24	RR	Sp	Ch	½E	½E	IntR-W	IntR-W	.....	W&S	.....	Art	P-S	Kelly-Springfield K60
Ful	D-M	Ful	SG	Un-WE	.....	Spi	Met	Tor	Rus	8.80	Sp	Sp	I-G	½E	½E	Ext	IntR-W	Ross	S&N	.....	Art	R-S	Keystone
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	She	She	6.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Smith	C-S	P-S	Kimball AB
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	She	She	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Smith	C-S	P-S	Kimball AK
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Smith	C-S	P-S	Kimball AE
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	Int-RW	IntR-W	Woh	S&N	Smith	C-S	P-S	Kimball AF
War	D-M	War	SG	Un-WE	3	Spi	Met	Own	Tim	5.06	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Jac	S&N	StM	Art	P-S	Kissel Express
War	D-M	War	SG	Un-WE	3	Spi	Met	She	She	7.80	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	.....	S&N	Prud	Art	P-S	Kissel General Utility
War	D-M	War	SG	Sep-Un	4	Spi	Met	Tim	Tim	8.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Prud	Art	P-S	Kissel Freighter
War	D-M	War	SG	Sep-Un	4	Spi	Met	She	She	11.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Kissel Heavy Duty
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	7.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	SanF	Art	R-S	Kleiber
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	7.75	RR	Sp	Worm	½E	½E	Int-RW	IntR-W	Ross	S&N	Smith	C-S	R-S	Kleiber
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	8.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Kleiber
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	8.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Kleiber
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Kleiber
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	11.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Kleiber
Mec	D-M	Mec	SG	Un-WE	3	M&E	Met	Shu	Own	7.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Jones	Art	P-S	Koehler D
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Shu	Tim	9.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Wayne	Art	P-S	Koehler M
B-L	D-M	B-L	SG	Sep-Un	.....	Spi	Met	Shu	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Day	C-S	P-S	Koehler F
B-L	D-M	B-L	SG	Sep-Un	4	.....	.....	Tim	Tim	9.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Hoop	Art	P-S	Lange EA
B-L	D-M	B-L	SG	Un-WE	3	Nor	Fab	Sal	Sal	5.75	Sp	Sp	S-B	½E	½E	ExtR-W	IntR-W	Gem	W&W	Indes	P-S	P-S	Larrabee K2
B-L	D-M	B-L	SG	Un-WE	3	.....	.....	She	She	7.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Hoop	Art	P-S	Larrabee J4
B-L	D-M	B-L	SG	Sep-Un	4	.....	.....	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Larrabee K4
B-L	D-M	B-L	SG	Sep-Un	4	.....	.....	She	She	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Larrabee L4
B-L	D-M	B-L	SG	Sep-Un	4	.....	.....	She	She	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Larrabee W
B-L	D-M	G-L	SG	Un-WE	.....	Spi	Met	Col	Dun	6.20	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Bimel	Art	R-S	Luedinghaus C
B-L	D-M	DG&M	SG	Un-WE	.....	Spi	Met	Shu	Wis	8.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	.....	.....	P-S	Luedinghaus W
B-L	D-M	DG&M	SG	Un-WE	.....	Spi	Met	Shu	Wis	8.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	.....	.....	P-S	Luedinghaus K
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Tim	Tim	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Maccar L2
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Tim	Tim	8.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Maccar HA
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Tim	Tim	7.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Maccar H2
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Tim	Tim	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Maccar MA
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Maccar G
B-L	D-M	B-L	SG	Un-WE	4	Own	Met	Own	Own	17.50	....	Sp	.....	½T	.....	Ext	Ext	Own	.....	Own	C-S	.....	MacDonald A
Own	D-M	Own	SG	Un-WE	.....	Spi	Met	Own	Own	7.60	Sp	Sp	B-S&ch	½E	½E	IntR-W	ExtDr	Own	W&W	.....	.....	P-S	Mack AB
Own	D-M	Own	SG	Un-WE	4	Spi	Met	Own	Own	7.60	Sp	Sp	B-S&ch	½E	½E	IntR-W	ExtDr	Own	W&W	.....	.....	P-S	Mack AB
Own	D-M	Own	SG	Un-WE	4	Spi	Met	Own	Own	6.99	RR	....	B-S&ch	½E	½E	ExtDr	IntR-W	Own	W&W	.....	.....	P-S	Mack AB
Own	Pla	Own	SG	Un-WJ	3	Spi	Met	Own	Own	8.49	RR	....	Ch	½E	½E	Ext	IntR-W	Own	W&W	.....	.....	P-S	Mack AC
Own	Pla	Own	SG	Un-WJ	3	Spi	Met	Own	Own	9.00	RR	....	Ch	½E	½E	Ext	IntR-W	Own	W&W	.....	.....	P-S	Mack AC
Own	D-M	Own	SG	Un-WE	.....	Spi	Met	Own	Own	10.53	RR	....	Ch	½E	½E	ExtDr	IntR-W	Own	W&W	.....	.....	P-S	Mack AB Tractor
Own	Pla	Own	SG	Un-WJ	.....	Spi	Met	Own	Own	10.50	RR	....	Ch	½E	½E	Ext	IntR-W	Own	W&W	.....	.....	P-S	Mack AC
Own	Pla	Own	SG	Un-WE	3	Spi	Met	Own	Own	10.76	RR	....	Ch	½E	½E	Ext	IntR-W	Own	W&W	.....	.....	P-S	Mack AC Tractor
Own	Pla	Own	SG	Un-WE	3	Spi	Met	Own	Own	11.58	RR	....	Ch	½E	½E	Ext	IntR-W	Own	W&W	.....	.....	P-S	Mack AC
Own	Pla	Own	SG	Un-WJ	3	Spi	Met	Own	Own	11.58	RR	....	Ch	½E	½E	Ext	IntR-W	Own	W&W	.....	.....	P-S	Mack AC Tractor
Own	Pla	Own	SG	Un-WJ	.....	Spi	Met	Own	Own	12.92	RR	....	Ch	½E	½E	Ext	IntR-W	Own	W&W	.....	.....	P-S	Mack AC Tractor
Own	Pla	Own	SG	Un-WJ	3	Spi	Met	Own	Own	14.10	RR	....	Ch	½E	½E	Ext	IntR-W	Own	W&W	.....	.....	P-S	Mack AC Tractor
Ful	D-M	Ful	SG	Un-WE	4	Blood	Met	She	She	8.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Dom	Art	R-S	Mapleleaf AA
Ful	D-M	Ful	SG	Un-WE	4	Blood	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Dom	Art	R-S	Mapleleaf BB

For abbreviations, see pages 350 and 351.

Specifications of American

Make and Model	Tons Capacity	Wheel-Base, Ins.	TIRE SIZE		ENGINE															ELECTRICAL SYSTEM		
												OILING SYSTEM		FUEL SYSTEM			GOVERNOR		SPEED				
			Front, Ins.	Rear, Ins.	Make	Number Cylinders, Bore and Stroke	Cylinders Cast	Camshaft Drive Type	Radiator Core Make	Radiator Core Type	Water Circulation	Type	Oil Pump Type	Carbureter Make	Carbureter Size, Ins.	Fuel Feed	Make	Type	Motor in R.P.M.	Truck in M.P.H.	Generator Make	Ignition System, Make	Ignition System, Type
Mapleleaf CC	4	160	36x5	36x5d	Hink.	4–4½x5½	4	Met-Gear.	McCo.	PT.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Hink.	Cent.	1200	12	West.	Eis.	S&C.
Mapleleaf DD	5	160	36x6	40x6d	Hink.	4–4½x5½	4	Met-Gear.	McCo.	PT.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Hink.	Cent.	1200	11	West.	Eis.	S&C.
Master JW	1½	142	34x3½	34x5	Buda.	4–4¼x5½	4	Met-Gear.	Chic.	Fin.	Pump.	Cir-Spl.	Pist.	Own.	1¼	Vac.	McCan.	Suc.	1175	15			S-P.
Master D&W	2½	144	34x4	36x7	Buda.	4–4¼x5½	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Own.	1¼	Vac.	McCan.	Suc.	1100	13			S-P.
Master A	3½	158	36x5	40x5d	Buda.	4–4½x6	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Own.	1½	Vac.	Pier.	Cent.	1000	11			S-P.
Master E	3½	158	36x5	40x5d	Buda.	4–4½x6	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Own.	1½	Vac.	Pier.	Cent.	1000	11			S-P.
Master B	5	170	36x6	40x6d	Buda.	4–4½x6½	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Own.	1½	Vac.	Pier.	Cent.	925	9			S-P.
Master F	5	170	36x6	40x6d	Buda.	4–4½x6½	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Own.	1½	Vac.	Pier.	Cent.	925	9			S-P.
Menominee HT	1	130	34x3½*	36x5*	Wis.	4–3½x5	4	Met-Gear.	G&O.	Fin.	Pump.	Cir-Spl.	Gear.	Stromb.	1	Gra.			1350	18	Bosch.	Eis.	S-P.
Menominee H	1½	144	36x3½*	36x5*	Wis.	4–4x5	4	Met-Gear.	G&O.	Fin.	Pump.	Cir-Spl.	Gear.	Stromb.	1	Gra.			1350	17	Bosch.	Eis.	
Menominee D	2	144	36x4	36x8	Wis.	4–4x6	4	Met-Gear.	G&O.	Fin.	Pump.		Gear.	Stromb.	1¼	Gra.			1350	16	Bosch.	Eis.	S-P.
Menominee G	3½	160	36x5*	36x10*	Wis.	4–4½x6	4	Met-Gear.	G&O.	Fin.	Pump.	Cir-Spl.	Gear.	Stromb.	1¼	Gra.			1250	12	Bosch.	Eis.	
Menominee J3	5	160	36x6	40x12	Wis.	4–4½x6	2	Met-Gear.	G&O.	Fin.	Pump.	Cir-Spl.	Gear.	Stromb.	1½	Gra.			1250	12	Bosch.	Eis.	
Moline 10	1½	130	34x5p	36x6p	Own.	4–3½x5	4	Met-Gear.	Own.	Fin.	Ther.	Hol-Crk.	Gear.	Tillot.	1¼	Gra.	Pharo.	Cent.	1800	24	Aut-L.	Splitd.	
Moreland 22C	2½	168	36x4	36x8	Cont.	4–4½x5½	2			Fin.						Gra.				21	Splitd.		
Moreland 22H	3½	186	36x5	40x5d	Cont.	4–4½x6	2			Fin.						Gra.				23	Splitd.		
Napoleon 9	1	133	35x5p	35x5p	Gray-B.	4–3½x5	4	Met-Gear.	Chic.	Fin.	Ther.		Gear.		1	Gra.			1800	31	G&D.	G&D.	
Napoleon 11	1½	133	35x5p	36x6p	Gray-B.	4–3½x5	4	Met-Gear.	Chic.	Fin.	Ther.		Gear.		1	Gra.			1800	25	G&D.	G&D.	
Nelson LeMoon G	1½	....	36x3½	36x6	Cont.	4–4¼x5¼	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Gra.	Pharo.		1100	20	West.		
Nelson LeMoon G	2½	....	36x4	36x7	Cont.	4–4¼x5¼	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Gra.	Pharo.		1000	17	West.	Bosch.	
Nelson LeMoon G	3½	....	36x5	36x5d	Cont.	4–4½x5½	2	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Gra.	Pharo.		1100	15	West.		
Nelson LeMoon G	5	....	36x6	40x6d	Cont.	4–4½x6	2	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1½	Gra.		Cent.	1100	12	West.		
Netco DK	2	144	36x4	36x8d	Cont.	4–4¼x5½	2	Met-Gear.	E&M.	Fin.	Pump.	Cir-Spl.	Pist.	Zenith.	1¼	Vac.				20		Eis.	D-P.
Netco HL	2½	168	36x4	36x8d	Cont.	4–4½x5½	2	Met-Gear.	E&M.	Fin.	Pump.	Cir-Spl.	Pist.	Zenith.	1½	Vac.				20	West.	Eis.	D-P.
Niles E	2	150	36x4*	36x7*	Cont.	4–4½x5½	4	Met-Gear.	Mod.	Cel.	Pump.	Cir-Spl.	Pist.	Stromb.	1¼	Gra.	Mon.	Cent.			Eis.	Eis.	
Noble B30	1½	156	36x3½	36x5	Buda.	4–3¾x5¼	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1	Vac.	Pier.	Cent.	1200	15	West.	Eis.	S-P.
Noble C40	2	160	36x4	36x7	Buda.	4–4x5½	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Pier.	Cent.	1075	15	West.	Eis.	S-P.
Noble D50	2½	162	36x4	36x8	Buda.	4–4¼x5½	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Pier.	Cent.	1080	15	West.	Eis.	S-P.
Noble E70	3½	182	36x5	36x10	Buda.	4–4½x6	4	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Pier.	Cent.	972	12	West.	Eis.	S-P.
Northway B2	2	161	36x4*	36x4d*	Own.	4–4x6	4		G&O.		Pump.			Stromb.		Vac.	Pier.	Cent.			Bijur.	Wagnr.	
Northway B3	3½	160	36x5	40x5d	Own.	4–4x6	4		G&O.		Pump.			Stromb.		Vac.	Pier.	Cent.	1350	16	Bijur.	Wagnr.	
Norwalk 25E	1	130	34x3½*	34x4d*	Lyc.	4–3½x5	4	Met-Gear.	Stan.	Cel.	Ther.	Cir-Spl.	Pist.	Zenith.	1	Vac.			2200	30	Dyn.	Delco.	O-C.
Norwalk 35E	1½	143	34x3½*	34x5d*	Lyc.	4–3½x5	4	Met-Gear.	Stan.	Cel.	Ther.	Cir-Spl.	Pist.	Zenith.	1	Vac.			2200	25	Dyn.	Delco.	
Norwalk 35E Special	2	143	34x3½*	34x6d	Buda.	4–3¾x5¼	4	Met-Gear.	Stan.	Cel.	Pump.	Cir-Spl.	Pist.	Zenith.	1	Vac.			1600	20	Dyn.	Delco.	O-C.
Ogden A2	¾	125	34x5p	34x5p	Cont.	4–3½x5	4	Met-Gear.	Chic.	Fin.	Ther.	Cir-Spl.	Pist.	Stromb.	1	Vac.							
Ogden D	1½	131	36x3½	36x5	Cont.	4–3½x5	4	Met-Gear.	Chic.	Fin.	Ther.	Cir-Spl.	Pist.	Stromb.	1	Gra.	Pier.	Cent.			Vesta.	Splitd.	O-C.
Ogden E	2½	150	36x4	36x8	Cont.	4–4½x5¼	4	Met-Gear.	Chic.	Fin.	Pump.	Cir-Spl.	Pist.	Stromb.	1¼	Gra.	Pier.	Cent.			Vesta.		O-C.
Ogden F	3½	175	36x5	40x10	Cont.	4–4½x5½	2	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1½	Gra.	Pier.	Cent.					O-C.
Ogden G	5	168	36x6	40x12	Cont.	4–4½x6	2	Met-Gear.	Chic.	Fin.	Pump.	Hol-Crk.		Stromp.	1½	Gra.	Cont.	Cent.	900	11			O-C.
Old Hickory W	1	135	36x3½p	36x4p	Cont.	4–3½x5	4		Long.	Fin.	Ther.	Cir-Spl.		Stromb.		Vac.	Pier.	Cent.	1200	18		Eis.	
Old Reliable A	1½	150	34x4	36x6	Wis.	4–4x5	4	Met-Gear.	Chic.	Fin.	Pump.	Cir-Spl.	Gear.	Stromb.	1¼	Vac.	Mon.	Suc.	1600	15	Vesta.	Bosch.	S&O.
Old Reliable B	2½	160	34x4	36x8	Wis.	4–4¼x6	4	Met-Gear.	Chic.	Fin.	Pump.		Gear.	Stromb.	1½	Vac.	Mon.	Suc.	1600	15	Vesta.	Bosch.	S&O.
Old Reliable C	3½	168	36x5	36x10d	Wis.	4–4¼x6	4	Met-Gear.	Chic.	Fin.	Pump.	Cir-Spl.	Gear.	Stromb.	1¼	Vac.	Mon.	Suc.	1600	15	Vesta.	Bosch.	S&O.
Old Reliable D	5	186	36x6	40x12	Wis.	4–4½x6	2	Met-Gear.	Chic.	Fin.	Pump.	Cir-Spl.	Gear.	Stromb.	1½	Vac.	Mon.	Suc.	1600	15	Vesta.	Bosch.	S&O.
Old Reliable K&L	7	136	36x6	40x14	Wau.	4–5x6½	2	Met-Gear.	Chic.	Fin.	Pump.	Cir-Spl.	Ecc.	Stromb.	1½	Gra.	Wau.	Cent.	1400	11		Bosch.	S&O.
Olympic	2½	156	36x4*	36x8*	Buda.	4–4½x5½	4	Met-Gear.	Long.	Fin.	Pump.		Gear.	Zenith.	1¼	Gra.	Opt.	Cent.					
Oneida B	1½	144	36x6*	38x7*	Hink.	4–4x5½	4	Met-Gear.	Mod.	Cel.	Pump.	Hol-Crk.	Gear.	Stromb.	1	Vac.	Hink.	Cent.	1600	25	West.	Bosch.	
Oneida C	2½	160	38x7*	40x8*	Hink.	4–4x5½	4	Met-Gear.	Mod.	Cel.	Pump.	Hol-Crk.	Gear.	Stromb.	1	Vac.	Hink.	Cent.	1600	22	West.	Bosch.	
Oneida D	3½	170	36x5	36x10	Hink.	4–4½x5½	4	Met-Gear.	Mod.	Cel.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Hink.	Cent.	1450	18	West.	Bosch.	
Oneida E	5	180	36x6	40x12	Hink.	4–4½x5½	4	Met-Gear.	Mod.	Cel.	Pump.	Hol-Crk.	Gear.	Stromb.	1½	Vac.	Hink	Cent.	1400	11	West.		
Oshkosh A	2	136	36x6p	36x6p	H-S.	4–3½x5	4	Met-Gear.	Bre.	Fin.	Ther.	Cir-Spl.	Gear.	Zenith.	1¼	Vac.		Cent.	1600	21	NE.	NE.	O-C.
Oshkosh B	2½	146	38x7p	38x7p	Her.	4–4x5⅛	4	Met-Gear.	Bre.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.		Cent.	1500	21	NE.	NE.	O-C.
Packard EC	2	144	36x6	40x8	Own.	4–4 3/16x5 1/16	4	Met-Gear.	Fed.	Fin.	Pump.	Cir-Spl.	Gear.	Own.	1⅜	Pr.	Own.	Cent.	1800	27	Bijur.	Dixie.	S-P.
Packard ED	3	156	36x5	36x5d	Own.	4–4½x5½	4	Met-Gear.	Fed.	Fin.	Pump.	Cir-Spl.	Gear.	Own.	1⅜	Pr.	Own.	Cent.	1075	12	Bijur.	Dixie.	S-P.
Packard EF	5	156	36x6	40x6d	Own.	4–5x5½	4	Met-Gear.	Fed.	Fin.	Pump.	Cir-Spl.	Gear.	Own.	1⅜	Pr.	Own.	Cent.	1075	11	Bijur.	Dixie.	S-P.
Paige 52–19	1½	140	34x3½	34x5	Hink.	4–4x5½	4	Met-Gear	Natl.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Hink.	Cent.	1550	20	Remy.	Bosch.	S-P.
Paige 54–20	2½	150	34x4	34x8	Hink.	4–4¼x5½	4	Met-Gear.	Natl.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Simp.	Cent.	1500	17	Remy.	Bosch.	S-P.
Paige 51–18	3½	160	36x5	36x5d	Hink.	4–4½x5½	4	Met-Gear.	Natl.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Simp.	Cent.	1450	15	Remy.	Bosch.	S-P.
Parker G1	2½	150	34x4	36x8	Wis.	4–4¼x6	4	Met-Gear.	Bre.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Pier.	Cent.	1050	15	West.	Eis.	S&O.
Parker J20	3½	160	36x5	40x10	Wis.	4–4½x6	4	Met-Gear.	Bre.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.	Pier.	Cent.	1050	14	West.	Eis.	S&O.
Parker M20	5	160	36x6	40x12	Wis.	4–5x6	2	Met-Gear.	Bre.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1½	Vac.	Pier.	Cent.	1050	12	West.	Eis.	S&O.
Patriot Revere	1	128	35x5p	35x5p	Cont.	4–3¾x5	4	Met-Gear.	B&W.	PT.	Ther.	Cir-Spl.	Pist.	Stromb.	1¼	Vac.					Bijur.	At-K.	
Patriot Lincoln	2	140	34x3½*	34x5*	Hink.	4–4x5½	4	Met-Gear.	B&W.	PT.	Pump.	Hol-Crk.	Gear.	Stromb.	1	Vac.							
Patriot Washington	3	156	36x4*	36x7*	Hink.	4–4½x4½	4	Met-Gear.	B&W.	PT.	Pump.	Hol-Crk.	Gear.	Stromb.	1¼	Vac.							
Pierce-Arrow X5	2	150	36x4	36x4d	Own.	4–4x5½	4	Met-Gear.	Rome T.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1½	Pr.	Own.	Cent.	1600	18	Delco.	Delco.	C-D.
Pierce-Arrow W2	3½	162	36x5	36x5u	Own.	4–4½x5¾	4	Met-Gear.	Rome T.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1½	Pr.	Own.	Cent.	1200	16	Delco.	Delco.	C-D.
Pierce-Arrow R10	5	168	36x5	40x6d	Own.	4–4½x6½	4	Met-Gear.	Rome T.	Fin.	Pump.	Hol-Crk.	Gear.	Stromb.	1½	Pr.	Own.	Cent.	1200	14	Delco.	Delco.	C-D.
Pioneer 59AA	1	130	32x4½p	32x4½p	GB&S.	3¾x4¼	4	N-M-G.		Own.	Cel.	Ther.	Cir-Spl.	Ecc.	Zenith.	1¼			2400	40	Aut-L.	Bosch.	D-P.
Pittsburgher B	2½	160	36x5*	36x7*	Cont.	4–4¼x5½	4	Met-Gear.	G&O.	Fin.	Pump.	Cir-Spl.	Pist.	Stromb.	1¼	Vac.	Mon.	Suc.	1600	18	Opt.		
Pittsburgher C21	3	162	36x5*	36x7*	Mid.	4–4¼x5¼	4	Met-Gear.	G&O.	Fin.	Pump.	Pre.	Gear.	Stromb.	1¼	Vac.	Mon.	Suc.	1400	16	Opt.		
Power F	2	140	36x6*	40x8*	Hink.	4–4¼x5	2	Met-Gear.	G&O.	Fin.	Pump.	Hol-Crk.	Gear.	Zenith.	1½	Gra.	Hink.	Cent.	1600	22	West.	Eis.	
Power C	3½	160	36x5c	40x10c	Hink.	4–4½x5½	2	Met-Gear.	G&O.	Fin.	Pump.	Hol-Crk.	Gear.	Zenith.	1¼	Vac.	Hink.	Cent.	1600	14	West.	Eis.	
Rainier R21	¾	125	35x5p	35x5p	Cont.	4–3½x5	4	Met-Gear.	Har.	Cel.	Ther.	Cir-Spl.		Zenith.	1	Vac.	Mon.	Suc.					
Rainier R19	1	133	34x3½	34x4 d,c	Cont.	4–3¾x5	4	Met-Gear.	Har.	Cel.	Ther.			Zenith.	1	Vac.	Mon.	Suc.	1400	20			
Rainier R18	2	147	34x4	34x6	Cont.	4–4⅛x5¼	4		E&M.	Fin.	Pump.	Cir-Spl.	Pist.	Zenith.	1	Vac.	Pier.	Cent.		16			
Rainier R16	1½	147	34x3½	34x5	Cont.	4–3¾x5	4	Met-Gear.	Har.	Cel.	Ther.	Cir-Spl.		Zenith.	1	Vac.	Mon.	Suc.		18			
Rainier R20	2½	165	34x4	34x7	Cont.	4–4⅛x5¼	4			Fin.	Pump.	Hol-Crk.		Zenith.	1¼	Vac.	Pier.	Cent.		16			
Rainier R15	3½	170	36x5	36x5d	Cont.	4–4½x5½	2		E&M.	Fin.	Pump.	Hol-Crk.	Gear.	Zenith.	1½	Vac.	Pier.	Cent.	1200	15		Eis.	
Rainier R17	5	172	36x6	40x6d	Cont.	4–4½x6	2		E&M.	Fin.	Pump.	Hol-Crk.	Gear.	Zenith.	1½	Vac.	Pier.	Cent.		15		Eis.	
Reo F	¾–1¼	128	34x4½p	34x4½p	Own.	4–4¼x4½	2	Met-Gear.	Own.	Fin.	Pump.	Cir-Spl.	Pist.	Johsn.	1	Gra.					Remy.		
Republic 75	¾	124	32x4½p	32x4½p	Lyc.	4–3½x5	4	Met-Gear.	G&O.	Cel.	Ther.	Cir-Spl.	Pist.	Stromb.	1	Vac.			1900	35	Aut-L.	Aut-L.	S&C.
Republic 10	1	124	34x3	34x4	Cont.	4–3¾x5	4	Met-Gear.	G&O.	Cel.	Ther.	Cir-Spl.	Pist.	Stromb.	1	Gra.	Own.	Suc.	1150	17		Bosch.	S&C.
Republic 10E	1	124	34x5p	34x5p	Cont.	4–3¾x5	4	Met-Gear.	G&O.	Cel.	Ther.	Cir-Spl.	Pist.	Stromb.	1	Gra.			1510	25	Delco.	Bosch.	S&C.
Republic 11X	1½	144	34x3½	34x5	Cont.	4–3¾x5	4	Met-Gear.	G&O.	Cel.	Ther.	Cir-Spl.	Pist.	Stromb.	1	Gra.	Own.	Suc.	1200	15			S&C.
Republic 19	2½	144	36x4	36x7	Cont.	4–4⅛x5¼	4	Met-Gear.	G&O.	Cel.	Pump.	Cir-Spl.	Pist.	Stromb.	1¼	Gra.	Pharo.	Hyd.	894	12			S&C.
Republic 19W	2½	154	36x4	36x7	Wau.	4–4x5½	2	Met-Gear.	G&O.	Cel.	Pump.	Cir-Spl.	Gear.	Stromb.	1¼	Gra.	Wau.	Cent.	980	12			S&C.
Republic 20	3½	165	36x5	36x10	Cont.	4–4½x5½	2	Met-Gear.	G&O.	Fin.	Pump.	Cir-Spl.	Pist.	Stromb.	1¼	Gra.	Pharo.	Hyd.	966	12			S&C.
Rowe HSW	¾	122½	34x5p	34x5p	Wis.	4–3½x5	4	Met-Gear.	Fed.	Cel.	Pump.	Hol-Crk.	Gear.	Zenith.	1¼	Gra.	Simp.	Cent.	1500	30	Eis.	Eis.	S&C.
Rowe CW	1½	133	36x6p	36x6p	Wis.	4–3¾x5	4	Met-Gear.	Fed.	Cel.	Pump.	Hol-Crk.	Gear.	Zenith.	1¼	Gra.	Simp.	Cent.	1500	26	Eis.	Eis.	S&C.
Rowe CDW	2	140	34x4	36x3½d	Wis.	4–4x5	4	Met-Gear.	Fed.	Cel.	Pump.	Hol-Crk.	Gear.	Zenith.	1¼	Gra.	Simp.	Cent.	1500	20		Bosch.	S&C.
Rowe GSW	3	158	34x5	36x5d	Wis.	4–4x6	4	Met-Gear.	Fed.	Cel.	Pump.	Hol-Crk.	Gear.	Zenith.	1¼	Gra.	Simp.	Cent.	1400	19	Eis.	Bosch.	S&C.
Rowe HW	4	158	36x5	36x6d	Wis.	4–4½x6	4	Met-Gear.	Fed.	Cel.	Pump.	Hol-Crk.	Gear.	Zenith.	1¼	Gra.	Simp.	Cent.	1400	17	Eis.	Bosch.	S&C.

For abbreviations, see pages 350 and 351.

Trucks (Continued)

CLUTCH		TRANSMISSION												SPRINGS		BRAKES		STEERING		WHEELS			
		GEARSET				UNIVERSAL JOINTS		AXLES															
Make	Type	Make	Type	Location	Forward Speeds	Make	Type	Front Make	Rear Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Final Drive Type	Front	Rear	Service	Emergency	Steering Gear Make	Steering Gear Type	Make	Type	Frame Material	Make and Model
Ful	D-M	Ful	SG	Un-WE	4	Blood	Met	She	She	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Dom	Art	R-S	Mapleleaf CC
Ful	D-M	Ful	SG	Sep-Un	4	Blood	Met	She	She	13.00	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Mapleleaf DD
Own	D-M	Own	SG	Un-WE	3	Spi	Met	Shu	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Prud	Art	P-S	Master JW
Ful	D-M	Ful	SG	Un-WE	4	Spi	Met	Tim	Tim	8.50	Sp	Sp	I-G&W	½E	½E	IntD-R	IntR-W	Ross	S&N		C-S	P-S	Master D&W
B-L	D-M	B-L	SG	Sep-Un	4		Met	Tim	Tim	10.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Master A
B-L	D-M	B-L	SG	Sep-Un	4		Met	Tim	Wal	10.41	RR	Sp	I-G	½E	½E	IntDr	IntR-W	Ross	S&N		C-S	P-S	Master E
B-L	D-M	B-L	SG	Sep-Un	4		Met	Tim	Tim	11.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Master B
B-L	D-M	B-L	SG	Sep-Un	4		Met	Tim	Wal	11.53	Sp	Sp	I-G	½E	½E	IntDr	IntR-W	Ross	S&N		C-S	P-S	Master F
Det	D-M	Cotta	CM	Un-WE	3	Spi	Met	Shu	Wis	7.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	R-S	Menominee HT
Det	D-M	Cotta	CM	Un-WE	3	Spi	Met	Shu	Wis	8.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	R-S	Menominee H
Det	D-M	Cotta	CM	Un-WE		Spi	Met	Cont	Wis	8.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	R-S	Menominee D
Det	D-M	Cotta	CM	Sep-Un	4	Spi	Met	Cont	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Menominee G
Det	D-M	Cotta	CM	Sep-Un	4	Spi	Met	Cont	Tim	11.66	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Menominee J3
B&B	Pla	Own	SG	Un-WE		Arvac	Met	Col	Tor	8.00	Sp	Sp	I-G	El	El	Ext	IntR-W	Ross	S&N	MWCo	Art	P-S	Moline 10
Own	D-M	Own		Sep-Un	4	Own	Fab	Tim	Tim		RR	RR	Worm			IntR-W	IntR-W	Ross		Smith	C-S	P-S	Moreland 22
Own	D-M	Own		Sep-Un	4	Own	Fab	Tim	Tim		RR	RR	Worm			IntR-W	IntR-W	Ross		Smith	C-S	P-S	Moreland 22H
Ful	D-M	Ful	SG	Un-WE	3	Blood	Met	Tor		6.00		Sp	I-G	½E	½E	Ext	ExtDr	Lav	S&N	Roy	Art	R-S	Napoleon 9
Ful	D-M	Ful	SG	Un-WE	3	Blood	Met	Tor	Mid	7.50			I-G	½E	½E	Ext	ExtDr	Lav	S&N	Roy	Art	R-S	Napoleon 11
B-L	D-M	B-L	SG	Un-WE	3	Own	Fab	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Prud	Art	R-S	Nelson LeMoon G
B-L	D-M	B-L	SG	Un-WE	3	Own	Fab	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav					Nelson LeMoon G
B-L	D-M	B-L	SG	Un-WE	4	Own	Fab	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Prud	Art	R-S	Nelson LeMoon G
B-L	D-M	B-L	SG	Sep-Un	4	Own	Fab	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Prud	Art	R-S	Nelson LeMoon G
B-L	D-M	B-L	SG	Sep-Un		East	Met	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&S	Arch	Art	P-S	Netco DK
B-L	D-M	B-L	SG	Sep-Un		East	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&S	Arch	Art	P-S	Netco HL
B-B	Pla	Cov	SG	Sep-Un	3	Blood	Met	Tim	Tim		RR		Worm	½E	½E	IntR-W	IntR-W	Gem	W&W		Art	P-S	Niles E
Ful	D-M	Ful	SG	Un-WE		M&E	Met	She	She	8.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	W&S	Bimel	Art	P-S	Noble B30
Ful	D-M	Ful	SG	Un-WE	3	M&E	Met	She	She	8.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	W&S	Bimel	Art	P-S	Noble C40
Ful	D-M	Ful	SG	Sep-Un	4	M&E	Met	She	She	8.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	W&S	Bimel	Art	P-S	Noble D50
Ful	D-M	War	SG	Sep-Un	4	M&E	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	W&S	Bimel	Art	P-S	Noble E70
Ful	D-M	Ful	SG	Un-WE	4	Spi	Met	She	She		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross		Clark	C-S	P-S	Northway B2
Ful	D-M	Ful	SG	Un-WE	4	Spi	Met	She	She		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross		Clark	C-S	P-S	Northway B3
B-B	Pla	G-L	SG	Un-WE	3	UMCo	Met	Sal	Chic	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	CAS	W&W	E&O	Art	P-S	Norwalk 25E
B-B	Pla	G-L	SG	Un-WE	3	BCo	Met	She	She	8.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	CAS	W&W	E&O	Art	P-S	Norwalk 35E
B-B	Pla	G-L	SG	Un-WE		BCo	Met	She	She	7.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Dit	W&W	E&O	Art	P-S	Norwalk 35E Special
B-L	D-M	B-L	SG	Un-WE	3	M&E	Met	Tim	Tim	6.20	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Stan	Art	P-S	Ogden A2
B-L	D-M	B-L	SG	Un-WE	3	M&E	Met	Tim	Tim	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Stan	Art	P-S	Ogden D
B-L	D-M	B-L	SG	Sep-Un	4	M&E	Met	She	She	8.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Stan	Art	P-S	Ogden E
B-L	D-M	B-L	SG	Sep-Un	4	M&E	Met	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Stan	Art	P-S	Ogden F
B-L	D-M	B-L	SG	Sep-Un	4	M&E	Met	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Stan	Art	P-S	Ogden G
B-B	Pla	G-L	SG	Un-WE	3	Blood	Met	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav		Stan	Art	R-S	Old Hickory W
Ful	D-M	Ful	SG	Un-WE			Met	She	She	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	StM	Art	R-S	Old Reliable A
Ful	D-M	Ful	SG	Sep-Un	4	Spi	Met	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	StM	Art	R-S	Old Reliable B
Ful	D-M	Ful	SG	Sep-Un		Spi	Met	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	StM	Art	R-S	Old Reliable C
Uni	D-O	B-L	SG	Sep-Un	4	Spi	Met	She	She	10.25	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	StM	Art	R-S	Old Reliable D
Uni	D-O	Own	SG	Un-WJ	4		Met	Cont	Own	10.36	RR	Sp	Ch	½E	½E	ExtDr	IntR-W	Ross	S&N	StM	Art	R-S	Old Reliable K&L
B-L	D-M			Un-WE			M&F	Tim	Tim	7.75	RR		Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	StM	Art	P-S	Olympic
Ful	D-M	Ful	SG	Sep-Un	3			Shu	Wis	7.75	RR	Sp	Worm	½E	El	IntR-W	IntR-W	Ross	S&N	StM	Art	P-S	Oneida B
Ful	D-M	Ful	SG	Sep-Un	4	Pet	M&F	Shu	Wis	8.66	RR	Sp	Worm	El	El	IntR-W	IntR-W	Ross	S&N	StM	Art	P-S	Oneida C
Ful	D-M	Ful	SG	Sep-Un	4		M&F	Tim	Tim	10.66	RR	Sp	Worm	El	El	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Oneida D
Ful	D-M	Ful	SG	Sep-Un	4		M&F	Tim	Tim	11.66	RR	Sp	Worm	El	El	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Oneida E
B-L	D-M	B-L		Un-WE	4	Pet	Met	Own	Own	8.25	Sp	Sp	StB	½E	½E	ExtDr	R-W	Ross	S&N	Roy	Art	P-S	Oshkosh A
B-L	D-M	B-L	SG			Pet	Met	Own	Own	8.00	Sp	Sp	StB	½E	½E	ExtR-W	R-W	Ross	S&N	Roy	Art	P-S	Oshkosh B
Own	D-M	Own	SG	Un-WE	4		M&F	Own	Own	8.00	RR	TA	Worm	½E	½E	ExtDr	IntR-W	Own	W&W	Own		R-S	Packard EC
Own	D-M	Own	SG	Un-WE	4		M&F	Own	Own	9.00	RR	TA	Worm	½E	½E	ExtDr	ExtR-W	Own	W&W	Own		R-S	Packard ED
Own	D-M	Own	SG	Un-WE	4		M&F	Own	Own	10.66	RR	TA	Worm	½E	½E	ExtDr	R-W	Ross	S&N	Own		R-S	Packard EF
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	7.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	P-S	Paige 52–19
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Paige 54–20
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.33	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Own		P-S	Paige 51–18
B-L	D-M	Ful	SG	Sep-Un	4	Blood	Met	Shu	Own	7.75	RR	Sp	Worm	½E	½E	ExtDr	IntR-W	Ross	S&N	Bimel	Art	P-S	Parker G1
B-L	D-M	War	SG	Sep-Un	4	Blood	Met	Shu	Own	8.75	RR	Sp	Worm	½E	½E	ExtDr	IntR-W	Ross	S&N	Smith	C-S	P-S	Parker J20
B-L	D-M	War	SG	Sep-Un	4	Blood	Met	Shu	Own	10.25	RR	Sp	Worm	½E	½E	ExtDr	IntR-W	Ross	S&N	Smith	C-S	P-S	Parker M20
B-B	Pla	Cov	SG	Sep-Un	3		Fab	Flint	Emp	6.20	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	CAS	W&S	Bimel	Art	P-S	Patriot Revere
Cov	D-M	Ful	SG	Sep-Un	4		Fab	Shu	Emp	7.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	W&S	Bimel	Art	P-S	Patriot Lincoln
Cov	D-M	Cov	SG	Sep-Un	4		Fab	Shu	Wis	9.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	W&S	Bimel	Art	P-S	Patriot Washington
Cov	D-M	Cov	SG	Sep-Un	4	Spi	M&F	Eat	Eat		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Pierce-Arrow X5
Cov	D-M	Own	SG	Sep-Un	4	Spi	M&F	Own	Own		RR	TA	Worm	½E	½E	ExtDr	IntR-W	Ross	S&N	Day	C-S	P-S	Pierce-Arrow W2
Cov	D-M	Own	SG	Sep-Un	4	Spi	M&F	Own	Own	10.00	RR	TA	Worm	½E	½E	ExtDr	IntR-W	Ross	S&N	Day	C-S	P-S	Pierce-Arrow H10
DG&M	Pla	G-L	SG	Un-WE	3	Own	Fab	Cont	I-M	6.00	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Woh	S&N	Bimel	Art	P-S	Pioneer 59AA
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	W&W	Smith	C-S	P-S	Pittsburgher B
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	Vul	Vul	9.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	W&W	Smith	C-S	P-S	Pittsburgher C21
Ful	D-M	Ful	SG	Un-WE	4	Arvac	Met	Vul	Vul	7.75	Sp	Sp	Worm	½E	½E	R-W	R-W	Ross	S&N	StM	Art	R-S	Power F
Ful	D-M	Ful	SG	Sep-Un	4	Arvac	Met	Cont	Wis	10.00	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	StM	Art	R-S	Power C
B-L	D-M	B-L	SG	Un-WE	3	Hart	Met	Tim	Tim	6.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Jones	Art	P-S	Rainier R21
B-L	D-M	B-L	SG	Un-WE	3	Hart	Met	She	She	7.80	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Jones	Art	P-S	Rainier R19
B-L	D-M	B-L	SG	Un-WE		Spi	Met	She	She	8.66	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Jones	Art	P-S	Rainier R18
B-L	D-M	B-L	SG	Un-WE		Hart	Met	She	She	7.80	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Jones	Art	P-S	Rainier R16
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	8.50	RR		Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Jones	Art	P-S	Rainier R20
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	10.33	RR		Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Jones	Art	P-S	Rainier R15
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	Tim	Tim	13.66	RR		Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Rainier R17
Own	D-M	Own	SG	Sep-Un	3	Own	Met	Own	Own	4.70	Sp	TA	S-B	½E	½E	Ext	IntR-W	Own	P&S	Prud	Art	P-S	Reo F
Own	D-M	Own	SG	Un-WE	3	Spi	Met	Tor	Tor	5.38	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N	MWCo	Art	P-S	Republic 75
Ful	D-M	Ful	SG	Un-WE	3	Spi	Met	Tor	Tor	6.28	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N		Art	P-S	Republic 10
Ful	D-M	Ful	SG	Un-WE	3	Spi	Met	Tor	Tor	6.28	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N		Art	P-S	Republic 10E
Ful	D-M	Ful	SG	Un-WE	3	Hart	Met	Tor	Tor	8.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N	MWCo	Art	P-S	Republic 11X
Ful	D-M	Ful	SG	Un-WE		Spi	Met	Tor	Tor	8.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N	MWCo	Art	P-S	Republic 19
Ful	D-M	Ful	SG	Un-WE		Pet	Met	Tor	Tor	8.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Jac	S&N	MWCo	Art	P-S	Republic 19W
Ful	D-M	Ful	SG	Un-WE		Spi	Met	Sav	Tor	10.26	Sp	Sp	I-G	½E	½E	ExtR-W	ExtDr	Jac	S&N	Smith	Art	P-S	Republic 20
B-L	D-M	B-L	SG	Un-WE	3	Spi	Met	She	She	5.00	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W	Hoop	Art	R-S	Rowe HSW
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	She	She	6.50	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Hoop	Art	R-S	Rowe CW
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	She	She	7.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Hoop	Art	R-S	Rowe CDW
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	She	She	7.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Hoop	Art	R-S	Rowe GSW
B-L	D-M	B-L	SG	Un-WE	4	Spi	Met	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Hoop	Art	R-S	Rowe HW

For abbreviations, see pages 350 and 351.

Specifications of American

Make and Model	Tons Capacity	Wheel-Base, Ins.	TIRE SIZE Front, Ins.	TIRE SIZE Rear, Ins.	ENGINE Make	ENGINE Number Cylinders, Bore and Stroke	ENGINE Cylinders Cast	ENGINE Camshaft Drive Type	ENGINE Radiator Core Make	ENGINE Radiator Core Type	ENGINE Water Circulation	OILING SYSTEM Type	OILING SYSTEM Oil Pump Type	FUEL SYSTEM Carbureter Make	FUEL SYSTEM Carbureter Size, Ins.	FUEL SYSTEM Fuel Feed	GOVERNOR Make	GOVERNOR Type	SPEED Motor in R.P.M.	SPEED Truck in M.P.H.	ELECTRICAL SYSTEM Generator Make	ELECTRICAL SYSTEM Ignition System, Make	ELECTRICAL SYSTEM Ignition System, Type
Rowe FW	5	170	36x6	40x6d	Wis	4–4½x6	4	Met-Gear	Fed	Cel	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Simp	Cent	1300	17	Eis	Bosch	S&C
Ruggles	1	124	34x5	34x5	Cont	4–4x5				Cel	Pump	Cir-Spl		Stromb									
Ruggles	2		34x7	34x7*	Own		4																
Rumely A	1½	144	36x3½	36x5	Buda	4–3¾x5¼	4	Met-Gear	Mod	Fin	Pump	Hol-Crk	Gear	Stromb	1	Gra	Pier	Cent	1090	15	G&D	Berlg	
Samson 15	¾	118	32x4p	32x4p	Own	4–3 11/16x4	4	Met-Gear	MPCo	PT	Pump	Cir-Spl	Gear	Zenith	1	Gra	Mon	Suc	1670	25	Aut-L	Remy	O&S
Samson 25	1¼	118	35x5p	35x5p	Own	4–3 11/16x5¼	4	Met-Gear	MPCo	PT	Pump	Cir-Spl	Gear	Zenith	1	Gra	Mon	Suc	1312	20	Aut-L	Remy	O&S
Sandow G	1	120	34x3½*	34x5*	Cont	4–3½x5	4	Met-Gear	Chic	Fin	Ther	Cir-Spl	Ecc	Stromb	1	Gra			1400	25	Bosch	Bosch	D-P
Sandow CG	1½	135	34x4*	35x5*	Cont	4–3¾x5	4	Met-Gear	Chic	Fin	Ther	Cir-Spl	Ecc	Stromb	1	Gra			1400	22	Bosch	Bosch	D-P
Sandow J	2½	165	36x4*	36x7*	Cont	4–4½x5½	4	Met-Gear	Chic	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Gra	Mon	Suc	1100	15	Bosch	Bosch	D-P
Sandow N	3½	175	36x5	36x5d	Cont	4–4½x5½	4		Chic	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Gra	Mon	Suc	1200	14			D-P
Sandow L	5	175	36x6	36x6d	Cont	4–4½x5½	4	Met-Gear	Chic	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Gra	Mon	Suc	1100	12			D-P
Sandford 25	2½	174	36x4	36x4d	Cont	4–4 1/16x5¼	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Pist	Stromb	2	Gra	Pier	Cent	1000	15		Eis	
Sandford W35	3½	174	36x5	36x5d	Cont	4–4½x5½	2	Met-Gear	McCo	Fin	Pump	Cir-Spl	Pist	Stromb	2	Gra	Pier	Cent	1000	13		Eis	
Sandford W50	5	174	36x5	36x6d	Cont	4–4½x5½	2	Met-Gear	McCo	Fin	Pump	Cir-Spl	Pist	Stromb	2	Gra	Pier	Cent	1000	11		Eis	
Schacht F	2	156	36x4	36x7	Buda	4–4¼x5½	4	Met-Gear	Bre	Fin	Pump	Hol-Crk	Gear	Schebl	1¼	Gra	Dup	Cent	1000	15	West	Bosch	S-P
Schacht F	3	156	36x5	36x5d	Buda	4–4¼x5½	4	Met-Gear	Bre	Fin	Pump	Hol-Crk	Gear	Schebl	1¼	Gra	Dup	Cent	1000	15	West	Bosch	S-P
Schacht E	4	168	36x5	40x6d	Buda	4–4½x6	4	Met-Gear	Bre	Fin	Pump	Hol-Crk	Gear	Schebl	1¼	Gra	Dup	Cent	1000	20	West	Bosch	S-P
Schacht E	5	168	36x6	40x12	Buda	4–4½x6	4	Met-Gear	Bre	Fin	Pump	Hol-Crk	Gear	Schebl	1¼	Gra	Dup	Cent	1000	15	West	Bosch	S-P
Schwartz A	1¼	130	34x4½p	34x4½p	Lyc	4–3½x5	4	Met-Gear	G&O	Cel	Ther	Cir-Spl		Carter	1	Vac			1800	30	West	West	S&O
Schwartz B2W	2	140	34x3½	34x6	Buda	4–3¾x5¼	4	Met-Gear	Fed	Cel	Pump	Hol-Crk	Gear	Stromb	1	Gra	Mon	Suc	1450	18	G&D	Bosch	S&O
Schwartz C2W	3	150	36x4	36x8	Buda	4–4¼x5½	4	Met-Gear	Fed	Cel	Pump	Hol-Crk	Gear	Stromb	1½	Gra	Mon	Suc	1308	16	G&D	Bosch	S&O
Schwartz DW	5	170	36x6	36x12	Buda	4–4½x6	4	Met-Gear	Fed	Cel	Pump	Hol-Crk	Gear	Stromb	1¼	Gra	Simp	Suc	1200	14	G&D	Bosch	S&O
Selden A	1½	137½	34x3½	34x5	Cont	4–3½x5	4	Met-Gear	Long	Fin	Ther	Cir-Spl	Ecc	Stromb	1	Gra	Pier	Cent	1200	18	NE	Eis	O-C
Selden 2½A	2½	145	36x4	36x7	Cont	4–4 1/16x5¼	4	Met-Gear	Long	Fin	Pump	Cir-Spl	Ecc	Stromb	1	Gra	Pier	Cent	1200	16	NE	Eis	O-C
Selden 3½A	3½	162	36x5	36x10	Cont	4–4½x5½	2	Met-Gear	Long	Fin	Pump	Cir-Spl	Ecc	Stromb	1¼	Gra	Pier	Cent	1125	14	NE	Eis	O-C
Selden 5A	5	164	36x5	40x12	Cont	4–4¼x6	2	Met-Gear	Long	Fin	Pump	Hol-Crk	Gear	Stromb	1½	Gra	Cont	Cent	1125	13	NE	Eis	O-C
Service 15	¾–1	132	34x4½p	35x5	Mid	4–3⅜x5	4	Com-Gear	Long	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Gra			1800		Remy	Remy	
Service 31	1½	150	36x3½	36x6	Buda	4–4x5½	4	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac			1300		West	Eis	
Service 36	1½–2	150	36x6p	38x7p	Buda	4–4¼x5½	4	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac			1300		West	Eis	
Service 51	2½–3	160	36x4	36x7	Buda	4–4¼x5½	4	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac			1300		West	Eis	
Service 71	3½	171	36x5	36x5d	Buda	4–4¼x5½	4	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac			1300		West	Eis	
Service 76	3½	171	36x5	36x5d	Buda	4–4½x6	4	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac			1200		West	Eis	
Service 101	5	171½	36x6	40x6d	Buda	4–4½x6	4	Met-Gear	McCo	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac			1200		West	Eis	
Signal NF	1	132	34x5p	36x6p	Cont	4–3¾x5	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Gear	Stromb		Gra	Pier			25		Eis	
Signal H	1½	144	34x4	36x6	Cont	4–4⅛x5¼	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Gear	Stromb		Gra	Pier			15	Delco	Eis	
Signal J	2½	150	34x4	36x8	Cont	4–4⅛x5½	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Gear	Stromb		Gra	Pier	Cent		15	Delco	Eis	
Signal M	3½	168	36x5	40x10	Cont	4–4½x5½	4	Met-Gear	McCo	Fin	Pump	Cir-Spl	Gear	Stromb		Gra	Pier			12		Eis	
Signal R	5	180	36x6	40x12	Cont	4–4¾x6	2	Met-Gear	McCo	Fin	Pump	Cir-Spl		Stromb		Gra	Cont			12		Eis	
Standard 1K	1½	134	34x3½	34x5	Cont	4–3¾x5	4	Met-Gear	Long	Fin	Pump	Cir-Spl	Pist	Stromb	1	Gra	Mon	Suc	1200	17			
Standard 76	2½–3	140	36x4	34x7	Cont	4–4⅛x5¼	4	Met-Gear	Long	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Gra	Mon	Suc	1200	15			
Standard 66	3½–4	160	36x5	36x10	Cont	4–4½x5½	2	Met-Gear	Long	Fin	Pump	Cir-Spl	Pist	Stromb	1¼	Vac	Mon	Suc	1100	12			
Standard 5K	5–6	164	36x6	40x12	Cont	4–4¾x6	2	Met-Gear	Long	Fin	Pump	Cir-Spl	Gear	Stromb	1½	Vac	Cont	Cent	1000	10			
Sterling 1½	1½	142	36x3½*	36x5*	Own	4–4x5¼	2	Met-Gear	McCo	Cel	Pump	Cir-Spl	Gear	Zenith	1¼	Vac	Wau	Cent	1050	16	G&D	Eis	S-P
Sterling 2	2	142	36x4*	36x6*	Own	4–4x5¼	2	Met-Gear	McCo	Cel	Pump	Cir-Spl	Gear	Zenith	1¼	Vac	Wau	Cent	1150	16	G&D	Eis	S-P
Sterling 2½	2½	156	36x4*	36x4d*	Own	4–4⅜x5½	2	Met-Gear	McCo	Cel	Pump	Cir-Spl	Gear	Zenith	1¼	Vac	Wau	Cent	1080	15	G&D	Eis	
Sterling 3½	3½	162	36x5*	40x5d*	Own	4–4½x6¼	2	Met-Gear	McCo	Cel	Pump	Cir-Spl	Gear	Zenith	1½	Vac	Wau	Cent	1030	14	West	Eis	
Sterling 5	5	168	36x6	40x6d	Own	4–5x6¼	2	Met-Gear	McCo	Cel	Pump	Cir-Spl	Gear	Zenith	1½	Vac	Wau	Cent	1030	14	West	Eis	D-P
Sterling 5	5	174	36x6	40x5d	Own	4–5x6¼	2	Met-Gear	McCo	Cel	Pump	Cir-Spl	Gear			Vac	Wau	Cent	1000	18	West	Eis	S-P
Sterling 7½	7½	174	36x6	40x7d	Own	4–5x6¼	2	Met-Gear	McCo	Fin	Pump	Cir-Spl	Gear	Zenith	1½	Vac	Wau	Cent	1000	16	West	Eis	S-P
Stoughton C	¾	131	34x4½p	34x4½p		4–3¾x5	4	Met-Gear	Chic	Fin	Ther	Cir-Spl	Pist	Stromb	1	Gra						West	
Stoughton A	1	130	35x5p	35x5p	Wau	4–3¾x5¼	4			Fin	Pump	Cir-Spl	Gear	Stromb	1	Gra	Wau	Cent	1200		Dyn		
Stoughton B	1½	140½	36x3½	36x5	Wau	4–3¾x5¼	4	Met-Gear		Fin	Pump	Cir-Spl	Gear	Stromb	1	Gra	Wau	Cent	1200		Dyn		
Stoughton D	2	140½	36x4	36x7	Her	4–4x5½	4	Met-Gear		Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Gra	Dup	Cent	1400		West		
Stoughton F	3	158	36x5	36x5d	Her	4–4½x5½	4	Met-Gear		Fin	Pump	Hol-Crk	Gear	Stromb	1½	Gra	Dup	Cent	1200		West		
Sullivan E	2	150	36x4	36x7	Buda	4–4½x5½	4	Met-Gear	Bush	Fin	Pump	Hol-Crk		Stromb	1¼	Vac						Bosch	C-C
Sullivan H	3½	156	36x5	36x5d	Buda	4–4½x6	4	Met-Gear	Bush	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac	Pier	Cent	1350	14			C-C
Super Truck 40	2	156	36x6*	40x8*	Wau	4–3¾x5¼	4	Met-Gear	Chic	Fin	Pump	Cir-Spl	Gear	Zenith	1	Gra	Wau	Cent	1100	13		Bosch	
Super Truck 50	2½	156	36x4	36x8	Wis	4–4x6	4	Met-Gear	Chic	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Simp	Cent	1100	12	Vesta		
Super Truck 70	3½	164	36x5	40x5d	Wis	4–4¼x6	4	Met-Gear	Chic	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Simp	Cent	1100	11	Vesta	Bosch	
Super Truck 100	5	164	36x5	40x12	Wis	4–4¾x6	2	Met-Gear	Chic	Fin	Pump	Hol-Crk	Gear	Zenith	1½	Gra	Simp	Cent	1100	11	Vesta		
Tiffin GW	1½	135	36x3½	36x5	Cont	4–4⅛x5½	4	Met-Gear	G&O	Fin	Pump	Cir-Spl	Pist	Schebl	1¼	Gra	Pier	Cent	1200	16	West	Bosch	D-P
Tiffin MW	2½	148	36x4	36x3½d	Cont	4–4⅛x5¼	4	Met-Gear	G&O	Fin	Pump	Cir-Spl	Pist	Schebl	1¼	Gra	Pier	Cent	1200	14	West	Bosch	D-P
Tiffin F35	3½	160	36x5	40x5d	Cont	4–4½x5	2	Met-Gear	G&O	Fin	Pump	Hol-Crk	Pist	Stromb	1¼	Gra	Pier	Cent	1100	14	West	Bosch	D-P
Tiffin TW	5	168	36x6	40x6d	Cont	4–4¾x6	2	Met-Gear	G&O	Fin	Pump	Hol-Crk	Pist	S hebl	1½	Gra	Cont	Cent	1100	12	West	Bosch	D-P
Tiffin UW	6	168	36x6	40x12	Cont	4–4¾x6	2	Met-Gear	G&O	Fin	Pump	Hol-Crk	Pist	Schebl	1½	Gra	Cont	Cent	1100	12	West	Bosch	D-P
Titan	2	156	34x4*	36x7*		4–4x5								Stromb								Eis	
Titan	3½	156	36x5	36x10	Buda	4–4½x5½								Stromb			Simp		1200			Eis	
Titan	5	156	36x5	40x12	Buda	4–4½x6								Stromb			Simp		1100	15		Eis	
Titan	6	156	36x5	40x12	Buda	4–4½x6								Stromb			Simp		1100	13		Eis	
Tower J	1½	142	35x5p	38x7p	Cont	4–4⅛x5½	4	Met-Gear	Own	Fin	Pump	Cir-Spl	Pist		1¼	Gra		Cent					O-C
Tower H	2½	146	36x4	36x8	Cont	4–4½x5½	4	Met-Gear	Bre	Fin	Pump	Cir-Spl	Pist		1¼	Gra	Pier		1160	15		Eis	
Tower G	3½	165	36x5	36x10	Cont	4–4½x5½	2	Met-Gear	Bre	Fin	Pump	Cir-Spl	Pist		1½	Gra		Cent	1150	12			
Traffic Speedboy	1½	128	35x5p	35x5p	Cont	4–3½x5	4	Met-Gear	Own	Cel	Ther	Cir-Spl	Pist	Carter	1	Vac			1800	35	G&D	Bosch	O-C
Transport 20	1	130	34x3½*	34x4*	Buda	4–3¾x5⅛	4	Met-Gear	Mod	Cel	Ther	Cir-Spl	Gear	Stromb	1	Gra	Simp	Cent	1692	25	Eis	Eis	C-C
Transport 30	1½	140	34x3½*	34x4*	Cont	4–3¾x5	4	Met-Gear	Mod	Cel	Ther	Cir-Spl	Pist	Stromb	1	Gra	Simp	Cent	1680	25	Eis	Eis	C-C
Transport 50	2½	150	36x4*	36x8*	Cont	4–4⅛x5¼	4	Met-Gear	Mod	Cel	Pump	Cir-Spl	Pist	Stromb	1¼	Gra	Dup	Cent	1210	18	Eis	Eis	C-C
Transport 70	3½	170	36x5*	36x10*	Buda	4–4½x6	4	Met-Gear	Mod	Cel	Pump		Gear			Gra	Dup	Cent	1112	14	NE	Eis	C-C
Traibold K	2½	146	36x4*	36x7*	Buda	4–4½x5½	4	Met-Gear	AmC	Fin	Pump	Hol-Crk	Pist	Zenith		Gra					Aut-L		
Traylor B	1½	140	34x3½	34x6	Buda	4–3¾x5½	4	Met-Gear	G&O	Fin	Ther	Hol-Crk	Gear	Zenith	1	Gra			1900	30	West	Splitd	
Traylor C	2	146	36x4	36x7	Buda	4–4x5½	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Pier	Cent		20	West	Splitd	
Traylor D	3	150	36x4	36x8	Buda	4–4½x5½	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Pier	Cent		18	West	Splitd	
Traylor E	4	170	36x5	40x5	Buda	4–4¼x6	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Simp	Cent		15	West	Bosch	
Traylor F	5	170	36x6	40x6	Buda	4–4½x6	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Zenith	1¼	Gra	Simp	Cent		15	West	Bosch	
Triangle AA	1	115	34x4½*	34x4½*	H-S	4–3⅛x5	4	Met-Gear	Perf	PT	Ther	Cir-Spl	Gear	Stromb	1	Gra			2200	40	NE	NE	O-C
Triangle A	1½	144	34x3½*	34x6*	Wau	4–3¾x5½	4	Met-Gear	Perf	PT	Pump	Cir-Spl	Gear	Stromb	1	Gra	Wau	Cent	1450		Eis	Eis	O-C
Triangle C	2	147	36x4*	36x6*	Wau	4–3¾x5¼	4	Met-Gear	Perf	PT	Pump	Cir-Spl	Gear	Stromb	1	Gra	Wau	Cent	1450		Eis	Eis	O-C
Triangle D	2½	150	36x4*	36x7*	Wau	4–4x5½	2	Met-Gear	WR Co	Fin	Pump	Hol-Crk	Gear	Stromb	1½	Gra	Wau	Cent	1300		Splitd	Eis	O-C
Twin City BW	2	150	36x4	36x7	Buda	4–4x5½	4	Met-Gear	Mod	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Vac	Simp	Cent	1100	14	NE	Bosch	S&O
Twin City AW	3½	168	36x5	40x5d	Own	4–4¼x6	4	Met-Gear	Mod	Fin	Pump	Hol-Crk	Gear	Schebl	1¼	Vac	Own	Cent	1000	12	NE	Bosch	S&O
Ultimate A	2	140	36x3½*	36x6*	Buda	4–4½x5½	4	Met-Gear	Bush	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Gra	Pier	Cent	1600	20	Bosch	Eis	
Ultimate BB	3	154	36x4	36x8	Buda	4–4¼x5½	4	Met-Gear	Bush	Fin	Pump	Hol-Crk	Gear	Stromb	1¼	Gra	Pier	Cent	1600	18	Bosch	Eis	
Union FW	2½	155	36x5	36x8	Wis	4–4x6	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Schebl	1¼	Gra	Dup	Cent	1072	15	Lee-N	Eis	S&O
Union HW	4	174	36x6	40x12	Wis	4–4½x6	4	Met-Gear	G&O	Fin	Pump	Hol-Crk	Gear	Schebl	1¼	Gra	Dup	Cent	1430	15	Lee-N	Eis	S&O
Union JW	6	167	36x6	40x14	Wis	4–5x6	2	Met-Gear		Cel	Pump	Hol-Crk	Gear	King	1½	Gra	Dup	Cent	1110	12	Lee-N	Eis	S&O
United AT	1½	145	34x3½	34x5	Buda	4–3¼x5½	4	Met-Gear	Mod	Fin	Pump	Hol-Crk	Gear	Stromb	1	Gra	Simp	Cent	1245	18	Remy	Eis	

For abbreviations, see pages 350 and 351.

Trucks (Continued)

CLUTCH		TRANSMISSION												SPRINGS		BRAKES		STEERING		WHEELS			
		GEARSET				UNIVERSAL JOINTS		AXLES															
Make	Type	Make	Type	Location	Forward Speeds	Make	Type	Front Make	Rear Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Final Drive Type	Front	Rear	Service	Emergency	Steering Gear Make	Steering Gear Type	Make	Type	Frame Material	Make and Model
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	She	She	8.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	R-S.	Rowe FW
.....	D-M	Ful	SG	Un-WE.	.....	.....	.....	.....	Col	5.55	.....	.....	.....	½E	½E	.....	.....	Jac.	.....	.....	.....	.....	Ruggles .....
.....	.....	.....	.....	.....	.....	Spi	.....	.....	Own	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ruggles .....
Ful	D-M	Ful	SG	Un-WE.	3	Blood	Met	Shu	She	7.80	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	MWCo.	Art.	P-S	Rumely A
Own	Pla	Chev.	SG	Sep-Un.	3	Own	Met	Olds	Cen	6.33	TT	TT	S-B	½E	½E	ExtR-W.	IntR-W.	Jac.	S&N	Hayes	Art.	P-S	Samson 15
Own	Pla	Mun.	SG	Sep-Un.	3	Own	Met	Cen	Cen	6.83	TT	TT	S-B	½E	½E	ExtR-W.	IntR-W.	Jac.	S&N.	Hayes	Art.	P-S	Samson 25
Ful	D-M	Ful	SG	Un-WE.	3	Spi	Met	Tim	Tim	7.00	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	Stan	Art.	P-S	Sandow G
Ful	D-M	Ful	SG	Un-WE.	3	Spi	Met	She	She	8.90	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	Stan	Art.	P-S	Sandow CG
B-L	D-M	B-L	SG	Un-WE.	4	Spi	Met	Tim	Tim	9.25	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	.....	.....	P-S	Sandow J
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	10.33	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	.....	.....	P-S	Sandow N
B-L	D-M	B-L	SG	.....	.....	Spi	Met	Tim	Tim	11.66	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	.....	.....	P-S	Sandow L
B&B	Pla	B-L	SG	Sep-Un.	4	Spi	Met	She	She	3.70	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Hoop	Art.	P-S	Sandford 25
B&B	Pla	B-L	SG	Sep-Un.	4	Spi	Met	She	She	3.70	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Hoop	Art.	P-S	Sandford W35
B&B	Pla	B-L	SG	Sep-Un.	4	Spi	Met	She	She	4.60	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	P-S	Sandford W50
B&B	Pla	Own	SG	Sep-Un.	4	M&E	Met	Own	Own	8.66	RR	TA	Worm	½E	½E	ExtDr.	IntR-W.	Own.	W&W.	StM	Art.	R-S.	Schacht F
B&B	Pla	Own	SG	Sep-Un.	4	M&E	Met	Own	Own	9.66	RR	TA	Worm	½E	½E	ExtDr.	IntR-W.	Own.	W&W.	StM	Art.	R-S.	Schacht F
B&B	Pla	Own	SG	Sep-Un.	8	M&E	Met	Own	Own	10.50	RR	TA	Worm	½E	½E	ExtDr.	IntR-W.	Own.	W&W.	StM	Art.	R-S.	Schacht E
B&B	Pla	Own	SG	Sep-Un.	8	M&E	Met	Own	Own	14.00	RR	TA	Worm	½E	½E	ExtDr.	IntR-W.	Own.	W&W.	StM	Art.	R-S.	Schacht E
Ful	D-M	Ful	SG	Un-WE.	3	M&E	Met	Shu	Eat	6.14	Sp.	Sp.	S-B	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	SWCo.	Art.	P-S	Schwartz A
Ful	D-M	Ful	SG	Un-WE.	4	M&E	Met	Shu	She	8.75	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	SWCo.	Art.	P-S	Schwartz B2W
Ful	D-M	Ful	SG	Un-WE.	4	M&E	Met	Shu	She	8.15	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	SWCo.	Art.	P-S	Schwartz C2W
Ful	D-M	Ful	SG	Sep-Un.	4	M&E	Met	Shu	She	10.25	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	P-S	Schwartz DW
B-L	D-M	B-L	SG	Un-WE.	3	Spi	Met	Tim	Tim	.....	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Lav.	S&N.	Arch	Art.	P-S	Selden A
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	.....	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Gem.	W&W.	Stan	C-S.	P-S	Selden 2½A
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	.....	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Gem.	W&W.	Stan	C-S.	P-S	Selden 3½A
Det	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	.....	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Gem.	W&W.	Stan	C-S.	P-S.	Selden 5A
B-L	D-M	B-L	SG	Un-WE.	3	M&E	M&F	Own	Eat	.....	Sp.	Sp.	S-B	½T	½E	IntR-W.	IntR-W.	Own.	W&S.	Detroit	P-S	R-S.	Service 15
B&B	Pla	B-L	SG	Sep-Un.	4	M&E	Met	Tim	Tim	.....	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross	S&N.	Bimel	Art.	R-S.	Service 31
B&B	Pla	B-L	SG	Sep-Un.	4	M&E	Met	Tim	Tim	.....	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Bimel	Art.	R-S.	Service 36
B&B	Pla	B-L	SG	Sep-Un.	4	M&E	Met	Tim	Tim	.....	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Bimel	Art	R-S.	Service 51
B&B	Pla	B-L	SG	Sep-Un.	4	M&E	Met	Tim	Tim	8.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Stan	C-S.	R-S.	Service 71
B&B	Pla	B-L	SG	Sep-Un.	4	M&E	Met	Tim	Tim	7.80	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Stan	C-S.	R-S.	Service 76
B&B	Pla	B-L	SG	Sep-Un.	4	M&E	Met	Tim	Tim	10.25	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Stan	C-S.	R-S.	Service 101
B-L	D-M	B-L	SG	Sep-Un.	3	Spi	Met	Tim	Tim	7.20	RR	....	Worm	½E	½E	ExtR-W.	IntR-W.	Ross.	S&N.	StM	Art.	P-S	Signal NF
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	7.75	RR	....	Worm	.....	½E	ExtR-W.	IntR-W.	Ross.	S&N.	StM	Art.	P-S	Signal H
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	9.25	RR	....	Worm	½E	½E	ExtR-W.	IntR-W.	Ross.	S&N.	StM	Art.	P-S	Signal J
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	12.00	RR	....	Worm	½E	½E	ExtR-W.	IntR-W.	Ross.	S&N.	StM	Art.	P-S	Signal M
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	11.66	RR	....	Worm	½E	½E	ExtR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	P-S	Signal R
B-L	D-M	B-L	SG	Un-WE.	3	Spi	Met	Tim	Tim	7.20	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	.....	Art.	P-S	Standard 1K
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	8.50	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N	.....	Art.	R-S.	Standard 76
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	10.30	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Gem.	W&W.	.....	Art.	P-S	Standard 66
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	11.33	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Gem.	W&W.	.....	C-S.	P-S	Standard 5K
B-L	D-M	B-L	SG	Un-WE.	4	.....	Met	Tim	Tim	7.00	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	Prud	Art.	P-S	Sterling 1½
B-L	D-M	B-L	SG	Un-WE.	4	.....	Met	Tim	Tim	7.70	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	Prud	Art.	P-S	Sterling 2
B-L	D-M	B-L	SG	Un-WE.	4	.....	Met	Tim	Tim	7.70	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	Prud	Art.	P-S	Sterling 2½
Hele	D-O	Own	CM	Sep-Un.	3	.....	Met	Tim	Tim	8.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	Prud	Art.	P-S	Sterling 3½
Hele	D-O	Own	CM	Sep-Un.	3	.....	Met	Tim	Tim	8.80	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&S.	Prud	Art.	P-S	Sterling 5
Hele	D-O	Own	CM	Sep-Un.	6	UMCo	Met	Cont	Own	7.04	RR	Sp.	Ch	½E	½E	IntR-W.	ExtDr.	Ross.	W&S.	Smith	C-S.	P-S	Sterling 5
Hele	D-O	Own	CM	Sep-Un.	6	UMCo	Met	Cont	Own	7.04	RR	Sp.	Ch	½E	½E	IntR-W.	Ext	Ross.	W&S.	Smith	C-S.	P-S	Sterling 7½
.....	.....	.....	.....	Un-WE.	3	Therm	Fab	Col	Col	5.87	Sp.	Sp.	S-B	½E	½E	Ext	IntR-W	.....	S&N	.....	Art.	P-S	Stoughton C
B-L	D-M	B-L	SG	Un-WE.	3	Therm	Fab	She	She	6.00	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	.....	S&N	.....	Art.	P-S	Stoughton A
B-L	D-M	B-L	SG	Un-WE.	3	Therm	Fab	She	She	7.80	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	.....	S&N	.....	Art.	P-S	Stoughton B
B-L	D-M	B-L	SG	Un-WE.	4	Therm	Fab	She	She	8.66	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross	.....	.....	Art.	P-S	Stoughton D
B-L	D-M	B-L	SG	.....	4	Therm	Fab	She	She	8.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross	.....	.....	Art.	P-S	Stoughton F
B-L	D-M	B-L	SG	Un-WE.	4	Spi	Met	Tim	Tim	7.75	Sp.	Sp.	Worm	El	El	IntR-W.	IntR-W.	Ross.	S&N.	Wayne	Art.	P-S	Sullivan E
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	Tim	Tim	10.33	RR	Sp.	Worm	El	El	IntR-W.	IntR-W.	Ross.	S&N.	Wayne	Art	P-S	Sullivan H
Ful	D-M	Ful	SG	Un-WE.	3	Therm	Fab	Shu	Wis	.....	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Lav.	S&N.	Prud	Art.	P-S	Super Truck 40
Ful	D-M	Ful	SG	Un-WE.	4	Therm	Fab	She	She	8.75	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Lav.	S&N.	Prud	Art.	P-S	Super Truck 50
Ful	D-M	Ful	SG	Sep-Un.	4	Spi	Met	She	She	10.75	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	P-S	Super Truck 70
Ful	D-M	Ful	SG	Sep-Un.	4	Spi	Met	She	She	10.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	P-S	Super Truck 100
Ful	D-M	Ful	SG	Un-WE.	3	Pet	Met	She	She	7.75	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	P-S	Tiffin GW
Ful	D-M	Ful	SG	Un-WE.	4	Pet	Met	She	She	8.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	P-S	Tiffin MW
Det	D-M	Cotta	CM	Sep-Un.	4	Pet	Met	She	She	8.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	R-S.	Tiffin F35
B&B	Pla	Cotta	CM	Sep-Un.	4	Pet	Met	She	She	10.25	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	R-S.	Tiffin TW
B&B	Pla	Cotta	CM	Sep-Un.	4	Pet	Met	She	She	10.25	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	R-S.	Tiffin UW
.....	.....	.....	CM	.....	4	.....	.....	Own	Own	.....	.....	.....	.....	½E	½E	IntR-W.	.....	.....	.....	.....	.....	.....	Titan .....
.....	.....	Own	CM	.....	4	.....	.....	Own	Own	.....	.....	.....	.....	½E	½E	IntR-W.	.....	.....	.....	.....	C-S.	P-S	Titan .....
.....	.....	Own	.....	.....	4	.....	.....	.....	.....	.....	.....	.....	.....	½E	½E	IntR-W.	IntR-W.	.....	.....	.....	C-S.	P-S.	Titan .....
.....	.....	Own	.....	.....	4	.....	.....	.....	.....	.....	.....	.....	.....	½E	½E	IntR-W.	IntR-W.	.....	.....	.....	C-S.	P-S.	Titan .....
Ful	D-M	Ful	SG	Un-WE.	.....	.....	Met	Shu	Tim	7.25	RR	Sp.	Worm	½E	½E	Int	Int	Ross	W&W.	.....	Art	P-S	Tower J
Ful	D-M	Ful	SG	Un-WE.	.....	Spi	Met	Tim	Tim	.....	RR	Sp.	Worm	½E	½E	Int	Int	Ross	S&N.	.....	Art	P-S	Tower H
Ful	D-M	Ful	SG	Un-WE.	4	Spi	Met	Tim	Tim	.....	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross	S&N	.....	Art	P-S	Tower G
Cov	D-M	Cov	SG	Un-WE.	3	.....	Fab	Own	Rus	6.15	Sp.	Sp.	I-G	El	El	Ext	IntR-W.	Own.	W&W.	Day	Art.	R-S	Traffic Speedboy
Ful	D-M	Ful	SG	Un-WE.	3	Snead	Fab	Col	Clark	7.25	Sp.	Sp.	I-G	½E	½E	Ext	IntR-W.	Jac.	S&N.	Prud	Art	P-S	Transport 20
Ful	D-M	Ful	SG	Un-WE.	3	Hart	Met	Col	Clark	7.60	Sp.	Sp.	I-G	½E	½E	ExtR-W.	IntR-W.	Jac.	S&N.	Prud	Art	P-S	Transport 30
Ful	D-M	Ful	SG	Un-WE.	4	Hart	Met	Col	Clark	8.15	Sp.	Sp.	I-G	½E	.....	Dr	IntR-W.	Jac.	S&N.	Prud	Art	P-S	Transport 50
B&B	Pla	Cotta	CM	Un-WE.	4	Hart	Met	Shu	Clark	10.00	Sp.	Sp.	I-G	½E	½E	Dr	IntR-W.	Jac.	S&N.	Clark	C-S	P-S	Transport 70
Ful	D-M	Ful	SG	Un-WE.	4	.....	.....	.....	.....	.....	RR	TA	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	.....	Art	P-S	Trabold K
Cov	D-M	Cov	SG	Un-WE.	3	M&E	Met	She	She	7.80	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Sch	Art	P-S	Traylor B
Cov	D-M	Cov	SG	Un-WE.	3	M&E	Met	She	She	7.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Sch	Art.	P-S	Traylor C
Own	Pla	Own	SG	Un-WE.	4	Hart	Met	She	She	7.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Sch	Art	P-S	Traylor D
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	She	She	8.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.		Traylor E
B-L	D-M	B-L	SG	Sep-Un.	4	Spi	Met	She	She	10.25	RR	Sp.	Worm	½E	½E	ExtR-W.	Ext	Ross.	S&N	Smith	C-S.	P-S	Traylor F
Ful	D-M	Ful	SG	Un-WE.	3	Uni	Met	Tor	Clark	6.75	Sp.	Sp.	I-G	½E	½E	ExtDr.	ExtR-W.	Gem.	W&W.	North	Art.	R-S.	Triangle AA
Ful	D-M	Ful	SG	Un-WE.	3	Uni	Met	Col	Clark	7.25	Sp.	Sp.	I-G	½E	½E	ExtDr.	ExtR-W.	Gem.	W&W.	.....	Art.	R-S.	Triangle A
Ful	D-M	Ful	SG	Un-WE.	3	Uni	Met	Tor	Clark	9.00	Sp.	Sp.	I-G	½E	½E	ExtDr.	ExtR-W.	Gem.	W&W.	.....	.....	R-S.	Triangle C
Ful	D-M	Ful	SG	Un-WE.	4	Uni	Met	Tor	Clark	9.00	Sp.	Sp.	I-G	½E	½E	ExtDr.	ExtR-W.	Gem.	W&W.	.....	.....	R-S.	Triangle D
Ful	D-M	Ful	SG	Un-WE.	3	Arvac	Met	Shu	Clark	8.00	Sp.	Sp.	I-G	½E	½E	Ext	IntR-W.	Ross.	S&N.	Bimel	Art.	R-S.	Twin City BW
B&B	Pla	Ful	SG	Sep-Un.	4	.....	M&F	Tim	Tim	10.33	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	S&N.	Smith	C-S.	R-S.	Twin City AW
B-L	D-M	B-L	SG	Un-WE.	4	Spi	Met	She	She	6.50	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	W&W.	Jones	Art.	P-S	Ultimate A
B-L	D-M	B-L	SG	Un-WE.	4	Spi	Met	She	She	7.75	RR	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Ross.	.....	Jones	Art.	P-S	Ultimate BB
Ful	D-M	Ful	SG	Un-WE.	4	Uni	Met	She	Wal	7.66	Sp.	Sp.	B-S	El	El	ExtDr.	IntR-W.	Ross.	S&N.	.....	Art.	P-S	Union FW
Ful	D-M	Ful	SG	Sep-Un.	4	Uni	Met	Shu	Wal	11.50	Sp.	Sp.	B-S	El	El	ExtDr.	IntR-W.	Ross.	S&N.	.....	C-S.	P-S	Union HW
Ful	D-M	Ful	SG	Sep-Un.	4	M&E	.....	Sav	Wal	10.50	Sp.	Sp.	B-S	El	El	ExtDr.	IntR-W.	Ross.	S&N.	Smith	C-S.	P-S	Union JW
Ful	D-M	Ful	SG	Un-WE.	3	Spi	Met	She	She	7.00	Sp.	Sp.	Worm	½E	½E	IntR-W.	IntR-W.	Jac.	S&N.	.....	Art.	P-S	United AT

For abbreviations, see pages 350 and 351.

Specifications of American

Make and Model	Tons Capacity	Wheel-Base, Ins.	TIRE SIZE		ENGINE																ELECTRICAL SYSTEM		
												OILING SYSTEM		FUEL SYSTEM			GOVERNOR		SPEED				
			Front, Ins.	Rear, Ins.	Make	Number Cylinders, Bore and Stroke	Cylinders Cast	Camshaft Drive Type	Radiator Core Make	Radiator Core Type	Water Circulation	Type	Oil Pump Type	Carbureter Make	Carbureter Size, Ins.	Fuel Feed	Make	Type	Motor in R.P.M.	Truck in M.P.H.	Generator Make	Ignition System, Make	Ignition System, Type
United....BT	2½	....	36x4	36x7	Buda...	4–4¼x5½	4	Met-Gear..	Mod....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Simp....	Cent..	1225	15	Remy..	Eis....	.....
United....CT	3½	157	36x5	36x5d	Buda...	4–4¼x5½	4	Met-Gear..	Mod....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Simp....	Cent..	1233	13	Remy..	Eis....	.....
United States....N	1½	144	36x3½	36x5	Cont....	4–3¾x5	4	Met-Gear..	Long....	Fin...	Pump.	Cir-Spl..	Ecc...	Stromb..	1	Vac...	.....	.....	1400	19	Bosch..	Bosch..	.....
United States....R	3	156	36x4	36x4d	Hink....	4–4x5½	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Hink....	Cent..	1400	17	Bosch..	Eis....	.....
United States....S	4	168	36x5	36x5d	Hink....	4–4½x5½	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	Hink....	Cent..	1200	12	Bosch..	Eis....	.....
Velie....46	1½	133	36x3½	36x5	Cont....	4–3¾x5	4	N-M-G....	McCo...	Fin...	Pump.	Cir-Spl..	Ecc...	Stromb..	1	Gra...	Mon....	Suc....	....	16	Bijur...	.....	C-C...
Veteran....E	1½	186	34x5p	34x5p	Buda...	4–3¾x5½	4	Met-Gear..	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1	Vac...	Dup....	Cent..	....	20	.....	.....	C-C...
Veteran....D	2½	156	36x4	36x7	Buda...	4–4½x5½	4	Met-Gear..	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Vac...	Dup....	Cent..	1000	18	.....	Eis....	C-C...
Veteran....H	3½–4	156	36x5	36x10	Buda...	4–4½x6	4	Met-Gear..	McCo...	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1½	Vac...	Simp....	Cent..	1000	14	.....	Eis....	C-C...
Vim....29	½	108	31x4p	31x4p	Own....	4–3⅛x4½	4	Met-Gear..	.....	Fin...	.....	Cir-Spl..	Ecc...	Zenith...	7/8	Gra...	West....	West..	2000	33	.....	.....	O-C...
Vim....30	½	127	32. 4½p	32x4½p	Own....	.....	4	.....	.....	Fin...	Ther..	Cir-Spl..	Ecc...	Zenith...	7/8	Gra...	.....	West..	200	33	.....	.....	O-C...
Vim....31	1	125	35x5p	35x5p	Her.....	4–3¾x5½	4	Met-Gear..	.....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1	Gra...	.....	.....	1800	30	.....	Splitd..	O-C...
Vim....23	3	175	36x5	36x5	Her.....	4–4¼x5½	4	Met-Gear..	.....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Dup....	Suc...	1250	14	.....	Splitd..	O-C...
Vulcan....25	2½	148	36x4*	36x8*	Wis.....	4–4¼x6	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Pier....	Cent..	1250	15	.....	Eis....	.....
Vulcan....35	3½	168	36x5	40x10	Wis.....	4–4½x6	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Pier.....	Cent..	1150	11	.....	.....	.....
Walker Johnson....A	2	140	34x3½	34x6	Buda...	4–3¾x5⅛	4	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1	Vac...	.....	.....	1700	30	.....	Eis....	.....
Walker Johnson....B	3	150	36x4	36x8	Buda...	4–4¼x5½	4	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Zenith...	1¼	Gra...	Pier.....	Cent..	1440	18	Eis....	Eis....	.....
Walter....15	5	168	36x6	40x6d	Wau....	4–4½x6¼	2	Met-Gear..	Bush....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Gra...	Wau....	Cent..	1100	15	West...	Apollo..	.....
Watson....1	1	128	34x5p	34x5p	Buda...	4–3⅝x5⅛	4	Met-Gear..	G&O....	Cel...	Pump.	Cir-Spl..	.....	Zenith...	1	Gra...	.....	.....	....	35	Dyn...	.....	.....
White....15–45	¾	143½	34x5p	34x5p	Own....	4–4¼x5½	4	Met-Gear..	.....	Cel...	Pump.	Hol-Crk.	Gear..	Own....	1½	Vac...	Own....	Cent..	....	...	.....	.....	.....
White....15	¾	133½	34x5p	34x5p	Own....	4–3¾x5⅛	4	Met-Gear..	.....	Cel...	Pump.	.....	Pist...	Own....	1¼	Gra...	.....	.....	....	...	.....	.....	.....
White....20	2	145½	36x4	36x4d	Own....	4–3¾x5⅛	4	Met-Gear..	.....	Cel...	Pump.	.....	Pist...	Own....	1¼	Gra...	.....	.....	....	...	.....	.....	.....
White....20–45	2	168	36x4*	36x4d*	Own....	4–4¼x5¾	4	Met-Gear..	.....	Cel...	Pump.	Hol-Crk.	Gear..	Own....	1½	Vac...	Own....	Cent..	....	...	.....	.....	.....
White....40	3½	174	36x5	40x5d	Own....	4–3¾x5½	4	Met-Gear..	.....	Fin...	Pump.	Hol-Crk.	Gear..	Own....	1½	Vac...	Own....	Cent..	....	...	.....	.....	.....
White....45	5	174	36x6	40x6d	Own....	4–4¼x5¾	4	Met-Gear..	.....	Fin...	Pump.	Hol-Crk.	Gear..	Own....	1½	Vac...	Own....	Cent..	....	...	.....	.....	.....
White Hickory....1	1	134	34x5p	34x5p	Cont....	4–3¾x5	4	Met-Gear..	Chic....	Fin...	.....	.....	.....	Stromb..	....	Vac...	Dup....	Cent..	1310	22	.....	Eis....	.....
White Hickory....H	1½	144	36x3½	36x5	Cont....	4–3¾x5	4	.....	Chic....	Fin...	.....	.....	.....	Stromb..	....	Vac...	Dup....	Cent..	1190	15	.....	Eis....	.....
White Hickory.....	3½	156	36x5	36x5d	Cont....	4–4½x5½	2	.....	Chic....	Fin...	.....	.....	.....	Stromb..	....	Vac...	Dup....	Cent..	1157	12	.....	Eis....	.....
Wichita....K	1	144	36x3*	36x4*	Wau....	4–3¼x5¼	4	Met-Gear..	E&M...	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1⅜	Gra...	Wau....	Cent..	1000	13	NE....	Eis....	.....
Wichita....L	1½	144	36x3½*	36x5*	Wau....	4–3¼x5¼	4	Met-Gear..	E&M...	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1⅜	Gra...	Wau....	Cent..	1000	12	NE....	Eis....	.....
Wichita....M	2	144	35x5*	36x6*	Wau....	4–3¾x5¼	4	Met-Gear..	E&M...	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1⅜	Gra...	Wau....	Cent..	1000	12	NE....	Eis....	.....
Wichita....R	2½	144	36x4*	36x7*	Wau....	4–3¾x5¼	4	Met-Gear..	E&M...	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1⅜	Gra...	Wau....	Cent..	1000	12	NE....	Eis....	S-P...
Wichita....RX	2½	160	36x4*	36x8*	Wau....	4–4⅜x5¾	2	Met-Gear..	E&M...	Cel...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Wau....	Cent..	1000	12	NE....	Eis....	S-P...
Wichita....O	3½	165	36x5	36x5d	Wau....	4–4½x6¼	2	Met-Gear..	E&M...	Cel...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Wau....	Cent..	1000	9	NE....	Eis....	S-P...
Wichita....S	5	165	36x6	40x6d	Wau....	4–4½x6¼	2	Met-Gear..	E&M...	Cel...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Wau....	Cent..	1000	8	NE....	Eis....	S-P...
Wilcox Trux.....	1	130	36x4*	36x4*	Buda...	4–3¾x5¼	4	Com-Gear.	Long....	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1	Gra...	Simp....	Cent..	1500	....	West...	.....	.....
Wilcox Trux....B	1½	135	36x4*	36x5*	Own....	4–4¼x5	2	Com-Gear.	Long....	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1½	Gra...	Dup....	Cent..	1100	....	.....	.....	.....
Wilcox Trux....C	2½	150	36x4*	36x3½*	Own....	4–4¼x5	2	Com-Gear.	Long....	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1½	Gra...	.....	Cent..	1100	....	.....	.....	.....
Wilcox Trux....E	3½	162	36x5*	36x5d*	Buda...	4–4½x6	4	Com-Gear.	Long....	Fin...	Pump.	.....	Gear..	Stromb..	1½	Gra...	Dup....	Cent..	1100	....	West...	.....	.....
Wilcox Trux....F	5	162	36x5	40x12	Buda...	4–4¾x6½	4	Com-Gear.	Long....	Fin...	Pump.	Cir-Spl..	Gear..	Stromb..	1½	.....	.....	.....	1000	....	.....	.....	.....
Wilson....F	1½	140	36x3½	36x5	Own....	4–3¾x5	4	Met-Gear..	Long....	Fin...	Ther..	Cir-Spl..	Pist...	Stromb..	1	Gra...	Pier.....	Cent..	1100	19	Eis....	.....	.....
Wilson....EA	2½	152	36x4	36x7	Own....	4–4⅛x5½	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1¼	Gra...	Pier.....	Cent..	1100	15	Eis	.....	.....
Wilson....G	3½	160	36x5	36x5d	Own....	4–4½x5½	2	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1½	Vac...	Pier.....	Cent..	1100	15	Eis....	.....	.....
Wilson....H	5	160	36x6	40x6d	Own....	4–4¾x6	2	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Pist...	Stromb..	1½	Vac...	Pier.....	Cent..	1100	15	Eis....	.....	.....
Winther....751	¾–1	135	34x4½p	35x5p	H-S.....	4–3½x5	4	Met-Gear..	Bre.....	PT...	Ther..	Cir-Spl..	Gear..	Stromb..	1	Vac...	.....	.....	1600	30	West...	West...	O-C...
Winther....39	1½	140	34x3½	34x5	Wis.....	4–3¾x5	4	Met-Gear..	Bre.....	PT...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Vac...	.....	.....	1400	20	Eis....	Eis....	O-C...
Winther....430	1½	132	32x4	32x4	Wis.....	4–3¾x5	4	Met-Gear..	Bre.....	PT...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	.....	.....	1400	15	Eis....	Eis....	O-C...
Winther....49	2	147	34x4	34x4d	Wis.....	4–4x5	4	Met-Gear..	Bre.....	PT...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Vac...	.....	.....	1400	17	Eis....	Eis....	O-C...
Winther....50	2½	110	36x6p	42x9p	Wis.....	4–4x6	4	Met-Gear..	Bre.....	PT...	Pump.	Hol-Crk.	Gear..	Master..	1½	Vac...	.....	.....	1250	18	West...	West...	O-C...
Winther....450	2½	150	34x5	36x6	Wis.....	4–4x5	4	Met-Gear..	Bre.....	PT...	Pump.	Hol-Crk.	Gear..	Stromb..	1½	Gra...	.....	.....	1400	13	Eis....	Eis....	O-C...
Winther....70	3½	150	36x5	36x5d	Wis.....	4-4x6	4	Met-Gear..	Bre.....	PT...	Pump.	Hol-Crk.	Gear..	Master..	1¼	Vac...	.....	.....	1250	15	West...	West...	O-C...
Winther....109	5	162	36x6	40x6d	Wis.....	4–4½x6	4	Met-Gear..	Bre.....	PT...	Pump.	Hol-Crk.	Gear..	Master..	1½	Vac...	Dup....	Cent..	1200	12	West...	Eis....	O-C...
Winther....140	7	162	36x6	40x7d	Wis.....	4–5x6	2	Met-Gear..	Bre.....	PT...	Pump.	Hol-Crk.	Gear..	Master..	1½	Vac...	Dup....	Cent..	1000	10	West...	Eis....	O-C...
Witt-Will....N	1½	144	36x3½	36x7	Cont....	4–3¾x5	4	.....	Bre.....	Fin...	Pump.	Cir-Spl..	Pist...	Zenith...	1½	Gra...	Pier.....	Cent..	1500	25	.....	Eis....	S-P...
Witt-Will....P	2½	144	36x3½	36x7d	Cont....	4–4⅛x5¼	4	Met-Gear..	Bre.....	Cel...	Pump.	Cir-Spl..	Pist...	Zenith...	1¼	Gra...	Pier.....	Cent..	1500	40	.....	Eis....	S-P...
Wolverine....J1	1	140	34x3½*	34x5*	Cont....	4–3¾x5	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1	Gra...	Pharo...	O-Op..	1400	18	Bosch..	Eis....	.....
Wolverine....J1½	1½	140	34x3½*	34x5*	Cont....	4–3¾x5	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb .	1	Gra...	Pharo...	O-Op..	1480	18	Bosch..	.....	.....
Wolverine....J2	2	148	34x4*	34x7*	Cont....	4–3¾x5	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb .	1	Gra...	Pharo...	O-Op..	1400	18	Bosch..	Eis....	.....
Wolverine....K	2½–3	168	36x4*	36x8*	Cont....	4–4⅛x5¼	4	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Pharo...	O-Op..	1300	14	Bosch..	Eis....	.....
Wolverine....L	3½	186	36x5	36x10	Cont....	4–4½x5½	2	Met-Gear..	Long....	Fin...	Pump.	Hol-Crk.	Gear..	Stromb..	1¼	Gra...	Pharo...	O-Op..	1200	12	Bosch..	Eis....	.....

For abbreviations, see pages 350 and 351.

1922 Specifications of

MAKE AND MODEL	Load Capacity in Tons	Wheel-base in Inches	TIRES			Distance from Ground to Top of Frame Ins.	BATTERY						MILES PER CHARGE	MOTOR				SPEED IN MILES PER HOUR		CONTROLLER		DRIVE			
			Kind	SIZE IN INCHES			Location	Make	No. Plates per Cell	No. Cells	No. Trays	Amp. Hr. Capacity	Loaded	Location and Number	Make	Horsepower	Voltage	Light	Loaded	Location	Speeds Ahead	GEARING		Total Gear Reduction	Propulsion Taken by†
				Front	Rear																	First Reduction	Final Drive		
C. T.....BR2-A	¾	91⅝	solid*.	36x3	36x3½	32¾	amid-u	Ex*...	9*	42*	5*	136*	45*	unit-x-2.	G.E..	1½	84	14	13	st-col..	4	spur...	spur..	11.5–1	rad-rd*.
C. T.....BR2	1	101	solid*.	36x3½	36x4	32½	amid-u	Ex*...	11*	42*	5*	170*	50*	unit-x-2.	G.E..	1½	84	14	12	st-col .	4	spur...	spur..	11.5–1	rad-rd*.
C. T.....BR-4	2	116	solid*.	36x4	36x4d	35 3/16	amid-u	Ex*...	15*	42*	6*	238*	50*	unit-x-2.	G.E..	2	84	12	10	st-col..	4	spur...	spur..	12.14–1	rad-rd*.
C. T.....AR-7	3½	126	solid*.	36x5	36x5d	36¼	amid-u	Ex....	19*	42*	6*	306*	40*	unit-x-2.	G.E..	2	84	10	8	st-col.	4	spur...	spur..	17.32–1	rad-rd*.
C. T.....AK-7	3½	122	solid*.	36x6	36x4d	38⅛	amid-u	Ex....	19*	42*	6*	306*	45*	unit-x-4.	G.E..	1½	84	11	9	st-col.	4	spur...	spur..	17.32–1	rad-rd*.
C. T.....AK-10	5	132	solid*.	36x7	36x4d	38⅝	amid-u	Ex....	21*	42*	9*	340*	45*	unit-x-4.	G.E..	1½	84	10	8	st-col.	.....	spur...	spur..	20.14–1	rad-rd*.
Lansden.....G	½	96	pneu..	32x4½	32x4½	30	opt...	Ex....	9*	44*	4*	136*	50*	unit-x-1.	G.E..	....	88	16½	15	indash	4	her.....	bevel..	11.12–1	springs.
Lansden.....M	1	108	solid..	36x3	36x3½	34	amid-u	Ex....	11*	44*	10*	170*	50*	unit-j-1..	G.E..	....	88	12	10	in dash	4	bevel...	rol-ch.	11.9–1	rad-rd..
Lansden.....M	2	121	solid..	36x4	36x3d	36	amid-u	Ex....	15*	44*	6*	238*	50*	unit-j-1.	G.E..	....	88	11	9	in dash	4	bevel...	rol-ch.	12.8–1	rad-rd..
Lansden.....M	3½	133	solid..	36x5	36x4d	39	amid-u	Ex....	17*	44*	6*	272*	45*	unit-j-1..	G.E..	....	88	10	8	in dash	4	bevel...	rol-ch.	13.1 –1	rad-rd..
Lansden.....M	5	146	solid..	36x6	36x5d	39	amid-u	Ex....	19*	44*	6*	306*	40*	unit-j-1..	G.E..	....	88	9	7	in dash	4	bevel...	rol-ch.	12.3 –1	rad-rd..
TEC.....1102	2½	65½	solid..	20x5	20x5	.....	amid-u	Ex*...	9*	34*	5*	136*	.....	in whls-4	G.E..	18 Max	60	10	7	in dash	3	spur...	int-g..	14.00–1	springs.

Trucks (Continued)

CLUTCH		TRANSMISSION												SPRINGS		BRAKES		STEERING		WHEELS			Make and Model
		GEARSET †				UNIVERSAL JOINTS		AXLES															
Make	Type	Make	Type	Location	Forward Speeds	Make	Type	Front Make	Rear Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Final Drive Type	Front	Rear	Service	Emergency	Steering Gear Make	Steering Gear Type	Make	Type	Frame Material	
Ful	D-M	Ful	SG	Sep-Un	4	Spi	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N		C-S	P-S	United BT
Ful	D-M	Ful	SG	Sep-Un	4	Spi	Met	She	She	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N		C-S	P-S	United CT
Ful	D-M	Ful	SG	Un-WE	3	Blood	Met	Shu	Clark	7.60	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Lav	S&N	Sch	Art	P-S	United States N
B-L	D-M	B-L	SG	Sep-Un	4		F&B	She	She	8.70	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Sch	Art	P-S	United States R
B-L	D-M	B-L	SG	Sep-Un	4		M&F	She	She	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav	S&N	Sch	Art	P-S	United States S
B&B	Pla	Dur	SG	Un-WE		Arvac	Met	Col	Tor	8.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N	Mut	Art	P-S	Velie 46
B&B	Pla	Cotta	CM	Un-WE	3	Spi	Met	She	She	6.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Veteran E
B&B	Pla	Cotta	CM	Un-WE		Spi	Met	She	She	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Veteran D
B&B	Pla	Cotta	CM	Un-WE	4	Spi	Met	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	R-S	Veteran H
B&B	Pla		SG	Un-WE	3		Met			5.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W		W&W		Art	P-S	Vim 29
B&B	Pla	Own	SG	Un-WE			Met			5.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W		W&W		Art	P-S	Vim 30
Cov	D-M	Cov	SG	Un-WE	3		Met			6.50	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W		W&W		Art	P-S	Vim 31
B-L	D-M	B-L	SG	Sep-Un	4		Met			7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W		W&W		C-S	P-S	Vim 23
B-L	D-M	B-L	SG	Sep-Un	4	Spi	Met	She	She	8.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Vulcan 25
B-L	D-M	B-L	SG	Sep-Un	4	Therm	Fab	She	She	11.75	RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Vulcan 35
Ful	D-M	Ful	SG	Un-WE	3	Spi	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Arch	Art	P-S	Walker Johnson A
Ful	D-M	Ful	SG	Un-WE	4	Spi	Met	Tim	Tim	8.50	Sp	Sp	Worm		½E	IntR-W	IntR-W	Ross	S&N	Arch	Art	P-S	Walker Johnson B
B-L	D-M	War	SG	Sep-Un	4	M&E	Met	Own	Own	9.00	Sp	Sp	I-G	El	El	ExtR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Walter 15
B-L	D-M	B-L	SG	Un-WE		Spi	Met	Shu	Shu	2.00	Sp	Sp	S-B	½E	½E			Ross	S&N		Art	P-S	Watson
Own	Pla	Own	SG	Un-WE		Own	Met	Own	Own		RR	Sp	S-B	½E	½E	ExtR-W	IntR-W	Own	W&S	Own	Art	P-S	White 15–45
Own	Pla	Own	SG	Sep-Un	4	Own	Met	Own	Own		RR	Sp	S-B	½E	½E	ExtR-W	IntR-W	Own	W&S	Own	Art	P-S	White 15
Own	Pla	Own	SG	Sep-Un	4	Own	Met	Own	Own		RR	Sp	B-S	½E	½E	ExtR-W	IntR-W	Own	W&S	Own	C-S	P-S	White 20
Own	Pla	Own	SG	Un-WE	4	Own	Met	Own	Own		RR	Sp	B-S	½E	½E	Dr	IntR-W	Own	W&S	Own	C-S	P-S	White 20–45
Own	Pla	Own	SG	Un-WE	4	Own	Met	Own	Own		RR	Sp	I-G	½E	½E	Dr	IntR-W	Own	W&S	Own	C-S	R-S	White 40
Own	Pla	Own	SG	Un-WE	4	Own	Met	Own	Own		RR	Sp	I-G	½E	½E	Dr	IntR-W	Own	W&S	Own	C-S	R-S	White 45
Ful	D-M	Ful	SG	Un-WE	3	M&E	Met	Tim	Tim		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav		Bimel	Art	P-S	White Hickory
Ful	D-M	Ful	SG	Un-WE	3	Arvac	Met	Tim	Tim		RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross		Bimel	Art	P-S	White Hickory H
Ful	D-M	Ful	SG	Sep-Un	4	M&E	Met	Tim	Tim		RR	Sp	Worm	½E	½E	IntR-W	IntR-W	Lav		Smith	Art	P-S	White Hickory
Own	Con	B-L	SG	Sep-Un	4	Own	Fab	She	She	7.80	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	P-S	Wichita K
Own	Con	B-L	SG	Sep-Un	4	Own	Fab	She	She	8.60	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	P-S	Wichita L
Own	Con	B-L	SG	Sep-Un	4	Own	Fab	She	She	8.60	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Bimel	Art	P-S	Wichita M
Own	Con	B-L	SG	Sep-Un	4	Own	Fab	She	She	10.33	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Wichita R
Hart	Con	B-L	SG	Sep-Un	4	Own	Fab	She	She	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Day	C-S	P-S	Wichita RX
Hart	Con	B-L	SG	Sep-Un	4	Own	Fab	She	She	11.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Wichita O
Hart	Con		SG	Sep-Un	4	Own	Fab	She	Sav	14.00	Sp	Sp	B-S	½E	½E	IntR-W	IntR-W	Ross	S&N	Smith	C-S	P-S	Wichita S
B-L	D-M	B-L	SG	Un-WE		Det	Met	Shu	She		Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Gem	W&W		Art	P-S	Wilcox Trux
M&E	D-M	Own	SG	Sep-Un	4		F&M	Tim	Wal		Sp	Sp	Worm	½E	½E	IntR-W	ExtR-W	Own	W&W	Smith	C-S	P-S	Wilcox Trux B
M&E	D-M	Own	SG	Sep-Un		Hart	F&M	Shu	Wal		Sp	Sp	Worm	½E	½E	R-W	R-W	Own	W&W	Smith	C-S	P-S	Wilcox Trux C
M&E	D-M	Own	SG	Sep-Un		Uni	Met	Tim	Wal		RR		Worm	½E	½E	R-W	R-W	Own	W&W	Smith	C-S	P-S	Wilcox Trux E
M&E	D-M	Own	SG			Uni	F&M	Tim	Wal														Wilcox Trux F
B&B	Pla	Cotta	CM	Sep-Un	4	Therm	F&M	Tim	Tim	6.00	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	R-S	Wilson F
B&B	Pla	Cotta	CM	Sep-Un	4	Therm	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		Art	R-S	Wilson EA
B&B	Pla	Cotta	CM	Sep-Un	4	Therm	F&M	Tim	Tim	8.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		C-S	R-S	Wilson G
B&B	Pla	Cotta	CM	Sep-Un		Therm	M&E	Tim	Tim	10.25	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N		C-S	R-S	Wilson H
War	D-M	War	SG	Un-WE	3	Pet	Met	Tor	Tor	6.60	Sp	Sp	I-G	½E	½E	ExtDr	ExtR-W	Lav	S&N	MWCo	Art	R-S	Winther 751
Ful	D-M	Ful	SG	Un-WE	3	Pet	Met	Col	Med	7.00	Sp	Sp	I-G	½E	½E	Ext	ExtDr	Lav	S&N	Med	C-S	R-S	Winther 39
Ful	D-M	Ful	SG	Un-WE	3	Pet	Met	Own	Med	9.00	Sp	Sp	I-G	½E	½E		ExtDr	Lav	S&N	Med	C-S	R-S	Winther 430
B&B	Pla	B-L	SG	Sep-Un	4	Blood	Met	Tor	Clark	8.08	Sp	Sp	I-G	½E	½E	ExtR-W	ExtR-W	Ross	S&N	Med	C-S	R-S	Winther 49
Ful	D-M	B-L	SG	Sep-Un	4	Blood	Met	Tor	Clark	8.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N	Own	C-S	R-S	Winther 50
Ful	D-M	Ful	SG	Sep-Un	3	Pet	Met	Own	Clark	12.00	Sp	Sp	I-G	½E	½E	ExtR-W	ExtDr	Lav	S&N	Med	C-S	R-S	Winther 450
B&B	Pla	B-L	SG	Sep-Un	4	Blood	Met	Tim	Clark	9.00	Sp	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N	Clark	C-S	R-S	Winther 70
B&B	Pla	B-L	SG	Sep-Un	4	Blood	Met	Tim	Clark	12.50	Sp	Sp	I-G	½E	½E	IntR-W	IntR-W	Ross	S&N	Clark	C-S	R-S	Winther 109
B&B	Pla	B-L	SG	Sep-Un	4	Pet	Met	Tim	Clark	12.50	Sp	Sp	I-G	½E	½E	IntR-W	IntR-W	Ross	S&N	Clark	C-S	R-S	Winther 140
B-L	D-M	B-L	SG	Un-WE	3	Spi	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Arch	Art	P-S	Witt-Will N
B-L	D-M	B-L	SG	Un-WE	3	Spi	Met	Tim	Tim	7.75	Sp	Sp	Worm	½E	½E	IntR-W	IntR-W	Ross	S&N	Arch	Art	P-S	Witt-Will P
Ful	D-M	Ful	SG	Un-WE		Uni	Met	Shu	Rus	8.20	RR	Sp	I-G	½E	½E	ExtR-W	IntR-W	Gem			Art	P-S	Wolverine J1
Ful	D-M	Ful	SG	Un-WE	3	Uni	Met	Shu	Rus	8.80	RR	Sp	I-G	½E	½E	ExtR-W	IntR-W	Gem	W&W		Art	P-S	Wolverine J1½
Ful	D-M	Ful	SG	Un-WE	3	Uni	Met	Shu	Rus	8.80	RR	Sp	I-G	½E	½E	ExtR-W	IntR-W	Gem	W&W		Art	P-S	Wolverine J2
Ful	D-M	Ful	SG	Un-WE		Uni	Met	Shu	Rus	9.40	RR	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N		C-S	R-S	Wolverine K
Ful	D-M	Ful	SG	Un-WE	4	Uni	Met	Shu	Clark	10.00	RR	Sp	I-G	½E	½E	ExtR-W	IntR-W	Ross	S&N	Clark	C-S	R-S	Wolverine

For abbreviations, see pages 350 and 351.

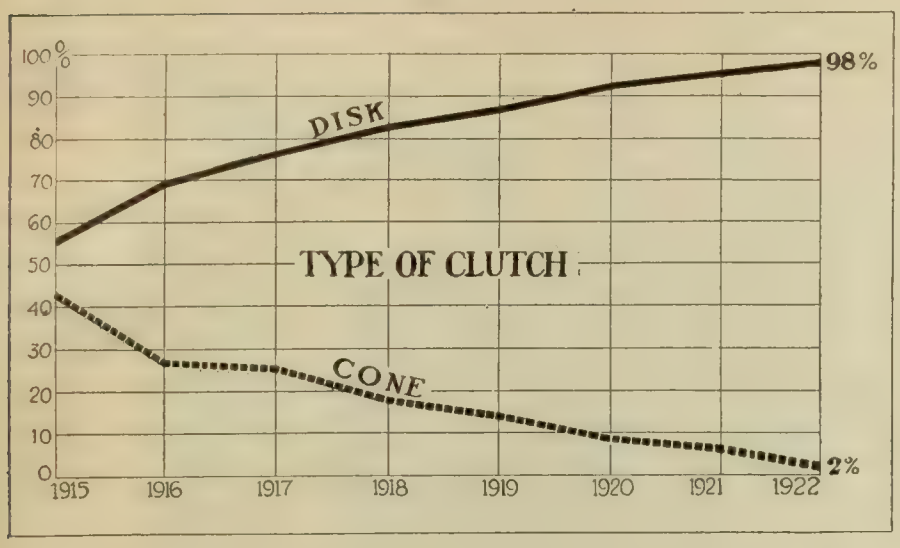
American Electric Trucks

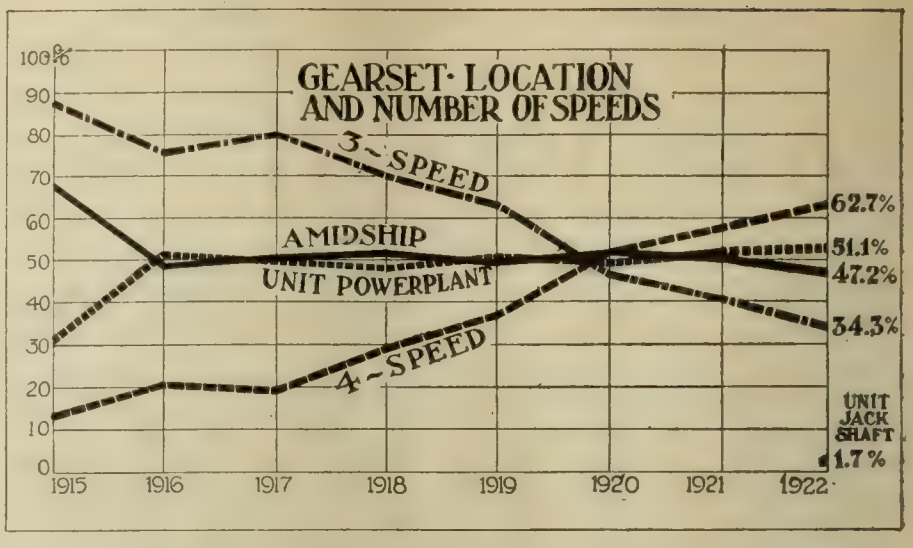
TEC 1202	2½	91	solid	20x5	20x5		amid-u	Ex*	9*	34*	5*	136*		in whls-4	G.E.	18 Max	60	10	7	in dash	3	spur	int-g	14.00–1	springs
Walker M	½	94	solid	34x3	36x3½	33	amid-u	opt						unit-x-1	West	3	60	15	14	u-seat	5		spur	16½–1	springs
Walker K	1	96	solid	34x3½	36x4	35	amid-u	opt						unit-x-1	West	3	60	14		u-seat	5		spur	16½–1	springs
Walker L	2	112	solid	38x4	38x6	36	amid-u	opt						unit-x-1	West		60	13	12	u-seat	5		spur	16 1/7-1	springs
Walker P	3½	131	solid	36x5	36x5d	40	amid-u	opt						1	West	6½	60	12	11	u-seat	5		spur	18 1/6-1	springs
Walker N	5	141	solid	36x6	38x6d	40	amid-u							unit-x-1	West	6½	60	11	10	u-seat	5		spur	18 1/6-1	springs
Ward WS-2	¾	88	solid	32x3	32x3½	29	amid-o	opt						amid-1	GEW				11-13	chas-f	4		worm		springs
Ward WA-2	¾	90	solid	32x3½	34x4	33½	amid-o	opt						amid-1	GEW				10-12	chas-f	4		worm		springs
Ward WA	¾	90	solid	32x3½	34x4	33½	amid-u	opt						front-c-1	GEW				10-12	u-seat	4		worm		springs
Ward WB	1	102	solid	34x4	36x5	34½	front-u	opt						front-c-1	GEW				9-10½	u-seat	4		worm		springs
Ward WM	1–1¼	88	solid	32x3	32x4	30	amid-o	opt						amid-1	G.E.				10-12	chas-f	4		worm		springs
Ward WD	2	114	solid	36x5	36x7	38	amid-u	opt						front-c-1	GEW				8-9	u-seat	4		worm		springs
Ward WF	3½	132	solid	36x6	36x10	40½	amid-u	opt						front-c-1	GEW				7-8	u-seat	5		worm		springs
Ward WH	5	146	solid	36x7	40x12	44	amid-u	opt						front-c-1	GEW				6-7	u-seat	5		worm		springs

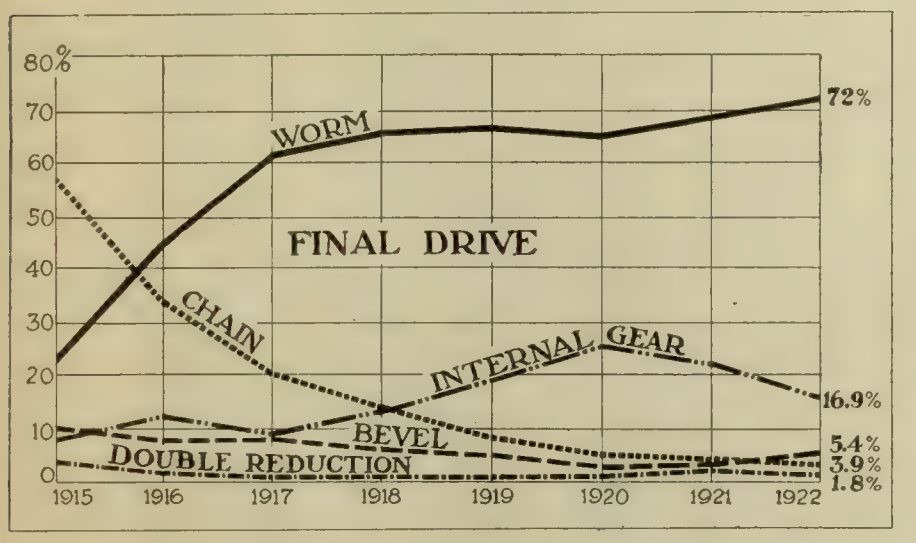
ABBREVIATIONS—Types of Construction and Parts Makers

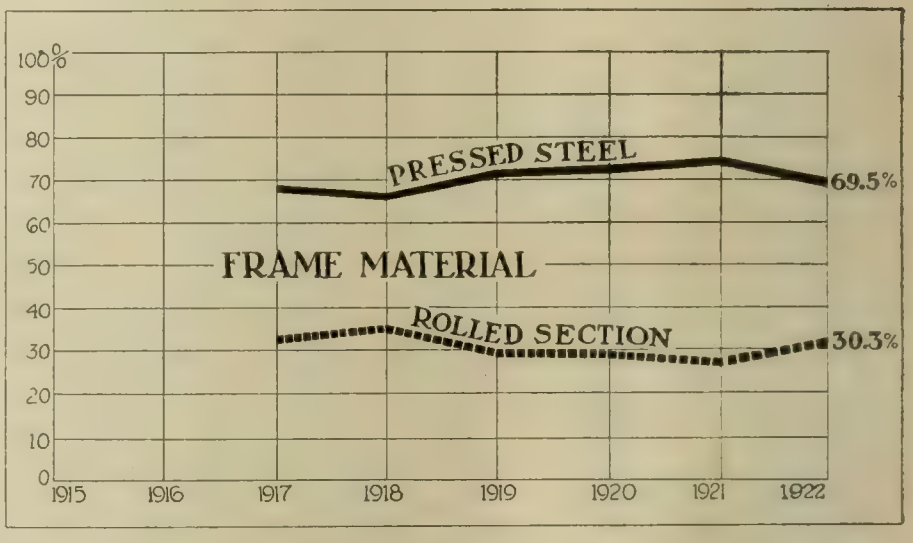
*with other options
†torque taken by springs in all vehicles listed, other options in case of C. T. make
amid-o—amidships, over frame
amid-u—amidships, underslung below frame
chas-f—in chassis front
d—dual
Ex—Exide
front-c—front center
front-u—in front, under frame
G. E.—General Electric
GEW—General Electric—Westinghouse
her—herringbone gear
int-g—internal gear
opt—optional
pneu—pneumatic
rad-rd—radius rod
rol-ch—roller chain
st-col—on steering column
unit-j—unit jackshaft
unit-x—unit with axle
u-seat—under seat
West—Westinghouse

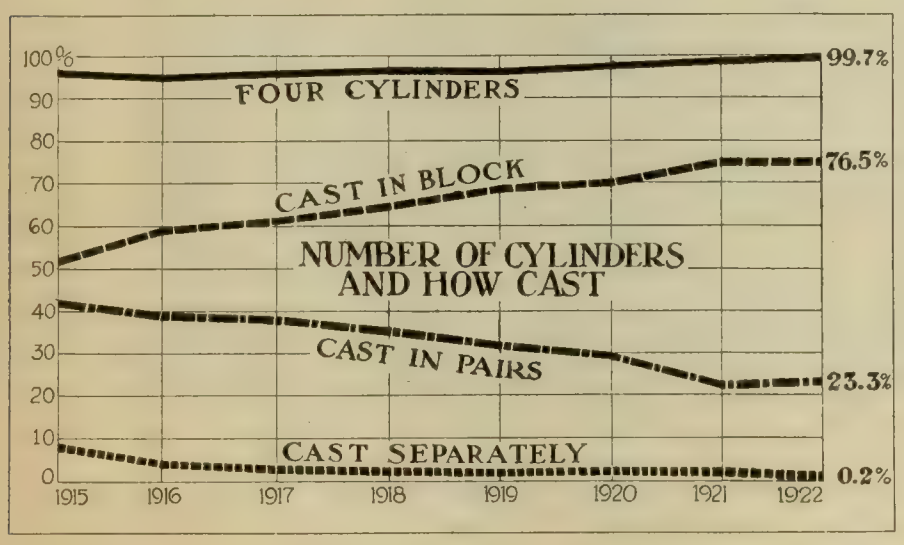
Tendencies in American Truck Design

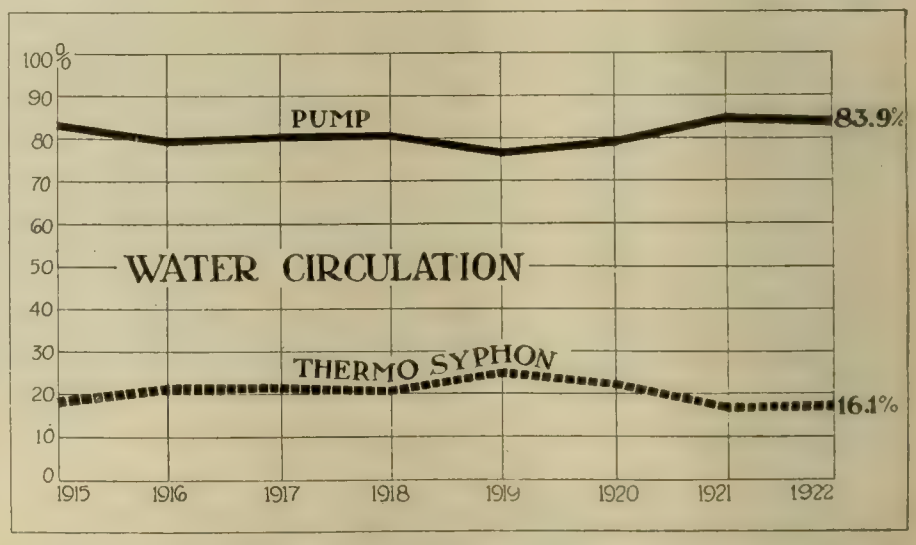


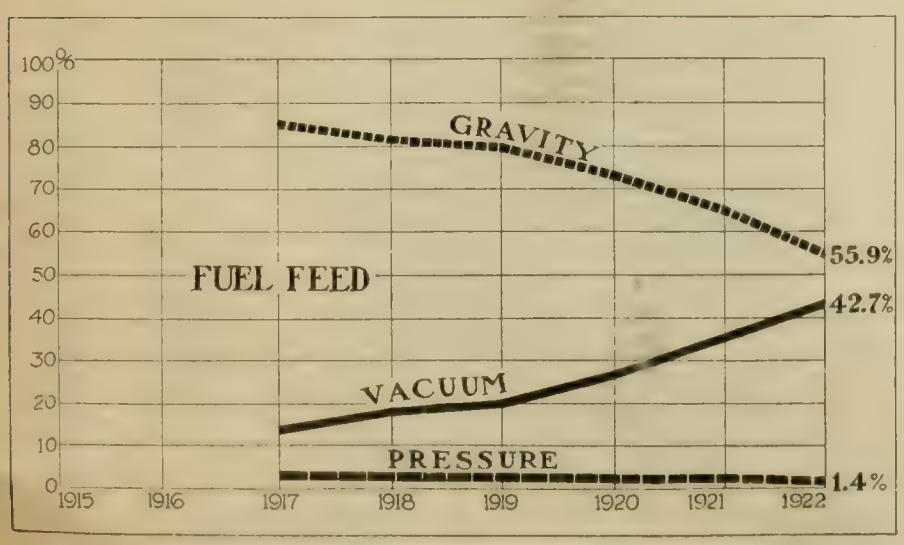


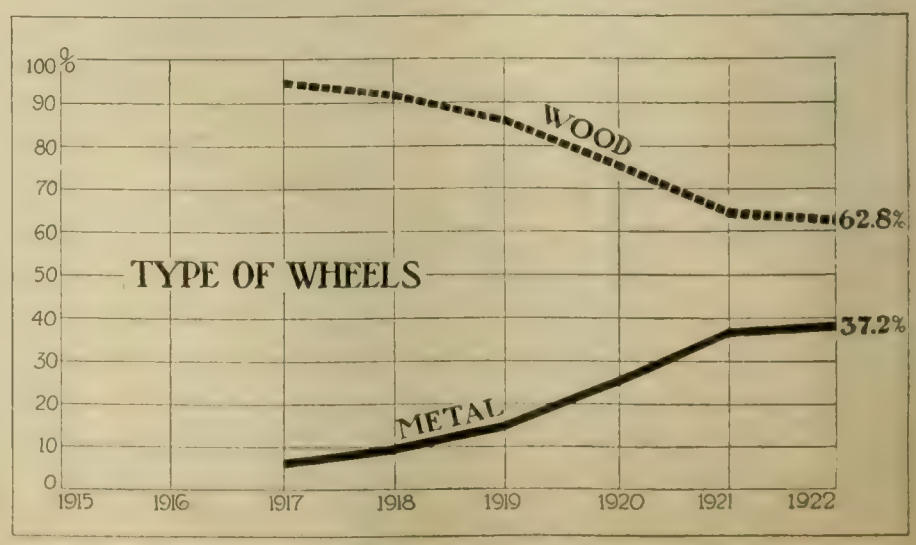












See page 349 for discussion of trends in American truck designs

Tendencies in British Truck Design For 1922

Chassis for useful loads of 7,000 to 10,000 still the main product of the industry. Worm drive increasing in popularity, but no British trucks have internal gear drive on wheels. Straight-sided piston almost universal.

By M. W. Bourdon

FROM the earliest days British truck manufacturers in general showed a tendency to give more attention to the type of chassis carrying 3 to 3½ tons (say, 6700 to 7500 lb.) of useful load, and this type still predominates among British products of this nature, though in a number of cases it has been strengthened so as to deal with loads up to 10,000 lb.; nearly 50 per cent of the models of all makers come, in fact, within this enlarged range. The next in importance, so far as number of models is concerned, is the chassis designed for 4500 to 5500 lb. load.

The light delivery van chassis carrying loads of from 2000 to 3500 lb. has received scant attention, though for 1922 there is a decided increase in the number of models of this size available to purchasers.

There is a tendency to design chassis for heavier load units than hitherto and approximately 16 per cent of British trucks are offered for loads running from 11,000 to 16,000 lb.

The tendency to cater for heavier individual loads on gasoline trucks is accounted for by an endeavor on the part of the makers to invade a field hitherto held almost exclusively by steam trucks. Whether they will, in this sphere, be able to make headway against the steamer remains to be seen.

As the accompanying specification table shows, the four-cylinder engine is practically universal on British trucks.

There is no general tendency on the part of makers to depart from the pair-cast cylinder arrangement, which occurs in 76 per cent of engines.

L-head cylinders continue to predominate and percentages for 1922 show no tendency toward the adoption of overhead valves. On the other hand, those makers who in the past have favored the T-head arrangement continue to do so in one or two instances.

There is no general practice in regard to camshaft drive. The skew pinion leads with 42 per cent, but the silent chain is also widely used (32 per cent) and in 23 per cent of chassis straight-toothed pinions occur in the distribution. Where overhead valves are used the push-rod system of operation is generally favored, Maudslay being the only maker employing an overhead camshaft, a feature which has always characterized this make of truck.

A pump for water circulation occurs on 85 per cent of engines, but in 18 per cent of these it is driven by belt, the pump casing in most instances being located on, or integral with, the front of the cylinder water jacket, the pump shaft being a prolongation of the fan shaft.

Gilled tube radiators with vertical tubes and a cast aluminum casing very largely predominate, this arrangement serving on 90 per cent of trucks.

Seventy-six per cent of engines which are mounted directly in the main frame have a 3-point suspension system, though rarely, indeed, is there any degree of flexibility in the points of attachment. On the other hand, when a sub-frame occurs it has a 4-point support in 65 per cent of chassis and the engine is supported upon it, also at four points.

In connection with pistons, aluminum is only used in 7 per cent of engines, the straight-sided type is almost universal for either cast iron or aluminum, and three compression rings occur in 79 per cent of engines.

For engine lubrication the pressure system embodying a drilled crankshaft is most in favor, though 25 per cent of engines have pressure lubrication for the main journals only, the big-ends and other parts depending upon splash from troughs. Troughs alone serve for 21 per cent of engines, while only 4.5 per cent have a full pressure system, which includes a lead to the small end of the connecting rods. The gear type of oil pump is almost universal, very few examples of the plunger pattern being observable.

Magneto ignition is also almost universal, and would be so but for the fact that one touring car maker offers a commercial vehicle with battery ignition. Twelve months ago there was a slight tendency toward fitting an impulse starter with magneto ignition on some of the larger types of engines, but at the present time there are only 6 per cent of British trucks so equipped, and on 73 per cent of chassis the makers positively refuse to fit it, even at an extra cost.

Last year the makers of 40 per cent of British trucks refused to fit electric lighting, but this percentage is now reduced to 6, though only on 4 per cent of models is it included, except as an extra. No British truck has an electric starter as standard, and on 65 per cent the makers refuse to fit one, there being no provision for the motor or its transmission.

In regard to transmission details, the cone clutch in one form or another accounts for 76 per cent of chassis, the dry, single-plate type having advanced in favor only from 19 to 22 per cent since last year.

The gearset is arranged as a unit with the engine in only 5 per cent of trucks.

Worm drive has increased in popularity to the extent of 5 per cent since last year, 57 per cent of British trucks now having this form of transmission. Next in favor is the double chain (22.5 per cent), this being followed by a double-reduction system of bevel and spur pinion.

Only 13 per cent of trucks have both brakes on the rear wheels. This actually represents a 10 per cent reduction since last year, which is accounted for by the larger number of new models with brakes on transmission and wheels.

British Truck Chassis

NAME	Net Load Capacity Lb.	No. of Cyls. Bore and Stroke Ins.	Normal R.P.M.	Cyls. Heads	Cyls. Cast	Valve Arrangement	Camshaft Drive	Water Circulation	Water Pump Drive	RADIATOR Type	RADIATOR Casing Material	PISTONS Engine Mounting	PISTONS No. of Rings	PISTONS Scraper Ring	Wrist Pin Fixing	Engine Lubrication	Carburettor Make	Governor Fitted	IGNITION Type	IGNITION Timing	Impulse Starter	Fuel Feed	Tank Location
A.E.C.	7800	4-4¼x5½	1000	Int..	Pairs..	L...	Chain..	Pump.	Belt...	Tub...	Alum..	3 Pt...	4	Yes..	Rod...	Sp. & P.	Zenith...	No...	Mag..	Fixed.	No...	Grav..	Seat..
A.E.C.	9000	4-4¾x5⅞	1000	Int..	Pairs..	L...	Chain..	Pump.	Belt...	Tub...	Alum..	3 Pt...	4	Yes..	Rod...	Sp. & P.	Zenith...	Yes..	Mag..	Var...	Yes..	Press..	Rear..
Albion[1]	2800	4-3½x5	1100	Det..	Block.	L...	Skew ..	Pump.	Belt...	Tub...	Alum..	3 Pt...	3	No...	Bosses..	.....	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Dash..
Albion[2]	5600	4-4½x5	1100	Int..	Block.	L.	Str Pin.	Pump.	Belt...	Tub...	Alum..	3 Pt...	3	No...	Bosses..	.....	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Dash..
Albion	9000	4-4½x5	1100	Int..	Block.	L...	Str Pin.	Pump.	Belt...	Tub...	Alum..	3 Pt...	3	No...	Bosses..	.....	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Dash..
Austin	3350	4-3¾x5	1000	Det..	Block.	L...	Chain..	Pump.	Pos....	Tub...	Alum..	3 Pt...	3	Yes..	Rod...	H.C.S..	Zenith...	No..	Mag..	Var...	No...	Grav..	Dash..
Beardmore	1700	4-3⅛x4¾	1200	Det..	Block.	L...	Chain..	Pump.	Belt...	Tub...	Sheet..	4 Pt...	3	.....	Bosses..	H.C.S..	Zenith...	No...	Mag..	Fixed.	Ex...	Grav..	Seat..
Belsize	1350	4-3½x4⅝	1000	Int..	Block.	L...	Chain..	Pump.	Pos...	Cell...	.....	3 Pt...	3	No...	Bosses..	H.C.S..	Zenith...	No...	Mag..	Fixed.	No...	Vac...	Seat..
Bristol	7800	4-4½x5¾	1400	Int..	Pairs..	L...	Chain..	Ther..	.....	Tub...	Alum..	3 Pt...	3	No...	Rod...	Spl.....	Claudel..	Yes..	Mag..	Var...	No...	Opt...	Opt...
Churchill	7800	4-5 x6	1000	Int..	Pairs..	L...	Skew ..	Pump.	Pos....	Tub...	Alum..	4 Pt...	4	Yes..	Rod....	H.C.S..	Claudel..	No...	Mag..	Var...	No...	Press..	Seat..
Caledon[3]	9000	4-4⅝x5½	1000	Det..	Pairs..	Sl...	Chain..	Pump.	Pos....	Tub...	Alum..	3 Pt...	3	No...	Rod....	H.C.S..	Claudel..	Opt..	Mag..	Var...	Yes..	Grav..	Seat..
Commer	4500	4-4 x4¾	1200	Int..	Pairs..	L...	Str Pin.	Ther...	.....	Tub...	Alum..	3 Pt...	3	No...	Bosses..	Spl.....	Claudel..	No...	Mag..	Var...	No...	Grav..	Seat..
Commer	6700	4-4½x5½	1000	Int..	Pairs..	L...	Str Pin.	Ther...	.....	Tub...	Alum..	3 Pt...	3	No...	Bosses..	Spl.....	Claudel..	No...	Mag..	Var...	No...	Grav..	Seat..
Commer	9000	4-4⅝x5½	1000	Int..	Pairs..	L...	Str Pin.	Ther...	.....	Tub...	Alum..	3 Pt...	3	No...	Bosses..	Spl.....	Claudel..	No...	Mag..	Var...	No...	Grav..	Seat..
Commer	12000	4-4¾x5½	1000	Int..	Pairs..	L...	Str Pin.	Ther..	.....	Tub...	Alum..	3 Pt...	3	No...	Bosses..	Spl.....	Claudel..	No...	Mag..	Var...	No...	Grav..	Seat..
Cubitt	1700	4-3⅛x5½	1800	Det..	Block.	L...	Str Pin.	Ther...	.....	Cel...	Sheet..	4 Pt...	3	Yes..	Float...	H.C.S..	Smith...	No...	Batt..	Var...	No...	Grav..	Dash..
Daimler	4500	4-3¾x5½	1100	Det..	Pairs..	Sl...	Chain..	Pump.	Pos....	Tub...	Alum..	3 Pt...	3	No...	Bosses..	Sp. & P.	Zenith...	No...	Mag..	Fixed.	No...	Grav..	Seat..
Dennis	4500	4-4⅛x5⅞	1000	Int..	Pairs..	T...	Str Pin.	Pump.	Pos...	Tub...	Alum..	4 Pt...	3	Yes..	Bosses..	Sp. & P.	Claudel..	No...	Mag..	Var...	No...	Grav..	Seat..
Dennis	7800	4-4½x3⅞	1000	Int..	Pairs..	T...	Str Pin.	Pump.	Pos...	Tub...	Alum..	4 Pt...	3	Yes..	Bosses..	Sp. & P.	Claudel..	No...	Mag..	Var...	No...	Grav..	Seat..
Dennis	12000	4-4½x5⅞	1000	Int..	Pairs..	T...	Str Pin.	Pump.	Pos...	Tub...	Alum..	4 Pt...	3	Yes...	Bosses..	Sp. & P.	Claudel..	No...	Mag..	Var...	No...	Grav..	Seat..
Enfield-Allday	3350	4-4 x5⅛	1100	Int..	Pairs..	T...	Str Pin.	Ther..	.....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Zenith...	No...	Mag..	Var...	No...	Grav..	Seat..
Guy	2800	4-3¼x4½	1400	Det..	Block.	L...	.....	Ther...	.....	Tub...	Alum..	3 Pt...	3	No...	Float...	Spl.....	.....	No...	Mag..	Var...	No...	Grav..	Dash..
Guy	4500	4-4 x5½	1000	Det..	Block.	L...	Chain..	Ther...	.....	Tub...	Alum..	4 Pt...	3	Yes..	Float...	H.C.S..	Zenith...	No...	Mag..	Var...	No...	Grav..	Dash..
Guy	6700	4-4 x5½	1000	Det..	Block.	L...	Chain..	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	Yes..	Float...	H.C.S..	Zenith...	No...	Mag..	Var...	No...	Grav..	Dash..
Halley	4500	4-4 x5¼	1000	Int..	Pairs..	L...	Skew...	Ther..	.....	Tub...	C.I....	4 Pt...	4	Yes..	Bosses..	Sp. & P.	Zenith...	Yes..	Mag..	Var...	Ex..	Grav..	Seat..
Halley	7800	6-3½x6	1200	Det..	Three.	L...	Chain..	Pump.	Pos...	Tub...	Alum..	4 Pt...	4	Yes..	Float...	Spl.....	Zenith...	No...	Mag..	Var...	Ex...	Grav..	Seat..
Halley	12000	4-5 x6½	1000	Int..	Pairs..	L...	Skew...	Pump.	Pos...	Tub...	Alum..	4 Pt...	4	Yes..	Bosses..	Sp. & P.	Zenith...	Yes..	Mag..	Var...	Ex...	Grav..	Seat..
Hallford	4000	4-3⅝x5½	1000	Int..	Pairs..	T...	Str Pin.	Pump.	Pos...	Tub...	Alum..	3 Pt...	4	No...	Bosses..	Spl.....	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Seat..
Hallford	5600	4-4⅝x5½	1000	Int..	Pairs..	T...	Str Pin.	Pump.	Pos...	Tub...	Alum..	3 Pt...	4	No...	Bosses..	Spl.....	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Seat..
Hallford	8000	4-4⅝x5½	1000	Int..	Pairs..	T...	Skew...	Pump.	Pos....	Tub...	Alum..	4 Pt...	4	Yes..	Bosses..	Sp. & P.	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Seat..
Hallford	11000	4-4¾x5½	1000	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Tub...	Alum..	4 Pt...	4	Yes..	Bosses..	Sp. & P.	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Seat..
Karrier[4]	6700	4-5 x6	1060	Int..	Pairs..	L...	Chain..	Pump.	Pos....	Tub...	Alum..	3 Pt...	3	No...	Bosses..	Spl.....	Zenith...	No...	Mag..	Var...	Ex...	Grav..	Seat..
Leyland[5]	4500	4-4½x5	850	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Claudel..	Opt..	Mag..	Var...	No...	Grav..	Seat..
Leyland[6]	9000	4-4⅝x6	1000	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Claudel..	Opt..	Mag..	Var...	No...	Grav..	Seat..
Leyland	11000	4-5 x6	1150	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Cell...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Claudel..	Opt..	Mag..	Var...	No...	Grav..	Seat..
Marathon	4500	4-3⅛x5⅛	1500	Det..	Block.	L...	Skew...	Pump.	Belt...	Tub...	Alum..	3 Pt...	3	Yes..	Bosses..	Sp. & P.	Zenith...	No...	Mag..	Var...	Ex...	Grav..	Seat..
Maudslay	6700	4-4½x5	1000	Int..	Pairs..	I...	Skew...	Pump.	Belt...	Tub...	Alum..	4 Pt...	4	Yes..	Bosses..	Press...	Zenith...	No...	Mag..	Var...	No...	Vac...	Dash..
Maudslay	10100	4-5 x5	1000	Int..	Pairs..	I...	Skew...	Pump.	Belt...	Tub...	Alum..	4 Pt...	4	Yes..	Bosses..	Press...	Zenith...	No...	Mag..	Var...	No...	Vac...	Dash..
Maudslay	13500	4-4¾x6	1000	Det..	Block.	I...	Bevels..	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	Press...	Zenith...	No...	Mag..	Var...	No...	Vac...	Side...
McCurd	9000	4-4½x5½	600	Int..	Pairs..	T...	Worm..	Pump.	Pos....	Tub...	Alum..	3 Pt...	4	Yes..	Bosses..	Spl.....	Zenith...	No...	Mag..	Var...	Ex...	Grav..	Seat..
Pagefield[7]	6700	4-4¾x5½	1000	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Seat..
Pagefield[8]	9000	4-4¾x5½	1000	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Zenith...	Yes..	Mag..	Var...	No...	Grav..	Seat..
Palladium	7800	4-4½x5½	1250	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Tub...	Alum..	3 Pt...	3	Yes..	Bosses..	Sp. & P.	Zenith...	No...	Mag..	Var...	Yes..	Grav..	Seat..
Scammell	22000	4-5 x5½	1200	Det..	Pairs..	I...	Skew...	Pump.	Pos....	Tub...	Alum..	3 Pt...	3	Yes..	Float...	H.C.S..	Zenith...	No...	Mag..	Var...	No...	Grav..	Dash..
Star	3350	4-3½x5⅞	1000	Int..	Pairs..	L...	Chain..	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Zenith...	No...	Mag..	Var...	No...	Grav..	Seat..
Star	5600	4-3½x5⅞	1000	Int..	Pairs..	L...	Chain..	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Zenith...	No...	Mag..	Var...	No...	Grav..	Seat..
Star	6700	4-4 x5⅞	1000	Det..	Block.	L...	Str Pin.	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	No...	Bosses..	H.C.S..	Zenith...	No...	Mag..	Var...	No...	Grav..	Seat..
Straker-Squire	11000	4-4½x6½	1000	Det..	Block.	I...	Chain..	Pump.	Belt...	Tub...	Alum..	4 Pt...	3	.....	Conrod.	Special.	.....	Yes..	Mag..	Var...	.....	Grav..	Dash..
Thornycroft	4500	4-4 x5½	1000	Det..	Block.	F...	Skew...	Pump.	Belt...	Tub...	Alum..	4 Pt...	2	Yes..	Float...	H.C.S..	Solex....	Yes..	Mag..	Var...	No...	Grav..	Dash..
Thornycroft[9]	6700	4-4½x6	1000	Int..	Pairs..	T...	Skew...	Pump.	Belt...	Tub...	Alum..	3 Pt...	3	Yes..	Float...	H.C.S..	Solex....	Yes..	Mag..	Var...	No...	Grav..	Dash..
Thornycroft	11000	4-4½x6	1000	Int..	Pairs..	T...	Skew...	Pump.	Belt...	Tub...	Alum..	3 Pt...	3	Yes..	Float...	H.C.S..	Solex....	Yes..	Mag..	Var...	No...	Grav..	Dash..
Tilling-Stevens	5600	4-4⅛x4⅝	1000	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	Yes..	Bosses..	Sp. & P.	Zenith...	Opt..	Mag..	Fixed.	Ex...	Grav..	Seat..
Tilling-Stevens[10]	9000	4-5 x6	1000	Int..	Pairs..	L...	Chain..	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	Yes..	Bosses..	Sp. & P.	Zenith...	Opt..	Mag..	Fixed.	Ex...	Grav..	Seat..
Tilling-Stevens	4500	4-4⅛x4⅝	1000	Int..	Pairs..	L...	Skew...	Pump.	Pos....	Tub...	Alum..	4 Pt...	3	Yes..	Bosses..	Sp. & P.	Zenith..	Opt..	Mag .	Fixed.	Ex...	Grav..	Seat..
Vulcan	3350	4-3½x4¾	1200	Int..	Block.	L...	Skew...	Pump.	Pos....	Tub...	Alum..	3 Pt...	3	No...	Bosses..	Spl.....	Zenith...	Opt..	Mag..	Var...	No...	Grav..	Dash..

For abbreviations, see pages 340 and 341.

[1]This same chassis is also built with a 3-in. longer wheel base and a rolled frame and is then rated at 3350 lbs. carrying capacity.
[2]Made also with a 6-in. longer wheelbase and then rated at 6700 lbs.
[3]Rated at 16,000 lbs. when fitted with double chain drive and greater reduction ratio.
[4]Rated at 9000 lbs. with an 8.23 reduction and at 11,000 lbs. with an 8.9 reduction.
[5]Specifications of 6700 lbs. model the same except that gear ratio is 7.25 and wheelbase 157 in.
[6]Specifications of 1300 lbs. model the same except that wheelbase is 9 in. longer.

Percentages of Design Features in British Trucks, 1922

Cylinder Heads
Integral ..... 73 per cent
Detachable ..... 27 per cent

Valve Arrangement
L ..... 70 per cent
T ..... 16.5 per cent
I ..... 7.5 per cent
Single Sleeve ..... 4.5 per cent
F ..... 1.5 per cent

Camshaft Drive
Skew pinions ..... 42 per cent
Chain ..... 32 per cent
Straight pinions ..... 23 per cent
Worm gear ..... 1.5 per cent
Bevels ..... 1.5 per cent

Water Circulation
Pump ..... 85 per cent
Thermo ..... 15 per cent

Water Pump Drive
Positive ..... 72 per cent
Belt ..... 18 per cent

Radiator; Type
Gilled tubes ..... 87 per cent
Plain tubes ..... 7 per cent
Cellular ..... 6 per cent

Tubular; Hor. or Vert.
Vert ..... 93 per cent
Hor. ..... 7 per cent

Casing Material
Cast aluminum ..... 95 per cent
Sheet metal ..... 3 per cent
Cast iron ..... 2 per cent

Engine Mounting
In sub frame ..... 51 per cent
In main frame ..... 49 per cent

Specifications for 1922

CLUTCH		GEAR SET			PROPELLER SHAFT					BRAKES				SPRINGS		WHEELS						NAME
					Type of Joints					Hand		Pedal										
Type	Friction Surface	Location	No. of Speeds	Position of Lever	Front	Rear	Final Drive	Drive Trans. by	Torque Taken by	Type	Location	Type	Location	Front	Rear	Type	Standard Tyres	Back Axle Gear Ratio	Wheel Base Inches	Track Inches	Type of Frame	
Dry Pl.	Fab....	Sep....	3or4	Right	Star...	Star...	Worm..	Sprgs...	T. Arm	Int...	Wh....	Int....	Wh.....	½ Ell	½Ell.	W.c.s..	Solid..	.....	170	70	Flitch.	A.E.C.
Dry Pl.	Fab....	Sep....	4	Right	Star...	Star...	Worm..	Sprgs...	T. Arm	Int...	Wh....	Int....	Wh.....	½ Ell	½ Ell	W.s..	Solid..	Opt...	170	68	Pressed.	A.E.C.
Dry Pl.	Fab....	Sep....	3	Right	Star...	Star...	Worm..	Sprgs...	Sprgs...	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	Opt...	Opt. ..	.....	129	61	Pressed..	Albion[1]
Dry Pl.	Fab....	Sep....	3	Right	.....	.....	Chain..	R. Rod.	T. Arm.	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	S.c.s..	Solid..	.....	157	70	Rolled..	Albion[2]
Dry Pl.	Fab....	Sep....	3	Right	.....	.....	Chain..	R. Rod.	T. Arm	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	S.c.s..	Solid..	.....	173	70	Rolled..	Albion
Dry Pl.	Fab....	Unit..	4	Cent..	Pot...	Pot...	Worm..	Sprgs...	Sprgs...	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	W.s.c..	Solid..	8.6	126	60	Pressed.	Austin
Cone...	Fab....	Sep....	4	Right	Fab...	Fab...	Beb....	Sprgs...	Sprgs...	Int...	Wh....	Ext...	G. Set..	½ Ell	¾ Ell	Wood.	Pneu..	4.64	100	54	Pressed	Beardmore
Cone...	Fab....	Unit..	4	Right	Lea...	Lea...	S.P.Bev	Sprgs...	Sprgs...	Int...	Wh....	Int....	Wh.....	½ Ell	½ Ell	H.p.s..	Pneu..	4	99	56	Pressed	Belsize
Dry Pl.	Fab....	Sep....	4	Cent..	Lea...	Lea...	Worm..	Sprgs..	Sprgs...	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	Opt...	170	70	Pressed..	Bristol
Cone...	M.-M...	Sep....	4	Right	.....	.....	Chain..	R. Rod.	Sprgs...	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	Wood	Solid..	.....	180	65	Rolled..	Churchill
Cone...	Fab....	Sep....	4	Right	Star...	Pot....	Worm..	Sprgs...	Sprgs...	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	8	171	66	Pressed.	Caledon[3]
Cone...	Lea....	Sep....	3	Right	Int....	C. Pin.	Worm..	P.s.c....	P.s.c....	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	7.33	144	66	Pressed.	Commer
Cone...	Lea....	Sep....	4	Right	C. Pin.	C. Pin.	Worm..	Sprgs...	Sprgs...	Ext...	G. Set.	Int...	Wh....	½ Ell	½ Ell	H.c.s..	Solid..	7.66	165	68	Rolled..	Commer
Cone...	Lea....	Sep....	3	Right	.....	.....	Chain..	R. Rod.	T. Rod.	Int...	Wh....	Ext...	G. Set..	½ Ell	½Ell	H.c.s..	Solid..	7.5	165	68	Rolled.	Commer
Cone...	Lea....	Sep....	4	Right	.....	.....	Chain..	R. Rod.	Sprgs.	Int...	Wh....	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	9.3	162	72	Rolled...	Commer
Cone...	Fab....	Sep....	4	Right	Fab...	Fab...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	Wh....	½ Ell	½ Ell	H.p.s..	Pneu..	4.12	126	54	Pressed..	Cubitt
Cone...	Fab....	Sep....	4	Right	Star...	Star...	Worm..	Sprgs...	Sprgs..	Int...	Wh...	Int...	Wh....	½ Ell	½ Ell	W.c.s..	Solid..	7.25	138	63	Flitch...	Daimler
Dry Pl.	Fab....	Sep...	4	Cent..	Star...	Star...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	6.75	144	62	Pressed.	Dennis
Cone...	Fab....	Sep...	4	Right	Star...	.....	Worm..	P.s.c....	P.c.s....	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	7.75	156	66	Pressed..	Dennis
Cone...	Fab....	Sep...	4	Right	Star...	.....	Worm..	P.s.c....	P.s.c....	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	8.75	170	66	Pressed..	Dennis
Cone...	Fab....	Sep...	3	Right	.....	.....	Chain..	C. Case	C. Case	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	Disk..	Solid..	.....	147	66	Pressed..	Enfield-Allday
Dry Pl.	Fab....	Unit..	3	Cent..	Star...	Fab...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Int...	Wh....	½ Ell	½ Ell	H.c.s..	Opt..	.....	112	56	Pressed..	Guy
Cone...	Fab....	Sep...	4	Right	Fab...	Fab...	B.&S..	Sprgs..	Sprgs..	Int...	Wh...	Int...	F.d.s..	½ Ell	½ Ell	S.c.s..	Solid..	6.33	148	60	Pressed..	Guy
Cone...	Fab....	Sep...	4	Right	Star...	Pot....	B.&S..	Sprgs..	Sprgs..	Int...	Wh...	Int...	F.d.s..	½ Ell	½ Ell	H.c.s..	Solid..	6.8	148	60	Pressed..	Guy
Cone...	Lea....	Sep....	3	Right	.....	.....	Chain..	R. Rod.	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	W.c.s.	Solid..	.....	.....	.....	Rolled...	Halley
Dry Pl.	Fab....	Sep...	4	Right	Fab...	Fab...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	F.d.s..	½ Ell	½ Ell	H.c.s..	Solid..	7.66	160	62	Rolled..	Halley
Dry Pl.	Fab....	Sep...	4	Right	.....	.....	Chain..	R. Rod.	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	W.c.s.	Solid..	.....	169	66	Rolled...	Halley
Cone...	Fab....	Sep...	3	Right	.....	.....	Chain..	R. Rod.	T. Arm.	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	S.c.s..	Solid..	.....	130	62	Pressed..	Hallford
Cone...	Fab....	Sep...	3	Right	.....	.....	Chain..	R. Rod.	T. Arm	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	S.c.s..	Solid..	.....	148	64	Pressed..	Hallford
Cone...	Fab....	Sep...	4	Right	.....	.....	Chain..	R. Rod.	T. Arm	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	S.c.s..	Solid..	.....	162	72	Pressed..	Hallford
Cone...	Fab....	Sep...	4	Right	.....	.....	Chain..	R. Rod.	T. Arm	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	S.c.s..	Solid..	.....	180	72	Pressed..	Hallford
Cone...	Lea....	Sep...	4	Right	C. Pin.	Pot...	B.&S..	P.s.c....	P.s.c....	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	6.65	168	66	Pressed..	Karrier[4]
Cone...	Fab....	Sep...	4	Right	Pot...	Pot...	Worm..	P.s.c....	P.s.c....	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	7	141	65	Pressed .	Leyland[5]
Cone...	Fab....	Sep...	4	Right	Pot...	Pot...	B.&S..	P.s.c....	P.s.c....	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	7.86	168	65	Pressed.	Leyland[6]
Cone...	Fab....	Sep...	4	Right	Pot...	Pot...	B.&S..	P.s.c....	P.s.c....	Int....	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	8.9	181	65	Pressed..	Leyland
Cone...	Fab....	Sep...	4	Right	Fab...	Fab...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	F.d.s..	½ Ell	½ Ell	H.c.s..	Solid..	6.75	126	58	Pressed..	Marathon
Cone...	Lea....	Sep...	4	Right	Star...	Pot...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	7.75	162	66	Rolled...	Maudslay
Cone...	Lea....	Sep....	4	Right	Star...	Pot...	B.&S..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	8.25	174	66	Rolled...	Maudslay
Cone...	Lea....	Sep...	4	Cent...	Star...	Pot...	B.&S..	Sprgs...	Sprgs..	Int....	Wh...	Ext...	G. Set..	½ Ell	½ Ell	Disk..	Solid..	8.25	186	66	Rolled...	Maudslay
Cone...	Lea....	Sep...	4	Right	Star...	Star...	Worm..	R. Rod.	T. Arm.	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	W.c.s..	Solid..	7.1	174	66	Pressed..	McCurd
Cone...	Fab....	Sep...	4	Right	Star...	Pot...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	Disk..	Solid..	.....	174	69	Pressed..	Pagefield[7]
Cone...	Fab....	Sep...	4	Right	Star...	Pot...	B.&S..	T. Arm.	T. Arm.	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	W.c.s..	Solid..	.....	164	69	Pressed..	Pagefield[8]
Dry M.	Fab....	Sep...	4	Right	Star...	Star...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	Cant..	H.c.s..	Solid..	7.8	176	68	Pressed..	Palladium
Cone...	Fab....	Sep...	3	Right	.....	.....	Chain..	R. Rod.	Sprgs..	Int...	Wh...	Ext...	G.S et..	½ Ell	½ Ell	W.c.s..	Solid..	.....	120	64	Pressed..	Scammell
Cone...	Fab....	Sep...	4	Right	Pot...	Pot...	Worm..	Sprgs..	T. Arm.	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	Disk..	Solid..	5	138	57	Pressed..	Star
Cone...	Fab....	Sep...	4	Right	Pot...	Pot...	Worm..	R. Rod.	T. Arm.	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	Disk..	Solid..	6.8	150	60	Pressed..	Star
Cone...	Fab....	Sep...	4	Right	Star...	Pot...	Worm..	R. Rod.	T. Arm.	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	H.c.s..	Solid..	6.8	150	60	Pressed..	Star
Dry Pl.	Fab....	Sep...	4	Right	Star...	Star...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Int...	Wh....	½ Ell	½ Ell	H.c.s.	Solid..	7 or 8	174	72	Pressed..	Straker-Squire
Cone...	Fab....	Sep...	3	Cent..	Lea...	Lea...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	W.c.s..	Solid..	7.25	144	62	Pressed..	Thornycroft
Cone...	Fab....	Sep...	4	Right	Lea...	Lea...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	W.c.s.	Solid..	7.25	156	67	Pressed..	Thornycroft[9]
Cone...	Fab....	Sep...	4	Right	L.Ring	Lea...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	W.s.c..	Solid..	10.6	169	71	Pressed..	Thornycroft
Cone...	Fab....	Sep...	4	Right	C. Pin.	Star...	Worm..	Sprgs..	Sprgs..	Ext...	Wh...	Int...	Wh....	½ Ell	½ Ell	H.c.s..	Solid..	6	144	57	Pressed..	Tilling-Stevens
Cone...	Fab....	Sep...	4	Right	Star...	C. Pin.	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Int...	Wh....	½ Ell	½ Ell	H.c.s..	Solid..	6.5	174	68	Pressed..	Tilling-Stevens[10]
.....	.....	.....	....	.....	Star...	C. Pin.	Worm..	Sprgs..	Sprgs..	Ext...	Wh...	Int...	Wh....	½ Ell	½ Ell	H.c.s.	Solid..	10.3	144	57	Pressed..	Tilling-Stevens
Cone...	Fab....	Sep...	4	Cent..	C. Pin.	Pot...	Worm..	Sprgs..	Sprgs..	Int...	Wh...	Ext...	G. Set..	½ Ell	½ Ell	S.c.s..	Solid..	6.2	137	56	Pressed..	Vulcan

For abbreviations, see pages 340 and 341.

[7]Also made as a tractor of 98 in. wheelbase and with a load rating of 7800 lbs.

[8]Made also with worm drive (Hotchkiss), disk wheels and 177 in. wheelbase.

[9]Specifications of 9000 lbs. model the same except 8.25 gear reduction and 163 in. wheelbase.

[10]Also made with a 10.3 gear reduction and with this reduction and an engine with 4¾-in. bore.

In Main Frame

3 point .....76 per cent
4 point .....24 per cent

In Sub Frame

4 point .....82 per cent
3 point .....18 per cent

Sub Frame Support

4 point .....65 per cent
3 point .....35 per cent

PISTONS

Material

Cast iron .....93 per cent
Aluminum ..... 7 per cent

Type

Straight side .....91 per cent
Hour glass ..... 9 per cent

Number of Rings

3 .....79 per cent
4 .....19 per cent
2 ..... 2 per cent

Scraper Ring

Not fitted .....54 per cent
Fitted .....46 per cent

Wrist Pin Fixing

In bosses .....73 per cent
Floating .....15 per cent
In connecting rod .....12 per cent

Engine Lubrication

Pressure .....40 per cent
Trough and pressure .....25 per cent
Trough .....21 per cent
Miscellaneous .....9.5 per cent
Full pressure .....4.5 per cent

Carbureter Make

Zenith .....67.5 per cent
Claudel .....24.5 per cent
Solex ..... 6.0 per cent
Smith ..... 2.0 per cent

Governor Fitted?

No .....47.5 per cent
Yes .....33.0 per cent
Optional .....19.5 per cent

(*Continued on page* 366)

Continental Commercial Vehicle

NAME and NATIONALITY	Rated Capacity (Tons)	Wheelbase (In.)	Track (In.)	No. Cyls. Bore and Stroke (Mm.)	Cylinder Arrangement	Valve Location	Cylinder Head	Lubrication System	Water Circulation	Electric Starter	Governor	Clutch	No. Forward Speeds	Final Drive	Propeller Shaft	BRAKES Type and Location: Location	Foot	Hand	Type of Wheels	TIRES: Kind	Size in Millimeters: Front	Rear
FRENCH																						
Ariès	4	162	66	4- 90x150	Blk.	L.	Fix.	Pres.	T.	None.	Yes.	Dsk.	4	Chn.	.	Tr.	Ext.	R. Ext.	C. Sol.	S.	1000x130	1000x130
Ariès	5	162	66	4-100x150	Blk.	L.	Fix.	Pres.	T.	None.	Yes.	Dsk.	4	Chn.	.	Tr.	Ext.	R. Ext.	C. St.	S.	1000x130	970x160
Berliet	¾	123	56	4- 90x130	Blk.	L.	Det.	Circ.	P.	Yes.	No.	Dsk.	3	S. B.	E.	R.	Int.	R. Int.	Disk.	P.	880x120	880x120
Berliet	1½	138	56	4- 90x130	Blk.	L.	Det.	Circ.	P.	Yes.	No.	Dsk.	3	Wrm.	O.	R.	Int.	R. Int.	Disk.	P.	895x135	895x135
Berliet	2½	150	70	4-110x140	Prs.	L.	Fix.	Pres.	P.	None.	Yes.	Pla.	4	D. R.	E.	Tr.	Ext.	R. Int.	Disk.	P.	955x155	955x155
Berliet	3	144	70	4-110x140	Prs.	L.	Fix.	Pres.	T.	None.	Yes.	Pla.	4	Wrm.	O.	R.	Int.	R. Int.	Disk.	P.	955x155	955x155
Berliet	5	165	70	4-110x140	Prs.	L.	Fix.	Pres.	T.	None.	Yes.	Pla.	4	Chn.	.	Tr.	Ext.	R. Int.	C. St.	S.	950x140	1030x160
Brasier	1¾	133	56	4- 85x150	Blk.	L.	Fix.	Circ.	T.	Opt.	None.	Con.	4	Bev.	O.	Tr.	Ext.	R. Int.	Disk.	P.	880x180	880x120
Brasier	3½	150	67	4-100x150	Blk.	L.	Fix.	Circ.	P.	None.	Yes.	Con.	4	Chn.	.	Tr.	Ext.	R. Int.	Disk.	S.	955x155	955x155
Brasier	5	165	67	4-100x150	Blk.	L.	Fix.	Circ.	P.	None.	Yes.	Con.	4	Chn.	.	Tr.	Ext.	R. Int.	Steel.	S.	1000x120	970x160
Cottin-Desgouttes	1½	138	55	4- 80x160	Blk.	L.	Det.	Pres.	P.	None.	No.	Con.	4	D. R.	O.	Tr.	Ext.	R. Int.	Disk.	P.	935x135	935x135
Cottin-Desgouttes	2	138	55	4- 90x160	Blk.	L.	Det.	Pres.	P.	None.	No.	Con.	4	D. R.	O.	Tr.,	Ext.,	R. Int.	Disk.	P.	935x135	935x135
De Dion Bouton	2	149	63	4- 90x140	Blk.	L.	Fix.	Pres.	P.	Opt..	None.	Pla.	4	I. G.	O.	Tr.	Ext.	R. Int.	Disk.	P.	895x135	893x135
De Dion Bouton	3½	162	63	4-100x140	Prs.	L.	Fix.	Pres.	P.	None.	Yes.	Pla.	4	I. G.	O.	Tr.	Ext.	R. Int.	Stl.	S.	930x120	930x120
De Dion Bouton	5	169	63	4-110x150	Prs.	L.	Fix.	Pres.	P.	None.	Yes.	Pla.	4	I. G.	O.	Tr.	Ext.	R. Int.	Stl.	S.	950x140	1030x160
Delahaye	1½	146	60	4- 85x130	Blk.	L.	Fix.	Pres.	P.	Opt.	No.	Con.	4	Bev.	O.	Tr.	Ext.	R. Int.	Disk.	P.	895x135	895x135
Delahaye	4	162	66	4-100x160	Blk.	L.	Fix.	Pres.	P.	Opt.	Yes.	Con.	4	Chn.	.	Tr.	Ext.	R. Int.	Wood.	S.	940x130	1000x130
Delahaye	5	165	66	4-100x160	Blk.	L.	Fix.	Pres.	P.	Opt.	Yes.	Con.	4	Chn.	.	Tr.	Ext.	R. Int.	Wood.	S.	950x140	1030x160
Delaunay-Belleville	3	142	67	4- 90x150	Prs.	L.	Fix.	Pres.	P.	None.	None.	Dsk.	4	D. R.	O.	Tr.	Ext.	R. Int.	Wood.	P.	930x120	930x120
Delaunay-Belleville	4	157	67	4-100x140	Prs.	L.	Fix.	Pres.	P.	None.	Yes.	Dsk.	4	Chn.	.	Tr.	Ext.	R. Int.	Wood.	S.	930x120	1000x140
Delaunay-Belleville	5	157	67	4-100x140	Prs.	L.	Fix.	Pres.	P.	None.	Yes.	Dsk.	4	Chn.	.	Tr.	Ext.	R. Int.	Wood.	S.	930x120	1030x160
Dewald	7½	169	67	4-110x150	Prs.	L.	Fix.	Pres.	P.	Yes.	Yes.	Con.	4	Chn.	.	Tr.	Ext.	R. Int.	Wood.	S.	1030x180	1030x200
Exshaw (Steam)	7	137	86	2-155x140	Sep.	.	.	Pres.	.	.	.	.	..	Chn.	.	.	.	.	Stl.	S.	900x160	970x180
Latil	10[1]	137	71	4-105x140	Blk.	L.	Fix.	Circ.	T.	None.	Yes.	Con.	5	I. G.	.	R.	Int.	R. Int.	Stl.	S.	1000x140	1000x130
Latil	3[2]	137	66	4-105x140	Blk.	L.	Fix.	Circ.	T.	None.	Yes.	Con.	4	I. G.	.	R.	Int.	R. Int.	Disk.	P.	955x155	955x155
Latil	20[3]	118	71	4-120x160	Blk.	L.	Fix.	Circ.	T.	None.	Yes.	Con.	5	I. G.	.	R.	Int.	R. Int.	Stl.	S.	1160x120	1160x120
Panhard-Levassor	1½	122	60	4- 72x140	Blk.	L.	Fix.	Circ.	P.	Yes.	None.	Pla.	4	Bev.	E.	R.	Int.	R. Int.	Disk.	P.	880x120	880x120
Panhard-Levassor	3	146	67	4- 85x140	Blk.	S.	Det.	Circ.	P.	Yes.	Yes.	Pla.	4	Bev.	E.	R.	Int.	R. Int.	Disk.	P.	955x155	955x155
Peugeot	4	154	63	4-100x150	Blk.	L.	Fix.	Pres.	P.	No.	Yes.	Con.	4	Wrm.	E.	Tr.	Ext.	R. Int.	Stl.	S.	940x130	1000x130
Peugeot	4	154	63	4-100x150	Blk.	L.	Fix.	Pres.	P.	Opt.	Yes.	Con.	4	Wrm.	E.	Tr.	Ext.	R. Int.	Disk.	P.	955x155	955x155
Renault	1½	146	60	4- 80x140	Blk.	L.	Fix.	Circ.	T.	Yes.	No.	Con.	4	D. R.	E.	Tr.	Ext.	R. Int.	Disk.	P.	835x135	835x135
Renault	3	150	67	4- 95x160	Blk.	L.	Fix.	Circ.	T.	Yes.	Yes.	Con.	4	Bev.	E.	Tr.	Ext.	R. Int.	Disk.	P.	955x155	955x155
Renault	5	165	67	4- 95x160	Blk.	L.	Fix.	Circ.	T.	No.	Yes.	Con.	4	Pln.	O.	Tr.	Ext.	R. Int.	Stl.	S.	950x130	1030x130
Renault	7	188	67	4-125x160	Prs.	L.	Fix.	Circ.	T.	Yes.	Yes.	Con.	4	Pln.	O.	Tr.	Ext.	R. Int.	Stl.	S.	970x180	1000x130
Rochet-Schneider	1½	130	56	4- 80x130	Blk.	L.	Fix.	Pres.	T.	None.	No.	Con.	4	Bev.	E.	Tr.	Ext.	R. Int.	Disk.	P.	880x120	880x120
Saurer	3	162	63	4-100x170	Blk.	L.	Fix.	Circ.	P.	Yes.	Yes.	Con.	4	D. R.	O.	R.	Int.	R. Int.	Wood.	S.	1010x120	1050x160
Saurer	5	177	64	4-110x180	Blk.	L.	Fix.	Circ.	P.	Yes.	Yes.	Con.	4	D. R.	O.	R.	Int.	R. Int.	Wood.	S.	955x155	955x155
S. O. M. U. A.	5	152	69	4-105x150	Sep.	I.	Fix.	Pres.	P.	None.	Yes.	Dsk.	3	I. G.	O.	Tr.	Ext.	R. Bnd.	Stl.	S.	900x140	950x150
S. O. M. U. A.	7	152	69	4-110x150	Sep.	I.	Fix.	Pres.	P.	None.	Yes.	Dsk.	3	I. G.	O.	Tr.	.	R. Bnd.	Stl.	S.	900x140	950x150
Unic	1½	123	52	4- 80x130	Blk.	L.	.	Pres.	P.	Opt.	Yes.	Con.	4	D. R.	O.	Tr.	Ext.	R. Ext.	Disk.	P.	820x120	820x120
Unic	2¼	139	60	4- 80x130	Blk.	L.	.	Pres.	P.	Opt.	Yes.	Con.	4	D. R.	O.	Tr.	Ext.	R. Ext.	Disk.	P.	895x135	895x135
ITALIAN																						
Fiat	1	110	55	4- 80x140	Blk.	L.	Fix.	Pres.	P.	None.	No.	Dsk.	4	Bev.	E.	Tr.	Ext.	R. Int.	Disk.	P.	820x120	820x120
Fiat	1½	120	55	4-100x140	Blk.	L.	Fix.	Pres.	P.	None.	No.	Dsk.	4	Bev.	E.	Tr.	Ext.	R. Int.	Disk.	P.	880x120	880x120
Fiat	4	142	65	4-100x180	Blk.	L.	Fix.	Pres.	P.	None.	Yes.	Dsk.	4	Chn.	.	Tr.	Ext.	R. Int.	Stl.	S.	900x110	1060x120
Fiat	7	137	70	4-130x200	Blk.	L.	Fix.	Pres.	P.	None.	Yes.	Dsk.	4	Chn.	.	Tr.	Ext.	R. Int.	Stl.	S.	900x160	1200x180
Spa	3	145	66	4- 95x200	Blk.	L.	Fix.	Pres.	P.	None.	None.	Dsk.	4	Chn.	O.	Tr.	Ext.	R. Int.	Stl.	S.	820x100	950x100
SWISS																						
Berna	3	161	62	4-100x170	Blk.	L.	Fix.	Pres.	P.	None.	Yes.	Dsk.	4	Bev.	E.	Tr.	Ext.	R. Int.	Wood.	S.	900x120	930x120
Berna	5	173	63	4-115x160	Blk.	L.	Fix.	Pres.	P.	None.	Yes.	Con.	4	I. G.	O.	Tr.	Ext.	R. Int.	Stl.	S.	900x160	1030x160

ABBREVIATIONS:—

Capacity:
P—Passengers

Cylinder Head:
Fix—Integral
Det—Detachable

Camshaft Drive:
Ch—Chain

He—Helical Gears
Sp—Spur Gears

Valve Location:
F—1 valve in head and 1 at side
I—Both valves in head
L—Both valves at side
S—Sleeve valve
T—Valves on opposite sides

Type of Lubricating System:
Pres—Pressure
Circ. or **Spl**—Splash (including systems which have pressure feed to main bearings only.)

Water Circulation:
P—Pump
T—Thermo-Syphon

Electric System:
Eisem—Eisemann
Opt—Optional

Governor:
Cent—Centrifugal

Clutch Type:
Con—Cone
D-C—Double Cone
Dsk—Disk
Pla—Plate

Percentages of Design Features in British Trucks, 1922

(*Continued from page* 365)

Ignition; Type
Magneto ..... 98 per cent
Battery ..... 2 per cent

Ignition Timing Control
Variable ..... 87 per cent
Fixed ..... 13 per cent

Impulse Starter
No ..... 73 per cent
Extra ..... 21 per cent
Yes ..... 6 per cent

Electric Lighting
Extra ..... 90 per cent
No ..... 6 per cent
Yes ..... 4 per cent

Electric Starter
No provision ..... 65 per cent
Supplied at an extra cost.... 35 per cent

Fuel Feed
Gravity ..... 89 per cent
Vacuum ..... 6 per cent
Pressure ..... 3 per cent
Optional ..... 2 per cent

Tank Location
Underseat ..... 67.0 per cent
On dashboard ..... 28.0 per cent
Optional ..... 2.0 per cent
At rear of frame ..... 1.5 per cent
At side of frame ..... 1.5 per cent

Engine Bearings—Crankshaft, Number
3 ..... 88 per cent
5 ..... 10 per cent
2 ..... 2 per cent

Crankshaft, Type
Plain ..... 88 per cent
Ball ..... 10 per cent
Roller ..... 2 per cent

Camshaft, Number
3 ..... 84 per cent
4 ..... 13 per cent
5 ..... 3 per cent

Camshaft, Type
Plain ..... 76 per cent
Ball and plain ..... 15 per cent
One ball, 2 plain ..... 6 per cent
Roller and plain ..... 3 per cent

Gearset Bearings—Mainshaft; Front
Ball ..... 81 per cent
Roller ..... 11 per cent
Plain ..... 8 per cent

Mainshaft, Rear
Ball ..... 74.5 per cent
Roller ..... 11 per cent
Plain ..... 8 per cent
Ball and roller ..... 6.5 per cent

Chassis Specifications—1922

NATIONALITY MAKE AND MODEL	Tons or Passenger Capacity	Wheelbase (Ins.)	No. Cyls. Bore and Stroke (Mm.)	Normal R.P.M.	Brake Horse Power	Valve Location	Camshaft Drive	Type of Lubricating System	Water Circulation	Electric System	Governor Type	Clutch Type	Forward Speeds	Final Drive	Torque Taken by	Type of Steering Gear	BRAKES Type & Location: Hand	BRAKES Type & Location: Foot	Chassis Weight (Lbs.)	Type of Wheels	TIRES: Kind	TIRES: Size in Millimetres: Front	TIRES: Size in Millimetres: Rear
GERMAN																							
Adler L	2	142	4- 86x135	1600	34	L...	Sp..	Spl....	P...	Bosch.	None..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	3200	C. St..	P...	975x175	1075x225
Adler L3D	3	169	4-101x156	1000	40	L...	Sp..	Spl....	P...	Eisem.	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	7060	C. St..	S...	930x140	1010x120
Adler L5A	5	178	4-110x156	1000	40	L...	Sp..	Spl....	P...	Fenag.	Cent..	Con..	4	Chn...	.....	Scr....	Int. R..	Ext. Tr..	7500	C. St..	S...	930x140	1030x140d
Benz 1½	1½	142	4-100x150	1200	30	L...	He..	Spl....	P...	Bosch.	Cent..	Dsk..	4	S. B..	T.T..	Scr....	Int. R..	Ext. Tr..	3860	Wood	P...	925x150	1025x200
Benz Bus	22P	165	4-110x165	1000	40	L...	He..	Spl....	P...	Bosch.	Cent..	Dsk..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	5960	S. dsk.	S...	930x120	930x120d
Benz 5	5	167	4-120x180	1000	50	L...	He..	Spl....	P...	.....	Cent..	Dsk..	4	Chn...	.....	Scr....	Int. R..	Ext. Tr..	7060	C. St..	S...	930x120	1050x160d
Bergmann 3½	3½	162	4-110x150	1150	38	L...	Sp..	Spl....	P...	.....	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	7720	C. St..	S...	.....	.....
Bergmann 2½	2½	152	4-110x150	1050	35	L...	Sp..	Spl....	P...	Bosch.	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	5070	C. St..	S...	.....	.....
Buessing II Bus	22P	173	4-110x150	1000	45	I...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	5300	A. dsk.	P...	975x175	1150x250
Buessing III Bus	26P	173	4-110x150	860	40	I...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	7060	C. St..	S...	930x120	1030x140d
Buessing V	4-5	181	4-130x130	860	40	I...	He..	Pres...	P...	Bosch.	Cent..	Con..	4	Chn...	.....	Wrm..	Int. R..	Ext. Tr..	8050	C. St..	S...	930x140	1050x160d
Daag E.C.	3-4	163	4-110x160	1000	45	L...	Sp..	Pres...	P...	.....	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	6830	C. St..	S...	930x120	1030x150d
Daag E.K.	4-5	179	4-125x160	1000	50	L...	Sp..	Pres...	P...	.....	Cent..	Con..	4	Chn...	.....	Wrm..	Int. R..	Ext. Tr..	7500	C. St..	S...	930x140	1050x160d
Daimler D.C.30	3½	157	4-108x150	1000	38	I...	Sp..	Pres...	P...	Opt...	Cent..	Con..	4	Bev...	T.A..	Scr....	Int. R..	Ext. Tr..	6520	C. St..	S...	770x120	770x140
Daimler DR4-5	4½	164	4-120x160	880	45	I...	Sp..	Pres...	P...	Opt...	Cent..	D.C..	4	I.G..	.....	Scr....	Int. R..	Ext. Tr..	8600	C. St..	S...	770x140	850x160
Dixi 4	4-5	171	4-120x180	850	55	L...	Sp..	Spl....	P...	.....	Cent..	Con..	4	Chn...	.....	Scr....	Int. R..	Ext. Tr..	6830	C. St..	S...	830x120	1030x140d
Dixi 3	3	157	4-110x165	1000	45	L...	Sp..	Spl....	P...	Bosch.	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	6280	C. St..	S...	930x120	1030x140d
Dixi 2	2	150	4- 95x165	1000	35	L...	Sp..	Spl....	P...	Bosch.	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	5070	C. St..	S...	930x120	930x120d
Duerkopp L¾	¾	129	4- 91x100	1500	24	L...	Sp..	Spl....	T...	.....	Cent..	Con..	4	S.B....	T.T..	Wrm..	Int. R..	Ext. Tr..	....	Wood.	P...	820x120	820x135
Duerkopp L1½	1½	141	4- 90x130	1500	28	L...	Sp..	Spl..	P...	.....	Cent..	Con..	4	S.B....	T.T..	Wrm..	Int. R..	Ext. Tr..	....	Wood.	.....	.....	.....
Duerkopp L3	3	164	4-115x130	1200	30	L...	Sp..	Spl....	P...	.....	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	....	C. St..	S...	930x120	1030x140d
Duerkopp L4-5	4-5	173	4-130x160	1100	56	L...	Sp..	Spl....	P...	.....	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	....	C. St..	S...	930x140	1050x160d
Faun B	2	152	4-116x150	950	42	L...	Sp..	Spl....	P...	Bosch.	Cent..	Dsk..	4	Wrm..	T.T..	Scr....	Int. R..	Ext. Tr..	4780	S. dsk.	S...	920x110	920x110d
Faun SN	3½	161	4-116x150	950	42	L...	Sp..	Spl....	P...	Bosch.	Cent..	Dsk..	4	Wrm..	Spr..	Scr....	Int. R..	Ext. Tr..	5960	Wood.	S...	830x120	930x120d
Faun SA4	4-5	161	4-116x150	950	42	L...	Sp..	Spl....	P...	Bosch.	Cent..	Dsk..	4	Chn...	.....	Scr....	Int. R..	Ext. Tr..	7950	C. St..	S...	930x120	1030x140d
Hansa-Lloyd L1½	1½	138	4- 90x140	1200	30	L...	Ch..	Pres...	T...	Bosch.	Cent..	Dsk..	4	Wrm..	T.T..	Scr....	Int. R..	Ext. Tr..	4080	C. St..	S...	860x 90	860x 90d
Hercules B1½	1½	147	4- 82x120	1100	20	L...	He..	Pres...	P...	.....	Cent..	Con..	3	Bev...	T.A..	Scr....	Int. R..	Ext. Tr..	....	Wood.	S...	860x 90	870x100
Hercules G2	2	152	4-110x150	1000	35	L...	He..	Pres...	P...	.....	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	5840	C. St..	S...	920x110	920x110d
Hille K3	3½	159	4-110x155	1100	40	I...	He..	Spl....	P...	.....	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	7720	C. St..	S...	930x120	1030x140d
Horch 1	1	136	4- 80x130	1800	30	L...	Ch..	Pres...	P...	Bosch.	Cent..	Con..	4	S.B....	T.T..	Scr....	Int. R..	Int. Tr..	2430	C. St..	P...	935x135	935x135
Horch 3	3	163	4-115x155	1000	42	L...	Ch..	Pres...	P...	Bosch.	Cent..	Con..	4	S.B....	T.T..	Scr....	Int. R..	Int. Tr..	6180	C. St..	S...	930x120	1010x120d
Magirus 1½	1½	129	4- 85x130	1400	25	L...	Sp..	Spl....	P...	Bosch.	Cent..	Dsk..	4	S.B....	Spr..	Scr....	Ext. R	Ext. Tr..	3750	Wood.	P...	880x125	880x125d
Magirus 2	2½	135	4- 95x150	1200	34	L...	Sp..	Spl....	P...	Bosch.	Cent..	Dsk..	4	S.B....	T.A..	Scr....	Ext. R	Ext. Tr..	4420	C. St..	S...	920x100	920x110
Magirus 2½	2½	140	4-110x160	1100	40	L...	Sp..	Spl....	P...	Bosch.	Cent..	Dsk..	4	S.B....	T.A..	Scr....	Ext. R	Ext. Tr..	4850	C. St..	S...	920x110	930x120
Magirus 3½	3-3½	173	4-135x180	1100	70	L...	Sp..	Spl....	P...	Bosch.	Cent..	Dsk..	4	S.B....	T.T..	Scr....	Ext. R	Ext. Tr..	6400	C. St..	S...	930x120	930x120
M.A.N. 2	2	152	4-112x160	1000	37	T...	Sp..	Pres...	P...	Opt...	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	4740	Wood.	S...	920x100	930x120d
M.A.N. 3	3-3½	165	4-112x160	1000	37	T...	Sp..	Pres...	P...	Opt...	Cent..	Con..	4	Bev...	T.T..	Wrm..	Int. R..	Ext. Tr..	5630	Wood.	S...	930x120	1030x140d
M.A.N. 4-5	4-5	160	4-120x180	1000	45	T...	Sp..	Pres...	P...	Opt...	Cent..	Con..	4	Chn...	.....	Wrm..	Int. R..	Ext. Tr..	6420	Wood.	S...	830x120	1030x140d
Mannesmann-Mulag LC	3-3½	122	4-125x150	900	44	T...	Sp..	Pres...	P...	.....	Cent..	Con..	4	Bev...	T.A..	Wrm..	Int. R..	Ext. Tr..	6830	S. dsk.	S...	930x120	1030x140d
Mannesmann-Mulag 56C	4-5	165	4-130x150	900	52	T...	Sp..	Pres...	P...	.....	Cent..	Con..	4	Chn...	.....	Wrm..	Int. R..	Int. Tr..	9260	S. dsk.	S...	930x140	1030x140d
Nacke III	3	157	4-108x160	950	38	F...	Sp..	Spl....	P...	.....	Cent..	Con..	4	Wrm..	Spr..	Scr....	Int. R..	Ext. Tr..	6620	C. St..	S...	930x120	1010x120d
N.A.G. L8	4-5	178	4-120x170	900	45	I...	Sp..	Pres..	P...	Bosch.	Cent..	Con..	7	Bev...	T.A..	Scr....	Int. R..	Ext. Tr..	7280	S. dsk.	P...	1015x200	1015x200d
N.A.G. L8C	4-5	178	4-120x170	900	45	I...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Chn...	.....	Scr....	Int. R..	Ext. Tr..	7620	C. St..	S...	930x140	1030x140d
N.A.G. KL	3	163	4-120x170	900	45	I...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Bev...	T.A..	Scr....	Int. R..	Ext. Tr..	6620	C. St..	S...	930x120	1030x140d
N.A.G. Bus	26P	166	4-120x170	900	45	L...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Bev...	T.A..	Scr....	Int. R..	Ext. Tr..	7180	C. St..	S...	930x120	1030x140d
Opel 4	4	168	4-115x150	1000	40	L...	He..	Pres...	P...	Bosch.	Cent..	Con..	4	Bev...	T.A..	Wrm..	Int. R..	Ext. Tr..	....	C. St..	S...	930x120	1050x140d
Richard & Hering 2	2	169	4-100x140	1100	38	L...	Sp..	Pres...	P...	.....	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	3970	Wood.	S...	870x100	870x100d
Vomag 2	2	152	4-110x160	1000	35	L...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	5300	Wood.	S...	920x100	930x120d
Vomag 3	3	159	4-110x160	1000	35	L...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	5960	Wood.	S...	930x120	1010x120d
Vomag 3C	3	165	4-110x160	1000	35	L...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Chn...	.....	Scr....	Int. R..	Ext. Tr..	6400	Wood.	S...	930x120	930x120d
Vomag 4-5C	4-5	178	4-115x160	1000	42	L...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Chn...	.....	Scr....	Int. R..	Ext. Tr..	6620	C. St..	S...	930x120	1030x140d
Vomag 4-5	4-5	178	4-115x160	1000	42	L...	Sp..	Pres...	P...	Bosch.	Cent..	Con..	4	Bev...	T.T..	Scr....	Int. R..	Ext. Tr..	6620	C. St..	S...	930x120	1030x140d

Propeller Shaft:
O—Open
E—Enclosed

Final Drive:
Bev—Bevel Gear
Chn—Chain
D-R—Double reduction
I-G—Internal Gear
S-B—Spiral Bevel

Pln—Planetary
Wrm—Worm

Torque Taken By:
Spr—Springs
T-T—Torque Tube
T-A—Torque Arm

Type of Steering Gear:
Scr—Screw
Wrm—Worm

Type of Wheels:
A-dsk—Aluminum Disk
C-St—Cast Steel
C-Sol—Cast Solid
S-dsk—Steel Disk
Stl—Steel

Brake Type and Location:
R—on Rear Wheels
Tr—On Gearset

Bnd—Band
Int—Internal
Ext—External

Tires, Kind:
P—Pneumatic
S—Solid
d—Dual

*—all rear tires on French, Italian and Swiss trucks listed are dual.

Layshaft, Front and Rear
Ball .....81 per cent
Roller .....11 per cent
Plain ..... 8 per cent

Pilot
Ball .....49 per cent
Plain .....34 per cent
Floating bush .....10 per cent
Roller ..... 7 per cent

Wheel Bearings, Front
Floating bush .....60 per cent
Roller .....16.5 per cent
Plain .....16.5 per cent
Ball ..... 7 per cent

Rear
Floating .....53 per cent
Plain .....20 per cent
Roller .....18 per cent
Ball ..... 9 per cent

Differential Bearings
Ball .....82 per cent
Roller .....13 per cent
Plain ..... 5 per cent

Clutch, Type
Cone .....58 per cent
Dry single plate .....22 per cent
Inverted cone .....18 per cent
Dry multiplate ..... 2 per cent

Clutch Shaft Universals, Type; Front
Fabric disk .....41 per cent
Pot .....15 per cent
Miscellaneous metallic .....14 per cent
Toothed ring .....10 per cent
Leather disk ..... 8 per cent
Steel disk ..... 7 per cent
Sliding ..... 5 per cent

Rear
Fabric disk .....40 per cent
Miscellaneous .....22 per cent
Pot .....16 per cent
Leather disk ..... 9 per cent
Steel disk ..... 9 per cent
Toothed ring ..... 4 per cent

Gearset Location
Separate in main frame.....58 per cent
Separate in sub frame.....37 per cent
Unit with engine ..... 5 per cent

No. of Speeds
4 .....76 per cent
3 .....22 per cent
3 or 4 ..... 2 per cent

Position of Lever
Right .....89 per cent
Central .....11 per cent

Propeller Shaft, Type
Open .....77 per cent
Semi-enclosed .....23 per cent

Propeller Shaft Joints, Front
Star .....50 per cent
Pot .....15 per cent
Cross pin .....12 per cent
Leather disk .....12 per cent
Fabric disk ..... 9 per cent
Internal tooth ..... 2 per cent

Tractor Design Trends Reflected in 1922 Specifications

More models in three-plow class than in other size groups. Tendency toward higher plowing speeds is noted. Proportion of valve-in-head engines shows marked increase but percentage of vertical cylinder types is decreased. Water injection with fuel in over 40 per cent of all models listed.

By P. M. Heldt

THE table of tractor specifications this year covers 123 tractor models. It includes only tractors adapted for field plowing, and no motor cultivators and garden tractors. These are listed in a separate table on pages 372 and 373. One reason for eliminating these two classes from the table is not that we consider them of lesser importance, but rather that, by confining the table to regular field tractors, we get a more precise picture of practice in tractor design when working out the percentages of various features. The table last year contained the specifications of 122 tractors, among which there were six motor cultivators and garden tractors. It would thus seem that the industry during the past year had grown, in spite of the unfavorable economic situation. The growth referred to, of course, is one measured by number of models in production and not by volume of business done.

Of the 123 tractors listed, four are 1-plow tractors; 13, 2-plow; 8, 2-3 plow; 34, 3-plow; 14, 3-4 plow; 20, 4-plow; 5, 4-5 plow, and 17, 5 or more plow, while 8 have no plow rating. For tractors to have no rating in terms of the number of plow bottoms they will pull is new.

Last year we included the 2-3-plow tractors in the 2-plow class and the 3-4 plow tractors in the 3-plow class. Following that method, the tractors listed this year divide as follows: Single-plow, 4; 2-plow, 21; 3-plow, 48; 4-plow, 25; more than 4-plow, 17; no rating, 8.

Plowing speeds of the 2-plow tractors vary all the way from 2 to 3½ m.p.h., the average being 2.62 m.p.h. In the 3-plow class the limits of speeds are exactly the same, but the average is a trifle lower—2.59 m.p.h. Speeds of 4-plow tractors vary from 2 to 3¼ m.p.h. and the average figures out to 2.57 m.p.h. The tractors of more than 4-plow capacity have plowing speeds of 1.9 to 3 m.p.h., the average being 2.31 m.p.h.

Some years ago the S.A.E. Tractor Division adopted a standard plowing speed of 2 1/3 m.p.h., which was based on the average practice at that time. It will be seen from the averages derived from our table that there is a tendency toward increased plowing speeds, and there are few new models brought out that are designed to operate at less than 3 m.p.h., but in view of the numerous old models which are continued from year to year the average naturally changes slowly.

There is a strong tendency toward the use of the valve-in-head engine, which is more pronounced in the tractor field than in any other branch of the automotive industry except possibly that of aircraft. Of this year's tractors 55.5 per cent have valve-in-head engines, 42.8 per cent L-head and 1.7 per cent (two models) T-head engines.

The vertical engine being very far in the lead in all other branches of the industry, one would naturally expect it to gain in the tractor industry, where the horizontal type is rather strongly intrenched with the old line manufacturers. It is therefore quite surprising to find that whereas last year the vertical engines constituted 76 per cent of the total, this year their proportion amounted to only 71.5 per cent, the remainder in each case being horizontal engines.

In making a comparison of the percentages of engines with different numbers of cylinders, it is seen that the four-cylinder had gained somewhat. This gain is very slight, however, and is accounted for by the fact that this year single and six-cylinder engines are each found on only a single tractor, as against two tractor models each last year. The comparative figures are as follows:

	1921	1922
Single cylinder engines	2 per cent	0.8 per cent
Two cylinder engines	15 per cent	14.7 per cent
Four cylinder engines	81 per cent	83.7 per cent
Six cylinder engines	2 per cent	0.8 per cent

Another unexpected discovery is that block casting has receded in popularity; considering only the four-cylinder engines, 54 per cent were block-cast last year, but only 42.9 per cent this year. The pair-cast engine is now found on 47.6 per cent of the four-cylinder tractors, as compared with 38 per cent last year, and the singly cast on 9.5 per cent, as compared with 8 per cent last year.

Governors are almost universally fitted to the engines, and with two exceptions these are of the centrifugal type. One of the exceptions is an hydraulic governor and the other an electric. Only the Oil-Pull tractor uses oil as the cooling medium, all others employing water.

While in respect to most features the changes one way or the other are insignificant, there has been a decided trend away from thermo-siphon toward pump circulation of the cooling medium. Last year 26 per cent of all tractors had thermo-siphon cooling, this year the proportion has shrunk to 16.3 per cent. It would almost seem that in tractor work where, on account of the heavy duty character of the service and the frequent use of kerosene as fuel, the transfer of heat to the jacket is intense, the thermo-siphon system of circulation had not proved entirely satisfactory.

In connection with the lubrication system we have this year introduced a somewhat different system of classification from that employed last year, which renders a comparison impossible. We distinguish between the hollow crankshaft system, the circulating splash system and the mechanical lubricator system, also sometimes referred to as the non-circulating system. Then there is a fourth system in which oil is fed under pressure to the main bearings but all other parts are lubricated by splash. This simple classification does not fully identify each system, but is sufficiently definite to serve our purpose. It is found

that 41.7 per cent of the engines have hollow crankshaft lubrication; 40 per cent circulating splash; 15.8 per cent mechanical lubricators, and 2.5 per cent pressure lubrication without a hollow crankshaft.

Of the pumps employed in the lubricating system 63.1 per cent are of the gear type this year, as compared with 60 per cent last year; 29.1 per cent of the piston type as compared with 34.6 per cent, and 7.8 per cent of the vane or eccentric type, as compared with 5.4 per cent.

Water is injected with the fuel in 41.5 per cent of all tractor models. In connection with 22.8 per cent of the tractors listed no pretense is made to using any heavier fuel than gasoline. Hence of the tractors in which heavier fuels may be used, 54 per cent use water injection as a means of controlling the fuel knock.

Gravity fuel feed, always the predominant method in tractor practice, has almost exactly maintained its last year's standing. Its representation is 85.4 per cent this year as compared with 86 per cent last year. Vacuum fuel feed has gained somewhat at the expense of pump or pressure feed. In 1921, 9 per cent had pump feed and 5 per cent vacuum feed, while this year each method of feed is represented on 7.3 per cent of the tractors.

Fuel Tank Capacities

A determination was made this year for the first time of the average total fuel capacity of each class of tractor according to plow capacity. It was found that the 2-plow tractors have an average capacity of 15.5 gal.; the 2-3 plow, 21 gal.; the 3-plow, 22 gal.; the 3-4 plow, 24.5 gal., and the 4-plow, 30 gal. This refers to the total fuel capacities. That is, where provision is made for carrying two fuels, the capacities for both are added together. If we take the fuel capacities of the 2, 3 and 4-plow tractors we see that they are closely proportional to the plow capacities. For each plow a fuel supply of about 7½ gal. can be carried. The endeavor usually is to make the fuel tank capacity ample for a day's operations. As the fuel consumption increases with the speed of plowing—all other things being equal—it is well to note that this general average of 7½ gal. per plow bottom also corresponds to the average speed of about 2.6 m.p.h. If the plowing speed is higher it would evidently be advisable to provide, for a somewhat greater fuel supply, while if the speed is lower a smaller supply will suffice.

Only three models of tractors are being equipped with battery ignition and the magneto remains the almost exclusive ignition source. It is noteworthy that there are many blank spaces in the ignition system column, indicating that many manufacturers have not yet concluded arrangements for their ignition equipment for the year, or at least had not when the questionnaire was filled out.

Practice as regards types of clutch remains about the same. Disk and plate are still the most used type, shoe clutches holding second place. The percentages are as follows: Dry disk and plate, 52.7 per cent; shoe, 26.4 per cent; contracting, 8.2 per cent.; cone, 7.3 per cent; disk in oil, 5.4 per cent. Last year the classification was somewhat different, the disk in oil and the contracting clutches not being separated out, and friction driven tractors, which have no clutch, being included in the percentages. The proportions then were: Friction driven, 7 per cent.; cone, 3 per cent; disk, 60 per cent; block, 30 per cent. It is quite likely that most of the contracting clutches in this year's tabulation would also come under the heading block clutches.

Not so many tractors have three forward speeds as formerly. The following table gives a comparison of last year's tractors with the present ones with respect to number of forward speeds provided.

	1921	1922
Single speed	15 per cent	18 per cent
Two speeds	58 per cent	59 per cent
Three speeds	24 per cent	18 per cent
Four or more speeds	3 per cent	5 per cent

Fifteen out of 123 tractors are provided with a differential lock. Of course, there are a few among these 123 tractors which have no differential and therefore could not have a lock for same. Live axles, which mean completely enclosed drives at the center of the tractor, are found on 30.9 per cent of the models.

Steering is in 70.7 per cent of the models by means of steering knuckles, or what is known as the Ackermann steering, while 20 per cent have swinging front axles and 9.3 per cent miscellaneous steering mechanisms. Some of these 9.3 per cent are two-wheel tractors which steer by the curved rack or gear sector method, and at least one steers by means of a fork like a bicycle.

Thirteen of the 123 tractors listed, or 10.5 per cent, are of the creeper type. This compares with 6 per cent creepers in 1921, but with 14.5 and 14 per cent in 1920 and 1919 respectively.

Frames of structural steel, chiefly channels, are used on 78.4 per cent of all the models; pressed steel frames on 2.4 per cent; cast frames on 9.2 per cent, while 10 per cent of the tractors have no frames.

The wheelbase of a tractor is not easily changed, and if the averages this year are somewhat different from last year it is partly due to the fact that then the 2-3 plow tractors were counted as 2-plow and the 3-4 plow as 3-plow. The following table gives the averages for both years:

	1921	1922
Two-plow tractors	79.5 (79.5)	76.2
Two-three plow tractors	..	84.6
Three-plow tractors	85 (85.5)	85.2
Three-four plow tractors	..	86.4
Four-plow tractors	100	92

The figures in parenthesis indicate the results for 1922 worked out on the same basis as for 1921, and show that there has been no material change.

Drive wheel diameters during the two years compare as follows:

	1921	1922
Two-plow tractors	46.3 in.	47 in.
Three-plow tractors	53.4 in.	51.2 in.
Four-plow tractors	57 in.	58.4 in.

In this comparison all 2-3 plow tractors are counted as 2-plow and all 3-4 plow as 3-plow. Keeping the hypenated ratings apart, the results for 1922 are as follows: Two-plow, 44.5 in.; 2-3 plow, 50.4 in.; 3-plow, 50.5 in.; 3-4 plow, 52,5 in.; 4-plow, 56.5 in.; 4-5 plow, 67 in.

There has been no appreciable change in the average weight. Weights of 1922 tractors of the different classes average as follows: Two-plow, 3450 lb.; 2-3 plow, 4300 lb.; 3-plow, 5085 lb.; 3-4 plow, 6180 lb.; 4-plow, 7150 lb.; 4-5 plow, 12,000 lb.

Garden Tractors

Garden tractor and garden tractor engine specifications are given this year in a separate table as separate units, although some garden tractors have appeared in previous tabulations. These specifications are of special interest at this time, as there is a belief in certain quarters that the small tractor has an excellent commercial future.

Three firms are shown as manufacturing stock engines for garden tractors. Two of these stock jobs are of the 4-cycle type, the Evinrude motor being of the 2-cycle type. A non-detachable cylinder head is used in every case, as is the four-point engine support. Gasoline is the fuel burned in each of the stock garden tractor engine models.

Specifications of American

Name and Model	Price	Plow Capacity	Plowing Speed M. P. H.	H. P. Rating	Make	No. Cyl., Bore and Stroke	Cylinder Type	R. P. M.	Engine Type	Cylinder Cast	GOVERNOR: Make of Governor	GOVERNOR: Type of Governor	Weight, Lbs.	COOLING SYSTEM: Cooling Fluid	COOLING SYSTEM: Cooling Capacity, Gals.	COOLING SYSTEM: Radiator Make	COOLING SYSTEM: Fluid Circulat'n	LUBRICATION: Lubrication System, Type	LUBRICATION: Oil Pump, Type	FUEL: Carburetor Make and Size, Ins.	FUEL: Water Injected with Fuel
All-in-One....A	$1,975	2-3	2⅓	15-30	Weidely...	4-4x5½	I...	900	Vert..	Block.	Weidely...	Cent....	....	W..	12½	Own.....	Pump.	Hol-C.S....	Piston...	Kingston...1¼	.....
Allis-Chalmers.....	.....	1	2½	6-12	LeRoy....	4-3⅛x4½	L...	1000	Vert..	Block.	LeRoy....	Cent....	....	W..	3½	Own.....	Ther..	Circ-Sp....	Piston...	Kingston... ⅞	No...
Allis-Chalmers.....	.....	3	2½	14-27	Midwest...	4-4⅛x5¼	I...	1100	Vert..	Pairs..	Midwest...	Cent....	905	W..	6	Own.....	Pump.	Hol-C.S....	Gear....	Kingston...1¼	No...
Allis-Chalmers.....	.....	3-4	2⅓	18-30	Own.....	4-4¾x6½	I...	830	Vert..	Block.	Own.....	Cent....	1580	W..	10	Own.....	Pump.	Hol-C.S....	Gear....	Kingston...1½	Yes...
Allis-Chalmers.....	.....	4	2½	22-38	Own.....	4-4¾x6½	I...	930	Vert..	Block.	Own.....	Cent....	1580	W..	10	Own.....	Pump.	Hol-C.S....	Gear....	Kingston...1¾	No....
Allwork.....G	.....	3	2½	14-28	Own.....	4-4¾x6	L...	900	Vert..	Singly.	Own.....	Cent....	1180	W..	10	Perfex....	Pump.	.....	Piston...	Kingston...1½	No...
Allwork.....C	.....	3	2¾	14-28	Own.....	4-5x6	L...	900	Vert..	Singly.	Own.....	Cent....	1200	W..	12	Perfex....	Pump.	Hol-C.S...	Gear....	Kingston...1½	No...
Andrews-Kinkade.....D	2,400	....	.....	.....	Climax....	4-5x6½	L...	800	Vert..	Pairs..	Climax....	Cent....	1175	W..	12	Spirex....	Pump.	Hol-C.S...	Vane....	Stromberg..1½	Yes-K
Appleton.....	1,500	....	.....	12-20	Buda.....	4-4¼x5½	L...	1000	Vert..	Block.	Pickering..	Cent....	800	W..	8	Modine...	Pump.	Hol-C.S...	Gear....	Schebler....1¼	Yes...
Aro.....	495	....	.....	.....	.....	1-4½x5	....	800	Vert..	Singly.	.....	.....	....	W..	2	S-J.....	Ther..	Circ-Sp....	Piston...	Schebler....1¼	.....
Aultman-Taylor.....	.....	4	2¼	15-30	Climax....	4-5x6½	L...	900	Vert..	Pairs..	Climax....	Cent....	1100	W..	8⅛	G & O....	Pump.	Hol-C.S...	Vane....	Kingston...1⅜	No...
Aultman-Taylor.....	.....	6	2¼	22-45	Own.....	4-5½x8	I...	600	Hori..	Pairs..	Own.....	Cent....	2875	W..	85	Own.....	Pump.	Mech.....	.....	Kingston...2	Yes...
Aultman-Taylor.....	.....	8-10	2¼	30-60	Own.....	4-7x9	I...	550	Hori..	Pairs..	Own.....	Cent....	3790	W..	120	Own.....	Pump.	Mech.....	.....	Kingston...2½	Yes...
Automotive.....	1,785	3	.....	12-24	Hercules...	4-4x5⅛	L...	1000	.....	Block.	Pierce....	Cent....	850	W..	7½	McCord...	Pump.	Pres.....	Gear....	Kingston.....	No...
Avery.....	.....	2-3	.....	8-16	Own.....	2-5½x6	I...	750	Opp...	Singly.	Own.....	Cent....	925	W..	12½	Own.....	Ther..	Circ-Sp....	Gear....	Kingston...1¼	Yes...
Avery.....	.....	3-4	.....	12-20	Own.....	4-4½x6	I...	950	Opp...	Block.	Own.....	Cent....	1250	W..	11	Own.....	Pump.	Mech.....	.....	Kingston...1¼	Yes...
Avery.....	.....	3-4	.....	12-25	Own.....	2-6½x7	I...	700	Opp...	Singly.	Own.....	Cent....	1350	W..	17½	Own.....	Ther..	Circ-Sp....	Gear....	Kingston...1½	Yes...
Avery.....	.....	3-4	.....	14-28	Own.....	4-4⅝x7	I...	900	Opp...	Block.	Own.....	Cent....	1620	W..	30	Own.....	Ther..	Circ-Sp....	Gear....	Kingston...1¼	.....
Avery.....	.....	4-5	.....	18-36	Own.....	4-5½x6	I...	750	Opp...	Pairs..	Own.....	Cent....	2150	W..	33	Own.....	Ther..	Circ-Sp....	Gear....	Kingston...1½	Yes...
Avery.....	.....	5-6	.....	25-50	Own.....	4-6½x7	I...	700	Opp...	Pairs..	Own.....	Cent....	2700	W..	55	Own.....	Ther..	Circ-Sp....	Gear....	Kingston...2	Yes...
Avery.....	.....	8-10	.....	45-65	Own.....	4-7¾x8	I...	600	Opp...	Pairs..	Own.....	Cent....	3300	W..	90	Own.....	Ther..	Circ-Sp....	Gear....	Kingston...2	Yes...
Avery.....	.....	2	.....	.....	Own.....	6-3x4	I...	1250	Vert..	Block.	Own.....	Throt...	470	W..	6¾	Own.....	Ther..	Circ-Sp....	Gear....	Kingston... ⅞	No...
Avery Track Runner.....	.....	3	2 1/16	.....	Own.....	4-4x5½	I...	1000	Vert..	Block.	Own.....	Hydr....	....	W..	....	.....	Pump.	Hol-C.S....	.....	Kingston.....	.....
Bates.....	.....	3	2½	15-25	Own.....	4-4¼x6	I...	800	Hori..	Block.	Own.....	Cent....	975	W..	8	Own.....	Pump.	Hol-C.S...	Gear....	Own.....1½	Yes...
Bates (Steel Mule).....F	.....	3	3½	18-25	Midwest...	4-4⅛x5¼	I...	1100	Vert..	Pairs..	Simplex...	Cent....	1000	W..	6	Perfex....	Pump.	Hol-C.S...	Gear....	Bennett....1¼	No...
Best.....30	3,100	4	3 1/16	18-30	Own.....	4-4¾x6½	I...	800	Vert..	Singly.	Own.....	Cent....	1600	W..	9	Own.....	Pump.	Hol-C.S...	Gear....	Ensign.....1½	No...
Burn-Oil.....	1,495	3	4	15-30	Own.....	2-6¾x7	I...	700	Hori..	Pairs..	Own.....	Cent....	....	W..	16	Eureka....	Pump.	Mech.....	.....	Schebler....1½	No...
Case.....10-18	.....	2	3	10-18	Own.....	4-3⅞x5	I...	1050	Vert..	Block.	Own.....	Cent....	....	W..	9	Own.....	Pump.	Hol-C.S...	Piston...	Kingston...1⅛	No...
Case.....15-27	.....	3-4	2¼-3	15-27	Own.....	4-4½x6	I...	900	Vert..	Block.	Own.....	Cent....	....	W..	11	Own.....	Pump.	Hol-C.S...	Piston...	Kingston...1⅜	No...
Case.....22-40	.....	4-5	3¼	22-40	Own.....	4-5½x6¾	I...	850	Vert..	Pairs..	Own.....	Cent....	....	W..	15½	Own.....	Pump.	Mech.....	.....	Kingston...2	Yes...
Caterpillar.....T-11	.....	4	3	25-	Own.....	4-4¾x6	I...	900	Vert..	Pairs..	Own.....	Cent....	1400	W..	7½	Modine...	Pump.	Hol-C.S....	Gear....	Schebler....1½	No...
Caterpillar.....T-16	.....	6	3	40-	Own.....	4-6½x7	I...	700	Vert..	Singly.	Own.....	Cent....	2300	W..	12	Own.....	Pump.	Hol-C.S...	Gear....	Kingston...2	No...
Chase.....12-25	1,825	3	2¾	12-25	Buda.....	4-4½x5½	L...	1050	Vert..	Block.	Pierce....	Cent....	....	W..	8½	.....	Pump.	Hol-C.S...	Gear....	Kingston...1½	.....
Cletrac.....F	795	....	.....	9-16	Own.....	4-3¼x4½	L...	1600	Vert..	Block.	Own.....	Cent....	....	W..	....	McCord...	Pump.	Circ-Sp....	Piston...	Tillotson...1	.....
Cletrac.....W	1,345	2	3½	12-20	Own.....	4-4x5½	I...	1265	Vert..	Block.	Own.....	Cent....	....	W..	....	McCord...	Pump.	Mech.....	Gear....	Kingston...1¼	No...
Dakota.....	1,750	3	2¾	15-27	Doman....	4-4¾x6	T...	800	Vert..	Pairs..	Doman....	Cent....	800	W..	16	S.-J.....	Pump.	Hol-C.S...	Gear....	Linga.....1¼	No...
Depue.....A	2,800	3	.....	20-30	Buda.....	4-4½x6	L...	1000	Vert..	Block.	Simplex...	Cent....	950	W..	8	Perfex....	Pump.	Hol-C.S...	Gear....	Stromberg..1½	No...
Emerson-Brantingham 12-20	.....	3	2.7	12-20	Own.....	4-4¾x5	L...	900	Vert..	Pairs..	Own.....	Cent....	997	W..	7½	Modine...	Pump.	Circ-Sp....	Piston...	Stromberg..1½	Yes...
Emerson-Brantingham....Q	.....	3	2.26	12-20	Own.....	4-4¾x5	L...	850	Vert..	Pairs..	Pickering..	Cent....	1100	W..	9	Perfex....	Pump.	Circ-Sp....	Piston...	Bennett....1½	Yes...
Emerson-Brantingham 16-32	.....	4	2.26	16-32	Own.....	4-5¼x7	L...	750	Vert..	Pairs..	Pickering..	Cent....	2000	W..	10	Modine...	Pump.	Circ-Sp....	Piston...	Stromberg..1¾	Yes...
Fageol.....D	.....	2	2.0	9-18	Lycoming..	4-3½x5	L...	1200	Vert..	Block.	Red Devil.	Cent....	....	W..	....	Perfex....	Pump.	Circ-Sp....	Piston...	Tillotson.....	No...
Farm Horse.....B	1,885	4	2.5	18-30	Climax....	4-5x6½	L...	850	Vert..	Pairs..	Climax....	Cent....	1400	W..	10	S.-J.....	Pump.	Mech.....	Vane....	Bennett....1½	Yes...
Farquhar.....15-25	.....	3-4	2.0	15-25	Buda.....	4-4½x6	L...	1000	Vert..	Block.	Pierce....	Cent....	1057	W..	12	Perfex....	Pump.	Hol-C.S...	Gear....	Kingston...1¼	No...
Farquhar.....4-30	.....	4-5	2.3	18-35	Own.....	4-6x8	I...	550	Vert..	Pairs..	Own.....	Cent....	....	W..	94	Own.....	Pump.	Circ-Sp....	Gear....	Kingston...2	No...
Farquhar.....4-40	.....	6-7	2.3	25-50	Own.....	4-7x8	I...	550	Vert..	Pairs..	Own.....	Cent....	....	W..	94	Own.....	Pump.	Circ-Sp....	Gear....	Kingston...2	No...
Fordson.....	395	2	2.5	-18	Own.....	4-4x5	L...	1000	Vert..	Block.	.....	.....	650	W..	12	Own.....	Ther..	Circ-Sp....	.....	Holley.....1¼	Yes...
Fox.....E	3,100	4	2.6	20-40	Own.....	4-5½x7½	I...	650	Hori..	Pairs..	Own.....	Cent....	2017	W..	12	Perfex....	Pump.	Hol-C.S....	.....	Kingston...1½	Yes...
Frick.....A	.....	2-3	2⅓	12-20	Erd.....	4-4x6	I...	900	Vert..	Block.	Erd.....	Cent....	900	W..	7¾	Perfex....	Pump.	Circ-Sp....	Piston...	Kingston...1¼	No...
Frick.....C	.....	3-4	2.1	15-28	Beaver....	4-4¾x6	I...	900	Vert..	Block.	Taco.....	Cent....	1000	W..	9¾	Perfex....	Pump.	Hol-C.S...	Gear....	Bennett....1½	No...
Gray.....	.....	4	3.0	18-36	Waukesha.	4-4¾x6¾	L...	950	Vert..	Pairs..	Waukesha.	Cent....	840	W..	8	.....	Pump.	Circ-Sp....	Gear....	Bennett....1½	No...
Hart-Parr.....	945	2	3.0	-20	Own.....	2-5¼x6½	I...	800	Hori..	Pairs..	Own.....	Cent....	890	W..	7¾	Perfex....	Pump.	Mech.....	Piston...	Schebler....1¼	Yes...
Hart-Parr.....	1,295	3	3.0	-30	Own.....	2-6½x7	I...	750	Hori..	Pairs..	Own.....	Cent....	1170	W..	10	Perfex....	Pump.	Mech.....	Piston...	Schebler....1½	Yes...
Heider.....D	870	2	2.5	9-16	Waukesha.	4-4¼x5¾	L...	1000	Hori..	Pairs..	Waukesha.	Cent....	800	W..	9	Perfex....	Pump.	Circ-Sp....	Gear....	Kingston...1	Yes...
Heider.....C	995	3	2.25	12-20	Waukesha.	4-4½x6¾	L...	900	Hori..	Pairs..	Waukesha.	Cent....	900	W..	10	Perfex....	Pump.	Circ-Sp....	Gear....	Kingston...1¼	Yes...
Huber.....	1,185	3	2.5	12-25	Waukesha	4-4½x5¾	L...	1000	Vert..	Pairs..	Waukesha.	Cent....	600	W..	8	Perfex....	Pump.	Circ-Sp....	Gear....	Kingston...1¼	Yes...
Huber.....	1,885	3	3.0	15-30	Midwest...	4-4½x6	I...	1000	Vert..	Pairs..	Taco.....	Cent....	1200	W..	11¼	Perfex....	Pump.	Hol-C.S...	Gear....	Kingston...1¼	No...
Illinois.....C	.....	4	2.5	15-30	Climax....	4-5x6½	L...	850	Vert..	Pairs..	Climax....	Cent....	1000	W..	7	Modine...	Pump.	Hol-C.S...	Eccentric	Stromberg..1½	No...
Imperial.....	5,000	12	2.25	40-70	Own.....	4-7½x9	I...	400	Hori..	Singly.	Own.....	Cent....	4500	W..	45	Own.....	Pump.	Mech.....	Piston...	Kingston...2	Yes...
Indiana.....F	895	1	2.5	5-10	LeRoi....	4-3⅛x4½	L...	1000	Vert..	Block.	LeRoi....	Cent....	335	W..	5	Candler...	Ther..	Circ-Sp....	Piston...	Kingston...1	.....
International.....8-16	670	2	2.75	8-16	Own.....	4-4¼x5	I...	1000	Vert..	Block.	Own.....	Cent....	....	W..	11	.....	Ther..	Circ-Sp....	Piston...	Ensign.....	No...
International.....15-30	.....	3	3.0	15-30	Own.....	4-4½x6	I...	1000	Vert..	Block.	Own.....	Cent....	....	W..	....	.....	Ther..	Circ-Sp....	Gear....	Ensign.....	Yes...
International.....15-30	.....	4	2.4	15-30	Own.....	4-5¼x8	I...	575	Hori..	Pairs..	Own.....	.....	....	W..	40	.....	Pump.	Mech.....	.....	Own.....	Yes...
Klumb.....	.....	4	2.5	18-32	Climax....	4-5x6½	L...	850	.....	Pairs..	Own.....	Cent....	1150	W..	10	S.-J.....	Pump.	Pres.....	Vane....	Stromberg.....	Yes...
Knudson.....	2,000	4	3.0	25-45	Own.....	4-5⅛x9	I..	500	Vert..	Singly.	Own.....	Cent....	1500	W-O	35	Own.....	Ther..	Circ-Sp....	Ec'entric	Own.....1¾	Yes...
Lauson.....S	1,495	3	3.25	12-25	Midwest...	4-4⅛x5¼	I...	1200	Vert..	Pairs..	Taco.....	Cent....	950	W..	8	Perfex....	Pump.	Hol-C.S...	Gear....	Kingston...1¼	No...
Lauson.....15-30	1,985	3-4	2.5	15-30	Beaver....	4-4¾x6	I...	950	Vert..	Block.	Taco.....	Cent....	1100	W..	12	Perfex....	Pump.	Hol-C.S...	Gear....	Kingston...1½	.....
Leader.....M	.....	3-4	2.25	16-32	Climax....	4-5x6½	L...	800	Vert..	Pairs..	Climax....	Cent....	1200	W..	12	.....	Pump.	Hol-C.S...	Gear....	Stromberg..1½	No...
Leader.....G-U	.....	3-4	2.25	18-36	Climax....	4-5x6½	L...	900	Vert..	Pairs..	Climax....	Cent....	1200	W..	12	.....	Pump.	Circ-Sp....	Gear....	Stromberg..1½	No...
Leonard.....	2,530	3	2.7	20-30	Buda.....	4-4½x6	L...	1000	Vert..	Block.	Duplex....	Cent....	....	....	....	.....	Pump.	Hol-C.S...	Gear....	Zenith.....1¼	No...
Linn.....	5,100	6	2.0	.....	Waukesha	4-5x6¼	L...	1000	Vert..	Pairs..	Waukesha.	Cent....	1000	W..	....	McCord...	Pump.	Circ-Sp....	Gear....	Schebler....1½	No...
Little Giant.....B	2,200	4	2.5	16-22	Own.....	4-4½x5	L...	950	Vert..	Pairs..	Own.....	Cent....	1250	W..	9	S.-J.....	Pump.	Circ-Sp....	Gear....	Kingston...1½	Yes...
Little Giant.....A	3,300	6	2.5	26-55	Own.....	4-5½x6	L...	750	Vert..	Pairs..	Pickering..	Cent....	1650	W..	10	S.-J.....	Pump.	Circ-Sp....	Gear....	Stromberg..1¾	Yes...
Minneapolis.....	900	3	2.21	12-25	Own.....	4-4½x7	....	750	.....	Block.	Own.....	Cent....	....	W..	8⅞	Cellulos...	Pump.	Mech.....	.....	Kingston...1½	Yes...
Minneapolis.....	.....	3-4	2.75	17-30	Own.....	4-4¾x7	....	775	.....	.....	Own.....	Cent....	....	W..	8½	S.-J.....	Pump.	Mech.....	.....	Kingston...1¾	Yes...
Minneapolis.....	.....	4-5	2.7	22-44	Own.....	4-6x7	....	700	.....	Pairs..	Own.....	Cent....	....	W..	14	S.-J.....	Pump.	Mech.....	.....	Kingston...2	Yes...
Minneapolis.....	.....	8-10	2.1	35-70	Own.....	4-7¼x9	....	550	.....	Pairs..	Own.....	Cent....	....	W..	60	.....	Pump.	Mech.....	.....	Kingston...2½	Yes...
Mohawk.....E	785	....	2.25	8-16	Light.....	4-3¼x4½	L...	1000	Vert..	Block.	Pierce....	Cent....	365	W..	6	Bush.....	Ther..	Circ-Sp....	Piston...	Kingston...1	No...
Moline.....D	990	2-3	3.0	9-18	Own.....	4-3½x5	I...	1400	Vert..	Block.	Remy.....	Elec....	720	W..	6	Modine...	Ther..	Hol-C.S....	Gear....	Holley.....1¼	No...
Nilson.....	2,475	4	2.5	20-40	Waukesha	4-5x6¼	L...	900	Vert..	Pairs..	Waukesha.	Cent....	1000	W..	14	S.-J.....	Pump.	Hol-C.S...	Gear....	Stromberg..1½	No...
Oil Pull.....K	1,485	3	2.1	12-20	Own.....	2-6x8	I...	560	Hori..	Pairs..	Own.....	Cent....	....	O..	10½	Own.....	Pump.	Circ-Sp....	.....	Own.....2¼	Yes...
Oil Pull.....H	2,285	4	2.1	16-30	Own.....	2-7x8½	I...	530	Hori..	Pairs..	Own.....	Cent....	....	O..	15	Own.....	Pump.	Circ-Sp....	.....	Own.....2½	Yes...
Oil Pull.....G	3,175	6	2.0	20-40	Own.....	2-8x10	I...	450	Hori..	Singly.	Own.....	Cent....	....	O..	17	Own.....	Pump.	Circ-Sp....	.....	Own.....2¾	Yes...
Oil Pull.....E	4,590	8-10	1.9	30-60	Own.....	2-10x12	....	375	Hori..	Singly.	Own.....	Cent....	....	O..	70	Own.....	Pump.	Circ-Sp....	.....	Own.....3¼	Yes...
Oshkosh.....M	650	1	2.5	6-12	Own.....	2-4x6	I...	1000	Hori..	Pairs..	Own.....	Cent....	600	W..	8	Modine...	Pump.	Hol-C.S...	Piston...	Kingston...1¼	No...
Oshkosh.....H	985	3	3.0	12-24	Own.....	2-6x7	I...	900	Hori..	Pairs..	Own.....	Cent....	900	W..	10	Modine ..	Pump.	Hol-C.S...	Piston...	Kingston...1¾	Yes...
Peoria.....L	1,600	3	3.0	12-25	Climax....	4-4x6½	L...	800	Vert..	Pairs..	Climax....	Cent....	1000	W..	11	Eureka....	Pump.	Hol-C.S...	Eccentric	Stromberg..1½	No...
Pioneer.....	.....	4	2.5	20-40	Own.....	4-5½x6	L...	750	Opp...	Pairs..	Pierce....	Cent....	....	W..	20	S.-J.....	Pump.	Hol-C.S...	Gear....	Kingston...1½	Yes...
Pioneer.....	.....	10	2.5	40-75	Own.....	4-7x8	L...	650	Opp...	Pairs..	Own.....	Cent....	....	W..	35	S.-J.....	Pump.	Hol-C.S...	Gear ..	Kingston...2	Yes .
Port Huron.....A	1,500	3	.....	12-25	Chief.....	4-4 x6	I...	900	.....	.....	Pickering..	Cent....	1000	W..	8¾	Bremer....	Pump.	Pres.....	Gear ..	Kingston.....	No...
Reliable.....	.....	2	2.25	10-20	Own.....	2-6x7	I...	600	Hori..	Pairs..	Own.....	Cent....	1120	W..	40	Own.....	Ther..	Mech.....	Piston...	Own.....1¼	Yes...
Rex.....	1,600	3	2.5	12-25	Waukesha.	4-4¼x5¾	L...	900	Vert..	Pairs..	Waukesha.	Cent....	....	W..	....	.....	Pump.	Circ-Sp....	Gear....	Kingston...1½	No...
Samson.....M	.....	2-3	2.5-3.25	.....	Own.....	4-4x5½	L...	1100	Vert..	Block.	Own.....	Cent....	839	W..	10	.....	Pump.	Hol-C S...	Gear....	Kingston...1¼	No...
Sandusky.....J	1,250	2	2.0	10-20	Own.....	4-4¼x5¼	L...	1050	Vert..	Block.	Own.....	Cent....	849	W..	8	Perfex..	Pump.	Circ-Sp....	Piston...	Kingston...1¼	Yes...
Sandusky.....E	1,750	4	2.0	15-35	Own.....	4-5x6½	L...	750	Vert..	Singly.	Own.....	Cent....	2060	W..	30	Perfex....	Pump.	Circ-Sp....	Piston...	Kingston...2	Yes...
Shelby.....C	.....	2	2.6	9-18	Waukesha.	4-3¾x5¼	L...	1000	Vert..	Block.	Waukesha.	Cent....	625	W..	8	Modine...	Pump.	Circ-Sp....	Gear....	Kingston...1¼	No...
Shelby.....D	.....	3	2.7	15-30	Beaver....	4-4¾x6	I...	900	Vert..	Block.	Taco.....	Cent....	1000	W..	10	Modine...	Pump.	Hol-C.S...	Gear....	Kingston...1½	No...
Steady Pull.....	1,485	3	2.5	12-24	Own.....	4-4x5	I...	900	Vert..	Block.	.....	.....	800	W..	6	Perfex....	Pump.	Circ-Sp....	Gear....	Stromberg..1¼	No...
Stinson.....	1,835	4	2.85	18-36	Beaver....	4-4¾x6	I...	1000	Vert..	Block.	.....	.....	1000	W..	10	Todd.....	Pump.	Hol-C.S...	Gear....	Kingston...1⅜	Yes...

Brlng—Berling; **B.&B.**—Borg and Beck; **B-L**—Brown-Lipe; **Cent**—Centrifugal; **Circ-Sp**—Circulating Splash; **Cont**—Contracting Band; **D-D**—Dry Disk; **D-O**—Disk in Oil; **Dist**—Distillate; **Elec**—Electric; **Fric**—Friction; **G**—Gasoline; **Gr**—Gravity; **Hyd**—Hydraulic;

Farm Tractors for 1922

SYSTEM			Electrical	CLUTCH		TRANSMISSION						WHEELS				FRAME			Name and Model	
Fuel Feed	Fuel Tanks and Capacities, Gals	Air Cleaner, Make	Ignition System Make	Make	Type	Make of Transmission	Number Forw'd Speeds	Final Drive	Differential Lock	Drive Wheel Axle Type	Steering Type	No. Driving Wheels	Diameter and Face, Ins.	No. of Tracks	No. of Non-Drive Wheels	Material	Wheel-base, Ins.	Total Weight, Lbs.		
Gr....	2-5G-22K....	Vortox....	Brlng.....	Detlaff..	D.D....	American..	2	Rim....	No..	Dead....	Fork.....	2	52x8	....	1	Struct..	94	4800	All-in-One.....	A
Gr....	1-8½G.....	Taco.....	.....	B. & B..	D.D....	Own.....	1	Rim....	No..	Dead....	Worm.....	2	48x6	....	2	None...	80	2500	Allis-Chalmers.....	
Gr....	1-20G.....	Taco.....	.....	Own....	Shoe....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	46x12	....	2	None...	78	4400	Allis-Chalmers.....	
Gr....	1-73..G-25K.	Taco.....	.....	Own....	Shoe....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	50x12	....	2	None...	94	6150	Allis-Chalmers.....	
Gr....	1-35G.....	Taco.....	.....	Own....	Shoe....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	50x12	....	2	None...	94	6150	Allis-Chalmers.....	
Gr....	2-5G-23K....	Bennett...	Bosch.....	Own....	D.D....	Own.....	3	Spoke....		Rev.....	Knuckle...	2	38x12	....	2	Struct..	75	4800	Allwork.....	G
Gr....	2-5G-24K....	Bennett...	Bosch & Kingston	Own....	D.D....	Own.....	3	Rim....	No..	Rev.....	Knuckle...	2	48x12	....	2	Struct..	80	5200	Allwork.....	C
Gr....	2-25G-5K....	Bennett...	Dixie.....	Own....	D.D....	Own.....	2	Spoke...	No..	Dead....	Knuckle...	2	54x14	....	2	Struct..	96	5000	Andrews-Kinkade.....	D
Gr....	2-5G-20K....	Bennett...	.....	B.&B...	D.D....	Nuttall....	2	Rim....	No..	Rev.....	Knuckle...	2	54x12	....	2	Struct..	96	4900	Appleton.....	
Gr....	1-2G.....	Donaldson.	Brlng.....	Own....	.....	.....	1	Axle....	No..	Live.....	.....	2	30x4	....	2	None...	.....	.....	Aro.....	
Gr....	2-6G-16K....	Bennett...	Eisemann....	T.D....	D.D....	Own.....	1	Rim....	No..	Rev.....	Knuckle...	2	70x12	....	2	Struct..	98½	8100	Aultman-Taylor.....	
Gr....	2-20G-35K...	.....	Eisemann....	Own....	Shoe....	Own.....	2	Rim....	No..	Rev.....	Swinging..	2	70x20	....	2	Struct..	102	12,800	Aultman-Taylor.....	
Gr....	2-20G-60K...	.....	Eisemann....	Own....	Shoe....	Own.....	1	Rim....	No..	Rev.....	Swinging..	2	90x24	....	2	Struct..	136	23,400	Aultman-Taylor.....	
.....	1-18G.....	Bennett...	Eisemann....	B.&B...	Plate....	Own.....	2	Axle....	Yes.	Live.....	Power.....	2	40x10	....	2	Steel...	70	3,950	Automotive.....	
Gr....	1-2¼G 13½K	Bennett...	.....	Own....	.....	Own.....	2	Spoke...	No..	Rev.....	Swinging..	2	50x12	....	2	Struct..	90	4,900	Avery.....	
Gr....	1-6G-16K....	.....	.....	Own....	D.D....	Own.....	2	Hub....	No..	Rev.....	Knuckle...	2	52x14	....	2	Struct..	80	6,000	Avery.....	
Gr....	1-3¼G-20K..	Bennett...	.....	Own....	Shoe....	Own.....	2	Spoke...	No..	Rev.....	Swinging..	2	56x20	....	2	Struct..	95	7,500	Avery.....	
Gr....	1-3¼G-20K..	Bennett...	.....	Own....	D.D....	Own.....	2	Spoke...	No..	Rev.....	Knuckle...	2	60x16	....	2	Struct..	96	7,540	Avery.....	
Gr....	1-5½G-34K..	Bennett...	.....	Own....	D.D....	Own.....	2	Spoke...	Yes.	Rev.....	Swinging..	2	65x20	....	2	Struct..	97	9,750	Avery.....	
Gr....	1-5½G-34K..	.....	.....	Own....	D.D....	Own.....	2	Spoke...	No..	Rev.....	Swinging..	2	69x20	....	2	Struct..	114	12,500	Avery.....	
Gr....	1-5½G-45K..	.....	.....	Own....	D.D....	Own.....	2	Spoke...	No..	Rev.....	Swinging..	2	87½x24	....	2	Struct..	138	22,000	Avery.....	
Gr....	1-10K.....	Bennett...	.....	Own....	D.D....	Own.....	3	Rim....	No..	Dead....	Knuckle...	2	38x10	....	2	Struct..	90	3,164	Avery.....	
Gr....	1-30G.....	Opt.....	Dixie.....	Own....	D.D....	Own.....	3	.....	.....	.....	Knuckle...	....	.....	2	.....	.....	.....	5,000	Avery Track Runner.....	
Gr....	2-2G-15K....	Own.....	.....	Own....	Cont....	Own.....	3	Rim....	Yes.	Dead....	Knuckle...	2	54x12	....	2	Struct..	80	4,000	Bates.....	
Gr....	2-5-10G.....	R.W.....	Bosch.....	B.&B...	D.D....	Own.....	2	Axle....	Yes.	Dead....	Knuckle...	....	.....	2	2	Struct..	80	4,850	Bates (Steel Mule).....	F
Vac...	2-2¾G-30K..	Pomona...	Brlng.....	Own....	Plate....	Own.....	2	Rim....	....	Dead....	.....	....	.....	2	....	None....	.....	7,560	Best.....	30
Gr....	1-30K.....	Bennett...	.....	Own....	Cont....	Own.....	2	Rim....	No..	Live.....	Knuckle...	2	56x12	....	2	Cast....	.....	.....	Burn-Oil.....	
Gr....	2-2G-10½K..	Own.....	.....	Own....	Shoe....	Own.....	2	Spoke...	Yes.	Live.....	Knuckle...	2	42x9	....	2	Cast....	65	3,820	Case.....	10-18
Gr....	2-2¾G-20K..	Own.....	.....	Own & B.&B..	D.D....	Own.....	2	Spoke...	Yes.	Live.....	Knuckle...	2	52x14	....	2	Cast....	76½	6,460	Case.....	15-27
Gr....	2-3¾G-26½K.	Own.....	.....	Own....	Shoe....	Own.....	2	Spoke...	Yes.	Live.....	Knuckle...	2	56x16	....	2	Struct..	96	9,700	Case.....	22-40
Vac...	1-45G.....	Own.....	Eisemann....	Own....	D.D....	Own.....	3	Axle....	.....	.....	.....	....	.....	2	....	Cast....	83	9,300	Caterpillar.....	T-11
Vac...	1-45G.....	Own.....	K-W.....	Own....	D.D....	Own.....	3	Axle....	.....	.....	.....	....	.....	2	....	Cast....	98	19,500	Caterpillar.....	T-16
Gr....	2-1G-9K....	.....	Dixie.....	Bierman.	Shoe....	Own.....	2	Rim....	....	Dead....	Knuckle...	2	48x12	....	1	Struct..	69	5500	Chase.....	12-25
Gr....	2-¼G-6K....	Own.....	.....	B.&B...	Plate....	Own.....	1	Axle....	No..	.....	Swing ng..	....	.....	....	....	None....	.....	.....	Cletrac.....	F
Gr....	2-¾G-13K...	Own.....	.....	B.&B...	D.D....	Own.....	1	Axle....	No..	.....	.....	....	.....	2	....	Struct..	.....	.....	Cletrac.....	W
Vac...	1-20G.....	Cyclone...	.....	Bierman	Shoe....	Own.....	1	Axle....	....	Live.....	Knuckle...	1	42x10	....	2	Struct..	108	5,300	Dakota.....	
Gr....	1-16G.....	Cyclone...	Bosch.....	B.&B...	D.D....	Own.....	3	Axle....	No..	Live.....	Swinging..	4	40x12	....	....	Struct.	99	6,800	Depue.....	A
Gr....	2-4G-20K....	Bennett...	K.W.....	Own....	Cone....	Own.....	2	Spoke...	No..	Rev.....	Knuckle...	2	54x12	....	2	Struct..	87½	4,550	Emerson-Brantingham	12-20
Gr....	1-4G-16K....	Bennett...	K.W.....	Own....	Cone....	Own.....	3	Spoke...	No..	Dead....	Knuckle...	2	60x12	....	2	Struct..	93	6,500	Emerson-Brantingham	Q
Gr....	1-5G-35K....	Bennett...	Simms.....	Own....	Cone....	Own.....	2	Spoke...	Yes.	Dead....	Swinging..	2	72x16	....	2	Struct..	126	9,400	Emerson-Brantingham	16-32
Gr....	1-12G.....	Own.....	Dixie.....	Own....	.....	Own.....	1	Axle....	.....	.....	Knuckle...	2	.....	....	2	Struct..	77	3,500	Fageol.....	D
Gr....	2-5G-18K....	Oren.....	Dixie.....	T.D....	D.D....	.....	2	Spoke...	No..	Dead....	Knuckle...	2	52x26	....	2	Struct..	82	5,200	Farm Horse.....	B
Gr....	2-5G-25K....	R.W.....	K W.....	M.E....	D D....	Own.....	2	Rim....	No..	Dead....	Knuckle...	2	54x10	....	2	Struct..	83	5,700	Farquhar.....	15-25
Gr....	2-30G-30K...	.....	K W.....	Own....	Fric....	Own.....	1	Rim....	No..	Dead....	Swinging..	2	84x20	....	2	Struct..	132	16,000	Farquhar.....	4-30
Gr....	2-30G-30K...	.....	K.W.....	Own....	Fric....	Own.....	1	Rim....	No..	Dead....	Swinging..	2	84x24	....	2	Struct..	132	19,000	Farquhar.....	4-40
Gr....	2-¼G-21K..	Own.....	Own.....	Own....	D.O....	Own.....	3	Axle....	No..	Live.....	Knuckle...	2	42x12	....	2	None...	63	2,425	Fordson.....	
Vac...	2-2G-20K....	.....	Dixie.....	Own....	Shoe....	Own.....	3	Spoke...	No..	Dead....	Knuckle...	2	60x12	....	2	Struct..	90	6,700	Fox.....	E
Gr....	2-3G-20K....	Bennett...	.....	Own....	Shoe....	Nuttall....	2	Rim....	No..	Rev.....	Knuckle...	2	60x10	....	2	Struct..	92	5,700	Frick.....	A
Gr....	1-3G-17K....	Bennett...	.....	Own....	Shoe....	Nuttall....	2	Rim....	No..	Rev.....	Knuckle...	2	60x12	....	2	Struct..	92	6,450	Frick.....	C
Gr....	1-3G.....	Bennett...	Bosch.....	Own....	Cone....	Own.....	2	.....	.....	Rev.....	Knuckle...	1	54x54	....	2	Struct..	.....	6,200	Gray.....	
Gr....	2-1G-14K....	Own.....	K.W.....	Own....	Cont....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	46x10	....	2	Struct..	76	3,750	Hart-Parr.....	
Gr....	2-1G-23K....	Own.....	K.W.....	Own....	Cont....	Own.....	2	Rim....	No.	Rev.....	Knuckle...	2	52x18	....	2	Cast....	89	5,275	Hart-Parr.....	
Gr....	2-7G-14K....	Bennett...	.....	.....	.....	Own.....	7	Axle....	No..	Live.....	Knuckle...	2	54x8	....	2	Struct..	90	4,000	Heider.....	D
Gr....	2-7G-14K....	Bennett...	.....	.....	.....	Own.....	7	Axle....	No..	Live.....	Knuckle...	2	57x10	....	....	Struct..	96	6,000	Heider.....	C
Gr....	1-11¼G-22K.	Bennett...	Kingston...	Own....	Shoe....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	60x10	....	....	Struct..	91	5,000	Huber.....	
Gr....	1-23¼G....	R. W....	Eisemann....	Own....	D.D....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	60x10	....	....	Struct..	91	5,800	Huber.....	
Gr....	1-3G-15K....	Bennett...	.....	T.D....	D.D....	Foote.....	4	Axle....	No..	Live.....	Knuckle...	2	54x12	....	2	Struct..	92	5,000	Illinois.....	C
Gr....	1 or 2-70G..	Bennett...	K.W.....	Own....	Shoe....	Own.....	2	Rim....	Yes.	.....	Swinging..	2	96x30	....	2	Struct..	137	20,800	Imperial.....	
Gr....	1-12G.....	Bennett...	Kent.....	Own....	.....	Own.....	4	Spoke...	No..	Dead....	Swinging..	2	50x12	....	2	Cast....	.....	2,200	Indiana.....	F
Gr....	2-11G-11¼K.	Own.....	Dixie.....	Own....	D.D....	Own.....	3	Spoke...	....	Dead....	Knuckle...	2	40x12	....	2	Struct..	86	3,600	International.....	8-16
Gr....	2-1G-16K....	Own.....	.....	Own....	D.D....	Own.....	....	Axle....	....	Live.....	Knuckle...	2	50x12	....	2	Cast....	85	5,400	International.....	15-30
Pres..	2-24K.....	Own.....	.....	Own....	.....	Own.....	2	Spoke...	....	Dead....	Knuckle...	2	66x14	....	2	Pressed.	94	8,700	International.....	15 30
Gr....	5G-20K....	Bennett...	Splitdorf....	Own....	Shoe....	Own.....	2	Axle....	No..	Live.....	Knuckle...	2	48x12	....	2	Channel	84	6,000	Klumb.....	
Gr....	2-2G-40K...	Own.....	Kingston....	Own....	Shoe....	Own.....	2	Axle....	Yes.	Rev.....	Swinging..	2	60x18	....	....	Struct..	42	6,000	Knudson.....	
Gr....	1-19G.....	Taco.....	Splitdorf....	Own....	Shoe....	Own.....	2	Spoke...	No..	Rev.....	Knuckle...	2	48x12	....	2	Struct..	78	4,500	Lauson.....	S
Gr....	1-2G-18K....	Taco.....	Splitdorf....	Own....	Shoe....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	54x12	....	2	Struct..	86	6,000	Lauson.....	15-30
Gr....	1-3¼G-30K..	United....	Dixie.....	B.&B...	D.D....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	54x12	....	2	Struct..	76	5,800	Leader.....	M
Gr....	1-3¼G-20K..	United....	Dixie.....	B.&B...	D.D....	Own.....	2	.....	No..	Dead....	.....	....	.....	2	....	Struct..	.....	6,800	Leader.....	G-U
Vac...	1-28G.....	Own.....	Dixie.....	Hilliard.	D.D....	Own.....	2	.....	Yes.	.....	.....	4	50x12	....	....	Struct..	98	5,500	Leonard.....	
Vac...	1-30G.....	.....	Westinghouse	B-L....	D.D....	B-L.....	4	.....	No..	Dead....	Knuckle...	2	.....	2	....	Struct..	135	11,000	Linn.....	
Gr....	1-5G-20K....	Donaldson.	.....	Own....	Cone....	Own.....	3	Rim....	No..	Dead....	Knuckle...	2	54x14	....	2	Struct..	87	5,000	Little Giant.....	B
Gr....	1-5G-35K....	Donaldson.	.....	Own....	Cone....	Own.....	3	Rim....	No..	Dead....	Knuckle...	2	66x20	....	2	Struct..	102	8,500	Little Giant.....	A
.....	2-3G-18.3K..	.....	K.W.....	.....	.....	Own.....	2	Axle....	.....	Live.....	Knuckle...	....	56x12	....	....	Struct..	109	6,600	Minneapolis.....	
.....	2-6.3G-17.8K	Bennett...	Dixie.....	Own....	D.D....	Own.....	2	Axle....	.....	Live.....	Knuckle...	....	54x12	....	....	Struct..	79⅞	6,400	Minneapolis.....	
.....	2-9G-30K....	.....	K.W.....	.....	.....	Own.....	2	Axle....	.....	Live.....	Swinging..	....	62x10	....	....	Struct..	109½	12,410	Minneapolis.....	
.....	2-20G-80K...	.....	K.W.....	.....	.....	Own.....	2	Axle....	.....	Live.....	Swinging..	....	85x30	....	....	Struct..	136	22,500	Minneapolis.....	
Gr....	1-2G-10K....	Bennett...	.....	B.&B...	D.D....	Own.....	1	Axle....	No..	Live.....	Swinging..	2	42x8	....	2	Cast....	67½	2,300	Mohawk.....	E
Gr....	1-15G.....	Bennett...	Remy.....	B.&B...	D.D....	Own.....	1	Rim....	Yes.	Dead....	.....	2	52x8	....	....	None...	.....	3,380	Moline.....	D
Gr....	1-28G.....	Bennett...	Bosch.....	T.D....	D.D....	Own.....	2	Axle....	No..	Live.....	Knuckle...	3	52x10	....	2	Struct..	100	6,850	Nilson.....	
Pres..	2-1G-23K....	Donaldson.	.....	Own....	Shoe....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	51x12	....	2	Struct..	80	6,632	Oil Pull.....	K
Pres..	2-1G-31K....	Donaldson.	.....	Own....	Shoe....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	56x16	....	2	Struct..	92½	9,600	Oil Pull.....	H
Pres..	2-1G-45K....	Donaldson.	.....	Own....	Shoe....	Own.....	2	Rim....	No.	Rev.....	Knuckle...	2	64x20	....	2	Struct..	103	12,820	Oil Pull.....	G
Pres..	2-3G-70K....	.....	.....	Own....	Shoe....	Own.....	1	Rim....	No..	Rev.....	Swinging..	2	80x30	....	2	Struct..	141	26,700	Oil Pull.....	E
Gr....	.....	.....	.....	Own....	.....	Own.....	1	Rim....	Yes.	Dead....	Knuckle...	2	48x7	....	2	Struct..	72	3,000	Oshkosh.....	M
Gr....	2-1G-13K....	Bennett...	Kent.....	Own....	Cont....	Own.....	1	Rim....	Yes.	Rev.....	Knuckle...	2	56x10	....	2	Cast....	90	3,800	Oshkosh.....	H
Gr....	1-5G-25K....	Taco.....	Eisemann....	Own....	Cone....	Own.....	3	Axle....	No..	Live.....	Knuckle...	2	50x12	....	2	None...	84	4,700	Peoria.....	L
Gr....	1-30G.....	Bennett...	.....	Own....	D.O....	Own.....	3	Hub....	No..	Live.....	Knuckle...	2	60x18	....	2	Struct..	89	6,500	Pioneer.....	
Gr	2-75G-30K..	Bennett...	K.W.....	Own....	D.D....	Own.....	3	Hub....	No..	Live.....	Knuckle...	2	96x24	....	2	Struct..	156	24,000	Pioneer.....	
Gr....	5G-25K.....	Own.....	Eisemann....	Rock....	Fric....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	56x10	....	2	Channel	93	5,960	Port Huron.....	A
Pres..	1-15K.....	.....	Dixie.....	Own....	Shoe....	Own.....	1	Axle....	No..	Live.....	Swinging..	2	48x10	....	2	Struct..	66	3,785	Reliable.....	
Gr....	1-5G-20K....	.....	K.W.....	.....	D.D....	Own.....	2	Rim....	No..	Live.....	Knuckle...	2	60x10	....	2	Struct..	.....	5,600	Rex.....	
Gr....	2-3G-20K....	Own.....	Simms.....	Own....	D.O....	Own.....	2	Axle....	No..	Live.....	Knuckle...	2	45x12	....	2	None...	64¼	3,034	Samson.....	M
Gr....	1-5G-15K....	Bennett...	.....	Own....	Cone....	Own.....	2	Rim....	No.	.....	Knuckle...	2	48x12	....	2	Struct..	96	4,724	Sandusky.....	J
Gr....	1-5G-25K....	Bennett...	.....	Own....	Shoe....	Own.....	3	Rim....	No.	.....	Swinging..	2	56x16	....	2	Struct..	100	8,228	Sandusky.....	E
Gr....	1-17G.....	Bennett...	Dixie.....	Fuller...	D.O....	Fuller.....	3	Axle....	No.	Dead....	Knuckle...	2	42x12	....	2	Struct..	72	3,300	Shelby.....	C
Gr....	2-4G-14K....	Bennett...	Dixie.....	T.D....	D.D....	Foote.....	2	Rim....	No.	Live.....	Knuckle...	2	48x12	....	2	Struct..	80	4,500	Shelby.....	D
Gr....	1-15G.....	Oren.....	Bosch.....	T.D....	D.D....	Foote.....	2	Spoke...	No.	Dead....	Knuckle...	2	42x12	....	2	Struct..	87	3,450	Steady Pull.....	
Gr....	1-32½K.....	Own.....	Dixie.....	Own....	Cont....	Own.....	1	Axle....	No.	Live.....	Knuckle...	2	60x12	....	2	Cast....	114	7,200	Stinson.....	

Hori—Horizontal; **H-B**—Horizontal Bars; **Hol-C.S.**—Hollow Crankshaft; **K**—Kerosene; **Mech**—Mechanical Lubricator; **O**—Oil; **Pres**—Pressure; **Rev**—Revolving; **S-J**—Shotwell-Johnson; **Struct**—Structural Steel; **T-D**—Twin Disk; **Throt**—Throttle; **Vac**—Vacuum; **W**—Water.

Specifications of American

Name and Model	Price	Plow Capacity	Plowing Speed M. P. H.	H. P. Rating	Make	No. Cyl., Bore, and Stroke	Cylinder Type	R. P. M.	Engine Type	Cylinder Cast	GOVERNOR: Make of Governor	GOVERNOR: Type of Governor	Weight, Lbs.	COOLING SYSTEM: Cooling Fluid	COOLING SYSTEM: Cooling Capacity, Gals.	COOLING SYSTEM: Radiator Make	COOLING SYSTEM: Fluid Circulat'n	LUBRICATION: Lubrication System, Type	LUBRICATION: Oil Pump, Type	FUEL: Carburetor Make and Size, Ins.	FUEL: Water Injected with Fuel
Tioga	$2,625	3–4	2.7	15–27	Wis. MW.	4–4½x6	I...	1000	Vert..	Pairs..	Pharo.....	Cent....	1200	W..	7¾	G. & O....	Pump.	Hol-C.S...	Gear....	Stromberg..1¼	No...
Titan (I. H. C.)	700	3	2.75	10–20	Own.....	2–6½x8	I...	575	Hori..	Pairs..	Own.....	Cent....	....	W..	40	Own.....	Ther..	Mech.....	.....	Ensign.....	No...
Topp-Stewart B	3,500	4	2.5	30–45	Waukesha.	4–4¾x6¾	L...	950	Vert..	Pairs..	Waukesha.	Cent....	....	W..	12	Bremer....	Pump.	Circ-Sp....	Gear....	Stromberg..1½	No...
Toro	.....	2	2.0	6–10	LeRoi.....	4–3½x4½	L...	1200	Vert..	Block.	LeRoi.....	Cent....	325	W..	4	S.-J.....	Ther..	Circ-Sp....	Piston...	Kingston... ⅞	No...
Townsend	895	2–3	2.5	10–20	Own.....	2–6½x7	I...	550	Hori..	Pairs..	Own.....	Cent....	1100	W..	50	Own.....	Pump.	.....	Piston...	Own.....1½	Yes...
Townsend	1,485	3–4	2.5	15–30	Own.....	2–7x8	I...	500	Hori..	Pairs..	Own.....	Cent....	1600	W..	70	Own.....	Pump.	Hol-C.S...	Piston...	Own.....1¾	Yes...
Townsend	2,750	6–8	2.5	35–50	Own.....	2–8½x10	I...	475	Hori..	Pairs..	Own.....	Cent....	2200	W..	100	Own.....	Pump.	Hol-C.S...	Piston...	Own.....2¼	Yes...
Tracklayer 60	5,450	8	2.62	35–50	Own.....	4–6½x8½	I...	650	Vert..	Singly.	Own.....	Cent....	2600	W..	18	Own.....	Pump.	Circ-Sp....	Gear....	Ensign.....2	No...
Traylor	715	1	2.75	6–12	LeRoi.....	4–3½x4½	L...	1200	Vert..	Block.	LeRoi.....	Cent....	330	W..	4	G. & O....	Ther..	Hol-C.S...	Gear....	Kingston....⅞	No...
Trundaar	3,750	4	2.5	25–40	Waukesha.	4-5x6¼	L...	850	Vert..	Pairs..	Waukesha.	Cent....	....	W..	11	Modine...	Pump.	Hol-C.S...	Gear....	Stromberg..1½	.....
Twin City	1,580	3	2.9	12–20	Own.....	4–4¼x6	I...	1000	Vert..	Block.	Pierce.....	Cent....	1040	W..	10½	Modine...	Pump.	Hol-C.S...	Gear....	Holley.....1¼	No...
Twin City	3,175	5	2.9	20–35	Own.....	4–5½x6¾	I...	900	Vert..	Block.	Own.....	Cent....	1800	W..	18	Modine...	Pump.	Hol-C.S...	Gear....	Holley.....2	No...
Twin City	5,250	8	2.0	40–65	Own.....	4–7¾x9	I...	535	Vert..	Singly.	Own.....	Cent....	4125	W..	130	Own.....	Pump.	Mech.....	.....	Holley.....2½	No...
Wallis K	.....	2–3	3.5	15–25	Own.....	4–4¼x5¾	I...	900	Vert..	Singly.	Own.....	Hyd....	750	W..	6	Modine...	Pump.	Circ-Sp....	Piston...	Bennett....1¼	No...
Waterloo Boy N	1,450	3	3.0	12–25	Own.....	2–6½x7	I...	750	Hori..	Pairs..	Own.....	Cent....	1200	W..	13	Modine...	Pump.	Circ-Sp....	Piston...	Schebler....1½	Yes...
Wellington B	.....	2–3	2.25	12–22	Erd.....	4–4x6	I...	900	Vert..	Block.	Erd.....	Cent....	860	W..	7	Modine...	Pump.	Circ-Sp....	Piston...	Stromberg..1⅜	No...
Wellington F	.....	3	3.0	16–30	Chief.....	4–4¾x6	I...	1000	Vert..	Block.	Chief.....	Cent....	1020	W..	9	Modine...	Pump.	Hol-C.S...	Gear....	Stromberg..1½	No...
Wetmore	1,585	3	3.37	12–25	Waukesha	4–4x5¾	L...	1000	Vert..	Pairs..	Waukesha.	Cent....	900	W..	....	Ideal.....	Pump.	Hol-C.S...	Gear....	Schebler....1¼	No...
Whitney B	595	2	2.5	9–18	Own.....	2–5½x6½	L...	750	Opp...	Singly.	Own.....	Cent....	650	W..	....	.....	Pump.	Mech.....	.....	.....1½	No...
Wichita T	2,000	3–4	2.5	15–30	Beaver....	4–4½x6	I...	950	Vert..	Block.	Duplex....	Cent....	1080	W..	9	Perfex.....	Pump.	Hol-C.S...	Gear....	Ensign.....1¼	No...
Wisconsin	2,450	4	2.5	20–40	Waukesha	4–5x6½	L...	950	Vert..	Pairs..	Waukesha.	Cent....	1000	W..	12	Perfex	Pump.	Hol-C.S...	Gear....	Stromberg..1½	No...
Wisconsin	3,200	5	2.5	.....	Climax....	4–5½x7	L...	800	Vert..	Pairs..	Climax....	Cent....	1500	W..	18	Perfex.....	Pump.	Hol-C.S...	Eccentric	Stromberg..1½	No...
Yuba	3,100	....	.....	15–25	Wisconsin.	4–4¼x6	L...	800	Vert..	Block.	.....	.....	920	W..	5½	Modine...	Pump.	Circ-Sp....	Gear....	Stromberg..1¼	No...
Yuba	5,000	....	.....	25–40	Own.....	4–5¼x7	I...	700	Vert..	Pairs..	Own.....	Cent....	.....	W..	9	Modine...	Pump.	.....	.....	Stromberg..1¼	No...
Yuba	4,650	....	.....	25–40	Wisconsin.	4–5¾x7	T...	700	Vert..	Pairs..	Own.....	Cent....	1543	W..	9	Modine...	Pump.	Circ-Sp....	Gear....	Stromberg..1½	No...
Zelle	.....	3	2.5	12–25	Buda.....	4–4¼x5½	L...	1000	Vert..	Block.	Pierce.....	Cent....	....	W..	....	.....	Pump.	Hol-C.S...	Gear....	Carter.....	Yes...

Brlng—Berling; **B.&B.**—Borg and Beck; **B-L**—Brown-Lipe; **Cent**—Centrifugal; **Cir Sp**—Circulating Splash; **Cont**—Contracting Band; **D-D**—Dry Disk; **D-O**—Disk in Oil; **Dist**—Distillate; **Elec**—Electric; **Fric**—Friction; **G**—Gasoline; **Gr**—Gravity; **Hydr**—Hydraulic;

American Garden Tractor

NAME	Model	Price—Dollars	Rating—Horsepower	Type—Walking, Riding	Length Overall (Inches)	Width (Inches)	Height (Inches)	Clearance (Inches)	Total Weight (Pounds)	Engine Make	Number of Cylinders	Bore and Stroke (Inches)	Stroke—Cycle. Two or Four	Valve Arrangement	Revolutions per Min. Normal or Range	Governor—Make, Type	Engine Weight (Pounds)	Lubrication System—Splash with Fuel	Oil Supplied by	Ignition System—Battery, Magneto	Ignition Make
Acme Cultivator Co. Salem, Ohio	Acme, Jr.....	215	-1.9	W...	76	18½	29	9	235	B. & S..	1	2½x2½	4	L..	1500	None..	45	Cir. spl..	Plgr...	Mag.	Own flywh.
American Farm Mach. Co., Minneapolis, Minn.	Kinkade.....	140	3- 1½	W...	78	8½	20	....	180	Own....	1	3 x3	4	I..	700-1400	None..	100	Spl.....	Grav..	Opt..	.....
Beeman Tractor Co., Minneapolis, Minn.	G.....	285	1½-4	W...	86	17 -25	40	11½	560	Own....	1	3½x4½	4	L..	800-1200	.....	...	Spl.....	Grav..	Mag.	Heinze....
Central Tractor Co., Greenwich, Ohio	Centaur.....	385	-5	Both.	70	30½	38	13	700	NewWy.	1	4½x4½	4	L..	800	Cent..	275	Spl.....	Grav..	Mag.	Bosch.....
H. C. Dodge, Inc., Boston, Mass.	Sprywheel....	150	-1	W...	63	7½	37	....	135	Own....	1	2½x2½	2	...	600-1000	None..	28	W th fuel	.....	Both.	Bosch.....
Gilson Mfg. Co, Port Washington, Wis.	Bolens.....	180	-1.4	W...	64	18½	38	14	190	B. & S..	1	2½x2½	4	L..	1200	None..	43	Cir. spl..	Plgr...	Mag.	Flywh....
Midwest Engine Co., Indianapolis, Ind.	Utilitor, 501...	345	2⅓-4	W...	84	17½-30½	36	8	750	Own....	1	3½x4½	4	L..	1200	Funk..	...	Spl.....	Ring..	Mag.	Eisemann..
	Utilitor 501A..	395	2⅓-4	R....	88	23 -42	36	8	925	Own....	1	3½x4½	4	L..	1200	Funk..	...	Spl.....	Ring..	Mag.	Eisemann..
New Britain Machine Co., New Britain, Conn.	NB-2.....	375	6	Both.	98	28 -33	39	10	750	Own....	2	2¾x4	4	L..	1500	None..	...	Cir. spl..	Flywh.	Mag.	Sims.....

Garden Tractor

NAME	Model	Engine Rating Horsepower at R.P.M.	Stroke—Cycle	Number of Cylinders	Bore and Stroke Inches	Revolutions Per Minute Normal or Range	Engine Mounting Vertical—Horizontal	Piston Displacement Cubic Inches	Cylinder Head Detachable	Valve Arrangement	Inlet Valve Port Diameter Inches	Inlet Valve Lift Inches	Exhaust Valve Port Diameter Inches	Exhaust Valve Lift—Inches	Cam Follower Type	Volume of Compression Space Cubic Inches	Piston Length—Inches	Number of Piston Rings	Width of Piston Rings—Inches	Is Scraper Ring Used	Weight Piston with Pin and Rings Pounds	Weight of Connecting Rod Pounds	Length of Connecting Rod Center to Center—Inches	Width of Piston Pin Bearing Inches	Diameter Piston Pin Bearing Inches	Width Connecting Rod Lower End Bearing Inches	Diameter Connecting Rod Lower End Bearing—Inches	Diameter of Crankshaft Inches
Briggs and Stratton Co. Milwaukee, Wis.	P...	1 -2200	4	1	2½x2½	1600-2200	Vert.	12.27	No..	L...	3½₂	3₃₂	1	5⁄16	Wedge..	5.4	2½	2	.156	No..	11⁄16	9⁄16	5¾	1	9⁄16	⅞	⅞	1
Cushman Motor Works Lincoln, Neb.	44	4 - 800	4	1	4 x4	400- 900	Vert.	50.25	No..	L...	1⅜	1⁄16	1 1⁄16	¼	Mush-room	..	4 1⁄16	3	9⁄32	No..	4¾	1¾	6¾	2	1	1⅝	1⅜	1⅜
Evinrude Motor Co..... Milwaukee, Wis.	..	1½- 900	2	1	2⅝x2½	900	Vert.	.....	No..	..	...	..	...	..	.....	..	...	3	5⁄16	.....	...	...	...	5⁄8	...	1¼	⅞	⅞

Abbreviations: **R. P.**—Rotary Pump; **P. P.**—Piston Pumps; **C. S.**—Circular Splash; **G. S.**—Gravity Splash; **W. G.**—With Gas; **P. S.**—Pressed Steel; **S. S.**—Semi-Steel; **O. F.**—Own Flywheel.

Farm Tractors for 1922—Continued

SYSTEM			Electrical	CLUTCH		TRANSMISSION						WHEELS				FRAME			
Fuel Feed	Fuel Tanks and Capacities, Gals.	Air Cleaner, Make	Ignition System Make	Make	Type	Make of Transmission	Number Forw'd Speeds	Final Drive	Differential Lock	Drive Wheel Axle Type	Steering Type	No. Driving Wheels	Diameter and Face, Ins.	No. of Tracks	No. of Non-Drive Wheels	Material	Wheel-base, Ins.	Total Weight, Lbs.	Name and Model
Gr....	2-1G-24K....	Optional..	Dixie.....	T.D....	D.D....	Own.....	2	Hub....	Yes.	Dead.....	Knuckle...	2	36x16	....	2	Struct...	81⅞	5,200	Tioga
Pump.	1-16K.....	Own.....	K.W.....	Own....	Shoe....	Own.....	2	Spoke...	No..	Dead.....	Knuckle...	2	54x10	....	2	Struct...	91	5,710	Titan (I.H.C.)
Gr....	1-25G.....	Bennett...	Eisemann....	Hilliard .	D.O....	Own.....	3	Rim....	No..	Dead.....	Swinging..	4	42x12	....	....	Struct...	100	7,800	Topp-Stewart ..... B
Gr....	1-11G.....	Donaldson.	.....	Own....	Cont....	Own.....	2	Spoke...	No..	Dead.....	Knuckle...	2	41x6	....	2	None...	54	2,600	Toro
Pres..	1-12K.....	Optional...	K.W.....	Own....	Shoe....	Own.....	1	Axle....	No..	Live.....	Knuckle...	2	48x12	....	2	Struct...	84	4,500	Townsend
Pres..	1-18K.....	Optional...	K.W.....	Own....	Shoe....	Own.....	1	Axle....	No..	Live.....	Knuckle...	2	56x18	....	2	Struct...	90	6,500	Townsend
Pres..	1-35K.....	Optional...	K.W.....	Own....	Shoe	Own.....	1	Axle....	No..	Live.....	Knuckle...	2	60x24	....	2	Struct...	110	.....	Townsend
Vac...	2-5G-55K....	Pomona...	K.W.....	Own....	Plate....	Own.....	2	Rim....	No..	Dead.....	.....	.....	.....	2	....	Struct...	.....	.....	Tracklayer 60
Gr....	1-12G.....	Oren.....	Dixie.....	B.&B...	D.D....	Own.....	1	Rim....	No..	Dead.....	Knuckle...	4	38x10	....	2	Struct...	76	1,750	Traylor
Gr....	2-3G-26K	Own.....	Bosch.....	Hilliard .	Plate....	Own.....	2	Axle....	No..	Live.....	.....	.....	.....	2	....	None...	.....	9,200	Trundaar
Gr....	2-1½G-23K..	Bennett...	Bosch.....	T.D....	D.D....	Own.....	2	Axle....	No..	Live.....	Knuckle...	2	50x12	....	2	Cast....	84	4,660	Twin City
Gr....	2-1½G-40K..	Bennett...	Bosch.....	T.D....	D.D....	Own.....	2	Axle....	No..	Live.....	Knuckle...	2	60x20	....	2	Cast....	97	8,440	Twin City
Gr. ..	2-10G-95K...	.....	K.W.....	Own....	Cont....	Own.....	1	Rim....	No..	Rev.....	Knuckle...	2	84x24	....	2	Struct..	144	23,700	Twin City
Gr....	1-20G or K..	Bennett...	Brlng.....	T.D....	D.D....	Own.....	2	Axle....	No..	Live.....	Knuckle...	2	48x12	....	2	Pressed..	84	3,560	Wallis ..... K
Gr....	2-1G-20K....	.....	Dixie.....	Own....	Cont....	Own.....	2	Rim....	No..	Rev.....	Knuckle...	2	52x12	....	2	Struct...	88	5,910	Waterloo Boy ..... N
Gr....	2-10G-20K...	R.W.....	Dixie.....	T.D....	D.D....	Foote.....	2	Spoke...	No..	Rev.....	Knuckle...	2	48x12	....	2	Struct...	85½	4,500	Wellington ..... B
Gr....	2-10G-15K...	R.W.....	Dixie.....	T.D....	D.D....	Foote.....	2	Axle....	No..	Live.....	Knuckle...	2	48x12	....	2	Struct...	75½	5,000	Wellington ..... F
Gr....	2-2G-12K....	.....	.....	Fuller...	D.O....	Fuller.....	3	Spoke...	No..	Dead.....	Knuckle...	2	46x10	....	2	Struct...	74	2,900	Wetmore
Gr....	2-2G-15K....	.....	.....	Own....	Cont....	Own.....	3	Axle....	No..	Live.....	Knuckle...	2	48x10	....	2	Pressed.	81	3,000	Whitney ..... B
Gr....	2-½G-28K...	Bennett...	.....	T.D....	D.D....	Nuttall....	2	Axle....	No..	Live.....	Knuckle...	2	48x12	....	2	Struct...	93 5/16	6,000	Wichita ..... T
Gr....	2-5G-25K....	Optional..	.....	T.D....	D D....	Foote.....	2	Rim....	No..	Rev.....	Knuckle...	2	52x12	....	2	Struct...	90	5,440	Wisconsin
Gr....	2-5G-25K....	Optional..	.....	T.D....	D.D....	Foote.....	2	Rim....	No..	Rev.....	Knuckle...	2	52x12	....	....	Struct...	92	7,800	Wisconsin
Gr....	2.....	Pomona...	Bosch.....	Paragon.	D.D....	Own.....	2	.....	No..	.....	Swinging..	....	.....	2	....	Struct..	90	5,680	Yuba
Gr....	2-4G, 21D...	Pomona...	Bosch.....	Paragon.	D.D....	Own.....	2	.....	No..	.....	Swinging..	....	.....	2	....	Struct..	.....	9,980	Yuba
Gr....	2-8G-38K....	Pomona...	Bosch.....	Paragon.	D.D....	Own.....	2	.....	No..	Dead.....	Swinging..	....	.....	2	....	Struct..	.....	9,980	Yuba
Vac...	2-5G-25K ...	Leonard...	Bosch.....	B.&B...	D.D....	Own.....	4	Rim....	No..	Rev.....	Knuckle...	2	.....	....	2	Struct...	72	3,800	Zelle

Hori—Horizontal; **H-B**—Horizontal Bars; **Hol.-CS.**—Hollow Crankshaft; **K**—Kerosene; **Mech**—Mechanical Lubricator; **O**—Oil; **Pres**—Pressure; **Rev**—Revolving; **S-J**—Shotwell-Johnson; **Struct**—Structural Steel; **T-D**—Twin Disk; **Throt**—Throttle; **Vac**—Vacuum; **W**—Water.

Specifications — 1922

Carbureter, Make	Type and Size	Fuel Tank Capacity (Gallons)	Air Cleaner, Make	Type	Cooling Medium	Water Capacity (Gallons)	Circulation of Cooling Medium —Fan, Pump, Thermo-siphon	Belt Pulley: Diameter	Belt Pulley: Face	Belt Pulley: R.P.M.	Clutch-Make, Type	Number of Speed Changes	Plowing and Cultivating Speed, Miles per Hour	Gear Reduction—Engine to Drive Wheels	Final Drive Method—Belt, Chain, Spur, Internal, Worm, Open-Inclosed	Wheels: Number of Driving	Wheels: Diameter, Face (Ins.)	Wheels: Non-Driving—Number Diameter, Face (Inches)	Steering Arrangement—Handles, Clutches, Foot Bar, Wheel	Frame—Built-up, Cast Integral	Handle Bars—Rigid, Spring Mntd	Draw Bar—Rigid, Adjustable	Implements, Make	Manner of Attachment—Single Pnt Universal, Separate Attchmnt	Size Plow Recommended (Ins.)	Lawn Mower Attachment—Make, Size, Number (Inches)
B. & S...	¾	1	Own.....	Dry..	Air..	...	Fan..	3¼	1¾	250	Own pos..	1	1 -3	80	Wrm. incl....	2	21 x3⅜	2- 7x2	Hndl...	Int....	Rig..	Rig. Adj.	Std.....	Univ.	4-6	1-36
Schebler.	D-½	1	Own.....	.....	Air..	...	Fan..	3	3	Direct	Own pos..	1	1 -2½	40	Intl. incl.....	1	20 x5	.....	Hndl...	Int....	Rig..	Adj.....	Std.....	.....	5	Std. 1-30
Kingston	L-¾	1½	Donaldson.	Dry..	Wtr.	1¼	T. S..	4½	3¼	1000	Own D.C.	1	¾-2½	35.4	Spur. incl....	2	25 x3¼	2- 9x3	Hndl...	Int....	Sprg.	Adj.....	Std.....	SinU.	8	Std. 3-84
Holley...	.....	3	Own.....	Dry..	Air..	...	Fan..	4	6	800	Dry disc..	1 & R.	1 -2½	34	Chn. incl....	2	28 x4	2	Hndl...	B.U....	Rig..	Rig. Adj.	Std.....	Sing..	9-10	Std.
Own....	½	1	Own.....	Dry..	Air..	...	None	None	...	.....	None.....	1	1½-4	24, 30	Chn. & in. inc	1	20 x3½	2	Hndl...	B.U....	Rig.	Rig. Adj.	Own std.	.....	6	Own 1-20
B. & S...	¾	½	Donaldson.	Dry..	Air..	...	Fan..	3	2	200	Own.....	1	¾-3	.....	Chn. open...	2	16 x3	2-12x1	Hndl...	B.U....	Rig.	Adj.....	Std.....	Snap.	None	Std. 1-30
Holley...	⅞	1½	Own.....	Wet..	Wtr.	1½	T.S...	4⅝	3½	.....	Own D.C	1	1 -4	35	Int. incl.....	2	24¾ x4, 8	2-14x3	Hnd. C.	C. Int.	Sprg.	Adj.....	Std.....	Sing..	10	Std. 3-30
Holley...	⅞	1½	Own.....	Wet..	Wtr.	1½	T.S..	4⅝	3½	.....	Own D.C.	1	1 -4	35	Int. incl.....	2	24¾ x4, 8	2-14x3	Hnd C.	Int....	Sprg.	Adj.....	Std.....	Sing..	10	Std. 3-30
Kingston	L-¾	2	Bennett...	Dry..	Wtr.	3	T.S..	5½	4¼	1500	Band.....	1	2 -2¼	62.5	Spur. incl....	2	32 x4	2-16x3	Hndl...	Int....	Sprg	Rig.....	Own std.	.....	9	Std. 3-30

Engine Specifications

Number of Crankshaft Bearings	Length Crankshaft Bearings Inches: Front	Length Crankshaft Bearings Inches: First Int.	Length Crankshaft Bearings Inches: Rear	Camshaft Diameter Inches	Is Cylinder Offset	Amount of Offset—Inches	Carburetor Size—Inches	Intake Manifold Integral with Exhaust—Separate	Cooling Medium	Cooling Medium Circulation	Lubrication System Splash With Fuel	Material of Crankcase	Material—Lower Half of Crankcase	Material of Cylinders	Material of Pistons	Maximum Horsepower Developed at R.P.M.	Maximum Torque Developed at R.P.M.	Is Governor Fitted	Governor Type	Governed Speed—R.P.M.	Maximum Brake Horsepower Average Product	Weight Engine Less Ignition and Carburetor Pounds	Overall Width of Engine Inches	Overall Height of Engine Inches	Overall Length of Engine Inches	Points of Engine Support	Fuel Recommended	Ignition System Battery-Magneto	Make of Ignition System	Spark Plug Size
2	1⅛	.	1⅜	1	No..	..	½	Sep.	Air...	Fan....	C. S.	C.I....	P. S.	S. S.	S. S.	2400	1250	No...	.....	...	1	36	9½	17	10½	4	Gas.	Mag..	O. F	Metric..
2	3 11/32	.	3 13/32	⅝	Yes.	3/16	1	Sep.	Water.	R. P.	G. S.	C.I....	C.I....	C.I....	C.I....	....	....	Yes..	Flyball.	800	4.17	190	16¾	22¾	21½	4	Gas.	Both.	Dixie.	½" Pipe
2	3	.	4	...	.....	..	...	.....	Water.	P. P.	W. G.	C.I....	C.I....	C.I....	C.I....	1200	....	.....	.....	...	....	35	12⅝	16⅞	17 1/16	4	Gas.	Mag..	O. F.	⅞"-18..

Abbreviations: R. P.—Rotary Pump; **P. P.**—Piston Pumps; **C. S.**—Circular Splash; **G. S.**—Gravity Splash; **W. G.**—With Gas; **P. S.**—Pressed Steel; **S. S.**—Semi-Steel; **O. F.**—Own Flywheel.

British Agricultural Tractor Practice

Depression of agricultural industry during 1921 discouraged development. Chain tracks and three wheels have only one representative each. Only eleven makers in all. Two self-contained motor plows represented

By M. W. Bourdon

THE depressing conditions under which agriculture labored during last year resulted in the British tractor industry coming almost to a standstill; so much so that two or three makers who had previously been enthusiastic in their merchandising methods ceased advertising, manufacturing, and apparently gave up all endeavors to sell tractors for the time being. Whether they will launch out again with the original or new designs when industrial conditions improve remains to be seen; as they are concerns with other products beyond tractors, they are in a position to lie dormant on this side for a while.

While only a minority of British tractor makers have thus been content to take things lying down, the others, despite their continued efforts toward promoting sales, have not seen fit to vary their designs except in very small details. Austin has been the most energetic on the sales side—despite financial troubles—and has been as successful as any. This type of machine, a lightweight, frameless, is one appealing to a large proportion of British farmers, whose fields in most parts of the country rarely exceed 25 to 30 acres in extent. This fact accounts for the popularity of the Fordson. The Austin engine, it will be noted, is ¼ in. less in the bore than the Fordson, but the tractor does not appear to suffer on this account in respect of either performance or popularity; its engine has a slightly higher normal speed than that of the other, and probably develops approximately the same brake-horsepower—it has, in fact, the highest normal engine speed of any British machine, viz., 1500 r.p.m.

Chain track machines are less popular than ever among British makers; the Martin of this type has been discarded, its place being taken by a four-wheeler with a 4¼ x 5½-in. Galloway engine. The only British creeper now made is the Blackstone, which has a three-cylinder engine starting and running on kerosene, the fuel being injected into the combustion chamber separately from the air, which enters at a pressure of 80 to 90 lb. per square inch. A low-tension magneto is used, and a system of starting by compressed air is provided.

The Peterboro, with a Ricardo-designed engine, having that engineer's trunk pistons, has, like all agricultural tractors, been under a cloud during the past 12 months and has not had a fair opportunity of showing its worth from the practical and merchandising standpoint since it was first introduced at the 1920 trials. It is one of the heaviest of British tractors of modern design, weighing 5600 lb. with its 4¾ x 5½-in. engine. Beyond the design of the latter, the machine has no unusual features.

The Saunderson Junior machine put forward at the same time as the Peterboro has been temporarily held off the market until sales conditions improve, and only the original two-cylinder heavy model of this make is now being made. This is a pre-war design which has sold well in the past and given good service. It is, however, a general purpose tractor, and is offered as entirely suitable for road traction as well as for plowing and cultivating.

At one time there was a tendency among British makers to design for general traction purposes and fit springs fore and aft to accord with the national regulations concerning road vehicles. But that policy appears to have lapsed almost completely.

Two makes of self-contained motor plows now represent this type of machine in the British industry, the Crawley and the Fowler. Two others have dropped out during the past 12 months.

From the foregoing it will be realized that, so far as design is concerned, and also to a very great extent in respect of sales, British tractors have been almost stagnant during 1921, and, although Austin for one will this year attempt to liven up this side of his organization, the prospects of makers who contemplate development in design and output during 1922 are by no means promising at the moment.

British Agricultural Tractors 1922

MAKE	Make of Engine	No. of Cyls. Bore and Stroke (Ins.)	Normal R.P.M.	Lubrication System	Type of Oil Pump	Fuel	Type of Clutch	Final Drive Gears	No. of Wheels: Driving	No. of Wheels: Non-Driving	Driving Wheels Diameter and Width (Ins.)	Wheelbase (Ins.)	Driving Axle	Frame	Weight (Lbs.)	Water Injected	Air Cleaner Type	BELT PULLEY: Diameter (Ins.)	BELT PULLEY: Width (Ins.)	BELT PULLEY: R.P.M.	BELT PULLEY: Position	Forward Speeds	TRACTOR SPEED M. P. H.: 1st	2nd	3rd	Rev.
Austin	Own....	4-3¾x5	1500	Hol. c. s.	Gear..	Opt...	Cone..	Spur..	2	2	42x10	68	Live..	None...	3136	No...	Wet...	24	6	360	Side..	2	2½	4¼	...	2
Blackstone	Own....	3-5 x6½	750	Hol. c. s	Gear..	Ker...	Cone..	Spur..	ch. tr	..	.....	..	Sta...	Struct..	5400	Yes..	None..	10& 17	6	500	Frt..	3	2	3	3½	1½
Crawley*	Own....	4-4½x5½	950	Hol. c. s.	Gear..	Gas...	Cone..	Spur..	2	1	48x 8	..	Sta...	Press'd.	4704	No...	None..	14	6	550	Side..	2	3¾	2½	...	1½
Fowler*	Wauk...	4-3¾x5¼	1200	Hol. c. s.	Gear..	Opt...	Plate..	Spur..	2	1	54x 8	..	Sta...	Struct..	4480	No...	Dry...	8	4¾	1040	Side..	2	1¾	3	...	1½
Glasgow	Cont....	4-4⅛x5¼	1150	Circ. sp..	Piston	Ker...	Cone..	Bevel.	3	..	39x12[1] & 8[2]	75	Live..	None...	4144	No...	Dry...	9	6	1150	Side..	2	2½	4½	...	1¾
Martin	Gall....	4-4¼x5½	1000	Circ. sp..	Piston	Ker...	Cone..	Spur..	2	2	52x12	86	Sta...	Struct..	5600	No...	Wet...	18	6	450	Side..	2	2	3½	...	2
Omnitractor	Own....	2-6½x9	750	Hol. c. s.	Gear..	Ker...	Cone..	Spur..	2	2	60x16	90	Sta...	Struct..	7500	Yes..	Dry...	15	6	500	Side..	2	2¼	4½	...	2½
Peterboro	Ricar....	4-4¾x5½	950	Hol. c. s.	Piston	Ker...	Cone..	Spur..	2	2	54x10	87	Live..	Struct..	5600	No...	Dry...	12	6	900	Rear.	2	1⅞	2¾	...	1⅜
Saunderson	Dion....	2-5½x8	750	Hol. c. s.	Gear..	Ker...	Cone..	Spur..	2	2	48x10	90	Live..	Struct..	5824	No...	Dry...	12	7	750	Side..	..	1⅝	2⅛	4¼	2⅛
Wallis (British)	Ruston..	4-4¼x5¾	850	Circ. sp..	Gear..	Ker...	Plate..	Spur..	2	2	48x12	84	Live..	None...	4212	Yes..	Wet...	18	6¾	850	Side..	2	2½	3½	...	2½
Weeks-Dungey	Wauk...	4-4¼x5¾	900	Circ. sp..	Gear..	Ker...	Plate..	Spur..	2	2	40x10	60	Live..	Struct..	3920	No...	Dry...	8	6	900	Rear.	3	1¾	2¾	4½	1½

*Self-contained motor plow.

Current Specifications Indicate Great Diversity in Airplane Design

Aeronautic industry is still too young and variety of uses too great for standardization or concentration on production of a few types. About half American planes listed are for commercial or passenger carrying purposes and twenty per cent are sport planes. Others mostly military types.

THERE is such great diversity in the design of modern airplanes that it is difficult to discover any marked trends by comparing the specifications given herewith with those published in these columns in former years. It is therefore easy to conclude that the aeronautic industry is far from settling down to the production of relatively standardized vehicles. In fact, aside from the production of an occasional sporting plane or one designed for some special character of service, and a few for passenger carrying purposes, there is but little business outside that placed with a few concerns by the Government.

Of the 31 American planes listed in the accompanying table of specifications, about half are intended for commercial and passenger service. Of these one, an experimental type, is designed for carrying 27 passengers, one twelve passengers, one six and the others from two to five, including the crew. Forty per cent of the remainder (20 per cent of the total) listed are sporting types, and the others are mostly military types designed by or for the Government and built by it in some instances. The largest of the American machines are designed to carry a useful load of about 5000 lbs., and the fastest, according to the figures given, are the two Curtiss machines. One of these, in fact, holds the speed record for a closed course, having won the Pulitzer Trophy last November when it flew 150 miles at an average speed of 176.3 miles per hour. It is interesting to note that the weight of the American machines varies from 5.24 lb. per hp. for the high speed machines to over 20 lb. for some of the slower and larger machines. On the other hand the wing loading varies from 5 lb. per sq. ft. to 13.75 lb.

Nearly all of the American machines are fitted with water-cooled engines.

The European airplanes listed are of an even greater diversity of design than the American machines. They range from the giant Caproni, designed to carry 100 persons, down to the single seaters. There are several machines designed to carry from 10 to 25 persons, among the largest of these being the Handley-Page, Morane-Saulnier, Breguet, Vickers-Vimy and Fiat.

Weights per hp. vary from 5.1 lb. for the Hanriot-Dupont (which is the fastest, according to the figures given, of all the machines listed) to 25.3, while wing loadings vary from 20.6 to 5.8 lb. per sq. ft. Of all the machines listed the Breguet and the P.R.B., an Italian plane, are credited with the largest range of action, each of these being capable of flying 1000 miles at high speed. without stop.

The airplane industry suffered more acutely from the industrial depression of 1921 than any other unit of the automotive industry. Conditions have been such during the past year that production has been practically at a standstill so far as many manufacturers are concerned. An upward swing is expected, however, during 1922.

Specifications of American Aircraft Engines 1921-1922

(Compiled for Automotive Industries by A. & D. R. Black)

Name and Model	CYLINDER DATA					Piston Displ., Cu. Ins.	RATING		Approx. Gals. Gas per Hour	CONSUMPTION PER B.H.P. HR. IN LBS.			WEIGHT IN LBS.			Brake M. E. P. Lbs. Sq. In.	Compression Ratio	Carburetor	Ignition	INSTALLATION DIMENSIONS IN INCHES				
																				Overall			Height Above Eng. Bed	Center to Center of Beds
	No.	Arrgt.	Cooling	Bore	Stroke		B.H.P.	Crank R.P.M.		Gas	Oil	Total	Dry Eng.	Jacket Water	Total					Length	Height	Width		
Aeromarine....U-6-D	6	Vert....	W...	4¼"	6½"	552.48	152	1750	12.95	.509	.031	.54	518	27	545	124.0	5.32	Zenith...	Dixie...	61¾	40 3/16	23¼	24 7/8	14
Aeromarine....U-8-D	8	V-60°...	W...	4¼"	6½"	736.67	195	1750	14.2	.471	.011	.482	554	36	590	124.0	5.32	Zenith...	Dixie...	52 5/8	34 7/16	32 3/4	22 1/16	13 5/32
Curtiss.....CD-12	12	V-60°...	W...	4½	6"	1145.0	385	2000	32.1	.5	.015	.515	700	38	738	135.0	5.7	B&BorZ.	Berk....	58 1/8	37½	28¼	21½	15 3/4
Curtiss.....C-G	6	Vert....	W...	4½"	6"	573.0	160	1750	13.3	.50	.015	.515	420	19	439	128.0	5.2	Zenith...	Berk....	57 3/4	40 3/4	23 1/8	24 11/32	15 3/4
Hall-Scott.....L-4	4	Vert....	W...	5"	7"	549.68	125	1700	12.0	.57	.029	.599	380	10¾	390¾	112.9	5.25	Stmbg...	Delco...	52	41 3/4	22	20 3/4	16
Hall-Scott.....L-6	6	Vert....	W...	5"	7"	824.67	200	1700	19.0	.55	.029	.579	530	16	546	112.9	5.25	Stmbg...	Delco...	65	44	18¼	20½	16
Lawrence.....L-4	3	Radial..	A....	4¼"	5¼"	225.0	62	1820	5.25	.5	.03	.53	160	..	160	120.0	5.0	Stmbg...	Dixie...	22 3/8	35 3/8	35 1/8		
Lawrence.....J-1	9	Radial..	A....	4½"	5½"	787.5	220	1800	18.7	.5	.03	.53	425	..	425	123.0	5.0	Stmbg...	Dixie...	Dia. 36	Dia. 43½	Dia. 43½	....	Flange 19¼
Packard.....825	8	V-60°...	W...	5"	5¼"	825.0	230	1800	18.5	.48	.03	.51	550	23	573	125.0	5.5	Pack....	Mag....	50 7/8	38 11/32	27 3/4	22 13/32	B.C. 14½
Packard.....1237	12	V-60°...	W...	5"	5¼"	1237.0	350	1800	30.0	.51	.03	.54	740	39	779	124.0	6.5	Pack....	Mag....	63¼	38 11/16	27 3/4	22 3/4	14½
Packard.....2025	12	V-60°...	W...	5¾"	6½"	2025.0	582	1800	51.0	.52	.03	.55	1120	51	1171	126.0	5.5	Pack....	Mag....	72 5/8	45 1/4	31 3/4	26 5/32	17 3/4
Steel Prod.Rausie E-6	6	Vert....	W...	5"	6"	707.0	175	1650	14.5	.50	.038	.538	540	25	565	119.0	5.5	Stmbg...	Dixie...	60	47	23½	30	15 3/8
Union.....3-6	6	Vert....	W...	4¾"	6½"	691.0	125	1400	11.0	.56	.018	.578	496½	..	....	109.0	5.5	Zenith...	Philb...	69½	53¼	24	30¼	16
War Dept.....W	18	W.....	W...	....	....	....	App. 700	1700		Gene	ral D	ata N	ot R	eleased	For P	ublicati	on							
Wright.....E-2	8	V-90°...	W...	4.724	5.118	718.9	190	1800	15.0	.48	.02	.50	480	45	525	116.4	5.5	Stmbg...	Dixie...	49 1/8	34 3/8	33 7/16	18¾	13 3/32
Wright.....H-3	8	V-90°...	W...	5.512	5.906	1126.4	325	1800	26.7	.50	.02	.52	625	58	683	127.0	5.5	Stmbg...	Dixie...	51¾	39 5/8	38 5/8	23½	14 1/16

Specifications of American and

(Compiled for Automotive In

Nationality Make and Model	GENERAL						ENGINE			WING AND TAIL DATA					
			Over-all Dimensons							Angle of Incidence		Chord		Span	
	Type	Use	Length, Ft.-In.	Height, Ft.-In.	Width, Ft.-In.	Crew and Pass.	No.	Make	Total H.P.	Upper deg.	Lower deg.	Upper, Ft.-In.	Lower, Ft.-In.	Upper, Ft.-In.	Lower, Ft.-In.
AMERICAN															
Aeromarine 40-U	PB Boat	PA	28-11 3/16	12- 7	48- 6	2	1	Aeromarine, U-6-D	130	3½	2	6- 3	6- 3	48- 6	37- 6
Aeromarine 44-U	PB Boat	PA	28-11 3/16	12- 7	48- 6	3	1	Aeromarine, U-6-D	130	3½	2	6- 3	6 -3	48- 6	37- 6
Aeromarine 50-U	PB Boat	PA	28-11 3/16	12- 7	48- 6	2	1	Aeromarine, U-8-D	180	4⅓	3	6- 3	6- 3	48- 6	37- 6
Aeromarine 75	TB Boat	C	49- 4	18- 9	103-9	12	2	Liberty, C	700	4	4	8- 0	8- 0	103- 9	74- 4
Aeromarine 80	PB Boat	C	38- 6	14- 7	74- 0	6	1	Liberty, C	350	5½	4	6- 3	6- 3	74- 0	....
Aerial Transport VBL-1	TB Land	C	39- 6	12- 3	57- 0	2	1	Liberty	400	0	0	7- 3	7- 3	57- 0	52- 0
**Bethlehem Baco Skylark	TB Land	SP	23- 0	8- 0	29-10 Folded	2	1	Lawrence	60	....	....	4- 0	4- 0	29-10	29-10
Barnhardt BT-15	TB Land	C	32- 6	10- 1½	22- 0	5	2	Curtiss, OX-5	180	....	....	5- 6	5- 6	49- 1	49- 1
Cox-Klemin, Mercedes-Standard	TB Land	PA	27- 4	10-10	43-11	3	1	Mercedes	190	2½	2½	6- 0	6- 0	43-11	31- 0
Cox-Klemin DH-6 Benz	TB Land	PA	28- 0	10- 9½	35-11	2	1	Benz	150	4	4	6- 4	6- 4	35-11	35-11
**Curtiss Cactus Kitten	TT Land	SP	19- 3	8- 6	20- 0	1	1	Curtiss, C-12	435	....	....	....	....	20- 0	20- 0
**Curtiss Navy Racer	TB Land	SP	20- 0½	8-11	22- 8	1	1	Curtiss, CD-12	405	....	0	4- 0	4- 0	22- 8	22- 8
Dayton-Wright FP-2	TB Seaplane	AP	36-10¼	14- 0	15- 5	4	2	Liberty, A	840	2	2	7- 0	7- 0	51- 5	51- 5
Elias TA-1	TB Land	Trn.	23- 0¾	9-11	32- 7	2	1	A-B-C Wasp	170	4	4	5- 8	5- 8	32- 7	32- 7
Heath, E. B	TB Land	SP	18- 0	6- 6	24- 0	1	1	Heath	20	4	....	4- 0	4- 0	24- 0	....
Huff-Daland TA-2	TB Land	Trn	21- 6	....	35- 2	2	1	A-B-C Wasp	170	2	2	6- 0	4- 0	35- 2	35- 2
Kinner K-1	TB Land	PA	19- 0	7- 6	26- 3	2	1	Kinner	60	....	....	4- 0	4- 0	26- 3	26- 3
Loening 23	PM Boat	PA	29- 0	8- 0	43- 0 Folded	5	1	Liberty	400	4½	....	8- 0	....	43- 0	....
Martin, Glen L. MB-2	TB Land	B	43- 7 5/16	15- 6¾	37-10	3	2	Liberty	840	2	2	7-11	7-11	74- 2	74- 2
Martin, James V. K-4	TB Seaplane	MS	16-10	7- 1	24- 2	1	1	Lawrence	60	2	2	3- 3	3- 3	24- 2	2-4 2
Nebraska	TB Land	C	27- 0	11- 7	44- 7	3	1	Hispano-Suiza	....	....	....	6- 0	....	....	....
**Orenco Tourister II	TB Land	PA	....	9- 4	39- 0	5	1	Wright, E-2	190	2	2	5- 0	5- 0	39- 0	39- 0
Remington-Burnelli RB	TB Land	E & C	41- 2	18- 0	74- 0	27	2	Liberty	800	2	2	10- 6	10- 6	74- 0	74- 0
War Department GA-1	PT Land	AT	33- 7⅜	14- 3	65- 6	3	2	Liberty	800	1½	1½	6- 8	6- 8	65- 6	65- 6
War Department XBIA	TB Land	O	25- 6	9- 9½	39- 4 9/16	2	1	Wright-Hispano	300	1¾	1¾	5- 6	5- 6	39- 4 9/16	39- 4 9/16
War Department USD9A	TB Land	O	30- 2	11- 2	45-11	2	1	Liberty	400	2½	2½	5- 9	5- 9	45-11	45-11
Wittemann DHM2	TB Land	M	30- 2½	11- 5	48- 8	1	1	Liberty	400	3	3	5- 6	5- 6	48- 8	48- 8
**Waterman OX5	TM Land	SP	....	....	21- 9 Folded	1	1	Curtiss, OX-5	90	....	....	5- 6	....	21- 9	....
**Longren	TB Land	PA	19- 0¼	7- 8	9- 8	2	1	Anzani	60	3	2	4- 3	4- 3	27-11	21-11
Martin, Glenn L. GMB	TB Land	B	46-10	14- 7	71- 5	3	2	Liberty	800	2	2	7-10	7-10	71- 5	71- 5
Rogers Const. TAD-1	TB Land	SP	....	....	29- 0	....	1	Curtiss, OX-5	90	....	0	4- 6	4- 6	29- 0	29- 0
AUSTRIAN															
W. K. F. Co.—Sport-Plane	TB Land	SP	14- 4	....	17- 3	1	1	Haacke	35	....	....	3- 3	3- 3	17- 3	17- 3
Aviatik Co.—Phoenix	TB Land	F	25- 0	9- 7	36- 0	2	1	Hiero	230	4	3½	5- 6	4-11	36- 0	28- 2
Avia Co.—B. H.	TM Land	SP	19- 0	6- 8	35- 5	2	1	Austro Damler	40	....	....	4- 2	....	35- 5	....
Aero Co.—AE-2.01	TB Land	SP	17-10	8- 0	23- 8	1	1	Hispano-Suiza	220	....	....	4- 3	3- 3	23- 8	22- 6
BELGIAN															
Droesbeke Co.—Droesbeke	TB Land	SP	18- 6	....	18- 6	...	1	Hispano Suiza	300	....	....	3- 3	3- 3	18- 6	18- 6
BRITISH															
Armstrong—Siddeley / Whitworth—Sinaia	TB Land	DB	....	....	....	....	2	Siddeley-Tigers	....	Details	withheld	by Eng.	Authorities		
A. V. Roe—Antarctic	TB Seaplane	SP	22- 5	9- 7	26- 3	2	1	La Rhone	80	5.5	5.5	4- 0	4- 0	26- 3	24- 0
A. V. Roe—Avro-Lion	TB Land	SP	18- 2	8- 6	25- 6	1	1	Napier-Lion	450	....	....	4- 6	4- 6	25- 6	24- 6
Bristol Co.—Bristol Commercial	TB Land	C	42- 0	11- 0	54- 0	10	1	Napier-Lion	450	....	....	6-10	6-10	54- 0	54- 0
DeHaviland Co—DH-29	TM Land	C	43- 0	....	54- 0	14	1	Napier-Lion	450	....	....	12- 4 Tapered	....	54- 0	....
DeHaviland Co—DH-32	TB Land	C	39- 0	13- 6	50- 0	9	1	Rolls-Royce	360	3	3	6- 6	6- 6	50- 0	50- 0
Fairey Co.—Fairey III-D	TB Seaplane	F	36- 1	14- 6	46- 1	2	1	Rolls-Royce Eagle	360	....	....	5- 6	5- 6	46- 1	46- 1
Gloucestershire Co—Mars I or Bamel	TB Land	R	21- 0	....	23- 0	1	1	Napier-Lion	450	....	....	4- 9	4- 9	23- 0	23- 0
Handley-Page Co.—V-1500	2T2 PB Land	C	64- 0	23- 0	126- 6	25	4	Rolls-Royce Eagle	1400	....	....	13 -0	13- 0	126- 6	126-6
HandasydeCo.—300-Monoplane	TM Land	C	33 -3	9- 0	47- 0	6	1	Hispano-Suiza	300	....	....	Tapered	....	47- 0	....
HandasydeCo.—450-Monoplane	TM Land	C	39- 6	10- 2	57- 0	10	1	Napier-Lion	450	....	....	Tapered	....	57- 0	....
F. H. Lowe Co.—Marlburian	TM Land	S	16- 9	8- 4	27- 4	2	1	Gnome	60	....	....	5- 3	....	27- 4	....
Parnall Co.—Puffin-Amphibian	TB Seaplane	S	....	....	....	....	1	Napier-Lion	450	....	....	Details		Withheld	
Sage Co.—Sage No. 10	TB Amphibian	F	29- 3	12- 2	40- 0	2	1	Cosmos Jupiter	450	....	....	6- 9	5- 9	40- 0	26- 3
Supermarine Co.—Seal—MK II Amphibian	TB Boat	N	32-10	14-10	48- 0	3	1	Napier-Lion	450	3	3	7- 0	7- 0	48- 0	48- 0
Vickers—Saunders Valentia	TB Boat	C	58- 0	22- 0	112- 0	5	2	Rolls-Royce Condor	1200	5	5	10- 6	10- 6	112- 0	....
Vickers—Viking MK-IV	PBBoatAmphib	C or N	33- 6	15- 1	50- 0	5	1	Napier-Lion	450	6	6	7- 1	7- 1	50- 0	50- 0
Vickers—Vickers Vim	PB Land	Trn	32- 4	12- 4	47- 8	2	1	Rolls-Royce	360	4.25	4.25	5- 6	5- 6	47- 8	47- 8
Vickers—Vimy Ambulance	TB Land	A	42- 8	13- 3	68- 0	8-12	2	Napier-Lion	900	....	....	10- 6	10- 6	68- 0	68- 0
DUTCH															
N. A. V. O.—N. A. V.-6	TM Land	C	28-10	11- 2	45- 3	6	1	Benz	220	....	....	8- 4	....	45- 3	....
Netherlands—Fokker C-II	TB Land	C	24- 9	9- 5	23- 8	3	1	B. M. W.	185	....	....	....	....	23- 8	....
Netherlands—Fokker F-III	TM Land	C	33-10	10- 6	52- 6	6	1	Siddeley Puma	230	....	....	10- 4	....	52- 6	....
Van Berkel—W. B.	TM Seaplane	F	44- 6	14- 6	62- 0	2	1	Rolls-Royce Eagle	360	....	....	....	....	62- 0	....
FRENCH															
Breguet—Leviathan XX	TB Land	C	46- 0	16-10	83- 7	12	2	Bugatti	800	....	....	9- 6	9- 6	83- 7	83- 7
Buscaylet Co.—Amphibian	TM	C	83- 8	16- 5	136-0	....	3		1500	....	....	31-0 Tap	....	136- 0	....
Caudron—C-39	TB Seaplane	C	43- 0	14- 0	68- 6	6	3	Clerget	390	....	....	....	....	68- 6	68- 6
Caudron—C-60	TB Land	R	24- 7	....	33- 4	2	1	Clerget	130	....	....	....	....	33- 4	31- 4

ABBREVIATIONS—

*—Estimated
A—Ambulance
AT—Attack
B—Bombing
C—Commercial
DB—Day Bombing
E—Experimental
F—Fighting
L—Lower
M—Mail Carrier
Ms—Messenger
N—Naval
P—Pusher
PA—Passenger
PB—Pusher Biplane

**Taken from published data. All other data regarding American planes supplied by manufacturers.

Foreign Airplanes 1921-1922.

dustries by A. & D. R. Black)

WING AND TAIL DATA — Areas in Square Feet											WEIGHT IN LBS.							PERFORMANCE						
																		High Speed			Climb		Service or	Range at
Wings Total —Ail's	Ailerons	Stabilizer	Elevators	Vert. Fin.	Rudder	Non-skid Planes	Gap Ft.-In.	Stagger In.	Sweepback deg.	Dihedral deg.	Empty	Gas and Oil	Useful Load	Total Gross	Useful % Gross	Lbs. per H.P.	Lbs. per Sq. Ft.	M.P.H.	Alt. Feet	Low Speed M.P.H.	Mins.	Feet	Approx. Ceiling (Feet)	High Speed Miles
504	58.0	39.0	25.6	15.0	17.5	None..	6- 6	8	None...	2	2,161	278	638	2,799	22.8	21.5	5.55	76.0	SL	44.0	10.0	2,400	....	....
504	58.0	39.0	25.6	15.0	17.5	None..	6- 6	8	None...	2	2,245	282	821	3,067	26.8	23.6	6.1	73.5	SL	50.0	10.0	2,500	....	200
504	58.0	39.0	25.6	15.0	17.5	None..	6- 6	12	None...	2	2,240	471	931	3,275	28.4	18.2	6.5	87.8	SL	52.2	10.0	3,500	....	300
1,397	119.0	120.9	53.3	34.7	33.5	31.1	8-10½	None...	None...	1½	8,456	1,587	4,367	12,823	34.0	18.3	9.2	85.0	SL	50.0	....	....	....	340
803	105.5	54.8	45.6	19.6	27.0	16.0	7- 6½	None...	None...	2	4,300	1,020	2,100	6,500	32.3	19.7	8.09	91.0	SL	51.0	10.0	2,500	....	570
749	85.0	68.0	44.0	8.8	23.5	None..	7- 3	None...	None...	1½	3,460	960	3,320	6,780	49.0	16.9	9.05	102.0	SL	48½	6.0	3,000	10,000	450
214	.....	.....	.....	.....	.....	.....	5- 0	20	None...	1½	700	.....	600	1,300	46.0	19.3	5.0	90.0	SL	33.0	1.0	600	18,000	.....
526	80.0	36.0	23.0	10.3	19.0	None..	6- 8	None...	None...	None...	2,611	540	1,420½	4,031½	35.2	22.4	7.67	90.0	SL	40.0	10.0	3,000	10,000	405
429	42.0	24.0	22.0	4.0	10.0	None..	6- 0	.....	5	1¾	1,815	210	735	2,550	29.0	13.4	5.9	93.0	SL	35.0	21.0	10,000	15,000	165
436	76.0	36.0	26.0	5.0	12.0	None..	5- 8½	None...	None...	2	1,695	210	555	2,050	27.0	13.65	4.7	85.0	SL	30.0	20.0	10,000	16,500	200
175	.....	.....	.....	.....	.....	None..	.....	None...	None...	.....	.....	.....	.....	2,406	.....	5.53	13.75	Est 196.0	SL	70.0	.....	.....	.....	228
186	18.0	12.6	9.2	4.8	4.8	None..	4- 0	15	None...	.....	1,735	.....	430	2,165	19.86	5.24	12.5	Est 190.0	SL	70.0	.....	.....	.....	.....
668	88.0	53.8	29.0	20.8	28.7	None..	7- 8½	None...	None...	2	5,726	916	1,862	7,588	24.5	9.02	11.35	Est 120.0	SL	63.0	10.0	5,000	18,000	250
337	.....	.....	.....	.....	.....	.....	5- 8	None...	.....	2	1,447	219	615	2,062	29.8	14.75	6.1	97.0	SL	.....	16½	10,000	16,000	145
165	20.0	5.0	7.0	2.5	4.0	None..	4- 0	15	None...	1½ low	350	45	200	550	51.0	27.5	3.25	60.0 78.5	2,000 10,000	29.0	1.0	800	5,000	55
318	.....	.....	.....	.....	.....	.....	.....	.....	.....	2½ low	1,386	242	602	1,988	30.3	14.2	6.25	85.6	SL	.....	29½	10,000	11,700	256
200	30.0	14.0	12.0	3.0	6.0	None..	4- 6	.....	None...	2	600	60	400	1,000	40.0	16.66	5.0	76.0	SL	35.0	60.0	12,000	10,000	150
330	22.0	23.5	19.0	24.0	16.5	.....	.....	.....	.....	.....	2,200	390	960	3,550	38.0	8.5	10.7	135.0	19,500	50.0	10.0	10,000	22,000	.....
1,121	130.0	62.25	43.2	17.6	38.5	None..	8- 6	None...	None...	2 low	7,057	1,965	5,018	12,075	41.5	14.4	10.76	100.0	SL	60.0	10.0	4,000	9,000	450
150	16.0	12.0	7.0	None..	6.0	5.0	3- 6	None...	None...	None...	685	75	265	950	28.0	15.83	6.33	80.0	SL	.....	.....	.....	.....	240
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
358	40.0	27.7	23.1	4.7	11.8	None..	5- 3	14½	None...	None...	1,847	.....	978	2,825	34.5	15.7	7.3	110.0	SL	49.0	23.0	10,000	.....	264
1,323	124.0	50.0	104.0	25.0	48.0	None..	10- 9	None...	4	1½ 0	9,040	2,130	5,000	16,170	32.0	22.0	12.0	115.0 95.0	SL 8,000	48.0	10.0	5,000	14,000	630
1,016	.....	.....	.....	.....	.....	.....	5- 0	None...	None...	1½ 3	7,532	675	2,208	9,740	22.7	11.0	9.6	105.0	SL	.....	22.8	8,000	9,600	183
405.6	.....	.....	.....	.....	.....	.....	5- 5	18	.....	3½	2,010	341	984	2,994	32.8	8.85	7.4	126.0 133.0 117.6	10,000 SL 10,000	.....	10.0	10,000	20,900	319
514	.....	.....	.....	.....	.....	.....	6- 1½	13½	.....	2	2,815	933	1,507	4,322	34.8	9.9	8.4	126.2	SL	.....	13.25	10,000	18,700	855
500	73.2	37.2	23.6	5.6	15.8	None..	6- 0	9	None...	3	3,060	903	1,940	5,000	38.8	12.5	10.0	122.0	SL	50.0	9½	8,000	15,600	426
112	16.0	12.0	10.0	1.5	5.0	None..	.....	.....	None...	None...	885	86	245	1,130	21.7	12.5	11.1	130.0	SL	60.0	.....	.....	.....	.....
189	19.1	13.5	11.4	2.6	5.6	None..	.....	None...	None...	3	550	.....	500	1,050	47.5	17.5	5.55	.....	.....	.....	.....	.....	.....	.....
1,070	.....	.....	.....	.....	.....	.....	8- 4	None...	.....	None...	6,702	1,415	2,483	9,185	27.2	11.45	8.6	96.2 106.0	10,000 SL	.....	22.6	10,000	12,600	450
252	36.0	19.0	17.0	5.0	9.0	None..	5- 0	15	None...	2	1,142	142	573	1,815	20.0	19.7	7.2	85.0	SL	44.0	21.0	5,000	8,000	.....
101	6.0	8.0	4.5	3.0	3.5	None	3-4	21	None	{U 0 {L 2	....	150	....	740	....	21.0	7.4	81.0	SL	.....	....	....	....	400
247	17.2	....	12.9	....	7.5	None	5-3	22	None	....	1,800	280	930	2,730	34.0	11.9	11.0	113.0	SL	....	20.5	10,000	....	300
116.2	....	....	....	....	....	None	....	....	None	Tapered	582	90	430	1,012	42.5	25.3	8.7	70.0	SL	.....	10.0	3,300	....	250
172.2	....	....	....	....	....	None	4-3	8	None	{U-1 {L-2	1,200	....	710	1,910	32.0	8.7	11.1	136.0	SL	.....	....	....	....	....
122	....	....	....	....	....	None	4-3	14	None	....	1,410	....	520	1,930	26.9	6.4	16.0	177.0	SL	68	....	....	23,000	....
....	....	....	....	....	....	None	....	None	None	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
184.5	....	14.5	7.0	....	7.5	None	4-3	18	None	2 5	1,000	160	600	1,600	37.5	20.0	8.7	90.0	SL	43	15.0	5,000	....	350
....	....	....	....	....	....	None	4-6	None	None	U-0			Detail	s Wit	hheld									
672	....	....	....	....	....	None	5-9	None	None	L-3	3,900	800	2,900	6,800	42.6	15.1	10.1	122.0	SL	.....	22.0	10,000	13,500	400
440	....	54.0	31.0	9.0	16.2	None	....	....	Tapered	Tapered	4,350	....	3,150	7,500	42.0	16.7	17.1	....	....	.....	....	....	....	....
681	23.0	56.0	24.2	6.4	18.0	None	6-10	None	None	3	3,412	800	2,326	5,738	40.0	15.9	9.3	110.0	SL	.....	27.5	10,000	14,000	400
500	....	27.2	19.2	9.0	14.5	None	5-7	....	None	....	3,990	825	1,060	5,050	21.0	14.0	10.0	110.0	SL	.....	6.7	5,000	17,000	500
205	....	....	....	....	....	None	4-9	16	None	....	1,890	425	610	2,500	24.4	5.5	12.2	163.0	SL	.....	....	....	....	320
3,220	....	....	....	....	....	None	15-0	None	None	....	15,800	7,800	12,200	28,000	43.5	20.0	8.7	100.0	SL	50	8.0	5,000	....	900
375	....	....	....	....	....	None	....	....	Tapered	None	2,450	750	1,750	4,200	41.6	14.0	11.2	112.0	SL	45	5.0	3,000	15,000	500
540	....	....	....	....	....	None	....	....	Tapered	None	4,100	900	2,900	7,000	41.5	15.5	13.0	125.0	SL	45	5.0	3,000	15,000	450
107	18.0	8.8	9.8	1.8	4.6	None	....	....	None	2.5	450	....	....	....	....	....	....	100.0	SL	33	....	....	....	240
by	Englis	h Au	thoriti	es		None	....	....	None															
390	31.0	46.0	28.0	12.5	8.5	None	6-0	22	None	2	....	....	....	....	....	....	....	110.0	SL	....	10.0	10,000	16,500	400
644	....	....	....	....	....	None	....	....	None	3	....	....	1,790	....	....	....	....	104.0	SL	45	....	....	....	520
2,000	....	....	....	....	....	Yes	10-0	....	None	1.5	10,550	4,400	7,750	18,300	42.4	15.3	9.1	110.0	6,000	.....	9.5	6,000	.....	800
636	....	35.0	25.0	11.0	14.0	None	7-7	None	None	U-0 L-5	3,740	650	1,935	5,675	34.1	12.6	8.9	118.0	SL	50	3.3	3,000	17,000	480
488	69.0	52.0	29.0	2.6	13.0	None	6-1	None	None	4	2,950	335	695	3,645	19.0	10.1	7.5	100.0	SL	45	8.2	6,000	13,000	200
1,330	24.2	11.4	63.0	27.0	21.5	None	10-0	None	None	4	7,800	1,340	4,070	11,870	34.3	13.2	8.9	109.0	6,500	50	10.0	6,500	....	545
395	....	....	....	....	....	None	....	....	Tapered	Tapered	2,640	400	1,100	3,740	29.4	17.0	9.5	100.0	SL	.....	....	.....	....	450
290	....	....	....	....	....	None	....	....	None	....	1,820	300	780	2,600	30.0	14.0	9.0	115.0	SL	45	5.0	3,300	....	450
473	30.5	21.0	25.8	....	14.0	None	....	....	Tapered	Tapered	2,815	700	1,705	4,520	37.7	19.7	9.6	105.0	SL	.....	....	....	....	500
....	....	....	....	....	....	None	....	....	None	2.0	....	1,170	2,100	....	....	....	....	112.0	SL	50	17.0	6,800	12,000	940
1.500	....	77.0	88.6	44.0	21.5	None	11-8	None	3.5	4.0	5,720	3,300	8,180	13,900	58.8	17.4	9.3	118.0	SL	55	20.0	6,500	14,800	1,000
3,120	....	....	....	....	....	None	....	....	Tapered	Tapered	14,100	....	12,300	26,400	46.5	17.6	8.5	110.0	SL	.....	....	....	18,700	....
954	....	....	....	....	....	None	....	None	None	{U-0 {L-3	....	800	....	6,750	....	17.3	7.1	80.0	SL	.....	....	....	....	320
270	....	....	....	....	....	None	....	None	None	{U-0 {L-2.5	1,110	....	790	1,900	41.5	14.6	7.0	....	....	.....	....	....	....	....

PM—Pusher Monoplane
PT—Pusher Triplane
R—Racer
S—Scout or Pursuit
Sp—Sport
STP—Scout Torpedo Plane
Trn—Training
Tap—Tapered
T—Tractor
TB—Tractor Biplane
TM—Tractor Monoplane
TT—Tractor Triplane
TP—Torpedo Plane
TF—Trench Fighter
U—Upper

Specifications of American and For

Nationality, Make and Model	GENERAL						ENGINE			WING AND TAIL DATA					
			Over-all Dimensions							Angle of Incidence		Chord		Span	
	Type	Use	Length, Ft.-In.	Height, Ft.-In.	Width, Ft.-In.	Crew and Pass.	No.	Make	Total H.P.	Upper deg.	Lower deg.	Upper, Ft.-In.	Lower, Ft.-In.	Upper, Ft.-In.	Lower, Ft.-In.
FRENCH (Concluded)															
Ernoul—F. A. T. M.—A-2	TM Land	C	43- 0	....	72- 0	8	2	Salmson	460	....	....	Tapered	....	72- 0	....
Hanriot-Dupont—HD-22	TM Land	R	18- 9	7-10	21- 0	1	1	Hispano Suiza	320	....	....	....	....	21- 0	....
Farman—Levy	IP ZT B Boat	B	59- 0	....	108- 6	4	3	Panhard	1050	....	....	11-10	11-10	108- 6	....
Latham—Multi-Engine	2T-2P B Boat	C	60- 0	16- 0	104- 0	....	4	Salmson	1000	....	....	....	....	104- 0	78- 0
Nieuport Delage—30-T	TB Land	C	....	....	59- 0	8	1	Sunbeam	420	....	....	9-10	8- 4	59- 0	42- 8
Delage—Sea Qui-Plan	TM Land	R	20- 0	6- 8	26- 4	1	1	Hispano-Suiza	300	2	....	4-11	....	26- 4	....
S. P. A. D.—S-33 Berline	TB Land	C	29- 9	10- 6	28- 4	6	1	Salmson	250	....	....	....	....	38- 4	34- 2
Morane Saulnier — Cantilever Monoplane	TM Land	C	56- 8	10- 5	93- 0	18	5	Lorraine Dietrich	1110	....	....	19- 0	....	93- 0	....
Monge—Monge Monoplane	TM Land	R	23- 0	....	26- 3	1	1	Hispano-Suiza	300	2	....	Tapered	....	26- 3	....
Monge—Monge Biplane	TB Land	R	23- 0	....	26- 3	1	1	Hispano-Suiza	300	2	2	Tapered	Tapered	26- 3	18- 0
Potez—VIII R	TB Land	SP	19- 5	8- 2	26- 3	2	1	Le Rhone	80	....	....	4- 6	4- 6	26- 3	23- 6
Potez—IX	TB Land	C	32- 0	10- 7	46- 3	5	1	Lorraine Dietrich	370	....	....	....	....	46- 3	46- 3
Potez—X	TB Land	C	40- 4	14- 3	60- 2	11	3	Hispano-Suiza	420	0	0	9- 3	9- 3	60- 2	56- 0
Spad—Spad Navy	TB Land	N	26- 0	....	34- 4	2	1	Hispano-Suiza	275	....	....	7- 8	5- 6	34- 4	30- 3
Wibault—3-C-1	TM Land	S	27-11	....	37- 5	....	1	Hispano-Suiza	300	....	....	....	....	37- 5	....
Wibault—2-B N-2	TB Land	C	41-10	....	55- 5	12	1	Renault	600	....	....	10- 2	10- 2	45- 3	55- 5
GERMAN															
Albatros—W-10	PM Boat	C	31-10	6- 6	45- 9	4	1	Mercedes	120	....	....	7- 0	....	45- 9	....
Albatros—Commercial	TM Land	C	34- 1	11- 7	52- 6	8	1	B. M. W	185	....	....	11- 6	....	51- 0	....
Dornier—C-I	TB Land	F	24- 5	8- 8	34- 6	2	1	Mercedes	160	....	....	5- 0	5- 0	34- 6	30- 0
Dornier—C-III	TM Land	C	29-10	8- 3	55- 9	6	1	B. M. W	185	....	....	9-10	....	55- 9	....
Dornier—CS-I	TM Seaplane	F	....	....	....	2	1	Benz	195	....	....	....	....	....	....
Dornier—CS-II	TM Boat	C	33- 2	9- 0	55- 9	6	1	B. M. W	185	....	....	9-10	....	55- 9	....
Dornier—D-I	TB Land	F	....	....	....	1	1	B. M. W	185	....	....	....	....	....	....
Dornier—Dragon Fly	TM Boat	SP	23- 6	7- 5	27- 7	3	1	Siemens-Halske	60	....	....	5- 5	....	27- 7	....
Dornier—G-I	TM Land	C	40- 0	10-11	69- 0	9	2	B. M. W	370	....	....	13- 1	....	69- 0	....
Dornier—GS-I	IP-IT M Boat	C	50- 3	14- 2	69- 0	8	2	Maybach	520	....	....	14- 2	....	69- 0	....
Dornier—GS-II	IP-IT M Boat	C	54- 0	14- 2	74- 0	8	2	Maybach	520	....	....	14- 2	....	74- 0	....
Dornier—Zeppelin Monoplane	TM Land	C	33- 0	11- 0	62- 8	8	2	Argus	240	....	....	....	....	62- 8	....
Dornier—Sport	TM Boat	SP	23- 6	7- 5	28- 2	3	1	Stern	60	....	....	5- 5	....	28- 2	....
Hawa—F-10	TT Land	C	28-10	12-10	37-10	5	1	Benz	220	....	....	UL 5.7	M 3.11	....	37-10
L. F. G.—V-3A	PM Boat	C	31- 0	7- 8	47- 4	3	1	B. M. W	185	....	....	7-10	....	47- 4	....
L. F. G.—V-8	PB Boat	C	27- 5	9- 5	44- 5	3	1	Mercedes	120	....	....	....	....	44- 5	44- 5
L. F. G.—V-13 Strella	TB Seaplane	C	35-10	12- 9	57- 6	4-6	1	Benz	220	....	....	....	....	57- 6	57- 6
L. F. G.—V-18 Sassnitz	PB Boat	C	33- 5	10-10	54- 0	6	1	Mercedes	160	....	....	....	....	54- 0	54- 0
L. F. G.—V-20 Arkona	TM Seaplane	C	30- 2	10- 9	42- 2	4	1	Benz	150	....	....	....	....	42- 2	....
L. V. G.—G-300	TT Land	C	33- 7	12-10	80- 4	....	2	Maybach	520	....	....	....	....	80- 4	....
Rieseler—Sport	TM Land	SP	18- 9	....	23- 0	1	1	Haacke	30	2	....	5- 6	....	23- 0	....
Sablatnig—C-3	TM Land	F	28- 6	....	44- 7	2	1	Maybach	260	....	....	8-10	....	44- 7	....
Sablatnig—P-1	TB Land	C	29- 3	11- 4	36- 1	5	1	Benz	200	....	....	....	....	36- 1	....
Sablatnig—P-3	TM Land	C	29- 4	10- 8	52- 6	6	1	Maybach	260	....	....	....	....	52- 6	....
S. W. S.—C-1	TB Land	F	25-10	9- 7	38- 0	2	1	B. M. W	185	....	....	5- 7	4- 5	38- 0	35-11
ITALIAN															
Ansaldo—A-300-2	TB Land	SP	28- 0	9- 9	36-10	3	1	Fiat	300	....	....	....	....	36-10	36- 0
Ansaldo—Balilla	TB Land	R	22- 6	9- 0	26- 0	1	1	Curtiss K-12	400	....	....	....	....	26- 0	....
Ansaldo—IX	TB Land	SP	28- 0	9- 6	30- 3	2	1	S. P. A	220	....	....	....	....	30- 3	....
Caproni—Capro-Nissimo	4P-4T Triple Triplane Boat	C	74- 0	31- 6	100- 0	100	8	Liberty	3200	....	....	U M L 9-0		U M L	100-0
Fiat—Commercial	TB Land	C	43-10	14- 9	69-0	11	3	Fiat	900	....	....	10- 6	10- 6	69- 0	....
Fiat—BR	TB Land	C	32- 3	12- 6	50-10	..	1	Fiat	700	....	....	7- 8	7- 8	50-10	....
Fiat—R-2	TB Land	F	28- 8	10-10	40- 5	2	1	Fiat	300	3.5	3.5	....	....	40- 5	40- 5
Nieuport-Macchi.—M-7	PB Boat	N	26- 7	9-10	33- 2	1	1	Isotta Fraschini	250	....	....	....	....	33- 2	....
Nieuport Macchi.—M-9	PB Boat	S	30-10	10- 5	50- 6	2	1	Fiat	280	....	....	....	....	50- 6	....
Nieuport Macchi.—M-12	PB Boat	S	35- 4	12- 0	56- 0	2	1	Ansaldo	450	....	....	....	....	56- 0	....
Nieuport Macchi.—M-14	TB Land	F	18- 6	8- 3	26- 7	1	1	Le Rhone	110	....	....	....	....	26- 7	....
Nieuport Macchi.—M-15	TB Land	F	28- 2	10-10	44- 3	2	1	Fiat	280	....	....	....	....	44- 3	....
Nieuport Macchi.—M-16	TB Land	SP	13-11	7- 0	19- 8	1	1	Anzani	30	3	3	3- 4	3- 4	19- 8	19- 8
Nieuport Macchi.—M-18	PB Boat	C	32- 0	10- 8	52- 0	3	1	Isotta Fraschini	160	....	....	....	....	52- 0	....
Nieuport Macchi.—M-18	PB Boat	C	32- 0	10- 8	52- 0	4	1	Isotta Fraschini	250	....	....	....	....	52- 0	....
P. R. B.—P. R. B.	2P-2T Boat	C	59- 3	22- 6	105- 6	..	4	Isotta Fraschini	1100	....	....	....	....	105- 6	105- 6
Savoia—S-8	PB Boat	C	29- 7	11- 0	45- 1	2-3	1	Isotta Fraschini	260	....	....	....	....	41-10	45- 1
Savoia—S-9	PB Boat	C	32- 4	11-10	44- 9	2-3	1	Fiat	280	....	....	....	....	44- 9	44- 9
Savoia—S-12	PB Boat	C	37- 8	12- 5	49- 5	4	1	Ansaldo	450	....	....	....	....	49- 5	45- 1
Savoia—S-13	PB Boat	C	26- 6	10- 4	36- 4	2	1	Isotta Fraschini	250	....	....	....	....	36- 4	32- 4
Savoia—S-13	PB Boat	C	27 -	10- 0	26- 6	1	1	Isotta Fraschini	250	....	....	....	....	26- 6	23-11
Savoia—S-21	PB Boat	R	25- -	9- 7	25- 2	1	1	Ansaldo	300	....	....	....	....	....	25- 2
Savoia—S-22	IT-IP Boat	C	35- 6	11- 6	44-6	8	2	Isotta Fraschini	520	....	....	....	....	44- 6	44- 6
JAPANESE															
Oguri—A-2	TB Land	Trn	23- 0		28- 6	2	1	Hispano-Suiza	180	....	....	4- 7	4- 7	28- 6	28- 6
Itoh—Fuji-I-GO	TB Land	Trn	19-10	8- 3	30- 7	2	1	Clerget	120	3	3	4- 6	4- 6	30- 7	30- 7

ABBREVIATIONS—

*—Estimated
A—Ambulance
At—Attack
B—Bombing
C—Commercial
DB—Day Bombing
E—Experimental
F—Fighting
L—Lower
M—Mail Carrier
Ms—Messenger
N—Naval
P—Pusher
PA—Passenger
PB—Pusher Biplane

**Taken from published data. All other data regarding American planes supplied by manufacturers.

eign Airplanes 1921-1922—Concluded

WING AND TAIL DATA											WEIGHT IN LBS.							PERFORMANCE						
Areas in Square Feet																		High Speed			Climb		Service or	Range at
Wings Total —Ail's	Ailerons	Stabilizer	Elevators	Vert. Fin.	Rudder	Non-skid Planes	Gap Ft.-In.	Stagger In.	Sweepback deg.	Dihedral deg.	Empty	Gas and Oil	Useful Load	Total Gross	Useful % Gross	Lbs. per H.P.	Lbs. per Sq. Ft.	M.P.H.	Alt. Feet	Low Speed M.P.H.	Mins.	Feet	Approx. Ceiling (Feet)	High Speed Miles
....	....	....	....	....	....	None	....	....	None	Tapered	3,600	1,120	2,970	6,570	45.2	14.3	....	126.0	6,500	55	....	....	26,000	500
81	....	....	....	....	....	None	....	....	None	None	....	....	....	1,650	....	5.1	20.6	217.0	....	.....	....	....	....	....
2,150	....	....	....	....	....	None	....	None	None	U-0 L-0	9,900	....	5,500	15,400	35.7	14.7	7.2	90.0	SL	.....	....	....	....	....
1,940	....	....	....	....	....	None	....	None	None	....	9,810	2,500	6,060	15,870	38.2	15.9	8.2	101.0	SL	.....	8.0	3,000	....	500
880	....	....	....	....	....	None	9-10	Negative	None	U-2 L-0	4,400	1,650	3,520	7,920	44.4	18.9	9.0	....	....	.....	....	....	....	....
118	10.7	13.8	....	....	....	None	....	....	None	None	....	....	....	1,980	....	6.6	16.8	173.0	SL	.....	....	....	....	....
463	....	....	....	....	....	None	....	....	Upper Only	None	2,200	....	2,200	4,400	50.0	17.5	9.5	110.0	SL	.....	10.1	3,300	....	....
1,300	.....	.....	.....	.....	.....	None	.....	.....	.....	.....	9,500	.....	6,000	15,500	38.7	14.0	11.9	150.0	SL	.....	.....	....	15,000	....
163	....	....	....	....	....	None	....	....	Tapered	None	....	....	....	2,100	....	7.0	12.9	200.0*	SL	.....	....	....	....	....
217	....	....	....	....	....	None	None	None	Tapered	....	....	....	....	2,100	....	7.0	9.7	198.0*	SL	.....	....	....	....	....
204	....	....	....	....	....	None	5-0	22	None	2.5	660	....	510	1,170	43.5	14.6	5.8	....	....	.....	....	....	....	....
473	....	....	....	....	....	None	....	....	None	U-0 L-2	2,540	730	1,600	4,140	38.7	11.2	8.8	120.0	SL	.....	....	....	....	500
1,010	....	....	....	....	....	None	9-0	None	None	2.5	3,960	1,190	2,840	6,800	41.7	16.2	6.8	100.0	SL	.....	....	....	....	500
355	....	....	....	....	....	None	....	....	None	None	2,260	....	1,020	3,280	31.1	11.9	9.2	130.0	SL	.....	15.0	6,500	....	....
....	....	....	....	....	....	None	....	....	....	....	....	....	990	....	....	....	....	160.0	15,000	.....	....	....	20,000	....
....	....	....	....	....	....	None	....	....	....	....	....	....	5,060	....	....	....	....	124.0	6,000	.....	....	....	16,400	....
287	....	....	....	....	....	None	....	....	None	Tapered	1,800	300	840	2,640	31.7	22.0	9.2	80.0	SL	.....	6.0	3,300	17,000	300
520	....	....	....	....	....	None	....	....	None	None	2,310	330	1,870	4,180	44.7	22.6	8.0	154.0	SL	.....	10.0	4,000	....	225
283	....	....	....	....	....	None	4-10	14	None	U-0 L-0	1,610	225	750	2,360	31.7	14.7	8.4	118.0	SL	.....	....	....	16,400	320
506	....	....	....	....	....	None	....	....	None	None	2,420	360	1,600	4,020	40.5	21.7	7.9	105.0	SL	.....	....	....	16,300	420
310	....	....	....	....	....	....	....	....	....	....	2,580	200	650	3,230	20.0	16.5	10.4	112.0	SL	.....	....	....	....	225
506	....	....	....	....	....	None	....	....	None	None	3,220	300	1,320	4,540	29.1	24.5	9.0	96.0	SL	.....	....	....	13,000	280
193	....	....	....	....	....	None	....	.....	None	None	1,520	200	400	1,920	20.8	10.4	10.0	133.0	SL	.....	....	....	....	250
150.5	....	....	....	....	....	None	....	....	None	None	770	....	550	1,320	41.7	22.0	8.8	80.0	SL	.....	....	....	....	....
860	....	....	....	....	....	None	....	....	....	....	5,180	730	2,420	7,600	31.9	21.0	8.8	112.0	SL	.....	....	....	19,500	450
850	....	....	....	....	....	None	....	....	None	None	6,600	770	2,860	9,460	30.2	18.4	11.1	112.0	SL	.....	....	....	14,800	380
1,033	....	....	....	....	....	None	....	....	None	None	6,780	770	3,020	9,800	30.9	18.8	9.5	112.0	SL	.....	....	....	14,800	380
....	....	....	....	....	....	None	....	....	None	....	3,190	600	2,420	5,610	43.0	23.0	....	120.0	SL	60	....	....	....	600
151	....	....	....	....	....	None	....	....	None	None	770	....	550	1,320	41.7	22.0	8.7	80.0	SL	.....	....	....	....	....
484	....	....	....	....	....	None	U M M L 4-0 4-7	12	None	U-0 M-2 L-2	....	450	1,543	....	....	....	....	106.0	SL	.....	....	....	....	460
320	....	....	....	....	....	None	....	....	None	3	2,140	360	1,100	3,240	34.0	17.5	10.1	93.0	SL	....	....	....	....	360
....	....	....	....	....	....	None	....	None	None	U-0 L-2.5	....	....	....	2,770	....	23.1	....	80.0	SL	.....	....	....	....	....
....	....	....	....	....	....	None	....	....	Yes	....	....	300	....	4,700	....	21.4	....	100.0	SL	.....	....	....	....	600
....	....	....	....	....	....	None	....	....	....	....	....	320	....	....	....	....	....	85.0	SL	.....	....	....	....	330
....	....	....	....	....	....	None	....	....	None	....	....	300	....	....	....	....	....	100.0	SL	.....	....	....	....	400
1.235	....	....	....	....	....	None	....	....	None	....	6,500	1,600	2,500	9,000	27.8	17.3	7.3	80.0	SL	40	20.0	10,000	....	420
118	....	....	....	....	....	None	....	....	None	None	330	44	176	506	34.4	16.9	4.3	75.0	SL	30	10.0	3,300	....	200
323	....	....	....	....	....	None	....	....	....	....	2,260	300	660	2,920	22.6	11.2	9.1	....	....	.....	10.0	10,000	....	....
....	....	....	....	....	....	None	....	....	None	....	1,400	....	1,200	2,600	46.0	13.0	....	....	....	.....	....	....	....	....
484	....	....	....	....	....	None	....	....	None	None	3,080	400	1,870	4,950	37.8	19.7	10.2	110.0	SL	.....	....	....	....	350
331	21.5	24.0	19.3	5.0	7.4	None	4-9	31	U-2 L-0	U-2 L-0	1,670	....	880	2,550	34.4	13.8	7.7	97.0	SL	.....	....	....	22,000	....
405	....	....	....	....	....	None	....	....	None	U-0 L-2	2,300	....	1,200	3,500	34.3	11.7	8.6	13.0	SL	45	16.0	10,000	....	....
225	....	....	....	....	....	None	....	None	None	U-0 L-2	1,823	300	544	2,367	23.0	5.9	10.5	170.0	SL	61	....	....	....	255
290	....	....	....	....	....	None	....	None	None	U-0 L-2	....	....	1,000	....	....	....	....	145.0	SL	45	30.0	20,000	....	....
7,680	....	....	Ailero Rear	ns on	Tripla	ne	None	8-7	None	None	....	32,800	6,000	22,200	55,000	40.4	17.0	7.2	90.0	SL	.....	....	....	....	540
....	....	....	....	....	....	....	8-8	....	....	L-2	7,040	1,650	3,960	11,000	35.9	12.2	....	125.0	SL	50	....	....	15,000	....
775	....	....	....	....	....	....	....	....	....	....	4,950	1,200	2,200	7,150	30.7	10.2	9.2	150.0	SL	.....	11.0	10,000	....	600
....	....	....	....	....	....	None	....	None	None	U-0 L-3	2,680	560	990	3,670	26.9	12.2	....	111.0	SL	.....	6.0	3,300	....	420
280	....	....	....	....	....	None	....	....	....	U-0 L-3	1,710	380	670	2,380	28.1	9.5	8.5	125.0	SL	.....	10.5	10,000	....	500
522	....	....	....	....	....	None	....	....	....	....	2,790	740	1,210	4,000	30.2	14.3	7.8	116.0	SL	.....	10.5	6,500	....	550
657	....	....	....	....	....	None	....	....	....	....	3,930	1,000	1,720	5,650	31.0	12.3	8.5	118.0	SL	.....	....	....	....	600
186	....	....	....	....	....	None	....	....	....	....	900	150	440	1,340	32.8	12.2	7.2	116.0	SL	.....	5.5	6,500	....	250
450	....	....	....	....	....	None	....	....	....	....	2,480	490	1,120	3,600	31.1	12.9	8.0	124.0	SL	.....	10.7	6,500	....	370
122	....	....	....	....	....	None	....	None	None	U-0 L-3.5	350	65	220	570	38.6	19.0	4.7	80.0	SL	.....	9.0	3,300	....	250
484	....	....	....	....	....	None	....	....	....	....	2,250	220	680	2,930	23.2	18.3	6.1	112.0	SL	50	....	....	....	200
484	....	....	....	....	....	None	....	....	....	....	2,450	485	1,100	3,550	31.0	14.2	7.3	105.0	SL	.....	8.0	3,300	....	370
2,300	....	....	....	....	....	None	....	None	None	....	9,900	5,000	7,700	17,600	43.0	16.0	7.7	105.0	SL	55	....	....	....	1,050
495	49.5	21.1	....	....	21.5	....	....	....	....	....	1,980	....	1,030	3,010	34.1	11.6	6.1	89.0	SL	.....	14.0	6,500	....	....
517	40.4	26.7	....	....	19.6	....	....	....	....	....	2,640	480	1,320	3,960	33.4	14.1	7.7	116.0	SL	.....	14.0	6,500	....	450
590	53.2	38.7	....	....	25.8	....	....	....	....	U-0 L-2	3,520	800	1,760	5,280	33.4	11.7	8.9	133.0	SL	.....	8.0	6,500	....	500
354	31.6	24.7	....	....	16.8	....	....	....	....	....	1,920	550	1,030	3,010	34.1	12.0	8.5	129.0	SL	.....	8.5	6,500	..	600
211	23.9	12.9	....	....	14.9	....	....	....	....	....	1,600	250	460	2,060	22.3	8.2	9.8	151.0	SL	.....	....	....	....	300
....	....	....	....	....	....	None	....	....	None	U-0 L-0	1,540	....	440	1,980	22.2	6.6	....	160.0	SL	.....	....	....	16,500	....
....	....	....	....	....	....	None	....	None	None	U-0 L-0	3,500	800	2,000	5,500	36.4	10.6	....	139.0	SL	.....	....	....	20,000	560
323	....	17.2	19.4	2.5	10.7	None	4-7	None	None	1.0	1,670	....	420	2,090	20.0	11.6	6.5	102.0	SL	50	10.0	10,000	....	....
250	24.0	13.5	11.0	....	8.0	None	4-6	None	None	U-0 L-1	1,630	200	550	2,180	25.2	18.2	8.7	95.0	SL	45	3.5	3,300	....	300

PM—Pusher Monoplane
PT—Pusher Triplane
R—Racer
S—Scout or Pursuit
SP—Sport
STP—Scout Torpedo Plane
T—Tractor
Trn—Training
Tap—Tapered
TB—Tractor Biplane
TM—Tractor Monoplane
TT—Tractor Triplane
TP—Torpedo Plane
TF—Trench Fighter
U—Upper

Trend in American Motorcycle Design

THERE is little to be said regarding engineering trends in American motorcycles. A major part of the field is covered by a comparatively small number of makers, while the retardation of motorcycle sales has been so great during the past year that there has been little development in any phase of the business.

A new model was added to the Indian line during the year. It has been christened the "Chief" and in a general way is simply a large sized edition of the "Scout" model. Its engine has the same bore and stroke as has the regular "Standard" Indian model.

There have been minor refinements in the line of practically every maker, but no important changes are to be noted. One new company has entered the field with a two-cycle machine of radical design. This newcomer is called the Neracar. It has been produced in England for some two years, but American production will not begin until the spring of 1922.

While the engineering phases of motorcycle development will always be important, they do not appear to be of paramount interest during the next few years. The development and rejuvenation of the motorcycle industry will depend more upon the ability and vision of those in charge of marketing than upon the efforts of the engineer. It is true, of course, that a capable, sound product and a fair price must be the basis of all successful marketing effort, but the lack of progress in the motorcycle industry during recent years cannot be laid at the door of the engineer. Had the salesmanagers been as successful in marketing their product as were the engineers in designing it and making it capable of service, it is not likely that there would have been a decreased motorcycle registration of more than 27,000 in 1921.

It has been something of a tradition in the American motorcycle industry that the two-cycle type machine is received with particular disfavor in this country, although in England this type machine has enjoyed a popularity equal to that of the four-cycle type. It is interesting to note in the American specification table presented herewith that out of the ten different makes listed, engines of the two-cycle type are used on five different makes, while four-cycle type engines are used on six different makes: one manufacturer makes both two- and four-cycle types.

Viewed from a production standpoint, of course, this ratio would be entirely different, for instead of being 6 to 5 in favor of the four-cycle engine it would be something like 23 to 1.

The table shows the radical reduction in prices which has taken place during 1921. The lowest price on the 1920 specification table was $200, while the lowest on the 1921 table is $140. $600 was the highest price for an electrically equipped model last year at this time, while the present table shows $475 as the top.

A change in frame type is shown by the specifications. Last year 27.7 per cent of the models listed had diamond type frames as against 72.3 per cent with loop type or some variation of the loop type. This year the diamond type predominates on the models listed in the tables, the percentages being: Diamond type, 55.5 per cent; loop type, 33.3 per cent; cradle type, 5.5 per cent; keystone type, 5.5 per cent. This change in per cent is due chiefly to the adoption of the diamond type on the five Iver-Johnson models listed.

The helical spring front forks type has increased from 50 per cent of the total in 1920 to 58 per cent in 1921. The leaf spring front forks type has decreased from 44 per cent in 1920 to 42 per cent in 1921.

American vs. British Practice

A marked difference exists between American and British motorcycle practice, in respect to size, weight, and various design features. There are many reasons for this, some of them being due to difference in road conditions, temperament and customs of users, taxation, fuel cost and competition with the motorcar. There are those who think that there is not sufficient reason for the wide difference in some particulars, that is that the manufacturers, especially in this country, have not interpreted the market correctly, and are therefore not supplying the type of machine which would see the widest sale.

However this may be, it is interesting to note that the average British motorcycle is lighter and less powerful

American Motor

NAME AND MODEL	POWER PLANT								TRANSMISSION					
	Cylinders		Piston Displacement	Cycle Type	Lubrication Type	Carburetor—Make and Size	Ignition—Make	Max. Hp.	Gear Ratio			Change Speed Gear Type	Clutch Type	Final Drive
	Number Bore and Stroke	Arrangement							1st	2nd	3rd			
Cleveland.....1922	1-2¾x2¾	Vert.	16.3	2	O. & G.	Scheb.....	Bosch.	5	6.2	10.3	...	Pos..	O-D	Chain.
Excelsior.....	2-3 21/64x3½	Vee..	61.0	4	Spl.....	Scheb. 1...	Brlng.	17	9.9	6.7	4.1	Prog.	D-D	Chain.
Evans.....G	1-2 x1¾	Vert.	90.0	2	O. & G.	Own.....	Brlng.	....	10.0	...	...	.....	.....	Belt...
Harley-Davidson.....	2-2¾x3	Opp..	35.6	4	Spl.....	Scheb. ¾..	Own..	6	12.9	8.3	5.0	Prog.	O-D.	Chain.
Harley-Davidson.....	2-3 5/16x3½	Vee..	60.3	4	Spl.....	Scheb. 1...	Own..	16	9.7	6.5	4.3	Prog.	D-D	Chain.
Harley-Davidson.....	2-3 7/16x4	Vee..	74.0	4	Spl.....	Scheb. 1¼.	Own..	18	9.7	6.5	4.3	Prog.	D-D	Chain.
Henderson.....	4-2 11/16x3½	Vert.	80.4	4	Force..	Zen. 1.....	Simms	24	7.5*	5.6	3.4	Prog.	O-D	Chain.
Indian.....Scout	2-2¾x3 1/16	Vee..	36.3	4	Sp. F...	Scheb ¾... or Carter..	Split..	11	12.0	7.6	4.8	Prog.	O-D	Chain.
Indian.....Standard	2-3 1/16x3 31/32	Vee..	60.8	4	Sp. F...	Scheb. 1¼. or Carter..	Split..	18	10.5	6.6	4.2	Prog.	D-D	Chain.
Indian.....Chief	2-3 1/16x3 31/32	Vee..	60.8	4	Sp. F...	Scheb. 1¼. or Carter..	Split..	18	11.9	7.5	4.8	Prog.	O-D	Chain.
Iver-Johnson....16-7CTS	2-3¼x3¾	Vee..	31.1	2	Force..	Scheb.....	Bosch.	8	6.5	3.7	...	Hub.	D-D	Chain.
Iver-Johnson.....16-7	2-3¼x3¾	Vee..	31.1	2	Force..	Scheb.....	Bosch.	8	6.5	3.7	...	Hub.	D-D	Chain.
Iver-Johnson....16-4CTS	1-3¼x3¾	Vert.	31.1	4	Force..	Scheb.....	Bosch.	5	6.5	3.7	...	Hub.	.....	Chain.
Iver-Johnson.....16-4C	1-3¼x4¼	Vert.	35.2	4	Force..	Scheb.....	Bosch.	5	4.2	...	...	.....	D-D	Chain.
Iver-Johnson.....16-4B	1-3¼x3¾	Vert.	31.1	4	Sp. F...	Scheb.....	Bosch.	4	....	...	...	.....	D-D	Belt...
Neracar.....	1-2½x2¾	Vert.	13.5	2	O. & G.	B. & B.....	Own..	2½	....	...	...	Fric..	.....	Chain.
Reading-Stand..22T-22TE	2-3⅜x4	Vee..	71.5	4	Spl.....	Scheb. 1¼.	Bosch.	16	3.9	6.0	9.2	Prog.	D-D	Chain.
Schickel.....	1-3 x2½	Vert.	17.6	2	O. & G.	Own.....	Split.. Brlng.	3½	6.0	9.0	...	D-G	O-D	Chain.

*Reverse—5.87
†—Optional

ABBREVIATIONS:

Lubrication Type:
O&G—mix oil with gasoline
Spl—splash
Sp-f—splash and force

Change Speed Gear Type:
D-G—direct gear
Fric—Friction
Hub—2-speed hub
Pos—positive clutch
Prog—progessive sliding
Plan—planatary

Slid—Sliding

Frame Type:
Crad—Cradle
Dia—Diamond
Keys—keystone
L&CS—loop and cradle springs

as Revealed by the 1922 Specifications

than the average American type. The American machines vary in weight from 70 to 460 lb., the average weight being 289 lb., while the average piston displacement is 46.5 cu. in. British machines vary in weight from 90 to 350 lb., the average being 223 lb., while the average displacement is only 29.1 cu. in., or about five-eighths as great as the American. The average British machine, however, sells for about $400 at current exchange rates, while the average American machine sells for $291, in spite of its greater weight and higher power. These figures are of course based on the average figures for the models listed in each case and would be considerably different if based on total production.

It is interesting to note that the average American machine sells for about $1 per lb., while the British machines average about $1.80 per lb.

Final Drive

In respect to design it will be noted that nearly half of the British motorcycles have a final drive by belt, nearly all of these having a first reduction by chain. The balance are all-chain drive. Of the American machines listed, only two, or about 11 per cent, have belt drive, one reason being that the American machine is as a rule too heavy and too powerful to use a belt of convenient proportions satisfactorily. The belt drive has certain marked advantages, as well as some disadvantages, but is not well suited for use on heavy and powerful machines.

Despite the bad year through which the motorcycle industry, in common with others, has just passed, there were numerous encouraging signs. The realization on the part of manufacturers that there are ways to sell motorcycles other than that of spending money to support racing is one of the most important. One manufacturer has ceased to support a racing team, while another is conducting a really scientific market analysis upon which to base production and sales plans.

The last meeting of the Motorcycle and Allied Trades Association in New York brought forth discussion among the manufacturers of many problems vital to the industry and the serious phases of the situation were discussed in a constructive way. There is an old saying to the effect that the presence of one swallow doesn't necessarily mean that spring has arrived, but in the present instance the simile might be turned around by saying that the coming of the swallow at least indicates that winter is going.

Present indications are that 1922 will witness some interesting events in the motorcycle industry, at least from a commercial angle. A definite effort will be made by one company to market a radical type motorcycle strictly along utility and personal convenience lines. One of the established manufacturers is seriously going into market analysis. Another has refused to support racing teams. Another is radically readjusting his dealer organization. Things are being done, and 1922 is likely to see some results accomplished.

There has been some tendency recently on the part of the motorcycle manufacturers to break away from the bicycle trades and to carry on their exhibits and marketing policies alone to a greater or less extent. This tendency was exemplified by the decision of the motorcycle manufacturers a month or so ago not to participate in the annual mid-summer meeting of the Cycle Trades of America at Atlantic City. It has been felt for some time that this summer meeting did not accomplish anything very constructive from a business standpoint and that the motorcycle manufacturers could cash in on their time better by holding a separate motorcycle meeting at a time and place more favorable for their particular purposes.

All these movements are in line with the general realization of the fundamental problems of the industry which seems to be taking place throughout the various motorcycle companies. A serious situation confronts the motorcycle industry from a marketing standpoint and the necessity for a careful analysis of all the factors involved has become evident.

As might be expected this realization has not yet spread through the dealer organizations; it is really still in the process of being born among manufacturers. It will be necessary, however, for the manufacturers to build up dealer organizations capable of carrying out constructive marketing plans.

cycle Specifications

FRAME AND WHEELS						MISCELLANEOUS								
Wheelbase	Frame Type	Front Forks Type	Tires—Size (In.)	Road Clearance Exclusive of Pedals	Height of Saddle Above Ground	Starting System	Lighting System	Brakes—No. and Type	Gas Tank Capacity (Gals.)	Oil Tank Capacity (Qts.)	Weight Empty (Lbs.)	Speed—Normal in M.P.H.	Price	Price—Electrically Equipped
56¼	Dia.....	Hel.....	26x3	6	29½	K.....	Split.....	1 Ext...	2¼	...	180	35	$185	$220
59	Dia.....	Hel.....	27x3½	5½	30	K.....	Split.....	1 Ext... 1 Int....	3	3	385	70	....	365
49	Loop....	.....	.....	7	....	P.....	Bring.....	Coast... Hub....	1¼	...	70	28	...	140
53½	Dia.....	Hel.....	26x3	...	28	K.....	Own Gen.... Exi. Bat.....	1 Ext.... 1 Int....	2½	2	260 280	..	310	340
60	Loop....	Hel.....	28x3	...	30½	K.....	Own Gen.... Exi. Bat.....	1 Int.... 1 Ext....	3⅛	4¾	345 365	65	335	365
60	Loop....	Hel.....	28x3	...	30½	K.....	Own Gen.... Exi. Bat.....	1 Int.... 1 Ext....	3⅛	4¾	350 370	70	360	390
60	Crad....	Hel.....	27x3½	4¼	29	K.....	Split.....	1 Ext... 1 Int....	3	3	416	72	...	475
54	Loop....	Leaf....	26x3	5	28	K.....	Split.....	1 Ext....	2¾	3	300 327	..	...	345
59½	L.&C.S..	Leaf....	28x3	5½	32	K.....	Split.....	1 Ext... 1 Int....	3¼	3	378½	..	...	370
60⅜	Loop....	Leaf....	28x3	5	30	K.....	Split.....	1 Ext... 1 Int....	3⅜	3⅛	410	..	...	435
56	Dia.....	Leaf....	28x3	6	32	K.....	Prest.....	1 Ext....	2	1½	260	..	250	...
56	Dia.....	Leaf....	28x3	6	32	K.....	Prest.....	1 Ext...	2	1½	260	..	225	...
56	Dia.....	Leaf....	28x3	6	32	K.....	Prest.....	1 Ext...	2	1½	220	..	200	...
56	Dia.....	Leaf....	28x3	5	32	K.....	Prest.....	1 Ext...	2	1½	220	..	175	...
56	Dia.....	Leaf....	28x3	6	32	K.....	Prest.....	1 Ext...	2	1½	215	..	150	...
55½	Own....	Own....	26x3	8½	....	K.....	Own.....	1 Int....	2	...	165	..	...	225
58	Dia.....	Hel.....	28x3	5	30	K.....	Split.....	1 Ext... 1 Int....	3	3½	343 366	65	345	375
53	Keys....	Hel.....	26x2¼	5½	29	K.....	Bring.....	1 Ext...	1½	...	160	30	185	195

Front Forks Type:
Hel—helical spring
Leaf—leaf spring
Starting System:
K—kick
P—pedal
H—hand crank
Clutch Type:
O-D—oil disk
Motorcycles:
D-D—dry disk
Ignition make:
Eisem—Eisemann
Carburetor make:
Zen—Zenith
Scheb—Schebler
B&B—Ball & Ball

British Motorcycle

(Compiled for Automotive

MAKE	ENGINE								TRANSMISSION								MISCELLANEOUS						
									GEAR RATIO									BRAKES					
	No. Cylinders Bore and Stroke m. m.	Piston Displacement cu. cm.	Cylinder Arrangement	Valve Location	Cycle Type	Lubrication Type	H. P.	Engine Make	1	2	3	Clutch Type	Final Drive	Gearset Make	Frame Type	Tire Size In.	Lighting System Make	Front	Rear	Fuel Tank Capacity Gal.	Weight Lbs.	Price (£)	New Model
A. J. S.	1-74x81	348.0	L	L	4	Spl...	2¾	Own.....	12	7½	5	Plate...	Chain.	Own....	R	26x2¼	.....	Int...	Int...	1.75	210	85	No...
A. J. S.	2-74x93	799.8	V	L	4	Spl...	7	Own.....	16	9	5	Plate...	Chain.	Own....	R	28x3	Lucas...	Int...	Int...	2.25	336	135	No...
Allon	1-70x76	292.4	.....	.....	2	Spl...	2¾	Own.....	9	.....	5¾	Plate...	Ch & b	Own....	R	26x2¼	.....	Ext...	Ext...	.....	180	60	No...
Ariel	1-86x85	493.7	.....	L	4	Spl...	3½	Own.....	16	9	5	Plate...	Ch & b	Own....	R	26x2½	Lucas...	Rim..	V rim.	2.12	280	95	No...
Ariel	1-92x100	664.7	.....	L	4	Spl...	4½	Own.....	16	9	5	Plate...	Chain.	Own....	R	28x3	Lucas...	Int...	Int...	2.62	318	105	No...
Ariel	2-73x95	795.2	V	L	4	H-S..	6	Own.....	14	7¾	4⅝	Plate...	Ch & b	Own....	R	26x2½	Lucas...	Rim..	V rim.	2.12	300	110	No...
Ariel	2-82x94	992.8	V	O'In.	4	Spl...	8	M. A. G...	14	7¾	4⅝	Plate...	Chain.	Own....	R	28x3	Lucas...	Int...	Int...	2.62	335	125	Yes..
Armis	1-70x76	292.4	....	L	4	Spl...	2¾	J. A. P....	9½	.....	5	Plate...	Ch & b	Burman.	R	26x2¼	.....	Rim..	V rim.	1.5	170	.....	No...
Armis	1-74x81	348.0	.....	.....	2	Spl...	3½	Precision..	9½	.....	5	Plate...	Ch & b	Burman.	R	26x2¼	.....	Rim..	V rim.	1.5	180	.....	No...
Armis	2-70x85	654.2	V	L	4	Spl...	5	J. A. P....	.....	.....	.....	Plate...	Ch & b	Burman.	R	26x2½	.....	Rim..	V rim.	1.5	220	.....	No...
Bat	2-76x85	671.2	V	L	4	Spl...	6	J. A. P....	11	8	4½	Multi-d	Chain.	St. Arch.	S	28x3	.....	None..	Int & ext....	2.0	300	85	No...
Beardmore Precision	1-70x90	346.4	.....	Sleeve	4	.....	3½	Barr& Strd	8	.....	4¼	Plate...	Ch & b	St. Arch.	R	26x2¼	Bt. H...	Ext...	V rim.	2.0	198	.....	Yes..
Beardmore Precision	1-74x81	348.0	.....	.....	2	Spl...	3½	Own.....	9	.....	5	Expand	Chain.	Own....	S	26x2¼	.....	Ext...	Int...	2.0	230	75	No...
Beardmore Precision	1-89x96	597.2	.....	L	4	.....	4¼	Own.....	15	9	5½	Multi-d	Chain.	St. Arch.	S	28x3	Bt. H...	Ext...	Int...	2.0	300	105	Yes..
Bradbury	1-74x80	344.0	.....	L	4	Spl...	2¾	Own.....	10	.....	5	Plate...	Ch & b	Own....	R	26x2⅜	.....	Rim..	V rim.	1.5	240	80	No...
Bradbury	1-89x89	553.7	.....	L	4	Spl...	4	Own.....	15	8½	5	Plate...	Chain.	Own....	R	26x2½	.....	Rim..	Int...	1.5	280	92	No...
Bradbury	2-74x86	739.8	V	L	4	Spl...	6	Own.....	15	8½	5	Plate...	Chain.	Own....	R	26x2¼	.....	Rim..	Int...	2.25	325	117	No...
Bradbury	2-80x99	995.2	V	L	4	Spl...	8	Own.....	12	8	4½	Plate...	Chain.	Own....	R	28x3	.....	Rim..	Int...	2.25	340	135	Yes..
Brough	2-70x64	493.0	Opp.	L	4	Spl...	3½	Own.....	8½	5¼	4¼	Multi-d	Chain.	St. Arch.	R	26x2⅜	.....	Int...	V rim.	1.75	196	.....	No...
Brough	2-70x90	692.6	Opp.	L	4	Spl...	5	Own.....	12	7½	4½	Multi-d	Chain.	St. Arch.	R	26x2½	.....	Int...	V rim.	2.25	255	.....	No...
B. S. A.	1-85x95	539.1	.....	L	4	Spl...	4¼	Own.....	13	8	5	Plate...	Chain.	Own....	R	26x2½	.....	V rim.	V rim.	1.75	263	110	Yes..
B. S. A.	1-85x95	539.1	.....	L	4	Spl...	4¼	Own.....	13	8	5	Plate...	Ch & b	Own....	R	26x2½	.....	V rim.	V rim.	1.75	256	107	No...
B. S. A.	2-76x95	862.0	V	L	4	Spl...	6	Own.....	13	8	5	Plate...	Chain.	Own....	R	26x3	.....	V rim.	V rim.	1.75	328	132	Yes..
B. S. A.	2-80x98	985.2	V	L	4	Spl...	8	Own.....	13	8	5	Plate...	Chain.	Own....	R	28x3	.....	V rim.	Int...	2.12	350	145	Yes..
Calthorpe	1-67x69	243.4	.....	.....	2	Spl...	2½	Peco.....	.....	9	5½	Plate...	Ch & b	St. Arch.	R	24x2	.....	Rim..	V rim.	1.25	160	36	Yes..
Calthorpe	2-64x76	489.0	V	L	4	Spl...	4	J. A. P....	15	8	5	Plate...	Ch & b	Burman.	R	26x2¼	.....	Rim..	V rim.	1.75	212	.....	Yes..
Campion	2-85x85	964.7	V	L	4	Spl...	8	J. A. P....	12	8	4¾	Multi-d	Chain.	St. Arch.	R	28x3	.....	Int...	Int...	2.5	335	140	Yes..
Cedos	1-62x70	211.3	.....	.....	2	Spl...	2¼	Own.....	.....	.....	.....	None...	Ch & b	Own....	R	24x2¼	B. T. H.	V rim.	V rim.	1.75	140	.....	No...
Cedos	1-67x70	246.9	.....	.....	2	Spl...	2½	Own.....	.....	.....	.....	None...	Ch & b	Own....	R	26x2¼	B. T. H.	V rim.	V rim.	1.75	150	.....	No...
Connaught	1-73x70	293.0	.....	.....	2	Pet...	2¾	Own.....	.....	9⅝	5¼	Plate...	Ch & b	St. Arch.	R	26x2¼	.....	V rim.	V rim.	1.5	165	57	No...
Connaught	1-	.....	.....	.....	2	Spl...	3½	Own.....	16	9	5	Plate...	Chain.	Burman.	R	26x2½	.....	.....	Int. & ext.	2.0	.....	75	Yes..
Cotton	1-70x70	269.4	.....	.....	2	Spl...	2½	Villiers....	.....	9	5	Plate...	Ch & b	St. Arch.	R	26x2¼	Villiers..	Rim..	V rim.	1.75	160	52	No...
Cotton	1-71x88	348.4	.....	L	4	Spl...	2¾	Blackb'r'e.	.....	9	5	Plate...	Ch & b	St. Arch.	R	26x2¼	B. T. H.	Rim..	V rim.	1.75	173	65	Yes..
Coulson	1-70x70	269.4	.....	.....	2	Spl...	2½	Liberty...	.....	.....	.....	Plate...	Ch & b	.....	S	26x2¼	.....	.....	2 Int..	1.25	180	67	Yes..
Coulson	1-71x88	348.4	....	L	4	Spl...	2¾	Blackb'r'e.	.....	.....	.....	Plate...	Ch & b	Burman.	S	26x2½	.....	.....	2 Int..	1.25	191	78	No...
Coulson	1-85x88	499.3	....	L	4	Spl...	4¼	Blackb'r'e.	.....	.....	.....	Plate...	Ch & b	Burman.	S	26x2½	.....	.....	2 Int..	1.5	240	.....	No...
Diamond	1-70x70	269.4	.....	.....	2	Spl...	2½	Villiers....	.....	11	6	Plate...	Ch & b	St. Arch.	R	26x2¼	.....	Rim..	V rim.	2.0	167	42	No...
Diamond	1-70x76	292.4	.....	L	4	Spl...	2¾	J. A. P....	.....	11	6	Plate...	Ch & n	St. Arch.	R	26x2¼	.....	Rim..	V rim.	2.0	168	58	No...
Dot	1-70x90	346.4	.....	L	4	Spl...	2¾	J. A. P....	9	7	5	Plate...	Chain.	Albion..	R	26x2⅜	.....	Int...	Int...	1.75	175	90	Yes..
Dot	2-85x85	964.7	V	L	4	Spl...	8	J. A. P....	7¾	5	3½	Multi-d	Chain.	St. Arch.	R	28x3	.....	Ext...	Int...	2.25	260	150	Yes..
Douglas	2-61x60	350.6	Opp.	L	4	Spl...	2¾	Own.....	.....	.....	8½	6	Plate...	Ch & b	Own....	R	26x2¼	.....	Rim..	V rim.	1.25	175	75	No...
Douglas	2-68x68	493.8	Opp.	I	4	Spl...	3½	Own.....	.....	.....	.....	Plate...	Chain.	Own....	R	26x2½	.....	Shoe..	Int...	1.5	260	130	Yes..
Douglas	2-74x68	585.0	Opp.	L	4	Spl...	4	Own.....	12	8	5	Plate...	Ch & b	Own....	R	26x2⅜	.....	Rim..	V rim.	2.0	250	135	No...
Douglas	2-83x68	737.0	Opp.	H	4	Spl...	6	Own.....	12	7	4½	Plate...	Chain.	Own....	R	26x3	.....	Shoe..	Int...	2.0	320	.....	Yes..
Dunelt	1-85x88	499.3	.....	.....	2	Spl...	4	Own.....	12	7	4½	Multi-d	Ch & b	St. Arch.	R	28x3	.....	V rim.	V rim.	2.25	270	85	No...
Duzmo	1-89x79	492.0	.....	H	4	Spl...	3½	Own.....	.....	.....	.....	.....	Belt...	.....	R	26x2½	.....	.....	2Vrim.	1.75	215	80	No...
Duzmo	1-89x79	492.0	.....	H	4	Spl...	3½	Own.....	12	7	5	Multi-d	Chain.	St. Arch.	R	26x2½	.....	Int...	V rim.	1.75	245	115	Yes..
Eagle	1-70x64	246.5	.....	H	4	Spl...	2¼	.....	.....	11	6	Plate...	Chain.	St. Arch.	R	26x2⅜	.....	Int..	V rim.	2.0	165	105	Yes..
Eagle	1-70x70	269.4	.....	.....	2	Spl...	2½	Villiers....	.....	11	6	Plate...	Ch & b	St. Arch.	R	26x2¼	Villiers..	Rim..	V rim.	1.5	190	56	Yes..
Eagle	1-70x76	292.4	.....	L	4	Spl...	2¾	J. A. P....	.....	11	6	Plate...	Ch & b	St. Arch.	R	26x2¼	.....	Rim..	V rim.	2.0	210	70	Yes..
Eagle	1-70x90	346.4	.....	L	4	Spl...	3	J. A. P....	.....	11	6	Plate...	Chain.	St. Arch.	R	26x2⅜	.....	Int...	V rim.	2.0	230	88	Yes..
Eagle	1-85x85	482.3	.....	L	4	Spl...	3½	J. A. P....	14	8½	5¼	Multi-d	Chain.	St. Arch.	R	26x2½	.....	V rim.	V rim.	2.5	240	110	Yes..
Eagle	1-85x95	539.1	....	L	4	Spl...	4¼	J. A. P....	14	8½	5¼	Multi-d	Chain.	St. Arch.	R	26x2½	.....	V rim.	V rim.	2.5	250	110	Yes..
Eagle	2-70x88	677.2	V	L	4	Spl...	6	J. A. P....	14	8½	5¼	Multi-d	Chain.	St. Arch.	R	26x2½	.....	V rim.	V rim.	2.5	290	125	Yes..
Economic	2-52x34	144.5	Opp.	.....	2	Pet...	2	Own.....	.....	14	9	.....	Ch & b	Own....	R	26x2¼	Flywheel	Rim..	V rim.	1.5	94	34	Yes..
Enfield	1-64x70	225.2	.....	.....	2	Pet...	2¾	Own.....	.....	9	5	Exp. Ring..	Chain.	Own....	R	24x2¼	.....	Rim..	V rim.	1.62	147	55	No...
En eld	2-85x85	964.7	V	L	4	Spl...	8	Vickers....	.....	8¼	4½	Exp. Ring..	Chain.	Own....	R	28x3	.....	V rim.	V rim.	2.0	280	.....	No...
Excelsior	1-70x70	269.4	.....	.....	2	Spl...	2½	Villiers....	.....	.....	.....	5½	Belt...	.....	R	26x2¼	Villiers..	Rim..	V rim.	1.12	137	40	Yes..
Excelsior	1-71x88	348.4	.....	L	4	Spl...	2¾	Blackb'r'e.	15	9	5	Plate...	Chain.	Burman.	R	26x2¼	.....	Rim..	Ext...	1.12	197	82	Yes..
Excelsior	1-86x112	650.6	.....	L	4	Spl...	4½	Own.....	15	9	5	Plate...	Chain.	Burman.	R	28x3	.....	Rim..	V rim.	2.0	294	95	No...
Excelsior	2-76x85	671.2	V	L	4	Spl...	6	J. A. P....	15	9	5	Plate...	Chain.	Burman.	R	28x3	Lucas...	Rim..	Ext...	2.0	298	105	No...
Francis Barnett	1-70x70	269.4	.....	.....	2	Spl...	2½	Villiers....	.....	*11	6	Plate..	Ch & b	St. Arch,	R	26x2¼	Villiers..	Rim..	V rim.	1.5	150	62	Yes.
Francis Barnett	1-70x76	292.4	.....	L	4	Spl...	2¾	J. A. P....	.....	10	6	Plate..	Ch & b	St. Arch.	R	26x2¼	M. L....	Rim..	V rim.	1.75	188	73	No..
Hawker	1-69x76	284.1	.....	.....	2	H. S..	2¾	Own.....	.....	.....	.....	None...	Ch & b	Own....	R	26x2¼	.....	.....	2Vrim.	2.0	160	52	No...
Hawker	1-71x88	348.4	.....	L	4	Spl...	2¾	Blackb'r'e.	15	10	5½	Plate...	Chain.	Burman.	R	26x2¼	.....	Int...	Int...	2.0	190	84	Yes..
Hawker	1-71x88	348.4	.....	H	4	Spl...	2¾	Blackb'r'e.	Var.	Var.	Var.	Plate...	Chain.	Burman.	R	26x2¼	.....	Int...	Int...	2.0	200	100	Yes..
Hawker	1-85x97	550.4	.....	L	4	Spl...	4¼	Blackb'r'e.	16	10	5	Plate...	Chain.	Burman.	R	26x2¼	.....	Int...	Int...	2.0	200	90	Yes..
Hazlewood	1-70x76	292.4	.....	L	4	Spl...	2¾	J. A. P....	.....	10	6	Plate...	Ch & b	St. Arch.	R	26x2¼	.....	Rim..	V rim.	1.5	160	67	Yes..
Hazlewood	1-85x85	482.3	.....	L	4	Spl...	4	J. A. P....	10	.....	6	Plate...	Ch & b	Own....	R	26x2½	.....	V rim.	V rim.	1.75	280	98	Yes..
Hazlewood	2-70x76	292.4	V	L	4	Spl...	6	J. A. P....	13½	8	4½	Plate...	Ch & b	Own....	R	26x2½	.....	V rim.	V rim.	1.75	300	.....	Yes..
Hazlewood	2-85x85	964.7	V	L	4	Spl...	8	J. A. P....	12½	7	4¼	Plate...	Chain.	Own....	R	28x3	.....	V rim.	Int...	2.5	330	.....	No...
Hobart	1-67x70	246.9	.....	.....	2	Spl ..	2½	Morris.....	.....	10	5¾	Plate...	Ch & b	St. Arch.	Opt.	26x2¼	B. T. H.	Rim..	V rim.	1.5	165	55	Yes..
Hobart	1-70x76	292.4	.....	L	4	Spl ...	2¾	J. A. P....	.....	10	5¾	Plate...	Ch & b	St. Arch.	Opt.	26x2¼	B. T. H	Rim..	V rim.	1.75	180	68	No...
Hobart	1-70x90	346.4	.....	L	4	Spl...	2¾	J. A. P....	15	9¼	5¾	Multi-d	Chain.	St. Arch.	Opt.	26x2¼	B. T. H.	V rim.	V rim.	1.75	190	90	Yes..
Hudson	1-62x70	211.3	.....	.....	2	Spl..	2¼	Own.....	.....	10	5¾	Plate...	Ch & b	Own....	R	26x2	.....	Rim..	V rim.	1.5	.....	63	No...
Hudson	1-87x100	594.5	.....	H	4	Spl ..	4½	Own.....	12	8	4½	Plate...	Chain.	St. Arch.	R	28x3	.....	Int...	Int...	2.5	.....	100	Yes..
Humber	2-75x68	600.0	Opp.	L	4	Spl...	4½	Own.....	14	8½	5	Multi-d	Chain.	Own....	R	26x2½	.....	Rim..	V rim.	2.25	275	105	No...

ABBREVIATIONS

Cylinder Arrangement:
*Inclined side by side, water cooled.
Opp—Horizontally opposed.

Location:
L—Valves in side pockets.
O'In—Overhead inlet, side exhaust.
O'Ex—Overhead exhaust, side inlet.
H—Both valves in the head.

Lubrication:
H-S—Oil forced to journals and crankpin through drilled crankshaft.
HSD—Drilled crankshaft, drip feed to one journal bearing, thence by centrifugal force to crankpin.
spl—Splash; crankcase supplied by hand pump, drip, semi-automatic or automatic feed, or oil supply carried on crankcase pump.
Pet—Lubricating oil mixed with fuel.

Clutch Type:
plate—Single dry plate, fabric faced or cork inserts.
multi-d—Multiple dry disk, fabric faced.
exp-ring—Expanding ring.

Final Drive:
ch—All chain.
ch & b—Primary drive by chain; final by V belt.
b—Belt.

Brakes:
rim—Horseshoe type applying to tire rim.
int—Expanding shoes in hub drum.
ext—Contracting band on hub drum.
shoe—Single exterior shoe applying to large diameter drum.
V-rim—Shoe applying to special or V belt rim.

Frame Type:
R—Rigid.
S—Spring.

Specifications—1922

Industries by M. W. Bourdon)

MAKE	ENGINE								TRANSMISSION							MISCELLANEOUS						
									GEAR RATIO								BRAKES					
	No. Cylinders Bore and Stroke m. m.	Piston Displacement cu. cm.	Cylinder Arrangement	Valve Location	Cycle Type	Lubrication Type	H. P.	Engine Make	1	2	3	Clutch Type	Final Drive	Gearset Make	Frame Type	Tire Size In.	Lighting System Make	Front	Rear	Fuel Tank Capacity Gal.	Weight Lbs.	Price (£)	New Model
Imperial	1-70x76	292.4	.....	L	4	Spl...	2¾	Own.....	16	9	5¾	Plate...	Chain.	Own....	R	26x2¼	M. L....	Int...	Int...	1.75	180	73	Yes
Imperial	1-85x85	482.3	.....	L	4	Spl...	4	J. A. P....	13½	8½	4½	Plate...	Chain.	Own....	R	26x2½	M. L....	Rim..	Int...	1.75	190	95	Yes
Imperial	2-85x85	964.7	V	L	4	Spl...	8	Own.....	13½	8½	4½	Plate...	Chain.	Own....	R	28x3	Lucas...	Rim..	V rim	2 0	.....	118	No.
James	1-66x70	239.5	.....	.....	2	Spl...	2¼	Own.....	.....	10½	5½	None...	Ch & b	Own....	R	26x2¼	.....	Int...	V rim	1 5	150	60	No.
James	2-64x77	485.2	V	L	4	Spl...	3½	Own.....	10	7	5	Multi-d	Chain.	Own....	R	26x2¼	.....	Int...	Int...	2 0	230	105	No.
James	1-86x103	597.7	.....	L	4	Spl...	4¼	Own.....	14	8	5	Multi-d	Chain.	Own....	R	28x3	.....	Rim..	Int...	2 0	296	105	No.
James	2-76x89	807.4	V	L	4	Spl...	7	Own.....	14	8	5	Multi-d	Chain.	Own....	R	28x3	.....	Int...	Int...	2 0	325	125	No.
J. E. S	1-60x60	169.6	.....	H	4	Spl...	1½	Own.....	.....	12½	7	None...	Belt...	Own....	R	24x2	.....	Rim..	V rim.	1 0	90	49	Yes
Lea Francis	2-64x77	247.7	V	O'In	4	Spl...	3½	M. A. G...	12	7½	5	Plate...	Chain.	Own....	R	26x2⅜	.....	V rim	V rim	2 0	210	110	No.
Lea Francis	2-64x92	295.9	V	O'In	4	Spl...	5	M. A. G...	13½	7½	5	Plate...	Chain.	Own....	R	26x3	Lucas...	V rim	V rim	2 0	275	125	Yes
Levis	1-62x70	211.3	.....	.....	2	H.S.D	2¼	Own.....	.....	.....	5¾	None...	Belt...	.....	R	24x2¼	.....	Rim..	V rim	1 25	110	48	No.
Levis	1-67x70	246.9	.....	.....	2	H.S.D	2½	Own.....	.....	9	5	Plate...	Ch & b	St. Arch.	R	24x2¼	.....	Rim..	V rim	1.5	140	66	Yes
L. M. C	1-85x88	499.3	.....	L	4	Spl...	3½	Own.....	Op.	Op.	Op.	Multi-d	Ch & b	St. Arch.	R	26x2½	.....	.....	2Vrim.	2.0	210	85	No.
L. M. C	2-79x85	416.6	V	L	4	Spl...	6	Own.....	Op.	Op.	Op.	Multi-d	Chain.	St. Arch.	R	26x2½	.....	.....	Int. & Ext.	2.0	250	115	No.
L. M. C	2-79x98	480.4	V	L	4	Spl...	8	Own.....	Op.	Op.	Op.	Multi-d	Chain.	St. Arch.	R	28x3	.....	.....	Int. & Ext.	3 0	280	125	Yes
Martinsyde	2-70x88	677.2	V	O'Ex	4	Spl...	6	Own.....	17	11	5¼	Plate...	Chain.	Own....	R	26x3	Lucas...	V rim	V rim	2.5	250	.....	Yes
Matchless	2-82x94	992.8	V	O'In	4	Spl...	8	M. A. G...	13	7¾	4½	Plate...	Chain.	Own....	S	28x3	Lucas...	Rim..	Int...	2.5	320	130	No.
Metro Tyler	1-70x70	269.4	.....	.....	2	Spl...	2½	Own.....	.....	10	5½	Plate...	Ch & b	Albion..	R	26x2¼	B. T. H	Rim..	V rim	1.25	165	60	No.
Metro Tyler	1-70x70	269.4	.....	.....	2	Spl...	2½	Own.....	.....	11	6	None...	Ch & b	Own....	R	26x2¼	B. T. H	Rim..	V rim	1.50	180	70	No.
Metro Tyler	2-71x88	696.8	V	L	4	Spl...	6	Own.....	10½	6½	4	Multi-d	Chain.	St. Arch.	R	26x2½	B. T. H	Int...	Int...	2.25	260	125	Yes
Norton	1-79x120	588.2	.....	L	4	Spl...	3½	Own.....	.....	.....	3½	None...	Belt...	.....	R	26x2¼	Lucas...	Rim..	V rim	2 0	203	80	No.
Norton	1-79x120	588.2	.....	L	4	Spl...	3½	Own.....	.....	.....	4	Multi-d	Chain.	St. Arch,	R	26x2¼	Lucas...	Rim..	V rim	2 0	241	115	No.
Norton	1-82x120	633.7	.....	L	4	Spl...	4	Own.....	.....	.....	4	Multi-d	Chain.	St. Arch.	R	26x3	Lucas...	Rim..	V rim.	2.25	287	120	No.
N. U. T.	2-64x76	489.0	V	L	4	Spl...	3½	Own.....	12	7¼	4½	Multi-d	Chain.	St. Arch.	R	26x2½	Lucas...	Rim..	Int...	2.0	175	110	Yes
N. U. T.	2-70x88	677.2	V	L	4	Spl...	5	Own.....	12	7¼	4½	Multi-d	Chain.	St. Arch.	R	26x2½	Lucas...	Rim..	Int...	2.0	295	120	Yes
O. K	1-70x76	292.4	.....	.....	2	Spl...	2½	Own.....	.....	.....	.....	Plate...	Chain.	Albion..	R	26x2½	.....	Int...	V rim	1.12	188	55	Yes
Olympic	1-70x76	292.4	.....	L	4	Spl...	2¾	J. A. P....	.....	.....	5¾	Plate...	Ch & b	Burman.	R	26x2½	.....	Rim..	V rim.	1.75	185	70	Yes
Peters	1-76x76	344.7	.....	.....	2	Spl...	3½	Own.....	11	.....	3¾	None...	Belt...	.....	S	26x2½	Runb...	.....	2Vrim.	2.75	145	66	Yes
P. & M	1-84x100	554.2	.....	L	4	Spl...	4½	Own.....	12 & 18	8	5¼	Exp. Ring..	Chain.	Own....	R	26x2½	.....	V rim.	Ext...	2.0	280	115	Yes
Quadrant	1-87x110	653.9	.....	L	4	Spl...	4½	Own.....	13	8	5	Plate...	Ch & b	St. Arch.	R	26x2½	.....	Rim..	V rim	2.25	280	80	Yes
Radco	1-67x70	246.9	.....	.....	2	Spl...	2½	Own.....	.....	.....	.....	Plate...	Ch & b	Burman.	R	24x2¼	M. L....	Rim..	V rim	1.37	130	42	No.
Raleigh	1-71x88	348.4	.....	L	4	Spl...	2¾	Own.....	10½	.....	5¼	Plate...	Ch & b	St. Arch.	R	26x2¼	.....	V rim.	V rim.	1.75	190	68	Yes
Raleigh	1-76x88	399.2	.....	L	4	Spl...	3	Own.....	12	7¼	4½	Multi-d	Ch & b	St. Arch.	R	26x2¼	.....	V rim.	V rim.	1.75	210	78	Yes
Raleigh	2-87x85	1010.6	Opp.	L	4	Spl...	6	Own.....	11	7	4	Multi-d	Ch & b	St. Arch.	S	26x2¾	.....	V rim.	Int...	2.5	295	130	No.
Rover	1-85x88	499.3	.....	L	4	Spl...	4	Own.....	16½	9	5½	Multi-d	Chain.	Own....	R	26x2½	.....	V rim.	Int...	2.0	280	100	No.
Rover	1-85x88	499.3	.....	L	4	Spl...	4	Own.....	14	7½	4½	Multi-d	Chain.	Own....	R	26x2½	.....	V rim.	Int...	2.0	250	110	Yes
Rover	2-70x85	654.2	V	L	4	Spl...	5	J. A. P....	16½	9	5½	Multi-d	Chain.	Own....	R	28x3	.....	V rim.	Int...	2.0	300	120	No.
Ruby	1-74x80	344.0	.....	L	4	Spl...	2¾	Own.....	10	.....	6	Plate...	Ch & b	Own....	R	26x2¼	.....	V rim.	V rim.	1.5	180	70	No.
Ruby	1-74x86	369.9	.....	L	4	Spl...	3	Own.....	12	9	6	Plate...	Ch & b	Own....	S	26x2½	.....	V rim.	V rim.	1.75	240	90	No.
Ruby	2-85x85	964.7	V	L	4	Spl...	8	J. A. P....	14	8½	5¼	Multi-d	Chain.	St. Arch.	S	28x3	Lucas...	V rim.	Int...	2.0	280	.....	No.
Rudge	1-85x88	499.3	.....	O'In.	4	Spl...	3½	Own.....	7	.....	3½	Multi-d	Belt...	Exp. pul.	R	26x2½	.....	Rim..	V rim	2.75	240	85	No.
Rudge	1-85x88	499.3	.....	O'In.	4	Spl...	3½	Own.....	11½	8½	4½	Plate...	Chain.	Own....	R	26x2½	M. L....	Shoe..	Shoe..	2.75	270	100	Yes
Rudge	2-85x88	998.6	V	O'In.	4	Spl...	8	Own.....	10	7	4	Plate...	Chain.	Own....	R	28x3	M. L....	Shoe..	Shoe..	2.75	295	120	Yes
Scale	1-71x88	348.4	.....	H	4	Spl...	2¾	Black'br'e.	11½	7	5	Plate...	Chain.	Burman.	R	26x2¼	.....	V rim.	V rim.	1.5	175	95	Yes
Scale	1-85x95	539.1	.....	L	4	Spl...	4¼	Blackb'r'e.	12	7¼	5½	Multi-d	Chain.	St. Arch.	R	26x2½	.....	V rim.	V rim.	1.75	210	100	No.
Scott	2-70x63	485.0	*	.....	2	Spl...	3½	Own.....	5½	.....	3¾	Exp. Ring..	Chain.	Own....	R	26x2½	.....	Rim..	Shoe..	1.75	194	105	Yes
Scott	2-73x63	527.0	*	.....	2	Spl...	3¾	Own.....	8	.....	4¼	Exp. Ring..	Chain.	Own....	R	26x2½	Lucas...	Rim..	Shoe..	2.0	230	110	No.
Sirrah	1-64x76	244.5	.....	L	4	Spl...	2¼	J. A. P....	.....	.....	.....	Plate...	Chain.	Burman.	R	24x2	.....	Rim..	V rim	1.5	170	84	Yes
Sirrah	1-70x76	292.4	.....	.....	2	Spl...	2¾	Own.....	.....	.....	.....	None...	Belt...	None....	R	26x2¼	.....	Rim..	V rim	1.5	160	38	Yes
Sirrah	1-70x76	292.4	.....	L	4	Spl...	2¾	J. A. P....	.....	.....	.....	Plate...	Ch & b	Burman.	R	26x2¼	.....	Rim..	V rim	1.5	190	55	No.
Sirrah	1-71x88	348.4	.....	L	4	Spl...	2¾	Blackb'r'e.	.....	.....	.....	Plate...	Ch & b	Burman.	R	26x2¼	.....	Rim..	V rim	1.5	220	67	No.
Sirrah	1-70x90	346.4	.....	L	4	Spl...	2¾	J. A. P....	.....	.....	.....	Plate...	Ch & b	Burman.	R	26x2¼	.....	Rim..	V rim	1.5	210	73	Yes
Sirrah	2-70x88	677.2	V	L	4	Spl...	5	J. A. P....	.....	.....	.....	Multi-d	Ch & b	St. Arch.	R	26x3	.....	Rim..	V rim	1.75	280	125	Yes
Spark	1-70x70	269.4	.....	.....	2	Spl...	2½	Villiers....	.....	.....	6	None...	Belt...	None....	R	26x2¼	Villiers.	.....	2Vrim.	1.75	140	40	Yes
Sparkbrook	1-70x70	269.4	.....	.....	2	Spl...	2½	Villiers....	9	.....	5½	Plate...	Ch & b	St. Arch.	R	26x2¼	Villiers.	Rim..	V rim	1.75	140	60	No.
Sparkbrook	1-70x90	346.4	.....	L	4	Spl...	2¾	J. A. P....	.....	.....	.....	Multi-d	Ch & b	St. Arch.	R	26x2½	.....	Rim..	V rim	1.75	160	84	Yes
Stanger	2-70x70	538.8	V	.....	2	Spl...	5	Own.....	11	7	4¼	Multi-d	Ch & b	St. Arch.	S	26x2½	.....	Rim..	V rim	2.50	130	110	Yes
Sun	1-70x64	246.5	.....	.....	2	Spl...	2½	Valveless..	9½	.....	5½	Plate...	Ch & b	St. Arch.	R	26x2¼	M. L....	Rim..	V rim	1.5	170	44	Yes
Sunbeam	1-85x88	499.3	.....	L	4	Spl...	3½	Own.....	14¼	8	5¼	Multi-d	Chain.	Own....	R	26x2½	Lucas...	V rim.	Int...	1.75	240	126	No.
Sunbeam	1-77x105	488.9	.....	L	4	Spl...	3½	Own.....	9½	6	4	Multi-d	Chain.	Own....	R	26x2⅜	Lucas...	V rim.	V rim.	1.5	225	138	Yes
Sunbeam	1-85x105	595.8	.....	L	4	Spl...	4¼	Own.....	14½	8	5¼	Multi-d	Chain.	Own....	R	26x2½	Lucas...	V rim.	Int...	1.75	285	144	Yes
Sunbeam	2-85x88	964.7	V	L	4	Spl...	8	J. A. P....	12	7	4½	Multi-d	Chain.	Own....	R	28x3	Lucas...	V rim.	Int...	1.75	330	168	No.
Triumph	1-64x70	225.2	.....	.....	2	Pet...	2¼	Own.....	10	.....	6	None...	Ch & b	Own....	R	26x2¼	M. L....	Rim..	V rim.	1.12	129	65	No.
Triumph	1-81x97	499.8	.....	H	4	Spl...	3½	Own.....	11¾	7	4¼	Multi-d	Chain.	Own....	R	26x3	M. L....	Rim..	V rim.	1.5	240	120	Yes
Triumph	1-85x97	550.4	.....	L	4	Spl...	4	Own.....	13½	8	5	Multi-d	Ch & b	St. Arch.	R	26x2½	M. L....	Rim..	V rim.	1.5	230	105	No.
Triumph	1-85x97	550.4	.....	L	4	Spl...	4	Own.....	13½	8	4¾	Multi-d	Chain.	Own....	R	26x2½	M. L....	Rim...	V rim.	1.5	242	115	No.
Trump	1-70x76	292.4	.....	L	4	Spl...	2¾	J. A. P....	10	.....	5¼	None...	Ch & b	Ch. Lea.	R	26x2¼	.....	Rim..	V rim.	1.75	160	60	Yes
Trump	1-85x85	482.3	.....	L	4	Spl...	4	J. A. P....	8	6	4	Multi-d	Chain.	St. Arch.	R	26x2½	.....	Rim..	V rim.	2.0	250	105	No.
Trump	2-76x85	772.0	V	L	4	Spl...	6	J. A. P....	8	6	4	Multi-d	Chain.	St. Arch.	R	24x2½	.....	Rim..	V rim.	2.0	260	130	No.
Velocette	1-62x73	220.4	.....	.....	2	Spl...	2¼	Cwn.....	9	.....	5	Multi-d	Chain.	Own....	R	24x2¼	M. L....	Int...	Int...	1.5	160	65	No.
Velocette	1-63x80	249.4	.....	.....	2	Spl...	2½	Own.....	14	9	5	Multi-d	Chain.	Own....	R	24x2¼	M. L....	Int...	Int...	1.5	170	68	Yes
Verus	1-62x70	211.3	.....	.....	2	Spl...	2¼	Own.....	.....	.....	6	None...	Belt...	None....	R	26x2	.....	Rim..	V rim.	1.5	130	48	No.
Verus	1-70x70	269.4	.....	.....	2	Spl...	2½	Own.....	.....	.....	.....	Plate...	Ch & b	Burman.	R	24x2½	.....	Rim..	V rim.	1.5	160	60	No.
Verus	1-64x76	244.5	.....	L	4	Spl...	2¼	J. A. P....	.....	.....	.....	Plate...	Chain.	Burman.	R	24x2	.....	Int...	V rim.	1.5	150	95	Yes
Verus	1-71x88	348.4	.....	L	4	Spl...	2¾	Blackb'r'e.	.....	.....	.....	Plate...	Ch & b	Burman.	R	26x2¼	.....	Rim..	V-rim.	1.5	190	77	Yes
Verus	1-70x90	346.4	.....	L	4	Spl...	2¾	J. A. P....	.....	.....	.....	Plate...	Chain.	Burman.	R	26x2¼	M. L....	Int...	V rim.	1.5	210	92	Yes
Verus	2-	.....	V	L	4	Spl...	6	Blackb'r'e.	.....	.....	.....	Multi-d	Chain.	St. Arch.	R	26x3	Lucas...	Int...	V rim.	1.5	260	135	Yes
Wolf	1-70x70	269.4	.....	.....	2	Spl...	2½	Villiers....	.....	.....	.....	Plate...	Ch & b	Albion..	R	26x2¼	Villiers.	Rim..	V rim.	1.0	147	45	No.
Wolf	1-71x88	348.4	.....	L	4	Spl...	2¾	Blackb'r'e.	9	.....	5½	Multi-d	Ch & b	St. Arch.	R	26x2¼	.....	Rim..	V rim.	1.0	193	75	No.
Wolf	1-85x97	550.4	.....	L	4	Spl...	4¼	Blackb'r'e.	13½	8	5	Multi-d	Ch & b	St. Arch.	R	26x2½	.....	Rim..	V-rim.	1.5	224	95	No.
Zenith	2-68x68	493.8	Opp.	H	4	Spl...	3½	Bradshaw .	13¾	7	4¾	Multi-d	Chain.	St. Arch.	R	26x2½	.....	V rim.	V rim.	2.0	270	119	Yes
Zenith	2-70x88	677.2	V	L	4	Spl...	5	J. A. P....	11¾	.....	5	Cone...	Belt...	None....	R	26x2½	.....	Rim..	V rim.	2.0	290	118	No.
Zenith	2-85x85	964.7	V	L	4	Spl...	8	J. A. P....	11	.....	4¼	Cone...	Belt...	None....	R	28x3	.....	V rim	V rim.	2.0	320	130	No.

British Motorcycle Trends

Popularity of 2½-2¾h.p. lightweight still increasing. Forty-six per cent of machines have stock engines and 58% stock gearsets. Brakes show improvement. Multiplicity of models feature of most British lines.

By M. W. Bourdon

FIRST observable just before the war and continued in 1919, the lightweight motorcycle movement in England has gained increased force and intensity during the past twelve months, and whereas until recently the mainstay of the British industry was the single cylinder four-cycle machine of from 3½ to 4 hp. weighing 250-300 lb., the honors are now fairly equally divided between that type and the lightweight with either a two-cycle or four-cycle engine of from 2½ to 2¾ hp. and turning the scale at 160 to 180 lb.

This smaller pattern has up to this year been sold exclusively for solo use, generally with a two-speed gear, but by no means infrequently with only a single ratio and direct belt drive. But for 1922 quite a number of makers have, after strengthening the frame and modifying the machine in one or two other details, put it forward for passenger work with a light sidecar. In this form with a three-speed gearset and chain-belt drive it has already established itself in the public favor, for although hitherto it has not been sold as a dual purpose machine it has been used quite extensively with sidecar attachments in 1921, owners having themselves fitted it up as a combination, despite the makers' warning that they did so at their own risk.

It should not be assumed from the foregoing that the medium-weight 3½-4 hp. single cylinder machine has been superseded by the light weight; that is not so, for it retains just as firm a hold as hitherto and the demand for the lighter and cheaper machines is additional—a demand, in fact, which constitutes almost an entirely new market for motorcycles. Favor is almost evenly given to two-cycle and four-cycle engines for lightweights, for taking all models of all makers up to 2¾ hp. the two-cycle engine is fitted to 52 per cent, which compares with 45 per cent at this time last year. When, however, one ignores limitations as to horsepower and includes all machines from the smallest to the largest (8 hp. two-cylinder), the four-cycle motor predominates, appearing on 75 per cent, a 5 per cent drop in twelve months.

Twelve months back the popularity of the 3½-4 hp. single cylinder was threatened by two-cylinder horizontally opposed engines, a number of new models appearing, offered at prices comparing favorably with the other type. But these two-cylinder medium-powered machines have not made much headway, and up to 5-6 hp. the single cylinder still holds the field.

One of the outstanding features of the British motorcycle industry of late has been the exceedingly large number of new models of all types put forward for 1922. This will be realized to the full when it is said that of the 160 machines dealt with in the accompanying specification table 49.5 per cent are new models. Admittedly, in many cases they are based upon 1921 models and embody additional rather than new and substituted features. Further, the old models are retained as optional patterns, which results in a great many makers offering a large variety of types. As will be seen from the table, a one-model policy is quite exceptional; many firms offer four alternative types and half a dozen are listed in some cases. One firm actually catalogues 12 models under two different names, these ranging from a 2½ hp. lightweight with two-cycle engine to an 8 hp. twin-cylinder four-cycle.

The tendency for motorcycle makers to fit stock engines and gearsets continues, and 46 per cent of all machines have engines made by specialists, while stock gearsets appear on 58 per cent. Also as hitherto, the J. A. P. engines predominate among stock productions, though as the makers of this range do not supply a two-cycle motor, the percentage of their productions in stock engines used by all manufacturers has fallen from 60 to 53 per cent in twelve months. Fifty-four per cent of engines are made by the motorcycle manufacturers, while the two-cycle Villiers stock engine with its flywheel magneto now has the chief representation in this type, viz. 44 per cent. For the first time a sleeve valve engine has made its appearance on British motorcycles, this being the Barr & Stroud, made under the Burt & McCullum (Argyll) patents with a single interior sleeve. Among multi-cylinder engines the V type continues to predominate, and has, in fact, gained slightly during the year; it now occurs on 76 per cent of the two-cylinder engines as compared with 20 per cent horizontally opposed, the remaining 4 per cent having cylinders side by side, slightly inclined, and are of the two-cycle type. Last year British motorcycles included a three-cylinder and a four-cylinder model, but these have now disappeared. Cylinder heads are detachable in only 21 per cent of all engines, and valves in the head, while they have increased slightly, hold a representation of less than 7 per cent. One maker—Martinsyde—has a peculiar valve arrangement, the exhaust being overhead and the inlet at the side of the cylinder, the exhaust valve being accommodated in a detachable cage and seating. There are two or three examples of overhead inlets with side exhaust.

A marked variation in design is the increased number of anti-friction bearings (ball and roller) in place of plain gun-metal bushes for the crankshaft and big-end. It still remains usual practice, however, to fit a plain bearing on the timing side of the crankshaft, 65 per cent of engines having this arrangement with either a ball or roller bearing on the driving side. Roller bearings are favored far and away in preference to the ball variety for connecting rod big-ends, the respective percentages being 55 and 3 per cent, the remainder being plain. The majority (75 per cent) of wrist pins are still attached to the piston bosses, though there has been an appreciable increase in the number which float in both piston and rod, the percentage in this respect having increased from 4 to 17. Splash lubrication still predominates with 84.5 per cent.

Tendencies in British Motorcycle Design

Engine, Two or Four-Cycle

Four	75 per cent
Two	25 per cent

Up to 2¾ Hp.

Two-cycle	52 per cent
Four-cycle	48 per cent

No. of Cylinders

1	60 per cent
2	40 per cent

Engine, Make

Own	54 per cent
Stock	46 per cent

Multi Cylinder Arrangement

V	76 per cent
Hor. opposed	20 per cent
Inclined	4 per cent

Cylinder Head Detachable?

No	79 per cent
Yes	21 per cent

Engine Bearings, Driving Side

Plain	47 per cent
Ball	33 per cent
Roller	17.5 per cent
Plain and Ball	2.5 per cent

Timing Side

Plain	65 per cent
Ball	23 per cent
Roller	9 per cent
Plain and ball	3 per cent

Big-End

Roller	55 per cent
Plain	42 per cent
Ball	3 per cent

Valve Arrangement

L head	62.5 per cent
Valveless	25 per cent
Overhead (I)	6.9 per cent
Overhead Inlet (F)	4.4 per cent
Overhead Exhaust	.6 per cent
Sleeve	.6 per cent

Wrist Pin Fixing

In piston bosses	75 per cent
Floating	17 per cent
In connecting rod	8 per cent

Lubricating System

Splash	84.5 per cent
Circulating splash	7 per cent
Splash and pressure	3 per cent
Petroil	2.5 per cent
Pressure	1.5 per cent
Hollow shaft, drip feed	1.5 per cent

Clutch Type

Plate	60 per cent
Multi plate	35 per cent
expanding cone expanding band expanding ring	5 per cent

Clutch Control Hand or Foot

Hand	88 per cent
Foot	10 per cent
H & F	2 per cent

Gearset

Stock	58 per cent
Own	42 per cent

No. of Speeds

3	62.5 per cent
2	31.5 per cent
1	3.25 per cent
Variable (expanding pulley)	2 per cent
4	.75 per cent

Gearset Location

Separate	98 per cent
Unit	2 per cent

Type of Transmission

Chain	51 per cent
Chain and belt	41 per cent
Belt	8 per cent

Frame

Rigid	90 per cent
Sprung	8 per cent
Optional	2 per cent

Wheels; Detachable and Interchangeable

No	90 per cent
Yes	10 per cent

Brakes, Front

Tyre rim	50 per cent
V rim	26 per cent
Expanding shoes	17.5 per cent
Band	3.5 per cent
Shoe	3 per cent

Brakes, Rear

V rim	64 per cent
Expanding shoes	22 per cent
Band	4 per cent
Two V rim	3 per cent
Expanding and band	2.5 per cent
Shoe	2.5 per cent
Two expanding	2 per cent

German Motorcycle Specifications

NAME AND MODEL	POWER PLANT: CYLINDERS Number Bore and Stroke	CYLINDERS Arrangements	Piston Displacement (Cu. In.)	Cycle Type	Lubrication Type	Carburetor Make	Ignition Make	Maximum H. P.	TRANSMISSION: Number of Speeds	Change Speed Gear Type	Clutch Type	Final Drive Type	FRAME AND WHEELS: Wheelbase (Ins.)	Frame Made From	Front Forks Type	Tire Size (Ins.)	MISCELLANEOUS: Starting System	Lighting System	Brakes: No. and Type	Fuel Tank Capacity in Gals.	Weight Ready For Road (Lbs.)	Maximum Speed M. P. H.
Adria R	1-67x80	Vert.	22.3	4	Spl.	Meco	Bosch	2.5	1	.....	None	Belt	49.7	Stl-tube	Spr.	26x2	P.	None	1-Ext.	1.06	124	40
Ardie 2HP	1-70x75	Vert.	17.6	2	O&G.	Opt.	Eise	2.3	2	Prog.	Cone.	Belt	53.2	Stl-tube	Spr.	26x2½	K.	None	2-Int.	2.38	172	37
Golem Chair Type	1-50x60	Hor.	7.2	2	O&G.	Pallas	Fly-wh.	1	1	.....	Cone.	Chn. Blt	47.3	Stl-tube	Spr.	15x2⅛	K.	None	1-Ext.	.....	77	25
K. C 2HP	2-51.5x62	Opp.	15.7	2	O&G.	Own	Bosch	2	1	.....	Cone.	Chn	50.5	.....	Bicy.	24x2	P.	None	1-Ext.	1.45	121	34
Kreiger 4HP	1-80x99	Vert.	30.7	4	Force.	Opt.	Bosch	4	3	Slid.	Cone.	Car-shft.	55.2	Stl-tube	Spr.	28x2½	K.	None	2-Ext.	2.64	247	47
Krupp Scooter	1-60x70	Vert.	12.1	4	Spl.	Tuto	Fly-wh.	1.55	1	.....	Disk	Sp-gear.	47.3	Pr-sheet	Spr.	15x2¼	.....	None	2-Int.	0.40	99	25
Lomos Chair Type	1-55x60	Obl.	8.7	2	O&G.	Tuto	Bosch	1.2	1	.....	Cone.	Belt	53.2	Stl-tube	Spr.	20x2	.....	None	2-Int.	1.32	121	31
Lorenz Scooter	1-62x70	Vert.	12.9	4	Spl.	Meco	Bosch	1.6	1	.....	Cone.	Belt	49.2	Pr-sheet	Spr.	15x2¼	.....	None	1-Ext.	0.79	110	19
Mars A20	2-80x95	Opp.	58.3	4	Force.	Pallas	Bosch	7.3	2	Slid.	Exp.	Chn	58.8	Pr-sheet	Spr.	28x3	H.	None	2-Ext.	3.09	304	50
Megola Chair Type	5-52x60	Rot.	38.9	4	Spl.	Zenith	Bosch	4.88	1	Plan.	.....	D-fr-wh	55.2	Pr-sheet	Spr.	28x3	K.	None	2-Int.	4.76	242	47
M. F. Z 2HP	1-64x77	Vert.	15.3	4	Force.	Graetzin	Bosch	2.5	2	Slid.	Disk	Belt	52.0	Stl-tube	Spr.	26x2¼	K.	Bosch	1-Rim.	2.38	132	43
N. S. U 2HP	1-66x71	Vert.	15.3	4	Force.	Pallas	Bosch	2.2	2	Slid.	Disk	Belt	52.4	Stl-tube	Spr.	26x2¼	K.	None	1-Rim.	1.85	154	37
N. S. U 3HP	1-75x80	Vert.	21.6	4	Force.	Pallas	Bosch	3	2	Hub	.....	Belt	52.8	Stl-tube	Spr.	26x2½	K.	None	2-Ext.	1.98	232	40
N. S. U 4HP	2-63x80	Vee.	30.4	4	Force.	Pallas	Bosch	4.5	3	Slid.	Disk	Belt	54.3	Stl-tube	Spr.	26x2½	K.	None	2-Ext.	2.11	221	50
N. S. U 8HP	2-80x99	Vee.	60.7	4	Force.	Pallas	Bosch	8	3	Slid.	Disk	Chn	58.3	Stl-tube	Spr.	28x3	K.	Bosch	2-Int.	2.38	309	62
Pawa 1.5HP	1-60x80	Vert.	13.8	2	Spl.	Tuto	Bosch	1.7	1	.....	Cone.	Belt	54.3	Stl-tube	Spr.	20x2½	K.	None	2-Ext.	0.79	110	37
Postler Scooter	1-65x76	Vert.	15.4	4	Force.	Zenith	Bosch	1.8	2	Hub	Spr.	Belt	50.5	Pr-sheet	Spr.	15x2¼	.....	None	2-Ext.	0.53	137	28
Star 3HP	2-61x67	Opp.	24.0	4	Force.	Pallas	Opt.	3	3	Slid.	D-d.	Chn	57.2	Stl-tube	Spr.	26x2¼	K.	Bosch	2-Int.	2.64	187	40
Tautz Scooter	1-50x60	Hor.	7.2	2	O&G.	Adria	Eise	1	1	.....	Cone.	Chn	48.8	Pr-sheet	Spr.	20x1¾	.....	None	1-Int.	0.79	75	25
Triumph 2HP	1-70x72	Vert.	16.4	2	O&G.	Own	Bosch	2.6	2	Hub	.....	Belt	49.2	Stl-tube	Spr.	26x2¼	None	None	2-Ext.	1.85	137	37
Victoria 3HP	2-68x68	Opp.	30.1	4	Force.	Opt.	Bosch	4	2	Prog.	Cone.	Belt	58.3	Stl-tube	Spr.	26x2½	K.	Fenag.	2-Ext.	3.17	242	47
Wanderer 2HP	1-70x85	Vert.	19.9	4	Force.	Own	Bosch	2.5	2	Prog.	Disk	Belt	54.2	Stl-tube	Spr.	26x2¼	K.	None	2-Int.	1.98	242	37
Wanderer 4HP	2-70x80	Vee.	37.6	4	Force.	Own	Bosch	4.5	3	Prog.	Disk	Chn	55.2	Stl-tube	Spr.	26x2½	K.	None	2-Int.	2.64	276	53
Wegro 3HP	2-60x80	Vert.	27.6	2	O&G.	Tuto	Bosch	3.5	1	.....	Disk	Chn	55.9	Stl-tube	Spr.	28x3	K.	Bosch	2-Ext.	2.64	199	68

American Stock Engine Speci

MAKE AND MODEL	Designed for (Cars, Trucks, Tractors)	No. of Cylinders, Bore and Stroke	Engine Type	Cylinder Type	Cylinders Cast?	Cylinder Heads	Piston Material	Name of Alloy	No. of Piston Rings	Piston Pin Diameter	Piston Length	Piston Weight	Valve Clear Diameter	Valve Lift	Valve Head Material	Crankcase Integral With Cylinders?	Crankcase Material	Material of Lower Half	Cooling System	Oiling System	Pressure Regulation by Intake Vacuum	Oil Pump Type
Beaver JA	Trucks	4-4½x6	Ver	I-head	4	Det	Iron		4	1½	5 5/16	5¾	2 3/16	3/8	C-steel		Iron	Iron	Pump	Hol-crk		Gear
Beaver CL	Cars	6-3½x5¼	Ver	I-head	6	Det	Iron		4	1.09	4¾		1¾	3/8	Tung		Al	Al	Pump	Hol-crk		Gear
Beaver JB	Tractors	4-4¾x6	Ver	I-head	4	Det	Iron		4	1½	5 5/16	6¾	2 3/16	3/8	C-steel		Iron	Iron	Pump	Hol-crk		Gear
Buda ATU		4-5 x6½	Ver	L-head	4	Det	Iron		4	1 3/8	6¾		2¼	5/16	Ch-steel		Iron	Iron	Pump	Hol-crk		Gear
Buda BTU		4-4¾x6½	Ver	L-head	4	Det	Iron		4	1 3/8	6¾		2¼	5/16–3/8	Ch-steel		Iron	Iron	Pump	Hol-crk		Gear
Buda MU	C,T,Tr	4-3 5/8x5 1/8	Ver	L-head	4	Det	Iron		4	1 1/16	4½		1½	9/32–5/16	Ch-steel		Iron	Iron	Pump	Hol-crk		Gear
Buda YTU	T,Tr	4-4½x6	Ver	L-head	4	Det	Iron		4	1¼	6¼		2 1/8	9/32–5/16	Ch-steel		Iron	Iron	Pump	Hol-crk		Gear
Buda ETU	T,Tr	4-4¼x5½	Ver	L-head	4	Det	Iron		4	1 1/8	5 3/8		1 7/8	9/32–5/16	Ch-steel		Iron	Iron	Pump	Hol-crk		Gear
Buda FTU	T,Tr	4-4 x5½	Ver	L-head	4	Det	Iron		4	1 1/8	5 3/8		1 7/8	9/32–5/16	Ch-steel		Iron	Iron	Pump	Hol-crk		Gear
Buda CTU	T,Tr	4-3¾x5¼	Ver	L-head	4		Iron		4	1 1/16	5		1 5/8	9/32–5/16	Ch-steel		Iron	Iron	Pump	Hol-crk		Gear
Climax K	T,Tr	4-5 x6½	Ver	L-head	2	Det	Iron		3	1 23/64	5¾	5½	2¼	5/16	C-iron		Iron	Iron	Pump	Hol-crk	No	Ecc
Climax KU	T,Tr	4-5 x6½	Ver	L-head	2	Det	Iron		3	1 23/64	5¾	5½	2¼	5/16	C-iron		Iron	Iron	Pump	Hol-crk	No	Ecc
Climax TU	T,Tr	4-5½x7	Ver	L-head	2	Det	Iron		3	1 31/64	7	8¾	2¼	5/16	C-iron		Iron	Iron	Pump	Hol-crk	No	Ecc
Continental 7R	Cars,T	6-3¼x4½	Ver	L-head	6	Det	Iron		3	33/64	4 1/16	32	1½	5/16	Steel		Al	P-stl	Pump	Hol-crk	No	Gear
Continental E4	T,Tr	4-4½x5½	Ver	L-head	2	Int	Iron		3	1 7/16	5 5/8		2¼	5/16	Steel		Al	Al	Pump	Cir-spl	No	Pist
Continental E7	Trucks	4-4½x5½	Ver	L-head	2	Int			3	1 7/16	5 5/8		2 13/64	5/16	Steel		Al	P-stl	P,T	Cir-spl	No	Pist
Continental C2	T,Tr	4-4¼x5¼	Ver	L-head	4	Int	Iron		3	1 7/32	5¼		1 3/16	5/16	Steel		Al	Al	Pump	Cir-spl	No	Pist
Continental C4	Trucks	4-4¼x5¼	Ver	L-head	4	Int	Iron		3	1 7/32	5 1/8		1 1/16	9/32	Steel	Sep	Al	Al	Pump	Cir-spl	No	Pist
Continental N	Cars,T	4-3¾x5	Ver	L-head	4	Int	Iron		3	1 3/32	3¾	3¼	1 21/32	1 1/32	Al		Al	p-stl	P,T	Cir-spl	No	Pist
Continental B2	T,Tr	4-4¾x6	Ver	L-head	2	Det	Iron		3	1 3/8	6 1/8	7 11/12	2 1/8	1 1/32	Al		Al	Al	Pump	Hol-crk	No	Gear
Continental 9N	Trucks	6-3 1/8x5 1/4	Ver	L-head	6	Int	Iron		3	1 5/32	4½	3¼	1 17/32	9/32–1 1/32			Al	P-stl	Pump	Cir-spl	No	Pist
Erd D	Tractors	4-4¼x6	Ver	I-head	4	Det	Iron	C-iron	3	1¼	5¼	3¾	1¾	5/16	Steel		Iron	Al	Pump	Hol-crk		Gear
Falls X-9000	Cars	6-3 1/8x4 1/4	Ver	I-head	6	Det	Iron		3	¾			1¼	9/32	Steel	Yes	Iron	Ther	Cir-spl	No	Ecc	
G. B. & S. AA	C,T,Tr	4-3 3/8x5	Ver	L-head	4	Int	Iron		3	1 5/32	3¾	3 1/16	1 43/64	23/64			Al	Al	Pump	Hol-crk		Gear
G. B. & S. SS	Cars,T	4-3 3/4x4 1/4	Ver	L-head	4	Det	Iron		3	¾	3 15/16	2 5/16	1 5/8	7/32	Steel	Sep	Iron	P-stl	Ther	Cir-spl		Pist
Gray-Beall K	Cars	4-3½x5	Ver	I-head	4	Det	Iron		3	1	3 7/8	1½	1 5/8	9/25	Steel	Yes	Iron	P-stl		Cir-spl	No	Gear
Gray-Beall T	C,T,Tr	4-3½x5	Ver	I-head	4	Det	Iron		3	1	3 7/8	1½	1 5/8	9/25	Steel	Yes	Iron	P-stl		Cir-spl	No	Gear
Hercules CU2	T,Tr	4-3 3/4x5 1/8	Ver	L-head	4	Det	Iron		4	1 1/8	4 7/8	4 5/16	1 11/16	1 1/32	Steel	No	Iron	Iron	Pump	Hol-crk	No	Gear
Hercules CU3	T,Tr	4-4 x5 1/8	Ver	L-head	4	Det	Iron		4	1 1/8	4 7/8	4 5/16	1 11/16	1 1/32	Steel	No	Iron	Iron	Pump	Hol-crk	No	Gear
Hercules MU2	T,Tr	4-4 1/4x5 1/8	Ver	L-head	4	Det	Iron		4	1¼	5 1/8	5	1 7/8	1 1/32	Steel	No	Iron	Iron	Pump	Hol-crk	No	Gear
Hercules MU3	T,Tr	4-4 1/8x5 1/2	Ver	L-head	4	Det	Iron		4	1¼	5 1/8	5 9/16	1 7/8	1 1/32	Steel	No	Iron	Iron	Pump	Hol-crk	No	Gear
Hercules TU	T,Tr	4-4¾x6	Ver	L-head	2	Det	Iron		4	1 3/8	5 11/16	7¼	2 1/8	1 1/32	Steel	No	Al	Al	Pump	Hol-crk	No	Gear
Hercules T3	T,Tr	4-5 x6	Ver	L-head	2	Det	Iron		4	1 3/8	5 11/16	8 1/8	2 1/8	1 1/32	Steel	No	Al	Al	Pump	Hol-crk	No	Gear
Herschell-Spillman 90	Cars	6-3½x5	Ver	L-head	6	Det	Iron		3	7/8	3 3/8			5/16	Steel	Yes	S-stl	P-stl	Pump	Cir-spl		Gear
Herschell-Spillman 7000	C,T,Tr	4-3½x5	Ver	L-head	4	Det	Iron		3	7/8	3 3/8		1 9/16	5/16	Steel	Yes	S-stl	P-stl	Ther	Cir-spl		Gear
Herschell-Spillman 11000	Cars	6-3¼x5	Ver	L-head	6	Det	Iron		3	7/8	3 3/8		1 9/16			Yes	S-stl	P-stl	Pump	Cir-spl		Gear
Highway AA	Cars,T	4-3¾x5	Ver	L-head	4	Int	I or A	Lynite	3	1 3/32	3¾	1⅛	1 7/8	23/64	C-iron		Al	Al	Pump	Hol-crk	No	Gear
Hinkley 300	T,Tr	4-3¾x5 1/4	Ver	L-head	4	Det	Iron		3	1 1/8	4 3/4		1 3/4	5/16	C-iron		S-stl	P-stl	Pump	Hol-crk	No	Gear
Hinkley 400	T,Tr	4-4 x5¼	Ver	L-head	4	Det	Iron		3	1 1/8	4½		1 3/4	5/16	C-iron		S-stl	P-stl	Pump	Hol-crk	No	Gear
Hinkley 500	T,Tr	4-4¼x5½	Ver	L-head	4	Det	Iron		3	1¼	5¼		2	5/16	C-iron		S-stl	Al	Pump	Hol-crk	No	Gear
Hinkley 200	T,Tr	4-4½x5½	Ver	L-head	4	Det	Iron		3	1¼	5¼		2	5/16	C-iron		S-stl	Al	Pump	Hol-crk	No	Gear
Hinkley 1600	T,Tr	4-4½x5½	Ver	I-head	4	Det	Iron		3	1¼	5¼		2	5/16	C-iron		S-stl	Al	Pump	Hol-crk	No	Gear
Le Roi 2C	C,T,Tr	4-3 1/8x4½	Ver	L-head	4	Det	Iron		3	¾	3½		1½	3/16	C-iron	Yes	C-stl		Ther	Cir-spl		Pist
Lycoming K, KA, KB, KC	C,T,Tr	4-3½x5	Ver	L-head	4	Det	Iron		3	7/8	4	1½	1½	1 9/64	C-iron	No	Iron	P-stl	Ther	Cir-spl	No	Pist
Matthews F	C,T,Tr	4-3½x5	Ver	L-head	4	Det	Iron		3	7/8	3 25/32	2.4	1 3/8		C-iron	Yes		P-stl	P,T	Cir-spl		Gear
Matthews LM	Cars,T	4-3 7/8x4	Ver	L-head	4	Det	Iron		3	47/64	4¼	3.5	1 5/16	23/100–1/4	C-iron	Yes		Al,pst	Ther	Cir-spl		Gear
Midwest 400	T,Tr	4-4½x6	Ver	V-head	2	Det	Iron		3	1¼	5½	6 5/8	2¼	7/16	A	Sep	Iron	Iron	Pump	Hol-crk	Yes	Gear
Midwest 402	T,Tr	4-4¼x5¼	Ver	V-head	2	Det	Iron		3	1⅛	5 1/8	8	1 7/8	5/16–3/8	A	Sep	Iron	P-stl	Pump	Hol-crk	Yes	Gear
Midwest 408	C,T,Tr	4-3 5/8x5	Ver	V-head	4	Det	Iron		3	1	4 1/16	2 5/16	1½	3/8	A	Yes	Iron	Al	Pump	Hol-crk	Yes	Gear
Midwest 409	C,T,Tr	4-3 1/4x5½	Ver	V-head	4	Det	Iron		3	7/8	3 9/16		1½	3/8	A	Yes	Iron	Al	Ther	Hol-crk	Yes	Gear
Northway 80	Trucks	4-3½x5½	Ver	L-head		Det	Iron		4	1 7/64	4 3/16	3 5/16	1 5/8	39/100	Ch-stl	Yes	Iron	Al	T P	Hol-crk	No	Gear
Northway 84	Trucks	4-4 x5½	Ver	L-head		Det	Iron		4	1 15/64	5¼					Yes	Iron	Al	T,P	Hol-crk	No	Gear
Northway 88	Trucks	4-4½x6	Ver	L-head	1	Det	Iron		4	1 11/64	6	5.8	2¼	7/16	Ch-stl	Yes	Iron	Al	T,P	Hol-crk	No	Gear
Northway 309	Cars	8-3½x4½	V	L-head	4	Det	A	Lynite	4	55/64	4 3/8	1 3/16	1½	5/16	Ch-stl	Yes	Iron	P-stl	Pump	Hol-crk	No	Gear
Pittsburgh 92	Cars	8-3¼x5	V	L-head	4	Int	Iron		3	7/8	3½	2.06	1½	1/8	P-stl		Al	Al	Pump	Hol-crk	No	Gear
Pittsburgh 93	Cars,T	4-3 1/8x4½	Ver	L-head	4	Det	Iron		3	7/8	4½	2.13	1 1/8	1/4	P-stl	Yes	Iron	P-stl	Ther	Cir-spl		Pist
Reliable T	Tractors	2-6 x7	Hor	V-head	2	Det	Iron		3	1½	7	28	2 1/8	1/2	N-stl		Iron		Ther			Pist
Reliable 00	Tractors	2-6 x6	Hor	V-head		Det	Iron	20%S.	3	1 3/8	7 1/8	24	2 1/8	1 1/16	N-stl	Yes	S-stl		Pump	Hol-crk		Pist
Rochester G-1	Cars	4-4¼x6	Ver	V-head	4	Int	A	Lynite	3	1¼	4¾	16.9	2	3 1/64	A, tung		Al	Al	Pump	Hol-crk	No	Gear
Rochester 1000	Cars	6-3½x5	Ver	L-head	6	Det	A	Lynite	3	1 3/32	4	1 3/16	1 9/16	3/8	A		Al	Al	Pump	Hol-crk	No	Gear
Rutenber 25	Cars	6-3 1/8x5	Hor	L-head	6	Det	Iron	C-iron	4	¾	3¾	1 9/16	1 5/16	5/16	C-iron	Yes	C-iron	P-stl	Pump	Cir-spl		Pist
Stearns A	T,Tr	4-4¾x6½	Ver	V-head	4	Det	Iron		4	1 5/8	6		2¼	7/16	N-stl		Iron	Al	Pump	Hol-crk		Gaer
Stearns AU	T,Tr	4-4¾x6½	Ver	V-head	4	Det	Iron		4	1 5/8	6		2¼	7/16	N-stl		Iron	Al	Pump	Hol-crk		Gear
Stearns B	T,Tr	4-5 x6½	Ver	V-head	4	Det	Iron		4	1 5/8	6		2¼	7/16	N-stl		Iron	Al	Pump	Hol-crk		Gear
Stearns BU	T,Tr	4-5 1/8x6½	Ver	V-head	4	Det	Iron		4	1 5/8	6		2¼	7/16	N-stl		Iron	Al	Pump	Hol-crk		Gear
Stearns G	T,Tr	4-4¼x6	Ver	V-head	4	Det	Iron		4	1½	5¾		2	7/16	N-stl		Al	Al	Pump	Hol-crk		Gear
Stearns GU	T,Tr	4-4¼x6	Ver	V-head	4	Det	Iron		4	1½	5¾		2	7/16	N-stl		Al	Al	Pump	Hol-crk		Gear
Stearns H	T,Tr	4-4½x6	Ver	V-head	4	Det	Iron		4	1½	5¾		2	7/16	N-stl		Al	Al	Pump	Hol-crk		Gear
Stearns HU	T,Tr	4-4½x6	Ver	V-head	4	Det	Iron		4	1½	5¾		2	7/16	N-stl		Al	Al	Pump	Hol-crk		Gear
Stearns F	T,Tr	4-4 x6	Ver	V-head	4	Det	Iron		4	1½	5¾		2	7/16	N-stl		Al	Al	Pump	Hol-crk		Gear
Stearns FU	T,Tr	4-4 x6	Ver	V-head	4	Det	Iron		4	1½	5¾		2	7/16	N-stl		Al	Al	Pump	Hol-crk		Gear
Sphinx A	Cars	6-3¼x4½	Ver	T-head	6	Det	Iron		3	7/8	4					Yes	Iron	Al	Pump	Hol-crk	No	Gear
Supreme 5K	Cars	6-3¼x5	Ver	L-head	6	Det	Iron		3	7/8	4 1/8	1½	1 5/8	3/10	N-stl	Yes	Iron	P-stl	Pump	Hol-crk	No	Gear
Supreme S4	C,T,Tr	4-3 3/8x5	Ver	L-head	4	Det	Iron		3	7/8	4 1/8	1 5/8	1 5/8	3/10	N-stl	Yes	Iron	P-stl	Ther	Hol-crk	No	Gear
Turmo O	Cars	4-3 x5	Ver	L-head	4	Int	Iron		2	¾	3¼		1½	5/16	Iron		Iron	Iron	Ther	Hol-crk	No	Gear
Turmo N	Tractors	4-3 x4½	Ver	L-head	4	Int	Iron	S-stl	2	¾	3¼		1½	5/16	Iron		Iron	P-stl	Ther	Cir-spl	No	Pist
Turmo H	C,T,Tr	4-3¾x5	Ver	L-head	4	Det	Iron		4	1	3 7/8		1¾	3/8	Iron		S-stl	P-stl	Pump	Hol-crk		Gear
Turmo S	Cars	4-3½x5	Ver	L-head	4	Det	Iron		3	7/8	3¾		1 5/8	5/16	Iron		S-stl	I-P-st	Ther	Hol-crk		Gear
Twin City TW	T,Tr	4-4¼x6	Ver	I-head	4	Det	Iron	C-iron	4	1¼	5 1/32	5	1½	5/16	Ch-nic	Yes	Iron	P-stl	Pump	Hol-crk	No	Gear
Twin City AE	Tractors	4-5½x6¾	Ver	I-head	4	Det	Iron	C-iron	5	1 5/8	6¾	9¾	1¾	7/16	Ch-nic	Yes	Iron	Al	Pump	Hol-crk	No	Gear
Twin City BE	Tractors	4-7¾x9	Ver	I-head	1	Det	Iron	C-iron	4	2 3/16	10¼	1 5/8	3	23/32	C-iron		Iron	Iron	Pump	Spl, FF		
Waukesha EU	T,Tr	4-5 x6½	Ver	L-head	2	Det	Iron		3	1 3/8	6½	8 15/16	2 1/8	1 1/32	Spec-a		Al	Iron	Pump	Hol-crk	No	Gear
Waukesha DU	T,Tr	4-4½x6¼	Ver	L-head	2	Det	Iron		3	1 3/8	5 7/8	7½		1 1/32			Al	Iron	Pump	Hol-crk	No	Gear
Waukesha CU	T,Tr	4-4 3/8x5 3/4	Ver	L-head	2	Det	Iron		3	1¼	5 9/16	6¼		1 1/32	Spec-a		Al	Iron	Pump	Hol-crk	No	Gear
Waukesha FU	T,Tr	4-4 x5¾	Ver	L-head	2	Det	Iron		3	1¼	5 9/16			1 1/32	Spec-a		Al	Al, I	Pump	Hol-crk	No	Gear
Waukesha BUX	T,Tr	4-3¾x5¾	Ver	L-head		Det	Iron		4	1	3 7/8	3 1/8		5/16	Spec-a		Al	Iron	Pump	Cir-spl	No	Gear
Weidely M	T,Tr	4-3¾x5½	Ver	I-head	4	Det	Iron		4	1	4½	3 9/10	1 7/8	5/16	C-I, St	Yes	Iron	Iron	Pump	Hol-crk	No	Gear
Weidely MAU	T,Tr	4-4 x5½	Ver	I-head	4	Det	Iron		3	1	4 9/16	2 1/8	1 7/8	5/16	Steel	Yes		Iron	Pump	Hol-crk	No	Gear
Weidely MAU2	Trucks	4-3¾x5½	Ver	I-head	4	Det	Iron		3	1	4 9/16	2 3/8	1 7/8	5/16	Steel	Yes		Iron	Pump	Hol-crk	No	Gear
Weidely MAT	Cars	4-3¾x5½	Ver	I-head	4	Det	Iron		3	1	4 9/16	2 3/8	1 7/8	5/16	Steel	Yes	Iron	Al	Pump	Hol-crk	No	Gear
Weidely MAT	Trucks	4-3¾x5½	Ver	I-head	4	Det	Iron		3	1	4 9/16	2 1/8	1 7/8	5/16	Steel	Yes		Iron	Pump	Hol-crk	No	
Weidely MA	Trucks	4-3¾x5½	Ver	I-head	4	Det	Iron		3	1	4 9/16	2 1/8	1 7/8	5/16	Steel	Yes	Iron	Iron	Pump	Hol-crk	No	Gear
Weidely C	Cars	12-2 7/8x5	V	I-head	3	Det	Iron		3	5/8	3½	1 3/5	1 5/16	1/4	Steel		Al	Al	Pump	Hol-crk	No	Gear
Wisconsin CAU	T,Tr	4-3¾x5	Ver	L-head	4	Int	Iron		3	1 3/16	5 5/32	4 3/16	1½	5/16	Ch-nic		Al	Al	Pump	Hol-crk	No	Gear
Wisconsin EAU	T,Tr	4-4 x5	Ver	L-head	4	Int	Iron		3	1 5/16	4 25/32	4 5/16	1½	5/16	Ch-nic		Al	Al	Pump	Hol-crk	No	Gear
Wisconsin TAU	T,Tr	4-4 x6	Ver	L-head	4	Det	Iron		3	1 5/16	5 3/8	4 3/16	2 1/32		Ch-nic		Al	Al	Pump	Hol-crk		Gear
Wisconsin UAU	T,Tr	4-4¼x6	Ver	L-head	4	Det	Iron		3	1 5/16	5 1/8	4 7/8	2 1/32		Ch-nic		Al	Al	Pump	Hol-crk		Gear
Wisconsin VAU	T,Tr	4-4½x6	Ver	L-head	4	Det	Iron		3	1 5/16	4 15/16	4 5/16	2 1/32		Ch-nic		Al	Al	Pump	Hol-crk		Gear
Wisconsin RAU	T,Tr	4-4¾x6	Ver	L-head	2	Det	Iron		3	1 3/8	6 1/8	6 1/8	2 1/8		Ch-nic		Al	Al	Pump	Hol-crk		Gear
Wisconsin RBU	T,Tr	4-5 x6	Ver	L-head	2	Det	Iron		3	1 3/8	5 29/32	6½	2 1/8		Ch-nic		Al	Al	Pump	Hol-crk		Gear
Wisconsin M	T,Tr	4-5¾x7	Ver	T-head	2	Int	Iron		4	1 7/16	5¼	10 1/8	2 13/32	3/8	Ch-nic		Al	Al	Pump	Hol-crk		Gear
Wisconsin P	Trucks	6-5¾x7	Ver	T-head	2	Int	Iron		4	1 7/16	5¼	10 1/8	2 11/32	3/8	Ch-nic		Bron	Al	Pump	Hol-crk		Gear

A-Steel—Alloy Steel
A—Alloy
Al—Aluminum
C-Steel—Carbon Steel
Cent—Centrifugal
Cam—Camshaft
Ch-Stl—Chrome Steel
C-Iron—Cast Iron
Cir Spl—Circulating Splash
Det—Detachable
Ecc—Eccentric
F F—Force Feed
Hor—Horizontal
Hol Crk—Hollow Crankshaft
H-Gear—Hellical Gear

fications for 1922

Connecting Rod Material	Connecting Rod C. to C. Length	Connecting Rod Weight	Crankshaft Material	No. of Crankshaft Bearings	Crankpin Diameter	Main Bearing Diameter	LENGTH OF CRANKSHAFT BEARINGS Front	LENGTH OF CRANKSHAFT BEARINGS Rear	Camshaft Location	Camshaft Drive	Speed of Max. H.P.	Is Governor Fitted?	Type of Governor	Governor Speed	Weight of Engine	Overall Width	Overall Height	Overall Length	Engine Adapted for Kerosene?	Bell Housing Provided?	No. and Type of Bell Housing	MAKE AND MODEL
C-stl....	12½	8	C-stl....	3	2¼	2.37	3½	4½	In-Crk..	H-gear..	1200	Yes...	Cent..	950-1000	1100	23⅛	39	50⅞	Yes...	Yes...	S.A.E-2...	Beaver...JA
C-stl....	11	4¼	C-stl....	3	2¼	2.29	2¾	2¾	In crk...	Sil-ch...	2400	No....	.....	.....	700	25¾	34⅛	51½	No...	Yes...	S.A.E-3...	Beaver...CL
C-stl....	12½	8	C-stl....	3	2¼	2.37	3½	3½	In crk...	H-gear..	1200	Yes...	Cent..	950-1000	1100	23⅛	39	50¼	Yes.	Yes...	S.A.E.2...	Beaver...JB
A-stl....	14⅜	.....	A-stl....	3	2½	3.19	3⅞	4¾	In crk...	H-gear..	1100	Opt....	.....	900	.....	28¾	37½	47⅜	No...	Yes...	S.A.E-1...	Buda...ATU
A-stl....	14⅜	.....	A-stl....	3	2½	3.19	3⅞	4¾	In-crk...	H-gear..	1100	Opt....	.....	900	.....	28¾	37½	47⅜	No...	Yes...	S.A.E-1...	Buda...BTU
C-stl....	11¼	.....	C-stl....	3	1⅞	1.95	2½	3	In crk...	H-gear..	1400-1600	No....	.....	.....	.....	25¾	30⅞	33⅜	No...	Yes...	S.A.E-3...	Buda...MU
A-stl....	13¼	.....	A-stl....	3	2¼	2.25	3¼	4½	In crk...	H-gear..	1200	Opt....	.....	1000	.....	25¾	37¼	39¼	No...	Yes...	S.A.E-3...	Buda...YTU
A-stl....	12¼	.....	C-st	3	2⅛	2.25	3	4	In crk...	H-gear..	1400-1600	Opt....	.....	1100	.....	25¾	34⅛	37⅛	No...	Yes...	S.A.E.3...	Buda...ETU
A-stl....	12¼	.....	C-stl....	3	2⅛	2.25	3	4	In crk...	H-gear..	1400-1600	Opt....	.....	1100	.....	25¾	34⅛	37⅛	No...	Yes...	S.A.E.3...	Buda...FTU
A-stl....	11¼	.....	C-stl....	3	2	2.00	2¾	3½	In crk...	H-gear..	1400-1600	Opt....	.....	1150	.....	25¾	32½	36⅛	No...	Yes...	S.A.E-3...	Buda...CTU
C-stl....	13	8½	A-stl....	3	2¼	2.25	3½	4½	In crk...	H-gear..	1100	Yes...	Cent.	.....	1100	23	40	47½	Yes.	No	.....	Climax...K
C-stl....	13	8½	A-stl....	3	2¼	2.25	3½	4½	In crk...	H-gear..	1100	Yes...	Cent.	.....	1150	24	40	50½	Yes...	Yes...	S.A.E-2...	Climax...KU
C-stl....	14	11⅝	C-stl....	3	2½	2.50	4½	4½	In crk...	S-gear...	900	Yes...	Cent.	.....	1500	26	44	55¾	Yes.	Yes...	S.A.E-1...	Climax...TU
C-stl....	10½	3⅛	C-stl....	4	2¼	2.25	1⅞	2⅜	In crk...	H-gear..	2400	No....	.....	.....	580	24⅛	30⅝	40¾	No...	Yes.	S.A.E-3...	Continental...7R
.....	11	.....	C-stl....	3	2¼	2.21	3¾	4⅝	In crk...	H-gear..	1400	Opt....	.....	.....	650	26¾	34⅝	40	No...	Yes.	S.A.E-2...	Continental...E4
C-stl....	10¼	.....	C-stl....	3	2¼	2.21	3¾	4⅝	In crk...	H-gear..	1400	Opt....	.....	.....	660	30	36¾	42½	No...	Yes...	S.A.E-2...	Continental...E7
C-stl....	11	.....	C-stl....	3	2	2.21	3	4⅜	In crk...	S-gear...	1400	Opt....	.....	.....	580	24⅛	31	38	No...	Yes...	Own.....	Continental...C2
C-stl....	10½	51½	C-stl....	3	2⅜	2.21	3	4⅞	In crk...	H-gear..	1600	Opt....	.....	.....	560	26¾	33	36	No...	Yes...	S.A.E-2...	Continental...C4
C-stl....	10¼	.....	C-stl....	3	1⅞	2.21	2½	3½	In crk...	H-gear..	2200	Opt....	.....	1300	475	23⅛	30⅞	34½	No...	Yes...	S.A.E-3...	Continental...N
C-stl....	13¼	.....	C-stl....	3	2⅜	2.45	4	4	In crk...	H-gear..	1300	Yes...	Cent..	1100	1016	26¾	40⅝	45⅝	No...	Yes...	S.A.E-1...	Continental...B2
C-stl....	10¼	48¾	C-stl....	3	3	2.05	2¼	3⅜	In crk...	H-gear..	1800	No....	.....	.....	600	23⅛	29⅛	42½	No...	Yes...	S.A.E-3...	Continental...9N
A-stl....	12	.....	A-stl....	3	2½	2.50	2⅜	3⅜	In crk...	H-gear..	1600	Yes...	.....	.....	680	23⅛	38⅝	41⅝	Yes...	Yes..	Opt.....	Erd...D
C-stl....	8⅛	.....	C-stl....	3	1⅞	1.84	1⅞	3	In crk...	H-gear..	2000	No....	.....	.....	475	25¾	28⅝	38⅛	No...	Yes...	S.A.E-4...	Falls...X-9000
C-stl....	10¼	32¼	C-stl....	3	1⅞	2.25	2½	3	In crk...	H-gear..	2000	No....	Cent..	1100	425	25¾	33⅛	34⅛	No...	Yes...	S.A.E-3...	G. B. & S...AA
C-stl....	7	16¹¹⁄₁₆	C-stl....	3	1½	1.55	2¼	4	In crk...	S-gear...	1600	No....	.....	900-1000	366	23⅛	24	33	No...	Yes...	S.A.E-5...	G. B. & S...SS
.....	11	32¾	C-stl....	3	2	.206	2½	3	In crk...	Sil-ch...	2200	Opt....	.....	.....	460	27⅝	32¾	33¼	Yes...	Yes...	S.A.E-3, 4.	Gray-Beall...K
C-stl....	11	32¾	C-stl....	3	2	.206	2½	3	In crk...	S-gear...	2200	Opt....	.....	.....	467	25¾	33⅝	32½	Yes...	Yes...	S.A.E-3, 4.	Gray-Beall...T
C-stl....	11	80⅜	C-stl....	5	2	2.00	1½	3⅝	In crk...	H-gear..	2000	Opt....	Opt...	.....	750	25¾	35⅝	38⅝	Yes.	Yes...	S.A.E-3...	Hercules...CU2
C-stl....	11	80⅜	C-stl....	5	2	2.00	1½	3⅝	In crk...	H-gear..	1800	Opt....	Opt...	Opt.....	750	25¾	35⅝	38⅝	Yes...	Yes...	S.A.E-3...	Hercules...CU3
C-stl....	12	80⅜	C-stl....	5	2	2.00	1¾	4⅜	In crk...	H-gear..	1700	Opt....	Opt...	Opt.....	850	25¾	41	43⅝	Yes...	Yes...	S.A.E-2...	Hercules...MU2
C-stl....	12	80⅜	C-stl....	5	2	2.00	1¾	4⅜	In crk...	H-gear..	1600	Opt....	Opt...	Opt.....	850	25¾	41	43⅝	Yes...	Yes...	S.A.E-2...	Hercules...MU3
C-stl....	13¼	124	C-stl....	5	2⅜	2.37	2¼	4	In crk...	H-gear..	1500	Opt....	Opt...	Opt.....	1000	28¾	41⅜	44⅜	Yes...	Yes...	S.A.E-1...	Hercules...TU
C-stl....	13¼	124	C-stl....	5	2⅜	2.37	2¼	4	In crk...	H-gear..	1500	Opt....	Opt...	Opt.....	1000	28¾	41⅜	44⅜	Yes...	Yes...	S.A.E-1...	Hercules...T3
C-stl....	11	.....	C-stl....	3	2	2.20	2⅝	4	In crk...	H-gear..	2150	.....	Cent..	.....	575	25⅛	30⅞	44	.....	Yes...	S.A.E-3...	Herschell-Spillman...90
C-stl....	11	.....	C-stl....	2	2	2.00	4	4	In crk...	H-gear..	1900	Yes...	Cent..	.....	440	25⅛	31	35¾	.....	Yes...	SAE3-5...	Herschell-Spillman...7000
C-stl....	11	.....	C-stl....	3	2	2.37	2⅝	4	In crk...	H-gear..	2150	.....	Cent..	.....	575	25⅛	30⅞	44	.....	Yes...	S.A.E-3...	Herschell-Spillman...11000
C-stl....	10¼	48⅜	C-stl....	3	1⅞	2.22	2½	3	In crk...	H-gear..	2000	No....	.....	.....	425	.....	.....	.....	No...	Yes...	S.A.E-3...	Highway...AA
C-stl....	11½	.....	A-stl....	3	2⅛	2.20	3	3	In crk...	H-gear..	1600	Yes...	Cent..	1750	734	25¾	36	37¼	No...	Yes...	S.A.E-3...	Hinkley...300
C-stl....	11½	.....	A-stl....	3	2⅛	2.20	3	3	In crk...	H-gear..	1600	Yes...	Cent..	1750	739	25¾	36	37¼	No...	Yes...	S.A.E-3...	Hinkley...400
C-stl....	12	.....	A-stl....	3	2¼	2.33	3½	3½	In crk...	H-gear..	1600	Yes...	Cent..	1650	884	25¾	40	43⅞	No...	Yes...	S.A.E-2...	Hinkley...500
C-stl....	12	.....	A-stl....	3	2¼	2.33	3½	3½	In crk...	H-geer..	1500	Yes...	Cent..	1550	896	25¾	40	43⅞	No...	Yes...	S.A.E-2...	Hinkley...200
C-stl....	12	.....	A-stl....	3	2¼	2.33	3½	3½	In crk...	H-gear..	1650	Yes...	Cent..	1450	988	25¾	41½	43⅞	No...	Yes...	S.A.E-2...	Hinkley...1600
C-stl....	.....	.....	C-stl....	3	.....	1.75	2¾	2¾	In crk...	H-gear..	2200	Opt....	Cent..	.....	.....	.....	.....	.....	.....	Opt.....	.....	Le Roi...2C
C-stl....	9½	16½	C-stl....	2	2	2.06	.....	3⅜	In crk...	H-gear..	1800	No....	.....	.....	470	21⅝	26⅞	38⅛	No...	Yes...	S.A.E-3...	Lycoming...K, KA, KB, KC
C-stl....	9¼	3.16	C-stl....	3	1¾	2.00	.....	3¼	In crk...	H-gear..	2800	Yes...	Cent..	.....	445	27	29⅝	34⅝	Yes...	Yes...	Opt.....	Matthews...F
C-stl....	37	2.03	C-stl....	3	1¼	1.25	.....	3¼	In crk...	S-gear..	2000	No....	.....	.....	230	.....	.....	.....	No...	Yes...	S.A.E-5...	Matthews...LM
C-stl....	12	8⅛	C-stl....	3	3	3.00	2¾	3⅞	In crk...	H-gear..	1500	No....	Cent..	1500	1200	25¾	39⅞	47⅜	Yes...	Yes...	S.A.E-1.2,3	Midwest...400
C-stl....	1½	5½	C-stl....	3	2½	2.50	2½	3⅝	In crk...	H-gear..	1600-1700	No....	Cent..	1500	900	25¾	37½	43⅞	Yes...	Yes...	S.A.E-2, 3.	Midwest...402
C-stl....	10	.....	C-stl....	2	2½	2.50	.....	3⅝	In crk...	H-gear..	1800-2200	No....	Cent..	1500	600	25¾	35⅝	38⅝	Yes...	Yes...	S.A.E-2, 3.	Midwest...408
C-stl....	6½	.....	C-stl....	2	2¼	2.25	.....	2⅞	In crk...	H-gear..	2200-2600	No....	Suc...	1500	425	25¾	33⅜	33¼	No...	Yes...	S.A.E-3, 4.	Midwest...409
C-stl....	11	.....	C-stl....	3	2	2.18	2⅜	2¹¹⁄₁₆	In crk...	H-gear..	1500	Yes...	Cent..	1500	600	24¾	34⅜	44⅞	No.	Yes.	.....	Northway...80
C-stl....	11	.....	C-stl....	3	2⅛	2.18	2⅞	3¹³⁄₁₆	In crk...	H-gear..	1600	Yes...	Cent..	1200	709	24¾	35¾	51⅛	No...	Yes.	.....	Northway...84
C-stl....	12	.....	C-stl....	3	2⅜	2.30	3⅜	3¹³⁄₁₆	In crk...	H-gear..	1500	Yes...	Cent..	1000	850	28¾	35⅜	25½	No...	Yes.	.....	Northway...88
C-stl....	9½	.....	C-stl....	3	2⅛	2.04	3	3²³⁄₃₂	In crk...	H-gear..	2700	No....	.....	.....	710	26⅜	30⅝	56¼	No...	No	.....	Northway...309
C-stl....	11	3	C-stl....	3	1⅞	2.00	3	3¾	In crk...	H-gear..	2400	No....	.....	.....	710	27	30	40	No...	Yes	S.A.E-3...	Pittsburgh...92
C-stl....	11	2¹¹⁄₁₆	C-stl....	3	1⅛	1.80	2	3	In crk...	H-gear..	2000	Yes...	Cent..	1400	370	23	28	30	No...	No...	.....	Pittsburgh...93
C-stl....	18	26	C-stl....	3	3.00	.....	.....	5	In crk...	S-gear...	6000	Yes...	Cent..	600	1150	32	26	46	Yes...	.....	.....	Reliable...T
C-stl....	44	.....	C-stl....	2	2⅜	2.37	.....	2⅜	In crk...	S-gear...	750	Yes...	Cent..	.....	.....	.....	25	54	Yes...	.....	.....	Reliable...00
C-stl....	12	54⅝	C-stl....	2	2⅝	2.98	.....	4⅜	In crk...	Sil-ch...	2500	No....	.....	.....	575	26	34¼	40⅛	No...	Yes...	S.A.E-3...	Rochester...G-1
C-stl....	10	48	C-stl....	3	2¼	2.25	2½	3½	In crk...	H-gear..	2550	No....	.....	600	25¾	29⅜	52⅜	.....	No...	Yes...	S.A.E-3...	Rochester...1000
C-stl....	9½	46	C-stl....	3	2	2.00	2¾	3⅛	In crk...	H-gear..	2400	No....	.....	.....	545	26	26½	49¼	No...	Yes...	S.A.E-3...	Rutenber...25
C-stl....	13¼	.....	A-stl....	3	2¾	2.87	3½	4½	In crk...	H-gear..	1400	Yes...	Cent..	800-900	1150	24	42¾	49⅝	.....	.....	.....	Stearns...A
C-stl....	13¼	.....	A-stl....	3	2¾	2.87	3½	4½	In crk...	H-gear..	1400	Yes...	Cent..	800-900	1150	24	42¾	49⅝	Yes...	Yes...	S.A.E-1...	Stearns...AU
C-stl....	13¼	.....	A-stl....	3	2¾	2.87	3½	4½	In crk...	H-gear..	1400	Yes...	Cent..	800-900	1150	24	42¾	49⅝	Yes...	.....	.....	Stearns...B
C-stl....	13¼	.....	A-stl....	3	2¾	2.87	3½	4½	In crk...	H-gear..	1400	Yes...	Cent..	800-900	1150	24	42¾	49⅝	Yes...	Yes...	S.A.E-2...	Stearns...BU
C-stl....	12½	.....	A-stl....	3	2½	2.50	3¼	4	In crk...	H-gear..	1500	Yes...	Cent..	900-1000	850	23	38¾	46⅝	Yes.	.....	.....	Stearns...G
C-stl....	12½	.....	A-stl....	3	2½	2.50	3¼	4	In crk...	H-gear..	1500	Yes...	Cent..	900-1000	850	23	38¾	46⅝	Yes...	Yes...	S.A.E-3...	Stearns...GU
C-stl....	12½	.....	A-stl....	3	2½	2.50	3¼	4	In crk...	H-gear..	1500	Yes...	Cent..	900-1000	850	23	38¾	46⅝	Yes...	Yes...	.....	Stearns...H
C-stl....	12½	.....	A-stl....	3	2½	2.50	3¼	4	In crk...	H-gear..	1500	Yes...	Cent..	900-1000	850	23	38¾	46⅝	Yes...	Yes...	S.A.E-2...	Stearns...HU
C-stl....	12½	.....	A-stl....	3	2½	2.50	3¼	4	In crk...	H-gear..	1500	Yes...	Cent..	900-1000	850	23	38¾	46⅝	Yes...	Yes...	.....	Stearns...F
C-stl....	12½	.....	A-stl....	3	2½	2.50	3½	4	In crk...	H-gear..	1500	Yes...	Cent..	900-1000	850	23	38¾	46⅝	Yes...	Yes...	S.A.E-1...	Stearns...FU
C-stl....	10½	.....	A-stl....	4	2¼	2.25	1⅝	3⅛	.....	.....	2000	No....	.....	.....	.....	.....	.....	.....	Yes...	Yes...	.....	Sphinx...A
C-stl....	10	27	C-stl....	3	2	2.00	.....	.....	In crk...	H-gear..	2450	No....	.....	.....	552	26	32	41¾	No...	Yes	S.A.E-3	Supreme...SK
C-stl....	10	28	C-stl....	3	2	2.00	2⅛	3¹¹⁄₁₆	In crk...	H-gear..	2400	Opt....	.....	.....	430	25¾	32½	39	No...	Yes	Opt.....	Supreme...S4
C-stl....	10	.....	C-stl....	3	2	5.80	1¾	3¼	In crk...	H-gear..	2400	Yes...	.....	.....	325	24	28	33¾	No...	Yes	S.A.E-3	Turmo...O
C-stl....	10	.....	C-stl....	2	2	.....	.....	.....	In crk...	H-gear..	2200	Opt...	Cent..	.....	300	24	27	28	No...	Yes	S.A.E-4	Turmo...N
C-stl....	10	.....	C-stl....	3	2	2.00	1¾	3¼	In crk...	H-gear..	2100	Yes...	Cent..	.....	460	24½	30	35	No...	Yes	S.A.E-3	Turmo...H
C-stl....	10	.....	C-stl....	3	2	5.80	1¾	3¼	In crk...	H-gear..	2000	Yes...	Cent..	.....	425	24	28	34	No...	Yes	S.A.E-3	Turmo...S
C-stl....	12	.....	C-stl....	3	2⅜	7.70	2⅝	4	In crk...	H-gear..	1150	Yes...	Cent..	1000	1000	25⅜	39½	44⅝	Yes	Opt..	S.A.E-2...	Twin City...TW
C-stl....	14	15¾	C-stl....	3	3	9.00	4	5¾	In crk...	H-gear..	930	Yes...	Cent..	900	1750	29	50	55¾	Yes.	No	.....	Twin City...AE
C-stl....	20½	32	C-stl....	5	3½	3.50	3⅝	6¹⁵⁄₁₆	In crk...	H-gear..	600	Yes...	Cent..	535	4050	40³⁄₈	66¹⁵⁄₁₆	75¾	Yes.	No	.....	Twin City...BE
A-stl....	13¼	8¾	A-stl....	3	2⅜	7.37	4	4	In crk...	H-gear..	1400	Yes...	Cent..	1000	980	30½	40½	62	Yes.	Yes	S.A.E-1, 2	Waukesha...EU
A-stl....	13¼	7⅝	A-stl....	3	.....	7.37	3½	3½	In crk...	H-gear..	1500	Yes...	Cent..	1000	910	30½	40½	58	Yes.	Yes	S.A.E-1, 2.	Waukesha...DU
A-stl....	12¼	7¼	A-stl....	3	.....	7.37	3¼	3¼	In crk...	H-gear..	1500	Yes...	Cent..	1000	840	30½	38¾	55½	Yes.	Yes	S.A.E-1, 2.	Waukesha...CU
A-stl....	12½	7¼	A-stl....	3	.....	7.37	3¼	3¼	In crk...	H-gear..	1500	Yes...	Cent..	1000	825	30½	38¾	55½	Yes.	.....	S.A.E-1, 2	Waukesha...FU
A-stl....	10⅝	5⅝	C-stl....	3	.....	2.00	2½	2¹⁵⁄₁₆	In crk...	H-gear..	1800	Yes...	Cent..	1000	615	20⅞	29	36¾	Yes.	Yes	S.A.E-2, 3	Waukesha...BUX
A-stl....	11	4⅛	A-stl....	3	2	2.37	2½	4	In crk...	H-gear..	1800	Yes...	Cent..	1400	700	24³⁄₁₆	31⅜	39⅛	Yes.	No	.....	Weidely...M
A-stl....	11	4⅛	A-stl....	3	2	2.37	2½	4	In crk...	H-gear..	1400	Yes...	Cent..	1400	700	25¾	32⅝	40⅜	Yes...	Yes...	S.A.E-3...	Weidely...MAU
A-stl....	11	4⅛	A-stl....	3	2	2.37	2½	4	In crk...	H-gear..	1400	No....	.....	.....	700	25¾	32⅝	40⅜	.....	Yes...	S.A.E-3...	Weidely...MAU2
A-stl....	11	4⅛	A-stl....	.....	2	2.37	2½	4	In crk...	H-gear..	2000	No....	.....	.....	581	26	31⅜	37⅝	No...	Yes...	S.A.E-3...	Weidely...MAT
A-stl....	11	4⅛	A-stl....	3	2	2.37	2½	4	In crk...	H-gear..	2000	No....	.....	.....	.....	26	31⅜	37⅝	No...	Yes...	S.A.E-3...	Weidely...MAT
A-stl....	11	4⅛	A-stl....	3	2	2.37	2½	4	In crk...	H-gear..	2000	No....	.....	.....	.....	26	31⅜	40⅜	No...	Yes...	S.A.E-3...	Weidely...MA
.....	10	.....	.....	3	2	2.37	2¾	4	In crk...	H-gear..	2300	No....	.....	.....	750	26	33⅝	51	.....	Yes.	S.A.E-3...	Weidely...C
C-stl....	10½	4⅝	A-stl....	3	1¾	1.75	2¾	4	In crk...	H-gear..	1600	Opt....	.....	1000	450	21	31	35¹⁵⁄₁₆	Yes...	Yes...	S.A.E-3...	Wisconsin...CAU
C-stl....	10½	4⅝	A-stl....	3	1¾	1.75	2¾	4	In crk...	H-gear..	1600	Opt....	.....	1000	460	21	31	35¹⁵⁄₁₆	Yes...	Yes...	S.A.E-3...	Wisconsin...EAU
C-stl....	12	5¾	A-stl....	4	2	2.00	2½	3½	In crk...	H-gear..	1600	Opt....	.....	1000	650	21⁷⁄₁₆	30⅛	44⅜	Yes...	Yes...	S.A.E-3...	Wisconsin...TAU
C-stl....	12	5¾	A-stl....	4	2	2.00	2½	3½	In crk...	H-gear..	1600	Opt....	.....	1000	660	21⁷⁄₁₆	30⅛	44⅜	Yes...	Yes...	S.A.E-3...	Wisconsin...UAU
C-stl....	12	5¾	A-stl....	4	2	2.00	2½	3½	In crk...	H-gear..	1600	Opt....	.....	1000	680	21⁷⁄₁₆	30⅛	44⅜	Yes...	Yes...	S.A.E-3...	Wisconsin...VAU
C-stl....	12½	7⅜	A-stl....	3	2¼	6.98	3¾	4	In crk...	H-gear..	1600	Opt....	.....	1000	790	24	31¾	46	Yes...	Yes...	S.A.E-3...	Wisconsin...RAU
C-stl....	12½	7⅜	A-stl....	3	2¼	6.98	3¾	4	In crk...	H-gear..	1600	Opt....	.....	1000	800	24	31¾	46	Yes...	Yes...	S.A.E-3...	Wisconsin...RBU
C-stl....	14	9⅜	A-stl....	3	2⅜	2.37	4	6	In crk...	H-gear..	1200	Opt....	.....	300	1040	23½	37⅞	48¹⁄₁₆	Yes.	No	.....	Wisconsin...M
C-stl....	14	9⅜	A-stl....	4	2⅜	2.62	3⁷⁄₁₆	5¾	In crk...	H-gear..	1200	Opt....	.....	800	1275	23½	37⅞	64¹⁄₁₆	Yes.	No	.....	Wisconsin...P

Int—Integral
In Crk—In Crankcase
N-Steel—Nickel Steel

P-Steel—Pressed Steel
P, T—Pump, Thermosiphon
Pist—Piston

Sil-Ch—Silent Chain
S-Gear—Spur Gear
S-Steel—Semi-Steel

Spec-A—Special Alloy
Tung—Tungsten
Ther—Thermo-syphon

Ver—Vertical
V-Head—Valve-in-Head
V—Vee Type

Tendencies in British Passenger Car Design

(*Continued from page* 343)

Oil Pump Type

Gear	76 per cent
Plunger	19 per cent
Eccentric vane	3 per cent
Flywheel	1 per cent
Disk	1 per cent

Oil Pump Position

In sump	73 per cent
End of camshaft	21 per cent
Side of camshaft	6 per cent

Carbureter Make

Zenith	55 per cent
Own	14 per cent
Claudel	10 per cent
Smith, 5 jet	8 per cent
Cox	6 per cent
Solex	3 per cent
S. U.	2 per cent
W & P	1 per cent
Zephyr	1 per cent

Fuel Feed

Gravity	53 per cent
Vacuum	39 per cent
Pressure	8 per cent

Ignition

Magneto	86
Magneto and battery	6 } 92 per cent
Battery	8 per cent

Generator Drive

Belt	63 per cent
Positive	37 per cent

Electric Starter

Yes	84 per cent
No	8 per cent
Extra	5 per cent
Mechanical (seat lever)	3 per cent

Electric Equipment, Voltage

12	72 per cent
6	27 per cent
8	1 per cent

No. of Units

2	93 per cent
1	7 per cent

Crankshaft Bearings, Number

3	47 per cent
2	27 per cent
5	10.5 per cent
4	7.5 per cent
7	7 per cent
6	1 per cent

Type

Plain	92 per cent
Ball	3 per cent
Roller and plain	2 per cent
Ball and roller	1 per cent
Roller	1 per cent
Ball and plain	1 per cent

Camshaft Bearings, Number

3	44 per cent
2	26 per cent
4	22 per cent
7	5 per cent
5	3 per cent

Type

Bronze	50 per cent
White metal	32 per cent
Cast iron	7 per cent
Plain	4 per cent

(*Continued on page* 389)

Specifications of American

MAKE AND MODEL	Designed for Cars or Trucks	Load Capacity, Lbs. (Truck Axles)	Max. Drive Shaft Torque, Lb.-Ft.	Is Axle Trussed?	Type	Final Drive	GEAR RATIOS Standard	GEAR RATIOS Optional	Diameter of Axle Shafts	SPRING CENTERS Maximum	SPRING CENTERS Minimum	Torque Taken On	Provision for Radius Rods	Designed for Hotchkiss Drive?	Type of Differential
Clark B	Trucks	3500	520	No	½ Fl.	S-B	6.28	5.50	2	39½	38	Sprgs	No	Yes	B
Clark C	Trucks	2700	520	No	½ Fl.	S-B	5.66	5.10	2	40	38	Sprgs	Yes	No	B
Clark AH	Trucks	3000	455	No	F. Fl.	In-g	5.53		1⅛	39½	39	Sprgs	No	Yes	B
Clark AW	Trucks	3600	455	No	F. Fl.	In-g	6.75	6.008	1⅛	40	39½	Sprgs	No	Yes	B
Clark 1D	Trucks	4200	540	No	F. Fl.	In-g	7.00	7.60	1⅛	39	38	Sprgs	No	Yes	B
Clark 2D	Trucks	6500	830	No	F. Fl.	In-g	8.00		1½	39	38½	Sprgs	No	Yes	B
Clark 3D	Trucks	11000	1410	No	F. Fl.		10.00	9.00	1½	42½	40	Sprgs	No	Yes	B
Clark 3H	Trucks	11000	1410	No	F. Fl.	In-g	10.12		1⅝	43½		Sprgs	Yes	Yes	B
Clark 5D	Trucks	18000	1660	No	F. Fl.	In-g	12.50	10.00	1⅞	42½	40	Sprgs	No	Yes	B
Columbia 10000	Cars	2400	360	No	¾ Fl.	S-B	4.65	4.25	1¼	41	37	Sprgs	No	Yes	B
Columbia 50000	Cars	3600	615	No	¾ Fl.	S-B	4.40		1 1/16	41	37	Sprgs.*	No	Yes	B
Columbia 51000	Trucks	3600	400	No	¾ Fl.	S-B			1 1/16	41	37	Sprgs	No	Yes	S
Flint 2FA10	Cars	17000	1500	Yes	¾ Fl.	S-B	4.90	4.00	1⅜	40	34	Sprgs.**	No	Yes	B
Iron Mountain B1	Trucks	3500	378	No	½ Fl.	W	6.20	7.75				Sprgs	Yes	Yes	B
Iron Mountain B10	Trucks	4400	462	No	½ Fl.	W	7.75	5.20	1.75	39½	38½	Sprgs	No		B
Iron Mountain B15	Trucks	5800	573	No	½ Fl.	W	7.75	8.75	2	39½	38	Sprgs	No		B
Medway 30	Trucks	5600	550	No	F. Fl.	In-g	6.80	5.90		39	42	Sprgs	No		B, S-L
National A	Cars	2800	225	No	½ Fl.	W	4.75	4.25	1¾	43½	36	Sprgs	Yes	Yes	B
National 100	Trucks	3500	250	No	½ Fl.	W	6.20	7.75	2⅛	40	34	Sprgs	Yes	Yes	B
Parker 2000	Trucks		365	No	¾ Fl.	B	5.77	5.20	1¾	40	37	Sprgs	No	Yes	B
Parker 21	Trucks	4000	365	No	¾ Fl.	In-g	7.25	6.05		39	37	Sprgs	No	Yes	S-L
Parker 30	Trucks	5000	408	No		In-g	7.25	6.05		39	37	Sprgs	No	Yes	S-L
Parker 50	Trucks	7500	568	No		In-g	8.25	7.35		40	38	Sprgs	No	Yes	S-L
Parker 70	Trucks	11000	662	No		In-g	10.50	9.20		42	40	Sprgs	No	Yes	S-L
Parker 100	Trucks	15000	790	No		In-g	11.80	10.30		42	40	Sprgs	No	Yes	S-L
Peru 3595	Cars	1200	100	Yes	F. Fl.	S-B	4.75	4.75		41	35	Opt.	No	Yes	B
Peru 3600	Cars	2000	130	Yes	½ Fl.	S-B	4.50	4.75	1½	41	35	Opt.	No	Yes	B
Peru 3700	Cars	2000	130	No	½ Fl.	S-B	4.50	4.25	1½	41	38	Sprgs.*	No	Yes	B
Russell 30001	Trucks	4500	416	No		In-g	7.00	6.15	1⅛			Sprgs	No	Yes	B
Russell 45001	Trucks	6500	540	No		In-g	7.45	6.33	1⅛			Sprgs	No	Yes	B
Russell 60001	Trucks	8100	750	No		In-g	8.85	7.40	1¼			Sprgs	No	Yes	B
Salisbury A	Cars	2100		Yes	¾ Fl.	S-B	4.70	3.50	1¼	41⅜	36½	Sprgs.*	No	Yes	B
Salisbury B	C. & T.	2700		Yes	¾ Fl.	S-B	4.50	4.00	1⅜	41¼	36½	Sprgs	No	Yes	B
Sheldon W500	Trucks	1800		No	½ Fl.	W	5.50	14.67	1⅜	35	42	Sprgs	No	Yes	B
Sheldon W1001	Trucks	2670		No	½ Fl.	W	5.20	5.75	1 13/32	39	39¾	Sprgs	No	Yes	B
Sheldon W1501	Trucks	3650		No	½ Fl.	W	7.50	9.67	2 11/32	35	39	Sprgs	No	Yes	B
Sheldon W103	Trucks	5500		No	½ Fl.	W	7.75	5.50	2⅜	32	39	Sprgs	No	Yes	B
Sheldon W21	Trucks	6250		No	½ Fl.	W	7.75	4.50	2¾	32	39	Sprgs	No	Yes	B
Sheldon W31	Trucks	9560		No			8.75	11.75	3⅜	36	44	Sprgs	No	Yes	B
Sheldon W32	Trucks	12500		No	½ Fl.	W	8.75	11.75	3⅜	36	44	Sprgs	No	Yes	B
Sheldon 51	Trucks	15000		No	½ Fl.	W	8.75	13.00	3¾	43	46	Sprgs	No	Yes	B
Stan-Par 2050	Cars	2000		No	½ Fl.	B	4.50		1.37	42	38	Sprgs	No	Yes	B
Stan-Par 2550	Cars	2800		No	½ Fl.	B	4.50		1.56	42	38	Sprgs	No	Yes	B
Stan-Par 3070R	C. & T.	3850		No	½ Fl.	B	4.00		1.77	41	38	Sprgs.*	No	Yes	B
Thomson A.W.M.	Trucks	4000	102	Yes	F. Fl.	W	6.75	7.75	1.62	40	38	Sprgs	No	Yes	B
Thomson D.W.M.	Trucks	12000	200	Yes	F. Fl.	W	10.33	12.00	2.19	43	39.5	Sprgs	No	Yes	B
Thomson B.W.M.	Trucks	8500	165	Yes	F. Fl.	W	8.25	7.75	1.87	39¾	38¼	Sprgs	No	Yes	B
Timken 6250	Trucks	4000		No	½ Fl.	W	6.25		2	39½	39½	Sprgs	No	Yes	B
Timken 6352	Trucks	4750		No	½ Fl.	W	7.20	6.20	2⅛	39½	37	Sprgs	No	Yes	B
Timken 6460	Trucks	6250		No	½ Fl.	W	7.10	7.75	2⅝	38½	39½	Sprgs	No	Yes	B
Timken 6560	Trucks	8750		No	F. Fl.	W	7.75	8.50	1⅝	39¾	37	Sprgs	Yes	Yes	B
Timken 6660	Trucks	12500		No	F. Fl.	W	10.33	8.75	2	45	42½	Sprgs	Yes	Yes	B
Timken 6760	Trucks	16750		No	F. Fl.	W	11.66	10.25	2 5/16	46¾	42⅞	Sprgs	Yes	Yes	B
Timken 5000	Cars			No	½ Fl.	S-B	5.10	5.50		40	37	Opt.	No	Yes	B
Timken 5112	Cars			No	½ Fl.	S-B	4.66	4.40		40¼	37	Opt.	No	Yes	B
Timken 5302	Cars			No	½ Fl.	S-B	4.44	4.90		4	37	Sprgs	No	Yes	B
Timken 5762	Cars			No	F. Fl.	S-B	4.54	4.98		39½	39½	T.-Arm	No	No	B
Torbensen 750	Trucks	2700	405	No	F. Fl.	In-g	6.33	5.33	1.57	40¼	37¼	Sprgs	No	Yes	B
Torbensen 1000	Trucks	4200	560	No	F. Fl.	In-g	6.33	7.00	1.77	39¼	37½	Sprgs	No	Yes	B
Torbensen E1	Trucks	11000	1330	No	F. Fl.	In-g	10.20	9.00	3 5/32	44	39	Sprgs	No	Yes	S-L
Torbensen C	Trucks	7000	785	No	F. Fl.	In-g	8.20	9.00	2.16	39	37¾	Sprgs	No	Yes	B
U. S. AA	Cars	2400	130	No	½ Fl.	S-B	4.33	4.00	1⅝	30	41	Opt.	Yes	Yes	B, S-L
U. S. BB	Cars	2600	130	Yes	½ Fl.	S-B	4.60	4.00	1⅝	30		Opt.	Yes	Yes	B, S-L
Vulcan 3R	Trucks	6000	550	No	F. Fl.	W	7.75	7.00	1½	40½	37	Sprgs	Yes	Yes	B
Vulcan 4R	Trucks	9500	850	No	F. Fl.	W	7.75	8.50	1¾	40½	37	Sprgs	Yes	Yes	B
Walker 2A	Trucks	7700	800	No	F. Fl.	In-g	8.71		1	39	38¼	Sprgs	No	Yes	B
Walker 25A	Trucks	10150	1100	No	F. Fl.	In-g	8.49		1¼	40¼	35¾	Sprgs	No	Yes	B
Walker 5A	Trucks	19350	1500	No	F. Fl.	In-g	10.41		1⅜	45½	39½	Sprgs	No	Yes	B
Walker 7A	Trucks	26250	1650	No	F. Fl.	In-g	11.68		1½	44¾	43½	Sprgs	No	Yes	B
Wisconsin 800G	Trucks	4000		No	½ Fl.	W	7.75	6.20	2⅜	40	38	Sprgs	No	Yes	B
Wisconsin 800H	Trucks	5500		No	½ Fl.	W	8.25	7.25	2⅝	40	38	Sprgs	No	Yes	B
Wisconsin 800J	Trucks	7300		No	½ Fl.	W	8.66	7.75	2⅝	40	38	Sprgs	No	Yes	B
Wisconsin 900C	Trucks	8800		No	½ Fl.	W	8.66	9.66	3	41	38½	Sprgs	No	Yes	B
Wisconsin 900D	Trucks	12000			½ Fl.	W	10.00	9.00	3⅜	40	39	Sprgs	No	Yes	B
Wisconsin 900E	Trucks	1200		No	½ Fl.	W	10.00	9.00	3⅜	44½	42	Sprgs	No	Yes	B
Wisconsin 1000B	Trucks	16000		No	½ Fl.	W	11.75		3¾	46	40¾	Sprgs	No	Yes	B
Wisconsin 60A	Trucks	7300		No	½ Fl.	D-R			2⅝	40	38	Sprgs	No		B
Wisconsin 88C	Trucks	8800		No	½ Fl.	D-R			3	41	38½	Sprgs	No	Yes	B
Wisconsin 120K	Trucks	12000		No	½ Fl.	D-R			3⅜	50⅝		T.-Arm	Yes		B
Wisconsin 120B	Trucks	12000		No	½ Fl.	D-R			3⅜	40	39			Yes	B

ABBREVIATIONS

A Steel—Alloy Steel
Bl—Ball
B—Bevel
Br—Bronze
Br & St—Bronze and Steel
C-S—Carbon Steel
C-N—Chrome Nickel
C-Van—Chrome Vanadium
D R—Double Reduction
E-S—Electric Steel
F Fl—Full Floating
In G—Internal Gear
M-I—Malleable Iron
Man Br—Manganese Bronze
M-S—Molybdenum Steel
N-A—Nickel Alloy

Stock Axles for 1922

SERVICE BRAKES			EMERGENCY BRAKES			TYPE OF BEARINGS									
Type of Brake	Diameter of Drum	Width of Drum	Type of Brake	Diameter of Drum	Width of Drum	At Differential	At Wheels	On Pinion Shaft	Wheel Tread	Weight of Axle (Complete Without Wheels)	Housing Material	Shaft Material	Gear Material	MAKE AND MODEL
Ext..	16	2½	Int....	15⅝	1½	R.....	R. or Bl	Bl.....	56	480	S-C...	N-S.....	N-S.....	Clark.....B
Ext..	16	2	Int....	15⅝	1½	R	R.or Bl.	Bl.....	56	325	S-P...	N-S.....	N-S.....	Clark.....C
Ext..	14	2	.....	.....	...	R. or Bl.	R. or Bl.	R, Bl...	56	435	M-I...	N-S.....	C-S., N-S...	Clark.....AH
Ext..	14	2	.....	.....	...	R.....	R. or Bl.	R, Bl...	56	375	M-I...	N-S.....	C-S., N-S...	Clark.....AW
Ext..	16	2½	Int...	15⅝	1½	R. or Bl.	R. or Bl.	R, Bl...	56	505	S-C...	N-S.....	C-S., N-S...	Clark.....1D
Ext..	16½	.....	Int....	15	2½	R.....	R. or Bl.	R, Bl...	58	750	S-C...	N-S.....	C-S., N-S...	Clark.....2D
Ext..	20	3	Int....	19¼	2½	R.....	R. or Bl.	R, Bl...	70	953	S-C...	N-S.....	N-S.....	Clark.....3D
Ext..	9	4½	Int....	19¼	2½	R.....	R, Bl...	R, Bl...	65	810	.....	N-S.....	N-S.....	Clark.....3H
Int...	22¼	3	.....	.....	...	R.....	R, Bl...	R, Bl...	67	1280	S-C...	N-S.....	N-S.....	Clark.....5D
Ext..	12⅝	2½	Int....	12⅝	2½	R.....	B.....	R.....	56	230	P-S...	S.A.E. 2340.	S.A.E. 1020.	Columbia.....10000
Ext..	16	3	Int....	16	3	R.....	R.....	R.....	56	320	P-S...	S.A.E. 2340.	S.A.E. 2320.	Columbia.....50000
Ext..	16	3	Int....	16	3	R.....	R.....	R.....	56	335	P-S...	S.A.E. 2340.	S.A.E. 2320.	Columbia.....51000
Ext..	12	2½	Int....	12	2½	R, Bl...	R.....	Bl.....	56	210	M-I...	N-S.....	N-S.....	Flint.....2FA10
Int....	13⅝	1¾	Int....	13⅝	1¾	Bl.....	Bl.....	Bl.....	56	450	M-I...	S.A.E. 3135.	S.A.E. 3120.	Iron Mountain....B1
Int...	15⅝	2	Int....	15⅝	1¾	Bl.....	Bl.....	Bl.....	56	500	M-I...	S.A.E. 3135.	S.A.E. 3120.	Iron Mountain....B10
Int...	15⅝	2	Int....	15⅝	1¾	Bl.....	Bl.....	Bl.....	58	525	E-S...	S.A.E. 3135.	S.A.E. 3120.	Iron Mountain....B15
Ext..	7	4	.....	....	...	R.....	R, Bl...	Bl.....	56½	330	S-C...	N-S.....	N-S.....	Medway.....30
Int....	14	4⅜	Int....	14	4⅜	R.....	R.....	R.....	56	340	P-S...	S.A.E. 3145.	S.A.E. 3135.	National.....A
Int...	14	4⅜	Int...	14	4⅜	R.....	R.....	R.....	56	395	M-I...	S.A.E. 3145.	S.A.E. 3135.	National.....100
.....	.....	.....	Ext...	....	...	Bl.....	Bl.....	Bl.....	....	....	P-S...	Nickel.....	N-S.....	Parker.....2000
.....	.....	.....	.....	....	...	Bl.....	Bl, R...	Bl.....	56	400	M-I...	Nickel.....	N-S.....	Parker.....21
.....	.....	.....	.....	....	...	Bl.....	Bl, R...	Bl.....	56	425	M-I...	Nickel.....	N-S.....	Parker.....30
.....	.....	.....	.....	....	...	Bl.....	Bl, R...	Bl.....	60½	625	M-I...	Nickel.....	N-S.....	Parker.....50
.....	.....	.....	.....	....	...	Bl.....	Bl, R...	Bl.....	66	950	M-I...	Nickel.....	N-S.....	Parker.....70
.....	.....	.....	.....	....	...	Bl.....	Bl, R...	Bl.....	66	1200	M-I...	Nickel.....	N-S.....	Parker.....100
Ext..	12	1¾	Int....	12	1¾	R.....	R.....	Bl.....	56	185	M-I...	A-S.....	A-S.....	Peru.....3595
Ext..	14	1¾	Int....	14	1¾	R.....	R.....	R.....	56	200	M-I...	A-S.....	A-S.....	Peru.....3600
Ext..	14	1¾	Int....	14	1¾	R.....	R.....	R.....	56	200	Steel..	A-S.....	A-S.....	Peru.....3700
Ext..	14	.....	Int....	....	...	R, Bl...	R.....	Bl.....	....	....	M-I...	N-S.....	N-S.....	Russell.....30001
Ext..	15½	.....	Int....	15	...	R, Bl...	R.....	Bl.....	....	575	M-I...	N-S.....	N-S.....	Russell.....45001
Ext..	16½	.....	Int....	16	...	R, Bl...	R.....	Bl.....	....	656	Nickel	N-S.....	N-S.....	Russell.....60001
Ext..	14⅜	2¾	Int....	14	2¾	R.....	Bl.....	R, Bl..	56	289	P-S...	C-N.....	N-S.....	Salisbury.....A
Ext..	16⅜	2¾	Int....	16	2¾	R.....	R.....	R, Bl...	56	360	P-S...	C-N.....	N-S.....	Salisbury.....B
Int...	12	4	Int....	12	4	Bl.....	R, Bl...	Bl.....	56	268	M-I...	S.A.E. 2340.	Br.....	Sheldon.....W500
Int....	14	5	Int....	14	5	Bl.....	R, Bl...	Bl.....	56	460	M-I...	S.A.E. 2340.	Br.....	Sheldon.....W1001
Int...	16	5½	Int...	16	5½	Bl.....	R, Bl...	Bl.....	57	621	M-I...	S.A.E. 2340.	Br.....	Sheldon.....W1501
Int...	18	6	Int...	18	6	Bl.....	R, Bl...	Bl.....	59½	813	M-I...	S.A.E. 2340.	Br.....	Sheldon.....W103
Int...	18	6	Int....	18	6	Bl.....	R, Bl...	Bl.....	58	941	M-I...	S.A.E. 2340.	Br.....	Sheldon.....W21
Int...	20	8⅛	Int....	20	8⅛	Bl.....	R, Bl...	Bl.....	69¾	1436	Steel..	S.A.E. 2340.	Br.....	Sheldon.....W31
Int...	20	8⅛	Int....	20	8½	Bl.....	R, Bl...	Bl.....	69¾	1436	Steel..	M-S.....	Br.....	Sheldon.....W32
Int...	24	8¾	Int...	24	8¾	Bl.....	R, Bl...	Bl.....	70¾	2464	Steel..	S.A.E. 2340.	Br.....	Sheldon.....51
Ext..	12⅜	1¾	Int....	12	1¾	R.....	R.....	R.....	56	245	P-S...	S.A.E. 2335.	S.A.E. 2315.	Stan-Par.....2050
Ext..	14	2	Int...	13⅝	2	R.....	R.....	R.....	56	290	P-S...	S.A.E. 2335.	S.A.E. 2315.	Stan-Par.....2550
Ext..	16	2¼	Int....	15⅝	2¼	R.....	R.....	R.....	56	375	P-S...	S.A.E. 2335.	S.A.E. 2315.	Stan-Par.....3070R
Int...	18	4⅞	Int...	18	4⅞	B.....	B.....	B.....	56	610	M-I...	C-N.....	Man-Br.....	Thomson.....A.W.M.
Int....	20	7.06	Int...	20	7 1/16	B.....	B.....	B.....	68	1434	C-S...	C-N.....	Man-Br....	Thomson.....D.W.M.
Int...	18	6	Int...	18	6	B.....	B.....	B.....	59½	821	M-I...	C-N.....	Man-Br.....	Thomson.....B.W.M.
Int...	15	2½	Int...	15	2½	R.....	R.....	R.....	56	375	P-S...	C-N.....	Br. & St....	Timken.....6250
Int...	15	3	Int...	15	3	R.....	R.....	R.....	56	475	P-S...	C-N.....	Br. & St....	Timken.....6352
Int...	16	3¼	Int...	16	3¼	R.....	R.....	R.....	58	650	P-S...	C-N.....	Br. & St....	Timken.....6460
Int...	18	3½	Int...	18	3½	R.....	R.....	R.....	58½	850	P-S...	C-N.....	Br. & St....	Timken.....6560
Int...	21	3¾	Int...	21	3¾	R.....	R.....	R.....	65¾	1280	P-S...	C-N.....	Br. & St....	Timken.....6660
Int...	24	4	Int...	24	4	R.....	R.....	R.....	69½	1750	P-S...	C-N.....	Br. & St....	Timken.....6760
Ext...	12	1¾	.....	....	...	R.....	R.....	R.....	56	220	P-S...	C-N.....	C-Van.....	Timken.....5000
Ext..	14⅜	1¾	Int...	14	1½	R.....	R.....	R.....	56	265	P-S...	C-N.....	C-Van.....	Timken.....5112
Ext..	5½	2½	Int...	14⅛	2½	R.....	R.....	R.....	56	325	P-S...	C-N.....	C-Van.....	Timken.....5302
Ext..	16	2½	Int...	15⅝	2½	R.....	R.....	R.....	56	400	P-S...	C-N.....	C-Van.....	Timken.....5762
Ext..	14	2	Int...	13⅝	2	R.....	R.....	R.....	56	270	.....	N-S.....	.....	Torbensen.....750
Ext..	15	2½	Int...	....	2¼	R.....	R.....	R.....	56	370	.....	S.A.E. 3140.	N-S.....	Torbensen.....1000
Int...	19	3½	Ext..	10	4½	R.....	R.....	R.....	67½	1100	.....	N-S.....	S.A.E. 1050.	Torbensen.....E1
Ext..	18	2½	Int...	17 1/16	2¼	R.....	R.....	R.....	56	540	.....	S.A.E. 3140.	N-S.....	Torbensen.....C
Int...	14	4	Int...	14	...	R.....	Bl.....	R.....	56	240	S. & A.	M-S.....	N-A.....	U. S.....AA
.....	.....	.....	Int...	14	2¾	R.....	R.....	R.....	56	240	N-A..	M-S.....	N-A.....	U. S.....BB
Int...	18	6	Int...	18	6	R.....	R.....	Bl.....	58	700	Steel..	C-N.....	.....	Vulcan.....3R
Int...	20	6	Int...	20	6	R.....	R.....	Bl.....	58½	875	Steel..	C-N.....	.....	Vulcan.....4R
Ext..	8	4½	Int....	18½	3 5/16	Bl.....	Bl.....	R.....	56	420	C-S...	S.A.E. 3135.	S.A.E. 2320.	Walker.....2A
Ext..	8	4½	Int....	19½	3 5/16	Bl.....	Bl.....	R.....	....	615	C-S...	S.A.E. 3135.	S.A.E. 2320.	Walker.....25A
Ext..	12	6	Int....	20	4⅝	Bl.....	Bl.....	R.....	63½	835	C-S...	S.A.E. 3135.	S.A.E. 2320.	Walker.....5A
Ext..	12	6	Int....	24	5⅝	Bl.....	Bl.....	R.....	69½	1000	C-S...	S.A.E. 3135.	S.A.E. 2320.	Walker.....7A
Int...	17	2½	Int...	12¼	2½	Bl.....	.....	Bl.....	57½	550	.....	S.A.E. 3140.	.....	Wisconsin.....800G
Int...	17	2½	Int...	12¼	2½	Bl.....	.....	Bl.....	57½	640	.....	S.A.E. 3140.	.....	Wisconsin.....800H
Int...	17	2½	Int...	12¼	2½	Bl.....	.....	Bl.....	58	700	.....	S.A.E. 3140.	.....	Wisconsin.....800J
Int...	20	2½	Int....	15½	2½	Bl.....	.....	Bl.....	59½	875	.....	S.A.E. 3140.	.....	Wisconsin.....900C
Int...	20	2½	Int...	15½	2½	Bl.....	.....	Bl.....	60	975	.....	S.A.E. 3140.	.....	Wisconsin.....900D
Int...	20	2½	Int...	15½	2½	Bl.....	.....	Bl.....	64	1000	.....	S.A.E. 3140.	.....	Wisconsin.....900E
Int...	24	3½	Int...	18½	3½	Bl.....	.....	Bl.....	70	1590	.....	S.A.E. 3140.	.....	Wisconsin.....1000B
Int...	17	2½	Int...	12¼	2½	Bl.....	.....	Bl.....	87½	690	.....	S.A.E. 3140.	S.A.E. 2315.	Wisconsin.....60A
Int...	20	2½	Int...	15½	2½	Bl.....	.....	Bl.....	59½	870	.....	S.A.E. 3140.	S.A.E. 2315.	Wisconsin.....88C
Int...	20	2½	Int...	15½	2½	Bl.....	.....	Bl.....	72¾	....	.....	S.A.E. 3140.	S.A.E. 2315.	Wisconsin.....120K
Int...	20	2½	Int...	15½	2½	Bl.....	.....	Bl.....	60	970	.....	S.A.E. 3140.	S.A.E. 2315.	Wisconsin.....120B

N-S—Nickel Steel
P-S—Pressed Steel
R—Roller
½ Fl—Semi-Floating
S B—Spiral Bevel
S L—Self Locking
S-C—Steel Casting
S-P—Steel Pressing
S—Spur
S & A—Steel and Aluminum
Taper R—Taper Roller
¾ Fl—Three Quarter Floating
T-Arm—Torque Arm
W—Worm
*—With Torque Arm
**—On Torque Tube

Tendencies in British Passenger Car Design

(*Continued from page* 388)

Ball ..... 4 per cent
Ball and bronze..... 1 per cent
1 ball, 3 plain..... 1 per cent
Ball and plain..... 1 per cent

Gearset Bearings

Mainshaft, Type

Ball .....87 per cent
Roller ..... 8 per cent
Ball and roller..... 3 per cent
Ball and plain..... 1 per cent
Plain ..... 1 per cent

Layshaft, Type

Ball .....80 per cent
Plain .....12 per cent
Roller ..... 6 per cent
Ball and roller..... 1 per cent
Ball and plain..... 1 per cent

Pilot

Plain .....60 per cent
Ball .....31 per cent
Roller ..... 9 per cent

Wheel Bearings

Front

Ball .....63 per cent
Roller ..... 28 per cent
Ball and roller..... 7 per cent
Ball and plain..... 2 per cent

Rear

Ball .....76 per cent
Roller .....18 per cent
Ball and roller..... 4 per cent
Ball and plain..... 2 per cent

Differential Bearings

Ball .....86 per cent
Roller .....14 per cent

Clutch

Type

Dry single plate .....34 per cent
Cone .....29 per cent
Inverted cone .....23 per cent
Multi-plate in oil..... 7 per cent
Dry multi-plate ..... 6 per cent
Single plate in oil..... 1 per cent

Clutch Friction Material

Fabric facing .....76 per cent
Leather facing .....10 per cent
Metal to metal (plate clutches) 9 per cent
Metal facing (cone clutches). 2 per cent
Cork inserts ..... 2 per cent
Wood facing ..... 1 per cent

Clutch Shaft Joints

Front

Fabric disk .....44 per cent
Steel disk .....17 per cent
Miscellaneous .....39 per cent

Rear

Fabric disk .....42 per cent
Leather disk .....12 per cent
Steel disk .....12 per cent
Star ..... 10 per cent
Pot .....10 per cent
Miscellaneous .....14 per cent

Gearset Location

Amidships .....55 per cent
Unit engine .....28 per cent
Unit propeller shaft .....9.5 per cent
Unit axle .....7.5 per cent

Number of Speeds

3 .....54 per cent
4 .....46 per cent

Specifications of American Stock Gearsets for 1922

NAME AND MODEL	Designed for	Max. Engine Torque	Type	BEARINGS		No. of Speeds	WIDTH OF GEAR FACES					Housing Material	Shaft Material	Gear Material	Gear Teeth Pitch	GEAR RATIOS					Gear Location	Control Location	Sold with Clutch	Weight	NAME AND MODEL
				Main Shaft	Secondary Shaft		Const. Mesh Set	1st Inter.	2nd Inter.	Low	Reverse					First	Second	Third	Fourth	Reverse					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Ball BG1-2	C,Tr,T	...	Ind. Cl.	B	B	3	5/8	5/8	5/8	5/8	5/8	C.I.	Nic-Van	3½ Nickel	6-	2.98	1.89	1.00	....	3.64	On Eng.	C	Opt		Ball BG1-2
Ball BG3-4	C,Tr,T	...	Ind. Cl.	B	B	3	7/8	7/8	7/8	7/8	7/8	C.I.	Nic-Van	3½ Nickel	6-	3.00	1.70	1.00	....	3.50	On Eng.	C	Opt		Ball BG3-4
Brown Lipe 20	C	83⅓	Clash	B	P	3	9/16	5/8	5/8	5/8	5/8	I. & Al.	Chrome-S	S.A.E. 2320	6-8	3.34	1.66	1.00	....	4.17	On Eng.	C	Opt	102- 86	Brown Lipe 20
Brown Lipe 25	C	108⅓	Clash	B	P	3	9/16	5/8	...	5/8	5/8	I. & Al.	Chrome-S	S.A.E. 2320	6-8	3.33	1.68	1.00	....	4.35	On Eng.	C	Opt	89	Brown Lipe 25
Brown Lipe 30	C,T	133⅓	Clash	R	R	3	5/8	3/4	3/4	3/4	3/4	I. & Al.	Chrome-S	S.A.E. 2320	6-8	3.33	1.68	1.00	....	4.35	On Eng.	C	Opt	95-142	Brown Lipe 30
Brown Lipe 35-3	C	183⅓	Clash	R	R	3	5/8	3/4	3/4	3/4	3/4	I. & Al.	Chrome-S	S.A.E. 2320	6-8	3.36	1.76	1.00	....	4.32	On Eng.	C	Opt	95-142	Brown Lipe 35-3
Brown Lipe 35-3	T	183⅓	Clash	R	R	3	5/8	3/4	3/4	3/4	3/4	I.	Chrome-S	S.A.E. 2320	6-8	4.00	1.76	1.00	....	4.92	A	C	Opt	100	Brown Lipe 35-3
Brown Lipe 35-4	C	183⅓	Clash	R	R	4	5/8	3/4	3/4	3/4	3/4	I. & Al.	Chrome-S	S.A.E. 2320	6-8	5.35	2.84	1.76	1.00	6.43	On Eng.	C	Opt	150-198	Brown Lipe 35-4
Brown Lipe 35-4	T	183⅓	Clash	R	R	4	5/8	3/4	3/4	3/4	3/4	I. & Al.	Chrome-S	S.A.E. 2320	6-8	5.35	2.84	1.76	1.00	6.25	A	C	Opt	120	Brown Lipe 35-4
Brown Lipe 50-4	C,T	183⅓	Clash	R	R	4	7/8	7/8	7/8	7/8	3/4	I. & Al.	Chrome-S	S.A.E. 2320	6-8	5.35	2.84	1.76	5.35	6.43	On Eng.	C	Opt	147-211	Brown Lipe 50-4
Brown Lipe 50-4	...	183⅓	Clash	R	R	4	7/8	1	1	1	1	I.	Chrome-S	S.A.E. 2320	6-8	5.35	2.84	1.76	1.00	6.25	A	C	Opt	130	Brown Lipe 50-4
Brown Lipe 51-4	T	250	Clash	R	R	4	7/8	1	1	1 5/16	...	G.I.	Chrome-S	S.A.E. 2320	6-8	5.35	....	....	....	....	A	C	Opt	.....	Brown Lipe 51-4
Brown Lipe 55-4	...	250	Clash	R	R	4	7/8	1	7/8	1 3/8	1⅛	G.I.	Chrome-S	S.A.E. 2320	5-7	5.35	2.84	1.76	1.00	6.30	A	C	Opt	.....	Brown Lipe 55-4
Brown Lipe 60-4	T	275	Clash	R	R	4	1¼	1½	1½	1½	1⅜	I.	Chrome-S	S.A.E. 2320	5-7	5.35	2.84	1.76	1.00	6.43	A	C	Opt	235	Brown Lipe 60-4
Cotta 5S	T	...	Ind. Cl.	B	B	3	1¼	1¼	...	1¼	1¼	S.S.	S.A E. 2335	S.A.E. 2320	5-6	4.51	1.81	1.00	....	6.00	A	C	No	.....	Cotta 5S
Cotta 12-3	T & Tr	...	Ind. Cl.	B	B	3	1½	1½	...	1½	1½	S.S.	S.A.E. 2335	S.A.E. 2320	4½-5½	4.51	1.81	1.00	....	6.00	A	C	No	.....	Cotta 12-3
Covert MUC	C,T	118	Ind. Cl.	B	B	3	11/16	13/16	...	15/16	15/16	C.I.	S.A.E. 2320	S.A.E. 2320	6-8	3.62	1.91	1.00	....	4.46	On Eng.	C	Yes	.....	Covert MUC
Covert SA	T	184	Ind. Cl.	E. & R.	R	4	1⅛	1¼	1⅛	1 7/16	1 3/16	C.I.	S.A.E. 2320	S.A.E. 2320	5-7	5.07	3.04	1.63	1.00	6.76	A	.....	No	.....	Covert SA
Covert RAK4	T	147	Clash	B	B	4	7/8	1	1	1¼	1	C.I.	S.A.E. 2320	S.A.E. 2320	6-8	4.76	2.70	1.60	1.00	5.95	A	.....	No	.....	Covert RAK4
Covert RU4-C	T	147	Ind. Cl.	B	B	4	13/16	1	15/16	1¼	1	C.I.	S.A.E. 2320	S.A.E. 2320	6-8	4.76	2.70	1.60	1.00	5.95	On Eng.	C	Yes	.....	Covert RU4 C
Covert RA3	T	141	Ind. Cl.	B	B	3	7/8	1	...	1	15/16	C.I.	S.A.E. 2320	S.A.E. 2320	6-8	3.67	1.60	1.00	....	....	A	.....	No	.....	Covert RA3
Covert RUC3	C,T	141	Clash	B	B	3	7/8	1	...	1	15/16	C.I.	S.A.E. 2320	S.A.E. 2320	6-8	3.67	1.60	1.00	....	....	On Eng.	C	Yes	.....	Covert RUC3
Covert L	C	83	Ind. Cl.	B. & R.	R	3	5/8	11/16	...	11/16	11/16	C.I.	S.A.E. 2320	S.A.E. 2320	7-9	3.61	1.82	1.00	....	4.50	On Eng.	C	No	.....	Covert L
Detroit CY	C,T	200	Clash	B	B	3	3/4	7/8	...	7/8	7/8	G. I. & Al.	Nic-Steel	Nic-Steel	6-8	3.20	1.72	....	....	3.88	On Eng.	C	Opt	120-90	Detroit CY
Detroit H	T	...	Clash	B	B	4	7/8	1	1	1	1	C.I.	Nic-Steel	Nic-Steel	6-8	4.40	3.08	1.76	....	5.28	A	.....	No	160	Detroit H
Detroit Dy	C,T	140	Clash	B	R	3	3/4	3/4	...	3/4	3/4	G. I. & Al.	Nic-Steel	Nic-Steel	7-9	3.20	1.72	....	....	3.88	On Eng.	C	Opt	95- 70	Detroit Dy
Dundore N35	C,T	...	Clash	B	B	3	11/16	3/4	...	15/16	15/16	S.S.	S.A.E. 2345	S.A.E. 2320	6-8	3.07	1.76	....	....	4.00	On Eng.	C	No	85-120	Dundore N35
Dundore F50	T	...	Clash	B	B	3	7/8	1	...	1	1	S.S.	S.A.E. 2345	S.A.E. 2320	6-8	3.36	1.90	....	....	4.32	On Eng.	C	No	155	Dundore F50
Dundore K	C	...	Clash	B	B	4	3/4	3/4	3/4	3/4	3/4	Al	S.A.E. 5140	S.A.E. 5165	6-8	2.69	1.56	....	.73	3.46	A	.....	No	105	Dundore K
Dundore R	C	...	Clash	B	B	4	3/4	3/4	3/4	3/4	3/4	Al	S.A.E. 5140	S.A.E. 5165	6-8	2.69	1.56	....	.73	3.46	On Eng.	C	No	120	Dundore R
Durston 02500B	C,T	120	Clash	B	P	3	5/8	5/8	...	1	1	C.I.	Chrome-N	3½ Nic Steel	6-8	3.09	1.85	1.00	....	3.87	On Eng.	C	No	95	Durston 02500B
Fuller H	T,Tr	...	Clash	B	B	4	...	...	...	...	...	C.I.	3½ Nickel	3½ Nickel	6-8	6.30	3.20	1.70	1.00	6.30	A	C	Yes	.....	Fuller H
Fuller LTU4-5	C,T	...	Clash	B	B	3	7/8	7/8	7/8	7/8	7/8	C.I.	3½ Nickel	3½ Nickel	6-8	4.00	1.70	1.00	....	3.50	On Eng.	C	Yes	.....	Fuller LTU4-5
Fuller GU7-U8-7	C,T,Tr	...	Clash	B	B	4	7/8	1	1	1	1	C.I.	3½ Nickel	3½ Nickel	6-8	4.80	3.00	1.60	1.00	6.50	On Eng.	C	Yes	.....	Fuller GU7-U8-7
Fuller TU3-4-TU3	C,T	...	Clash	B	B	3	7/8	15/16	7/8	...	7/8	C.I.	3½ Nickel	3½ Nickel	6-8	3.00	1.70	1.00	....	3.50	On Eng.	C	Yes	150	Fuller TU3-4-TU3
Grant Lees K	C,T	140	Clash	B	P	3	9/16	5/8	...	5/8	5/8	C.I.	S.A.E. 2320	S.A.E. 2320	7-9	3.00	1.90	1.00	....	3.60	On Eng.	C	No	85	Grant Lees K
Grant Lees 515	C,T	200	Clash	B	B	3	11/16	3/4	...	3/4	3/4	C.I.	S.A.E. 2320	S.A.E. 2320	6-8	2.90	1.70	1.00	....	3.80	On Eng.	C	No	105	Grant Lees 515
Mech. Mach. MU	C	100	Clash	B	P	3	9/16	...	5/8	5/8	5/8	G.I.	S.A.E. 2340	S.A.E. 2340	7-9	3.04	1.75	1.00	....	3.99	On Eng.	C	No	75	Mech. Mach. MU
Mech. Mach. LU	C	150	Clash	B	P	3	11/16	3/4	...	3/4	3/4	G.I.	S.A.E. 2340	S.A.E. 2340	7-9	3.24	1.66	1.00	....	4.16	On Eng.	C	No	92	Mech. Mach. LU
Muncie T25	C	110	Clash	B	B, P	3	5/8	...	11/16	11/16	11/16	C.I.	3½ Nickel	S.A.E. 3120	6-8	2.60	1.70	1.00	....	3.40	On Eng.	C	No	90	Muncie T25
Muncie T23	C,T	180	Clash	B	B	3	3/4	...	25/32	13/16	13/16	C.I.	S.A.E. 2320	S.A.E. 3120	6-8	3.00	1.82	1.00	....	3.90	On Eng.	C	Opt	117½	Muncie T23
Pittsburgh 35T	T	80	Ind. Cl.	B. & R.	P	?	3/4	3/4	...	3/4	3/4	C.I.	3½ Nickel	3½ Nickel	7-9	1.00	1.76	3.36	....	4.33	On Eng.	C	Opt	120	Pittsburgh 35T
Warner Gear T38B	C	200	Clash	B	R	3	3/4	3/4	...	3/4	3/4	G. I., Al.	S.A.E. 1045	S.A.E. 2345	6-8	3.04	1.81	1.10	....	3.70	On Eng.	C	Yes	.....	Warner Gear T38B
Warner Gear T38C	T	130	Clash	B	R	3	3/4	3/4	...	3/4	3/4	G.I.	S.A.E. 1045	S.A.E. 2345	6-8	4.84	2.39	1.00	....	6.05	On Eng.	C	Yes	.....	Warner Gear T38C
Warner Gear T60	C	150	Clash	B	R	3	5/8	3/4	...	3/4	3/4	G. I., Al.	S.A.E. 1045	S.A.E. 2345	6-8	3.24	1.63	1.00	....	4.05	On Eng.	C	Opt	95	Warner Gear T60
Warner Gear T53	T	220	Clash	B	B	4	1	1¼	1¼	1⅜	1¼	C.I.	S.A.E. 2320	S.A.E. 2345	5-7	4.99	3.16	1.79	1.00	5.78	A	.....	No	.....	Warner Gear T53
Warner Gear T62	T	275	Clash	B	B	4	1¼	1⅜	1⅜	1½	1½	C.I.	S.A.E. 2320	S.A.E. 2345	5-7	5.84	3.22	1.75	1.00	6.74	A	.....	No	.....	Warner Gear T62
Warren A	C,T	...	Clash	B	B	3	11/16	3/4	...	3/4	3/4	C.I.	S.A.E. 3120	S.A.E. 2320	6-8	3.52	1.70	1.00	....	4.40	On Eng.	C	No	110	Warren A
Warren B	C,T	...	Clash	B	P	3	9/16	5/8	...	5/8	5/8	C.I.	S.A.E. 3120	S.A.E. 2320	7-9	2.98	1.73	1.00	....	3.62	On Eng.	C	No	90	Warren B
Warren C	C,T	...	Clash	B	B	3	11/16	3/4	...	3/4	3/4	C.I.	S.A.E. 3120	S.A.E. 2320	6-8	4.01	1.98	1.00	....	5.01	On Eng.	C	No	120	Warren C

ABBREVIATIONS:

Column 1:
C—Cars
T—Trucks
Tr—Tractors

Column 3:
Ind. Cl—Individual Clutch

Column 4:
B—Ball
R—Roller

Column 5:
B—Ball
P—Plain
R—Roller

Column 12:
Al—Aluminum
C-I—Cast Iron
G-I—Gray Iron
I & Al—Iron and Aluminum
S-S—Semi-Steel

Columns 13 & 14:
Chrome-N—Chrome Nickel
Chrome-S—Chrome Steel
Nic-Steel—Nickel Steel
Nic-Van—Nickel Vanadium

Column 21:
A—Amidships
On Eng—On Engine

Column 22:
C—Center

Column 23:
Opt—Optional

Fewer Firms in Isolated Electric Plant Field

1922 specifications indicate a reduction in number of firms. Plants listed divide into two classes: those for domestic and those for industrial uses. Most generators direct connected to engine. Governors provided by every maker. Outputs vary from .3 to 25 K.W. Watercooling predominates.

IN comparing the 1922 table of isolated electric lighting plants with that of last year the first thing that attracts attention is the great reduction in the number of makes represented. We are not prepared to say that all of the firms listed last year that do not appear in this year's table have discontinued making these plants, although we made every effort to get information from all actively engaged in the business.

The lighting plants listed really divide into two classes, viz., the small plants for domestic or farm use, and the larger plants for marine or industrial purposes. For the small plants the two standard voltages of 32 and 110 seem to be used almost exclusively. There are, however, a few plants which are offered in 65-volt models, and one plant can be had wound for 16 volts. This latter voltage is so low that it is probably furnished to meet very special conditions. Several of the larger plants can be had wound for 220 volts, a voltage commonly used in marine work.

The great majority of the generators are direct connected to the engines, but in addition there are plants having either gear, chain or belt drive. It will be observed that the belt-driven sets usually comprise a low-speed engine. With one exception the engine speed of these sets is not over 500 r.p.m. These low-speed engines have the advantage of more nearly silent and vibrationless running, but this is offset by the much greater floor space required. In this respect the chain and gear-driven sets are intermediate between the direct-connected and belt-driven sets. A gear-driven set occupies hardly any more space than a direct-coupled one, and chain-driven sets also can be made fairly compact.

Thirteen of the 57 plants listed are described as starting automatically. This in the case of sets in which the surplus output of the generator above that going into the line at the time is absorbed by a storage battery, means that the engine is started up automatically as soon as the charge in the battery drops below a certain predetermined point. In the case of so-called batteryless sets, it means that the engine is started up as soon as a light or other current-consuming device is turned on. Twenty of the 57 sets have the automatic stopping feature.

Practically all the smaller sets, those of less than 5 kw., have single-cylinder engines, the only exception being the Kohler, which is a batteryless plant. Most of the engines will run on either gasoline or kerosene. The engines of those sets in which some of the energy is stored in a storage battery operate at practically full load all the time, which makes it comparatively easy to run on kerosene.

Every engine is fitted with a governor. The requirement of reasonably constant voltage evidently makes the use of a governor necessary, though the electrical sets on automobiles operate without this device. Undoubtedly the higher voltage lamps are more sensitive to fluctuations in the electrical pressure and closer regulation is required. In about one-third of the sets an electric governor is used, while the governors on the rest of the engines are of the regular centrifugal type.

In view of the fact that every isolated electric plant has a storage battery connected with it, even those in which none of the current for the consuming devices passes through such a battery. it may seem strange that so many of the plants should use magneto ignition. The explanation undoubtedly is that battery systems are not made for the voltages of these batteries; if the ignition system were connected across a few of the cells of the battery only, the battery would become unbalanced, while charging a separate battery from the generator through a resistance is wasteful. Moreover, the cost of a battery system, together with a battery for same, is not far, if any, less than that of a magneto.

Generator speeds for isolated lighting plants have been standardized by the S. A. E. at 1200 and 1800 r.p.m., and, while these speeds are adhered to in a good many cases, still there is no high degree of uniformity in speeds as yet.

Outputs of the sets vary all the way from 0.3 to 25 kw. The great majority of the sets, however, have an output of from 1 to 1.5 kw. There are listed 10 sets of 1 kw., 8 sets of 1.25 kw. and 10 sets of 1.5 kw. One maker failed to give the ratings of his sets, having evidently stopped rating them. Some of the most successful makers use air-cooled engines, but a far greater number employ water-cooling. The generators of the smallest sets have two poles, but all direct-connected generators of more than 1-kw. output have four poles, and some of the larger ones have six. As to field windings, about half of the sets have compound windings and the other half shunt windings.

There seems to be no relation whatever between the storage-battery capacity furnished and the generator output, and a good many firms give options on batteries of widely differing capacities. An 80-ampere-hour battery is the smallest size furnished with 1-kw. sets, and a 230-ampere-hour the largest. With a larger battery the engine does not have to be started and stopped so frequently, the maximum load capacity of the set is greater and the battery should last longer, but the first cost of the plant increases rapidly with the size of the battery.

More than one-half of the sets are furnished with a power pulley on the engine shaft, so that power machines can be driven directly from the engine instead of only through the intermediary of an electric motor.

Specifications Isolated Electric Plants 1922

Name	PLANT					ENGINE							GENERATOR			BATTERY	
	Voltage	Drive	Automatic Start?	Automatic Stop?	Unit or Separate Construction	No. Cyls. Bore and Stroke	Fuel	Type of Speed Governor	Type Ignition	Normal r.p.m.	Crankshaft Bearings	Engine Cooling	Rated K. W.	No. Poles and Kind Field Winding	No. and Kind Generator Bearings	Standard 72-hr. Rating	Is Power Pulley Provided?
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Alamo	32	Dir	No	Yes	Unit	1-2¼x3¼	G	Elec	Mag	2000	2-1 Brnz 1 Ball	Water	1	2-Shunt	1-Brnz 1-Ball	190	No
Cushman	32	Blt	Yes	No	Unit	1-4x4	G	Cent	Bat	800	2-Die	Water	1	2-Comp	2-Brnz	Opt	Yes
Dayton	32	Blt	No	No	Sepr									2-Shunt	2-Brnz	Opt	
Delco	16-32	Dir	SA		Unit	1-2½x3	G or K	Elec	Bat			Air		4-Shunt			No
Delco	32-110	Dir	SA		Unit	1-3x5	G or K	Elec	Bat			Air		4-Shunt			No
Delco	110	Dir	SA		Unit	1-3x5	G or K	Cent	Mag			Air		4-Comp			No
Delco	32-65-110	Dir	SA		Unit	1-3¾x6	G or K	Elec	Bat			Air		6-Shunt			No
Delco	110	Dir	SA		Unit	1-3¾x6	G or K	Cent	Mag			Air		6-Comp			No
D-Light, L1500	32	Dir	No	Yes	Unit	1-3¼x5	G or K	Cent	Bat	1200	2-Ball	Air	1.5	4-Shunt			Yes
Electrion	32	Dir	Yes	Yes	Unit	1-2⅞x3	G or K	Elec	Mag	1600	2-Roller	Water	1	2-Shunt	1-Brnz	80	No
Fairbanks, Morse	32	Blt	No	No	Unit	1-3½x5	G or K	Cent	Mag	500	2-Bab	Water	.6	-Shunt	2-Ball		Yes
Fairbanks, Morse	32	Blt	No	No	Unit	1-4½x6	G or K	Cent	Mag	475	2-Bab	Water	1.5	4-Shunt	2-Ball		Yes
Fort Dearborn	32	Gear	No	No	Unit	1-2¾x5	G or K	Cent	Mag	1000	2-Ball	Air	1	4-Shunt	2-Brnz	80-160	Yes
Globe	40	Dir	No	No	Unit	1-2¾x4	G or K	Cent	Bat	1250	2-Bab	Water	1.25	4-Series	2-Ring	110-150-180	Yes
Kero Lectric	32	Dir	No	No	Unit	1-3¼x3¼	G or K	Elec	Bat	1150	2-	Water	1.	2-	1-Ball	90	Yes
Kohler	110	Gear	Yes	Yes	Unit	4-2x3	G	Cent & Elec	Mag	1000	2-Plain	Air & Water	1.5	4-Comp	1-Ball		No
Lalley Light	32	Dir	No	Yes	Unit	1-2⅝x2	G	Cent	Bat	1800	2-Ball	Water	1.25	Comp	2-Ball	115	No
Langstadt-Meyer	110	Dir	No	No	Unit	4-3⅛x4½	G	Cent	Mag	950 & 1100	2-Die	Water	4 & 6	4-Comp	1-Brnz	Opt	No
Langstadt-Meyer	32	Dir	No	No	Unit	1-3⅛x4½	G or K	Cent	Bat	1200	2-Die	Water	1.5	4-Shunt	1-Brnz	128 & 218	Yes
Lincoln-Light	32	Dir	No	Yes	Unit	1-3x3	G or K	Elec	Bat	1200	2-Ball	Water	1	4-Shunt	2-Ball	190	Yes
Main	32-110	Dir	Yes	Yes	Unit	1-2⅝x2½	G or K	Elec	Bat	1150	2-Brnz	Water or Oil	1.25	4-Comp	2-Ball	90	Yes
Main	32-110	Blt	No	No	Sepr	1-3½x5	G or K	Cent	Mag	400	2-Brnz	Water	.8	2-Shunt	2-Brnz	90	Yes
Main	110	Blt	No	No	Sepr	1-4½x7	G or K	Cent	Mag	325	2-Brnz	Water	2	4-Shunt	2-Ring	160	Yes
Marco	32	Chn	No	No	Unit		G or K	Cent	Mag	800	2-Bab	Air	1.5	4-Comp	2-Ball	Opt	Yes
Matthews	32	Dir	Yes	Yes	Unit	1-2x3	G		Bat	1250	2-Plain	Water	.3	2-Shunt	2-Plain		No
Matthews	32	Dir	Yes	Yes	Unit	1-3x3	G	Elec	Bat	1250	2-Plain	Water	1	4-Shunt	1-Plain		No
Matthews	110	Dir	Yes	Yes	Unit	4-3¾x4	G	Cent	Mag	1000	3-Plain	Water	10	4-Shunt & Comp	2-Plain		Yes
Matthews	110	Dir	Yes	Yes	Unit	4-3½x5	G	Elec	Mag	900	3-Plain	Water	6	4-Shunt	2-Plain		No
Matthews	110or220	Dir	No	No		4-4½x6	G or K	Cent	Mag	1000	4-Plain	Water	20	4-Shunt & Comp	2-Plain		No
National	32	Chn	Yes	Yes	Unit & Sepr	1	G or K	Cent	Mag	1800	2-Die	Air	1.25	4-Shunt	2-Ball	200	Yes
Owen	32	Dir	SA	SA	Unit	1-3x4	G	Cent	Bat	1400	3-Sleeve	Air & Water	1.25	4-Series	1-Sleeve	110	Opt
Phelps	32-110	Dir	No	Yes	Unit	1-3x4	G or K	Cent	Bat. & Mag	1265	2-Ball	Water	1.5	4-Comp	2-Ball	140, 290	Yes
Powerlite	32	Dir	No	Yes	Unit	1-3¼x3¼	G or K		Bat	1200	2-Brnz	Water	1	Series	1-Ball 1-Brnz	115 & 230	Yes
Reeco	32	Dir	No	No	Unit	1-4x5	G or K	Cent	Mag	475	2-Sleeve	Water	1.25	4-Shunt	2-Ring	Opt	Yes
Regalite	32	Dir		No	Unit	1-3¼x3½	G or K		Bat	600	2-Brnz	Air	.75	Comp	1-Brnz		Yes
Rohaco		Dir	No	No	Unit	1-3x4	G or K	Cent	Bat	1200	2-Ball	Water	1.5	4-Comp	2-Ball	170	Yes
Stearns	32	Dir	Yes	Yes	Unit	1-2⅝x3	G or K	Elec	Mag	1500	2-Ball	Water	.75	2-	1-Ring	110	Opt
Sturtevant	80-250	Dir	No	No	Unit	4-3¼x5	G or K	Cent	Mag		2-Plain	Water	5	6-Comp	1-Plain 1-Brnz		No
Sturtevant	80-250	Dir	No	No	Unit	4-4x6	G or K	Cent	Mag		3-Bab	Water	10	6-Comp	1-Plain 1-Brnz		No
Sturtevant	80-250	Dir	No	No	Unit	6-4x6	G or K	Cent	Mag		4-Bab	Water	15	6-Comp	1-Plain 1-Brnz		No
Sunbeam Farm-Lite	32	Dir	Yes	Yes	Unit	1-2¼x3	G	Elec	Bat	1250	1-Ball	Water	.65	4-Series	1-Ball	75	Yes
Swanlite	32	Dir	No	No	Unit	1-3x4	G or K		Bat	1200	2-Die	Water	1.25	4-Comp	2-	94-323	Yes
Swartz-Light	32	Dir	Yes	No	Unit	1-3x3¼	G	Elec	Mag	850	3-Bab	Water	1	4-Series	1-Ball	218	No
Swartz-Light, Pioneer	32, 110	Blt	Yes	No	Sepr	1-5x6½	G	Cent	Mag	450	2-Bab	Water	1.5	4-Series	2-Ball	218	Yes
Upco Lite		Dir	No	No		4-4¾x6	G or K	Cent	Mag	900	Brnz	Air & Water	15	Comp	1-Brnz		Opt
Upco Lite		Dir	No	No		4-6x7	G or K	Cent	Mag	750	Brnz	Air & Water	25	Comp	1-Brnz		Opt
Upco Lite	110	Dir	No	Yes	Unit	4-3⅛x4½	G or K	Cent	Mag	1100	3-Brnz	Air & Water	6	6-Comp	1-Brnz	220	Opt
Universal	32	Dir	No	Yes	Unit	1-2¾x4	G	Cent	Bat	1200	2-Brnz	Water	1	4-Comp	1-Roller	120	Yes
Western Electric	32	Dir	No	Yes	Unit	1-3½x4½	G or K	Cent	Bat	1000	1-Plain	Air	1.5	4-Shunt	1-Plain	288	Yes
Western Electric	32	Blt	No	No	Unit	1	G or K	Cent	Mag	1800	2-Plain	Water	.5	2-Shunt	2-Plain	144	Yes
Willys Light	32	Dir	No	Yes	Unit	1	G or K		Bat	1750	2-Sleeve	Air	1.25	4-Shunt		160	Yes
Winton		Dir	No	No	Unit	4-3x4	G	Cent	Mag	1200	2-Bab	Water	5	4-Comp	1-Bab		No
Winton		Dir	No	No	Unit	6-3x4	G	Cent	Mag	1200	3-Bab	Water	7.5	4-Comp	1-Bab		No
Wisconsin	32	Blt	No	No	Sepr	1-6½x9	G or K	Cent	Bat	350	2-Bab	Water		2-Shunt	2-Brass	Opt	Yes
Wisconsin	32	Blt	No	No	Sepr	1-5½x6	G or K	Cent	Bat	380	2-Bab	Water		2-Shunt	2-Brass	Opt	Yes
Wisconsin	32 & 65	Blt	No	No	Sepr	1-3¼x4½	G or K	Cent	Bat	400	2-Bab	Water		2-Shunt	2-Brass	Opt	Yes
Worthington	30	Dir & Blt	No	No	Sepr	1-4¾x7	K	Cent	Mag	475	2-Bab	Water	1.5	Shunt	2-	150-180-225-265	Yes

ABBREVIATIONS:—

Blt—Belt
Chn—Chain
Dir—Direct
S A—Semi-Automatic
Sepr—Separate

ENGINE:—
Bab—Babbitt
Bat—Battery
Brnz—Bronze
Cent—Centrifugal
Die—Die Cast
Elec—Electric
G—Gasoline
K—Kerosene
Mag—Magneto

GENERATOR:—
Comp—Compound

BATTERY:—
Opt—Optional

Marine Engine Specifications for 1922

American Marine Engines

Model	Rated H.P.	No. Cyls.	Bore and Stroke	Normal R.P.M.	Weight Complete Lbs.	Ignition
1922	8	1	6¼x 7½	360	1470	M. & B.
1922	10	1	7¼x 9	340	1850	M. & B.
1922	16	2	6¼x 7½	360	2250	M. & B.
1922	20	2	7¼x 9	340	2925	M. & B.
1922	27	2	8¼x10	320	3975	M. & B.
1922	25	3	6¼x 7½	375	2550	M. & B.
1922	35	3	7¼x 9	350	4075	M. & B.
1922	45	3	8¼x10	325	5050	M. & B.
1922	55	3	8¾x10½	300	6680	M. & B.
1922	40	4	6¼x 7½	450	3475	M. & B.
1922	50	4	7¼x 9	375	5160	M. & B.
1922	65	4	8¼x10	350	6675	M. & B.
1922	85	4	8¾x10½	325	8200	M. & B.
1922	65	6	6¼x 7½	500	4825	M. & B.
1922	80	6	7¼x 9	425	6950	M. & B.
1922	100	6	8¼x10	400	8900	M. & B.
1922	125	6	8¾x10½	375	10800	M. & B.
1922	22-25	2	6¼x 7½	500-600	2150	J. S.
1922	35-40	3	6¼x 7½	500-600	2450	J. S.
1922	50-55	4	6¼x 7½	500-600	3350	J. S.
1922	75-80	6	6¼x 7½	500-600	4800	J. S.
Aerothrust 2-Cycle G.-K.						
1922	3	2	2½x2¼	250-1600	85	J. S.
1922	5	2-3	x3½	250-1300	115	J. S.
Amphion 2-Cycle G.						
Auth.	3	2	2½x2½	900	77	Mag.
Inb.	3	2	2½x2½	900	67	Mag.
Anderson 4-Cycle G.-K.						
....	4½	1	4½x5	600	400	Mag.
....	8½	2	4½x5	600	600	Mag.
....	12½	2-5	x6	550	1000	Mag.
....	25	4-5	x6	550	1600	Mag.
....	50	4-7	x8½	450	3000	Mag.
Arrow 2-Cycle G.-K.						
K-1	2½-3	1-2¾x3		700	36	B. or M.
K-2	5-6	2-2¾x3		750	60	B. or M.
A-4	4-5	1-4	x4	650	110	B. or M.
C-21	3	1-2¾x3		1100	85	Mag.
C-21	3	1-2¾x3		1100	80	Mag.
Automatic 4-Cycle G.-K.						
Open base	3	1-	4¼x 5	500	300	Opt.
	6	2-	4¼x 5	500	525	Opt.
	9	3-	4¼x 5	500	760	Opt.
	6	1-	5½x 7	400	643	Opt.
	12	2-	5½x 7	400	1115	Opt.
	18	3-	5½x 7	400	1425	Opt.
	24	4-	5½x 7	400	1800	Opt.
	25	2-	7½x 9	350	2625	Opt.
	37	3-	7½x 9	350	3465	Opt.
	50	4-	7½x 9	350	4430	Opt.
	75	3-10	x14	275	8000	Opt.
	100	4-10	x14	275	11780	Opt.
Enclosed	30	4-	5 x 7	550	1850	J. S.
	45	6-	5 x 7	550	2700	J. S.
	40	4-	5½x 7	550	1950	J. S.
	60	6-	5½x 7	550	2900	J. S.
	50	4-	6½x 8	500	3000	J. S.
	75	6-	6½x 8	500	4500	J. S.
	70	4-	7½x 9	500	4000	J. S.
	105	6-	7½x 9	500	6000	J. S.
	100	4-	8½x10	500	6000	J. S.
	150	6-	8½x10	500	9000	J. S.
American 2-Cycle G.-K.						
1922	2½	1-3¼x3½		800	140	Bat.
1922	4	1-3⅞x3½		800	150	Bat.
1922	6	1-4¾x4½		800	200	Bat.
1922	8	1-5¼x5		600	335	Bat.
1922	8	2-3⅞x3½		1000	220	Bat.
1922	8	2-3⅞x3½		800	280	Bat.
1922	14	2-4¾x4½		700	350	Bat.
1922	20	2-5¼x5		600	495	Bat.
Capitol 4-Cycle G.						
HA-4	32-34	4-4¼x5½		1000	675	Bat.
HA-4 Spec.	60-65	4-4¼x5½		1500-2000	675	Bat.
B. O. E. C. 4-Cycle K. and Fuel Oil.						
A-12¾	50	1-12¾x18		250	17000	Aut.
Barker 2-Cycle, G. & K.						
A.	1¼	1-3 5/16x3½		500	110	Opt.
B.	2½	1-4⅛x4¼		500	170	Opt.
C.	4	1-4 9/16x5		450	220	Opt.
D.	6½	1-5½x6½		400	350	Opt.
G.	8	2-4 9/16x5		450	380	M. & B.
Bolinders 2-Cycle, Hot Bulb Ignition.						
NEII	500	4-20½x29½		160	114000	Surf.
NEII	350	4-16½x18⅞		225	52000	Surf.
NEII	270	4-15	x16⅛	250	38000	Surf.
NEI	175	2-16½x18⅞		225	26000	Surf.
NEI	135	2-15	x16⅛	250	19500	Surf.
NEI	100	2-13	x13⅜	325	12600	Surf.
NEI	80	2-11¾x12 3/16		350	9075	Surf.
NEI	60	2-10⅝x11		375	7040	Surf.
NEI	50	2- 9 7/16x 9 3/16		425	5225	Surf.
NEI	40	2- 8½x 9⅛		450	4180	Surf.
NE	50	1-13	x13⅜	325	7700	Surf.
NE	40	1-11¾x12 3/16		350	5555	Surf.
NE	30	1-10⅝x11		375	4840	Surf.
NE	25	1 9 7/16x 9 3/16		425	3465	Surf.
Brennan 4-Cycle G.						
M.	17-20	4- 4	x 5	1000	650	B. & M.
B.	25-35	4- 4½	x 5	800	750	B. & M.
"B" spec.	35-40	4- 4½	x 5	1200	700	B. & M.
6B	40-50	6- 4½	x 5	1200	850	B. & M.
6B Med.	40	6- 4½	x 5	750	950	B. & M.
11	30-40	4- 5	x 5	1000	850	B. & M.
12	35-50	4- 5½	x 6	800	1100	B. & M.
12	40-80	4- 6	x 6	800	1250	B. & M.
6D	75-100	6- 4½	x 6½	1000	800	B. & M.
Bridgeport 2-Cycle, G.-K.						
40	4½	1-4½x5		500	225	Opt.
50	6	1-5¼x5¼		500	260	Opt.
80	9	2-4½x5		500	375	Opt.
100	12	2-5¼x5¼		500	470	Opt.
R-1	8	1-4½x5		800	225	Opt.
S-1	11	1-5¼x5¼		800	260	Opt.
R-2	16	2-5¼x5		800	375	Opt.
S-2	22	2-4½x5¼		800	470	Opt.
Bridgeport 4-Cycle G.-K.						
142	14	2-5½x6½		500	850	Opt.
182	20	2-6½x7½		400	1200	Opt.
243	30	3-6½x7½		400	1800	Opt.
363	45	3-7½x9		375	3200	Opt.
484	60	4-7½x9		375	4000	Opt.
Buffalo 4-Cycle G.-K.						
....	3-4	2- 3	x 4	700	240	H.T.
....	5-6	2- 3½	x 5	600	400	H.T.
....	16-20	4- 3¾	x 5	800	710	H.T.
....	25-30	4- 4¾	x 5	800	800	H.T.
....	40-60	4- 5½	x 7	500-800	1730	H.T.
....	50-80	4- 6¾	x 9	500-800	2600	H.T.
....	10-12	2- 5	x 6½	400	1170	H.T.
....	13-15	2- 6	x 7½	350	1400	H.T.
....	20-22	2- 7	x 9	350	2100	H.T.
....	20-24	4- 5	x 6½	400	1960	H.T.
....	26-30	4- 6	x 7½	350	2525	H.T.
....	40-45	4- 7	x 9	350	3655	H.T.
....	60-70	6- 7	x 9	350	4850	H.T.
....	85-100	4-10	x12	300	8200	H.T.
....	125-150	6-10	x12	300	12800	H.T.
H. L. B. 2-Cycle G.						
E.	2-3	1-3.25x3		900	42	J. S.
H. L. B. 4-Cycle G.						
G.	4	2-2.5x5		900	125	J. S.
Cady 2-Cycle G.						
....	1½	1-3	x2½	700	45	J. S.
....	3	1-3 5/8x3¾		700	90	J. S.
....	6	2-3 5/8x3¾		700	135	J. S.
....	4	1-4⅛x4		700	140	J. S.
....	8	2-4⅛x4		700	205	J. S.
Cady 4-Cycle G.						
....	12-16	4-3¾x4		1000	300	J. S.
Caille Perfection 2-Cycle G.						
....	2½	1-3¼x3½		200-800	140	Bat.
....	3½-4	1-3⅞x3½		250-800	150	Bat.
....	6	1-4¾x4½		250x800	200	Bat.
....	8	1-5¼x5		100-500	335	Bat.
....	7-8	2-3⅞x3½		250-850	220	Bat.
....	14	2-4¾x4½		250-750	350	Bat.
....	18-20	2-5¼x5		100-600	495	Bat.
....	2	1-2⅝x2½		700	72	Mag.
....	2	1-2⅝x2½		700	61	Bat.
....	2	1-2⅝x2½		800	40	Mag.
Caille Perfection 4-Cycle G.						
....	14	4-3½x4		100-950	650	Mag.
Knox 2-Cycle G.-K.						
E.	3	1-4	x4	600	205	Opt.
E.	4½	1-4¼x4½		550	250	Opt.
E.	5½	1-5	x5¼	550	330	Opt.
E.	7½	1-5½x6¼		500	500	Opt.
E.	6	2-4	x4	600	340	Opt.
E.	9	2-4¼x4½		550	380	Opt.
E.	11	2-5	x5¼	550	480	Opt.
E.	15	2-5½x6¼		500	760	Opt.
Knox 4-Cycle G.-K.						
F.	25	2-7	x8	500	1900	J. S.
F.	50	4-7	x8	500	3300	B. & M.
F.	75	6-7	x8	500	4500	B. & M.
G.	6	1-5	x5¼	600	575	B. & M.
G.	8	1-5½x6¼		600	700	B. & M.
G.	12	2-5	x5¼	600	950	B. & M.
G.	16	2-5½x6¼		600	1100	B. & M.
Chesapeake 2-Cycle G.						
B.	5	1-5x5		500	275	Bat.
BB.	10	2-5x5		500	475	Bat.
Chesapeake 4-Cycle G.						
L.	7	1-5x6		475	350	Mag.
L.	14	2-5x6		475	575	Mag.
....	20	4-4x5		575	550	Mag.
Honest Clay 4-Cycle G.-K.						
S.	4	1-4½x 5		500	385	Bat.
S.	8	2-4½x 5		500	575	Bat.
R.	6	1-5½x 7		375	675	Bat.
R.	8	1-6½x 7		375	825	Bat.
R.	10	1-7½x 7		375	950	Bat.
R.	12	2-5½x 7		400	1300	Bat.
R.	16	2-6½x 7		400	1525	Bat.
R.	20	2-7½x 7		400	1750	Bat.
R.	25	4-5½x 7		450	2300	Mag.
R.	35	4-6½x 7		450	2600	Mag.
R.	50	4-7½x 7		450	3000	Mag.
O.	25-28	2-7½x 9		375	2650	Bat.
O.	30-35	2-8½x 9		375	2800	Bat.
O.	38-42	2-8½x10¼		375	3000	Bat.
T.	40-50	2-8½x10		375	4000	Mag.
T.	80-100	4-8½x10		375	7000	Mag.
Clift 4-Cycle G.						
....	4	1-3¾x4½		750	250	J. S.
....	8	2-3¾x4½		750	350	J. S.
....	7	1-5	x6	650	600	J. S.
....	15	2-5	x7	600	1200	M. & B.
....	20	2-5¾x7		600	1450	M. & B.
Clift 2-Cycle Semi-Diesel.						
....	100	4-11x13		300	20000	H. B.
Quayle 4-Cycle Hvid.						
4M-28	25-35	4-4¾x6½		650	2150	.....
4S-30	25-35	4-4¾x6½		600	1650	.....
Speedway 4-Cycle G.						
K.	22-28	4- 4	x 4½	1000-1400	560	Mag.
Z.	35-44	4- 4½	x 5½	1000-1200	950	Mag.
N.	50-66	6- 4½	x 5½	1000-1200	1200	Mag.
M.	48-75	4- 5¾	x 7	600-1000	1850	B. & M.
M.	75-130	6- 5¾	x 7	600-1000	2400	B. & M.
M.	130-150	6- 5¾	x 7	1000-1200	1900	B. & M.
M.	100-175	8- 5¾	x 7	600-1000	2900	B. & M.
M.	175-200	8- 5¾	x 7	1000-1200	2350	B. & M.
L.	30-115	6- 6¾	x 8½	400- 600	5000	B. & M.
R.	250-300	6- 6¾	x 8½	1000-1300	4000	B. & M.
H.	200-250	6-11	x12	350- 450	11400	B. & M.
Curtiss 4-Cycle G.						
OX-5	90	8-4	x5	1400	*390	Mag.
K-6	150	6-4½	x6	1700	*417	Mag.
K-12	400	12-4½	x6	2250	*680	Mag.
C-6	160	6-4½	x6	1750	*420	Mag.
C-12	400	12-4½	x6	2250	*685	Mag.
CD-12	325	12-4½	x6	1800	*678	Mag.

*With propeller hub but without oil and water.

Cummins 4-Cycle Heavy Oil.						
M-1	7-8	1-5x7½		550	900	.....
M-2	14-16	2-5x7½		550	1400	.....
M-3	21-24	3-5x7½		550	1800	.....
M-4	30-32	4-5x7½		550	2100	.....
Dodge 4-Cycle Hvid.						
....	12½	1-6¾x9		425	3800	.....
....	25	2-6¾x9		425	4800	.....
....	37½	3-6¾x9		425	6200	.....
....	50	4-6¾x9		425	7400	.....
....	75	6-6¾x9		425	9700	.....
Dow 4-Cycle Diesel.						
A.	320	6-12	x18	250	125000	.....
A.	425	8-12	x18	250	160000	.....
B.	500	6-15	x22¼	220	185000	.....
B.	666	8-15	x22¼	220	215000	.....
C.	500	6-16	x26	175	194000	.....
C.	666	8-16	x26	175	233000	.....
F.	900	6-21¼x28¾		140	325000	.....
H.	1500	6-24 5/8x37 5/8		125	534000	.....
Dupont 4-Cycle G.						
DT.	20	2-5x6½		700	1100	.....
DF.	40	4-5x6½		700	1600	.....
DS.	60	6-5x6½		700	2150	.....
New Parker 2-Cycle G.-K.						
Simplex	2	1-3x3		900	65	J. S.
Duplex	4	2-3x3		900	110	J. S.
Heav. Duty	4	1-4x4		700	125	Opt.
Elto 2-Cycle G. Outboard.						
....	3	2-2¼x2		1300	47	Bat.

Model	Rated H.P.	No. Cyls.	Bore and Stroke	Normal R.P.M.	Weight Complete Lbs.	Ignition
Enterprise 4-Cycle K. and Pr. Gas.						
....	6	1-6	x 8	420	1240	M. & B.
....	8	1-6¾	x 8	400	1360	M. & B.
....	10	1-7½	x 8½	375	1490	M. & B.
....	12	2-6	x 8	400	1760	M. & B.
....	16	2-6¾	x 8	400	1910	M. & B.
....	20	2-7½	x 8½	360	3240	M. & B.
....	25	2-8	x 9½	350	3470	M. & B.
....	30	3-6¾	x 8¼	400	3480	M. & B.
....	35	3-7½	x 9½	360	5160	M. & B.
....	45	3-8¼	x10¼	340	5370	M. & B.
....	60	3-9	x11	320	7230	M. & B.
....	40	4-6¾	x 8	400	4220	M. & B.
....	50	4-7½	x 9½	360	5790	M. & B.
....	65	4-8¼	x10¼	350	6480	M. & B.
....	85	4-9	x11	320	10200	M. & B.
....	100	6-8¼	x10¼	350	9890	M. & B.
....	125	6-9	x11	330	12360	M. & B.
....	50	2-9¼	x14	325	11250	Compr.
....	75	3-9¼	x14	325	16875	Compr.
....	100	4-9¼	x14	325	22500	Compr.
....	150	6-9¼	x14	325	33750	Compr.
....	200	8-9¼	x14	325	45000	Compr.
Erd 4-Cycle G.-K.						
T.	30	4-4	x6	900	750	Mag.
A.	42	4-4¾	x6	900	1100	Mag.
Evansville 4-Cycle G.						
....	3¾	1-4½	x5	500	300	Bat.
....	7½	2-4½	x5	500	400	Bat.
....	15	4-4½	x5	500	625	Mag.
....	5	1-5	x6	500	400	Bat.
....	10	2-5	x6	500	540	Bat.
....	20	4-5	x6	500	900	Mag.
....	8	1-6	x6¼	500	625	Bat.
....	16	2-6	x6¼	500	900	Bat.
....	24	3-6	x6¼	500	1200	Bat.
....	32	4-6	x6¼	500	1425	Mag.
....	11	1-7	x9	350	1150	Bat.
....	22	2-7	x9	350	1800	Bat.
....	44	4-7	x9	350	2900	Mag.
Evinrude 2-Cycle G.						
Standard	2	1-2⅝	x2½	800	73	Mag.
Heav. Duty	3½	1-3¼	x3	650	116	Mag.
CC.	2	1-2⅝	x2½	800	45	Mag.
DD.	4-5	2-2⅝	x2½	1200	68	Mag.
Fay and Bowen 4-Cycle G.						
L-40	10-17	4-3¼	x4½	800-1400	450	Mag.
LN-42	25-40	4-4¼	x5½	800-1400	700-900	Mag.
LN-43	25-40	4-4¾	x5½	600-1000	950	Mag.
L-44	30-45	4-5	x6¼	600-1000	1095	Mag.
L-63	30-50	6-4½	x5½	600-1000	900	Mag.
L-64	45-65	6-5	x6¼	600-1000	1480	Mag.

Models L-40, LN-43, L-44, L-64 made in cast iron construction only. Model L-63 made in aluminum construction only. Model LN-42 made in both aluminum and cast iron construction. Lowest weight applies to aluminum engine. Lowest r. p. m. applies to lowest power rating. Highest r. p. m. applies to highest power rating.

Frazer-Adams 2-Cycle G.					
....	2	1-3⅛	x3	200-1000	70 J. S.
....	4	2-3⅛	x3	200-1000	130 J. S.
....	5	1-3¾	x4¼	200-1000	140 J. S.
....	10	2-3¾	x4¼	200-1000	220 J. S.
Frisbie 4-Cycle G.-K.					
A.	5	1-4¾	x5	600	400 Bat.
C.	7	1-6	x6	550	560 Bat.
B.	10	2-4¾	x5	600	525 Bat.
D.	16	2-6	x6	600	825 Bat
R.	18	3-4¾	x5	650	725 Bat.
"T" 2-20	20	2-6	x6	600	1300 Bat.
N.	25	3-6	x6	600	1175 Bat.
E.	30	4-4¾	x5	800	925 Bat.
F.	40	4-6	x6	600	1400 Bat.
"T"4H50	50	4-6	x6	600	2500 Bat.
K.	50	6-4¾	x5	900	985 Bat.
L.	75	6-6	x6	750	2000 Bat.
"T" 4L	100	4-6	x6	1200	2200 Bat.
Gaeth 4-Cycle G. and K.					
....	14-18	2-5½	x8	400-600	1450 M. & B.
....	20-27	3-5½	x8	400-600	1800 M. & B.
....	28-36	4-5½	x8	400-600	2100 M. & B.
....	42-54	6-5½	x8	400-600	3000 M. & B.
....	36-50	4-5½	x8	400-600	2100 M. & B.
....	54-75	6-5½	x8	400-600	3000 M. & B.
Gaffga 2-Cycle G.					
A.	3	1-4	x4	550	225 Bat.
....	4	1-4⅝	x5	500	325 Bat.
....	5	1-5	x5½	475	350 Bat.
....	6	1-5½	x6	450	425 Bat.
....	8	1-6	x6½	400	475 Bat.
....	6	2-4	x4	550	375 Bat.
....	8	2-4⅝	x5	500	425 Bat.
....	10	2-5	x5½	475	525 Bat.
....	12	2-5½	x6	450	700 Bat.
....	16	2-6	x6½	400	850 Bat.
Gaffga 4-Cycle G.					
....	12	2-5	x6	600	900 Mag.
Gierholt 2-Cycle G. Outboard.					
....	2	1-2¾	x2½	900	40-56 Opt.

Model	Rated H.P.	No. Cyls.	Bore and Stroke	Normal R.P.M.	Weight Complete Lbs.	Ignition
G. B. & S. 4-Cycle G.						
T.	18	4-3¾	x4¼	1000	500	Mag.
Monarch 4-Cycle G.-K.						
....	5- 45	1 to 6-	5x6	525-575	....	Opt.
....	7- 60	1 to 6-	6x7	525-575	....	Opt.
....	72	4-	8x9	375-500	....	Opt.
....	40-168	2 to 6-	10x10	325-450	....	Opt.
Gray 2-Cycle G.-K.						
U.	3-4	1-3½	x3½	700-900	129	J. S.
U.	5½-7	1-4¼	x4¼	700-900	185	J. S.
U.	6-8	2-3½	x3½	700-900	240	J. S.
Gray 4-Cycle G.-K.						
UM.	10-25	4-3½	x5	500-1200	650	Mag.
VE.	18-35	4-4	x6	500-1200	850	Mag.
VE	25-50	4-4¾	x6	500-1000	1250	Mag.
Hartford 2-Cycle G.						
X.	3-5	1-4	x4½	500-700	330	M. & B.
X.	6-8	1-4½	x4½	500-700	335	M. & B.
X.	7-10	1-5	x5¼	500-700	440	M. & B.
X.	14-20	2-5	x5¼	500-700	620	M. & B.
Gray-Prior 4-Cycle G.-K.						
D-4	36	4-4½	x8	600-750	1950	M. & B.
Hall-Scott 4-Cycle G.						
L-M-4	125	4-5	x7	1700	1100	Del. 2 S.
L-M-6	200	6-5	x7	1700	1300	Del. 2 S.
Hess Mono-Marine 4-Cycle G.						
AC	5	1-3¾	x4	950	225	M. & B.
Hettinger 4-Cycle G.						
6	6	1-5⅛	x6	460	400	M. & B.
9	9	2-4⅛	x6	450	590	Bat.
12	12	2-5⅛	x6	450	650	Opt.
18	18	2-6⅛	x8	400	1500	Bat.
25	25	2-7⅛	x9	350	2000	Bat.
36	36	4-6⅛	x8	400	3000	Bat.
50	50	4-7½	x9	350	4500	Bat.
Bud-E 2-Cycle G.						
Bud-E.	5	2-3	x3	1200	126	Mag.
J. V. B. 4-Cycle G.-K.						
A4	28-40	4-4¾	x6	600-900	1450	Mag.
A4R	45-60	4-4¾	x6	1000-1450	1350	Mag.
Johnson 2-Cycle G. Outboard.						
....	2	2-2	x1½	2100	35	Mag.
Kahlenberg 2-Cycle G.-K.						
1922	2-3	1-3½	x 3½	600	125	M. & B.
1922	3-4	1-4	x 4	550	160	M. & B.
1922	4-6	1-5	x 5	400	400	M. & B.
1922	6-8	1-5⅛	x 6	400	550	M. & B.
1922	9-12	1-6½	x 7	350	750	M. & B.
1922	12-15	1-7	x 8	325	900	M. & B.
1922	6-8	2-4	x 4	550	350	M. & B.
1922	8-12	2-5	x 5	400	650	M. & B.
1922	12-16	2-5⅛	x 6	380	950	M. & B.
1922	18-24	2-6½	x 7	350	1300	M. & B.
1922	24-30	2-7	x 8	325	1800	M. & B.
1922	30-36	2-7¾	x 8	325	2000	M. & B.
1922	50-55	2-9	x10	300	3400	M. & B.
1922	27-36	3-6½	x 7	325	1700	M. & B.
1922	36-45	3-7	x 8	325	2600	M. & B.
1922	45-54	3-7¾	x 8	325	2800	M. & B.
1922	75-85	3-9	x10	300	5000	M. & B.
Kahlenberg 2-Cycle, Surface Ignition.						
1922	30-36	2- 8½	x 9	375	6000	Surf.
1922	45-54	3- 8½	x 9	375	8000	Surf.
1922	60-70	4- 8½	x 9	375	10000	Surf.
1922	50-60	2-10	x10½	340	8500	Surf.
1922	75-90	3-10	x10½	340	10000	Surf.
1922	100-120	4-10	x10½	340	15000	Surf.
1922	150	3-			23000	Surf.
1922	200	4-			30000	Surf.
Kermath 4-Cycle G.-K.						
3	3	1-3¼	x4	600	125	Mag.
4	4-5	2-3½	x4	800	300	Mag.
6	6-8	2-3¾	x4	800	320	Mag.
12	10-12	4-3½	x4	600-1200	470	Mag.
16	16-18	4-3¾	x4	600-1200	500	Mag.
20	20-25	4-4	x4	600-1200	535	Mag.
40	24-40	4-4½	x6¼	500-1200	1350	Mag.
Barber 2-Cycle G.						
. ..	2½	1-3¼	x3¼	750	75	J. S.
. .	5	2-3¼	x3¼	750	140	J. S.
. .	8	3-3¼	x3¼	750	190	J. S.
....	4	1-4	x4	600	150	J. S.
....	8	2-4	x4	600	270	J. S.
....	12	3-4	x4	600	390	J. S.
....	6	1-4¾	x4¾	600	245	J. S.
....	12	2-4¾	x4¾	600	375	J. S.
....	18	3-4¾	x4¾	600	500	J. S.
....	9	1-5½	x5¼	500	270	J. S.
....	18	2-5½	x5¼	500	535	J. S.
....	27	3-5½	x5¼	500	675	J. S.
Barber 4-Cycle G.						
....	3	1-3½	x5	600	125	J. S.
V.	7	2-3½	x5	600	150	J. S.

Model	Rated H.P.	No. Cyls.	Bore and Stroke	Normal R.P.M.	Weight Complete Lbs.	Ignition
Knox Valve-in-Head 4-Cycle G.-K.						
350	40	4-5	x5½	800	1100	M. & B.
940	20	4-3½	x5	900	780	Mag.
Koban 2-Cycle G. Outboard.						
H.	3	2-2⅝	x2⅜	800-900	80	M. & B
Lathrop 2-Cycle G.-K.						
1922	3	1-4	x4	500	....	Opt.
1922	4	1-4½	x5	500	....	Opt.
1922	5	1-5⅜	x5	500	....	Opt.
1922	6 Lt.	1-5½	x5	500	....	Opt.
1922	6 St.	1-5¼	x6½	400	....	Opt.
1922	7	1-6	x6½	375	....	Opt.
1922	8	1-6½	x6½	375	....	Opt.
1922	10	1-7	x7½	300	....	Opt.
1922	12	1-7½	x7½	275	....	Opt.
1922	8	2-4½	x5	550	....	Opt.
1922	10	2-5⅜	x5	500	....	Opt.
1922	12 Lt.	2-5½	x5	500	....	Opt.
1922	12 St.	2-5¼	x6½	400	....	Opt.
1922	14	2-6	x6½	400	....	Opt.
1922	16	2-6½	x6½	400	....	Opt.
1922	20	2-7	x7½	300	....	Opt.
1922	24	2-7½	x7½	275	....	Opt
1922	36	3-7½	x7½	275	....	Opt.
Lathrop 4-Cycle G.-K.						
1922	12	2-5⅜	x6½	500	....	Opt.
1922	16	2-5½	x6½	500	....	Opt.
1922	21	3-5⅜	x6½	500	....	Opt.
1922	30	3-5½	x6½	700	....	Opt.
1922	28	4-5⅜	x6½	500	....	Opt.
1922	40	4-5½	x6½	700	....	Opt.
1922*	16	2-5½	x8	400	1500	J. S.
1922*	24	3-5½	x8	400	2000	J. S
1922*	32	4-5½	x8	400	2400	J. S.
*Gasoline only.						
Leroi 4-Cycle G.						
2C	15	4-3⅛	x4½	1000	450	Opt.
Loane 4-Cycle G.-K.						
Crabber	3½	1-3¾	x5	750	250	J. S.
Fisherman	6	1-5	x6	600	650	J. S.
Fisherman	12	2-5	x6	600	1050	J S.
Ford	12-16	4-3¾	x4	1200	450	J. S.
Fisherman	18	3-5	x6	600	1350	J. S.
Fisherman	24	4-5	x6	600	1500	J. S.
Lockwood-Ash 2-Cycle G.						
Outboard	2	1-2⅝	x2½	700	65	Mag.
24	2½	1-3¼	x3½	750	....	J. S.
24	4	1-4	x4	750	....	J. S.
68	6	2-3½	x3½	800	....	J. S.
68	8	2-4	x4	800	....	J. S.
44*	14	4-3¾	x4½	800	600	Mag.
*4-Cycle.						
Maynard-Adams 4-Cycle G.-K.						
....	3½	1-3¾	x4	700	....	Mag.
....	8	2-3¾	x4¼	700	....	Mag.
Mecco 4-Cycle G.						
A.	4	1-4¼	x5	600	220	Mag.
B.	5	1-5	x6	500	375	Mag.
AA.	9	2-4¼	x5	600	375	Mag.
4A.	16	4-4¼	x5	600	500	Mag.
C2	12	2-5½	x6½	500	550	Mag.
C3	18	3-5½	x6½	500	775	Mag.
Mianus 2-Cycle G., K., etc.						
A.	3	1-4	x4	550	175	M. & B.
A.	5	1-4⅝	x5	500	280	M. & B.
A.	7½	1-5⅝	x6	450	415	M. & B.
A.	10	1-6½	x7	375	675	M. & B.
A-2	6	2-4	x4	550	300	M & B.
A-2	10	2-4⅝	x5	500	500	M. & B.
A-2	15	2-5⅝	x6	450	750	M. & B.
Mianus 4-Cycle G.						
F-2	16	2-6	x8	400	1600	M. & B.
F-3	24	3-6	x8	400	2200	M. & B.
F-4	32	4-6	x8	400	2750	M. & B.
Mianus Diesel 2-Cycle.						
7½	7½	1-5⅝	x6⅝	500	1000	Comp.
15	15	2-5⅝	x6⅝	500	1700	Comp.
30	30	2-7⅛	x9⅞	360	5100	Comp.
45	45	3-7⅛	x9⅞	360	6500	Comp.
60	60	4-7⅛	x9⅞	360	8200	Comp.
90	90	6-7⅛	x9⅞	360	13000	Comp.
Michigan Marine Motor 4-Cycle G.						
....	4	1-3¾	x4½	750	115	Opt.
Mietz Semi-Diesel 2-Cycle.						
....	15	2-	6x 6½	500	1995	Hot bulb
....	22	3-	6x 6½	500	2520	Hot bulb
....	40	2-	9x10	400	6300	Hot bulb
....	50	2-	10x12	340	11000	Hot bulb
....	60	3-	9x10	400	7500	Hot bulb
....	75	3-	10x12	340	14000	Hot bulb
....	100	4-	10x12	340	18000	Hot bulb
....	150	3-	14x18½	240	35000	Hot bulb
....	200	4-	14x18½	240	42000	Hot bulb
....	350	4-	16x21	210	65000	Hot bulb

Model	Rated H.P.	No. Cyls.	Bore and Stroke	Normal R.P.M.	Weight Complete Lbs.	Ignition
Murray & Tregurtha 4-Cycle G.						
E-2	18-20	2	6½x 8	425	1867	M. & B.
E-3	25-35	3	6½x 8	450	2216	M. & B.
E-4	40-50	4	6½x 8	450	2916	Opt.
E-6	60-75	6	6½x 8	500	3560	Opt.
F-4	60-70	4	7½x10	375-425	4667	Opt.
F-6	90-110	6	7½x10	400-450	6990	Opt.
K-6	300	6	6¼x7¾	1650	2100	J. S.
J-6	400	6	7¼x 9	1400	4000	J. S.
Miller 4-Cycle G.-K.						
F-1	4	1	4½x5	600	400	M. & B.
I-1	6	1	5¼x6	500	500	M & B.
F-2	10	2	4½x6	600	600	M. & B.
I-2	14	2	5¼x6½	500	800	M. & B.
E-4	12-20	4	3½x5	6-900	650	Mag.
F-4	18-24	4	4½x6	5-800	1200	Mag.
I-4	24-30	4	5¼x6	5-700	1500	Mag.
R-4	28-35	4	5¼x7½	4-550	1900	Mag.
S-4	40-50	4	6 x9	350-450	2700	Mag.
P-1*	2½	1	2¾x2½	850	70	Mag.
*Gasoline only.						
Missouri 4-Cycle G.						
....	8	2	4⅜x5	500	....	J. S.
....	12	2	5 x6	500	....	J. S.
....	18	4	4⅜x5	500	....	J. S.
....	24	4	5 x6	500	....	J. S.
Missouri 2-Cycle Semi-Diesel.						
....	7	1	5x6	500	....	Hot ball
....	14	2	5x6	500	....	Hot ball
....	22	3	5x6	500	....	Hot ball
....	30	4	5x6	500	....	Hot ball
N. & S. 4-Cycle Dist.						
Cub	4	1	3¾x 5	800	350	M. & B. and J. S.
Marine	20	2	7 x 9	350	3200	M. & B.
heavy	20	2	7 x 9	350	2800	M. & B.
duty	30	2	8 x10	325	3500	M. & B.
	40	3	8 x 9	325	4600	M. & B.
	80	3	10½x12	320	8000	M. & B.
Fordmarine 4-Cycle G.						
....	10-15	4	3¾x4	800-1000	550	Mag.
N. L. S. E. Co. 4-Cycle Diesel.						
....	120	4	9 x12½	350	17400	.....
....	180	6	9 x12½	350	22820	.....
....	240	8	9 x12½	350	28375	.....
....	240	4	13 x18	240	34400	.....
....	360	6	13 x18	240	56940	.....
....	480	8	13 x18	240	76000	.....
....	600	6	16½x24	225	120000	.....
20th Century 4-Cycle G.						
1922	15-20	2	6½x8½	400	2000	Mag.
1922	40-50	4	6½x8½	400	3400	Mag.
1922	65-75	6	6½x8½	400	4500	Mag.
Niagara 4-Cycle G.						
E2	12	2	4¾x5½	900	625	M. & B.
E4	22-35	4	4¾x5½	1000	925	M. & B.
D4	40-80	4	6¼x7	1000	1650	M. & B.
D6	60-120	6	6¼x7	1000	2350	M. & B.
D8	80-160	8	6¼x7	1000	3250	M. & B.
Special	5-15	4	2⅝x4	1000	300	M. or B
Ontario 2-Cycle G.						
....	2	1	2⅝x3	1650	70	Opt.
....	3	1	3½x3½	900	125	Opt.
....	6	2	3½x3½	900	190	Opt.
....	9	3	3½x3½	900	270	Opt.
....	12	4	3½x3½	900	350	Opt.
....	7	1	5 x5	450	300	Opt.
....	14	2	5 x5	600	500	Opt.
....	21	3	5 x5	600	700	Opt.
....	28	4	5 x5	600	900	Opt.
Palmer 4-Cycle G.						
NL1	3½	1	4½x 4½	4-600	350	Bat.
NL2	7	2	4½x 4½	4-600	350	Bat.
RW1	5½-6½	1	5⅜x 6	4-600	425	Bat.
RA1	4½	1	4½x 6	4-600	375	Bat.
RA2	9-11	2	4½x 6	4-600	650	Bat.
TM	10	4	2¾x 3¼	1000-1500	260	Bat.
VH	14	4	3 x 4½	1000-1200	700	Bat.
NR1	5-6	1	5 x 6	4-600	400	Bat.
NR2	10-12	2	5 x 6	4-600	750	Bat.
NR3	15-18	3	5 x 6	4-600	1000	Bat.
NR4	20-24	4	5 x 6	4-600	1250	Bat.
F2	16-18	2	6⅜x 8	350-400	1600	Bat.
F3	24-26	3	6⅜x 8	350-400	2000	Bat.
F4	32-35	4	6⅜x 8	350-400	2400	Bat.
F6	50-60	6	6⅜x 8	350-400	3800	Bat
NK2	20-25	2	7½x10	3-400	3000	Bat.
NK3	30-35	3	7½x10	3-400	3500	Bat.
NK4	45-50	4	7½x10	3-400	4200	Bat.
NK6	75-80	6	7½x10	3-400	5600	Bat.
Palmer 2-Cycle G.						
C*	4	1	4½x4½	450	240	M. & B.
D*	6	1	5 x6	450	350	M. & B.
Q1	2½	1	3¾x3½	700	125	J. S.
Q2	5	2	3¾x3½	700	180	J. S.
P1	4	1	4½x4½	650	210	J. S.
P2	8-10	2	4½x4½	650	325	J. S.
*Also kerosene.						

Model	Rated H.P.	No. Cyls.	Bore and Stroke	Normal R.P.M.	Weight Complete Lbs.	Ignition
Sturtevant 4-Cycle G.						
E-4	75	4	4½x6	1600	700	Mag.
Sumner 2-Cycle Heavy Oil.						
F.	350	4	16½x22	200	40000	Surf.
S.	600	6	16½x22	200	80000	Surf.
Stork 2-Cycle G.						
....	3	1	3½x3½	700	120	J. S.
....	4	1	4 x 4	700	180	J. S.
....	6	1	4½x4½	700	225	J. S.
....	8	1	5 x5	700	370	J. S.
....	6	2	3½x3½	700	200	J. S.
....	8	2	4 x4	700	400	J. S.
....	12	2	4½x4½	700	450	J. S.
....	16	2	5 x5	700	555	J. S.
....	12	3	4 x4	700	550	J. S.
....	18	3	4½x4½	700	600	J. S.
Stork 4-Cycle G.						
....	8	2	4½x5½	600	700	J. S.
....	10	2	5 x6	500	900	J. S.
....	12	2	5½x6½	500	900	J. S.
....	16	2	6 x7	400	1500	J. S.
....	20	2	6⅜x8	400	2000	J. S.
....	25	2	7½x9	400	2500	J. S.
....	16	4	4½x5½	700	1200	M. & B.
....	20	4	5 x6	500	1500	M. & B.
....	24	4	5½x6½	500	1500	M. & B.
....	32	4	6 x7	400	3000	M. & B.
....	40	4	6¾x8	400	3500	M. & B.
....	50	4	7½x9	400	4500	M. & B.
....	30	6	4½x5½	700	1400	M. & B.
....	50	6	5½x6½	700	1800	M. & B.
....	75	6	7½x9	400	6000	M. & B.
Union 4-Cycle G.-K.-Dist.						
Marine	7	1	5⅞x 6¾	450	....	M. & B.
....	14	2	5⅞x 6¾	500	....	M. & B.
....	21	3	5⅞x 6¾	500	....	M. & B.
....	28	4	5⅞x 6¾	500	....	M. & B.
....	35	3	7½x 9	360	4825	M. & B.
....	45	3	8¼x10½	330	6450	M. & B.
....	60	3	9 x11	320	7400	M. & B.
....	80*	3	10 x12	310	10700	M. & B.
....	85	4	9 x11	330	10140	M. & B.
....	110*	3	12 x15	280	17600	M. & B.
....	110*	4	10 x12	330	12350	M. & B.
....	150*	4	12 x15	290	22750	M. & B.
....	225*	4	14½x18	225	36400	M. & B.
....	250*	4	15¼x20	200	49785	M. & B.
....	300*	4	16 x21	210	55700	M. & B.
....	125	6	9 x11	320	14400	M. & B.
....	225*	6	12 x15	300	30600	M. & B.
....	325*	6	14½x18	225	50400	M. & B.
....	375*	6	15¼x20	200	69100	M. & B.
*Open crosshead cylinders.						
Universal 4-Cycle G.-K.						
C	9-12	4	2⅝x4	1200	325	Opt.
Doman 4-Cycle G.-K.						
K	4	1	3¾x4½	600	225	M. or B.
B	5-7	1	4¾x6	400-600	550	M. or B.
HM2	12-15	2	4¾x6	600-800	750	Mag.
HM4	25-40	4	4¾x6	600-900	1200	Mag.
T2	20-25	2	6 x7	400-800	1200	Mag.
T4	40-50	4	6 x7	400-800	1950	Mag.
Van Blerck 4-Cycle G.						
M-4	75-100	4	5¾x6	1000-1500	1798	M. & B.
M-6	112-150	6	5¾x6	1000-1500	2100	M. & B.
M-8	152-200	8	5¾x6	1000-1500	2667	M. & B.
MM-4	37-65	4	5¾x6	600-1000	1798	M. & B.
MM-6	52-94	6	5¾x6	600-1000	2100	M. & B.
MM-8	70-125	8	5¾x6	600-1000	2667	M. & B.
Vulcan 4-Cycle G.						
....	4	1	4⅝x 6	500	300	J. S.
....	5	1	5¼x 7	500	400	J. S.
....	7½	1	6½x 7¼	450	600	J. S.
....	11	1	7½x 8½	400	900	J. S.
....	8	2	4⅝x 6	550	650	J. S.
....	10	2	5¼x 7	500	900	J. S.
....	15	2	6½x 7¼	475	1300	J. S.
....	22	2	7½x 8½	425	2200	J. S.
....	25	3	6½x 7¼	475	1700	J. S.
....	35	3	7½x 8½	425	2800	J. S.
....	56	3	8¾x10½	400	4200	J. S.
....	16	4	4⅝x 6	550	900	J. S.
....	20	4	5¼x 7	500	1200	J. S.
....	30	4	6½x 7¼	475	2050	J. S.
....	45	4	7½x 8½	425	3400	J. S.
....	75	4	8¾x10½	375	5500	J. S.
....	40	6	5¼x 7	550	1750	J. S.
....	70	6	7½x 8½	425	4500	J. S.
Winona 2-Cycle G.						
....	5	1	4½x4½	700	....	J. S.
....	10	2	4½x4½	700	....	J. S.
....	15	3	4½x4½	700	....	J. S.
....	20	4	4½x4½	700	....	J. S.
Western 4-Cycle Diesel.						
....	75	3	9¼x14	325	21000	Comp.
....	100	4	9¼x14	325	26000	Comp.
....	150	6	9¼x14	325	35000	Comp.

Model	Rated H P.	No. Cyls.	Bore and Stroke	Norma R.P.M.	Weight Complete Lbs.	Ignition
Goshen 2-Cycle G. (White Mfg. Co.).						
A.	4	1	4x5	500	135	Bat.
B.	8	1	5x6	500	200	Bat.
E.	9	2	4x5	500	280	Mag.
F.	14	2	5x6	500	410	Mag.
Winton 4-Cycle G.						
W6	80	6	6½x 9	450	5400	Mag.
W5	125	6	8 x11	400	10000	Mag.
W11	200	6	9½x14	450	18000	Mag.
W28	150	6	6½x 9	900	4000	Mag.
W29	200	8	6½x 9	900	5000	Mag.
Winton 4-Cycle Diesel.						
W24A	300	6	12⅝x18	210	34 tons	.....
W35	200	6	11 x14	250	22 tons	.....
W40	400	8	12⅝x18	210	42 tons	.....
52	50	3	7½x11	425	5¾ tons	.....
53	75	4	7½x11	425	7½ tons	.....
54	125	6	7½x11	425	12 tons	.....
58	150	4	11 x14	260	15 tons	.....
Wisconsin 2-Cycle G.						
A.	5	1	4 x4	700	160	Bat.
B.	7	1	4½x4½	700	190	Bat.
C.	10	2	4 x4	750	240	Bat.
D.	15	2	4½x4½	750	300	Bat.
E.	20	3	4 x4	850	340	B. & M.
F.	27	3	4½x4½	900	400	B. & M.
J-L	2	1	2⅝x2½	750	55	Bat.
K-M	2	1	2⅝x2½	750	55	Mag.
N	3½	1	3¼x3¼	750	100	Mag.
Wisconsin 4-Cycle G.						
EM.	24	4	4 x5	1000	625	Mag.
AM.	40	4	4¾x5½	1000	800	Mag.
JM.	48	4	5.1x5.5	1000	800	Mag.
MM.	62	4	5¾x7	800	1290	Mag.
GM.	60	6	4¾x5½	1000	1360	Mag.
PM.	90	6	5¾x7	800	1565	Mag.
JRM.*	110	4	5.1x5.5	2200	875	Mag.
LRM.	158	6	5.1x5.5	2200	1225	Mag
*Racing engine.						
Wolverine 4-Cycle G.-K.						
Special	5	1	5½x 6	500	600	Mag.
	14	2	6½x 7	400-425	1545	Mag.
	22	3	6½x 7	400-425	2285	Mag.
	32	3	7½x 9	350-375	3914	Mag.
	42	3	8½x 9	350-375	4130	Mag.
	60	3	9½x12	300-325	7000	Mag.
	80	3	11 x12	300-325	7516	Mag.
	110	3	12½x14	300-325	12400	Mag.
	160	6	11 x12	330	13600	Mag.
	200	6	11 x15	330	17110	Mag.
Semi-Heav. Duty	35-40	4	5½x 7	700-800	1800	Mag.
....	40	2	8½x11	350	4800	Comp.
....	60	3	8½x11	350	8500	Comp.
....	80	4	8½x11	350	12000	Comp.
Wright Reliable 4-Cycle G.-K.						
S.	10	1	6 x7½	450	1280	Mag.
S.	20	2	6 x7½	450	1810	Mag.
S.	30	3	6 x7½	450	2416	Mag.
S.	40	4	6 x7½	450	3142	Mag.
S.	60	6	6 x7½	450	4630	Mag.
P.	15	1	7½x9	350	1780	Mag.
P.	30	2	7½x9	350	3018	Mag.
P.	45	3	7½x9	350	4068	Mag.
P.	60	4	7½x9	350	5065	Mag.
P.	90	6	7½x9	350	7000	Mag
Werkspoon Semi-Diesel 2-Cycle.						
Marine	9	1	*162x*164	500	1325	Hot ball
Marine	16	1	210x240	400	2800	Hot ball
Marine	24	1	236x280	375	3740	Hot ball
Marine	38	2	224x256	375	5450	Hot ball
Marine	55	2	260x290	375	7800	Hot ball
Marine	70	2	280x360	325	9250	Hot ball
Marine	120	2	360x400	300	17500	Hot ball
Marine	140	4	280x360	325	16000	Hot ball
Marine	180	2	420x480	250	25500	Hot ball
Marine	240	4	360x400	300	32000	Hot ball
Marine	360	4	420x480	250	46000	Hot ball
Marine	500	6	420x480	225	70000	Hot ball
*Dimensions in millimeters.						
Werkspoon Diesel 2-Cycle.						
....	550	6	420x750	165	160000	.....
....	850	6	520x900	135	240000	.....
....	150	3	300x500	225	30000	.....
....	200	4	300x500	225	40000	.....
Peerless 4-Cycle G.-K.						
....	5-6	1	5 x6	850	450	Bat.
....	10-12	2	5 x6	850	600	Bat.
....	16-20	4	4 x6	1000	750	M. & B.
....	25-35	4	5 x6	1000	850	M. & B
....	20-24	2	5¾x7	700	1200	M. & B.
....	40-50	4	5¾x7	700	1700	M. & B.
Pierce-Budd 2-Cycle G.						
....	4-6	1	4x4	1000-1500	125	Bat.
....	18-25	3	4x4	300-1800	240	Bat.
Red Wing 4-Cycle G.-K.						
D.	10-14	4	2¾x4	1000	340	Opt.
A.	14-20	4	3½x4½	800	670	Mag.
AA.	18-24	4	3¾x4¾	800	680	Mag.
F.	28-36	4	4 ⅛x5	1000	780	Mag.
B.	32-40	4	4½x5	1000	820	Mag.

Model	Rated H.P.	No. Cyls.	Bore and Stroke	Normal R.P.M.	Weight Complete Lbs.	Ignition
Regal 4-Cycle G.-K.						
Y*	2	1	3¼x3½	800	130	J. S.
FA.	4	1	4 x4½	800	290	J. S.
UA.	5	1	4½x5½	650	385	J. S.
EA.	7	1	5¼x6½	500	745	J. S. or
JA.	9	1	6½x7	400	1265	M. & B
FB.	8	2	4 x4½	800	540	J. S.
UB.	10	2	4½x5½	700	730	J. S.
EB.	14	2	5¼x6½	500	1040	J. S. or
JB.	18	2	6½x 7	400	1680	M. & B
FC.	16	4	4 x4½	700	730	J. S.
UC.	20	4	4½x5½	650	1035	J. S.
EC.	30	4	5¼x6½	500	1600	J. S.
CB.	32	4	4½x5½	1000	800	Mag.
JC.	36	4	6½x7	400	2700	J. S.
SC.	50	4	7½x9	400	4600	J. S.
SH.	100	8	7½x9	350	8600	J. S.
*Gasoline only.						
Roberts 4-Cycle G.-K.						
H.	8	2	3¾x4	1000	163	Opt.
H-4	16	4	3¾x4	1000	240	Opt.
Smith Marine 4-Cycle G.						
V-12 cyl.	400-500	12	5x7	1700	1250	Bat.
Mohawk 4-Cycle G.						
B20	3½	1	3½x3¾	900	145	Mag.
B21	7	1	4½x4½	900	225	Mag.
B22	7	2	3½x3¾	900	215	Mag.
B23	14-16	2	4½x4½	900	395	Mag.
S24	5-6	1	4⅛x3¾	1200	155	Mag.
S25	10-12	2	4⅛x3¾	1200	220	Mag.
S26	15-21	3	4⅛x3¾	1200	290	Mag.
S27	21-30	3	4½x4½	1200	495	Mag.
M28	6	1	4½x4½	700	275	Mag.
M29	12	2	4½x4½	700	400	Mag.
M30	18	3	4½x4½	700	510	Mag.
H31	5	1	4½x4½	500	310	Mag.
H32	10	2	4½x4½	500	510	Mag.
K33	6	1	4½x4½	700	280	Mag.
K34	12	2	4½x4½	700	410	Mag.
K35	25	4	4½x4½	700	775	Mag.
Scripps 4-Cycle G.-K.						
D-2	10-12	2	4¼x6	500-700	525	M. & B.
D-2	15-18	2	4¼x6	800-1000	525	M. & B.
D-4	25-40	4	4¼x6	600-950	975	M. & B.
D-4	40-60	4	4¼x6	1000-1600	900	M. & B.
D-6	35-55	6	4¼x6	600-900	1400	M. & B.
D-6	60-85	6	4¼x6	1000-1600	1290	M. & B.
Sears, Roebuck & Co. Motorgo 2-Cycle G.						
....	2½	1	3¼x3¼	750	97	Bat.
....	4	1	4 x4	750	135	Bat.
....	6	2	3½x3½	750	154	Bat.
....	8	2	4 x4	750	222	Bat.
Outboard	1¼	1	2⅝x2½	850	70	Bat.
					62	Mag.
Smalley 2-Cycle G.						
MB.	4-6	1	4½x4½	.....	.....	.....
MBB.	12-15	2	4½x4½	.....	.....	.....
Frisco Standard 4-Cycle, G., K., and Dist.						
C.	5	1	5¾x 6½	400	1555	Opt.
A²	8	2	4¾x 6	440	1800	Opt.
B²	10	2	5½x 6	400	2190	Opt.
E.	12	2	6 x 7	380	2750	Opt.
F.	16	2	6¼x 7½	360	2930	Opt.
M.	20	2	7¼x 9	320	4635	Opt.
H.	25	3	6¼x 7	450	3710	Opt.
K.	30	3	6½x 8	360	5045	Opt.
O.	40	3	8 x10	320	6820	Opt.
P.	50	3	8¾x10½	300	9215	Opt.
O⁴	65	4	8 x10	360	7120	Opt.
R.	80	3	9¾x12	280	12310	Opt.
P⁴	85	4	8¾x10½	350	13150	Opt.
S	110	3	11¾x15	250	20285	Opt.
R⁴	120	4	9¾x12	320	19500	Opt.
S⁴	175	4	11¾x15	275	28500	Opt.
S⁶	275	6	11¾x15	300	32700	Opt.
Standard 4-Cycle G.						
....	10-12	2	5 x 6½	400	850	M. & B.
....	16-18	2	6 x 8	350	1200	M. & B.
....	20-24	4	5 x 6½	400	1600	M. & B.
....	24-27	3	6 x 8	350	1800	M. & B.
....	32-37	4	6 x 8	350	2800	M. & B.
....	50-54	6	6 x 8	350	3200	M. & B.
....	50-60	4	6½x 8	550	3250	J. S.
....	65-75	4	8 x10	350	5300	M. & B.
....	70-90	6	6½x 8	550	4200	J. S.
....	90-100	6	8 x10	350	8000	M. & B.
....	125-150	6	8½x11	350	5800	M. & B.
....	220	6-10	x11	460	6300	M. & B.
....	300	6-12	x14	350	9500	M. & B.
....	500	6-12	½x13	350	18000	M. & B.
2K.W.*	4	1	4½x 4½	750	900	.....
4K.W.*	8	2	4½x 5½	700	1300	.....
*Auxiliary engines.						
Stearns 4-Cycle G.						
MA*	27-50	4	4¾x6½	500-950	1600	Mag.
MAU*	27-50	4	4¾x6½	500-950	1750	Mag.
MD*	35-60	4	5⅛x6½	500-950	1650	Mag.
MDU*	35-60	4	5⅛x6½	500-950	1850	Mag.
MDH†	60-75	4	5⅛x6½	500-600	2000	Mag.
MDR**	90-100	4	5⅛x6½	1500-1650	1150	Mag.
MG††	20-45	4	4¼x6	500-1200	1050	Mag.
MGU††	20-45	4	4¼x6	500-1200	1200	Mag.
MH††	22-50	4	4½x6	500-1200	....	Mag.
MHU††	22-50	4	4½x6	500-1200	....	Mag.
MHR**	65	4	4½x6	1650	....	Mag.
Sterling 4-Cycle G.						
D.	12-15	2	5½x7	400-500	1150	Mag.
FH.	25-55	4	5½x6¾	400-800	2050	M. & B.
FH.	35-85	6	5½x6¾	400-800	2450	M. & B.
FH.	50-115	8	5½x6¾	400-800	2750	M. & B.
FM.	60-85	4	5½x6¾	800-1200	1700	Mag.
FM.	85-125	6	5½x6¾	800-1200	2250	Mag.
FM.	120-170	8	5½x6¾	800-1200	2600	Mag.
FM.	240-300	8	6¾x9	800-1000	5000-5600	Mag.
FS.	90-100	4	5½x6¾	1200-1400	1400	Mag.
FS.	130-145	6	5½x6¾	1200-1400	1750	Mag.
FS.	180-200	8	5½x6¾	1200-1400	2400	Mag.
GR.	150	4	5¾x6¾	1500-1600	Under 1525	Bat.
GR.	225	6	5¾x6¾	1500-1600	Under 2000	Bat.
GR.	300	8	5¾x6¾	1500-1600	Under 2800	Bat.
GM.	98	4	5¾x6¾	600-1200	1875	M. & B.
GH.	63	4	5¾x6¾	400-800	2000	M. & B.
GM.	145	6	5¾x6¾	600-1200	2400	M. & B.
GH.	94	6	5¾x6¾	400-800	2500	M. & B.
GM.	195	8	5¾x6¾	600-1200	2900	M. & B.
GH.	126	8	5¾x6¾	400-800	3000	M. & B.
GRS.	185	4	5¾x6¾	1950	1550	Bat.
GRS.	275	6	5¾x6¾	1950	1960	Bat.
GRS.	365	8	5¾x6¾	1950	2500	Bat.

*Iron cases. †Incl. flywheel and silent iternal gear reduction drive in unit with flywheel inclosure propeller speed 60% engine speed. **—All aluminum, Lynite rods, high-speed pistons. ††—Aluminum cases.

British Marine Engine Practice

By M. W. Bourdon

THERE is no great divergence in type among the 160 odd models of marine engines made by approximately 30 British manufacturers. With the Green a notable exception, the vast majority are of a heavy duty pattern departing from automobile practice in many particulars, especially in respect of weight per b.h.p. and normal speed. Nevertheless, a few makers supply a modified car or truck type engine for light craft, though these motors rarely exceed 16-20 hp.; the Green series already mentioned stands quite alone with their separate steel cylinders and copper water jackets and made in sizes up to 450 hp. with from four to eighteen cylinders.

The representative British marine engine, as distinct from the Diesel and semi-Diesel pattern, is a four-cycle motor weighing from 40 to 80 lb. per horsepower and running normally at from 500 to 900 r.p.m. It is designed for kerosene as fuel, either starting on gasoline or having an exhaust jacketed vaporizing chamber heated initially by means of a blow lamp. It is not marked by high efficiency in fuel consumption but is a reliable and durable unit built for hard service.

Many makers have a big range of models, embracing a dozen or more combinations as to cylinder numbers and dimensions; and some of these firms are open to extend the range to meet with a specific demand. But there is, nevertheless, a tendency toward standardizing a smaller number of types and sizes in an endeavor to reduce manufacturing costs, which must obviously be high when a big range is made with such small outputs as are general.

Although the accompanying specification table deals only with gasoline and kerosene engines, it should be stated here that the field of the heavier types of the latter is being invaded by makers of crude oil motors working on the semi-Diesel principle. In fact, Brooke, who for years has specialized in marine engines of the former type, has seen fit to put forward a small single cylinder semi-Diesel motor. The latter type appeals to users of commercial craft, where weight is not so important a consideration as fuel cost.

Among gasoline and kerosene marine engines the four-cycle type very largely predominates, accounting for 93 per cent, the two-cycle motors including the range of the original maker (Day) of the type with crankcase compression, the largest of these being a two-cylinder model termed 16 hp. with a bore and stroke of 4¾ x 4¾ in.

Only 17 per cent of engines are put forward as burning gasoline exclusively, the remainder being offered for either gasoline or kerosene, or for the latter primarily. An impulse starter with magneto ignition is standard on 55 per cent of engines, the former fitting generally being put into or taken out of action by hand. L-head cylinders are the most widely in evidence (67 per cent), the T-head variety, which until comparatively recent years predominated, having still further receded, though still appearing throughout the range of two makers and intermittently in that of another. Valves in the head are exceptional; with an overhead camshaft

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British Marine Engines, 1922

Name	H. P.	Two or Four Cycle	No. of Cyls.	Bore and Stroke	Fuel	Normal R.P.M.	Impulse Starter	Lubrication System	Valve Arrgt.	Governor	Type of Water Pump	Type of Oil Pump	Price of Engine Only £	Weight of Engine Only Lb.
A B C	6	4	1	4¼x 5	Ker	800							72	240
A B C	12	4	2	4¼x 5	Ker	800							110	360
A B C	20	4	2	6 x 7	Ker	600							205	800
A B C	36	4	4	10½x12½	Ker	600							364	1520
A B C	35	2	1	10½x12½	Ker	350							575	4620
A B C	60	2	2	10½x12½	Ker	325							895	9100
A B C	120	2	4	10½x12½	Ker	325							1480	19800
Ailsa Craig	12	4	4	2¾x 4	Gas. or ker.	950	Yes	Press.	I[1]	No	Plunger	Gear	....	308
Ailsa Craig	4½	4	1	3½x 4½	Gas. or ker.	900	Yes	Press.	L	Yes	Plunger	Gear	80	308
Ailsa Craig	9	4	2	3½x 4½	Gas. or ker.	900	Yes	Press.	L	Yes	Plunger	Gear	135	420
Ailsa Craig	15	4	4	3½x 4½	Gas. or ker.	900	Yes	Press.	L	Yes	Plunger	Gear	260	812
Ailsa Craig	8½	4	1	4⅝x 6	Gas. or ker.	700	Yes	Press.	L	Yes	Piston	Plunger	161	700
Ailsa Craig	26	4	3	4⅝x 6	Gas. or ker.	700	Yes	Press.	L	Yes	Gear	Gear	341	1176
Ailsa Craig	17	4	2	5 x 5½	Gas. or ker.	700	Yes	Press.	L	Yes	Piston	Gear	240	924
Ailsa Craig	34	4	4	5 x 5½	Gas. or ker.	700	Yes	Press.	L	Yes	Piston	Gear	385	1372
Ailsa Craig	50	4	6	5 x 5½	Gas. or ker.	700	Yes	Press.	L	Yes	Piston	Gear	580	1904
Aster	7	4	1	4¾x 5⅞	Gas. or ker.	800	No	Press.	L	Yes	Gear	Gear	132[2]	590
Aster	7	4	4	2⅝x 3⅜	Gas. or ker.	1200	No	Circ. spl.	L	Yes	Gear	Gear	224[2]	500
Aster	14	4	2	4⅝x 5½	Gas. or ker.	900	No	Press.	L	Yes	Gear	Gear	236[2]	750
Aster	16	4	2	4¾x 5⅞	Gas. or ker.	800	No	Press.	L	Yes	Gear	Gear	232[2]	820
Aster	18	4	4	3⅝x 4¾	Gas. or ker.	900	No	Press.	L	Yes	Gear	Gear	281[2]	890
Aster	25	4	4	4⅝x 5½	Gas. or ker.	900	No	Press.	L	Yes	Gear	Gear	375[2]	1344
Aster	40	4	4	5⅝x 5⅞	Gas. or ker.	900	No	Press.	L	Yes	Gear	Gear	429[2]	1680
Aster	60	4	6	5⅝x 5⅞	Gas. or ker.	900	No	Press.	L	Yes	Gear	Gear	842[2]	2300
Aster	90	4	8	5⅝x 5⅞	Gas. or ker.	900	No	Press.	L	Yes	Gear	Gear	1000[2]	2910
Atlantic	7	4	2	3½x 4¾	Ker	1000	Yes	Drip. & Spl.	L	Yes	Piston	None	145[3]	.....
Atlantic	14	4	4	3½x 4¾	Ker	1000	Yes	Drip & Spl.	L	Yes	Piston	None	215[3]	.....
Atlantic	10	4	2	4 x 5	Ker	1000	Yes	Drip & Spl.	L	Yes	Piston	None	165[3]	1071
Atlantic	20	4	4	4 x 5	Ker	1000	Yes	Drip & Spl.	L	Yes	Piston	None	250[3]	1280
Atlantic	9	4	1	6 x 8	Ker	550	Yes	Drip & Spl.	L	Yes	Piston	None	165[3]	1452
Atlantic	16	4	2	5½x 7	Ker	550	Yes	Drip & Spl.	L	Yes	Piston	None	265[3]	1590
Atlantic	18	4	2	6 x 8	Ker	550	Yes	Drip & Spl.	L	Yes	Piston	None	300[3]	1753
Atlantic	30	4	4	5½x 7	Ker	550	Yes	Drip & Spl.	L	Yes	Piston	None	350[3]	1908
Atlantic	35	4	4	6 x 8	Ker	550	Yes	Drip & Spl.	L	Yes	Piston	None	450	2546[3]
Atlantic	60	4	6	6 x 8	Ker	550	Yes	Drip & Spl.	L	Yes	Piston	None	750	3000
Barcar	7½	4	1	5¼x 6	Gas. or ker.	750	Yes	Circ. spl.	L	No	Piston	Gear	85	784
Barcar	15	4	2	5¼x 6	Gas. or ker.	750	Yes	Circ. spl.	L	No	Piston	Gear	190	1120
Barcar	22½	4	3	5¼x 6	Gas. or ker.	750	Yes	Circ. spl.	L	No	Piston	Gear	310	1568
Barcar	30	4	4	5¼x 6	Gas. or ker.	750	Yes	Circ. spl.	L	No	Piston	Gear	415	1960
Boulton & Paul	3	4	1	3¼x 4½	Gas. or ker.	950	No	Circ. spl.	L	Yes	Gear	Spiral gear	85	240
Brit	7	4	1	5 x 7	Gas. or ker.	650	Ex	Drip.	L	Ex	Plunger	None	81	500
Brit	14	4	2	5 x 7	Gas. or ker.	650	Ex	Drip.	L	Ex	Plunger	None	146	800
Brit	8	4	1	5½x 8	Gas. or ker.	600	Ex	Drip.	L	Ex	Plunger	None	94	650
Brit	16	4	2	5½x 8	Gas. or ker.	600	Ex	Drip.	L	Ex	Plunger	None	214	1000
Brit	13	4	1	8 x10	Gas. or ker.	350	Ex	Drip.	L	Ex	Plunger	None	150	2000
Brit	30	4	2	8 x10	Gas. or ker.	380	Ex	Drip.	L	Ex	Plunger	None	240	3000
Brit	45	4	3	8 x10	Gas. or ker.	380	Ex	Drip.	L	Ex	Plunger	None	330	4000
Brooke	3	2	1	3⅜x 3¾	Gas. or ker.	850	Ex	Drip & Spl.		No	Plunger	None	....	140
Brooke	4	4	1	3⅝x 4¼	Gas. or ker.	950	Ex	Drip & Spl.	T	Yes	Eccentric	None	....	160
Brooke	8	4	2	3⅝x 4¼	Gas. or ker.	950	Ex	Circ. spl.	T	Yes	Eccentric	Gear	....	425
Brooke	14	4	3	3⅝x 4¼	Gas. or ker.	1000	Ex	Circ. spl.	L	Yes	Eccentric	Gear	....	700
Brooke	18	4	4	3⅝x 4¼	Gas. or ker.	1000	Ex	Circ. spl.	T	Yes	Eccentric	Gear	....	830
Brooke	25	4	6	3⅝x 4¼	Gas. or ker.	1000	Ex	Circ. spl.	L	Yes	Eccentric	Gear	....	1050
Brooke	20	4	2	5½x 6	Gas. or ker.	800	Ex	Circ. spl.	T	Yes	Eccentric	Gear	....	1100
Brooke	45	4	4	5½x 6	Gas. or ker.	900	Ex	Circ. spl.	T	Yes	Eccentric	Gear	....	1655
Brooke	65	4	6	5½x 6	Gas. or ker.	900	Ex	Circ. spl.	T	Yes	Eccentric	Gear	....	2100
Brotherhood-Ricardo	30	4	4	4¾x 5½	Ker	900	Ex	Pressure	L	No	Centrif.	Plunger	....	1500
Day	3	2	1	3¼x 3¼	Gas	850	No	Drip & Spl.	None	No	Gear	None	38	75
Day	6	2	1	4⅛x 4½	Gas	800	No	Drip & Spl.	None	No	Gear	None	55	175
Day	12	2	2	4⅛x 4½	Gas	750	No	Drip & Spl.	None	No	Gear	None	90	300
Day	16	2	2	4¾x 4¾	Gas	700	No	Drip & Spl.	None	No	Gear	None	110	450
Dixon	10	4	1	4¾x 6½	Gas. or ker.	900	Yes	Press.	T	Yes	Gear	Gear	200	634
Dixon	20	4	2	4¾x 6½	Gas. or ker.	900	Yes	Press.	T	Yes	Gear	Gear	325	832
Dixon	30	4	3	4¾x 6½	Gas. or ker.	900	Yes	Press.	T	Yes	Gear	Gear	440	1200
Dixon	40	4	4	4¾x 6½	Gas. or ker.	900	Yes	Press.	T	Yes	Gear	Gear	500	1450
Dixon	60	4	6	4¾x 6½	Gas. or ker.	900	Yes	Press.	T	Yes	Gear	Gear	650	1920
Dixon	70	4	4	6 x 6½	Gas. or ker.	950	Yes	Press.	F	Yes	Gear	Gear	940	2070
Dixon	105	4	6	6 x 6½	Gas. or ker.	950	Yes	Press.	F	Yes	Gear	Gear	1200	2800
Dixon	3½	4	1	3½x 3½	Gas. or ker.	950	Yes	Press.	F	Yes	Gear	Gear	100	225
Dixon	7	4	2	3½x 3½	Gas. or ker	950	Yes	Press.	F	Yes	Gear	Gear	175	390
Dixon	14	4	4	3½x 3½	Gas. or ker.	950	Yes	Press.	F	Yes	Gear	Gear	280	700
Dixon	250	4	12	7 x 7½	Gas. or ker.	900	Yes	Press.	F	Yes	Gear	Gear	....	5068
Dixon	10	4	2	3¾x 5	Gas. or ker.	900	No	Press.	L	No	Piston	Piston	180[4]	670
Dixon	15	4	2	4½x 6	Gas. or ker.	800	No	Press.	L	No	Piston	Piston	300[4]	1100
Dixon	20	4	4	3¾x 5	Gas. or ker.	900	No	Press.	L	No	Piston	Piston	400[4]	1000
Dixon	30	4	2	6½x 8¾	Gas. or ker.	550	No	Press.	L	No	Piston	Piston	500[4]	1500
Dixon	40	4	4	5½x 7½	Gas. or ker.	650	No	Press.	L	No	Piston	Piston	560[4]	3200
Dixon	60	4	4	6½x 8¾	Gas. or ker.	600	No	Press.	L	No	Piston	Piston	900[4]	5050
Dixon	90	4	6	6½x 8¾	Gas. or ker.	600	No	Press.	L	No	Piston	Piston	1280[4]	8300
Fyfe Wilson	10	4	4	2⅝x 4⅝	Gas	1000	No	Press.	L	No	Eccentric	Gear	100	220
Fyfe Wilson	18	4	4	3½x 5	Gas	1000	No	Press.	L	Yes	Gear	Plunger	175	400
Gardner	24	4	2	6½x 7½	Gas. or ker.	600	No	Press.	T	Yes	Gear	Gear	....	2800
Gardner	36	4	3	6½x 7½	Gas. or ker.	600	No	Press.	T	Yes	Gear	Gear	....	3470
Gardner	48	4	4	6½x 7½	Gas. or ker.	600	No	Press.	T	Yes	Gear	Gear	....	4140
Gardner	55	4	3	8 x 9	Gas. or ker.	500	No	Press.	T	Yes	Gear	Gear	....	5400
Gardner	75	4	4	8 x 9	Gas. or ker.	500	No.	Press.	T	Yes	Gear	Gear	....	6050
Gardner	110	4	6	8 x 9	Gas. or ker.	500	No	Press.	T	Yes	Gear	Gear	....	9400
Gardner	9	4	2	4 x 4½	Gas. or ker.	1000	No	Press.	T	Yes	Gear	Gear	....	420
Gardner	12	4	3	4 x 4½	Gas. or ker.	1000	No	Press.	T	Yes	Gear	Gear	....	530
Gardner	17	4	4	4 x 4½	Gas. or ker.	1000	No	Press.	T	Yes	Gear	Gear	....	672
Gardner	24	4	2	5½x 6½	Gas. or ker.	800	No	Press.	T	Yes	Gear	Gear	....	.....
Gardner	36	4	3	5½x 6½	Gas. or ker.	800	No	Press.	T	Yes	Gear	Gear	....	.....
Gardner	48	4	4	5½x 6½	Gas. or ker.	800	No	Press.	T	Yes	Gear	Gear	....	.....
Gleniffer	10	4	2	4¼x 5	Ker	900	Yes	Circ. spl.	L	Yes	Piston	Disk	130	900
Gleniffer	24	4	4	4¼x 5	Ker	900	Yes	Circ. spl.	L	Yes	Piston	Disk	255[5]	1350
Gleniffer	36	4	6	4¼x 5	Ker	900	Yes	Circ. spl.	L	Yes	Piston	Disk	370[5]	1670
Gleniffer	12	4	1	6 x 8	Ker	650	Yes	Circ spl.	L	Yes	Piston	Flywheel	185	2200
Gleniffer	25	4	2	6 x 8	Ker	650	Yes	Circ. spl.	L	Yes	Piston	Flywheel	280	2744
Gleniffer	50	4	4	6 x 8	Ker	650	Yes	Circ. spl.	L	Yes	Piston	Flywheel	505	3572
Gleniffer	75	4	6	6 x 8	Ker	650	Yes	Circ. spl.	L	Yes	Piston	Flywheel	745	4400
Grampian	10	4	2	4 x 5	Gas. or ker.	800	No	Spl.	L	No	Gear	None	120	560
Grampian	20	4	4	4 x 5	Gas. or ker.	800	No	Spl.	L	No	Gear	None	170	800
Green	35	4	4	4⅜x 4¾	Gas. or ker.	1250	Opt	Press.	I[6]	No	Gear	Gear	....	224
Green	50	4	6	4⅜x 4¾	Gas. or ker.	1250	Opt	Press.	I[6]	No	Gear	Gear	....	364

British Marine Engines, 1922—Continued

Name	H. P.	Two or Four Cycle	No. of Cyls.	Bore and Stroke	Fuel	Normal R.P.M.	Impulse Starter	Lubrication System	Valve Arrgt.	Governor	Type of Water Pump	Type of Oil Pump	Price of Engine Only £	Weight of Engine Only Lb.
Green	60	4	4	5½x 5¾	Gas. or ker.	1250	Opt	Press.	I[6]	No	Gear	Gear	....	610
Green	100	4	6	5½x 6	Gas. or ker.	1250	Opt	Press.	I[6]	No	Gear	Gear	....	950
Green	150	4	6	5⅝x 7	Gas. or ker.	1250	Opt.	Press.	I[6]	No	Gear	Gear	....	1220
Green	275	4	12	5⅝x 6¾	Gas. or ker.	1250	Opt	Press.	I[6]	No	Gear	Gear	....	1540
Green	450	4	18	5⅝x 7	Gas. or ker.	1250	Opt	Press.	I[6]	No	Gear	Gear	....	2200
Kelvin	3½	4	1	3½x 4¾	Gas. or ker.	800	Yes	Spl.	L	Yes	Gear	None	80[7]	400
Kelvin	7	4	2	3½x 4¾	Gas. or ker.	800	Yes	Spl.	L	Yes	Gear	None	108[7]	585
Kelvin	14	4	4	3½x 4¾	Gas. or ker.	800	Yes	Spl.	L	Yes	Gear	None	158[7]	780
Kelvin	8	4	1	5½x 7	Gas. or ker.	550	Yes	Spl.	L	Yes	Gear	None	115[7]	820
Kelvin	15	4	2	5½x 7	Gas. or ker.	550	Yes	Spl.	L	Yes	Gear	None	180[7]	1030
Kelvin	30	4	4	5½x 7	Gas. or ker.	550	Yes	Spl.	L	Yes	Gear	None	288[7]	1840
Kelvin	30	4	2	7½x10	Gas. or ker.	410	Yes	Spl.	L	Yes	Gear	None	324[7]	2360
Kelvin	60	4	4	7½x10	Gas. or ker.	410	Yes	Spl	L	Yes	Gear	None	540[7]	4250
McLaren	10	4	2	4 x 5	Ker.	850	No	Circ. spl.	L	No	Gear	Gear	....	500
McLaren	20	4	4	4 x 5	Ker.	850	No	Circ. spl	L	No	Gear	Gear	....	890
McLaren	30	4	6	4 x 5	Ker.	850	No	Circ spl.	L	No	Gear	Gear	....	1300
Parsons	7	4	1	4½x 6	Gas. or ker.	800	No	Press.	L	Opt	Eccentric	Gear	116	470
Parsons	14	4	2	4½x 6	Gas or ker.	800	No	Press.	L	Opt	Eccentric	Gear	174	625
Parsons	21	4	3	4½x 6	Gas. or ker.	800	No.	Press.	L	Opt	Eccentric	Gear	222	900
Parsons	28	4	4	4½x 6	Gas. or ker	800	No	Press.	L	Opt	Eccentric	Gear	260	1060
Parsons	42	4	6	4½x 6	Gas. or ker.	800	No	Press.	L	Opt	Eccentric	Gear	360	1610
Parsons	30	4	2	6½x 8	Gas. or ker.	600	No[1]	Press.	L	Yes	Eccentric	Gear	326	2060
Parsons	45	4	3	6½x 8	Gas. or ker.	600	No[1]	Press.	L	Yes	Eccentric	Piston	428	2695
Parsons	60	4	4	6½x 8	Gas. or ker.	600	No[1]	Press.	L	Yes	Eccentric	Piston	514	3205
Parsons	90	4	6	6½x 8	Gas. or ker.	600	No[1]	Press.	L	Yes	Eccentric	Piston	733	5010
Phillip	7	4	1	4¾x 5½	Gas. or ker.	850							....	600
Phillip	14	4	2	4¾x 5½	Gas. or ker.	850							....	950
Phillip	28	4	4	4¾x 5½	Gas. or ker.	850							....	1300
Phillip	20	4	4	4 x 5½	Gas. or ker.	850							....	950
Pollock (Clyde)	20	4	2	5½x 6	Ker.	700	Yes	Tr. & press.	I	Yes	Gear	Gear	150	1120
Pollock (Clyde)	40	4	4	5½x 6	Ker.	700	Yes	Tr. & press.	I	Yes	Gear	Gear	290	1680
Seal	4	4	1	4 x 3¼	Gas. or ker.	900							....	150
Seal	6	4	1	5½x 4½	Gas. or ker.	800							....	300
Seal	10	4	1	6¼x 5½	Gas. or ker.	800							....	450
Thornycroft[8]	15	4	2	4½x 6	Gas. or ker.	1000	No	Circ. spl.	L	Yes	Gear	Gear	....	924
Thornycroft[8]	30	4	4	4½x 6	Gas. or ker.	1000	No	Circ. spl.	L	Yes	Gear	Gear	....	1918
Thornycroft[9]	26	4	4	4 x 5½	Gas. or ker.	1100	No	Circ. spl.	F	Yes	Gear	Gear	....	1316
Thornycroft[10]	50	4	4	6 x 8	Gas. or ker.	700	No	Circ. spl.	F	Yes	Gear	Gear	....	2912
Thornycroft[10]	75	4	6	6 x 8	Gas. or ker.	700	No	Circ. spl.	F	Yes	Gear	Gear	....	4000
Thornycroft[11]	70	4	6	4 x 7	Gas	1300	No	Circ. spl.	F	No	Gear	Gear	....	1190
Wasp	7	4	1	4⅛x 6	Ker.	800	No	Circ. spl.	I	No	Plunger	Plunger	....	330
Wasp	14	4	2	4⅛x 6	Ker.	800	No	Circ. spl.	I	No	Plunger	Plunger	....	530
Watermota[12]	3	2	1	2¾x 3	Gas. (outboard)	900	No	Pet. & oil[13]	None	No	Plunger	None	62	100
Watermota	3	2	1	2¾x 3	Gas	900	No.	Pet. & oil	None	No	Plunger	None	34	60
Watermota	6	2	2	2¾x 3	Gas	900	No	Pet. & oil	None	No	Plunger	None	55	95
Wear	5	4	1	4¼x 6	Gas. or ker.	700	Ex	Circ. spl.	L	No.	Plunger	Plunger	140	670
Wear	10	4	2	4¼x 6	Gas. or ker.	700	Ex	Circ. spl.	L	No	Plunger	Plunger	210	950
Wear	20	4	4	4¼x 6	Gas. or ker.	700	Ex	Circ. spl.	L	No	Plunger	Plunger	350	1510
Wear	48	4	4	6½x 6½	Gas. or ker.	650	Ex	Circ. spl.	L	No	Plunger	Plunger	680	2660
Wear	70	4	6	6½x 6½	Gas. or ker.	650	Ex	Circ. spl.	L	No	Plunger	Plunger	1000	3135
Webber	15	4	2	4 x 6	Gas. or ker.	800	Ex	Press.	L	Yes	Plunger	Plunger	170	670
Webber	30	4	4	4 x 6	Gas. or ker.	800	Ex	Press.	L	Yes	Plunger	Plunger	....	.....
Wolseley	16	4	4	3⅝x 4¾	Gas. or ker.	1000	No	Circ. spl.	L	No	Gear	Gear	340	670
Wolseley	30	4	6	3¾x 5⅛	Gas. or ker.	1000	No	Circ. spl.	L	No	Gear	Gear	420	950
Wolseley	60	4	6	4¾x 5¾	Gas. or ker.	1000	No	Circ. spl.	L	No	Gear	Gear	800	1450

1—Overhead Camshaft; **2**—Price Includes Reverse Gear, Stern Gear and Kerosene Vaporizer; **3**—Price includes Water-Cooled Crankcase, Reverse Gear, Etc.; **4**—Price Includes Reverse Gear and Stern Gear; **5**—Price and Weight with Reverse Gear, Etc.; **6**—For High Speed Boats—with Overhead Camshaft and Electric Starter; **7**—Price and Weight with Reverse Gear, Etc.; **8**—For Commercial Craft and Auxiliaries; **9**—For Fast Launches; **10**—For Yachts, Fishing Boats, Etc.; **11**—For High Speed Boats; **12**—Price and Weight for Whole Outfit; **13**—Lubricating Oil Mixed with Fuel.

British Marine Engine Practice

(*Continued from page* 396)

they appear in all one maker's engines—the high efficiency Green motors already mentioned—and a similar arrangement occurs in a small new model Ailsa Craig, a well-established make with a range of four-cylinder types having many features common to automobile truck practice.

Throttle governors appear on 61 per cent of engines. The gear-wheel type of water pump with phosphor bronze gears is most widely favored in British marine engines, being used in 50 per cent; next comes the type consisting of an unringed piston and an eccentric rod, the solid plunger type with cam or crank pin operation coming third; only one engine has the purely centrifugal type of water pump so widely used on cars and trucks. Gear-wheel pumps for oil circulation still more largely predominate, being represented on 72 per cent of engines as against plunger 11 per cent and piston 9 per cent; one maker uses skew cut teeth for the interior pinions. The oil pump is almost invariably outside the sump of the crankcase and is usually located above the crankshaft level to increase accessibility when the engine is in position in the hull.

The majority of engines have a system of lubrication embodying a hollow or drilled crankshaft through which the oil is forced by the pump, but the pressure system rarely extends beyond the crankshaft, the camshaft bearings having catch-pits over them, while splash serves for other interior details. This represents an advance in design over that of quite recent years, when a simple drip feed and splash system was the rule.

In general appearance British marine engines are not "clean"; they do not exhibit an attempt to secure simplicity of controls and connections which characterizes automobile engines; they have the appearance of embodying many afterthoughts, and they are not, in the main, manufactured to very close limits of accuracy or interchangebility. But some of these shortcomings are intentional. The location of oil and water pumps is a case in point; they are purposely placed with exterior drives and well away from the crankcase in order that they may be more accessible when the engine is in position with, usually, its crankcase enclosed in a part of the hull or below bottom-boards.

Exports

Export Figures Show Sound Basis for Future Business

Closing months of 1921 showed an upward trend in American exports. Total business during 1921 reached 28 per cent of 1920 total despite greatly decreased unit value. Comparison of yearly statistics difficult since there never yet has been a normal year in export trade.

By George E. Quisenberry *

A STATISTICAL study of the American foreign trade in automobiles and automotive equipment for 1921 reveals that the year was one of drastic deflation and readjustment, with the low point having been reached in June, July and August, and with the closing months showing the natural upswing that resulted from the bettered business condition of the world in general. The position of the American exporter of automotive products at the end of the year may be likened to that of 1918, when the war closed, with every sign pointing to the larger demand and to the greater volume of shipments that came with the succeeding years. This reassertion of demand is again in evidence and, without a sudden expansion or a boom in the foreground, we well may expect shipments of much increased volume and value.

The trade in late 1921 bore many general resemblances to that of 1918. The volume in the two years was somewhat equal, a comparison of the shipments bearing out this assertion quite closely, and more than one exporter in late 1921 found orders on his books to duplicate almost those that were coming in as the war ceased. The automotive industry then was beginning to readjust itself to a changed state and to sense the demand that was springing throughout the world for automotive vehicles. A somewhat similar situation presents itself to-day. Commerce has gone through its deflation period and is adjusting itself to what, in want of a better term, we may call a normal progress. In this normal progress there is need for automobiles, trucks, tractors and equipment, and this need is again beginning to assert itself. The difference is that the desire a few years ago was for pleasure and luxury vehicles into which to sink wartime profits; to-day the demand calls for vehicles of transportation, essential and necessary in the daily conduct of business, industry and agriculture. This, rather than luxury, will be the basis of our future trade.

A capitulation of the 1921 sales from the United States shows the following results and comparison with the preceding year:

	1921		1920	
	No.	Value	No.	Value
Passenger cars	30,941	$32,573,665	142,508	$165,255,921
Motor trucks	7,402	10,300,404	29,126	46,765,781
Parts and accessories		38,949,574		85,362,093
Tires		16,466,155		52,570,103
Total		$98,029,216		$349,953,898

Porto Rico, Hawaii and Alaska not included.

To this must be added the shipments of tractors, motorcycles and airplanes to complete the statistical story of the year.

Shipments valued at $4,583,234 for eight months, March 1 to Oct. 31, from Canada are shown in tables published elsewhere in this issue.

On the four major items, with no consideration taken of the greatly decreased prices at which these products were sold, the total business in 1921 was just 28 per cent of that of 1920. The wonder is not that the amount was so low but that it was so high. When account is taken of the dumping, by some manufacturers, of long-pending orders in late 1920, the business situation that prevailed in all quarters and the lowering of prices, it will come as a surprise to many that such a total was possible in 1921. This can be accounted for only by the fact that American automotive equipment has won a solid place in international commerce and that its buying could only be slackened and not stopped in the midst of the most drastic deflation the world has ever known. There is every hope for the future of such an industry.

However, the comparison of one year's exports with another is almost a futile pastime. There has never been a normal year in this trade, so short a time has elapsed since the American makers began their overseas efforts and so short has been the time since the world, outside of the United States, began to realize the essential transportation quality of the automobile. However, the sale in 1921 of the major products (cars, trucks, tires and parts and accessories) was nearly three times that of 1914 and just below that of 1918, the figures for these years having been $36,704,073 and $124,016,496, compared with something more than $98,000,000 last year.

And even this total does not reveal the true volume in 1921, due to several factors with which some manufacturers may not be acquainted. These are the overseas construction of Ford cars and the volume of shipments from Canada. Ford assembles cars in many centers, such as Buenos Aires (where his plant within six months or more has been doubled in volume to a capacity of 150 daily), Sao Paulo, Manchester, Cadiz, Bordeaux, Copenhagen, Cork (for tractors) and Yokohama. The cars, trucks and tractors assembled in those cities are as surely American automobiles as though they were made at Highland Park. Their total shows, in the export statistics, only as parts.

Managing editor, El Automovil Americano.

Ford supplies many territories directly from Canada, the Ford Motor Co. of Canada, Ltd., being authorized to do business with the British dominions and colonies of Africa, Australasia, Asia, including India, and the Pacific. A recent announcement from the Canadian Ford company stated that there were now some 100,000 Ford automobiles in those sections and that, at the end of 1921, shipments were running at about 50 per cent of normal, with steady improvement being recorded.

General Motors, which vies with Ford for first honors in the export field, is now shipping all Buick and Chevrolet orders to every country from its Oshawa, Canada, plant at a rate that in early February, according to a statement of the company, was about 80 per day, and directed to such territories as Argentina, Brazil, Latin America, Australia, Spain and many others. The first of these shipments was made from Oshawa last October, although most of the orders during that month were shipped from the plants in this country. With November, however, all Buick and Chevrolet shipments were made from Oshawa, being cleared from Canadian ports or through New York in bond, thus not showing on the official export statistics from this country. Cadillac and G. M. C. trucks are still going forward from United States plants, as also have been Oakland models. However, with the formation of a Canadian Oakland company, the export shipments on this line also are being transferred to Oshawa. Further, a certain other volume of General Motors sales are credited from the London branch and have no part in either American or Canadian figures.

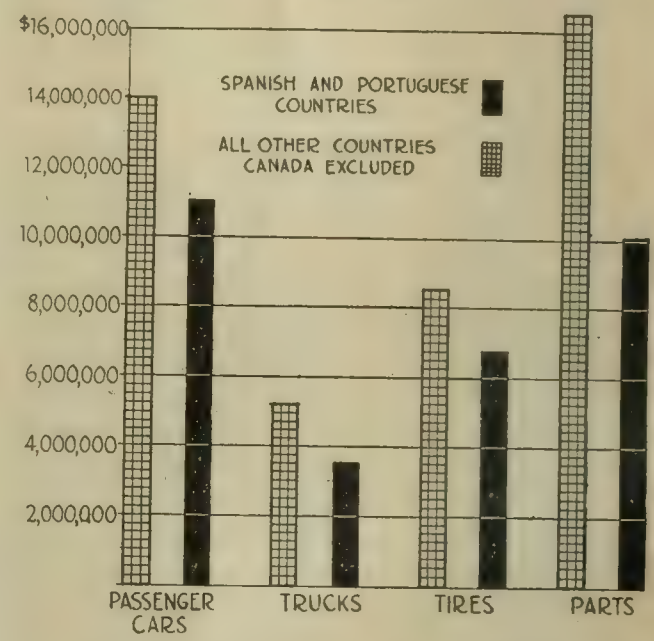
The extent of these Canadian shipments by the General Motors Export Co. during the last two months of 1921 and the opening part of 1922 has not been understood by many American exporters. With a reorganized personnel and with representatives throughout the world ready to take immediate advantage of any change in the general business situation, the company has again built up a heavy schedule of overseas business. Much of the plans of the General Motors Corp. for increased production this year is based upon the expectation that foreign sales will be materially heavier in 1922 than in 1921, and this seems justified by the current volume of export orders.

A statement from the General Motors Export Co. shows shipments of 195 cars to England and 176 to other parts of the world were made from the Oshawa plant in November. These figures were greatly exceeded in December, when 564 cars went to England and 774 to other parts of the world. Besides England, Australia and Argentina were the chief purchasers of these cars, and the company went into 1922 with schedules calling for even heavier shipments. This volume for November and December does not show on either the United States export statistics for the year or in the Canadian tables published elsewhere, these tables ending with Oct. 31. The December shipments of cars from the United States were 2652, as compared with the General Motors Canadian shipments of 1338.

Studebaker, in addition to Ford and General Motors, likewise supplies its overseas demands from Canada to some of those British dominions having preferential tariff arrangements. Other companies, perhaps, are doing likewise.

No previous year in the history of the industry was in any way analogous to 1921. The period opened with certain companies still shipping on old orders that had not been filled while the demand was so high at home in 1919 and 1920. Consequently, the first month or so showed shipments still keeping up to a high level. But these late shipments were to cause many troubles and to halt the normal progress of our export industry throughout the rest of the year. Stocks piled up in foreign centers, as in Buenos Aires which, early in 1921, reported unsold cars totalling 3500, exclusive of Fords. Shipments slackened off under the impact of these excessive deliveries and for months new orders were practically unknown to automotive exporters. The low point was reached, as was stated, in June, July and August, the exporters in the meantime having little other than orders from Mexico to keep them in business. Mexico, for 1921, forms a story in herself, but it was Mexico that for many months kept alive the hope of the automotive foreign sales manager, while dealers and distributers in other countries were valiantly battling against the piled-up surplus of cars.

However, those who made the blackest predictions about the future of automotive exporting did so without consideration of the world's recuperative powers. The



Comparison of Export Buyers — Canada excluded (U. S. Export Figures)

unsold stocks began to dwindle, as overseas dealers instituted every sort of sales efforts, marked down prices, started time payment plans or otherwise went after the problem that confronted them. The Buenos Aires bugaboo, for instance, blew away. As the year ended, the number of cars unsold in the custom house became nearer 300 than 3500 and new orders were sent by cable or mail to the United States. These new orders, led off by the perpetual exporter Ford, began to appear in September and October and, generally increased from all territories as exchange on the various purchasing countries improved or stabilized themselves. Australia and Argentina have the honor of leading in the new buying, but numerous other countries signalized the better conditions by turning up with actual orders or inquiries, the whole being in greater volume than for many months.

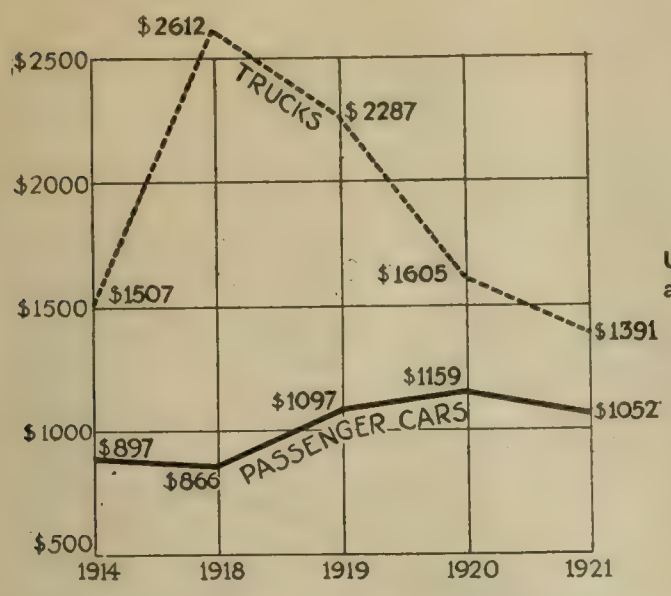
This, in a few words, is the merchandising history of the year—a year that probably will never be duplicated, but one that has cleansed the industry of much of the fungus growth that was its greatest enemy during the excessively prosperous days of 1919 and 1920. Only the better elements in the export business have survived the crash and these firms are preparing now for the more prosperous times that seem so positively on the horizon.

But the statistics for 1921 must not be overlooked to show the localities that have become of importance to the automotive trade. Some rather surprising shifts from 1920 are indicated by the year's totals and these should be studied carefully by manufacturers who are preparing to lay out their foreign sales plans and to develop those international outlets which are so needed to keep production to its highest output.

In order of importance, by the value of cars, trucks,

tires and parts shown in the export statistics, as released by the Bureau of Foreign and Domestic Commerce, but with totals computed by the Class Journal Co., the different territories in 1921 were:

Canada, England, Mexico, Australia, Argentina, Cuba, Dutch East Indies, New Zealand, Japan, Denmark, India,



Unit value of cars and trucks exported

Spain, Sweden, France, Philippine Islands, Brazil, South Africa, China, Uruguay and Belgium. Mexico jumped from fourteenth place in 1920 to third and India dropped from third to eleventh in 1921.

Canada, the leader, however, does not come within the province of the export office and England greatly slowed up purchases of completed cars and trucks, the volume to Britain of $12,086,160 for the year having been composed of $7,417,488 for parts and accessories, $3,352,008 for tires, $793,644 for cars and $423,020 for motor trucks. Because of this condition we find the countries of Latin America and the Far East assuming more significance as automotive buyers and these are the markets that the American exporter should cultivate the more strongly. This is borne out by a careful analysis of general conditions. The Far East and Latin America are resting undoubtedly on the most solid business foundations of any sections of the world, excepting the United States, Canada and Great Britain. Argentina is undergoing a commercial change that is truly remarkable, based upon a fundamental overturn affecting her most important crops. Wheat prices have jumped upward some 25 cents or more per bushel since Jan. 1, and this is the period of the Argentine harvest, with her big crops of wheat going on the market at these higher prices. This spells good conditions for the agriculturists of that southern country and should mark their return as buyers. Agentine exchange has appreciated so rapidly that early in February the premium on the dollar had been reduced to 14 or 15 per cent. Linseed, hides, wool and even mutton are being shipped to the United States in volume and the commercial situation in Argentina has improved accordingly, especially as the European purchase of grains and meats also has grown larger. Furthermore, with 75,000 or 80,000 automobiles, Argentina is exceeded in automotive ownership only by the United States, Canada, England, France and Germany.

Australia and New Zealand, under the impulse of somewhat similar conditions, but reflecting the changed commercial aspect throughout the world, developed an actual shortage of automobiles during the last quarter of the year and those manufacturers who were watching their markets with care suddenly found themselves making large shipments to that country. Sterling exchange, the remarkable gains of which are among the outstanding developments in world finance, climbed above $4.35 in early February, to within about 9 per cent of par, and the Australasian condition has reacted in conformity.

Few exporters to-day look upon Europe, excepting a few countries, as offering many immediate opportunities for the sale of American automobiles and this is amply borne out by the statistical picture. England was second on the list of buyers of all automotive products in 1921, Denmark and Spain were ten and twelve, Sweden and France thirteen and fourteen and Belgium ranked twenty. In the purchase of complete cars, no European nation ranked higher than tenth, as shown by the United States figures, England taking that place, with Spain as eleventh and Netherlands, Switzerland and Belgium fifteenth, sixteenth and seventeenth.

This probably indicates the European situation satisfactorily, with the exception that Spain may not be given sufficient importance. Spanish exchange has climbed materially and the balance of trade between that country and the United States now rests with Spain, due to increasing purchases here of Spanish products. The sale of automobiles there was almost impossible during 1921 because of a restrictive tariff, but that is being changed to a figure favoring imports and many evidences indicate that Spain will return to the automotive markets this year. It should be added that Spain is on a sound financial basis.

Fortunately, automotive buying became more general during the last few months of the year. Mexico, although still keeping up heavy purchases, lost much of the leadership that was hers in 1921, when the automobiles and trucks used in her borders actually increased in number from 40 to 50 per cent. But other countries, resuming trade, cut down the Mexican lead and no longer will that country be the only one in which merchandising effort should be made. Cuba and Porto Rico are taking automobiles again, Venezuela, Brazil and Colombia are buying cars, trucks and equipment. This is true of several territories of the Far East. India, which suffered from heavy overstocks in 1921, is buying in somewhat greater volume and this also is evidenced from the Dutch East Indies and the Philippines. South Africa has responded to the bettered conditions and, like India, should be more of a figure in 1922.

To complete the picture from 1921, it seems desirable to list the chief purchasers of the various products making up the major items. For completed cars (including chassis), the ranking, by value and not by number, was:

Canada, Mexico, Australia, Cuba, Dutch East Indies, Sweden, Japan, India, New Zealand, Argentina, England, Spain, South Africa, China, Philippine Islands, Nether-



Relative standing of leading countries, purchasers of all automotive products—Canada excluded (U. S. Export Figures)

lands, Switzerland, Belgium, Uruguay, Panama and Venezuela.

On parts and accessories which include shipments to the Ford branches, the order was Canada, England, Argentina, Denmark, Mexico, Cuba, France, Dutch East Indies, Brazil, Australia, Philippine Islands, Peru and Uruguay. The relative standing for motor trucks, by value and not by volume, was Canada, Mexico, Australia, Dutch East Indies, Japan, England, Cuba, Brazil, New Zealand, India, Philippine Islands, Netherlands, Straits Settlements, Sweden, China, Panama, Peru and Trinidad.

An entirely different line-up existed in regard to tires, the leading countries being England, Cuba, Mexico, Canada, Argentina and the Philippine Islands. These were followed by New Zealand, Sweden, Dutch East Indies, India, France, Spain, Denmark, Australia and South Africa.

The Spanish and Portuguese speaking countries played no inconsiderable part in bringing up the totals, despite the severity of their economic readjustment. They are credited with having imported approximately 31 per cent of all American shipments, a percentage that would be materially increased if no account were taken of the exports from this country to Canada. The final quarter of 1921 witnessed an increase of 38 per cent over the third quarter for their purchases. The following comparison has been made of the parts played by these countries in rolling up the export totals of 1920 and 1921. The comparison shows that 39 per cent of all cars in 1921 went to Spanish and Portuguese countries, against 26 per cent in 1920; 33 per cent of the trucks against 31, 41 per cent of the tires against 34 per cent, with parts purchases remaining unchanged at 25 per cent for each period. These figures are percentages of total world shipments.

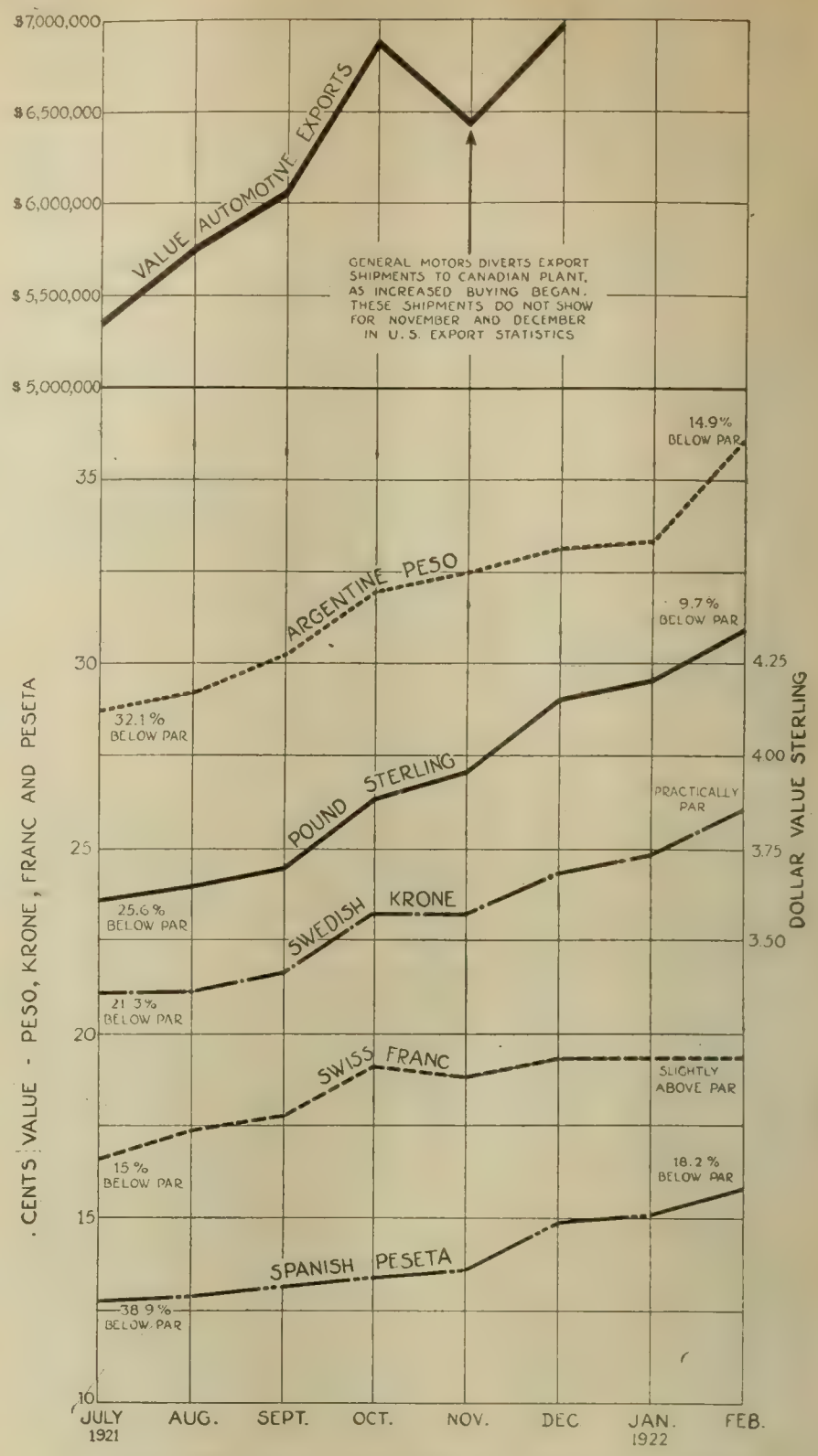
In closing this rather incomplete survey of the export field, it can be said that stocks of unsold cars have completely disappeared in many centers and are nearing liquidation elsewhere. that the adjustment period has proceeded staisfactorily and that the fundamental commercial situation in many countries has undergone a vast improvement in recent months, due to the bettered international aspect, both politically and economically. No considerable European competition, except in regard to tires, high-priced cars and some categories of heavy trucks is yet more than a possibility of the future, except in the European countries themselves. Road and highway improvement activities are under way in many sections and of immediate concern to manufacturers and producers, is the fact that overseas dealers and distributors within recent months have materially enhanced their service and merchandising facilities. The export section of the industry, here at home, has weathered the shock of the deflation period and has bettered itself accordingly. Thus, the following sentences from a Buenos Aires letter of recent date, written by a competent American business observer, points the way of the future:

"I can assure you that the friendship and good will of the automobile dealers are not lost. Also, I feel sure that our American manufacturers have shown a very ready disposition to get together with their local dealers and that the situation is adjusting itself in a manner satisfactory to all concerned."

South America Buys American Planes

The table of American airplane exports presented in this number comprises the first bringing together of this information in complete form for a period of years. The tables show the airplane exports for five years, including twelve months of 1921.

During these five years 581 airplanes were exported from this country, their total value amounting to $4,494,471. Some three million dollars' worth of this total is



Expansion of automotive exports followed exchange betterment during last 6 mo. of 1921

of little interest from an export trade standpoint since it comprised war supplies. The figures for the last three years, however, are of considerable value.

The striking point of these latter year figures is the large proportion of the total bought by Spanish-speaking countries. Out of a total business of $598,174 in 1920, the Spanish countries bought airplanes valued at $498,480. In 1921, the total exports were $314,940, while South America absorbed $222,061 worth. In other words, the trade with Latin America and other Spanish-speaking countries in 1920 amounted to 83 per cent of the total and in 1921 to 71 per cent.

These figures indicate that since the war, South America has furnished by far the best foreign market for American planes, and that there is a possibility of further development along this line. Taking the six-year period covered by the table, the Latin American business does not, of course, comprise so large a per cent of the total as during the last two years, since the war business was European. The Spanish countries did buy 36 per cent of the total value and 19 per cent of the total number.

Exports of Automotive Parts, 1907-1921 (

	1907	1910	1912	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918
Europe:										
Austria	$717	$2,511	$2,195	$4,572	$5,198	$1,045	.....	.....	.....	.....
Azores and Madeira Islands	.....	50	99	720	1,384	1,800	$1,532	$1,270	$198	$1,6
Belgium	5,187	9,991	13,614	4,897	20,978	446	.....	.....	906	.....
Bulgaria	.....	.....	823	40	390	.....	.....	.....	.....	.....
Czechoslovakia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Denmark	2,029	2,339	2,996	6,646	8,664	13,710	31,886	53,917	1,048	5,2
Finland	.....	.....	1,104	1,799	2,931	1,178	5,627	55	.....	.....
France	23,477	54,035	85,537	165,950	179,351	480,764	2,216,823	3,700,812	3,999,904	3,158,6
Germany	14,252	10,023	80,036	113,602	213,351	13,770	.....	.....	.....	.....
Gibraltar	.....	57	100	.....	514	229	617	525	61	.....
Greece	.....	.....	454	379	807	2,010	24,724	12,604	4,675	13,4
Latvia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Iceland and Faroe Islands	.....	.....	.....	17	180	880	456	2,608	2,757	3,3
Italy	5,502	4,421	6,304	14,156	50,580	65,521	115,260	180,977	99,947	26,1
Malta, Gozo & Cyprus Islands	.....	.....	.....	.....	.....	.....	.....	54	.....	.....
Netherlands	1,049	3,532	6,440	14,135	7,634	3,055	41,525	96,200	3,625	.....
Norway	400	2,684	934	1,636	1,893	15,607	59,769	100,542	18,855	65,2
Poland and Danzig	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portugal	.....	394	865	920	2,357	3,239	45,356	66,929	20,274	11,7
Roumania	.....	.....	2,734	1,003	887	.....	391	.....	.....	.....
Russia in Europe	4,004	7,004	1,743	9,566	14,079	123,667	2,498,879	1,624,431	328,633	1
Serbia, Montenegro and Albania	.....	.....	113	.....	.....	.....	4,932	.....	.....	.....
Spain	3,620	2,854	3,755	3,192	6,266	7,347	32,743	95,720	154,850	52,8
Sweden	9,748	3,818	3,789	4,276	6,140	4,211	37,917	26,891	4,032	.....
Switzerland	178	1,894	.....	457	1,069	400	1,150	565	54	.....
Turkey in Europe	.....	.....	964	116	.....	267	.....	.....	.....	.....
England	*116,248	240,329	931,909	922,866	1,282,388	3,282,973	7,202,475	6,121,211	6,329,114	3,328,5
Scotland		238	874	1,485	23,269	29,403	52,414	22,146	955	154,6
Ireland		54	523	451	250	208	7,181	1,264	.....	.....
Jugoslavia, Albania, etc.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
North America:										
Bermuda	.....	.....	52	330	254	125	615	64	7	.....
British Honduras	193	73	165	509	163	684	548	1,379	2,638	1,8
Canada	195,989	1,023,368	2,392,592	3,104,097	3,663,879	2,741,178	7,492,639	9,148,110	12,054,824	5,677,(
Central American States:										
Costa Rica	255	2,376	1,320	4,516	6,208	5,041	10,162	7,498	23,613	1,9
Guatemala	24	2,124	2,062	1,851	1,613	732	2,367	9,852	9,111	2,8
Honduras	1,465	48	151	308	1,053	6,870	15,649	12,639	11,952	4,3
Nicaragua	160	38	86	741	47	609	666	964	2,264	4,8
Panama	274	3,180	4,689	11,738	16,988	25,861	34,180	56,657	72,180	26,4
Salvador	.....	526	2,790	2,242	2,481	2,371	3,717	11,314	10,179	4,3
Mexico	131,553	81,248	47,479	46,743	41,508	30,819	42,258	125,823	431,440	260,4
Miquelon, Langley & St. Pierre Is.	.....	.....	.....	.....	300	.....	25	5	65	.....
Newfoundland and Labrador	132	1,508	2,026	2,993	3,901	3,632	8,672	9,972	4,129	5,1
West Indies, British:										
Barbados			3,209	5,055	4,177	4,216	6,383	14,452	15,089	7,1
Jamaica	†2,310	†14,085	23,569	25,355	24,693	32,337	53,867	54,854	65,429	22,(
Trinidad and Tobago			4,847	9,119	13,003	12,865	21,826	44,060	55,794	24,3
Other British			1,426	1,157	2,538	3,707	9,303	12,863	21,446	7,4
Cuba	18,095	49,088	31,594	35,928	48,217	101,429	411,731	906,710	1,028,277	566,4
Danish (Virgin Island of U. S.)	.....	.....	558	1,640	1,206	865	975	1,876	2,844	2,4
Dominican Republic	.....	253	3,381	1,331	3,439	3,633	12,389	35,301	39,816	44,4
Dutch	.....	.....	281	1,767	2,754	4,598	3,288	6,052	4,707	1,4
French	50	101	97	198	8,099	7,423	9,546	24,672	53,518	17,4
Haiti	.....	.....	331	2,212	1,095	185	3,285	3,962	24,385	7,4
South America:										
Argentina	10,137	22,150	70,446	74,138	92,663	49,990	222,637	1,458,111	3,088,534	706,4
Bolivia	190	.....	25	172	1,209	2,880	3,453	11,864	14,533	4,4
Brazil	8,665	7,802	35,680	108,859	84,602	28,633	59,935	134,326	233,414	103,4
Chile	3,527	663	2,656	4,711	22,405	14,721	72,939	248,043	806,015	359,4
Colombia	17	2,286	7,681	18,676	19,970	9,695	18,967	27,777	40,717	8,4
Ecuador	.....	613	3,461	9,115	6,324	4,458	8,014	12,648	12,964	4,4
Guiana:										
British	.....	1,303	3,181	3,809	4,583	5,116	6,809	23,597	35,081	23,4
Dutch	.....	7	12	39	911	1,702	2,052	3,212	3,282	1,4
French	.....	.....	6	125	.....	165	328	11	2,337	
Paraguay	.....	.....	32	.....	.....	1,030	848	228	698	
Peru	1,666	1,884	1,604	2,550	5,982	4,727	5,458	27,332	88,098	61,4
Uruguay	.....	1,390	12,599	32,978	21,401	14,359	27,086	125,913	183,005	47,4
Venezuela	.....	9	4,648	20,123	36,286	28,750	40,783	87,768	57,873	28,4
Asia:										
Aden	.....	.....	.....	502	1,676	361	998	4,541	263	
China	690	845	2,254	3,134	5,825	5,265	21,661	54,753	60,134	39,4
Kwantung (leased territory) ‡	.....	.....	.....	.....	.....	.....	46	1,747	672	
Chosen	.....	.....	748	2,271	2,791	282	10,377	2,125	2,812	9,4
East Indies, British:										
British India	2,444	6,387	14,568	18,336	47,923	44,735	129,562	345,855	294,909	99,4
Straits Settlements	1,343	1,172	5,273	14,660	25,100	20,388	39,025	70,043	69,968	66,4
Other British	.....	170	829	901	4,099	4,062	8,540	27,710	23,273	4,4
Dutch	1,758	4,577	3,452	11,453	15,368	15,232	34,638	193,225	192,430	338,4
French	.....	.....	.....	.....	.....	274	.....	.....	1,998	2,4
Far Eastern Republic	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Greece in Asia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hejas, Arabia, etc.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hongkong	123	290	2,711	92	626	1,088	2,180	2,885	7,702	9,4
Japan	5,021	3,375	39,681	51,619	35,637	26,028	30,446	116,130	319,038	235,4
Persia	.....	.....	.....	.....	.....	174	.....	.....	1,090	3,4
Palestine and Syria	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Russia in Asia	.....	67	.....	.....	.....	107,351	226,255	146,083	25,512	.....
Siam	2,134	921	970	1,925	4,905	2,451	34,412	9,734	7,639	3,4
Turkey in Asia	.....	.....	30	239	67	214	.....	.....	.....	3,4
Oceania, British:										
Australia	3,826	21,533	102,427	166,176	202,363	199,154	389,690	753,309	1,052,986	963,4
New Zealand	25,625	5,150	26,095	37,438	53,644	48,111	176,618	285,654	309,658	243,4
Other British	.....	.....	971	470	1,060	665	1,991	4,751	4,674	2,4
French	.....	.....	495	3,032	7,560	5,730	5,640	4,383	6,272	2,4
Other	.....	.....	.....	220	396	.....	66	936	7,138	2,4
Philippine Islands	4,168	17,154	62,631	53,434	69,933	40,228	63,756	116,670	178,036	198,4
Africa:										
Belgian Congo	.....	.....	.....	.....	.....	.....	34	.....	.....	..4
British:										
West	.....	.....	56	465	5,743	6,537	20,311	64,938	49,077	21,4
South	3,000	14,655	29,123	62,304	157,246	100,240	286,401	422,200	811,323	193,4
East	.....	2,473	851	1,444	3,203	3,929	11,371	9,599	23,290	4,4
Canary Islands	.....	76	13	879	1,505	1,939	2,111	3,261	1,300	
French Africa	.....	.....	327	73	200	2,660	2,458	2,316	7,163	1,4
Kamerun, etc.	.....	.....	.....	.....	999	522	21,098	.....	.....	..4
Liberia	.....	.....	.....	.....	.....	13	.....	33	106	..4
Madagascar	.....	.....	.....	.....	.....	.....	.....	4	175	
Morocco	.....	.....	.....	.....	166	3,386	9,928	2,431	7,347	..4
Portuguese Africa	.....	47	910	1,222	1,585	3,431	7,064	5,339	1,160	
Spanish Africa	.....	.....	.....	.....	.....	103	.....	.....	.....	..4
Other Countries	.....	.....	.....	.....	.....	.....	.....	.....	.....	..4
Egypt	110	277	99	295	130	1,494	4,751	2,623	716	..4

*Included in totals of exports to England. †Included in totals of Exports to Jamaica. ‡Previous to 1918 listed as British, French, German and

Country	Total
Austria (Prior 1920	285 / 834 — 15,268 / $14,356,322
Azores & Madeira I	99 / 288 — 9,338 / $9,241,204
Belgium	122 / 751 — 2,093 / $2,309,369
Bulgaria	28 / 461 — 822 / $866,455
Czechoslovakia	... / ... — 4 / $5,788
Denmark	10 / 498 — 717 / $439,006
Esthonia	11 / 260 — 98 / $70,031
Finland	1 / 000 — 20 / $15,017
France	1 / 200 — 187 / $105,879
Germany	76 / 362 — 3,641 / $3,886,878
Gibraltar	164 / 382 — 10,941 / $9,250,082
Greece	275 / 425 — 3,193 / $2,574,810
Hungary	12 / 518 — 180 / $146,597
celand & Faroe Is.	499 / 803 — 5,956 / $6,633,167
Italy	12 / 519 — 12 / $4,519
Lithuania	6 / 807 — 74 / $91,298
Malta, Gozo & Cypr	... / ... — 22 / $11,342
Netherlands	... / ... — ..... / .....
Norway	... / ... — 119 / $89,397
Poland & Danzig	4 / 871 — 642 / $358,075
Portugal	820 / 609 — 23,133 / $23,453,859
Roumania	105 / 013 — 5,447 / $5,213,926
Russia in Europe	41 / 251 — 1,182 / $1,175,764
Serbia & Monteneg	675 / 059 — 14,985 / $16,766,366
Spain	32 / 258 — 662 / $713,381
Sweden	9 / 502 — 9 / $6,502
Switzerland	..... / ..... — ..... / .....
Turkey in Europe	76 / 143 — 730 / $916,210
England	281 / 542 — 11,995 / $11,873,426
Scotland	69 / 964 — 69 / $34,964
Ireland	37 / 923 — 185 / $103,589
Jugoslavia & Albani	.... / .... — 2,457 / $3,547,595
Bermuda	63 / 498 — 518 / $465,265
British Honduras	377 / 746 — 1,731 / $1,346,607
Canada	..... / ..... — ..... / .....
Costa Rica	020 / 909 — 43,793 / $39,760,261
Guatemala	691 / 552 — 23,596 / $23,425,977
Honduras	11 / 018 — 257 / $227,896
Nicaragua	10 / 643 — 232 / $186,606
Panama	14 / 245 — 84 / $63,064
Salvador	467 / 484 — 12,917 / $13,432,035
Greenland	... / ... — 5 / $2,416
Mexico	15 / 198 — 39 / $25,523
Miquelon & Langely	73 / 890 — 1,809 / $1,760,337
Newfoundland & Lal	596 / 738 — 23,431 / $22,448,403
Barbados x	112 / 866 — 1,247 / $1,085,582
Jamaica x	67 / 077 — 379 / $355,836
Trinidad & Tobago x	94 / 718 — 1,010 / $718,935
Other British West I	6 / 690 — 108 / $66,323
Cuba	..... / ..... — 8 / $4,275
Virgin Is. of U. S.	..... / ..... — 15 / $7,205
Dutch W. Indies	..... / ..... — 13 / $7,999
French W. Indies	80 / 485 — 943 / $682,297
Haiti	31 / 562 — 454 / $452,754
Dominican Republic	2 / 950 — 2 / $6,950
Argentina	212 / 365 — 2,143 / $1,975,064
Bolivia	0,959 — 553,799
	83,675 — $551,644,708

Passenger Car Exports

	1907	1910	1912	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31 1918	1919	1920	1921	Total
	8	25	100	134	314	4	.....	.....	.....	.....	12	13	21	693
A.-Hungary)	$16,611	$26,178	$78,748	$91,781	$190,199	$2,310	.....	.....	.....	.....	$15,000	$7,927	$11,647	$508,508
	.....	2	13	16	20	18	6	1	.....	.....	25	12	4	118
	.....	$2,006	$7,866	$10,549	$10,771	$10,119	$2,272	$700	.....	.....	$12,078	$11,519	$3,135	$72,280
	35	58	122	94	244	12	.....	.....	.....	.....	1,628	2,450	533	5,337
	$58,859	$147,375	$140,585	$85,679	$139,681	$15,191	.....	.....	.....	.....	$1,784,133	$2,888,057	$379,193	$5,963,262
	.....	2	28	17	43	.....	.....	.....	.....	.....	1	17	12	129
	.....	$1,890	$19,716	$11,457	$21,679	.....	.....	.....	.....	.....	$3,220	$21,105	$5,995	$91,592
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$1,040	$1,040
	40	46	51	81	263	219	806	1,215	2	96	2,519	1,099	119	6,668
	$30,464	$46,024	$41,976	$77,149	$176,947	$156,296	$548,971	$932,768	$4,100	$155,416	$2,961,948	$1,349,134	$159,586	$6,719,812
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$2,106	$2,106
	.....	.....	24	51	106	17	.....	.....	.....	.....	187	82	33	514
	.....	.....	$26,203	$53,568	$83,835	$9,163	.....	.....	.....	.....	$254,378	$124,859	$44,250	$608,305
	111	246	574	818	1,427	451	2,087	1,367	1,169	495	866	582	153	11,048
	$489,047	$771,869	$469,721	$615,086	$919,060	$252,909	$1,428,325	$836,557	$1,518,858	$331,144	$1,999,773	$933,234	$359,071	$12,710,873
	66	100	288	845	1,411	16	.....	.....	.....	.....	.....	37	22	2,997
	$141,371	$265,218	$226,227	$764,389	$1,040,787	$17,364	.....	.....	.....	.....	.....	$72,319	$45,538	$3,091,135
	1	.....	1	7	64	9	15	9	.....	.....	34	86	8	237
	$2,500	.....	$1,673	$6,576	$33,030	$6,077	$16,165	$11,518	.....	.....	$27,493	$86,276	$10,653	$212,174
	.....	.....	14	5	25	36	124	78	4	.....	269	686	122	1,368
	.....	.....	$9,355	$4,080	$28,256	$28,431	$118,398	$79,913	$6,580	.....	$407,822	$876,740	$130,048	$1,693,494
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	2
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$3,500	.....	$3,500
	.....	.....	.....	2	5	3	.....	11	15	25	74	31	7	173
	.....	.....	.....	$1,016	$2,488	$2,128	.....	$5,134	$11,396	$22,666	$58,526	$30,553	$8,450	$142,357
	93	93	211	331	342	114	382	186	129	21	26	604	29	2,832
	$249,192	$333,193	$193,037	$280,961	$241,466	$70,265	$217,240	$126,432	$78,228	$32,345	$59,531	$682,263	$43,321	$3,280,139
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$1,200	$1,200
us, etc.	.....	.....	1	.....	1	.....	.....	.....	.....	.....	.....	29	59	236
	.....	.....	$500	.....	$422	.....	.....	.....	.....	.....	$19,065	$129,504	$40,603	$190,094
	19	33	103	111	141	96	439	485	.....	.....	1,160	3,103	398	6,148
	$49,146	$76,957	$78,363	$94,163	$117,131	$131,801	$399,017	$612,495	.....	.....	$1,387,680	$3,616,862	$427,776	$7,139,851
	1	22	78	78	145	125	732	922	97	187	1,835	3,200	55	7,504
	$330	$20,669	$66,897	$66,689	$118,338	$89,357	$592,560	$944,002	$115,810	$398,266	$2,355,339	$4,025,685	$67,500	$8,889,080
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	232	107	339
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$237,139	$92,278	$329,417
	.....	9	15	73	59	14	204	283	223	26	320	540	18	1,812
	.....	$11,429	$14,752	$58,931	$65,545	$18,255	$198,975	$271,421	$270,987	$38,228	$405,880	$843,837	$40,331	$2,266,804
	.....	.....	31	38	28	.....	2	.....	.....	.....	310	173	124	755
	.....	.....	$22,543	$30,337	$17,018	.....	$3,000	.....	.....	.....	$277,884	$150,634	$132,265	$670,428
	32	97	261	580	926	907	1,268	780	492	6	17	101	14	5,731
	$27,638	$107,310	$254,047	$484,913	$898,458	$1,527,768	$3,142,616	$943,003	$1,136,400	$6,605	$8,426	$68,449	$19,564	$8,880,336
	.....	.....	4	2	4	2	3	.....	.....	.....	.....	.....	.....	16
	.....	.....	$2,520	$1,160	$2,843	$2,950	$4,200	.....	.....	.....	.....	.....	.....	$14,325
	10	12	174	186	83	71	364	1,125	1,205	459	1,458	3,796	422	9,442
	$10,640	$18,330	$116,202	$127,621	$64,758	$59,555	$299,367	$1,195,887	$1,346,826	$610,844	$1,759,606	$5,576,482	$738,030	$11,991,663
	53	45	169	256	324	137	238	390	95	1	1,546	5,398	920	9,674
	$63,051	$55,118	$127,729	$235,918	$253,588	$108,652	$180,869	$360,554	$111,377	$2,800	$2,021,948	$6,766,770	$1,039,275	$11,454,648
	1	.....	12	22	79	2	6	9	3	1	428	1,413	275	2,265
	$750	.....	$7,873	$24,965	$56,838	$1,244	$4,499	$9,248	$1,533	$1,646	$472,549	$1,781,968	$409,619	$2,784,236
	1	.....	22	13	35	.....	.....	.....	.....	.....	68	593	57	801
	$2,000	.....	$13,886	$9,814	$21,052	.....	.....	.....	.....	.....	$52,504	$544,984	$54,106	$708,082
	.....	1,258	5,660	3,783	6,992	8,321	9,810	1,268	742	88	5,150	18,732	853	65,469
	.....	$2,391,984	$4,403,361	$2,893,785	$5,615,487	$6,849,145	$6,933,806	$1,444,346	$1,712,672	$134,102	$5,573,843	$20,964,717	$793,644	$63,618,540
	739**	12	22	6	25	143	158	4	150	.....	25	540	6	2,603
	$1,414,056**	$18,109	$28,901	$8,104	$46,948	$82,708	$124,138	$2,991	$217,000	.....	$34,633	$617,257	$5,025	$4,250,264
	.....	1	34	6	2	159	60	.....	.....	.....	914	902	28	2,120
	.....	$5,500	$22,186	$5,538	$1,593	$157,091	$55,014	.....	.....	.....	$897,065	$1,023,255	$21,349	$2,205,441
***	**Includes En	gland, Irela	nd and Sco	tland.	.....	.....	.....	.....	.....	.....	.....	11	35	46
	Jugoslavia an	d Albania**	* Previous	to 1920 cla	ssed with S	ervia and M	ontenegro.	.....	.....	.....	.....	$10,431	$29,119	$39,550
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$1,800
	3	.....	.....	1	4	1	.....	12	8	5	25	20	14	95
	$4,020	.....	.....	$1,800	$3,929	550	.....	$5,774	$6,858	$4,650	$15,598	$13,593	$9,988	$69,260
	611	3,102	6,288	6,723	4,377	4,127	10,017	14,421	12,985	1,625	8,826	8,047	5,242	92,693
	$969,385	$3,340,326	$7,560,655	$8,229,324	$5,445,052	$3,723,125	$6,555,334	$11,143,740	$10,189,865	$1,461,776	$9,393,009	$10,872,591	$7,186,865	$93,276,607
	.....	2	13	13	20	9	60	37	199	.....	20	98	20	510
	.....	$1,823	$12,603	$14,955	$17,877	$3,897	$28,325	$23,125	$85,070	.....	$19,470	$116,291	$28,254	$368,839
	4	16	19	10	26	10	24	35	34	2	125	185	71	606
	$2,743	$22,094	$38,109	$14,892	$36,763	$12,012	$23,552	$36,174	$46,657	$1,815	$151,667	$254,551	$102,141	$800,371
	.....	.....	3	4	4	31	34	42	16	6	22	44	35	243
	.....	.....	$7,114	$8,100	$3,286	$20,422	$22,652	$24,564	$12,292	$11,093	$14,549	$42,248	$39,663	$206,475
	3	.....	.....	.....	.....	.....	6	5	49	28	71	157	9	328
	$2,050	.....	.....	.....	.....	.....	$3,109	$2,120	$32,031	$28,991	$61,923	$170,165	$11,044	$311,433
	2	13	20	39	58	110	228	356	129	13	173	316	267	1,754
	$1,170	$13,289	$14,271	$43,432	$51,906	$85,990	$170,964	$216,711	$93,329	$13,864	$164,698	$323,929	$277,193	$1,503,937
	.....	3	6	11	10	16	68	75	54	32	86	191	16	576
	.....	$5,565	$10,658	$13,212	$13,323	$8,888	$54,598	$62,314	$68,297	$36,884	$124,996	$287,088	$24,007	$735,139
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	465	245	273	235	155	70	383	2,807	2,578	770	2,850	4,089	6,750	22,464
	$681,086	$459,077	$418,599	$423,123	$239,166	$66,830	$309,200	$1,642,011	$1,653,545	$793,614	$2,360,346	$3,525,210	$5,183,791	$19,006,558
etc.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	3	15	14	9	5	17	21	48	27	68	138	102	9	494
brador	$9,828	$18,285	$13,812	$10,353	$2,761	$11,681	$15,632	$38,910	$34,676	$72,887	$160,414	$148,518	$16,577	$576,153
	Includes Bar	bados, Ja-	16	7	14	19	63	121	58	4	76	144	57	601
	maica, Trin	idad and	$11,310	$5,973	$12,320	$8,699	$30,688	$62,364	$33,198	$3,300	$56,797	$118,663	$43,799	$409,642
	Tobago for	1907-1908-	53	62	66	80	273	335	236	43	121	421	221	1,969
	1909-1910.	.....	$52,659	$59,131	$61,475	$61,622	$205,239	$202,375	$149,673	$39,701	$116,425	$401,789	$165,013	$1,596,470
	.....	.....	31	43	47	59	128	204	161	19	182	450	124	1,455
	.....	.....	$31,343	$39,902	$49,079	$40,281	$87,167	$112,014	$100,571	$18,474	$137,564	$414,674	$97,929	$1,136,323
ndies *	35	104	4	7	13	38	100	124	80	24	53	153	85	892
	$56,059	$157,459	$1,960	$6,716	$11,061	$18,463	$51,612	$80,879	$50,009	$15,603	$35,966	$127,046	$62,199	$803,962
	67	120	202	223	297	1,359	3,698	3,529	2,975	871	2,887	6,293	1,692	24,549
	$129,226	$187,392	$234,569	$242,686	$254,428	$745,695	$2,091,295	$2,545,071	$3,029,813	$1,295,485	$3,121,228	$7,096,895	$1,428,162	$22,908,146
	.....	.....	5	4	3	3	9	18	23	13	27	66	45	217
	.....	.....	$3,303	$2,131	$2,954	$1,375	$3,426	$9,114	$12,313	$9,194	$20,010	$46,925	$27,359	$138,827
	.....	.....	3	19	13	24	21	32	12	2	13	69	39	249
	.....	.....	$1,647	$14,590	$9,605	$16,829	$10,945	$19,191	$7,435	$1,295	$7,369	$67,376	$21,059	$178,917
	.....	.....	.....	5	65	54	101	293	248	25	156	148	22	1,118
	.....	.....	.....	$3,877	$48,377	$34,906	$63,670	$154,990	$146,698	$21,561	$137,929	$129,713	$20,647	$763,368
	.....	1	2	38	2	.....	10	29	102	22	179	202	36	623
	.....	$1,510	$910	$24,499	$1,485	.....	$3,788	$13,780	$54,613	$18,408	$158,594	$171,293	$26,173	$475,053
	1	1	13	7	11	28	131	191	248	99	173	593	102	1,623
	$1,650	$4,000	$12,739	$5,382	$15,195	$14,609	$60,127	$96,173	$157,607	$87,290	$174,204	$577,560	$85,848	$1,315,795
	39	268	727	1,062	940	626	4,399	3,924	3,525	559	2,202	4,597	613	24,003
	$58,070	$174,677	$860,350	$1,181,735	$963,586	$294,129	$2,065,439	$2,336,001	$2,666,898	$708,853	$2,711,232	$5,828,057	$850,991	$21,277,221
	2	.....	.....	2	4	10	26	141	152	4	14	24	4	383
	$1,550	.....	.....	$1,493	$12,764	$5,462	$16,208	$100,151	$105,408	$8,548	$13,846	$39,639	$17,036	$322,105

lands, ...
zuela.
On pa... Ford bra... Denmark... Australia... ative sta... was Can... England, ... Islands, ... Panama, ...
An en... the leadi... Argentin... lowed by... France, ...

The Spa... no inconsi... the severit... credited v... cent of all... be materia... exports fr... of 1921 w... third quar... parison ha... tries in re... The compa... 1921 went ... 26 per cen... 31, 41 per... parts purc... each perio... shipments.*...

In closin... field, it ca... pletely dis... liquidation... proceeded ... mercial si... vast impro... internatio... No consid...*** to tires, h... trucks is ... cept in th... highway i... sections a... producers, ... tributors v... their servi... section of ... shock of t... cordingly. ... Aires lette... ican busin...

"I can ... of the aut... that our ... ready disp... ers and th... satisfactor...

South Am...

The tab... this numb... informatio... tables sho... twelve mo...

During ... from this ... 471. Som...

from 1907 to 1921

Country	1907	1910	1912	1913	1914	1915	1916	1917	1918	July 11 to Dec. 31 1918	1919	1920	1921	Total
Brazil	52	64	554	987	299	81	272	873	1,575	442	3,273	6,251	285	15,268
	$57,037	$67,687	$662,883	$1,035,247	$264,992	$52,939	$157,968	$523,383	$1,000,011	$424,317	$2,580,304	$6,761,382	$418,834	$14,356,322
Chile	44	3	30	78	195	120	826	2,587	3,399	673	454	797	99	9,338
	$52,905	$1,824	$39,873	$109,982	$160,194	$64,327	$530,211	$1,821,842	$3,576,511	$1,009,964	$700,997	$992,539	$142,288	$9,240,204
Colombia	.....	12	42	110	9	39	91	173	164	30	253	962	122	2,093
	.....	$22,482	$35,386	$113,334	$69,620	$34,956	$58,525	$118,937	$121,422	$27,542	$298,383	$1,247,976	$144,751	$2,309,369
Ecuador	.....	2	21	74	21	20	62	137	142	22	84	201	28	822
	.....	$2,168	$20,578	$55,372	$21,229	$11,233	$44,396	$106,478	$130,086	$29,471	$111,051	$288,884	$39,461	$866,455
Falkland Is.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....	.....	4
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$5,788	.....	.....	$5,788
British Guiana	.....	4	20	18	16	45	73	146	180	18	49	130	10	717
	.....	$5,952	$17,306	$14,313	$11,364	$24,311	$33,933	$65,989	$100,546	$18,472	$39,369	$92,665	$8,498	$439,006
Dutch Guiana	.....	.....	.....	.....	7	9	15	23	16	.....	7	10	11	98
	.....	.....	.....	.....	$3,948	$4,492	$7,181	$11,797	$17,775	.....	$3,872	$12,706	$8,260	$70,031
French Guiana	.....	.....	1	1	.....	.....	1	1	8	1	3	3	1	20
	.....	.....	$580	$558	.....	.....	$1,000	$498	$3,632	$318	$2,167	$5,264	$1,000	$15,017
Paraguay	5	1	.....	.....	.....	5	6	40	13	.....	13	102	1	187
	$2,394	$1,200	.....	.....	.....	$2,308	$2,256	$20,192	$5,025	.....	$5,780	$64,967	$1,200	$105,879
Peru	8	4	13	70	36	24	59	400	784	257	599	1,297	76	3,641
	$6,428	$5,004	$10,833	$55,646	[$31,362	$20,658	$40,388	$295,558	$913,669	$395,253	$662,528	$1,249,546	$185,362	$3,886,878
Uruguay	1	20	177	209	183	45	285	1,165	2,232	418	1,844	4,090	164	10,941
	$625	$23,666	$235,097	$273,253	$167,269	$25,706	$150,540	$612,838	$1,177,463	$307,221	$1,757,623	$4,055,458	$297,382	$9,250,082
Venezuela	1	.....	26	104	126	227	518	542	160	38	293	883	275	3,193
	$1,000	.....	$28,180	$109,499	$102,073	$143,086	$314,156	$327,507	$97,485	$56,021	$300,888	$821,490	$273,425	$2,574,810
Aden	.....	.....	.....	15	28	9	16	10	8	.....	29	52	12	180
	.....	.....	.....	$7,998	$20,990	$6,706	$9,166	$7,968	$6,879	.....	$25,197	$50,387	$10,518	$146,597
China	16	8	78	89	144	122	264	509	833	409	1,158	1,774	499	5,956
	$15,255	$13,785	$98,730	$90,459	$143,619	$119,635	$191,932	$383,371	$818,659	$402,275	$1,414,844	$2,356,699	$532,803	$6,633,167
Armenia, etc.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	12
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$4,519	$4,519
China, British	.....	.....	.....	.....	.....	.....	.....	.....	6	.....	.....	62	6	74
China, French	.....	.....	.....	.....	.....	.....	.....	.....	$3,000	.....	.....	$68,491	$19,807	$91,298
Kwantung	.....	.....	.....	.....	.....	.....	.....	20	2	.....	.....	.....	.....	22
China, German	.....	.....	.....	.....	.....	.....	.....	$9,325	$2,017	.....	.....	.....	.....	$11,342
Kwantung	Listed separately prior to 1918, as Kwantung thereafter.						.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Japanese	.....	1	1	.....	.....	.....	.....	33	10	38	36	.....	.....	119
	.....	$5,100	$850	.....	.....	.....	.....	$17,796	$7,321	$29,335	$28,995	.....	.....	$89,397
Chosen	.....	1	.....	7	2	2	7	5	2	3	11	595	4	642
	.....	$10,270	.....	$6,095	$1,795	$1,800	$4,780	$3,832	$1,300	$2,295	$9,272	$311,457	$1,871	$358,075
Britfsh India	45	26	253	439	437	315	2,289	3,603	73	27	2,624	12,014	820	23,133
	$26,067	$22,372	$203,740	$355,573	$379,954	$274,680	$1,638,262	$2,644,085	$53,428	$42,756	$2,891,943	$13,865,679	$909,609	$23,453,839
Straits Settlements	9	21	120	387	262	77	376	855	287	49	499	2,334	105	5,447
	$4,754	$20,955	$86,668	$319,247	$216,659	$70,210	$239,715	$585,820	$202,221	$53,934	$572,320	$2,638,794	$149,013	$5,213,926
Other British East Indies	.....	4	25	39	82	25	239	110	11	.....	102	490	41	1,182
	.....	$2,875	$20,882	$31,245	$73,175	$20,208	$168,685	$80,033	$17,740	.....	$114,609	$540,146	$96,251	$1,175,764
Dutch East Indies	67	33	120	278	290	105	1,064	3,206	1,272	1,078	1,820	4,765	675	14,985
	$36,629	$21,768	$70,055	$198,378	$208,722	$87,306	$753,128	$2,642,330	$1,302,800	$1,359,811	$2,369,241	$6,500,062	$1,061,059	$16,766,366
French Indo China	.....	.....	.....	.....	.....	.....	8	18	18	12	37	537	32	662
	.....	.....	.....	.....	.....	.....	$3,033	$17,967	$21,175	$18,069	$43,918	$568,961	$40,258	$713,381
Greece in Asia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	9
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$6,502	$6,502
Portuguese E. Indies	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hongkong	9	2	4	7	11	2	15	38	117	86	144	214	76	730
	$7,372	$3.788	$2,740	$6,673	$13,043	$1,475	$10,858	$35,255	$91,228	$86,006	$188,121	$341,191	$125,143	$916,210
Japan	15	12	118	312	96	28	153	652	2,139	1,514	2,805	2,796	1,281	11,995
	$19,242	$26,759	$143,619	$364,507	$100,995	$29,210	$120,061	$481,748	$2,040,897	$1,608,516	$2,890,034	$2,983,137	$983,542	$11,873,426
Hejaz, Mesopotamia, etc.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	69	69
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$34,964	$34,964
Persia	.....	.....	.....	.....	.....	.....	.....	.....	2	8	4	134	37	185
	.....	.....	.....	.....	.....	.....	.....	.....	$1,048	$4,625	$2,275	$76,718	$18,923	$103,589
Russia in Asia	2	3	.....	1	12	551	683	1,072	5	3	49	76	.....	2,457
	$1,884	$1,760	.....	$1,160	$14,998	$1,477,809	$529,385	$1,324,060	$8,425	$11,734	$52,145	$124,235	.....	$3,547,595
Siam	4	4	13	56	37	13	41	31	65	27	71	82	63	518
	$1,569	$6,407	$8,933	$35,934	$26,219	$10,317	$32,082	$15,915	$60,220	$22,005	$70,210	$92,457	$73,498	$465,265
Turkey in Asia	.....	1	1	1	7	1	.....	.....	.....	6	119	1,214	377	1,731
	.....	$1,200	$650	$824	$5,662	$1,000	.....	.....	.....	$3,965	$116,347	$930,661	$277,746	$1,346,607
Other Asia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Australia	62	437	2,597	2,083	3,099	2,169	5,335	5,055	4,307	1,582	3,905	8,882	3,020	43,793
	$57,731	$268,274	$2,260,320	$1,896,990	$2,615,896	$1,768,479	$4,147,302	$3,792,571	$3,410,557	$1,492,899	$4,016,751	$9,936,869	$3,065,909	$39,760,261
New Zealand	69	77	953	958	1,065	938	2,672	3,554	1,818	639	2,959	6,671	691	23,596
	$120,533	$55,236	$946,736	$990,837	$974,708	$784,206	$2,055,843	$2,558,118	$1,453,311	$607,807	$3,314,891	$8,190,277	$875,552	$23,425,977
Other British Oceania	.....	.....	75	3	9	2	28	19	30	7	23	32	11	257
	.....	.....	$73,932	$2,396	$6,014	$2,081	$18,227	$11,062	$20,863	$5,955	$17,264	$34,670	$11,018	$227,896
French Oceania	.....	1	3	11	46	8	92	22	12	3	11	13	10	232
	.....	$900	$2,920	$14,005	$45,184	$7,482	$56,789	$12,330	$7,612	$3,368	$11,118	$14,255	$10,643	$186,606
Other Oceania	.....	.....	.....	1	.....	1	7	12	12	7	8	22	14	84
	.....	.....	.....	$350	.....	$5,000	$3,208	$5,847	$11,029	$4,935	$6,285	$16,165	$10,245	$63,064
Philippine Is.	2	130	401	517	614	407	861	1,019	1,714	603	2,381	3,452	467	12,917
	$1,205	$175,626	$557,368	$577,040	$697,175	$425,001	$859,450	$686,731	$1,373,204	$616,437	$2,629,348	$3,932,108	$476,484	$13,432,035
Abyssinia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	.....	5
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$2,416	.....	$2,416
Belgian Congo	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24	15	39
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$16,325	$9,198	$25,523
British W. Africa	.....	.....	.....	4	32	42	63	240	202	43	357	753	73	1,809
	.....	.....	.....	$2,688	$18,319	$20,899	$35,361	$144,838	$115,772	$37,351	$393,405	$913,814	$77,890	$1,760,337
British S. Africa	2	75	331	1,279	1,618	695	2,859	3,423	2,142	541	3,019	6,688	596	23,431
	$1,817	$61,185	$306,606	$1,157,895	$1,437,883	$731,278	$2,040,977	$2,378,380	$1,706,136	$530,951	$3,462,330	$7,795,194	$687,738	$22,448,403
British E. Africa	.....	11	22	14	49	120	237	94	112	14	82	373	112	1,247
	.....	$10,463	$14,998	$12,802	$34,430	$75,188	$137,245	$55,681	$75,778	$14,445	$80,954	$432,819	$133,866	$1,085,582
Canary Is.	.....	1	3	10	15	27	51	31	15	.....	6	150	67	379
	.....	$850	$2,066	$6,426	$6,956	$12,015	$32,935	$24,525	$5,378	.....	$10,162	$196,216	$55,077	$355,836
French Africa	1	11	30	10	19	.....	2	41	121	89	198	369	94	1,010
	$950	$18,188	$20,164	$7,297	$17,273	.....	$1,155	$13,315	$50,550	$52,757	$144,023	$301,720	$69,718	$718,935
Kamerun, etc.	.....	.....	.....	5	19	7	20	.....	.....	.....	7	44	6	108
	.....	.....	.....	$3,175	$14,136	$4,865	$7,760	.....	.....	.....	$3,721	$27,976	$4,690	$66,323
Italian Africa	.....	.....	.....	.....	.....	.....	.....	3	.....	.....	.....	5	.....	8
	.....	.....	.....	.....	.....	.....	.....	$1,200	.....	.....	.....	$3,075	.....	$4,275
Liberia	.....	.....	.....	1	.....	.....	.....	1	12	.....	.....	1	.....	15
	.....	.....	.....	$805	.....	.....	.....	$975	$4,220	.....	.....	$1,205	.....	$7,205
Madagascar	.....	.....	.....	.....	.....	.....	7	1	2	.....	.....	3	.....	13
	.....	.....	.....	.....	.....	.....	$2,532	$808	$1,659	.....	.....	$3,000	.....	$7,999
Morocco	.....	.....	.....	.....	63	25	52	87	35	.....	237	364	80	943
	.....	.....	.....	.....	$29,497	$10,847	$20,574	$39,670	$17,718	.....	$162,016	$340,490	$61,485	$682,297
Portuguese Africa	1	7	16	20	24	6	56	7	9	12	18	244	31	454
	$2,110	$5,302	$13,096	$16,102	$21,563	$7,301	$38,510	$5,429	$9,673	$8,598	$16,636	$282,203	$23,562	$452,754
Spanish Africa	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$6,950	$6,950
Egypt	2	1	5	16	22	1	25	38	21	6	230	1,558	212	2,143
	$887	$998	$2,872	$10,156	$11,437	$695	$18,352	$22,113	$17,300	$20,850	$165,244	$1,553,898	$135,365	$1,975,064
Totals	2,862	6,926	21,757	24,293	28,306	23,880	56,234	64,808	52,312	14,345	67,145	142,508	30,959	553,799
	$4,890,886	$9,548,700	$21,550,139	$24,275,796	$25,392,963	$21,113,953	$40,660,263	$48,612,632	$45,331,366	$15,698,106	$73,700,527	$165,255,921	$32,583,675	$551,644,708

Truck Exports

Country	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918	1919	1920	1921	Total
	2	3	.....	.....	.....	.....	.....	10	3	1	19
Austria	$3,595	$7,455	.....	.....	.....	.....	.....	$18,500	$1,348	$520	$31,418
	.....	.....	.....	.....	.....	.....	.....	3	1	3	7
Azores and Madeira Islands	.....	.....	.....	.....	.....	.....	.....	$3,816	$3,650	$1,369	$8,835
	.....	.....	100	.....	.....	.....	.....	138	195	169	602
Belgium	.....	.....	$365,000	.....	.....	.....	.....	$307,778	$209,985	$77,756	$960,519
	2	.....	.....	.....	.....	.....	.....	.....	4	.....	6
Bulgaria	$1,528	.....	.....	.....	.....	.....	.....	.....	$9,723	.....	$11,251
	3	.....	44	41	58	2	.....	643	296	18	1,105
Denmark	$2,120	.....	$25,033	$36,413	$81,414	$3,800	.....	$1,339,380	$615,448	$33,375	$2,136,983
	.....	.....	.....	.....	.....	.....	.....	10	104	6	120
Finland	.....	.....	.....	.....	.....	.....	.....	$12,783	$212,594	$6,000	$231,377
	6	2	4,990	5,681	4,264	2,754	2,025	3,521	135	10	23,388
France	$10,709	$5,070	$13,523,843	$17,709,579	$13,854,903	$10,001,626	$8,011,335	$15,143,226	$434,943	$14,991	$78,710,225
	4	24	4	.....	.....	.....	.....	.....	47	1	80
Germany	$4,029	$18,462	$2,800	.....	.....	.....	.....	.....	$41,958	$535	$67,784
	.....	.....	.....	.....	.....	27	.....	.....	3	.....	30
Gibraltar	.....	.....	.....	.....	.....	$58,325	.....	.....	$4,756	.....	$63,081
	1	1	142	45	3	14	.....	37	71	26	340
Greece	$1,176	$1,800	$426,570	$98,815	$2,000	$32,000	.....	$80,891	$110,773	$28,846	$782,871
	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1
Hungary	.....	.....	.....	.....	.....	.....	.....	.....	$3,164	.....	$3,164
	.....	.....	.....	.....	.....	1	.....	26	38	.....	65
Iceland and Faroe Islands	.....	.....	.....	.....	.....	$2,245	.....	$21,661	$22,321	.....	$46,227
	.....	1	1	5	65	52	26	7	37	2	196
Italy	.....	$1,229	$8,000	$14,655	$159,775	$28,055	$87,577	$24,310	$67,775	$899	$392,275
	.....	.....	.....	.....	.....	.....	.....	.....	9	4	13
Malta, Gozo and Cypress	.....	.....	.....	.....	.....	.....	.....	.....	$11,557	$1,666	$13,223
	2	1	9	50	36	.....	.....	122	528	300	1,048
Netherlands	$4,489	$1,452	$19,069	$93,797	$55,305	.....	.....	$294,772	$593,491	$207,932	$1,270,307
	2	2	3	81	162	40	83	815	829	20	2,087
Norway	$2,200	$3,852	$4,689	$121,480	$226,741	$133,227	$212,574	$1,787,473	$1,434,715	$28,461	$3,955,412
	.....	.....	.....	.....	.....	.....	.....	.....	22	28	50
Poland and Danzig	.....	.....	.....	.....	.....	.....	.....	.....	$35,473	$61,368	$96,841
	1	8	5	295	21	12	10	30	156	1	539
Portugal	$1,400	$12,075	$10,291	$1,117,681	$45,087	$36,914	$42,300	$76,728	$284,197	$3,650	$1,630,323
	12	.....	.....	.....	.....	.....	.....	114	75	15	216
Roumania	$12,000	.....	.....	.....	.....	.....	.....	$94,951	$89,370	$25,102	$221,423
	13	2	2,251	3,909	1,733	406	.....	2	104	32	8,452
Russia in Europe	$34,163	$5,322	$7,666,883	$12,544,258	$5,428,979	$1,562,303	.....	$2,503	$59,535	$25,100	$27,329,046
	.....	.....	10	20	.....	.....	.....	4	.....	.....	34
Serbia and Montenegro	.....	.....	$6,300	$65,000	.....	.....	.....	$5,700	.....	.....	$77,000
	1	.....	1	30	29	46	33	209	567	27	943
Spain	$1,400	.....	$1,800	$57,277	$55,808	$97,910	$87,180	$409,493	$1,004,833	$49,592	$1,765,293
	.....	1	10	19	6	7	.....	211	821	64	1,139
Sweden	.....	$900	$17,600	$29,050	$10,879	$10,360	.....	$444,695	$1,416,124	$133,690	$2,063,298
	.....	.....	.....	.....	.....	.....	.....	33	78	9	120
Switzerland	.....	.....	.....	.....	.....	.....	.....	$40,044	$49,767	$14,929	$104,740
	.....	1	2	.....	.....	.....	.....	82	120	5	210
Turkey in Europe	.....	$2,000	$8,009	.....	.....	.....	.....	$118,005	$165,400	$16,715	$310,129
	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1
Ukraine	.....	.....	.....	.....	.....	.....	.....	.....	.....	$600	$600
	184	203	5,306	8,268	6,525	4,085	830	890	4,995	272	32,278
England	$119,468	$189,099	$14,042,325	$18,723,403	$17,061,105	$13,438,981	$2,456,993	$1,342,575	$7,148,880	$423,020	$74,945,849
	.....	.....	4	224	.....	447	.....	2	162	5	844
Scotland	.....	.....	$11,250	$271,745	.....	$1,203,328	.....	$1,779	$183,955	$7,290	$1,679,347
	.....	.....	1	8	.....	.....	2	15	45	.....	71
Ireland	.....	.....	$7,033	$39,776	.....	.....	$4,276	$19,948	$40,555	.....	$111,588
	.....	.....	.....	.....	.....	.....	.....	.....	3	2	5
Yugoslavia and Albania	.....	.....	.....	.....	.....	.....	.....	.....	$1,511	$1,430	$2,941
	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2
Bermuda	.....	.....	.....	.....	.....	.....	.....	.....	.....	$4,571	$4,571
	.....	.....	.....	.....	.....	2	1	.....	20	2	25
British Honduras	.....	.....	.....	.....	.....	$3,700	$834	.....	$14,442	$709	$19,685
	489	247	306	387	636	1,108	895	1,858	2,149	1,144	9,219
Canada	$1,004,237	$474,724	$705,213	724,827	$945,047	$1,381,542	$1,192,833	$2,896,325	$4,187,597	$1,795,129	$15,307,464
	2	8	2	.....	1	5	.....	1	14	13	46
Costa Rica	$3,463	$10,571	$4,165	.....	$900	$10,245	.....	$504	$22,553	$24,920	$77,321
	.....	.....	.....	2	4	3	.....	10	25	7	51
Guatemala	.....	.....	.....	$4,916	$4,323	$5,512	.....	$16,761	$38,105	$5,920	$75,537
	1	.....	6	6	4	6	.....	7	19	6	55
Honduras	$3,000	.....	$12,500	$14,540	$4,094	$3,373	.....	$9,589	$20,770	$15,555	$83,421
	.....	.....	.....	1	.....	1	2	11	23	5	43
Nicaragua	.....	.....	.....	$2,500	.....	$2,509	$5,742	$16,026	$32,253	$14,200	$73,230
	.....	5	6	32	75	47	16	38	68	71	358
Panama	.....	$7,243	$12,010	$55,171	$97,970	$47,859	$20,504	$30,148	$56,127	$98,790	$425,822
	.....	.....	.....	1	1	4	1	4	42	1	54
Salvador	.....	.....	.....	$1,300	$868	$14,811	$175	$8,897	$118,585	$3,166	$147,802
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Greenland	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	35	12	8	51	218	365	201	938	1,281	1,482	4,591
Mexico	$83,363	$17,509	$14,492	$100,500	$198,151	$525,664	$260,968	$1,205,664	$1,973,994	$1,554,554	$5,934,859
	.....	.....	.....	.....	.....	.....	.....	6	.....	.....	6
Miquelon, Langley, Etc.	.....	.....	.....	.....	.....	.....	.....	$6,000	.....	.....	$6,000
	4	1	1	1	1	2	5	10	12	3	40
Newfoundland and Labrador	$8,845	$1,221	$750	$1,692	$2,675	$7,250	$2,997	$23,306	$54,907	$6,275	$109,918
	.....	.....	.....	.....	1	2	5	15	58	3	84
Barbados	.....	.....	.....	.....	$1,506	$3,400	$11,792	$14,394	$52,148	$1,800	$85,040
	4	3	3	9	6	10	2	36	215	43	331
Jamaica	$9,234	$9,250	$7,292	$18,524	8,285	$6,775	$800	$42,828	$313,578	$51,469	$468,035
	.....	1	.....	2	2	14	7	69	202	68	365
Trinidad and Tabago	.....	$2,000	.....	$1,974	$5,722	$18,361	$15,089	$86,479	$271,451	$61,630	$462,706
	.....	.....	.....	6	1	28	4	25	56	22	142
Other British West Indies	.....	.....	.....	$11,327	$500	$89,914	$3,304	$14,301	$38,168	$17,626	$175,140
	14	.....	21	117	397	554	279	915	1,963	283	4,552
Cuba	$23,639	$33,500	$34,607	$176,647	$722,519	$1,130,982	$539,070	$1,955,509	$4,937,281	$366,710	$9,920,464
	1	.....	.....	.....	.....	2	.....	1	8	7	19
Virgin Islands of United States	$4,250	.....	.....	.....	.....	$2,845	.....	$3,350	$16,789	$5,701	$32,935
	.....	1	1	.....	2	.....	.....	3	18	6	31
Dutch West Indies	.....	$595	$1,463	.....	$2,095	.....	.....	$3,095	$8,542	$3,720	$19,510
	.....	.....	2	1	7	26	2	58	71	13	180
French West Indies	.....	.....	$3,975	$2,310	$13,305	$49,626	$3,650	$77,085	$55,607	$7,940	$213,498
	3	.....	.....	.....	2	11	2	8	27	14	67
Haiti	$5,553	.....	.....	.....	$1,324	$10,578	$1,200	$6,798	$51,358	$6,281	$83,092
	1	1	2	4	22	21	8	48	213	18	338
Dominican Republic	$1,858	$1,800	$3,372	$5,173	$23,640	$13,323	$11,597	$75,953	$226,982	$52,473	$416,171
	35	48	3	45	141	51	3	145	352	24	847
Argentina	$78,000	$65,225	$2,910	$33,063	$146,255	$50,124	$4,094	$291,430	$825,333	$70,111	$1,566,545

from 1913 to 1921

Country	1913	1914	1915	1916	1917	1918	July 1 to Dec. 31, 1918	1919	1920	1921	Total
Bolivia	.....	.....	.....	.....	*20*	*14*	*12*	*8*	*13*	.....	*67*
	.....	.....	.....	.....	$48,590	$24,958	$38,716	$12,376	$21,895	.....	$146,535
Brazil	*36*	*13*	*3*	*11*	*14*	*24*	*21*	*200*	*1,540*	*103*	*1,965*
	$75,073	$20,449	$2,861	$19,635	$8,300	$31,133	$19,167	$199,738	$1,191,577	$354,810	$1,922,743
Chili	.....	*2*	.....	*17*	*69*	*220*	*85*	*88*	*299*	*45*	*825*
	.....	$10,743	.....	46,566	$160,696	$282,638	$136,376	$131,055	$326,216	$64,636	$1,158,926
Colombia	*3*	.....	*1*	*4*	*2*	*3*	*2*	*38*	*275*	*35*	*363*
	$6,112	.....	$1,237	$1,236	$4,998	$7,100	$3,285	$39,341	$291,410	$66,440	$421,159
Ecuador	*1*	.....	.....	*2*	*1*	*3*	*4*	*5*	*46*	*20*	*82*
	$2,017	.....	.....	$3,378	$2,050	$6,876	6,520	6,865	$85,895	$41,818	$155,419
Falkland Islands	.....	.....	.....	.....	.....	.....	.....	.....	.....	*1*	*1*
	.....	.....	.....	.....	.....	.....	.....	.....	.....	$545	$545
British Guiana	.....	.....	*1*	.....	*1*	*7*	*1*	*35*	*123*	*5*	*173*
	.....	.....	$900	.....	$1,529	$5,100	$2,600	$24,119	$72,966	$7,686	$114,900
Dutch Guiana	.....	.....	.....	*1*	.....	.....	*1*	*1*	*6*	.....	*9*
	.....	.....	.....	$1,037	.....	.....	$1,000	$506	$4,111	.....	$6,654
French Guiana	.....	.....	.....	.....	.....	.....	.....	*4*	*1*	.....	*5*
	.....	.....	.....	.....	.....	.....	.....	$2,061	$3,061	.....	$5,122
Peru	.....	*3*	*2*	*5*	*25*	*73*	*52*	*207*	*900*	*52*	*1,319*
	.....	5,301	$3,484	$5,830	48,776	$155,834	$139,295	$215,175	$775,398	$89,401	$1,438,494
Uruguay	*7*	*1*	.....	*2*	*4*	*16*	*2*	*68*	*113*	*81*	*294*
	$19,280	$865	.....	$5,818	$10,437	$15,809	$2,000	$79,196	$113,479	$32,713	$279,597
Venezuela	*23*	*12*	*3*	*6*	*14*	*16*	*2*	*41*	*186*	*13*	*316*
	$34,291	$28,228	$7,164	$13,029	$28,502	$12,410	$2,200	$24,579	$144,308	$18,911	$313,622
Aden	.....	.....	.....	.....	.....	.....	.....	*1*	*2*	.....	*3*
	.....	.....	.....	.....	.....	.....	.....	$922	$7,188	.....	$8,110
China	.....	*7*	.....	*39*	*9*	*23*	*31*	*273*	*261*	*71*	*714*
	.....	$12,700	.....	$89,799	$14,287	$26,236	$46,595	$596,715	$464,785	$105,485	$1,356,602
China British	.....	.....	.....	.....	.....	.....	.....	*4*	*1*	.....	*5*
	.....	.....	.....	.....	.....	.....	.....	$6,335	$1,763	.....	$8,098
Kwantung	.....	*1*	.....	.....	.....	.....	.....	.....	.....	*13*	*14*
	.....	$2,451	.....	.....	.....	.....	.....	.....	.....	$26,435	$28,886
Chosen	*1*	.....	.....	*3*	.....	*2*	.....	.....	.....	.....	*6*
	$3,500	.....	.....	$5,027	.....	$1,629	.....	.....	.....	.....	$10,156
British India	.....	*7*	*7*	*135*	*126*	*11*	*1*	*260*	*1,612*	*132*	*2,291*
	.....	$12,091	$8,680	$208,067	$205,023	$20,275	$2,118	$563,339	$3,262,328	$269,760	$4,551,681
Straits Settlements	*2*	*7*	.....	*17*	*57*	*70*	*44*	*115*	*447*	*63*	*822*
	$5,588	$14,381	.....	$25,169	$61,881	$113,554	$64,425	$229,624	$857,410	$158,487	$1,530,519
Other British East Indies	.....	.....	*1*	*20*	*26*	*3*	.....	*16*	*69*	*4*	*139*
	.....	.....	$3,300	$27,841	$38,970	$7,138	.....	$27,700	$152,849	$4,192	$261,990
Dutch East Indies	*2*	*7*	*11*	*58*	*108*	*68*	*139*	*324*	*1,182*	*368*	*2,267*
	$4,840	$14,232	$9,567	$82,586	$137,609	$162,749	$313,725	$689,225	$2,920,663	$922,997	$5,258,193
French Indo China	.....	.....	.....	.....	.....	*2*	*3*	*16*	*141*	*8*	*170*
	.....	.....	.....	.....	.....	$3,500	$7,290	$11,556	$117,984	$7,522	$147,852
Greece in Asia	.....	.....	.....	.....	.....	.....	.....	.....	.....	*2*	*2*
	.....	.....	.....	.....	.....	.....	.....	.....	.....	$734	$734
Hejaz, Arabia, etc	.....	.....	.....	.....	.....	.....	.....	.....	.....	*14*	*14*
	.....	.....	.....	.....	.....	.....	.....	.....	.....	$10,663	$10,663
Hongkong	.....	.....	*1*	*3*	.....	*8*	*8*	*19*	*26*	*29*	*94*
	.....	.....	$780	$6,304	.....	$5,371	$10,500	$25,547	$55,377	$80,450	$184,329
Japan	*21*	*1*	*1*	*15*	*70*	*279*	*381*	*1,143*	*1,233*	*781*	*3,925*
	$32,770	$900	$3,382	$14,528	$59,198	$317,787	$636,692	$1,736,439	$1,590,760	$634,867	$5,027,323
Palestine and Syria	.....	.....	.....	.....	.....	.....	.....	.....	.....	*11*	*11*
	.....	.....	.....	.....	.....	.....	.....	.....	.....	$11,194	$11,194
Persia	.....	.....	.....	.....	.....	*4*	.....	.....	*20*	.....	*24*
	.....	.....	.....	.....	.....	$2,712	.....	.....	$10,601	.....	$13,313
Russia in Asia	.....	.....	*596*	*1,170*	*515*	.....	*15*	*21*	*9*	.....	*2,326*
	.....	.....	$1,903,221	$3,546,435	$1,662,144	.....	$18,200	$41,482	$18,491	.....	$7,189,973
Siam	.....	.....	.....	*9*	*8*	*6*	*2*	*8*	*5*	.....	*38*
	.....	.....	.....	$7,036	$6,700	$4,535	$4,867	$12,411	$8,965	.....	$44,514
Turkey in Asia	.....	*1*	*5*	.....	*2*	.....	.....	*14*	*93*	*41*	*156*
	.....	$1,354	$26,282	.....	$1,143	.....	.....	$27,695	$126,775	$62,627	$245,876
Australia	*17*	*32*	*57*	*201*	*194*	*109*	*15*	*418*	*986*	*720*	*2,749*
	$23,020	$37,378	$84,142	$295,538	$237,159	$163,405	$26,274	$565,406	$1,439,774	$1,194,900	$4,066,996
New Zealand	*1*	*39*	*20*	*93*	*75*	*74*	*52*	*225*	*522*	*157*	*1,058*
	$1,201	$61,599	$31,575	$149,848	$119,833	$145,764	$59,690	$501,488	$1,156,310	$331,898	$2,559,206
Other British Oceania	.....	.....	.....	*2*	*1*	*2*	.....	*9*	*6*	*1*	*21*
	.....	.....	.....	$2,612	$1,688	$2,404	.....	$9,779	$6,250	$2,168	$24,901
French Oceania	*2*	*4*	.....	*1*	*2*	*5*	*1*	*1*	*4*	.....	*20*
	$3,400	$7,625	.....	$860	$2,750	$6,480	$1,000	$600	$9,858	.....	$32,573
Other Oceania	.....	.....	.....	*1*	*3*	*4*	*2*	*8*	*9*	*1*	*28*
	.....	.....	.....	$1,530	$2,377	$5,518	$2,213	$7,020	$4,706	$500	$23,864
Philippine Islands	*43*	*38*	*27*	*58*	*53*	*163*	*32*	*516*	*1,155*	*234*	*2,319*
	$92,809	$64,805	$62,132	$88,286	$57,457	$215,106	$56,815	$798,540	$1,818,221	$221,650	$3,475,821
Abyssinia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Belgian Kongo	.....	.....	.....	.....	.....	.....	.....	*3*	*13*	*35*	*51*
	.....	.....	.....	.....	.....	.....	.....	.....	.....	$20,435	$20,435
British West Africa	.....	*1*	.....	*7*	*115*	*27*	*13*	*215*	*780*	*33*	*1,191*
	.....	$1,260	.....	$13,173	$124,574	$20,136	$15,097	$254,836	$1,137,335	$49,109	$1,615,520
British South Africa	*11*	*12*	*15*	*36*	*34*	*70*	*23*	*57*	*244*	*58*	*560*
	$9,476	$11,539	$40,280	$54,519	$82,957	$107,085	$26,750	$102,992	$425,129	$104,544	$965,271
British East Africa	.....	.....	.....	.....	.....	*1*	.....	*6*	*8*	*2*	*17*
	.....	.....	.....	.....	.....	$787	.....	$5,010	$17,338	$6,000	$29,135
Canary Islands	.....	*1*	.....	.....	*1*	.....	.....	*5*	*11*	*18*	*36*
	.....	$1,203	.....	.....	$575	.....	.....	$4,312	$32,311	$16,539	$54,940
French Africa	*1*	.....	.....	.....	.....	*18*	*11*	*44*	*339*	*11*	*424*
	$858	.....	.....	.....	.....	$12,963	$9,217	$17,157	$355,125	$5,632	$430,952
Kamerun, Etc	.....	.....	.....	.....	.....	.....	.....	*7*	*21*	*5*	*33*
	.....	.....	.....	.....	.....	.....	.....	$3,544	$20,736	$1,944	$26,224
Italian Africa	.....	.....	.....	.....	.....	.....	.....	.....	*5*	.....	*5*
	.....	.....	.....	.....	.....	.....	.....	.....	$11 500	.....	$11,500
Liberia	.....	.....	.....	.....	.....	.....	.....	.....	*2*	.....	*2*
	.....	.....	.....	.....	.....	.....	.....	.....	$1.156	.....	$1,156
Madagascar	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Morocco	.....	.....	.....	*7*	.....	.....	.....	*13*	*44*	*20*	*84*
	.....	.....	.....	$9,675	.....	.....	.....	$13,410	$24,376	$9,075	$56,536
Portuguese Africa	.....	*1*	.....	*1*	*1*	.....	*4*	*4*	*34*	*12*	*57*
	.....	$2,604	.....	$2,803	$2,500	.....	$7,725	$6,408	$34,950	$9,484	$66,474
Spanish Africa	.....	.....	.....	.....	.....	.....	.....	.....	*1*	.....	*1*
	.....	.....	.....	.....	.....	.....	.....	.....	$2.118	.....	$2,118
Egypt	.....	.....	.....	.....	*4*	.....	.....	*15*	*74*	*44*	*137*
	.....	.....	.....	.....	$9,624	.....	.....	$13,285	$69,492	$40,367	$132,768
Totals	*993*	*784*	*13,996*	*21,265*	*15,977*	*12,200*	*5,401*	*15,585*	*29,136*	*7,501*	*122,838*
	$1,737,141	$1,181,611	$39,140,682	$56,805,548	$42,343,502	$31,874,459	$14,637,236	$35,425,437	$46,775,781	$10,320,704	$280,182,248

American Tractor

	1914	1915	1916	1917	1918	July 1 to Dec 31 1918	Calendar Year 1919	1920	1921	Total for All Years
Europe:										
	20	.....	.....	.....	.....	.....	.....	.....	*1*	*21*
Austria-Hungary	$58,977	.....	.....	.....	.....	.....	.....	.....	$730	$59,707
	.....	.....	.....	.....	.....	.....	.....	.....	*2*	*2*
Azores, etc.	.....	.....	.....	.....	.....	.....	.....	.....	$2,781	$2,781
	.....	.....	.....	.....	.....	.....	*232*	*156*	*87*	*475*
Belgium	.....	.....	.....	.....	.....	.....	$191,710	$128,830	$78,418	$398,958
	8	.....	.....	.....	.....	.....	.....	*26*	*1*	*35*
Bulgaria	$9,433	.....	.....	.....	.....	.....	.....	$27,061	$440	$36,934
	.....	.....	.....	.....	.....	.....	.....	.....	*1*	*1*
Czechoslavakia	.....	.....	.....	.....	.....	.....	.....	.....	$202	$202
	.....	.....	*7*	*7*	*1*	*2*	*899*	*192*	*166*	*1,274*
Denmark	.....	.....	$23,905	$9,130	$2,370	$6,800	$770,715	$170,374	$164,990	$1,148,284
	.....	.....	.....	.....	.....	.....	*5*	*29*	.....	*34*
Finland	.....	.....	.....	.....	.....	.....	$6,800	$67,823	.....	$74,623
	2	*25*	*284*	*1,201*	*2,157*	*555*	*4,620*	*2,071*	*428*	*11,346*
France	$4,986	$100,500	$744,240	$1,259,232	$2,428,335	$1,036,879	$5,066,823	$1,691,594	$356,674	$12,689,223
	47	.....	.....	.....	.....	.....	*35*	*4*	*1*	*87*
Germany	$121,652	.....	.....	.....	.....	.....	$22,820	$2,812	$150	$147,434
	.....	.....	.....	.....	*94*	*39*	*126*	*36*	*9*	*304*
Greece	.....	.....	.....	.....	$95,500	$16,800	$85,723	$40,051	$10,717	$248,791
	.....	.....	.....	.....	.....	.....	*3*	*2*	.....	*5*
Iceland and Faroe Islands	.....	.....	.....	.....	.....	.....	$4,550	$3,208	.....	$7,758
	1	.....	.....	*135*	*5,406*	*2,570*	*375*	*53*	*1*	*8,541*
Italy	$3,683	.....	.....	$125,043	$4,742,132	$3,229,190	$682,379	$81,782	$400	$8,864,609
	1	.....	.....	*4*	.....	.....	*55*	*122*	*37*	*219*
Netherlands	$3,750	.....	.....	$7,400	.....	.....	$62,295	$93,376	$36,751	$203,572
	.....	.....	.....	*39*	*1*	*105*	*138*	*159*	*22*	*464*
Norway	.....	.....	.....	$58,648	$1,093	$125,890	$139,624	$182,891	$36,410	$544,556
	.....	.....	.....	.....	.....	.....	.....	*261*	*212*	*473*
Poland and Danzig	.....	.....	.....	.....	.....	.....	.....	$217,737	$234,424	$452,161
	.....	.....	.....	*1*	*20*	.....	*39*	*17*	*6*	*83*
Portugal	.....	.....	.....	$495	$31,239	.....	$52,787	$49,589	$19,080	$153,190
	23	.....	.....	.....	.....	.....	*106*	*77*	*5*	*211*
Roumania	$55,320	.....	.....	.....	.....	.....	$127,178	$114,610	$13,849	$310,957
	67	*26*	*44*	*136*	*366*	.....	*7*	*10*	*5*	*661*
Russia in Europe	$196,617	$69,370	$84,550	$353,666	$959,424	.....	$9,000	$10,200	$5,500	$1,688,327
	.....	.....	*20*	.....	.....	.....	*1*	.....	.....	*21*
Serbia, Montenegro, etc.	.....	.....	$27,000	.....	.....	.....	$584	.....	.....	$27,584
	2	.....	*1*	*53*	*12*	*8*	*182*	*492*	*220*	*970*
Spain	$7,405	.....	$1,050	$55,169	$11,728	$11,030	$212,985	$553,055	$179,564	$1,031,986
	.....	.....	.....	*6*	.....	.....	*275*	*333*	*322*	*936*
Sweden	.....	.....	.....	$5,304	.....	.....	$248,134	$438,105	$357,773	$1,049,316
	.....	.....	.....	.....	*1*	.....	*21*	*1*	*10*	*33*
Switzerland	.....	.....	.....	.....	$2,339	.....	$18,078	$1,625	$11,005	$33,047
	.....	.....	.....	.....	.....	.....	*20*	*3*	.....	*23*
Turkey in Europe	.....	.....	.....	.....	.....	.....	$28,564	$5,021	.....	$33,585
	.....	.....	.....	.....	.....	.....	.....	.....	*1*	*1*
Urkaine	.....	.....	.....	.....	.....	.....	.....	.....	$710	$710
United Kingdom:										
	.....	*80*	*641*	*2,926*	*8,862*	*1,029*	*2,088*	*977*	*960*	*17,563*
England	.....	$343,922	$1,843,229	$4,747,841	$8,807,131	$1,524,521	$1,490,515	$916,324	$867,772	$20,541,255
	.....	*1*	.....	.....	*64*	*9*	*1*	*31*	*1*	*107*
Scotland	.....	$1,562	.....	.....	$105,882	$52,466	$600	$24,967	$230	$185,707
	.....	.....	.....	*51*	.....	.....	*354*	.....	.....	*405*
Ireland	.....	.....	.....	$29,325	.....	.....	$209,613	.....	.....	$238,938
	.....	.....	.....	.....	.....	.....	.....	*7*	.....	*7*
Jugoslavia	.....	.....	.....	.....	.....	.....	.....	$8,622	.....	$8,622
North America:										
	.....	*1*	.....	*3*	.....	.....	.....	.....	*2*	*6*
British Honduras	.....	$298	.....	$8,315	.....	.....	.....	.....	$3,481	$12,094
	.....	.....	.....	.....	.....	.....	.....	.....	*2*	*2*
Bermuda	.....	.....	.....	.....	.....	.....	.....	.....	$1,262	$1,262
	382	*252*	*680*	*2,909*	*5,824*	*3,208*	*6,733*	*9,606*	*3,286*	*32,889*
Canada	$637,162	$281,867	$693,328	$3,047,523	$5,774,288	$2,628,569	$6,336,233	$8,420,955	$3,087,024	$30,906,949
Central American States:										
	.....	.....	.....	*1*	.....	.....	*5*	*21*	*3*	*30*
Costa Rica	.....	.....	.....	$2,275	.....	.....	$7,057	$16,591	$5,239	$31,162
	.....	.....	.....	.....	*1*	.....	*4*	*53*	*4*	*62*
Guatemala	.....	.....	.....	.....	$802	.....	$3,453	$44,675	$3,797	$52,727
	2	.....	*5*	*5*	.....	.....	*8*	*8*	*6*	*34*
Honduras	$3,682	.....	$8,928	$7,302	.....	.....	$13,835	$21,972	$8,945	$64,664
	2	.....	.....	.....	*2*	*2*	.....	*9*	*3*	*18*
Nicaragua	$2,170	.....	.....	.....	$2,800	$3,781	.....	$15,718	$4,209	$28,678
	.....	*2*	.....	.....	*16*	*7*	*12*	*3*	*4*	*44*
Panama	.....	$9,488	.....	.....	$12,412	$5,600	$15,739	$4,779	$13,294	$61,312
	.....	.....	.....	*1*	.....	*1*	*3*	*5*	.....	*10*
Salvador	.....	.....	.....	$2,800	.....	$1,400	$5,800	$6,088	.....	$16,088
	5	*3*	*26*	*59*	*285*	*113*	*291*	*391*	*257*	*1,432*
Mexico	$13,600	$12,400	$41,449	$91,902	$430,472	$150,585	$326,855	$775,133	$494,898	$11,942,294
	.....	.....	.....	.....	.....	.....	*4*	*2*	.....	*6*
Newfoundl'd and Labrador	.....	.....	.....	.....	.....	.....	$15,996	$9,855	.....	$25,851
West Indies, British:										
	.....	.....	.....	.....	*3*	.....	*8*	*4*	*5*	*20*
Barbados	.....	.....	.....	.....	$2,015	.....	$6,424	$3,225	$4,959	$16,623
	.....	.....	.....	.....	*1*	*8*	*13*	*16*	*11*	*49*
Jamaica	.....	.....	.....	.....	$230	$7,614	$16,034	$17,995	$12,964	$54,837
	.....	.....	.....	.....	*1*	*5*	*11*	*11*	*1*	*29*
Trinidad and Tobago	.....	.....	.....	.....	$1,632	$8,249	$15,076	$23,981	$1,545	$50,583
	.....	.....	.....	.....	*2*	*1*	*3*	*6*	*1*	*13*
Other British	.....	.....	.....	.....	$1,708	$1,496	$2,550	$5,966	$150	$11,870
	15	*24*	*60*	*179*	*165*	*110*	*253*	*390*	*32*	*1,228*
Cuba	$54,845	$77,531	$135,309	$209,157	$247,662	$154,615	$345,404	$606,739	$61,576	$1,892,838
	.....	.....	*1*	*1*	*4*	.....	*47*	*14*	*14*	*81*
Dominican Republic	.....	.....	$858	$4,650	$3,590	.....	$14,814	$126,239	$23,461	$173,612
Danish West Indies (Virgin Islands:	.....	.....	.....	.....	.....	*3*	*2*	*12*	*52*	*69*
	.....	.....	.....	.....	.....	$3,525	$2,177	$18,940	$3,011	$27,653
	.....	*1*	.....	.....	.....	.....	*2*	.....	*1*	*4*
Dutch	.....	$1,525	.....	.....	.....	.....	$704	.....	$1,959	$4,188
	.....	.....	.....	.....	*2*	.....	*8*	*3*	*4*	*17*
French	.....	.....	.....	.....	$2,095	.....	$10,065	$1,953	$2,204	$16,317
	.....	.....	.....	.....	*1*	.....	*13*	*9*	*2*	*25*
Haiti	.....	.....	.....	.....	$1,150	.....	$16,146	$34,490	$1,540	$53,326

Exports, 1914-1921

	1914	1915	1916	1917	1918	July 1 to Dec. 31 1918	Calendar Year 1919	1920	1921	Total for All Years
South America)										
	73	*4*	*18*	*5*	*7*	*46*	*528*	*920*	*611*	*2,212*
Argentina	$103,915	$1,828	$37,926	$7,848	$4,050	$66,778	$393,807	$721,527	$622,313	$1,959,992
	.....	.....	.....	.....	.....	*4*	*7*	*9*	*3*	*23*
Bolivia	.....	.....	.....	.....	.....	$6,300	$4,950	$3,519	$17,747	$32,516
	6	*1*	*5*	*8*	*4*	*11*	*96*	*269*	*71*	*471*
Brazil	$8,326	$2,724	$3,216	$7,499	$11,600	$12,600	$75,054	$308,236	$45,621	$474,876
	4	*1*	.....	*1*	*16*	*2*	*167*	*333*	*19*	*543*
Chile	$10,540	$1,346	.....	$3,175	$18,296	$2,922	$169,552	$304,242	$13,518	$523,591
	1	.....	*1*	.....	*12*	*1*	*14*	.....	*40*	*69*
Colombia	$3,620	.....	$2,100	.....	$10,728	$4,377	.....	$34,890	$87,920	$143,635
	.....	.....	.....	.....	.....	.....	*5*	*5*	*8*	*18*
Ecuador	.....	.....	.....	.....	.....	.....	$7,125	$6,000	$9,507	$22,632
	.....	.....	.....	*1*	*16*	*17*	*32*	*76*	.....	*142*
Guiana, British	.....	.....	.....	$3,100	$13,727	$16,683	$47,820	$96,719	.....	$178,049
	.....	.....	.....	.....	.....	.....	*2*	*8*	*4*	*14*
Guiana, Dutch	.....	.....	.....	.....	.....	.....	$2,536	$19,739	$4,687	$26,962
	.....	.....	.....	.....	.....	.....	.....	*1*	.....	*1*
Guiana, French	.....	.....	.....	.....	.....	.....	.....	$4,814	.....	$4,814
	1	.....	.....	.....	*6*	.....	.....	*2*	.....	*9*
Paraguay	$1,63	.....	.....	.....	$7,111	.....	.....	$8,050	.....	$16,799
	.....	.....	.....	*10*	*83*	*154*	*317*	*701*	*57*	*1,326*
Peru	$5,86	$3,971	.....	$19,508	$101,594	$182,418	$314,018	$552,360	$56,804	$1,236,538
	.....	.....	.....	.....	.....	*7*	*59*	*112*	*2*	*180*
Uruguay	.....	.....	.....	.....	.....	$5,495	$46,773	$100,825	$2,820	$155,913
	3	.....	.....	*3*	.....	.....	*22*	*45*	*19*	*92*
Venezuela	$3,753	.....	.....	$8,237	.....	.....	$26,149	$57,543	$76,385	$172,067
Asia:										
	.....	.....	.....	*4*	.....	.....	*7*	*14*	*1*	*26*
China	.....	.....	.....	$3,396	.....	.....	$13,091	$29,814	$1,288	$47,589
	.....	.....	.....	.....	.....	.....	.....	.....	*1*	*1*
Armenia, etc.	.....	.....	.....	.....	.....	.....	.....	.....	$1,740	$1,740
	.....	.....	.....	.....	.....	.....	.....	.....	*2*	*2*
Hejas, etc.	.....	.....	.....	.....	.....	.....	.....	.....	7,479	7,479
	.....	.....	.....	*3*	.....	.....	*1*	*2*	.....	*6*
Kwantung, leased territory	.....	.....	.....	$2,898	.....	.....	$2,670	$2,600	.....	$8,168
	.....	.....	.....	.....	.....	.....	*14*	.....	.....	*14*
Chosen	.....	.....	.....	.....	.....	.....	$22,271	.....	.....	$22,271
	.....	.....	.....	.....	.....	.....	.....	.....	*3*	*3*
Palestine and Syria	.....	.....	.....	.....	.....	.....	.....	.....	$4,500	$4,500
	.....	.....	.....	.....	.....	.....	.....	.....	*2*	*2*
Persia	.....	.....	.....	.....	.....	.....	.....	.....	$16,068	$16,068
East Indies, British:										
	2	.....	.....	*3*	*1*	*2*	*105*	*315*	*96*	*524*
British India	$4,629	.....	.....	$1,900	$2,842	$2,318	$86,437	$294,668	$140,925	$533,719
	.....	*1*	.....	.....	*1*	.....	*32*	*145*	*45*	*224*
Straits Settlements	.....	$3,000	.....	.....	$2,063	.....	$26,81	$207,281	$53,663	$292,825
	.....	.....	.....	.....	.....	.....	*13*	*17*	.....	*30*
Other	.....	.....	.....	.....	.....	.....	$8,110	$11,160	.....	$19,270
	.....	*5*	*3*	*5*	*2*	*7*	*47*	*184*	*153*	*406*
Dutch	.....	$18,217	$12,421	$24,400	$10,241	$5,847	$68,248	$352,725	$243,969	$736,068
	.....	.....	.....	.....	*1*	.....	*2*	*73*	.....	*76*
French	.....	.....	.....	.....	$4,900	.....	$1,552	$58,024	.....	$64,476
	.....	.....	.....	.....	.....	.....	.....	*1*	.....	*1*
Hong Kong	.....	.....	.....	.....	.....	.....	.....	$3,303	.....	$3,303
	.....	.....	.....	*14*	*5*	*11*	*50*	*146*	*60*	*286*
Japan	.....	.....	.....	$20,332	$15,016	$13,302	$172,036	$119,000	$57,441	$397,127
	.....	.....	.....	*113*	.....	.....	*2*	.....	.....	*115*
Russia in Asia	.....	.....	.....	$305,192	.....	.....	$7,500	.....	.....	$312,692
	.....	.....	.....	.....	.....	.....	*3*	*12*	*6*	*21*
Siam	.....	.....	.....	.....	.....	.....	$8,047	$19,588	$20,019	$47,654
	1	.....	.....	.....	.....	.....	*1*	*25*	*20*	*47*
Turkey in Asia	$2,762	.....	.....	.....	.....	.....	$440	$27,868	$25,288	$56,358
Oceania, British:										
	42	*18*	*32*	*22*	*21*	*21*	*252*	*600*	*228*	*1,236*
Australia	$71,428	$37,144	$37,441	$25,015	$19,505	$24,123	$279,371	$487,152	$169,973	$1,151,152
	.....	.....	*16*	*54*	*40*	*286*	*170*	*322*	*108*	*996*
New Zealand	.....	.....	$16,839	$57,863	$46,499	$181,588	$180,592	$360,734	$42,880	$886,995
	.....	.....	.....	*2*	.....	.....	.....	*3*	.....	*5*
Other British	.....	.....	.....	$2,964	.....	.....	.....	$2,040	.....	$5,004
	.....	.....	.....	.....	.....	.....	*1*	.....	.....	*1*
German	.....	.....	.....	.....	.....	.....	$614	.....	.....	$614
	.....	.....	.....	*1*	.....	.....	.....	*2*	.....	*3*
French	.....	.....	.....	$1,453	.....	.....	.....	$1,929	.....	$3,382
	.....	*3*	*2*	*7*	*13*	*52*	*687*	*1,461*	*220*	*2,445*
Philippine Islands	.....	$12,992	$9,560	$9,137	$28,107	$102,408	$769,045	$1,763,878	$241,991	$2,937,118
Africa :										
	.....	.....	.....	.....	.....	.....	*1*	.....	*3*	*4*
Belgian Kongo	.....	.....	.....	.....	.....	.....	$3,417	.....	$1,778	$5,195
British Africa:										
	1	.....	.....	.....	.....	.....	.....	*6*	*1*	*8*
West	$4,760	.....	.....	.....	.....	.....	.....	$30,068	$351	$35,179
	4	*3*	*2*	*4*	*36*	*14*	*325*	*407*	*22*	*817*
South	$11,399	$3,613	$1,527	$3,240	$21,267	$9,900	$189,392	$413,015	$29,933	$683,286
	.....	.....	.....	.....	.....	*1*	*15*	*61*	*19*	*96*
East	.....	.....	.....	.....	.....	$300	$20,849	$71,478	$23,604	$116,231
	3	.....	.....	.....	.....	*7*	*29*	*170*	*9*	*218*
Egypt	$7,988	.....	.....	.....	.....	$2,185	$23,249	$188,680	$13,858	$235,960
	1	.....	.....	*8*	*1*	*7*	*363*	*344*	*58*	*782*
French Africa	$2,289	.....	.....	$8,305	$1,124	$5,250	$390,261	$278,181	$64,215	$749,625
	.....	.....	.....	.....	.....	.....	.....	.....	*1*	*1*
Kamerum, etc.	.....	.....	.....	.....	.....	.....	.....	.....	$700	$700
	.....	.....	.....	.....	.....	.....	.....	.....	*1*	*1*
Italian, Africa	.....	.....	.....	.....	.....	.....	.....	.....	$600	$600
	.....	.....	.....	.....	*1*	*1*	*110*	*6*	.....	*118*
Morocco	.....	.....	.....	.....	$1,180	$575	$71,569	$8,377	.....	81,771
	.....	.....	*1*	.....	*3*	.....	*2*	*15*	.....	*81*
Portuguese Africa	.....	.....	$1,620	.....	$7,144	.....	$6,970	$30,911	.....	$46,645
	721	*455*	*1,858*	*7,988*	*23,560*	*8,426*	*20,436*	*22,481*	*8,081*	*94,006*
Totals	$1,416,294	$983,198	$3,726,496	$10,540,639	$23,995,023	$9,614,479	$20,026,172	$21,965,959	$8,223,672	$100,491,932

Tire Exports, 1911 to 1921

	1911	1913	1914	1915	1917	1918	July 1 to Dec. 31, 1918	Calendar Year 1919	1920†	1921†	Totals Including 1912, 1916
Europe:											
Austria-Hungary	$329	$299	$1,009	.....	.....	.....	.....	$43,121	$224,087	$95	$271,313
Azores and Madeira Islands	.....	.....	138	$178	.....	$72	.....	.....	66,698	469	77,928
Belgium	821	401,900	15,730	.....	.....	.....	$28,718	532,532	1,280,309	74,315	2,386,045
Bulgaria	.....	500	170	150	.....	.....	.....	.....	3,570	.....	4,390
Czechoslovakia	.....	.....	.....	.....	.....	.....	.....	.....	154	8,568	8,722
Denmark	98	16,611	11,414	12,288	$6,917	.....	.....	1,254,324	959,241	279,370	2,556,620
Esthonia	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,316	4,316
Finland	.....	1,545	4,585	.....	.....	.....	.....	23,367	440,157	47,845	517,539
France	185,473	20,205	5,448	8,723	425,132	661,648	425,149	3,535,178	2,369,018	384,358	8,417,384
Germany	29,979	401,196	132,181	6,090	.....	.....	.....	33,280	576,714	13,283	1,193,883
Gibraltar	.....	.....	.....	.....	.....	129	.....	175	43,028	508	43,840
Greece	.....	.....	271	2,680	34,654	2,000	.....	83,449	311,079	111,538	546,370
Iceland and Faroe Islands	.....	.....	.....	.....	61	.....	.....	23,961	2,855	6,991	33,868
Italy	537	1,150	915	11,740	101,362	55,913	585	226,245	992,648	25,110	1,752,029
Jugoslavia	.....	.....	.....	.....	.....	.....	.....	300	16,674	20,736	37,710
Latvia	.....	.....	.....	.....	.....	.....	.....	.....	.....	47	47
Lithuania	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,416	1,416
Malta, Gozo and Cyprus Islands	.....	.....	.....	.....	.....	.....	.....	424	72,669	11,805	84,898
Netherlands	.....	424	2,286	1,907	26,326	215	.....	1,043,981	1,813,149	112,028	3,027,269
Norway	1,295	456	5,649	7,394	11,937	525	6,668	845,690	1,430,389	320,256	2,640,339
Poland and Danzig	.....	.....	.....	.....	.....	.....	.....	.....	278,096	32,902	310,998
Portugal	693	282	157	1,434	9,055	15,488	4,388	176,303	367,321	17,166	518,548
Roumania	.....	146	211	.....	.....	.....	.....	70,785	590,620	45,892	708,404
Russia in Europe	655	729	1,168	6,480	143,916	94,264	211	1,402	13,569	.....	1,388,127
Spain	3,547	567	1,595	2,408	77,753	12,233	20,899	825,007	1,925,185	311,841	3,214,019
Sweden	8,335	5,301	77,537	26,707	6,347	.....	18,825	1,373,847	2,619,103	566,242	4,745,739
Switzerland	.....	.....	.....	.....	.....	.....	.....	220,052	628,659	97,376	946,087
Turkey in Europe	.....	.....	.....	1,927	.....	.....	.....	85,334	215,834	44,503	347,598
England	1,104,416	1,125,718	1,503,440	2,655,099	2,569,901	.....	78,573	1,508,460	4,178,548	3,352,008	29,047,161
Scotland	.....	.....	336	245	66,753	618,071	.....	263	144,294	4,390	333,139
Ireland	.....	.....	.....	.....	.....	.....	.....	.....	2,220	841	4,604
North America:											
Bermuda	.....	401	267	139	14	409	.....	268	593	564	4,095
British Honduras	15	163	727	64	590	3,469	2,503	6,663	6,744	4,990	26,576
Canada	405,778	1,324,459	961,937	772,574	1,485,939	1,766,518	350,345	1,021,014	2,704,230	1,041,168	13,707,233
Miquelon, Langley, etc.	.....	.....	.....	.....	.....	.....	.....	.....	20	.....	20
Newfoundland and Labrador	955	693	1,668	4,034	8,243	11,317	8,952	24,319	31,871	18,674	106,978
Central American States:											
Costa Rica	951	2,793	6,877	2,381	11,918	4,018	4,505	12,301	15,568	9,350	78,593
Guatemala	1,343	2,224	5,547	3,406	24,545	7,089	15,642	64,981	61,776	41,686	236,666
Honduras	.....	299	1,392	3,229	19,657	19,602	8,813	35,489	26,455	23,529	146,799
Nicaragua	.....	429	180	419	294	1,042	2,743	32,075	26,480	12,131	76,080
Panama	5,379	19,466	18,362	24,549	74,047	137,609	51,959	416,637	482,641	147,056	1,455,632
Salvador	525	1,705	2,084	2,617	22,530	22,319	17,036	95,664	98,074	50,971	212,844
Mexico	144,893	203,883	111,948	106,083	257,413	777,984	566,442	805,614	1,438,777	1,368,253	6,166,580
West Indies, British:											
Barbados	1,227	4,588	4,351	4,136	15,666	19,391	20,385	31,026	31,813	32,407	172,628
Jamaica	11,614	30,004	55,361	36,887	109,048	109,097	76,099	156,822	271,381	130,884	1,046,836
Trinidad and Tobago	689	16,364	17,023	22,672	45,654	107,353	49,838	78,435	184,000	122,641	677,515
Other British	477	1,869	2,472	3,327	21,526	25,991	20,787	33,700	83,550	19,735	222,281
Cuba	27,072	12,322	55,236	192,355	1,019,915	1,336,233	929,796	2,013,071	3,409,986	1,372,108	10,937,218
Danish (Virgin Islands of U. S.)	.....	540	1,739	577	2,753	6,939	6,089	8,679	21,658	29,227	79,490
Dominican Republic	321	2,306	2,902	3,062	37,441	61,684	54,755	121,891	274,442	138,811	718,772
Dutch	30	767	746	3,068	7,386	9,084	8,190	10,390	24,137	17,702	86,060
French	.....	115	1,045	1,527	19,399	36,474	32,493	159,176	103,374	20,898	375,908
Haiti	.....	765	2,336	526	2,287	13,091	16,323	60,102	83,815	40,153	220,396
South America:											
Argentina	3,541	8,153	21,920	34,096	1,301,344	1,649,840	859,259	1,788,147	3,126,889	837,960	10,129,674
Bolivia	.....	106	1,526	3,413	9,187	20,513	22,558	24,191	31,974	10,150	128,572
Brazil	10,112	47,537	11,839	27,425	606,876	455,102	111,550	1,018,055	1,965,201	226,694	4,940,822
Chile	262	2,844	10,636	21,353	264,608	725,876	481,919	795,440	525,635	112,338	3,010,069
Colombia	2,564	16,211	18,925	15,239	30,298	54,648	20,276	124,238	183,859	64,314	573,457
Ecuador	392	8,459	3,313	8,620	13,645	46,305	20,052	77,189	52,297	30,044	270,156
Falkland Islands	.....	.....	.....	.....	1,817	.....	.....	.....	.....	486	2,303
Guiana, British	624	2,726	3,420	3,884	10,171	29,437	39,488	49,637	108,717	21,941	277,362
Dutch	.....	63	544	308	2,588	1,918	3,385	3,265	5,518	4,401	22,329
French	.....	.....	.....	.....	45	.....	75	81	420	322	957
Paraguay	.....	.....	.....	16	35	.....	264	2,046	1,245	503	4,109
Peru	557	1,273	4,838	5,253	27,934	107,236	156,232	230,812	263,698	175,879	984,120
Uruguay	586	1,990	17,987	11,826	100,427	224,694	72,735	645,970	903,687	157,873	2,215,232
Venezuela	130	10,703	20,439	32,635	128,966	116,612	67,565	226,953	285,497	142,477	1,105,661
Asia:											
Aden	.....	.....	55	264	440	2,536	.....	1,847	16,714	8,459	31,930
China	590	622	28,326	18,971	36,952	53,089	48,536	254,784	421,364	126,585	1,031,917
Kwantung (leased territory)*	.....	152	.....	.....	.....	547	.....	1,425	3,710	106	7,120
Chosen (Korea)	.....	240	2,578	2,189	3,909	927	1,388	11,538	16,966	8,373	52,438
British India	874	882	3,555	15,441	145,820	416,411	133,146	557,396	1,096,377	390,931	2,880,751
Straits Settlements	283	1,133	7,174	8,595	142,271	214,887	352,666	636,101	1,109,200	111,966	2,649,160
Other British East Indies	160	337	30	1,883	6,692	52,466	20,236	18,477	33,169	7,894	160,763
Dutch East Indies	916	860	2,677	7,688	415,742	347,912	416,036	686,873	1,712,524	501,798	4,300,483
French East Indies	916	860	2,677	7,688	415,742	347,912	1,514	7,518	6,594	3,156	1,002,044
French Indo-China	.....	.....	.....	.....	.....	.....	.....	.....	.....	345	345
Greece in Asia	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,843	4,843
Hejaz, Arabia and Mesopotamia	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,736	8,736
Hongkong	997	677	1,057	879	3,252	6,412	15,289	79,334	41,268	48,495	262,417
Japan	15,319	29,975	18,629	12,741	34,243	83,235	57,441	422,432	491,246	191,477	1,390,414
Palestine and Syria	.....	.....	.....	.....	.....	.....	.....	.....	.....	33,966	33,966
Persia	.....	.....	.....	.....	.....	.....	.....	1,092	8,091	3,461	12,644
Russia in Asia	.....	.....	.....	.....	12,432	.....	8,806	266,674	17,923	.....	305,935
Siam	207	1,334	92	742	8,547	16,179	12,444	12,239	18,843	11,833	84,686
Turkey in Asia	.....	.....	.....	4,037	.....	.....	1,067	12,734	77,202	62,197	157,396
Oceania, British:											
Australia	3,292	58,068	94,321	245,240	783,209	819,755	496,882	751,584	1,498,312	260,844	5,338,276
New Zealand	7,078	26,270	35,695	201,379	689,705	946,804	354,715	1,023,807	2,255,999	614,703	7,112,010
Other British	.....	37	432	164	5,008	16,124	617	7,118	14,074	13,887	58,335
French	.....	.....	396	.....	518	5,211	6,073	13,516	13,719	15,006	54,585
Other Oceania	36	956	7,278	5,262	8,102	10,801	2,854	8,862	5,676	4,921	64,403
Philippine Islands	90,759	100,476	141,205	250,832	345,702	863,727	423,568	1,372,544	2,423,198	656,573	7,133,981
Africa:											
Belgian Kongo	.....	.....	.....	.....	.....	.....	.....	.....	2,352	.....	2,369
British Africa, West	.....	89	.....	1,149	10,967	33,470	25,210	122,940	709,696	151,674	1,082,544
South	8,310	17,057	27,090	32,822	391,211	693,065	372,606	479,934	1,778,167	256,488	4,355,017
East	.....	536	642	4,833	20,162	21,849	165	32,402	119,281	52,916	260,570
Canary Islands	.....	270	.....	.....	.....	.....	.....	4,545	18,326	24,951	49,960
Egypt	.....	.....	208	63	1,316	.....	.....	25,881	143,772	53,158	224,930
French Africa	.....	.....	.....	.....	420	2,399	131	28,821	53,082	5,742	90,695
Italian Africa	.....	.....	.....	.....	174	.....	.....	.....	.....	.....	174
Kamerun	.....	.....	.....	.....	.....	.....	.....	.....	8,125	919	9,044
Liberia	.....	.....	.....	.....	92	.....	.....	45	2,661	161	2,959
Madagascar	.....	.....	.....	.....	.....	.....	565	.....	.....	.....	762
Morocco	.....	.....	.....	.....	.....	.....	.....	225	14,830	2,951	18,006
Portuguese Africa	71	.....	.....	946	.....	.....	2,698	150	29,732	1,644	38,950
										Grand Total	$165,865,931

*Previous to 1918 listed as British, French and Japanese China. †Includes Casings, Inner Tubes and Solid Tires.

American Exports to Noncontiguous Possessions

AUTOMOBILES

Country	1919	1920	1921 (11 months)
Alaska	55	235	63
	$51,485	$303,219	$66,542
Hawaii	1,382	2,860	2,561
	$1,456,196	$3,011,547	$2,531,612
Porto Rico	645	1,544	451
	$854,602	$2,075,175	$507,857
Total number	2,082	4,639	3,075
Total value	$2,362,283	$5,389,941	$3,106,011

TRUCKS

Country	1919	1920	1921 (11 months)
Alaska	35	99	14
	$29,649	$89,748	$9,554
Hawaii	229	495	214
	$417,122	$687,390	$342,775
Porto Rico	131	429	118
	$344,887	$1,064,207	$175,388
Total number	395	1,023	346
Total value	$791,658	$1,841,345	$527,717

PARTS

Country	1917	1918	1919	1920	1921 (11 mos.)
Alaska	$35,701	$37,071	$42,080	$109,596	$42,092
Hawaii	352,242	333,720	329,892	595,765	455,893
Porto Rico	205,525	241,562	314,023	642,422	273,707
Total value	$693,468	$612,353	$685,995	$1,347,783	$771,692

TIRES

Alaska...Tires not separated from other rubber goods.		
Hawaii,	1917	$997,550
	1918	963,329
	1919	1,135,412
	1920	1,306,980
	1921 (11 months)	1,082,995
Porto Rico,	1917	712,052
	1918	812,444
	1919	867,457
	1920	1,396,912
	1921 (11 months)	590,176

American Airplane Exports, 1916-1921

Countries	1916	1917	1918	1919	1920	1921	Totals
France				2	2		4
				$15,000	$42,600		$57,600
Norway				2			2
				$22,000			$22,000
Sweden			3				3
			$44,239				$44,239
England	240	12	4			2	258
	$1,964,094	$170,954	$27,775			$10,000	$2,172,823
Spain	4						4
	$37,980						$37,980
Netherlands			6				6
			$76,226				$76,226
Canada	16	102	2	8	5	1	134
	$95,046	$616,068	$6,500	$28,200	$27,160	$5,000	$777,974
Mexico					4	15	19
					$28,000	$98,165	$126,165
Cuba				2	2	1	5
				$5,000	$15,500	$8,000	$28,500
Argentina	1				9	19	29
	$5,000				$38,050	$79,500	$122,550
Bolivia					1		1
					$25,180		$25,180
Brazil	3		2	1	9	1	16
	$20,000		$34,500	$18,000	$109,000	$1,396	$182,396
Colombia				1	1	1	3
				$10,000	$10,000	$5,000	$25,000
Peru				1	25	2	28
				$4,500	$272,750	$5,000	$282,250
China					5		5
					$20,220		$20,220
Japan	2	7	3		1	1	14
	$8,400	$52,520	$16,880		$5,714	$15,000	$98,514
Australia		2		2			4
		$17,000		$20,000			$37,000
Philippine Islands				25	1	2	28
				$92,600	$4,000	$61,079	$157,679
British Jamaica	1						1
	$875						$875
Dutch East Indies	2	12					14
	$27,000	$145,000					$172,000
Nicaragua						2	2
						$25,000	$25,000
Hong Kong						1	1
						$1,800	$1,800
Totals	269	135	20	44	65	48	581
	$2,158,395	$1,001,542	$206,120	$215,300	$598,174	$314,940	$4,494,471
Parts of Aeroplanes	$4,843,610	$3,133,903	$8,877,977	$3,249,226	$554,375	$157,608	$20,816,699

American Motor Boat Exports

1914-1921

Year	No.	Value
1914	400	$519,584
1915	164	$273,516
1916	264	$800,231
1917	230	$917,438
1918	218	$2,460,583
July 1-Dec. 31 1918	104	$2,126,682
1919	140	$358,851
1920	298	$1,008,872
1921	171	$1,007,620
Total	1,789	$9,473,377

American Marine Engine Exports

1914-1921

Year	No.	Value
1914	11,606	$1,599,364
1915	5,907	$753,476
1916	8,002	$3,139,955
1917	9,815	$2,204,114
1918	7,225	$2,553,104
July 1-Dec. 31 1918	2,814	$1,496,859
1919	10,485	$5,894,055
1920	9,615	$3,283,032
1921	4,016	$1,406,291
Total	69,485	$22,330,250

THE latest official statistics available concerning the Irish automotive trade are for 1920. The value of automotive products imported by Ireland during 1919 and 1920 were as follows:

	1919	1920
Cars	£895,000	£3,600,000
Motorcycles	83,100	120,000

These are total figures and include products which came through as well as from England together with those which went direct to Ireland. The value of direct imported cars and chassis into Ireland for 1920 was as follows:

From	
U. S. A.	£464,519
Belgium	33,889
Canada	29,332
Germany	1,488

Exports of Foreign Nations Show Scope of World Automotive Trade

British, Canadian, French, Italian, Belgian and German export figures are presented here in more detail than has ever before been available. The compilations, specially arranged for automotive manufacturers, help to make complete the picture of automotive commerce throughout the world.

PERHAPS the most striking feature of the export statistics of other automotive manufacturing countries is the divergence of practice as regards the presentation of export information. In some instances such as France, for example, the figures are presented in such a way as to mean almost nothing from a commercial point of view. In other cases the information is not sufficiently segregated and classified to be of maximum value. This is probably due to the fact that automotive exports have not played so important a part in the foreign trade of any country as they have in the case of the United States.

A study of British and French statistics for a period of years, however, indicates that each year more complete information is being given. The figures presented in the accompanying tables have been specially compiled in convenient form so that automotive manufacturers may be able to analyze readily both the size, character and location of their chief competition.

British exports for 1921 show that the automotive trade in England failed to hold up as well from an export standpoint as did American. The British totals, of course, do not compare in volume with those of the United States, but they have been nearly twice as large as those of Canada, viewing the figures in a general way for several years back.

Canadian exports took a decided drop in every automotive line last year. The 1921 figures are for eight months ending in November, the Canadian figures being kept on a March 1 to March 1 fiscal year basis. Thus the column head 1921 really consists chiefly of 1920 figures. Even though four months are missing, the statistics indicate this drop.

The number of passenger cars exported from Canada during the eight months included in the returns, for instance, has not reached a total of half the previous year. The situation as regards truck exports is worse, as the eight months' total is only about 13 per cent of the previous year's twelve months' total. These percentages are rather unfavorable, but do not by any means indicate a cessation of export activity in Canada. Despite the depression, $4,584,134 worth of automotive products were shipped out of Canada during the eight months of their last fiscal year.

A closer analysis of the figures shows that a large

British Parts Exports

Destination	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	Total
Argentine Republic	£83,111	£80,489							£14,472	£26,195		£204,267
Belgium	£53,079	£65,706	£67,664	£61,872	£13				£61,485	£132,858	£67,375	£510,052
Brazil									£7,556	£14,576	£37,760	£59,892
Denmark (including Faroe Islands)									£25,135	£80,386	£21,964	£127,485
France	£240,159	£231,762	£228,439	£170,569	£167,919	£271,953	£287,976	£164,478	£507,516	£450,780	£95,096	£2,816,647
Germany	£52,725	£75,278	£88,432	£63,574					£26	£4,118		£284,153
Italy	£53,037	£64,881	£63,136	£59,579		£91,265	£95,510	£78,340	£111,058	£192,513		£809,319
Japan (including Formosa and Japanese leased territories in China)			£10,065	£3,885	£1,782				£12,070	£21,579	£35,692	£85,073
Java									£14,675	£26,593		£41,268
Netherlands	£44,183	£26,835							£32,233	£90,942		£194,193
Norway									£7,798	£13,825		£21,623
Russia	£9,945	£15,702	£11,156	£141,129	£53,551	£32,764	£177,519		£1,392	£4,862	£1,111	£449,131
Spain							£25,198	£9,287	£25,962	£50,540	£56,010	£166,997
Sweden									£5,649	£42,167		£47,816
Switzerland			£4,696	£17,715	£602				£31,694	£17,372		£72,079
Turkey									£4,767	£20,759		£25,526
United States of America	£22,540	£39,604	£47,171	£49,249	£17,826	£20,448	£10,922	£4,422	£5,330	£26,009	£35,569	£279,090
Other Foreign Countries	£146,675	£225,406	£103,488	£96,844	£92,622	£118,958	£66,348	£42,092	£46,838	£150,838	£390,312	£1,480,421
Totals—Foreign Countries	£705,454	£825,663	£624,247	£664,416	£334,315	£535,388	£663,473	£298,619	£915,656	£1,366,912	£740,889	£7,675,032
Australia	£84,410	£103,357	£118,587	£139,034	£137,388	£56,574	£43,262	£36,145	£102,877	£271,034	£112,183	£1,204,851
British East Indies			£15,244	£19,526	£21,185	£114,981	£103,478	£77,328				£351,742
British India	£100,828	£104,517	£84,251	£69,342	£68,185				£163,434	£178,670	£264,670	£1,033,897
British West Africa									£12,053	£17,854		£29,907
Canada	£36,816	£27,093	£3,940	£2,634	£1,837				£6,354	£12,503	£13,885	£105,062
Cape of Good Hope	£38,512	£49,829	£48,991	£38,675	£36,488	£30,302	£17,396	£8,492	£19,058	£59,033	£29,898	£376,674
Ceylon and Dependencies									£11,421	£30,026	£8,028	£49,475
Egypt									£20,415	£45,247	£12,222	£77,884
Natal	£5,296	£5,188							£3,173	£16,151	£7,319	£37,127
New Zealand	£39,435	£41,945	£52,847	£60,517	£61,257	£38,136	£28,518	£17,129	£47,520	£132,492	£36,831	£556,627
Straits Settlements and Dependencies (including Labuan)									£15,265	£53,706	£25,547	£94,518
Transvaal	£37,061	£46,593	£32,702	£29,372	£21,915	£28,238	£15,630	£14,636	£10,283	£24,920	£9,880	£271,230
Union of South Africa									£26,271	£59,832		£86,103
Other British Possessions	£116.428	£203,722	£34,760	£37,791	£39,087	£38,917	£33,528	£23,836	£36,718	£77,734		£642,521
Total—British Possessions	£458,786	£582,244	£391,322	£396,891	£387,342	£307,148	£241,812	£177,566	£474,842	£979,202	£520,463	£4,917,618
Total—Exported from United Kingdom	£1,164,240	£1,407,907	£1,015,569	£1,061,307	£721,657	£842,536	£905,285	£476,185	£1,390,498	£2,346,114	£1,261,352	£12,592,650

British Exports—Complete Motor Vehicles

Destination	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	Total
	194	*247*	*304*	*62*	*23*	*2*	.....	.....	*19*	*54*	.....	*905*
Argentine	£96,332	£114,095	£127,881	£26,852	£8,355	£2,354	.....	.....	£11,304	£58,042	.....	£445,215
	47	*91*	*154*	*199*	.....	.....	.....	.....	*177*	*98*	*29*	*795*
Belgium	£18,560	£23,642	£40,051	£44,230	.....	.....	.....	.....	£119,629	£82,991	£28,111	£357,214
	113	*198*	*77*	*39*	*4*	*2*	*8*	.....	*3*	*78*	*26*	*548*
Brazil	£41,934	£69,005	£28,098	£14,951	£943	£965	£1,036	.....	£2,138	£67,922	£27,607	£254,599
China (Exclusive of Hong Kong, Macao and leased territories)	.....	.....	.....	.....	.....	.....	.....	.....	*10*	*207*	.....	*217*
	.....	.....	.....	.....	.....	.....	.....	.....	£4,443	£161,687	.....	£166,130
	13	*42*	*146*	*125*	*142*	*110*	*27*	.....	*77*	*148*	*49*	*879*
Denmark (including Faroe Is'ands)	£3,382	£11,884	£30,689	£32,053	£30,813	£69,831	£14,049	£2,195	£54,429	£130,198	£47,490	£427,013
	82	*126*	*419*	*110*	*410*	*456*	*113*	*2,527*	*325*	*67*	*49*	*4,675*
France	£42,736	£63,380	£87,678	£38,295	£190,848	£214,550	£38,611	£1,812,131	£248,939	£52,378	£41,413	£2,830,959
	20	*43*	*109*	*35*	.....	.....	.....	.....	.....	*9*	.....	*216*
Germany	£9,480	£12,841	£28,482	£12,809	.....	.....	.....	.....	.....	£7,905	.....	£71,517
	33	*80*	*69*	*15*	*4*	*17*	.....	.....	*29*	*99*	*70*	*416*
Japan (Including Formosa and Japanese leased territories in China)	£12,976	£40,222	£26,506	£7,718	£1,015	£7,528	.....	.....	£35,721	£112,574	£73,217	£317,477
	53	*51*	*77*	*123*	*46*	*9*	.....	.....	*3*	*93*	.....	*455*
Java	£19,990	£18,007	£30,530	£34,745	£12,808	£4,066	.....	.....	£2,095	£63,721	.....	£185,962
	.....	.....	.....	.....	.....	.....	.....	.....	*35*	*139*	.....	*174*
Netherlands	.....	.....	.....	.....	.....	.....	.....	.....	£21,513	£99,673	.....	£121,186
	.....	.....	.....	.....	.....	.....	.....	.....	*19*	*54*	.....	*73*
Norway	.....	.....	.....	.....	.....	.....	.....	.....	£19,241	£36,121	.....	£55,362
	.....	.....	.....	.....	.....	.....	.....	.....	.....	*27*	.....	*27*
Persia	.....	.....	.....	.....	.....	.....	.....	.....	.....	£24,246	.....	£24,246
	.....	.....	.....	.....	.....	.....	.....	.....	.....	*30*	.....	*30*
Portugal	.....	.....	.....	.....	.....	.....	.....	.....	.....	£19,968	.....	£19,968
	.....	.....	.....	.....	.....	.....	*183*	.....	*38*	*15*	*8*	*244*
Roumania	.....	.....	.....	.....	.....	.....	£33,345	.....	£35,100	£20,370	£5,741	£94,556
	81	*103*	*429*	*312*	*276*	*590*	*658*	.....	.....	*6*	*4*	*2,459*
Russia	£39,704	£57,547	£114,806	£187,525	£194,727	£445,545	£423,591	.....	.....	£10,189	£9,100	£1,482,734
	34	*44*	*120*	*60*	*22*	*20*	*23*	*6*	*51*	*166*	*79*	*625*
Spain	£15,576	£16,588	£33,729	£25,421	£11,290	£8,523	£12,117	£7,307	£41,469	£159,739	£92,435	£424,194
	.....	.....	.....	.....	.....	.....	.....	.....	*29*	*71*	.....	*100*
Sweden	.....	.....	.....	.....	.....	.....	.....	.....	£17,284	£53,119	.....	£70,403
	.....	.....	.....	.....	.....	.....	.....	.....	*22*	*129*	.....	*151*
Turkey	.....	.....	.....	.....	.....	.....	.....	.....	£13,894	£103,315	.....	£117,209
	50	*76*	*76*	*64*	*33*	*74*	*31*	*5*	*8*	*30*	*26*	*473*
United States of America	£27,516	£41,464	£59,600	£41,339	£23,792	£80,136	£37,144	£5,250	£12,720	£41,290	£43,963	£414,214
	307	*420*	*561*	*463*	*112*	*101*	*84*	*96*	*70*	*310*	*1,164*	*3,688*
Other Foreign Countries	£137,459	£158,671	£172,070	£165,166	£36,518	£49,832	£40,405	£76,034	£51,979	£238,222	£883,332	£2,009,683
	1,027	*1,521*	*2,541*	*1,607*	*1,072*	*1,381*	*1,127*	*2,634*	*915*	*1,780*	*1,495*	*17,100*
Totals to Foreign Countries	£465,645	£627,346	£780,120	£631,104	£511,109	£883,330	£600,298	£1,902,917	£691,898	£1,543,670	£1,252,409	£9,889,846
	1,208	*1,118*	*1,055*	*1,191*	*430*	*145*	*3*	*4*	*53*	*258*	*189*	*5,681*
Australia	£433,530	£402,389	£348,017	£369,306	£129,344	£42,778	£9,039	£733	£32,530	£179,739	£144,308	£2,091,713
	725	*706*	*1,223*	*1,121*	*718*	*340*	*124*	*74*	*287*	*1,570*	*552*	*7,440*
British India	£276,275	£252,010	£379,195	£325,777	£206,061	£106,616	£69,305	£81,306	£203,393	£1,132,631	£540,763	£3,573,332
	113	*123*	*169*	*94*	*7*	*10*	*3*	*3*	*2*	*3*	*42*	*569*
Canada	£67,280	£77,683	£91,511	£54,531	£5,925	£7,993	£1,150	£1,800	£2,600	£2,938	£58,749	£372,160
	281	*311*	*557*	*321*	*117*	*47*	*12*	*1*	*15*	*184*	*84*	*1,930*
Cape of Good Hope	£99,996	£117,237	£172,491	£95,168	£31,503	£10,397	£3,320	£246	£8,941	£105,107	£53,267	£697,673
	125	*142*	*178*	*156*	*62*	*47*	*3*	.....	*8*	*88*	*40*	*849*
Ceylon and Dependencies	£48,964	£53,207	£57,102	£46,975	£18,869	£15,982	£1,646	.....	£3,952	£45,838	£24,200	£316,735
	.....	.....	.....	.....	.....	.....	.....	.....	*47*	*39*	.....	*86*
Channel Islands	.....	.....	.....	.....	.....	.....	.....	.....	£13,680	£14,221	.....	£27,901
	.....	.....	.....	.....	.....	.....	*81*	*136*	*44*	*188*	*46*	*495*
Egypt	.....	.....	.....	.....	.....	.....	£16,542	£40,044	£26,726	£150,016	£35,360	£268,688
	89	*116*	*191*	*76*	*14*	*16*	*7*	*3*	*16*	*52*	*31*	*611*
Federated Malay States	£36,130	£45,987	£64,449	£22,883	£3,875	£3,255	£1,565	£670	£9,589	£41,632	£27,396	£257,431
	67	*83*	*115*	*100*	*28*	*13*	*6*	.....	*6*	*48*	*31*	*497*
Natal	£24,779	£27,644	£31,857	£32,563	£6,981	£3,620	£1,802	.....	£3,592	£32,044	£23,641	£188,523
	472	*594*	*829*	*907*	*604*	*184*	*30*	*4*	*61*	*464*	*151*	*4,300*
New Zealand	£193,583	£221,188	£245,096	£249,924	£154,489	£51,443	£8,209	£1,528	£34,052	£297,879	£99,869	£1,557,260
Straits Settlements and Dependencies (including Labaun)	*128*	*180*	*285*	*165*	*39*	*54*	*55*	.....	*24*	*256*	*67*	*1,253*
	£47,647	£66,792	£87,085	£48,664	£10,624	£15,721	£14,300	.....	£10,987	£183,190	£53,267	£538,177
	155	*239*	*262*	*149*	*46*	*59*	*8*	*1*	*7*	*47*	*26*	*999*
Transvaal	£53,600	£84,373	£83,180	£51,333	£13,208	£13,521	£1,916	£324	£3,934	£30,308	£19,217	£354,914
	146	*144*	*190*	*167*	*142*	*187*	*79*	*31*	*29*	*282*	.....	*1,397*
Other British Possessions	£56,990	£47,859	£56,266	£43,998	£37,581	£43,230	£13,435	£7,067	£10,846	£178,318	.....	£495,590
	3,509	*3,756*	*5,054*	*4,447*	*2,207*	*1,102*	*438*	*257*	*599*	*3,479*	*2,754*	*43,207*
Total Exports from United Kingdom	£1,338,774	£1,396,369	£1,616,249	£1,341,122	£618,360	£314,556	£142,229	£133,718	£364,822	£2,393,861	£2,332,446	£21,882,352

percentage of Canadian exports during the four years shown in the tables have gone to British possessions. This trend is even more marked in an analysis of the British exports, in which it appears that more than 60 per cent of Great Britain's automotive export trade has been sent to its own possessions.

The Canadian figures show a remarkable decrease in parts exports to certain South American countries during the last four years. In 1919, for instance, Canada exported $287,478 worth of parts to the Argentine, but that total had steadily decreased every year since, until during the eight months of the present fiscal year it has reached a low point of $116.

The Italian figures show up favorably as compared with 1920. The first six months of 1921 were equal to just about half of the 1920 total in number of cars exported. This would indicate that Italian exports for 1921 held up remarkably well.

About the usual number of Italian cars were sold in the United States, 151 having been brought here during the first six months of 1921. In 1920 we took 209 Italian cars; in 1915, 163, and in 1914, 217.

Australia bought more Italian cars during the first six months of last year than during the entire twelve months of any previous year. Turkey, on the other hand, took only eight Italian cars in half of 1921, while it absorbed 363 during the previous year.

The Italian import figures show that Italy has taken only 13 American cars in the first half of 1921, as against the 151 Italian cars bought by America. Taking the 1920 totals into consideration as well, however, the balance is in favor of the United States by 577 to 360.

The German export figures are so incomplete as to be of little practical value. Through a strange mix-up in the German department which prepares these figures, the data for May to September, 1921, is available, but

British Exports—Motor Vehicle Chassis

Destination	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	Total
Argentine Republic	.....	.....	.....	.....	.....	.....	.....	.....	.....	*19*	.....	*19*
	.....	.....	.....	.....	.....	.....	.....	.....	.....	£19,209	.....	£19,209
Belgium	*36*	*32*	*37*	*81*	.....	.....	.....	.....	*83*	*43*	*25*	*337*
	£13,690	£11,191	£13,520	£49,577	.....	.....	.....	.....	£59,160	£43,324	£35,809	£226,271
Brazil	.....	.....	.....	.....	.....	.....	.....	.....	*5*	*19*	*8*	*32*
	.....	.....	.....	.....	.....	.....	.....	.....	£4,295	£14,784	£8,257	£27,336
China (exclusive of Hong Kong Macao and leased territories)	.....	.....	.....	.....	.....	.....	.....	.....	*4*	*34*	.....	*38*
	.....	.....	.....	.....	.....	.....	.....	.....	£3,707	£26,328	.....	£30,035
Cuba	.....	.....	.....	.....	.....	.....	.....	.....	.....	*24*	.....	*24*
	.....	.....	.....	.....	.....	.....	.....	.....	.....	£26,871	.....	£26,871
Denmark (including Faroe Islands)	.....	.....	.....	.....	.....	.....	.....	.....	*43*	*23*	*2*	*68*
	.....	.....	.....	.....	.....	.....	.....	.....	£35,031	£18,989	£385	£54,405
France	*77*	*114*	*134*	*154*	*35*	*139*	*190*	*25*	*31*	*91*	*72*	*1,062*
	£40,316	£63,070	£98,351	£114,147	£18,040	£60,769	£95,712	£23,940	£14,618	£108,348	£90,691	£728,002
Germany	*55*	*32*	*25*	*26*	.....	.....	.....	.....	.....	.....	.....	*138*
	£25,136	£12,990	£10,767	£11,382	.....	.....	.....	.....	.....	.....	.....	£60,275
Japan (Including Formosa and leased territories in China)	.....	.....	.....	.....	.....	.....	.....	.....		*21*	*67*	*92*
	.....	.....	.....	.....	.....	.....	.....	.....	£1,86	£13,406	£39,974	£55,244
Netherlands	.....	.....	.....	.....	.....	.....	.....	.....	*58*	*60*	.....	*118*
	.....	.....	.....	.....	.....	.....	.....	.....	£44,696	£48,784	.....	£93,480
Norway	.....	.....	.....	.....	.....	.....	.....	.....	*13*	*11*	.....	*24*
	.....	.....	.....	.....	.....	.....	.....	.....	£7,440	£6,836	.....	£14,276
Portugal	.....	.....	.....	.....	.....	.....	.....	.....	*3*	*22*	.....	*25*
	.....	.....	.....	.....	.....	.....	.....	.....	£2,120	£16,842	.....	£18,962
Russia	*7*	*11*	*8*	*383*	*48*	*48*	*391*	.....	.....	*15*	.....	*911*
	£2,300	£1,540	£3,752	£209,860	£20,654	£48,378	£243,844	.....	.....	£12,887	.....	£543,215
Spain	.....	.....	.....	.....	.....	.....	.....	.....	*7*	*53*	*27*	*87*
	.....	.....	.....	.....	.....	.....	.....	.....	£3,937	£46,431	£40,656	£91,024
Sweden	.....	.....	.....	.....	.....	.....	.....	.....	*2*	*21*	.....	*23*
	.....	.....	.....	.....	.....	.....	.....	.....	£1,550	£16,319	.....	£17,869
United States of America	*59*	*14*	*7*	*65*	*53*	*36*	*5*	.....	*10*	*145*	*63*	*457*
	£27,492	£6,949	£4,359	£51,410	£41,642	£30,076	£2,850	.....	£8,742	£214,357	£104,891	£492,768
Other Foreign Countries	*66*	*119*	*137*	*104*	*67*	*16*	*6*	*7*	*31*	*38*	*208*	*799*
	£23,425	£48,759	£39,997	£43,167	£17,253	£8,236	£2,717	£2,697	£24,166	£41,814	£204,842	£457,073
Totals—Foreign Countries	*300*	*322*	*348*	*813*	*203*	*239*	*592*	*32*	*294*	*639*	*400*	*4,182*
	£132,359	£144,499	£170,746	£479,543	£97,589	£147,459	£345,123	£26,637	£211,326	£675,529	£525,505	£2,956,315
Australia	*367*	*702*	*617*	*413*	*112*	*126*	*15*	*20*	*96*	*876*	*342*	*3,686*
	£137,062	£229,592	£175,154	£122,591	£35,173	£42,016	£4,283	£3,374	£56,911	£515,418	£235,749	£1,557,332
British East Indies	*38*	*53*	*109*	*89*	*51*	*152*	*35*	*7*	.....	.....	.....	*534*
	£16,592	£21,018	£45,405	£34,570	£16,568	£65,739	£18,448	£6,170	.....	.....	.....	£324,510
British India	.....	.....	.....	.....	.....	.....	.....	.....	*174*	*908*	*49*	*1,131*
	.....	.....	.....	.....	.....	.....	.....	.....	£124,049	£748,814	£50,026	£922,889
Canada	*8*	*37*	*65*	*13*	.....	.....	.....	.....	*14*	*26*	*21*	*184*
	£3,567	£21,096	£37,586	£7,987	.....	.....	.....	.....	£9,618	£25,244	£16,546	£121,635
Ceylon and Dependencies	.....	.....	.....	.....	.....	.....	.....	.....	*7*	*36*	*2*	*45*
	.....	.....	.....	.....	.....	.....	.....	.....	£4,952	£26,143	£1,226	£32,321
New Zealand	.....	.....	.....	.....	.....	*37*	*6*	*2*	*51*	*431*	*89*	*616*
	.....	.....	.....	.....	.....	£10,308	£3,638	£1,350	£43,157	£316,089	£74,477	£449,019
Straits Settlements and Dependencies (Including Labaun)	.....	.....	.....	.....	.....	.....	.....	.....	*3*	*94*	*34*	*131*
	.....	.....	.....	.....	.....	.....	.....	.....	£2,737	£82,933	£24,282	£109,952
Union of South Africa	.....	.....	.....	.....	.....	.....	.....	.....	*10*	*55*	.....	*65*
	.....	.....	.....	.....	.....	.....	.....	.....	£7,283	£44,594	.....	£51,877
Other British Possessions	*22*	*66*	*95*	*108*	*117*	*12*	*10*	*4*	*29*	*59*	.....	*522*
	£7,109	£21,019	£36,392	£35,005	£37,851	£2,982	£1,995	£1,225	£11,552	£32,916	.....	£188,046
Total British Possessions	*435*	*858*	*886*	*623*	*280*	*327*	*66*	*33*	*384*	*2,485*	*537*	*6,914*
	£164,330	£292,725	£294,537	£200,153	£89,592	£121,045	£28,364	£12,119	£260,259	£1,792,151	£402,306	£3,657,581
Total	*735*	*1,180*	*1,234*	*1,436*	*483*	*566*	*658*	*65*	*678*	*3,124*	*927,811*	*11,096*
	£296,689	£437,224	£465,283	£679,696	£187,181	£268,504	£373,487	£38,756	£471,585	£2,467680	£900	£6,613,896

Motorcycles and Tricars for 1911 to 1921, Inclusive

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Belgium	*62*	*149*	*651*	*775*	.....	*1*	.....	.....	*652*	*792*
	£1,642	£5,924	£26,322	£32,683	.....	£38	.....	.....	£42,211	£64,385
Denmark (including Faroe Islands)	.....	.....	.....	.....	.....	.....	.....	.....	*666*	*945*
	.....	.....	.....	.....	.....	.....	.....	.....	£43,565	£69,248
France	*66*	*235*	*580*	*1,037*	*1,240*	*1,813*	*4,308*	*3,329*	*2,302*	*1,017*
	£2,284	£9,860	£25,451	£48,152	£65,361	£90,148	£232,982	£220,967	£168,868	£75,117
Italy	*219*	*730*	*1,781*	*2,811*	*481*	*642*	*383*	*1,076*	*311*	*1,430*
	£8,925	£30,673	£76,182	£125,758	£19,898	£33,085	£20,837	£77,742	£23,438	£118,869
Japan (including Formosa and Japanese leased territories in China)	.....	.....	.....	.....	.....	.....	.....	.....	*63*	*308*
	.....	.....	.....	.....	.....	.....	.....	.....	£4,552	£24,477
Netherlands	*138*	*172*	*563*	*941*	*666*	*1,204*	*331*	*6*	*501*	*2,765*
	£4,407	£6,544	£20,693	£35,516	£22,239	£41,505	£11,329	£146	£32,168	£208,118
Russia	*63*	*91*	*214*	*3,597*	*1,043*	*794*	*5,131*	.....	*42*	*37*
	£2,466	£3,892	£9,630	£207,299	£80,828	£45,244	£435,968	.....	£3,865	£3,334
Other Foreign Countries	*478*	*1,022*	*1,759*	*1,892*	*1,206*	*1,888*	*392*	*304*	*634*	*2,827*
	£18,359	£41,507	£74,223	£81,069	£50,447	£82,090	£17,828	£13,130	£45,410	£229,354
Totals	*1,026*	*2,399*	*5,548*	*11,053*	*4,636*	*6,342*	*10,545*	*4,715*	*5,171*	*10,121*
	£38,083	£98,400	£232,501	£530,477	£238,773	£292,110	£718,944	£311,985	£364,077	£792,902
Cape of Good Hope	*562*	*1,299*	*1,661*	*949*	*453*	*436*	*398*	*33*	*190*	*864*
	£19,817	£54,482	£72,906	£44,205	£21,548	£21,444	£19,676	£1,759	£13,095	£74,386
Natal	*134*	*485*	*539*	*505*	*243*	*684*	*443*	*80*	*181*	*231*
	£5,194	£19,988	£24,610	£22,567	£11,369	£34,565	£21,871	£4,394	£10,931	£20,034
Transvaal	*756*	*1,127*	*1,179*	*748*	*441*	*825*	*1,041*	*108*	*156*	*631*
	£28,981	£46,252	£52,841	£34,178	£20,119	£36,590	£54,710	£5,828	£10,471	£49,363
British India	*439*	*876*	*1,182*	*1,143*	*880*	*1,124*	*196*	*80*	*941*	*3,962*
	£8,113	£38,176	£55,181	£53,003	£38,636	£52,602	£9,459	£6,383	£63,700	£303,136
Australia	*1,468*	*2,600*	*2,646*	*2,826*	*1,727*	*1,282*	*601*	*164*	*535*	*1,160*
	£54,176	£99,940	£109,256	£118,877	£76,007	£57,448	£27,492	£9,060	£35,397	£92,165
New Zealand	*2,122*	*3,094*	*2,626*	*2,389*	*1,852*	*997*	*275*	*65*	*366*	*863*
	£82,629	£120,296	£118,735	£101,617	£74,920	£48,744	£14,440	£3,466	£24,145	£74,669
Other British Possessions	*843*	*1,175*	*1,469*	*1,264*	*695*	*1,157*	*660*	*407*	*828*	*3,453*
	£51,863	£50,962	£67,239	£55,549	£29,002	£51,466	£31,662	£20,229	£55,527	£262,248
Totals to British Possessions	*6,324*	*10,656*	*11,302*	*9,824*	*6,291*	*6,505*	*3,614*	*937*	*3,197*	*11,164*
	£240,773	£430,096	£500,768	£429,996	£271,601	£302,859	£179,310	£51,119	£213,266	£876,001
Totals—Exported from United Kingdom	*7,350*	*13,055*	*16,850*	*20,877*	*10,927*	*12,847*	*14,159*	*5,652*	*8,368*	*21,285*
	£278,856	£528,496	£733,269	£960,473	£510,374	£594,969	£898,254	£363,104	£577,343	£1,668,903

British Tire Exports

	1913	1914	1915	1916	1917	1918	1919	1920	1921	Totals
								177,464		
Argentine Republic..	£115,994	£27,064	£54,829	£103,522	£97,110	£116,886	£98,802	£253,355		£867,562
								2,373		
Austria and Hungary.								£22,950		£22,950
								203,480		
Belgium.....	£87,205	£36,031					£168,698	£2[illegible],659	£36,354	£603,947
								68,559		
Brazil.....	£25,521	£17,557	£21,449	£25,389	£20,757	£34,302	£39,449	£84,723	£13,042	£282,189
								699,270		
Denmark.....	£18,744	£15,520	£43,681	£53,141	£32,012	£715	£109,941	£206,755	£54,002	£534,511
								108,340		
France.....	£68,071	£61,204	£89,914	£248,398	£178,483	£301,623	£744,235	£473,780	£40,051	£2,205,759
								18,328		
Germany.....	£33,526	£18,463					£32,189	£144,700		£228,878
								27,058		
Greece.....							£20,895	£73,639		£94,534
								668,068		
Italy.....	£33,593	£20,572	£38,964	£86,309	£73,531	£128,655	£186,314	£509,689		£1,077,627
								8,853		
Java.....					£20,856	£27,924	£22,195	£52,741		£123,716
								7,469		
Morocco.....							£5,147	£41,692		£46,839
								219,325		
Netherlands.....	£11,425	£22,927	£30,650	£37,569	£4,858	£77	£120,768	£168,351		£396,625
								170,707		
Norway.....							£31,879	£68,503		£100,382
								8,017		
Portugal.....							£50,570	£56,849		£107,419
								145,448		
Russia.....							£15,753	£101,495	£23,916	£141,164
								65,427		
Spain.....					£42,710	£36,453	£102,302	£130,412	£63,110	£374,987
								476,880		
Sweden.....							£66,605	£119,649		£186,254
								40,839		
Turkey.....							£2,555	£102,741		£105,296
								117,909		
Other Foreign Countries.....	£72,918	£77,498	£99,107	£184,118	£67,229	£74,541	£134,705	£217,624	£673,593	£1,601,333
								3,233,814		
Total—Foreign Countries.....	£466,997	£296,836	£378,594	£738,446	£537,546	£721,176	£1,953,002	£3,105,307	£904,068	£9,101,972
								59,147		
Australia.....	£16,606	£30,960	£44,068	£61,902	£29,976	£43,210	£25,652	£125,138	£36,721	£414,224
								81,070		
British East Indies...	£93,995	£72,934	£74,031	£162,563	£166,566	£203,409	£227,346	£409,680		£1,410,524
								551,225		
British India.....	£5,275	£6,200	£4,055	£9,634	£47,986	£33,694		£221,205	£176,039	£504,088
								10,442		
British West Africa..							£59,768	£58,921		£118,689
Cape of Good Hope..	£63,190	£52,542	£78,857	£87,984	£199,248	£74,393			£36,790	£593,004
								27,430		
Ceylon and Dependencies.....								£17,036	£16,131	£33,167
								21,583		
East African Protectorate.....								£8,182		£8,182
								13,284		
Egypt.....							£14,738	£65 654	£15,306	£95,698
								18,752		
Gold Coast.....								£15,980		£15,980
Natal.....					£77,121	£9,822			£14,943	£101,886
								85,439		
New Zealand.....	£35,884	£47,397	£73,486	£72,553	£61,127	£89,029	£40,721	£146,296	£35,481	£601,974
								36,805		
Nigeria.....								£13,472		£13,472
								26,125		
Straits Settlements (Including Labaun).								£18,475	£10,723	£29,198
Transvaal.....	£39,621	£40,064	£32,775	£73,615	£58,828	£48,627			£26,760	£320,290
								237,482		
Union of South Africa.							£74,712	£271,551		£346,263
								57,518		
Other British Possessions.....	£27,792	£34,858	£59,621	£97,437	£62,190	£93,670	£29,750	£98,213		£505,351
								1,226,302		
Total — British Possessions.....	£282,363	£284,955	£366,893	£565,688	£703,042	£595,854	£472,687	£1,469,803	£368,894	£5,109,990
Total From Great Britain	£749,360	£581,791	£745,487	£1,304,134	£1,240,588	£1,307,030	£2,425,689	£4,575,110	£1,292,962	£14,211,962

the first three months of the year cannot be obtained.

In 1921 French automobile exports underwent a shrinkage which is not immediately apparent from the official statistics given herewith. The total for the first ten months of the year is 780,858,000 francs, and, on the assumption that the last two months will be equal to the average, the year would show an excess compared with the preceding twelve months. It is necessary to explain, however, that French automobile exports are declared in metric tons, and a value is given to these for statistical purposes only. In 1920 a metric ton was valued at 3000 francs, but quite recently it was decided to reduce this value to 2150 francs. The change in values has been made for the year 1920, but for the first ten months of 1921 the 3000 value has been maintained. When the year is completed and the reduced value is applied, it will be found that the value of French exports has dropped to about 671,000,000 francs, or appreciably less than for the year 1920.

In 1914 the value of a metric ton of automobiles was estimated at 850 francs. This value was successively increased to 1150 francs in 1915, to 1500 francs in 1916 and, finally, to 3000 francs in 1920. The reduction to 2150 francs was decided a couple of months ago, and has been applied to the 1920 figures. The figures for 1921 will not be revised until the totals for the year are available.

The figures given herewith comprise both passenger cars and trucks, but do not cover spare parts, tires or agricultural tractors. The shrinkage is general throughout the series and is particularly noticeable as regards Spain and Portugal. Among the few countries with which there has been an appreciable increase of business are the United States and Roumania. These figures are a reflection of the world depression which marked the year 1921.

Belgian Export

Belgium exported automobiles to the value of 36,623,218 francs during the year 1920, of which 27,177,929 francs were complete cars and 9,445,289 francs represented chassis only. For the first nine months of 1921 the total was 33,237,566 francs. It is necessary to go back to 1913 to get a comparison, for 1914 was interrupted by the war, and in 1919 the Belgian factories had not got completely into production. For 1913 the total volume of business was 32,017,265 francs, representing 1694 complete cars and 1548 chassis without bodies.

Before the war the Argentine was the best client of Belgium, followed very closely by Great Britain. Last year the greatest volume of business was done with England, with Holland second; the South American countries are not even given separately, but are grouped with other countries. In March, 1921, Belgium revised her import duties, adopting a 20 per cent ad valorem duty in place of the old duty based on weight. More recently it was decided to double the duty on German cars. When these changes were made the government department decided to issue grouped export figures for complete cars and chassis, which explains the absence of details for 1921.

For a better understanding of the figures, it is worth while to examine more closely the methods of compilation used by the British government in making up the British automotive export figures. The following explanatory material gives some of the chief factors involved:

For years 1911 to 1918 inclusive, commercial and passenger cars are combined under the title, "Motor Cars

Canadian Exports

Passenger Cars, 1919-1921

Country	1919*	1920*	1921*	Eight Mos. Ending Nov. 1, 1921	Total
	.....	46	58	22	126
Aden	.....	$22,262	$26,524	$8,227	$57,013
	268	534	356	2	1,160
Argentine Republic	$264,482	$609,960	$580,749	$2,139	$1,457,330
	4,080	3,937	3,289	1,820	13,126
Australia	$1,812,690	$2,196,647	$1,724,223	$790,044	$6,523,604
	.....	1	.....	.....	1
Belgium	.....	$1,000	.....	.....	$1,000
	27	.....	.....	.....	27
Bolivia	$24,701	.....	.....	.....	$24,701
	236	175	28	4	443
Brazil	$233,661	$181,304	$44,840	$1,837	$461,642
	1,149	3,842	2,174	797	7,962
British Africa	$557,773	$2,296,509	$1,280,720	$353,368	$4,488,370
	.....	2	.....	.....	2
British Guiana	.....	1,688	.....	.....	1,688
	900	4,949	1,557	389	7,795
British India	$402,361	$2,722,603	$923,771	$171,394	$4,220,129
	13	317	168	7	505
Ceylon	$5,963	$145,751	$96,619	$3,960	$252,293
	81	4	15	2	102
Chile	$92,518	$5,603	$24,578	$1,810	$124,509
	88	103	79	10	280
China	$65,819	$116,212	$127,997	$13,896	$323,924
	.....	12	.....	.....	12
Denmark	.....	$13,218	.....	.....	$13,218
	612	1,294	1,662	631	4,199
Dutch East Indies	$338,241	$695,185	$1,085,654	$270,421	$2,389,501
	1	1	.....	.....	2
Dutch West Indies	$1,189	$1,189	.....	.....	$2,378
	6	.....	.....	.....	6
Ecuador	$7,043	.....	.....	.....	$7,043
	.....	7	.....	.....	7
Egypt and Soudan	.....	$7,694	.....	.....	$7,694
	14	16	.....	.....	30
Fiji	$6,800	$7,089	.....	.....	$13,889
	4	1	.....	.....	5
France	$1,940	$1,500	.....	.....	$3,440
	10	9	.....	.....	19
French East Indies	$8,437	$11,074	.....	.....	$19,511
	1	2	.....	.....	3
French West Indies	$844	$1,688	.....	.....	$2,532
	.....	5	.....	.....	5
Hayti	.....	$5,407	.....	.....	$5,407
	49	7	.....	19	75
Hong Kong	$28,095	$8,954	.....	$32,289	$69,338
	.....	1	.....	.....	1
Italy	.....	$900	.....	.....	$900
	.....	1	.....	.....	1
Jamaica	.....	$500	.....	.....	$500
	162	11	17	4	194
Japan	$140,754	$18,445	$27,232	$4,229	$190,660
	6	5	.....	.....	11
Madagascar	$3,060	$2,216	.....	.....	$5,276
	.....	4	6	4	14
Mexico	.....	$6,250	$9,186	$5,329	$20,765
	.....	6	.....	.....	6
Morocco	.....	$7,878	.....	.....	$7,878
	.....	66	55	7	128
Netherlands	.....	$77,046	$83,091	$7,553	$167,690
	54	38	.....	.....	92
Newfoundland	$29,759	$22,704	.....	.....	$52,461
	1,588	2,820	2,326	30	6,764
New Zealand	$806,775	$1,638,823	$1,448,507	$29,134	$3,923,239
	.....	45	66	.....	111
Norway	.....	$56,938	$107,213	.....	$164,151
	3	.....	.....	.....	3
Persia	$1,530	.....	.....	.....	$1,530
	11	2	6	.....	19
Peru	$14,486	$2,678	$9,150	.....	$26,314
	.....	9	.....	.....	9
Philippine Islands	.....	$10,053	.....	.....	$10,053
	.....	33	8	1	42
Portugal	.....	$42,531	$14,364	$1,559	$58,504
	25	.....	.....	.....	25
Russia	$35,025	.....	.....	.....	$35,025
	8	.....	.....	.....	8
San Domingo	$8,085	.....	.....	.....	$8,085
	60	24	105	62	251
Siam	$31,905	$13,314	$48,740	$25,197	$119,156
	.....	27	51	.....	78
Spain	.....	$33,019	$86,193	.....	$119,212
	641	978	999	5	2,623
Straits Settlements	$312,759	$474,908	$535,047	$4,101	$1,326,815
	.....	59	36	23	118
Sweden	.....	$75,137	$62,862	$13,430	$151,429
	.....	6	.....	.....	6
Trinidad and Tobago	.....	$9,066	.....	.....	$9,066
	.....	15	.....	.....	15
Turkey	.....	$16,806	.....	.....	$16,806
	1,472	807	1,358	404	4,041
United Kingdom	$713,920	$967,465	$1,422,548	$342,017	$3,445,950
	52	83	796	88	1,019
United States	$39,295	$62,463	$1,037,386	$45,977	$1,185,121
	.....	69	75	1	145
Uruguay	.....	$80,538	$122,395	$1,114	$204,047
	.....	.....	330	70	400
Other Countries	.....	.....	$446,689	$47,327	$494,016
Total Passenger Car Exports	11,621	20,373	15,620	4,402	52,016
	$5,989,908	$12,672,265	$11,376,278	$2,176,352	$32,214,803

*Fiscal year, March 1 to March 1.

Truck Exports, 1919-1921

Country	1919*	1920*	1921*	Eight Mos. Ending Nov. 1, 1921	Total
	456	768	867	198	2,289
Australia	$240,307	$351,775	$443,950	$94,553	$1,130,585
	116	873	443	20	1,452
British Africa	$63,793	$420,038	$132,158	$9,066	$625,055
	79	724	636	192	1,631
British India	$37,421	$345,899	$342,438	$90,802	$816,560
	3	54	50	.....	107
Ceylon	$1,680	$26,704	$27,062	.....	$55,446
	.....	3	.....	.....	3
China	.....	$1,391	.....	.....	$1,391
	33	278	608	79	998
Dutch East Indies	$18,095	$128,418	$326,856	$36,414	$509,783
	.....	7	.....	.....	7
Egypt and Soudan	.....	$6,028	.....	.....	$6,028
	.....	2	.....	.....	2
Fiji	.....	$928	.....	.....	$928
	6	.....	.....	.....	6
Hong Kong	$3,071	.....	.....	.....	$3,071
	7	9	.....	.....	16
Newfoundland	$4,020	$6,908	.....	.....	$10,928
	512	878	668	.....	2,058
New Zealand	$289,842	$413,610	$368,699	.....	$1,072,151
	.....	15	.....	12	27
Siam	.....	$6,957	.....	$5,219	$12,176
	42	81	264	40	427
Straits Settlements	$27,018	$39,652	$139,040	$17,886	$223,596
	.....	3	.....	.....	3
St. Pierre and Miquelon	.....	$3,675	.....	.....	$3,675
	1,306	.....	.....	.....	1,306
Turkey	$621,023	.....	.....	.....	$621,023
	.....	425	619	6	1,050
United Kingdom	.....	$426,849	$643,344	$7,184	$1,077,377
	7	13	.....	5	25
United States	$7,500	$32,510	.....	$3,750	$43,760
	.....	.....	131	12	143
Other Countries	.....	.....	$75,556	$12,604	$88,160
Total Truck Exports	2,567	4,133	4,286	576	11,550
	$1,313,770	$2,211,342	$2,499,103	$277,478	$6,301,693

*Fiscal year, March 1 to March 1.

Exports of Tires, 1919-1921

Country	1919*	1920*	1921*	Eight Mos. Ending Nov. 1, 1921	Total
Argentine	$494,509	$366,712	$401,196	$88,818	$1,351,235
Austra ia	578,765	836,026	802,058	6,240	2,223,089
Belgium	.....	86,824	3,753	.....	90,577
Braz l	.....	76,361	168,160	26,388	270,909
British Africa	99,099	230,541	471,372	53,222	854,234
British Guiana	.....	15,552	22,953	8,967	47,472
British India	55,502	222,787	174,363	53,102	505,754
British West Indies	49,304	57,541	95,816	108,994	311,655
Ceylon	.....	8,406	53,913	10,705	73,024
Chile	.....	43,219	22,441	14,130	79,790
Cuba	164,819	30,385	21,067	1,470	217,741
Denmark	.....	108,244	88,026	31,163	227,433
Dutch East Indies	113,441	160,183	163,230	48,577	485,431
France	.....	245,458	660,136	2,140	907,734
Japan	20,353	138	20,925	24,948	66,364
Netherlands	.....	38,325	75,556	11,061	124,942
Newfoundland	.....	27,150	15,370	1,770	44,290
New Zealand	432,123	607,738	615,346	45,758	1,700,965
Panama	.....	87,289	132,959	12,537	232,785
Peru	.....	18,384	3,974	212	22,570
Spain	.....	161,387	185,974	15,028	362,389
Straits Settlements	.....	37,431	145	.....	37,576
Sweden	.....	33,404	82,471	1,200	117,075
United Kingdom	154,439	3,548,149	3,641,720	754,673	8,098,981
United States	407,162	253,249	179,133	66,183	905,727
Uruguay	.....	59,435	162,711	14,696	236 842
Other Countries	447,458	63,850	181,022	127,190	819,520
Total Tires Exported	$3,016,974	$7,424,168	$8,445,790	$1,529,172	$20,416,104

*Fiscal year, March 1 to March 1.

Automobile Parts, 1919-1921

Country	1919*	1920*	1921*	8 Months Ending Nov. 1, 1921	Total
Argentine Republic	$287,478	$36,933	$1,797	$116	$326,324
Australia	386,277	238,026	474,963	131,829	1,231,095
British Africa	124,887	228,930	369,210	109,344	832,371
British India	225,647	156,276	583,979	40,765	1,006,667
Dutch East Indies	23,055	9,664	96,062	64,108	192,889
New Zealand	89,981	80,401	451,727	12,711	634,820
Straits Settlements	74,388	27,796	246,154	17,525	365,863
United Kingdom	8,708	1,933,265	86,137	78,600	2,106,710
United States	282,273	352,471	1,870,093	106,769	2,611,606
Other Countries	49,602	33,704	82,203	39,365	204,874
Total Parts Exported	$1,552,296	$3,097,466	$4,262,325	$601,132	$9,513,219

*Fiscal year, March 1 to March 1.

French Automobile Exports from 1914 to 1921.

Value of Exports in FRANCS.

	1914	1915	1916	1917	1918	1919	1920	1921 (10 Months)
Great Britain	35,106,800	16,734,800	2,445,000	112,300	1,600	11,539,500	201,098,000	177,564,000
Germany	12,290,300	.....	.....	.....	.....	465,000	7,653,000	11,300,000
Belgium	14,141,400	.....	.....	15,600	.....	12,234,000	162,956,200	197,387,000
United States	1,726,400	3,459,200	1,864,200	150,200	31,200	2,187,000	11,321,100	78,384,000
Argentina	5,843,700	902,800	815,900	289,600	143,500	733,500	12,447,100	8,004,000
Italy	3,751,600	6,052,100	3,836,300	1,007,800	897,900	4,539,000	16,509,900	3,258,000
Switzerland	3,253,900	505,200	362,600	739,600	487,400	2,791,500	27,004,200	30,863,000
Spain	5,267,000	4,574,400	2,910,700	766,600	396,200	27,025,500	166,006,100	72,579,000
Egypt	587,300	392,900	196,600	32,800	14,000	153,000	4,995,100	6,124,500
Mexico	393,100	13,800	.....	.....	.....	3,000	5,902,600	3,376,500
Brazil	2,230,700	294,400	232,400	48,300	12,500	.....	7,892,000	3,526,500
Russia	3,559,800	24,455,800	62,308,000	0,842,700	.....	3,255,000	1,125,500	73,500
Holland	50,800	1,068,400	53,000	.....	.....	2,001,000	5,830,900	8,524,500
Portugal	2,093,000	1,108,000	657,200	205,100	218,400	5,170,500	13,655,700	5,365,500
Austria	654,500	.....	.....	.....	.....	.....	266,300	669,000
British India	350,700	1,307,600	17,200	39,900	.....	141,000	6,292,700	4,840,500
Denmark	95,500	378,900	199,700	.....	.....	1,401,000	6,586,200	3,289,500
Chili	1,054,800	471,800	298,000	.....	73,300	54,000	1,337,400	2,403,000
Turkey	1,267,200	.....	.....	.....	.....	448,900	3,573,700	8,821,500
Uruguay	96,900	62,100	65,600	.....	.....	606,000	3,445,100	592,500
Roumania	395,300	82,800	4,154,100	9,310,100	.....	2,637,000	5,128,500	13,782,000
Colombia	270,200	66,000	12,200	.....	.....	.....	473,000	165,000
Australia	522,800	136,900	109,200	.....	.....	.....	187,000	711,000
Canada	203,400	.....	.....	.....	.....	.....	182,700	117,000
Dutch Indies	.....	621,600	.....	.....	.....	.....	668,700	810,000
Other Countries	9,664,100	3,295,160	3,664,183	1,263,040	992,290	3,133,100	39,727,885	63,584,000
French Colonies	18,642,950	3,781,380	4,335,870	1,460,100	854,490	43,990,500	171,633,205	74,743,000
Total	123,514,250	69,766,040	88,537,953	36,283,740	4,122,780	124,509,000	883,699,790	780,858,000

BELGIAN AUTOMOBILE EXPORTS

1919, 1920 and first nine months of 1921

VALUE IN BELGIAN FRANCS

Country	Complete Cars				Chassis Only				Complete Cars and Chassis	
	1919		1920		1919		1920		1921 (9 months only)	
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value
Great Britain	38	541,400	352	7,294,600	3	51,000	256	3,853,775	221	6,768,396
Holland	48	463,000	225	3,994,846	..	.....	..	.....	178	4,651,499
France	17	324,000	95	1,721,702	7	85,800	62	857,332	82	1,875,073
Spain	11	212,000	127	3,249,500	..	.....	..	.....	92	3,604,600
Portugal	7	125,000	134	2,551,957	..	.....	..	.....	14	638,000
Germany	3	55,000	7	66,350	..	.....	20	674,500	54	1,777,000
Italy	..	.....	2	86,000	..	.....	7	75,575	..	.....
United States	..	.....	4	85,000	..	.....	3	74,000	19	737,000
Other Countries	26	391,470	253	8,127,974	34	282,325	191	3,910,107	345	13,185,998
Total	150	2,111,870	1199	27,177,929	44	419,125	539	9,445,289	1005	33,237,566

(Complete)." For 1919 and 1920 the cars were divided under the titles "Touring Cars (Including Cabs)" and "Commercial Vehicles (Including Motor Fire Engines, Motor Ambulances)." All motor car and truck figures have been combined in compiling the report herewith

German Automotive Exports, May to September, 1921

Country	Cars and Chassis (Kilograms)	Parts (Kilograms)	Tires (Kilograms)	Motorcycles (Number)
Austria	150,300	235,600	.....	.....
Belgium	250,600	41,000	.....	.....
Central America	34,100	1,800	.....	.....
Czecho Slovakia	.....	.....	100,700	.....
Dantzig	.....	.....	54,100	.....
Denmark	380,700	51,900	83,000	261
Finland	236,400	9,300	.....	.....
France	3,000	2,500	.....	.....
Great Britain	388,100	13,800	.....	.....
Hungary	.....	.....	28,300	.....
Italy	24,100	101,700	10,600	.....
Netherlands	943,700	60,700	123,600	252
Norway	140,100	6,200	.....	.....
Portugal	28,000	2,700	.....	.....
Saar District	.....	.....	48,500	.....
South America	167,900	13,900	15,200	.....
South East Asia	267,100	9,400	37,200	.....
Spain	491,900	32,500	.....	.....
Sweden	415,800	28,600	.....	44
Switzerland	345,800	40,100	87,200	123
United States	352,700	23,000	.....	.....
Other America	77,700	.....	.....	.....
Other Countries	1,291,800	143,210	207,800	387
Total Exports	5,989,800	817,910	796,200	1,067

under the one title, "Motor Cars."

In the several reports compiled a total for the several years will be noticed for the individual countries. This is not a true total of the automotive exports for the individual country except where there are complete figures for each year from 1911 to 1920, inclusive. The total is given

Italian Automobile Imports

For Years 1920 and 1921

COUNTRY	NUMBER OF CARS	
	1920	1921 (6 Months)
Austria	84	52
France	740	49
Germany	75	51
United States	564	13
Other Countries	92	23
Total	1555	188

Italian Car Exports

Country	1914	1915	1920	1921 (6 months)
Belgium	17	71	608	353
Denmark	1	4	143	10
France	210	374	451	282
Great Britain	985	684	3,068	1,301
Greece	73	31	106	241
Norway	16	24	172	51
Holland	41	21	283	80
Portugal	22	8	189	26
Spain	36	51	1,198	485
Switzerland	219	37	983	559
Turkey	37	....	363	8
British India	48	84	568	225
Australia	157	194	142	343
Algeria	2	....	227	13
Egypt	3	1	279	127
Argentine	131	35	332	225
Brazil	35	12	214	99
United States	217	163	209	151
Other Countries	1,041	691	1,785	1,180
Total	3,291	2,485	11,320	5,759

so that it will be possible to obtain a general idea as to the relative quantity of the imports from the United Kingdom.

It is interesting also to note the varying trend in exports from the different countries, as noted by the rise and fall in value of particular export markets. This trend is sometimes quite marked over a limited period of time, as, for instance, in the figures reported to the Automotive Division of the Department of Commerce by Commercial Attache Tower at London show the trend of passenger cars exported during November, 1921, to have been toward British dominions, colonies and possessions, and of commercial cars toward foreign countries.

Automotive Products Imported Into Great Britain, 1920-21

	NUMBER		VALUE IN POUNDS	
	1920	1921	1920	1921
Cars and Cabs	24,055	5,138	7,334,339	1,294,020
Trucks of all kinds	9,277	2,298	3,148,146	525,092
Chassis of Cars and Trucks	12,106	4,071	4,254,949	1,090,370
Motorcycles and Tricars	4,305	2,171	285,820	66,513
Parts of Cars and Trucks	.....	.....	8,709,846	2,922,642
Parts of Motorcycles and Tricars	.....	.....	121,539	123,212
Tires and Tubes	.....	.....	5,577,061	4,086,078

General Automotive Statistics

The Trend of the Petroleum Industry in 1921

Basic need for automotive transportation is again emphasized by the fact that the total yearly consumption of gasoline increased in spite of the prevailing business depression. Better refinery practice in recent years has resulted in higher ratio of gasoline recovered to crude oil refined.

Joseph E. Pogue[1]

ONE of the most remarkable industrial features of the year just closed—a year of almost unprecedented depression in business—was the fact that the consumption of gasoline in the United States increased about 6 per cent over the preceding year.[2] Those who had any doubt about the basic character of automotive transportation must have been surprised by this growth so at variance with the course of practically all other activities. In the presence of world-wide industrial stagnation this fact should stand out as a clear beam of light to the automotive industry and the petroleum industry alike.

The 6 per cent increase in gasoline consumption, it is true, represents a slowing down in the rate of increase that has characterized the past few years, inevitably so under the conditions. But the supply of crude petroleum, curiously enough, went on increasing at its accustomed geometric rate, and in consequence more oil became available than current needs could absorb. Thus, as the year wore on, the price of crude petroleum fell to substantially a pre-war level and, in spite of an unequaled demand for gasoline, the petroleum industry traversed the valley of depression along with the rest of the industries of the country. Had the petroleum industry been able to cut its production to the measure of demand, an easier journey through the dark months would doubtless have been the result.

The broad features of the crude petroleum situation in 1921, as contrasted with 1919 and 1920, are graphically shown in Fig. 1. Domestic production increased, but not so much as in 1920. Imports from Mexico likewise were greater, though to a less degree than in the previous year. On the other hand, the consumption of crude petroleum was less and the surplus went into storage. But how could our consumption of crude petroleum decline when, as just noted, the demand for gasoline increased? The answer is of outstanding importance to the automotive industry. In 1920, the ratio of gasoline production to crude petroleum consumption was 19.9 per cent, while in 1921, the ratio rose to 23.4 per cent; that is to say, the growth of technology supported an increase in motor fuel service on a decreased consumption of crude. This factor, though not absolutely needed in 1921, nevertheless was operative and represents the mainstay of the future in the event of a lagging supply of crude petroleum.

A more detailed view of the development of the crude petroleum situation is afforded by Fig. 2, where the principal factors are shown on a monthly basis over the past three years. The most striking features are the violent sag in price and the large imports, falling to a low point in August, but reaching unusual heights again in the fourth quarter of the year.

The imports are all from Mexico, and the productivity of the Mexican oil fields plays an important part in the petroleum supply of the United States. The serious inroads of salt water in the largest pools in Mexico have been discussed rather fully in an earlier article in this journal.[3] According to the best available information, the life of the known field in Mexico is limited, and the output of that country will shortly be considerably reduced pending the development of new productive areas,

[1]Consulting Engineer, New York.

[2]The statistics presented in this review were derived from the following sources: Data on crude petroleum from U. S. Geological Survey and American Petroleum Institute; refined products from U. S. Bureau of Mines; well data from *Oil and Gas Journal;* export figures from U. S. Bureau of Foreign and Domestic Commerce; prices calculated by the writer from quotations given in the *National Petroleum News,* and *The Oil, Paint, and Drug Reporter.*

[3] AUTOMOTIVE INDUSTRIES, Dec. 29, 1921, pp. 1254-1256. See also Pogue, The Economics of Petroleum, New York, 1921, pp. 18-21.

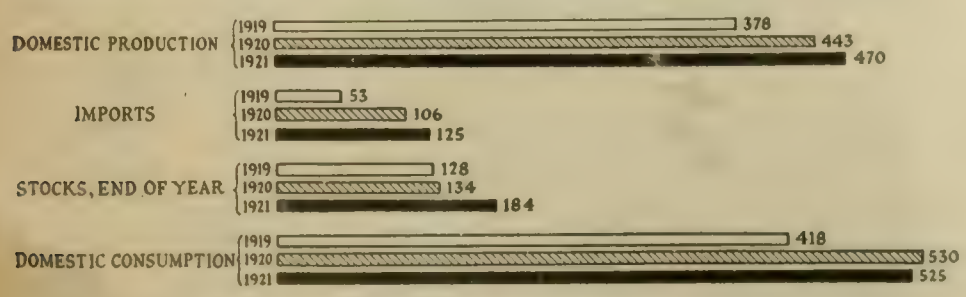


Fig. 1—Comparative views of the principal factors in the crude petroleum situation over the past three years, in millions of barrels

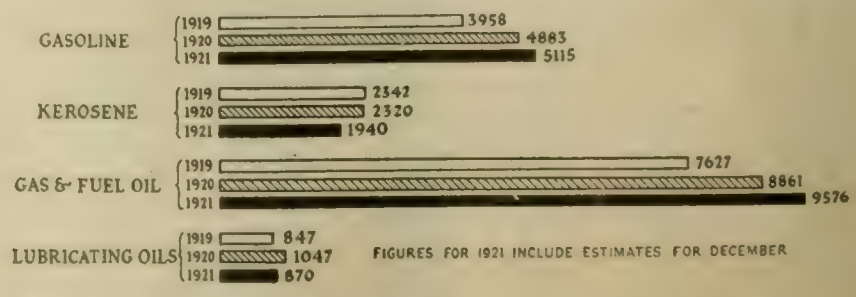


Fig. 5—Comparative view of the production of the principal petroleum products over the past three years, in millions of gallons

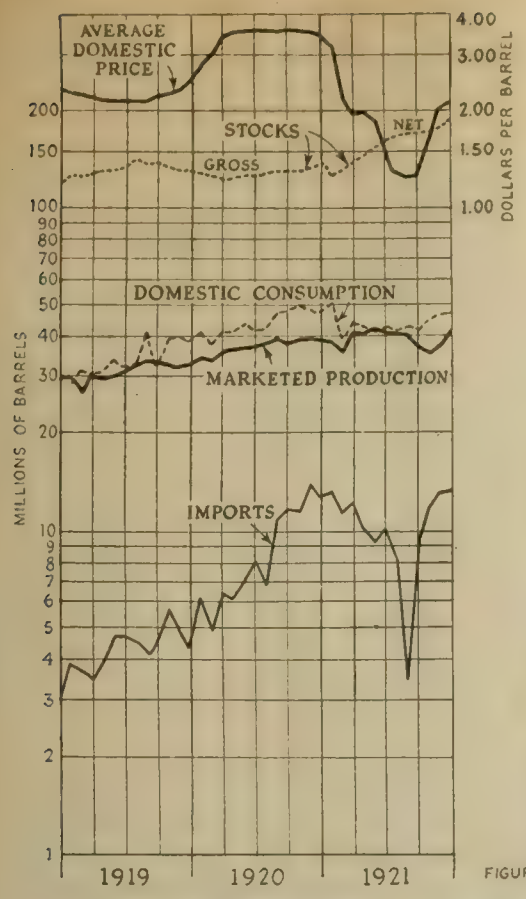


Fig. 2—Trend of the crude petroleum situation by months, 1919-1921

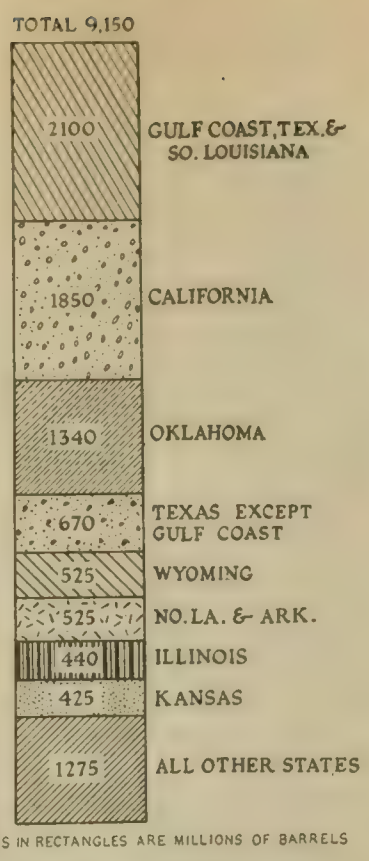


Fig. 3 — Distribution of the unmined supply of crude petroleum in the United States on January 1, 1922, according to inventory recently completed by the U. S. Geological Survey and the American Association of Petroleum Geologists

which, of course, will take time.

During 1921, domestic production of crude petroleum failed to increase as sharply as during 1920, although the closing months of the year saw the bringing in of a large number of gushers, particularly in the new Mexia field in central Texas. Although drilling was strongly curtailed by the decline in crude oil prices, the effect of fewer wells was offset by the large average size of the new wells brought into production. It seems that some of the most productive oil territory in the United States was penetrated by the drill in 1921.

During 1921 the United States Geological Survey, in co-operation with the American Association of Petroleum Geologists, made an exhaustive analysis of the unmined supply of crude petroleum in the United States. Using the same methods for estimating the national resource that are employed by all progressive oil companies for appraising the value of oil properties, the joint committee estimated that 9,000,000,000 barrels of oil recoverable by methods now in use remained in the ground in this country on Jan. 1, 1922. The distribution of this reserve is shown in Fig. 3, where it may be observed that 58 per cent of the total is allotted to Oklahoma, California, and coastal Texas and Louisiana. The oil reserve has been previously estimated by the Geological Survey; the previous appraisal made in 1918 is increased by nearly 70 per cent, but the total still looks small when compared with our annual draft now fast approaching the half billion point.

TABLE 1—TREND OF THE CRUDE PETROLEUM SITUATION
(In millions of barrels)

	Domestic Production	Imports	Stocks End of period	Domestic Consumption	Average price $ P. Bbl.
By Years					
1913	248	17.8	123	262	$1.14
1914	266	17.2	142	261	.93
1915	281	18.1	164	273	.75
1916	301	20.6	162	319	1.33
1917	335	30.2	146	378	1.77
1918	356	37.7	122	413	2.22
1919	378	52.8	128	418	2.25
1920	443	106.2	134	530	3.44
1921	470	125.3	184	525	1.86
By Months					
1921					
Jan.	37.9	13.2	124	48.3	3.28
Feb.	35.3	11.4	131	39.3	2.19
Mar.	41.0	12.3	138	45.2	1.98
Apr.	40.1	10.0	145	42.5	2.00
May	42.0	9.1	154	41.5	1.81
June	40.4	10.2	161	42.8	1.45
July	40.3	8.0	167	41.5	1.28
Aug.	41.0	3.4	168	42.6	1.25
Sept.	36.6	9.1	171	41.7	1.25
Oct.	35.6	11.6	173	45.2	1.63
Nov.	37.9	13.0	176	46.1	2.07
Dec.	42.0	13.8	184	47.8	2.10

TABLE 2—TREND OF THE PRODUCTION OF THE PRINCIPAL PRODUCTS OF PETROLEUM
(In millions of gallons)

	Gasoline	Kerosene	Gas and Fuel Oil	Lubricating Oils
By Years				
1914	1500	1935	3734	517
1915	....	....	....	...
1916	2059	1455	4664	625
1917	2851	1727	6513	754
1918	3570	1825	7321	841
1919	3958	2342	7627	847
1920	4883	2320	8861	1047
1921[a]	5115	1940	9576	870
By Months				
1921				
Jan.	460	205	837	86
Feb.	388	163	733	72
Mar.	420	169	758	73
Apr.	426	156	813	76
May	449	145	817	70
June	430	142	826	63
July	420	139	807	66
Aug.	432	144	784	66
Sept.	417	154	788	69
Oct.	441	182	834	76
Nov.	432	175	799	77
Dec.	...	...	...	..

[a]December estimated.

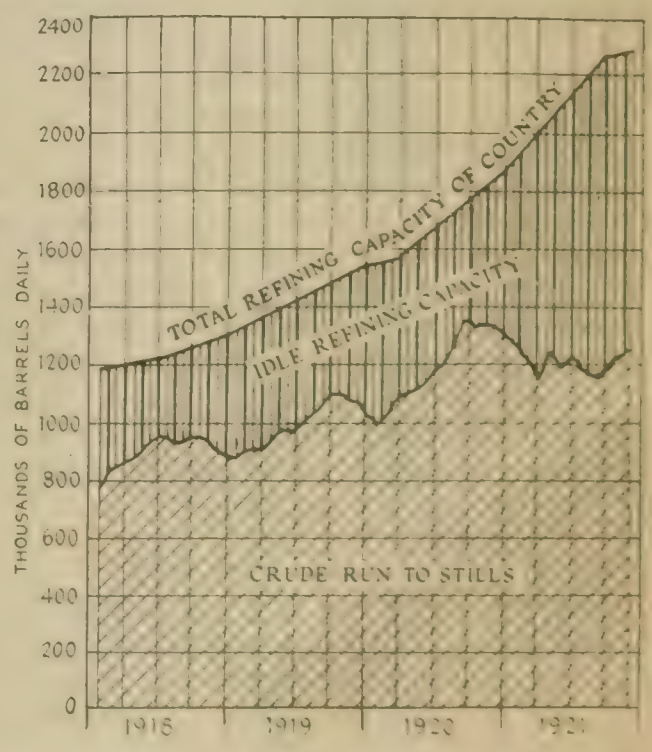


Fig. 4 — Refinery activity in the United States by months, 1918-1921, showing the proportion of the refinery capacity utilized

The present appraisal undoubtedly carries sufficient precision to warrant its careful consideration by everyone interested in the future of automotive transportation.

Refining Activity

The aggregate activity of the refineries of the country fell away during 1921 from the vigor displayed during the closing months of 1920, as illustrated in Fig. 4. The

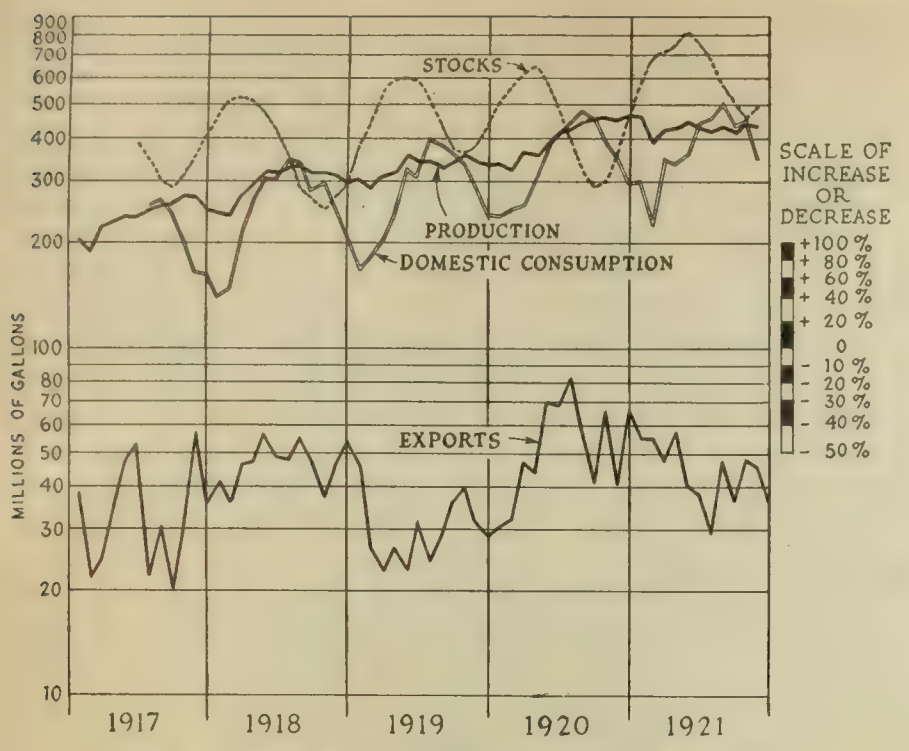


Fig. 6—Trend of the gasoline situation by months, 1917-1921.

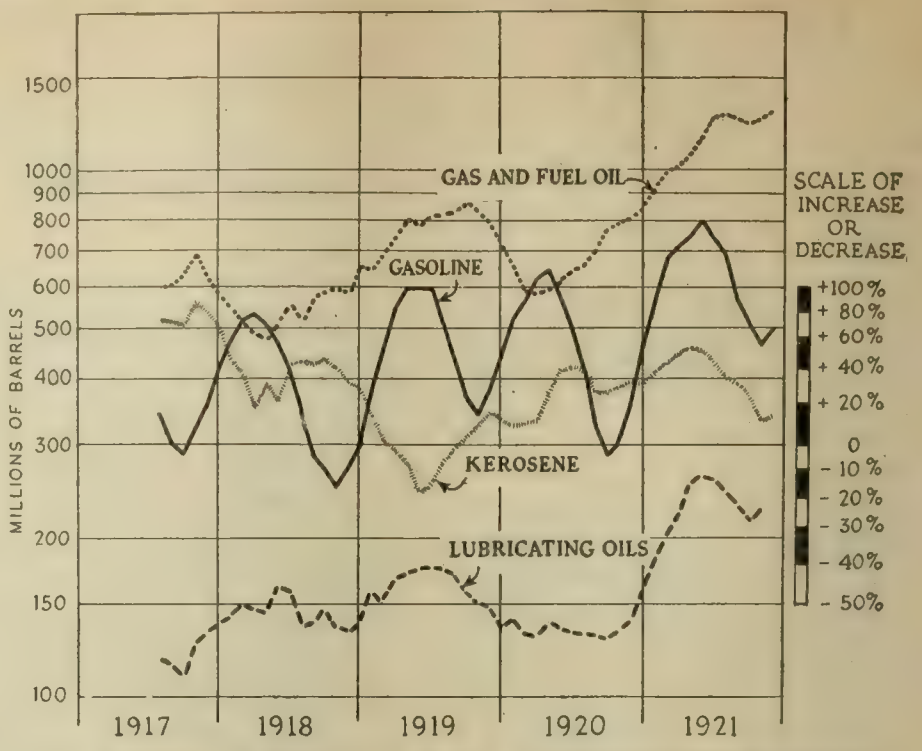


Fig. 7—Trend of the stocks of the principal petroleum products by months, 1917-1921.

decline, however, was moderate in comparison with the recession characteristic of almost all other productive enterprises. A considerable capacity of new stills, inaugurated during 1920, came to a head in 1921, so that the idle refinery capacity toward the close of 1921 was nearly double that of the previous year. Fig. 4 throws these facts into perspective and suggests the degree to which the total refinery capacity of the country has in recent years run in advance of our consumptive requirements. It should be noted, however, that much of this surplus capacity consists of incomplete refineries of the skimming or topping variety; that is, refineries which confine their efforts primarily to the manufacture of fuel oil and gasoline.

Output of Refined Products

A comparative view of the domestic production of the principal products of petroleum—gasoline, kerosene, gas and fuel oil, and lubricating oils—is given in Fig. 5. (See also Table 2.) It will be observed at once that the output of gasoline and fuel oil increased in 1921 as compared with 1920, but the production of kerosene and lubricating oils registered a decline. The advance in the case of gasoline, of course, reflects the increase in the consumptive requirements of automotive transportation previously adverted to, and fuel oil, as a joint product with gasoline, of necessity shared in this expansion. In fact, the enforced production of fuel oil under these circumstances created an unbalanced market condition that proved unusually embarrassing to the refiner. The decline in kerosene and lubricants was an accompaniment of the depression in industry that generally prevailed.

Exports of Refined Products

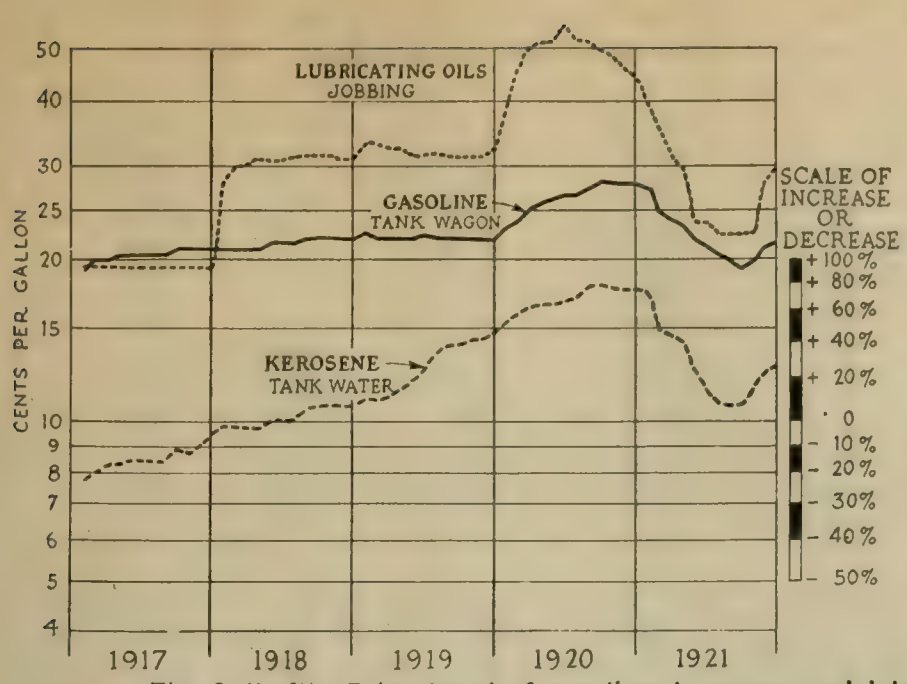
The quantity of refined mineral oils exported from the United States during 1921 is compared with the corresponding exports for a number of recent years in Table 3. In spite of the general falling off in export trade that characterized the past year, the shipments of petroleum products held up surprisingly well. Gasoline consignments, though a little below the attainments of 1920, nevertheless compared favorably with the preceding years. The same statement is essentially true of kerosene. Fuel oil, on the other hand, showed a slight advance over 1920, though the aggregate shipments of this commodity naturally did not approach the huge exports during the war years of 1917 and 1918. When we come to lubricating oils, however, a sharp decline as compared with 1920 is to be noticed, but as measured against the period 1913-19, the attainments of 1921 stand a little ahead of the average. In spite of the economic demoralization of foreign countries during 1920, it would appear that a surprisingly large demand for the products of petroleum manifested itself. The obvious conclusion would be that industrial activity in some of the countries abroad was not as stagnant during 1921 as the demoralized status of foreign exchange might lead one to suspect.

The Gasoline Situation

The trend of the gasoline situation by months during 1921 is pictured graphically in Fig. 6, on which the data for four preceding years have been entered to give perspective. The chart represents a record of this commodity for the entire period during which detailed statistics are available. One would probably be safe in stating that the chart of no other commodity would display so slightly the effect of the industrial depression in 1921. A close examination of Fig. 6, it is true, will reveal a slight lagging in the rates of growth of the several factors de-

TABLE 3—TREND OF THE EXPORTS OF THE PRINCIPAL PRODUCTS OF PETROLEUM
(In millions of gallons)

	Gasoline	Kerosene	Gas and Fuel Oil	Lubricating Oils
By Years,				
1913	188	1119	427	208
1914	210	1010	703	192
1915	282	837	812	240
1916	356	855	964	261
1917	416	658	1124	280
1918	559	491	1201	257
1919	372	979	618	275
1920	635	862	847	411
1921	533	749	854	289
By Months 1921				
Jan.	55	79	110	38
Feb.	54	68	73	30
Mar.	47	64	69	15
Apr.	57	59	72	23
May	41	52	51	17
June	39	64	62	15
July	29	36	77	19
Aug.	48	56	77	19
Sept.	37	55	86	21
Oct.	47	73	70	32
Nov.	46	76	41	28
Dec.	36	66	70	35



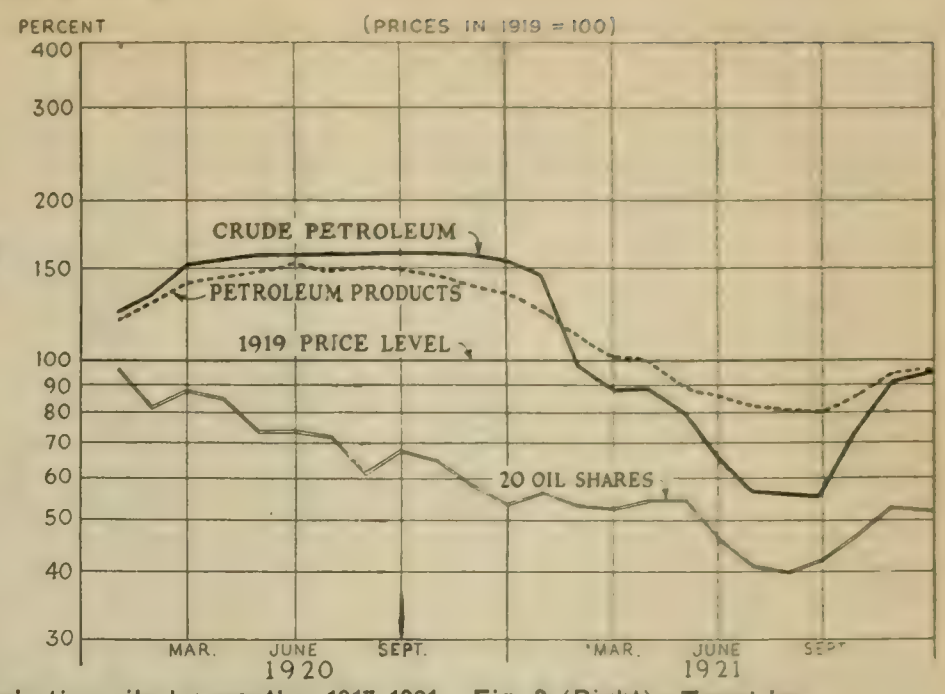


Fig. 8 (Left)—Price trend of gasoline, kerosene, and lubricating oils by months, 1917-1921. Fig. 9 (Right)—Trend by months, 1920-1921 of (a) the weighted average price of crude petroleum, (b) the weighted average price of the principal petroleum products, and (c) the average price of 20 oil shares

picted, but in a year of sharp industrial curtailment in all other directions, the mildness of the reaction in respect to gasoline is indeed striking.

The course of gasoline stocks during 1921 should receive special notice. The volume of this commodity in storage slightly exceeded its normal trend in midsummer, and toward the close of the year failed to decline quite to the normal level for that period. But the accumulation was not excessive, and we are far from entering the present year with a gross over-supply of gasoline.

Endpoint of Gasoline

In July, 1921, the U. S. Bureau of Mines conducted its fourth semi-annual motor gasoline survey, collecting and analyzing 115 samples of commercial gasoline representing a sampling of the entire country. The investigation, summarized in Table 4, showed that the gasoline marketed in July, 1921, was almost identical in volatility with that on sale in January, 1921, and considerably more volatile than the average product in use the preceding summer. These results, indeed, were easily predictable from the fact that the supply of gasoline in 1921 was ample and there was no commercial need to amplify the supply by raising its endpoint. The fact seems by now well established that the volatility of gasoline is a function of the relationship between supply and demand. In years when demand is crowding supply the endpoint tends to rise, while under reversed conditions the volatility of this product improves.

TABLE 4—ENDPOINT OF MOTOR-GASOLINE IN SELECTED CITIES IN RECENT YEARS
Data from U. S. Bureau of Mines
(In degrees Fahrenheit)

	1919	1920		1921	
	April	Jan.	July	Jan.	July
New York	411	418	432	417	422
Washington	426	439	449	439	442
Pittsburgh	425	425	454	430	435
Chicago	423	445	455	439	444
New Orleans	435	424	445	428	427
Salt Lake City	441	440	456	439	401
San Francisco	374	406	428	417	421
Average	417	427	446	429	427

Stocks of Petroleum Products

An epitome of oil conditions is afforded by a view of the changing quantity of refined mineral oils in storage in the United States. Such a view may be obtained from Fig. 7, where the stocks are plotted on a monthly basis for the entire period covered by detailed statistics. The striking feature of the chart is the large accumulation of fuel oil and lubricating oils in storage during 1921, both of these commodities more than doubling in volume. Here we have considerable evidence of the unbalanced range of demands that faced the petroleum refining industry throughout the whole year. To meet the requirements for gasoline, the product in strongest demand, the refineries over-produced in respect to fuel oil and lubricants.

Examining the 1921 trace of the curves in greater detail, we observe that the stocks mounted sharply during the first four or five months of the year, then declined for a period, and toward the close of the year started to increase again. With due allowance for seasonal changes that repeat with regularity from year to year, this course reflects the improvement in industry that came in the fall, but which was succeeded toward the end of the year by a general slackening and tendency toward reaction.

TABLE 5—INDEX NUMBERS OF THE AVERAGE PRICE OF CRUDE PETROLEUM AND ITS PRINCIPAL PRODUCTS
(Average prices in 1913 = 100)

	Gasoline	Kerosene	Fuel Oil	Lubricating Oils	Petroleum[a] Products	Crude Petroleum	All[b] Commodities
By years							
1913	100	100	100	100	100	100	100
1914	83	97	85	101	89	82	100
1915	75	90	68	97	80	66	101
1916	121	101	98	119	114	117	124
1917	132	108	147	126	130	155	176
1918	139	130	189	200	161	195	196
1919	142	162	149	209	159	197	212
1920	170	217	262	313	225	302	243
1921	143	164	122	179	150	163	177
By months							
1921							
Jan.	177	222	181	251	200	288	177
Feb.	160	189	135	218	176	192	167
Mar.	154	186	131	202	164	174	162
Apr.	151	178	131	194	160	176	154
May	141	160	116	154	142	159	151
June	137	146	102	154	137	127	148
July	132	137	96	148	131	112	148
Aug.	129	137	97	148	129	110	152
Sept.	126	137	97.5	148	128	110	152
Oct.	129	150	124	149	135	143	150
Nov.	137	162	137	184	151	182	149
Dec.	140	163	118	195	152	184	149

[a]Weighted average of gasoline, kerosene, fuel oil and lubricating oils.

[b]From U. S. Bureau of Labor Statistics.

TABLE 6—AVERAGE MONTHLY TANKWAGON PRICE OF GASOLINE IN SELECTED AMERICAN CITIES DURING 1921
(In cents per gallon)

1921	New York	Baltimore	Atlanta	Cleveland	Chicago	Kansas City	Houston	Salt Lake City	San Francisco
Jan.	31.0	28.3	29.0	29.8	26.6	24.9	25.4	32.0	27.0
Feb.	28.5	25.8	28.0	27.3	23.0	21.0	22.0	26.5	27.0
Mar.	26.5	24.5	26.3	27.0	23.0	21.0	21.0	28.0	25.0
April	26.0	24.5	26.0	26.3	22.3	20.4	21.0	28.0	25.0
May	26.0	23.7	26.2	24.6	20.0	18.7	20.2	27.2	23.8
June	24.6	22.0	22.5	22.8	19.5	18.2	14.3	27.0	23.0
July	24.0	21.5	20.8	21.0	18.0	16.7	14.0	24.8	23.0
Aug.	24.0	20.2	20.4	20.0	18.0	16.1	14.2	24.0	21.4
Sept.	24.0	20.5	20.3	20.0	17.0	15.7	15.0	24.0	21.0
Oct.	24.6	21.4	20.8	20.2	17.6	15.9	16.0	24.0	21.0
Nov.	25.8	23.5	23.3	21.8	19.1	17.8	18.8	25.1	21.0
Dec.	26.8	24.0	24.5	22.0	19.5	18.2	19.5	25.5	21.0

Prices of Mineral Oils

The year just closed witnessed an unprecedented decline in the prices of mineral oils, succeeded in turn by a sharp upward movement in the fall. The course of oil prices may be ascertained from Table 5 and Fig. 8. It is evident that oil prices followed the course of prices in general, though falling lower in midsummer than the average price level of all commodities, and in part rising above this level during the closing months of the year. In terms of pre-war prices taken as 100, crude petroleum ended the year at 184; gasoline, at 140; kerosene, at 163; fuel oil, at 118, and lubricating oils, at 195. By way of comparison, the average price of raw materials in the United States in December, 1921, according to calculations made by the Federal Reserve Board, was 140; of producers' goods, 127; of consumers' goods, 140.

The monthly price courses, 1917-21, of the oil products of chief interest to the automotive industry are shown graphically in Fig. 8, where the downward and upward movements during 1921 are thrown into perspective. The price of gasoline, as usual, was more stable than the prices of kerosene and lubricants, although gasoline definitely accommodated itself to the change in price level that affected all commodities. Prices in 1921, as shown by the chart, should be especially compared with prices in 1920. In general terms, the year just closed neutralized the price advances of 1920, leaving the price levels at approximately their 1919 heights.

To those interested in local gasoline prices, Table 6 will reflect the average monthly tank-wagon price of gasoline during 1921 in a number of cities selected so as to give a sample of the entire country. There was a fairly uniform price movement for this commodity throughout the whole country, illustrating its responsiveness to changing economic conditions both in the petroleum industry and outside.

As a summary picture of the broad price changes in the petroleum industry over the past two years, Fig. 9 is introduced. The most significant feature of this chart is the manner in which the stock market anticipated the price changes in crude petroleum and petroleum products.

Conclusions

The developments in the petroleum industry during 1921 of special interest from the automotive viewpoint may be summarized as follows:

(1) Domestic production of crude petroleum increased during 1921 in spite of drastic curtailment of industrial activities in practically all other directions.

(2) In the face of a notable decline in the number of oil wells completed, the aggregate output of the country became increasingly dependent upon flush production.

(3) The Mexican oil fields were exploited with unprecedented intensity, and many of the individual pools were exhausted during the year.

(4) Refinery activity slowed down, though not in keeping with industrial activities in general.

(5) The domestic consumption of gasoline increased about 6 per cent over the previous year.

(6) The prices of crude petroleum and its principal products suffered a precipitous decline during the first part of the year, but from September on recovered part of the ground lost.

(7) The closing week of the year registered the largest daily production of crude petroleum that this country had thus far enjoyed.

(8) An inventory of the unmined supply of crude petroleum, made by the U. S. Geological Survey and the American Association of Petroleum Geologists placed the unmined reserve at 9.1 billion barrels.

(9) The present year opens with nearly 50 per cent of the total crude petroleum output of the country coming from wells less than a year old.

TWENTY-NINE gallons of fuel oil are wasted for every ton of steel that is produced, according to the statement of William N. Best, the petroleum engineer in his new book on "Burning Liquid Fuel," recently published by the U. P. C. Book Company.

The book contains much interesting statistical and technical data, and covers in a thorough and comprehensive manner the various phases of the science of burning liquid fuel. Especially interesting is the table of crude petroleum produced through the world since 1857 in the various countries of the world. The table shows the following production for the period 1857-1918 inclusive.

Country	Bbls. of 42 Gal.	Percentage of Total
United States	4,608,571,719	61.41
Mexico	285,182,489	3.80
Russia	1,873,999,199	24.97
Dutch East Indies (a)	188,388,513	2.51
Rumania	151,408,411	2.02
India	106,162,365	1.41
Persia	14,056,063	.19
Galicia	154,051,273	2.05
Peru	24,414,387	.33
Japan and Formosa	38,498,247	.51
Trinidad	7,432,391	.10
Egypt	4,848,436	.07
Argentina	4,296,093	.06
Germany	16,664,121	.22
Canada	24,425,770	.33
Venezuela	317,823	.02
Italy	973,671	
Cuba	19,167	
Other Countries	397,000	
Total	7,504,107,138	100.00

Labor Statistics Show Strikes Have Not Diminished

Opposition to wage decreases chief cause of disputes during 1921. First 9 months produce 2,200 strikes. New York State has greatest number. Definite trends shown in relative importance of wage factors each year.

By Norman G. Shidle

STATISTICAL data regarding labor is usually such as relates to the difficulty workers have brought to industry in the way of strikes and industrial disputes. It should be recognized, however, that the figures which appear under the title of "labor statistics" are really only a part of the picture. In a certain sense the production figures of an industry are just as much "labor statistics" as are the records of strikes and lockouts.

The 1921 labor statistics show a continuance of the large number of strikes, despite industrial depression.

Two thousand two hundred strikes occurred the first 9 months of 1921. A rather broad estimate places the number of men involved in these strikes over a million and the number of days lost by factories because of the strikes at something like 50,000.

Statistics concerning labor in the United States do not provide the sort of fundamental data essential to any thorough analysis of our industrial problems. When the Department of Commerce recently took up matters of unemployment, it failed to find any adequate data available anywhere in government bureaus upon which to base sound studies of the practical problem it was approaching.

There is a very definite value, however, attached to the labor statistics compiled by the Bureau of Labor Statistics of the Department of Labor, provided they are properly analyzed and interpreted. The figures used here are either reprinted directly from the tables compiled by the Bureau or are the result of compilations based upon the work of the Bureau. The figures relating to 1921 are for 9 months only in every case, and slight variations may be expected when the final totals for the year are compiled.

In the very nature of things, it is impossible to discuss the really fundamental factors of industrial relations merely by the use of statistics concerning strikes, wages and cost of living. Being essentially a study of the psychology of the individual and an analysis of the individual in his relation to his task, the industrial relations problem lends itself less than any other industrial question to statistical treatment.

A study of the available statistics, however, enables the executive to sense certain broad general trends, to learn the present and probable future status of industrial unrest so far as it relates to the more virulent forms, such as strikes and lockouts, and to interpet, in the light of these general movements, the most effective methods for use in handling his own individual problems.

The necessity for constructively studying the problems of human relationships in industry is made even more apparent by the recent remark of a highly respected and conservative cabinet member, who said: "There is in the United States a well-defined and constantly growing unrest which already embraces probably 75 per cent of our population. This unrest is manifesting itself in the form of a discontent with any social system which permits widespread unemployment and physical privations in a country so abundantly blessed with natural resources as the United States."

Here is the statement of a man whose opinion on this subject undoubtedly has the respect of every reader of

PRINCIPAL CAUSES OF STRIKES AND LOCKOUTS 1916, 1917, 1918, 1919, 1920, AND FIRST THREE-QUARTERS OF 1921
(Approximate Percentages)

Matter in Dispute	STRIKES						LOCKOUTS					
	1916 per Cent	1917 per Cent	1918 per Cent	1919 per Cent	1920 per Cent	1921 per Cent	1916 per Cent	1917 per Cent	1918 per Cent	1919 per Cent	1920 per Cent	1921 per Cent
For increase of wages	35.10	35.60	42.50	30.42	42.33	4.5	10.57	13.50	13.49	19.86	17.24	2.08
Because of decrease of wages	1.00	0.80	1.07	2.46	3.93	43.6	1.84	1.59	1.93	2.48	18.97	12.50
Non-payment of wages	0.35	0.40	0.98	0.28	0.64	....	.....	0.79	.....	.....	.....	.....
Because of increase of hours	0.08	0.40	0.19	0.25	0.22	1.7	2.67	....	.....	.....	.....	.....
For decrease of hours	3.02	2.89	2.48	3.26	1.99	12.4	1.84	3.97	.....	6.60	.....	14.58
For increased wages and decreased hours	13.04	8.80	7.80	17.01	8.43	1.2	1.84	3.17	1.93	7.43	5.17	.....
Recognition of union	9.36	6.50	5.84	11.31	3.64	1.1	20.20	31.00	33.60	25.65	8.62	12.50
Recognition and wages	3.32	3.50	3.00	3.91	2.64	1.2	1.84	3.97	1.93	4.14	6.90	2.08
Recognition and hours	0.60	0.64	0.50	0.59	0.16	....	0.92	0.79	.....	0.83	1.72	.....
Recognition, wages and hours	1.85	1.32	2.08	5.49	1.32	0.3	4.59	.....	.....	5.79	5.17	.....
Recognition and conditions	.....	0.30	0.22	0.44	0.19	.....	.....	.....	.....	.....	.....	.....
General conditions	1.58	2.25	1.70	1.76	2.39	2.3	.....	3.17	1.93	.....	.....	2.08
Conditions and wages	1.52	1.65	1.57	1.66	1.71	0.5	1.84	0.79	1.93	0 83	5.17	2.08
Conditions and hours	0.08	0.40	0.06	0.05	0.06	.....	.....	0.79	.....	.....	.....	.....
Conditions, wages and hours	0.68	0.61	0.25	1.14	1.38	.....	.....	.....	.....	.....	.....	.....
Discharge of foreman demanded	0.46	0.88	1.67	0.46	0.96	.....	.....	0.79	.....	.....	.....	.....
Because of discharge of employees	3.32	4.80	4.30	4.35	4.48	2.0	4.59	2.38	.....	.....	.....	.....
Employment of non-union men	2.00	1.80	1.92	.....	1.19	1.3	3.67	0.77	.....	.....	.....	6.25
Relative to agreement	1.03	1.77	1.29	1.01	1.64	3.8	1.84	2.38	.....	3.31	5.17	4.17
New agreement	1.01	0.52	0.12	1.11	0.35	1.9	2.75	1.59	.....	.....	.....	2.08
Sympathy	0.87	1.61	1.07	3.08	2.04	1.3	0.92	0.79	0.97	.....	.....	.....
Jurisdiction	0.52	0.47	0.50	0.46	0.64	0.4	....	.....	.....	0.83	.....	.....
Miscellaneous	3.18	4.09	5.34	2.80	10.47	12.8	2.75	3.97	8.70	12.41	10.35	12.50
Not reported	16.00	18.00	13.55	6.60	7.20	7.7	30.30	23.80	33.60	9.99	15.52	27.10
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Fig. 1—Principal causes of strikes and lockouts

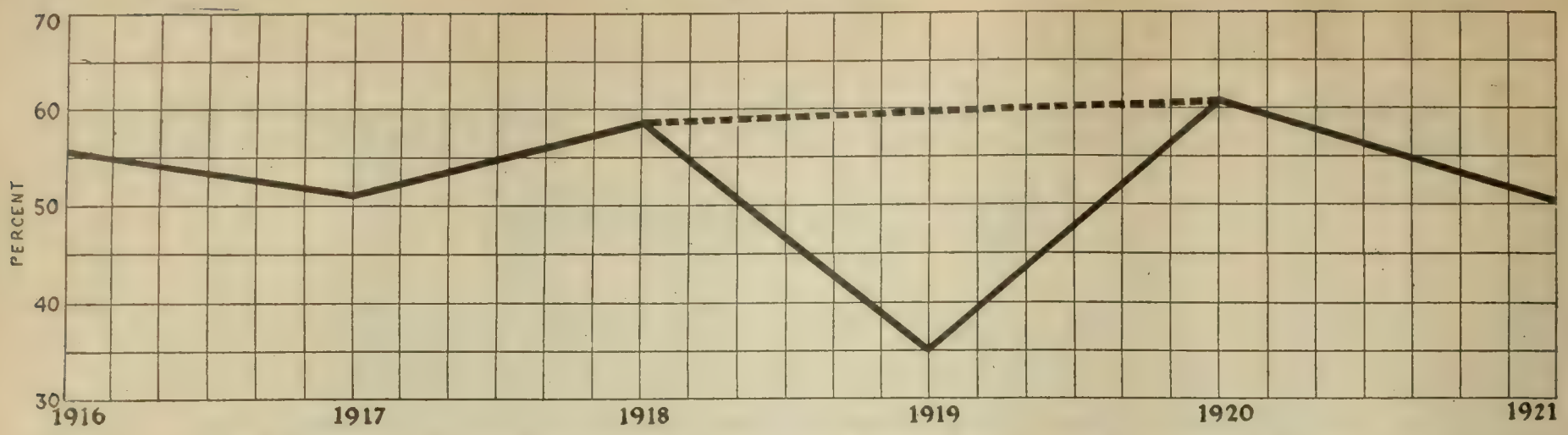


Fig. 2—Percentage of total number of strikes involving wages, in one form or another, as a cause

these lines. It brings home very forcibly the responsibility which rests upon those conducting industry to provide to every industrial worker an opportunity for the highest personal development of which the worker is capable. Not only is this necessary from a social point of view, but it is advantageous and profitable from the point of view of the individual industrial organization. The practical ideal of service—to those within and without the organization—is gradually being recognized in American industry as the steadiest and soundest road to increased business and permanent progress.

All this is a bit aside from the immediate matter of labor statistics, yet the "75 per cent" quoted above is probably the most significant "statistic" that has been estimated for some time.

It is essential, however, that a true estimate of value be placed upon all statistical data used in industry. The majority of strike statistics, for example, used in this article are indicative of the general sentiment of workers just about to the extent that such general sentiment is voiced by organized labor. Strikes are almost entirely the result of organized labor. Yet it must be recognized that just as much discontent and consequent reduction in production efficiency may occur in cases where labor is unorganized and strike records do not appear. The result in the latter case may be just as bad, but simply more difficult to record statistically.

This fact is not always sufficiently recognized by students of labor statistics and as a result erroneous conclusions are frequently drawn upon the basis of the data available. It is just as important in an analysis of this kind to understand clearly the limitations of the figures involved as to know the figures themselves.

Industrial depression has had little effect upon the number of strikes. The first three-quarters of 1921 show a total of 2200 strikes as against a total of 3109 for the entire year of 1920. Thus it appears that if the last quarters of 1921 produced as many strikes in proportion as did the three previous quarters the total for the year would be only slightly under that of 1920.

A review of the total number of strikes during the last six years shows a remarkable uniformity, the variation being less than 1000 in any case. The record follows:

Year	Strikes	Lockouts
1916	3,681	108
1917	4,324	126
1918	3,248	105
1919	3,444	125
1920	3,109	58
1921 (9 mo.)	2,200	56

There is one significant deduction, perhaps, that may be drawn from this uniformity. There is an indication that so long as present methods prevail on the part of employer and employed the struggle between the two is likely to be carried on with equal vigor regardless of the condition of industry or the surface causes that may be given for the outbreak in each case. For many years labor was underneath in the industrial struggle and some employers felt themselves secure in their power. The war brought to labor its first real opportunity to exercise power and the natural reaction from these previous years was for it to exercise that power to its fullest extent, unwisely in many instances.

Again the industrial scales have turned. Labor is plentiful, and the employer has the advantage, so far as dealing with his workers is concerned. If the uniformity of these strike figures shows anything at all, it is the certainty of continued future trouble if management seizes the opportunity which it now has to "get even" with workers for real or fancied wrongs during war and post-war days.

The handling of industrial relations during the next few months will have a very definite effect upon the rapidity with which any given company will be able to return to complete stability.

A prominent railroad executive stated recently that the willing and hearty co-operation of members of the railway brotherhoods would mean a saving in operating expenses of 4 to 5 per cent; that a certain proposed wage decrease for these brotherhood members would mean a saving of 1 per cent, and that consequently it would be very poor economy to make the proposed reduction if such action meant the loss of that willing and constructive co-operation.

Without debating the details of the figures involved in this statement, the words of this official, who had in mind only the management viewpoint, well illustrates the point made in preceding paragraphs. A careful study of personnel problems as related to the individual within the plant is possible at this time when production needs are not pressing. Experimentation is possible that would not be feasible when peak production is necessary. The uniform

RESULTS OF STRIKES AND LOCKOUTS, 1916-1921 (9 MO. OF 1921)

RESULT	STRIKES ENDING IN						LOCKOUTS ENDING IN					
	1916	1917	1918	1919	1920	(9 Mo.) 1921	1916	1917	1918	1919	1920	1921
In favor of employers	727	382	459	661	633	301	21	13	6	19	10	8
In favor of employees	733	614	612	565	360	285	16	17	15	16	7	5
Compromised	766	699	674	785	429	176	11	21	17	11	6	3
Employees returned pending arbitration	70	131	199	45	59	49	3	6	5	3	2	..
Not reported	99	190	190	36	197	105	2	1	21	21	2	4
Total	2,395	2,016	2,134	2,092	1,678	916	53	58	64	70	27	20

Fig. 3—Results of strikes and lockouts

OCCUPATIONS IN WHICH THE LARGEST NUMBER OF STRIKES AND LOCKOUTS OCCURRED IN EACH YEAR, 1916 TO 1920

INDUSTRY	STRIKES						LOCKOUTS						Grand Total
	1916	1917	1918	1919	1920	(9 Mo.) 1921	1916	1917	1918	1919	1920	(9 Mo.) 1921	
Building trades	376	447	418	445	498	515	18	21	16	19	8	8	2700
Clothing	222	483	418	309	269	172	5	12	18	7	16	3	1864
Iron and steel	72	56	72	68	24	19	..	..	2	8	1	..	320
Leather	34	19	15	27	29	16	..	..	1	..	3	..	140
Lumber	44	295	75	44	37	26	..	4	1	2	..	1	517
Metal trades	547	513	441	551	398	202	..	2	..	29	9	6	2671
Mining	402	418	185	174	178	74	14	31	23	2	2	1	1377
Paper manufacturing	51	39	35	44	39	34	3	2	5	3	..	..	537
Printing and publishing	25	40	40	64	76	323	2	1	..	6	2	9	555
Shipbuilding	27	103	136	108	44	19	4	3	4	1	..	..	430
Meat Cutting	70	38	39	71	42	17	..	..	3	2	..	..	261
Stonework	59	26	14	13	29	20	2	..	..	..	..	..	161
Textile	258	242	209	263	208	102	3	5	3	9	2	1	1297
Transportation	224	342	226	185	238	49	4	1	1	1	..	2	1324

Fig. 4—Occupations in which largest number of strikes occurred

strike figures show the results of obsolete methods.

The most striking thing in the table of strike causes is the natural change in the major causes of strikes. As usual the chief cause is wages, but in previous years—from 1916 at least—the strikes have been for increased wages; 1921 shows a reversal. The workers struck nearly 900 times during the first 9 months of 1921 because their wages had been decreased.

This change follows definitely the trend of the industrial situation, the workers striving to maintain what they have obtained in past years of fighting and the employers finding it necessary to reduce operating expenses. For the rest, strike causes showed little radical change, except in the case of decreased hours. Twelve per cent of the strikes in 1921 were fought over demands for less working hours, while 3 per cent was the highest reached in previous years, 1920 showing only about 2 per cent. The trend in lockout causes follows this same course, a greater percentage of lockouts having been instituted because the workers demanded decreased hours than ever before.

An interesting trend is brought out by the curve shown in Fig. 2, which was plotted on the basis of figures compiled from the table of strike causes. This curve shows the percentage of total strikes during the last six years in which wages figure either as a major or minor cause.

Wages As a Strike Cause

It appears that over half of the strikes during this period were fought over matters involving questions of wage, and that in only one year, 1919, has there been any marked deviation from a uniform proportion. In analyzing this curve it should be remembered that the announced cause of strikes has little relation to the fundamental causes. The announced cause is simply the point over which the break in relations finally came or the battleground chosen for a particular fight.

The 1919 deviation in this curve, however, marks the period at which labor attained its highest power in American industry. A possible interpretation of the drop in the curve may, consequently, be that at this time labor found itself in a position to actively fight for some of those other things which it had always desired but had never been able to take a stand on, because of the necessity for fighting for the primary life-giving factor, wages. The return of the curve to its apparently normal percentage indicates that workers are again under the necessity of fighting for the necessities.

Employers have won more strikes in 1921 than did the workers, although if the number of "compromised" strikes were added to the employees' total the employers would be behind for the year. There is some justification for such addition, since it is obvious that every time a strike is compromised the employer gives up something that he held before the strike occurred. Thus, the workers may not count the strike as won unless they obtain the results which they stated as their desire when starting the strike, yet if a compromise is made they have gained something. This has nothing to do with the rights or wrongs of the various matters under dispute, of course, but serves to illuminate to some extent the table shown in Fig. 3. During the past six years the number of strikes ending in favor of employers has been just about equal to the number ending in favor of employees.

Building Trades Furnish Most Trouble

The building trades furnished the most trouble for employers again in 1921 as they did in 1920, their record last year putting them ahead of the metal workers as strikers for the last six years.

The most startling jump in number of strikes during 1921 was made in the printing and publishing trades. Three hundred and twenty-three strikes and 9 lockouts occurred in this trade during the first 9 months of last year, while the 1920 total of 70 was the highest that had ever before occurred. The metal trades were involved in less strikes last year than during any similar period. Their total for the first three-quarters was only 202, which is small, comparatively speaking. The five trades involved in the greatest number of strikes last year were as follows:

Building trades	515
Printing and publishing	323
Metal trades	202
Clothing	172
Textile	102

The six-year total of strikes by trades looks somewhat different, however, as the miners played a large part in strikes during previous years, but engineered only 74 in 1921. The six-year totals are:

Building trades	2700
Metal trades	2671
Clothing	1864
Mining	1377
Transportation	1324
Textile	1297

It is impossible to determine the trade having the least number of strikes, since only those having at least a certain number are listed.

Allied Industry Strikes

The chart shown in Fig. 5 is based on six-year total strike figures in the industries shown. The six industries involved are all more or less allied to the automotive field, some more directly than others. The automotive executive, however, is interested in the general trend of industrial relations in allied industries, since he has found by experience that unstable labor conditions in an allied industry may affect his factory operations very materially.

The chart simply depicts graphically what is shown elsewhere in figures. It shows the leather industry to

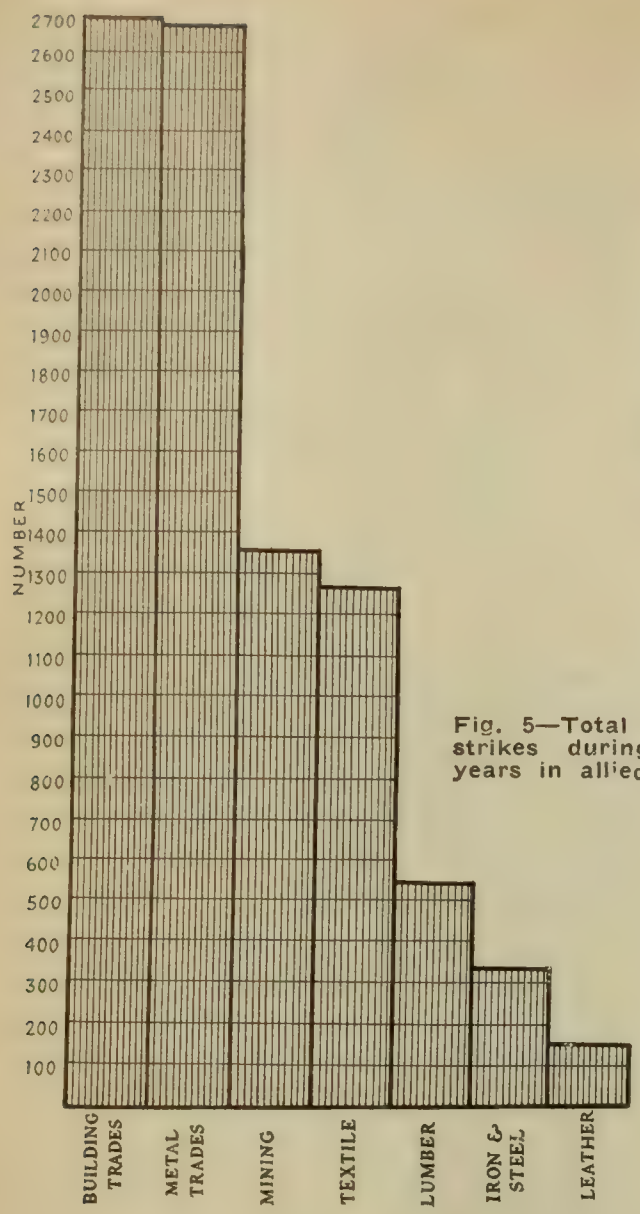


Fig. 5—Total number of strikes during last six years in allied industries

be in the best position of the entire group, having been involved in only 140 strikes in six years.

New York maintains its unenviable position as the State in which most strikes have occurred. Having held this honor without interruption for six years, the Empire State naturally has an excellent lead in the six-year total. There is little to be said concerning the statistics in Fig. 6, except that the 1921 results follow in almost exactly with the trends established during previous years.

New York, Pennsylvania and Massachusetts had the greatest number of strikes last year among this group of industrial high-strike states. The total for six years places the five leaders as follows:

New York	3224
Pennsylvania	2002
Massachusetts	1982
Illinois	1259
Ohio	1249

NUMBER OF STRIKES BEGINNING IN EACH YEAR IN SOME OF THE CHIEF INDUSTRIAL STATES, 1916, 1917, 1918, 1919, 1920 AND FIRST THREE QUARTERS OF 1921

	STRIKES						
	1916	1917	1918	1919	1920	1921	Total
New York	577	696	668	515	459	309	3224
Pennsylvania	566	481	304	265	202	184	2002
Massachusetts	374	342	341	376	366	183	1982
New Jersey	411	219	138	171	120	115	1174
Ohio	276	261	188	214	170	136	1249
Illinois	149	276	237	252	202	143	1259
Connecticut	325	178	90	120	124	59	898
Washington	57	290	126	78	54	57	662
Missouri	90	117	100	63	53	51	409
Indiana	70	65	68	91	64	32	455
Michigan	66	62	59	79	44	64	374

Fig. 6—Number of strikes in some of chief industrial states

DURATION OF STRIKES, 1916, 1917, 1918, 1919, 1920 AND 9 MONTHS OF 1921

	STRIKES ENDING IN						LOCKOUTS ENDING IN					
	1916	1917	1918	1919	1920	1921	1916	1917	1918	1919	1920	1921
1 day or less	179	282	229	105	88	37	..	2	..	..	..	..
2 days	183	111	170	69	63	20	2	2	1	1	..	..
3 days	146	102	127	80	53	29	1	3	..	..	1	..
4 days	124	61	111	78	50	21	1	1	..	..	..	..
5 to 7 days	330	213	251	185	140	56	6	3	3	3	1	2
8 to 14 days	408	215	268	287	213	75	10	4	4	4	3	2
15 to 21 days	224	118	151	199	104	80	7	3	9	9	2	1
22 to 29 days	99	54	69	113	88	40	2	4	3	3	2	1
30 to 90 days	266	185	225	517	298	184	6	8	29	29	7	7
Over 90 days	104	60	49	161	145	139	18	4	10	10	4	3
Not reported	332	615	484	298	436	136	..	24	5	11	7	2
Total	2395	2016	2134	2092	1678	817	53	58	64	70	27	18

Fig. 7—Duration of strikes

Again in 1921 the tendency toward a reduced length of strikes is apparent. As in previous years, the greatest number last from 1 to 3 months, but last year the number lasting this long was only 23 per cent of the total, as against 25 per cent in 1920 and 29 per cent in 1919. Thus it appears that industrial questions are having a tendency to be brought to a more rapid conclusion than in the past after a strike has started. Whether or not this tendency toward a rapid settlement has any relation to the satisfactory nature of the settlement cannot be determined from any available statistics.

Works Councils

Without presenting any statistical data it can be stated that very probably there has been a decrease in the number of works councils in the United States during 1921. This was expected by many as the natural result of industrial depression. It was natural, however, not so much as a result of industrial depression as of the spirit and purpose which was behind the original installation of such councils in some cases.

In certain instances "industrial democracy" was instituted without any special belief by the management in its essential soundness. Some managements installed it without understanding it or the almost certain lines of its development. The spirit behind some of these installations was defensive or offensive rather than co-operative.

In such cases the plan did not work out to the satisfaction of the management—and usually failed to satisfy the workers. Many such industrial councils have gone out of existence during the last two years.

Many others have survived, however, and are operating as helpful, constructive forces in aiding the management to weather the storm of industrial depression. The automotive industry has several examples of this successful type of council. The success has been achieved because the councils were originally installed, not with any philanthropic purpose, but with the purpose of developing the business and the factory to its highest efficiency through the utilization of the individual intelligence and co-operation of every man in the plant.

It is perfectly possible in many cases, of course, to obtain equally good results without any organized group of employees. It is worth while to point out again that the spirit behind the handling of industrial relations is the essential thing, while the mechanical means used to translate that spirit into action is a minor consideration in any case.

The truth of this principle has been well illustrated by the success or failure of the various works councils installed during war and post-war years. The principle itself has come to form the basis of operation for practically every plant in which harmonious relations exist between employers and employees.

Road Construction Lags Far Behind Car Registration

In 1914 there were 7 motor vehicles to a mile of surfaced road. To-day it is estimated that the proportion is 27 to 1. While accurate mileage figures for the last two years are not available, the following curve shows definite need for highway growth. Bureau of Roads Survey in progress.

WHILE accurate statistics are not yet available, it is probable that some 25,000 miles of surfaced road were added to the total for the United States during 1921. On Dec. 31, 1921, there were 15,834 miles of Federal Aid Road projects under way, and about 70 per cent of this total had been completed. Only about half of the new road construction during 1921 consisted of Federal Aid projects, however, so that the estimated total of 25,000 miles of new roads for the year is probably not far wrong.

More Federal aid money is being expended in Texas than in any other State so far as regards projects under construction at the end of 1921. New roads costing nearly $22,000,000 are under way in that State.

It is estimated by certain authorities that a billion dollars will be spent on highways during 1922. This sum would include carrying and amortization charges on outstanding bonds, administration expenses, traffic regulation, highway maintenance and highway construction. This expenditure has become necessary to efficient functioning of modern industrial transportation and is based upon sound economic foundation.

Vehicle Registration vs. Road Growth

It is interesting to compare the relative rate of growth of motor vehicle registration and the total mileage of improved roads in the United States. The accompanying chart brings out this relation clearly. The curves are constructed on a semi-logarithmic scale, thus permitting the lines to show the proportionate growth of these two factors.

It will be noted that the curve showing the rate of growth of motor vehicle registrations increases more rapidly and is more uniform than is the curved based upon surfaced road mileage. This is natural because the growth of the motor vehicle has steadily increased, whereas the surfaced road mileage has been subject to many hindrances which did not allow its growth to proceed along the lines it would naturally take on an economic basis.

Automobile registration was increased because of the individual needs and the individual action of supplying those individual needs. Road mileage increase has been dependent upon the group action of many individuals and has thus been slower and less steady than the growth in the number of vehicles in use.

Even though the curves are plotted only from 1914, the miles of paved road, it must be remembered, were entirely inadequate for the economic needs of transportation at that time. In 1914 there were 7 motor vehicles for every mile of paved road. To-day there are 27 motor vehicles for every mile of paved road.

Thus it becomes apparent that surfaced road mileage must increase at a considerably more rapid rate than motor vehicle registrations if the economic necessity for good roads is to be met.

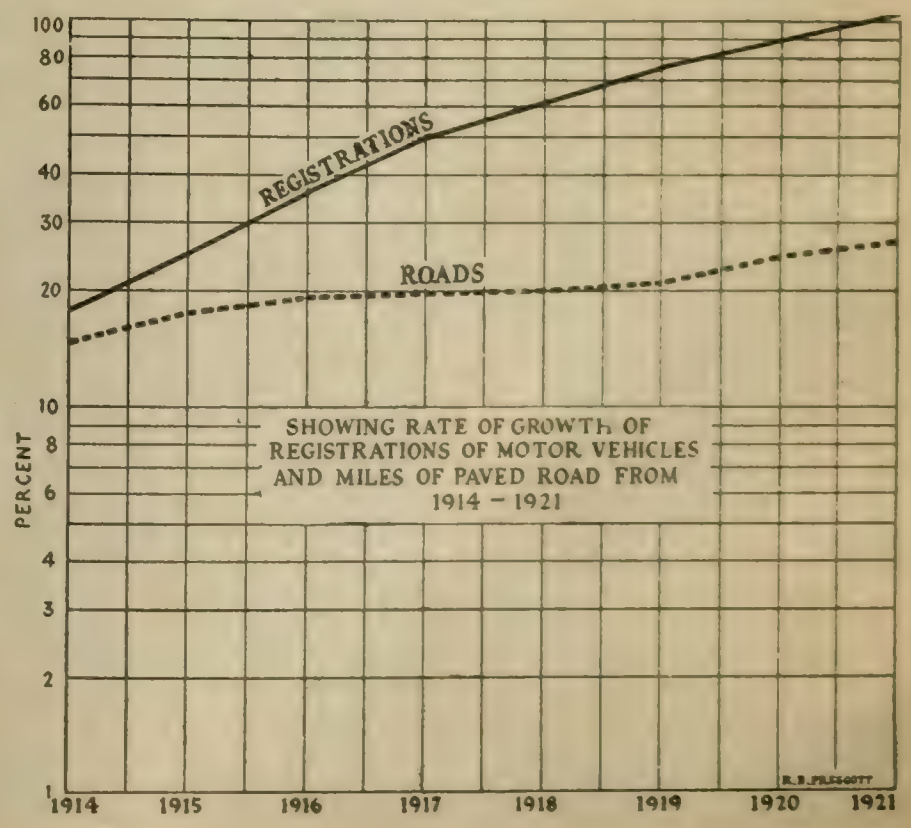
The figures used in constructing the road mileage curve are taken from the records of the U. S. Bureau of Roads for the years 1914-1918 inclusive. The figures are listed in reports of the Bureau as "Total of all surfaced roads." The 1919 figures are taken from the Bureau of Roads figures so far as regards State highway mileage. To this total, 20 per cent was added to take in county and other road construction.

Survey in Progress

For 1920 and 1921 accurate figures are not available anywhere at the present time. For certain internal departmental reasons, the Government did not collect this data for these years. A survey is under way at the present time, however, which will bring the figures entirely up to date. The estimates of 350,000 for 1920 and $375,000 for 1921, which are used in the chart, have been made on the basis of the best data available at the present time.

The exact accuracy of this 1921 figure, however, is not necessary to the purpose of the chart, as the relative growth of motor vehicle registrations and surfaced road mileage is well illustrated in any case.

There is a great need for highway transport education throughout the country, and the movements now devoted to this work should have the hearty support of the automotive industry. A thorough understanding of the economics of highway transport is essential to the maximum growth of car and truck use.



Automotive Vehicle

AMERICAN AUTOMOBILE RECORDS

Non-Competitive

Speedway Records, Class "B," Stock Chassis

300 to 450 Cubic Inches Piston Displacement

5 Miles	3:15.88	Mulford	Paige	Uniontown, Pa.	May 20, 1921
10 Miles	6:31.48	Mulford	Paige	Uniontown, Pa.	May 20, 1921
15 Miles	9:45.96	Mulford	Paige	Uniontown, Pa.	May 20, 1921
20 Miles	13:01.48	Mulford	Paige	Uniontown, Pa.	May 20, 1921
25 Miles	16:37.94	Mulford	Paige	Uniontown, Pa.	May 20, 1921
50 Miles	33:16.43	Mulford	Paige	Uniontown, Pa.	May 20, 1921
75 Miles	50:00.80	Mulford	Paige	Uniontown, Pa.	May 20, 1921
100 Miles	1:06:53.26	Mulford	Paige	Uniontown, Pa.	May 20, 1921

Speedway Records Regardless of Class, Non-Stock

¼ mile.....	0:05.91	Rader	Packard Special	Sheepshead Bay	July 28, 1917
½ mile.....	0:13.94	Rader	Packard Special	Sheepshead Bay	July 28, 1917
1 kilo.....	0:17.35	Rader	Packard Special	Sheepshead Bay	July 28, 1917
1 mile.....	0:28.76	Rader	Packard Special	Sheepshead Bay	July 27, 1919
2 miles.....	0:57.81	Rader	Packard Special	Sheepshead Bay	July 27, 1917
3 miles.....	1:26.61	Rader	Packard Special	Sheepshead Bay	July 27, 1917
4 miles.....	1:55.74	Rader	Packard Special	Sheepshead Bay	July 27, 1917
5 miles.....	2:24.65	Rader	Packard Special	Sheepshead Bay	July 27, 1917
10 miles.....	4:50.88	Rader	Packard Special	Sheepshead Bay	July 27, 1917

Straightaway Records, Class "B," Stock Chassis (Piston Displacement)

300 to 450 Cubic Inches

Kilometer	21.56	L. F. Goodspeed	Roamer	Daytona	April 22, 1921
1 mile	34.25	L. F. Goodspeed	Roamer	Daytona	April 22, 1921
2 miles	1:08.86	L. F. Goodspeed	Roamer	Daytona	April 22, 1921
3 miles	1:43.69	L. F. Goodspeed	Roamer	Daytona	April 22, 1921
4 miles	2:18.08	L. F. Goodspeed	Roamer	Daytona	April 22, 1921
5 miles	2:53.48	L. F. Goodspeed	Roamer	Daytona	April 22, 1921

Straightaway Records Regardless of Class, Non-Stock

½ mile	0:11.57	Milton	Duesenberg	Daytona,	Apr. 27, 1920
1 kilo	0:14.40	Milton	Duesenberg	Daytona,	Apr. 27, 1920
1 mile	0:23.07	Milton	Duesenberg	Daytona,	Apr. 27, 1920
2 miles	0:46.24	Milton	Duesenberg	Daytona,	Apr. 27, 1920
3 miles	1:12.18	Milton	Duesenberg	Daytona,	Apr. 25, 1920
4 miles	1:36.14	Milton	Duesenberg	Daytona,	Apr. 25, 1920
5 miles	2:00.04	Milton	Duesenberg	Daytona,	Apr. 25, 1920
10 miles	4:09.31	De Palma	Packard Special	Daytona,	Feb. 16, 1919
15 miles	6:48.75	De Palma	Packard Special	Daytona,	Feb. 17, 1919
20 miles	8:54.20	De Palma	Packard Special	Daytona,	Feb. 17, 1920

(Standing Start)

1 mile	0:38.83	De Palma	Packard Special	Daytona,	Feb. 17, 1920

(Officially recognized by the American Automobile Association as being the record for this country in each class.)

Competitive

Speedway Records Regardless of Class, Non-Stock

1 mile	0:40.23	De Palma	Mercedes	Des Moines, Ia.	June 24, 1916
2 miles	1:09.57	Louis Chevrolet	Frontenac	Chicago, Ill.	Sept. 3, 1917
3 miles	1:54.81	Resta	Peugot	Des Moines, Ia.	June 24, 1916
4 miles	2:14.22	Louis Chevrolet	Frontenac	Chicago, Ill.	Sept. 3, 1917
5 miles	2:56.35	Resta	Peugot	Omaha, Neb.	July, 15, 1916
10 miles	5:20.20	Milton	Duesenberg	Sheepshead Bay, N. Y.	June 14, 1919
15 miles	8:18.90	De Palma	Packard Special	Chicago, Ill.	Sept. 3, 1917
20 miles	10:50.20	De Palma	Packard Special	Chicago, Ill.	July 28, 1918
25 miles	14:12.72	De Palma	Packard Special	Chicago, Ill.	Sept. 3, 1917
50 miles	26:23.40	De Palma	Packard	Sheepshead Bay, N. Y.	June 14, 1919
75 miles	40:31.00	Hearne	Disteel-Duesenberg	Cotati, Cal.	Aug. 14, 1921
100 miles	54:05.80	Hearne	Disteel-Duesenberg	Cotati, Cal.	Aug. 14, 1921
150 miles	1:21:19.20	Hearne	Disteel-Duesenberg	Cotati, Cal.	Aug. 14, 1921
200 miles	1:55:11.05	Mulford	Hudson	Chicago, Ill.	June 16, 1917
250 miles	2:23:04.03	Aitken	Peugot	Sheepshead Bay, N. Y.	Sept. 30, 1916
300 miles	2:55:32.23	Anderson	Stutz	Sheepshead Bay, N. Y.	Oct. 9, 1915
350 miles	3:24:42.99	Anderson	Stutz	Sheepshead Bay, N. Y.	Oct. 9, 1915
400 miles	4:04:48.98	Resta	Peugot	Chicago, Ill.	June 26, 1915
450 miles	4:35:05.78	Resta	Peugot	Chicago, Ill.	June 26, 1915
500 miles	5:07:26.00	Resta	Peugot	Chicago, Ill.	June 26, 1915

Straightaway Records Regardless of Class, Non-Stock

10 miles	5:14.40	Bruce-Brown	Benz	Daytona	Mar. 24, 1909
20 miles	13:11.92	Burman	Buick Bug	Jacksonville	Mar. 30, 1911
50 miles	35:52.31	Burman	Buick Bug	Jacksonville	Mar. 28, 1911
100 miles	1:12:45.20	Bernin	Renault	Daytona	Mar. 6, 1908
150 miles	1:55:18.00	Disbrow	Special	Jacksonville	Mar. 31, 1911
200 miles	2:34:12.00	Disbrow	Special	Jacksonville	Mar. 31, 1911
250 miles	3:14:55.00	Disbrow	Special	Jacksonville	Mar. 31, 1911
300 miles	3:53:33.50	Disbrow	Special	Jacksonville	Mar. 31, 1911

SPEEDWAY RECORDS, 1921

One-mile, Otto Walker, Harley-Davidson, Fresno, Cal., Feb. 22, 1921. Time, 33 2/5 seconds.

Two-mile, Albert Burns, Indian, Fresno, Cal., Feb. 22, 1921. Time, 1:09 4/5.

Five-mile, Jim Davis, Harley-Davidson, Beverly, Cal., Apl. 24, 1921. Time, 2:51 4/5.

Ten-mile, Otto Walker, Harley-Davidson, Fresno, Cal., Feb. 22, 1921. Time, 5:45 4/5.

Twenty-five mile, Otto Walker, Harley-Davidson, Beverly, Cal., April 24, 1921. Time, 14:21 4/5.

Fifty-mile, Otto Walker, Harley-Davidson, Fresno, Cal., Feb. 22, 1921. Time, 29:34 3/5.

1921 MOTORCYCLE RACING RECORDS

National Championships

(61-Inch)

One-mile, Fred Ludlow, Harley-Davidson, Syracuse, N. Y. Time, 44.05 sec.

Five-mile, Fred Ludlow, Harley-Davidson, Syracuse, N. Y. Time, 3:45.54.

Ten-mile, Fred Ludlow, Harley-Davidson, Syracuse, N. Y. Time, 7:38.80.

Twenty-five mile, Fred Ludlow, Harley-Davidson, Syracuse, N. Y. Time, 19:17.60.

Fifty-mile, Fred Ludlow, Harley-Davidson, Syracuse, N. Y. Time, 38:52.13.

One Hundred mile, Ralph Hepburn, Harley-Davidson, Dodge City, Kan. Time, 1:07.52 2/5.

Two Hundred mile, Ralph Hepburn, Dodge City, Kan. Time, 2:17.54.

Three Hundred mile, Ralph Hepburn, Harley-Davidson, Dodge City, Kan. Time, 3:30.03.

Races at Syracuse held Sept. 19, 1921.

Races at Dodge City held July 4, 1921.

M. & A. T. A. RECORDS

Regardless of Course or National Championship Events

(61 cu. in. Solo)

One-mile, Otto Walker, Harley-Davidson, Fresno, Cal., Feb. 22, 1921. Time, 33 2/5 seconds.

Two-mile, Albert Burns, Indian, Fresno, Cal., Feb. 22, 1921. Time, 1:09 4/5.

Five-mile, Jim Davis, Harley-Davidson, Beverley, Cal., April 24, 1921. Time, 2:51 4/5.

Ten-mile, Otto Walker, Harley-Davidson, Fresno, Cal., Feb. 22, 1921. Time, 5:45 4/5.

Twenty-five mile, Otto Walker, Harley-Davidson, Beverly, Cal., April 24, 1921. Time, 14:21 4/5.

Fifty-mile, Otto Walker, Harley-Davidson, Fresno, Cal., Feb. 22, 1921. Time, 29:34 3/5.

One Hundred mile, Ralph Hepburn, Harley-Davidson, Dodge City, Kan., July 4, 1921. Time 1 hr. 7 min. 52 2/5 sec.

Two Hundred mile, Ralph Hepburn, Harley-Davidson, Dodge City, Kan., July 4, 1921. Time, 2 hr. 17 min. 54 sec.

Three Hundred mile, Ralph Hepburn, Harley-Davidson, Dodge City, Kan., July 4, 1921. Time, 3 hr. 30 min. 3 sec.

(61 cu. in. Sidecar)

One-mile, Floyd Dreyer, Indian, Toledo, Ohio, Aug. 14, 1921. Time, 51 3/5 sec.

Two-mile, Floyd Dreyer, Indian, To-

Speed Records

World's Racing Records at Brooklands

(Officially Recognized by the International Federation of Automobile Clubs.)

Distance or Time		Car	Piston Displacement (cu. in.)	Weight, lbs.	Time or Distance	Speed (m.p.h.)	Date
½ mile	s.s.	4-cyl. Benz	1311	3610	Normal 25.31s. Reverse 25.22s.	71.25	22- 1-14
½ mile	f.s.	4-cyl. Benz	1311	3610	14.076s.	127.877	8-11-09
1 kilometer	s.s.	4-cyl. Benz	1311	3610	Normal 29.62s. Reverse 31.57s.	73.57	22-12-13
1 kilometer	f.s.	4-cyl. Benz	1311	3610	17.761s.	125.947	8-11-09
1 mile	s.s.	4-cyl. Benz	1311	3610	Normal 41.26s. Reverse 41.16s.	87.34	22- 1-14
1 mile	f.s.	4-cyl. Benz	1311	3610	Normal 28.09s. Reverse 29.93s.	124.10	24- 6-14
2 miles	f.s.	4-cyl. Benz	1311	3610	58.99s.	122.05	14- 1-14
5 miles	f.s.	4-cyl. Benz	1311	3610	2m. 35.08s.	116.08	14- 1-14
10 miles	f.s.	4-cyl. Benz	1311	3610	5m. 19.78s.	112.57	22- 1-14
50 miles	s.s.	4-cyl. Talbot	290	2882	27m. 2.23s.	110.96	27-10-13
100 miles	s.s.	12-cyl. Sunbeam	552	3207	55m. 35.55s.	107.93	10-10-13
150 miles	s.s.	12-cyl. Sunbeam	552	3207	1h. 25m. 14.94s.	105.57	10-10-13
200 miles	s.s.	6-cyl. Sunbeam	276	2601	2h. 5m. 6.28s.	95.92	1-10-13
300 miles	s.s.	6-cyl. Sunbeam	276	2601	3h. 7m. 45.46s.	95.87	1-10-13
400 miles	s.s.	6-cyl. Sunbeam	276	2601	4h. 12m. 15.08s.	95.14	1-10-13
500 miles	s.s.	6-cyl. Sunbeam	276	2601	5h. 16m. 40.01s.	94.74	1-10-13
600 miles	s.s.	6-cyl. Sunbeam	276	2601	6h. 22m. 54.16s.	94.02	1-10-13
700 miles	s.s.	6-cyl. Sunbeam	276	2601	7h. 29m. 36.55s.	93.41	1-10-13
800 miles	s.s.	6-cyl. Sunbeam	276	2601	8h. 34m. 25.15s.	93.31	1-10-13
900 miles	s.s.	6-cyl. Sunbeam	276	2601	9h. 53m. 22.29s.	91.00	1-10-13
1000 miles	s.s.	6-cyl. Sunbeam	276	2601	11h. 6m. 38.87s.	90.00	1-10-13
1 hour	s.s.	12-cyl. Sunbeam	552	3207	107 M. 1672 Yds.	107.95	10-10-13
2 hours	s.s.	6-cyl. Sunbeam	276	2601	195 M. 189 Yds.	97.55	1-10-13
3 hours	s.s.	6-cyl. Sunbeam	276	2601	287 M. 856 Yds.	95.83	1-10-13
4 hours	s.s.	6-cyl. Sunbeam	276	2601	380 M. 628 Yds.	95.09	1-10-13
5 hours	s.s.	6-cyl. Sunbeam	276	2601	473 M. 464 Yds.	94.65	1-10-13
6 hours	s.s.	6-cyl. Sunbeam	276	2601	566 M. 589 Yds.	94.39	1-10-13
7 hours	s.s.	6-cyl. Sunbeam	276	2601	653 M. 147 Yds.	93.29	1-10-13
8 hours	s.s.	6-cyl. Sunbeam	276	2601	748 M. 247 Yds.	93.51	1-10-13
9 hours	s.s.	6-cyl. Sunbeam	276	2601	840 M. 1533 Yds.	93.43	1-10-13
10 hours	s.s.	6-cyl. Sunbeam	276	2601	910 M. 969 Yds.	91.06	1-10-13
11 hours	s.s.	6-cyl. Sunbeam	276	2601	989 M. 828 Yds.	89.95	1-10-13
12 hours	s.s.	6-cyl. Sunbeam	276	2601	1078 M. 460 Yds.	89.85	1-10-13
13 hours	s.s.	4-cyl. Argyll	159	2726	992 M. 483 Yds.	76.33	27- 5-13
14 hours	s.s.	4-cyl. Argyll	159	2726	1070 M. 57 Yds.	76.43	27- 5-13
15 hours	f.s.	6-cyl. Napier			1006 M. 1640 Yds.	67.13	29- 6-07
16 hours	f.s.	6-cyl. Napier			1068 M. 400 Yds.	66.76	29- 6-07
17 hours	f.s.	6-cyl. Napier			1139 M. 1100 Yds.	67.03	29- 6-07
18 hours	f.s.	6-cyl. Napier			1203 M. 830 Yds.	66.36	29- 6-07
19 hours	f.s.	6-cyl. Napier			1263 M. 1170 Yds.	66.51	29- 6-07
20 hours	f.s.	6-cyl. Napier			1327 M. 1190 Yds.	66.38	29- 6-07
21 hours	f.s.	6-cyl. Napier			1390 M. 1100 Yds.	66.22	29- 6-07
22 hours	f.s.	6-cyl. Napier			1458 M. 130 Yds.	66.27	29- 6-07
23 hours	f.s.	6-cyl. Napier			1519 M. 360 Yds.	66.05	29- 6-07
24 hours	f.s.	6-cyl. Napier			1581 M. 1310 Yds.	65.91	29- 6-07
Light Car Class, Over 67.1 cu. in. (1100 c.c.) and under 91.5 cu. in. (1500 c.c.)							
½ mile	f.s.	4-cyl. A.-C.	91	1145	17.12s.	105.14	3- 6-21
1 mile	f.s.	4-cyl. Lagonda	91	1269	41.41s.	86.91	5-10-21
50 miles	f.s.	4-cyl. A.-C.	91	1349	31m. 57.82s.	93.86	29-11-21
1 hour	f.s.	4-cyl. A.-C.	91	1349	94 M. 1227 Yds.	94.70	29-11-21
100 miles	f.s.	4-cyl. A.-C.	91	1349	1h. 3m. 18.50s.	94.77	29-11-21
3 hours	f.s.	4-cyl. Wolseley	76	1583	245 M. 1501 Yds.	81.95	24-11-21
6 hours	f.s.	4-cyl. Wolseley	76	1583	490 M. 393 Yds.	81.70	24-11-21
12 hours	f.s.	4-cyl. A.-C.	91	1547	736 M. 1684 Yds.	61.41	13-10-21
200 miles	s.s.	4-cyl. Talbot-Darracq	90	1547	2h. 15m. 6.08s.	88.82	22-10-21
500 miles	s.s.	4-cyl. Wolseley	76	1583	6h. 6m. 46.37.	81.79	24-11-21

M. & A. T. A. Records

(Continued)

ledo, Ohio, Aug. 14, 1921. Time, 1:42 3/5.

Five-mile, Floyd Dreyer, Indian, Toledo, Ohio, Aug. 14, 1921. Time, 4:20 2/5.

Ten-mile, Sam Riddle, Indian, Sheepshead Bay, Oct. 11, 1919. Time, 8:15 3/5.

Twenty-five mile, Teddy Carrol, Indian, Sheepshead Bay, Oct. 11, 1919. Time, 20:36 2/5.

SOLO

One-Mile Dirt Track Records

One-mile, Gene Walker, Indian, St. Louis, Mo., Nov. 8, 1921. Time 42.3 sec.

Two-mile, Gene Walker, Indian, St. Louis, Mo., Nov. 8, 1921. Time, 1:26 1/5.

Five-mile, Gene Walker. Indian, St. Louis, Mo., Nov. 8, 1921. Time, 3:38.

Ten-mile, Gene Walker, Indian, St. Louis, Mo., Nov. 8, 1921. Time, 7:23 3/5.

Twenty-five mile, Fred Ludlow, Harley-Davidson, Syracuse, N. Y., Sept. 19, 1921. Time, 19:17 6.

Fifty-mile, Fred Ludlow, Harley-Davidson, Syracuse, N. Y., Sept. 19, 1921. Time, 38·52.13.

SIDECAR

One-Mile Dirt Track Records

One-mile, Floyd Dreyer, Indian, Toledo, Ohio, Aug. 14, 1921. Time, 51 3/5 seconds.

Two-mile, Floyd Dreyer, Indian, Toledo, Ohio, Aug. 14, 1921. Time, 1:42 3/5.

Five-mile, Floyd Dreyer, Indian, Toledo, Ohio, Aug. 14, 1921. Time, 4:20 2/5.

Ten-mile, Floyd Dreyer, Indian, Toledo, Ohio, Aug. 14, 1921. Time, 8:39.

Twenty-five mile, Floyd Dreyer, Indian, Toledo, Ohio, Aug. 14, 1921. Time, 21:47.

SIDECAR

Half-Mile Dirt Track Records

One-mile, Lester Foote, Harley-Davidson, Greeley, Col., Sept. 16, 1920. Time, 1:13 3/5.

Two-mile, Jiggs Price, Harley-Davidson, Lima, Ohio, May 30, 1921. Time, 2:24 4/5.

Five-mile, Floyd Dreyer, Indian, Pittsburgh, Pa., Oct. 10, 1921. Time, 5:32.

Ten-mile, Floyd Dreyer, Indian, Pittsburgh, Pa., Oct. 10, 1921. Time, 11:11 1/5

Official World's Aviation Records

Airplane Duration Record

"Eddie" Stinson and Lloyd Bertaud in Larsen J.L.-6, all-metal monoplane, one 185 h.p. B. M. W. (Bavarian Motor Works) motor, over Roosevelt Field, Garden City, Long Island, N. Y., continuous flight, December 29th-30th, 1921—26 hrs., 19 min., 35 sec.

(This flight broke the former world's record held by Lucien Bossoutrout and Jean Bernard, who on June 1st, 1920, remained aloft 24 hrs., 19 min., 7 sec., in Farman Goliath, two Salmsons, 260 h.p. air-cooled motors, at Villesauvage-La Marmogne, France.)

Airplane Altitude Record

Lt. J. A. Macready, U. S. Army Air Service, in a Lepere biplane, 400 h.p. Liberty motor, with supercharger, over McCook Field, Dayton, O., September 28th, 1921—indicated alt., 40,800 ft. 37,800 ft. true alt. above sea level.

(This flight broke the former world's record held by Major Rudolph W. Schroeder, U. S. A. S., who on February 27th, 1920, in same machine reached indicated alt. 38,180 ft. and corrected or true alt. above sea level, 33,000 ft.)

Airplane Speed Record (Over a closed course)

Bert Acosta in Curtiss-Navy Racer (biplane) Curtiss, 400 h.p. 12 cyl. motor, winner of Pulitzer Trophy Race, at Omaha, Neb., November 3rd, 1921—153.59 miles (14 turns) in 52 min., 9 sec.; average speed of 176.7 m.p.h.

(This flight broke the world's record for closed course made by Georges Kirsch, winner of Deutsche de la Meurthe Trophy Race at Etampes, France, October 1st, 1921—186 miles (3 turns) in 69 min., 55 sec.; average speed, 173 m.p.h.)

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The 1922 Statistical Number

EVERY effort has been made to present in this number accurate and complete statistical data concerning all of the important phases of the automotive industry. The rapid growth which has taken place during the last decade and the wide field of usefulness developed by automotive products have made necessary some broad, comprehensive compilation of statistical information concerning the industry which will give an accurate picture of its past, its present status, and its probable future trend.

This is the aim of the Statistical Number of AUTOMOTIVE INDUSTRIES. Each year it is possible to go just a little further toward completeness. The degree to which our aim has been accomplished in 1922 must rest with the opinion of our readers.

We hope that no errors appear in the statistical data presented. Every care has been taken to prevent them. If any have crept in despite our vigilance, we want to know about them.

Further Automotive Taxation Unjust

FAIR play is the first essential of sound legislation and this essential is entirely lacking in the proposals of the House Ways and Means Committee for methods of raising money for the proposed Soldiers' Bonus. The only possible excuse for saddling the automobile industry with a greater tax burden is that it has always been a ready pack-horse for tax burdens and may be able to bear more.

The automobile industry is already paying to the United States Government some $150,000,000 in taxes every year, enough to support the legislative, judicial and executive branches of the Government, and numerous other administrative functions besides. The various States of the Union are yearly deriving an increased revenue from automobile fees, the total for 1921 having been $122,000,000. These latter fees are, of course, entirely justifiable since they are necessary for road maintenance and are properly chargeable to car and truck owners in most cases. But the purpose for which the present funds are being raised is no more the responsibility of automobile owners than of any other group in the country. The utter unfairness of the proposals is strikingly apparent when it is realized that out of $329,000,000 in taxes endorsed by the committee on Feb. 9, the automobile industry through the users of its product would be expected to pay $120,000,000 in gasoline and horsepower taxes.

It must be remembered in this connection that automobile owners will, of course, bear their proportionate share of the other taxes on amusements, tobacco, stock and bond transactions, etc. In other words, they are taxed as a special class and then as individual citizens.

A tax on gasoline or a tax on horsepower is a tax on transportation. If gasoline is to be taxed, coal used by the railroads and electric power used by the electric railways should also be taxed. The automobile to a large extent—and the truck in every case—is a utility transportation vehicle engaged in economically necessary and efficient transportation. There is no justice in the proposal that the automobile and the truck bear such a transportation tax alone.

Thus far we have considered only the unjust nature of the proposed tax without regard to the purpose for which it is proposed to raise it, although that consideration is, of course, behind the whole discussion. The question has too many angles to permit full discussion here, but it may be said in general that the proposal for a Soldiers' Bonus at this time has more support among those with a political than among those with a business or economic viewpoint.

Unit Costs and Industrial Unrest

STATISTICS concerning strikes and lockouts are not, of course, accurate measures of industrial unrest. Perhaps no definite units will ever be derived suitable for measuring the degree of efficiency with which our industrial organization if functioning as regards human relations. There is considerable danger, however, in accepting spurious standards of

measurement. The experience of a few cases, the events in a particular instance, the tendency to apply as a general rule the results of an individual experience—such standards are not sound measures.

There is some ground, however, for the belief that unit production cost constitutes something like a fair measure of the degree of industrial unrest in a given industry or in a given manufacturing plant. There is a definite relation between enthusiastic and interested co-operation on the part of individual workers and the final unit manufacturing cost of the product. It is obviously impossible to work out this relation in a mathematical formula, but a long series of observations under varying conditions indicate the definite presence of such a relation.

In studying the human factor of group organization, the acceptance of this relationship forms an excellent basis for procedure and experiment. The maximum efficiency can then be obtained only through a study of the individual potentialities of the worker and the development of opportunities in his work for the fullest utilization of his abilities along lines for which he is best fitted.

Pleasure Cars No More

WE still hear the American passenger car referred to occasionally as a "pleasure" car, but it has long since ceased to be properly classed in that category by all who realize its essentially utilitarian nature. Evidence of this fact can be had at every turn, but there is still a disposition on the part of legislators to regard automobiles in general as luxuries which should be burdened with taxation at every opportunity.

It is a well-known fact that the use of luxuries is greatly curtailed in times of general business depression such as we have passed through during the last year, hence if the automobile is in truth a luxury how is one to account for the fact that they were used more than ever in 1921? It is true, of course, that a small proportion of cars which can rightly be classed as luxuries were laid up all or most of last year, while many trucks which are normally busy all the time were idle because industry was operating far below capacity and many plants were entirely closed for a part of the year. In spite of this fact there were over one and a half million more cars and trucks registered in this country than ever before! The use of luxuries certainly does not increase in this fashion when times are hard.

Furthermore, there was more gasoline consumed in this country in 1921 than in any previous year. If proof that the automobile is a necessity is needed we submit that these facts should be sufficient to convince the most skeptical. About half the cars and trucks are used on the farm or in rural communities, and a very large percentage of those used in cities are employed wholly or largely for business purposes. Automotive transportation is a basic necessity. A tax upon it is just as much a tax upon transportation, as a tax on freight or passenger traffic by rail or steamship, and is justified only to the extent that taxes on other means of transportation are justified.

Possibilities of Wider Tractor Application

TRACTOR use originated in the grain belt, where immense acreages are often held by individuals or companies. The present type of tractor meets the requirements in that section very well. Plowing is the work calling for the greatest power, and the average tractor of to-day is specially designed for pulling plows. There is, of course, a great deal of other work on these grain belt farms, such as disking or harrowing, seeding and harvesting, as well as the different operations connected with haying. While the advantages of the tractor over the horse do not stand out as prominently in these operations as in plowing, still it can be readily adapted to them and does the work with a fair degree of efficiency. In such grain States as Kansas and Minnesota, the tractor has always been strong.

A very large acreage in the United States is devoted to what is generally known as row crops, which require cultivation during the growing period. These crops include corn, cotton, tobacco, potatoes and beans. In districts where these crops are grown, the principle of crop rotation is generally adhered to, and there is, in consequence, a greater diversity of operations. Of course, there is plowing to do on every farm, but it has been calculated that on the average farm in the corn belt, plowing constitutes only 20 per cent of all the work for which horses are used. Hence, it will be readily seen that a tractor specially designed for plowing and not suitable for cultivation does not particularly meet the requirements on corn belt farms, and can never be expected to completely motorize these farms. The same applies with practically equal force to farms devoted to several other kinds of row crops.

Some years ago quite a number of firms developed motor cultivators intended to supplement tractors on row crop farms. However, in view of the fact that the average farm in the corn belt consists of only about 150 acres and the average farm in the Eastern States of only about 100 acres, some men in the tractor industry have recently come to realize that for the great majority of row crop farmers separate machines for plowing and cultivating would represent altogether too great an investment. As with so much other farm machinery, the equipment would lie idle the greater part of the year so that the fixed charges for depreciation and interest on investment would loom very large in comparison with the items of operating cost.

It is therefore necessary, it seems, to combine the functions of plowing and cultivating in one machine, and as cultivating and other light draft jobs form the work on the majority of such farms, there is now a tendency to develop machines which are especially efficient in cultivating and while not ideal for plowing, will satisfactorily do the work. These tractors, of course, are not at all likely to replace the present type, which has a well-established field, but will open up a new field which has as yet hardly been touched by the tractor industry.

Tax Protests Flooding Washington

Class Legislation, Industry Declares

Proposed Levy Apparently Killed —Warning Issued, However, Against Over-Confidence

WASHINGTON, Feb. 15—A flood of protests which has inundated Washington for a week apparently has killed effectually the eight-point tax proposals offered by a sub-committee of the Ways and Means Committee of the House to provide the funds needed for a soldier bonus. These proposals included a 1-cent a gallon tax on gasoline and an impost of 25 cents per horsepower on motor vehicles.

Farm organizations were the first to roll up the tide of protests. Then the American Automobile Association swung into line and other automotive associations followed, together with many other business organizations.

Harding Favors Sales Tax

President Harding is unalterably opposed to this tax program and undoubtedly would veto any revenue-producing bonus bill which included them. It is understood he favors a sales tax as a substitute. The farmers are opposed to a sales tax, however, and the impression is growing that there may be no bonus legislation at this session.

Representatives of the industry warn against over-confidence, however, and declare the present is an opportune time to make clear, once and for all, that the industry does not propose to keep silent while it is being made the victim of class legislation.

Denied hearings by Congressman Fordney, representatives of the National Automobile Chamber of Commerce and the American Automobile Association turned to those who would suffer most from the imposition of these taxes.

Farmers Would Be Affected

According to T. C. Atkeson, Washington representative of the National Grange, more than 50 per cent of the proposed 25 cents per horsepower tax on motor vehicles and the one cent per gallon on gasoline would be borne by the farmers of the country, an addition which, in the face of the present low price for farm commodities would work untold harm, in his opinion.

This position is substantially that assumed by the American Farm Bureau Federation, whose tax expert, H. M. McKenzie, has appeared against each of the eight points of revenue proposed.

According to the officials of the A. A. A., the most serious aspect of the proposed new taxes is their effect upon the roadbuilding program of the country. The heavy tax burdens with which motor vehicle owners are now confronted has already brought about a very considerable resistance to further taxation for road purposes in many states. The imposition of further federal taxes upon the already heavy special discriminatory levies would be sufficient, in the opinion of leading highway authorities, to bring about serious diminution in appropriations for roadbuilding in the several states, with the net result that the highway program which is just now quickening into full vigor would be retarded and millions of dollars lost in the added maintenance cost which would be necessary as a result of neglect of the highways at this time.

(*Continued on page* 439)

INDUSTRY WOULD PAY ONE-THIRD OF BONUS

NEW YORK, Feb. 13—According to the plans tentatively approved by the tax section of the House Ways and Means Committee which suggests a levy of 25 cents per horsepower on motor vehicles, another $50,000,000 would be levied on car and truck users as part of the program to secure funds for the soldier's bonus.

An additional $70,000,000 would be collected in great part from passenger car and truck users by the proposal to tax gasoline 1 cent per gallon.

The remaining two-thirds of the proposed taxes, aggregating $329,000,000, would be levied on stock and bond transactions, theatre admissions, cigarettes and tobacco, real estate transactions and by an increased parcel post rate.

The N. A. C. C. in furnishing data to the committee showing the utilitarian feature of cars and trucks dwells on the fact that a very small proportion of the tax would accrue from their use in recreation, and the unfairness of placing one-third of the bonus cost on a group of the public engaged in essential transportation.

Chrysler Has Quit as Aide to Willys

Resigns All Offices — Fight with Bankers for Willys-Overland Control Begins

NEW YORK, Feb. 16 — Walter P. Chrysler, one of the outstanding figures in the industry, has resigned as executive vice-president and a director of the Willys-Overland Co. and all other Willys companies. No successor will be appointed, and he has made no announcement concerning his plans for the future.

The resignation of Chrysler came unexpectedly. It followed by a day his resignation as a director to make way for an Ohio resident. This step was voluntary and it was announced after the meeting at Toledo, at which four new directors were elected, that Chrysler would retain his position as executive vice-president.

Chrysler has three or four flattering offers under consideration, but it is understood he has not yet decided which to accept. In the meantime he has leased offices in this city.

After attending the directors' meeting in Toledo, Chrysler went immediately to Detroit. He is chairman of the board of the Maxwell Motor Corp. and is understood to have a considerable interest in that company, but his friends do not believe he will take over the active management.

So far as can be learned there is no basis for the report that he will become president of the General Motors Corp.

With the action taken at Toledo, John N. Willys dominates the board of directors of the Willys-Overland Co., and the fight between the bankers and the other interests for control has come out into the open.

Before the bankers' plan for a bond issue of $25,000,000 can be presented to the preferred stockholders, it must be approved by the board of directors. Lacking this approval this refinancing program will be held up. Even if it reached the preferred stockholders it would not be accepted by holders of 75 per cent of the preferred stock.

Representatives of the bank creditors are meeting to-day at the Chase National Bank to determine upon a course of action. While the assets of the Willys-Overland Co. are more than $100,000,000, the bank loans total only $16,556,000 at this time, and there is $4,000,000 in cash on hand.

See page 443 *for earlier story on reorganization of Willys-Overland board of directors.*

Durant to Build Car at Ford Price

Washington Will See Unveiling in March

Will Be Made in Quantities by Subsidiary Company—Official Statement Issued

NEW YORK Feb. 15—The following statement was issued to-day from the headquarters of Durant Motors, Inc.:

"W. C. Durant, president of Durant Motors, Inc., has accepted a contract to build in quantities a four-cylinder, five-passenger automobile to retail at $348. The car will be on exhibition at Washington, D. C., March 9 The name of the car and the company will be made known on that date."

Further details in regard to this sensational announcement were absolutely refused. It was stated positively that nothing more would be given out until the date fixed. Durant and his family started this week for Palm Beach to spend three weeks, and his associates here profess ignorance of the project.

It was asserted positively at the Durant offices, however, that there was no joker in the statement and that the announcement covered a bona-fide proposition of magnitude.

The price of the five-passenger Ford car without starter and demountable rims is $348. With the added equipment it is $443. The Durant car will be equipped with both starter and demountable rims.

Not to Be Built at Elizabeth

The new car, which will compete with the Ford and which, it is assumed, will be necessary to produce in quantities if it is to be profitable, has been developed by Durant engineers, but no information is obtainable as to where the experimental work has been done.

The manufacturing company undoubtedly will be a subsidiary of Durant Motors, Inc Whether or not a factory site has been selected is not known, but Durant's associates did not take seriously a suggestion that the new car might be built in the big new factory of the Willys Corp. at Elizabeth, N. J.

The reason for selecting Washington for the unveiling of the new car was left to the imagination.

Considerable significance may be attached to the fact that Edward Ver Linden, who is president of the Durant Motor Car Co. of Michigan and who formerly was president of the Olds Motor Works, has gone South "to build up his health" almost simultaneously with the departure of Durant for Florida, and that Ver Linden probably will visit Palm Beach.

It is understood, also, that Fred W. Warner, formerly head of the Oakland division of General Motors, who has been in charge of the sale of Durant stock in Michigan, will spend considerable time at the Durant plant at Lansing while Ver Linden is absent.

Court Orders Operations of Racine Tire Resumed

RACINE, WIS., Feb. 15—The Federal Court has directed H. O. Smith, receiver for the Racine Auto Tire Co., to resume factory operations immediately. The voluntary petition in bankruptcy filed last week by directors of the company was the result of a heavy loss suffered in the operations of 1920. This seriously hampered the company's working capital and made new financing necessary notwithstanding the fact that conditions were materially improved by the business done last year.

Like all tire manufacturing companies there was a heavy loss between the market and contract price on fabric. This aggregated slightly less than $400,000, and wiped out the profits of 1921 after plant depreciation had been absorbed and refunds paid on account of the decline in tire prices. There now is strong hope that reorganization of the company will permit continued production of the "Horseshoe" brand of tire.

One Building Will Hold British Automobile Show

LONDON Feb. 1 (*By Mail*)—An announcement is made by Sir Alfred Mays-Smith, president of the British Society of Motor Manufacturers, that negotiations are now practically completed whereby it will be possible to hold the London passenger car show this year in one building, thus obviating the dual show at Olympia and White City which has been so much objected to by exhibitors at the latter.

A large proportion of American cars have been staged at White City during the last two shows and, with other exhibitors in that section, have undoubtedly suffered in consequence of the tendency of the public to specialize upon the cars at Olympia.

EARL CONFERS ON REFINANCING

NEW YORK, Feb. 15—Clarence A. Earl and members of the creditors' committee which is working out the refinancing of Earl Motors, Inc., are in New York this week for conferences with Percy Johnston, president of the Chemical National Bank. It is understood that nothing has developed to interfere with the satisfactory working out of the financial program and that the additional money needed will be subscribed.

Ford Car, Tractor, Truck All for $1,000

Manufacturer Planning It, Army Officer Testifies at Muscle Shoals Hearing

WASHINGTON, Feb. 15—Henry Ford is attempting to lower his production costs so that he can sell farmers a Ford automobile, tractor and truck, all for $1,000, according to testimony given by General Beach, chief of the Corps of Engineers of the United States Army, who appeared before the House committee on military affairs, which is investigating the offer of Ford to take over the government property at Muscle Shoals. The present price of the three is $1,173.

Hopes to Go Down in History

"Mr. Ford has said that he hopes to be able to cut the production costs of his machine to such a price that farmers can buy an automobile, a tractor and a truck for $1,000," General Beach said. "I have every reason to believe that he aspires to go down in history as the man who did the most to develop the agricultural resources of his country and the agricultural possibilities of the world."

W. D. Mayo, chief engineer of the Ford company, testified that it is the intention of Ford to operate plant No. 1 at Muscle Shoals for the manufacture of automobiles and tractor parts from raw materials. Ford hopes to be able to reduce the costs of raw materials, Mayo said.

"That has been his dream for some years past," he declared.

This testimony was construed to imply that Ford would produce light metals, possibly aluminum, which would enter into the construction of his automobile, but Mayo did not commit himself definitely as to production plans. He confined his testimony wherever possible to the manufacture of fertilizers and the development of plans for Muscle Shoals plants and power stations.

Not to Sell Water Power

It was made clear by Mayo that Ford intends to use all the horsepower developed and will not sell power to private or public concerns, unless it becomes evident there will be a surplus.

Senator Norris of Nebraska said he would call Ford personally to appear before the Senate agricultural committee, of which he is chairman and which will begin hearings on the Muscle Shoals project tomorrow. It is expected Ford will accept the invitation.

Southern senators and representatives are very active in their efforts to obtain the approval of Congress for the Ford contract.

G. M. Aims to Make Flat Rate General

Gradually Extending Standardization of Practices—Business Outlook for Year Satisfactory

NEW YORK, Feb. 14—Flat rates for service throughout all its divisions is the ultimate aim of the General Motors Corp. Accomplishment of this end is being approached as rapidly as possible. While nothing revolutionary is proposed, it is the determination of the corporation to give the users of its products the best service possible. To this end standardization of practices is being extended gradually, and the importance of keeping the owners of motor vehicles satisfied is being emphasized in the sales organization, both wholesale and retail. This extends to the parts question and includes the carrying of adequate stocks. The ultimate result will be that every owner of a General Motors vehicle, no matter where he may be located, will find spare parts easily accessible and they will be installed at a flat rate.

The service question has been neglected in the past, it is felt, because all the energies of factory organizations were devoted to meeting the demand for cars. Factories now can easily turn out all the automobiles that can be sold and still give adequate consideration to the production of service parts. The sales organizations also have time to instruct dealers in some advanced business methods.

No Expansion Program Planned

General Motors regards the outlook for the coming year as satisfactory. Business thus far this year has been far in excess of the same period in 1921, and sales are expected to expand as the year progresses. An increase has been apparent in the past two weeks.

The corporation has no expansion program in mind, and all its operations will be on a conservative basis. The dissolution of the Scripps-Booth division is well under way and the manufacture of cars has been discontinued. No decision has been reached as to what disposition will be made of the factory, but it will be used in connection with some of the existing units.

Development work on the air-cooled line which the corporation will bring out is progressing satisfactorily, but not even an approximate date has been fixed for getting these models into production. The plans of the company concerning the new line are as nebulous as they have been for several months, and ample time will be given the engineering department to perfect the car before any attempt is made to put it on the market.

TEMPLAR HEARING POSTPONED

COLUMBUS, Feb. 14—The case of N. Clyburn against the Templar Motors Co. and its board of directors, praying for a receiver, which has been pending in the Franklin county courts, was again postponed when it came up for hearing. The new date fixed is Feb. 20. In the meantime Attorney F. S. Monnett, representing Clyburn, will take depositions on the merits of the case in order to aid the court in arriving at a decision.

Stockholders of the company in Columbus have received notices of the annual stockholders' meeting at Lakewood, Ohio, March 1.

Shaw's Plan to Purchase Allen Motors Cancelled

COLUMBUS, Feb. 14—Negotiations for the sale of the plant and tangible assets of the Allen Motor Co., which has been in the hands of George A. Archer and W. C. Willard as receivers for more than six months, to Frank P. Shaw of Chicago, have been declared off. Shaw made a bid of $570,000 for the plant and assets, excepting cash on hand and bills receivable, and this was accepted by Judge Sater in the federal court. Later it developed that he could not carry out the plan because of the difficulties of the Fort Dearborn banks.

H. C. Runyon, who has personal charge of the assets under the receivers, reports two offers for the plant. One of them provided for immediate liquidation, while the other looked toward the continuation of the plant as a going concern. Neither has been accepted so far, and creditors will likely be called together for the purpose of obtaining their views.

In the meantime the plant is giving service to Allen car owners in Columbus and Central Ohio.

British Dunlop Names Stockholders Committee

LONDON, Feb. 11 (*by cable*)—The situation of the Dunlop Rubber Co., Ltd., was reviewed critically by the stockholders at a long meeting with Chairman Szarvasy. An optimistic view was taken, but it was decided to appoint a stockholders' committee to investigate the situation.

It is stated the bankers of the Dunlop company have saved temporarily the position of the American Dunlop company by postponing for a year their claims for repayment. The bankers have suggested as a possible solution a combination with existing interests in America, and these prospects will be surveyed by Director Proctor of the Dunlop company, who has sailed for America for that purpose.

OWN PLANT FOR RELIANCE

LOS ANGELES, Feb. 13—The Pacific Reliance Motor Corp. has made arrangements to assemble the Reliance truck in a plant of its own in addition to building a ¾-ton truck for school and bus trade. Several of these light trucks already have been delivered. One is in service between Somerton and Yuma, Ariz. These activities will be in addition to the sale of Reliance trucks in the western territory.

Seager Suit Settled By Stewart-Warner

Settlement Made On $450,000 Basis—Gets Sparton System Patents

CHICAGO, Feb. 13—The Stewart-Warner Speedometer Corp. has settled out of court the suit brought against it by James D. Seager, Arthur L. Payton and Cornelia F. Thomas for infringement of patents on vacuum tank equipment. The settlement follows a decision by Judge Carpenter in Federal Court holding that the Seager patents are valid and have been infringed by the Stewart-Warner Corp. This patent litigation has been pending for years and came to trial last June.

The settlement was on the basis of approximately $450,000, the Stewart-Warner Corp. received an exclusive license to manufacture the vacuum feed devices covered by these patents.

In connection with the settlement, the Sparks Withington Co., manufacturer of the Sparton system, will retire from the manufacture of vacuum systems and surrender its patents to the Stewart-Warner Corp., according to a statement by the latter company.

Advantageous to Company

"The settlement is advantageous to the company because it clears up misunderstandings and also some other phases that are important," according to a statement by Vice-President Bucklin of the Stewart-Warner Corp.

In his decision, Judge Carpenter said that, while the Jay Webb invention on which the Stewart-Warner system is based, doubtless is an improvement over anything Seager or Harrington described, the essentials of the Seager combination are retained in it.

The Stewart vacuum gasoline system is used as standard equipment on more than 90 per cent of all passenger cars.

Cravens Named President of Climax Engineering Co.

CLINTON, IOWA, Feb. 13—George W. Cravens, formerly of Westfield, N. J., has been elected president of the Climax Engineering Co., and G. W. Dulany, Jr., president of the G. W. Dulany Trust of which the Climax Engineering Co. is a subsidiary, has been made chairman of the board. The other officers were re-elected. The company will proceed energetically with the production and sale of Climax heavy duty engines. It is in an enviable financial position, having no trade liabilities as of Dec. 31, 1921.

Cravens, the new president, has had a wide engineering and commercial experience. He was chief engineer for the Elkhart Carriage & Motor Car Co., general manager of the American Motors Corp. and general manager of the Universal Body Co. after a long service with the General Electric Co.

Harry Moock Quits as N.A.D.A. Manager

Goes with Hudson-Essex — Vane Succeeds Him—Hay Resigns Presidency

ST. LOUIS, Feb. 14—Harry G. Moock, who has been general manager of the National Automobile Dealers Association for three years, has resigned to become director of the newly organized merchandising department of the Hudson Motor Car Co. and Essex Motors. He will be succeeded by C. A. Vane, who has been general counsel of the association.

Moock's resignation was offered at a special meeting of the directors of the N. A. D. A. held here yesterday. The session was called primarily to elect a successor to Thomas J. Hay of Chicago, who resigned as president. He will be succeeded as head of the organization by W. J. Brace of the Hudson-Brace Motor Car Co. of Kansas City.

Other Work Calls Hay

Hay, who was elected at the annual meeting of the N. A. D. A. at Chicago on Jan. 31, is the Chandler and Cleveland distributor in that city. He explained that he was compelled to relinquish the position because his interest in the Chicago and Illinois associations took so much of his time that he would be unable to devote the necessary attention to the national organization.

The resignations of Hay and Moock were entirely unexpected by the rank and file of the organization which formally inaugurated a new policy at the annual meeting. Under this plan the superstructure would be based on 1000 distributors and dealers paying dues of $50 to $250 a year. This idea was devised to supplant the old $10 a year memberships scattered all over the country with a few $100 sustaining memberships.

In his new position with the Hudson and Essex companies, Moock's efforts will be centered on assisting distributors and dealers in solving their merchandising problem. As the result of his work for the past three years, it is probable there is no one in the country more intimately familiar with dealer problems.

Moock Former Salesman

Moock has been in the automobile business ten years, five of which were spent as a dealer automobile salesman and the remainder in association activity. He helped organize and became manager of the Rocky Mountain Automobile Trade Association, the first interstate automobile trade association in the United States. Prior to his entry in the automobile business, Moock was a bond and insurance salesman.

Moock resigned as secretary of the Rocky Mountain association to become assistant secretary of the N. A. D. A. of Nov. 1, 1918. During the early days of the association much of the secretarial work was done by President Fred Vesper who was assisted by Bart J. Ruddle, who retired as secretary of the Milwaukee association to come to St. Louis. With the election of Moock, Ruddle became Washington representative. Much of the credit for building up the membership in the association in the early days is due to E. E. Peake of Kansas City. Moock became general manager early in 1919.

Vane has been connected with the N. A. D. A. since March, 1919, when he gave up newspaper work to become Moock's assistant. His duties at that time included the compiling of information called for by members and publicity. His legal training later resulted in his appointment as general counsel.

MOOCK SAYS PIONEER WORK IS CONCLUDED

ST. LOUIS, Feb. 14—"I cannot adequately express the regret I feel at leaving the association," Harry G. Moock, manager of the N. A. D. A., stated in his resignation to the directors at a meeting yesterday. "However, I feel that the pioneering work of the N. A. D. A. is over and that plans have now been put on foot which will be so readily adaptable to profiting the quality dealer that the association's success is assured. The offer made to me by the Hudson-Essex companies was so attractive that in justice to my future and the future of my family I could not decline it.

"I want to thank all the dealers and trade association secretaries for the wonderful manner in which they have supported my work. It is a real heartache to sever the connection that has existed between us, and I want to assure them all that I will continue to keep an interest in their work and give them my personal assistance whenever and wherever possible."

Franklin Mails Checks for Quarterly Dividend

SYRACUSE, Feb. 13—The H. H. Franklin Manufacturing Co. of this city made a profit in 1921, according to President H. H. Franklin.

"The chief concern of manufacturers has been to safeguard their capital rather than to make a profit," Franklin said. "The liquidation of high priced materials on a falling market is a difficult undertaking, but it can be said that the industry is succeeding very well. The present trend in all markets is toward stability."

The company has sent out checks covering the regular quarterly dividend, to approximately 4,350 preferred shareholders. The dividend is approximately $89,000. When shareholders receive shares on which they are now making partial payments, the quarterly dividends will exceed $95,000.

Bock Bearing Forms Company in Britain

Becomes Associated with P. & W. MacClellan Co.—To Build Plant at Glasgow

TOLEDO, Feb. 13—Plans for active entrance into world trade have been announced by R. E. Clingan, vice-president of the Bock Bearings Co. In conjunction with British interests the Toledo corporation has organized the British Bock Bearings, Limited, and has arranged for the construction of a complete plant at Glasgow, Scotland.

The new British company will have all of Great Britain and her colonial possessions, including Australasia, as sales territory. The Americas, including Canada, will be supplied by the Toledo plant.

The British interests identified with the Bock Bearings Co. in the new venture are members of an old established concern doing business under the firm name of P. & W. MacClellan Co. and operating plants near London, at Glasgow and in India. It is capitalized at more than $10,000,000.

Field Already Organized

Clingan says the new field is already organized from a sales standpoint by the MacClellan interests. It will be six months before the Glasgow plant will be able to function, and during the period orders will be handled directly by the Toledo plant. All of the special machinery will also be manufactured in the Toledo plant.

An order for the General Omnibus Co. of London is now being put through the plant here.

The British interests have been investigating the proposition for more than a year and believe that the Bock antifriction bearing has tremendous sales possibilities throughout the Empire.

In India they believe there is a special field on the "freight wagons" used as a part of railroad equipment. These small cars have four wheels and are very much like the American trailers. Castor oil is used to lubricate the ordinary bearings, and in jungle sections the railroads have experienced difficulties due to the stealing of the oil by natives.

To Form Other Subsidiaries

They believe that through this peculiar annoyance and through their association with the International Railways Association in furnishing other railroad equipment they will be able to place Bock bearings on much of the freight and tram equipment overseas.

Other subsidiaries will be organized in countries on the continent to exploit the Block patent licenses within a few years.

Clingan said the Bock company here is noting an increase in orders. Production is gaining. Directors voted to pay up cumulative dividends on preferred stock which were passed last year, and the next regular dividend will be met.

Reach No Decision On Valve Standard

Tire, Rim and Wheel Associations Exchange Views—Matter Goes to Committee

CLEVELAND, Feb. 13—The Tire & Rim Association and the Automatic Wheel Association, both of which have their national offices in this city, joined in a meeting here for the purpose of agreeing on standard valve equipment for disc wheels.

The conference was arranged by the officers of both associations, the standard valve idea being evolved in the hope that something could be done that would enable the owner to inflate his tire with less trouble.

The engineers of both organizations presented arguments on the question, and samples of disc wheels, containing special equipment, were presented with explanations offered by the exhibitors.

Members of the two organizations met in the Hollenden Hotel in the morning with representatives present from many eastern and western states. Manufacturers from all districts of the country were asked to offer suggestions, and from these it is hoped to offer something later that will be acceptable to both organizations.

Report Coming Soon

The morning meeting ended without a definite plan being agreed upon. The members of both organizations directed that a committee be appointed to consider the subject and to report at an early date.

In the afternoon members of the wheel association met in Hotel Cleveland to review the discussion of the morning. At the conclusion of the afternoon session Secretary George L. Lavery while stating that no announcement would be made at the present time indicated the subject under consideration had not been settled, although all persons participating in the discussions were co-operating heartily.

The wheel association did take up the matter of freight rate differentials on truck and passenger car disc wheels. The concession granted by the railroads to truck wheels in the matter of freight rates has operated against the makers of disc wheels for passenger cars, it was stated. At this time, opportunities for business are more favorable in the passenger car business, according to speakers at the meeting, who argued that every step should be taken to help those manufacturers.

Plans were laid for bringing the matter to the attention of railroad executives and to push a campaign vigorously for an adjustment of rates.

NEW BOMBING PLANE COMPLETED

DETROIT, Feb. 10—The first of the three all-metal bombing planes being made at the Stout Engineering Laboratories of this city for the U. S. Navy has been completed and is about ready to be shipped to the experimental flying field. The ships are of similar specifications. They are internally trussed types of 60 ft. span, and the first is equipped with two Packard 360 hp. engines. These planes have a carrying capacity of 2 ton and the maximum flying speed, according to the builders, will be well over 100 miles per hour.

Rail Car Makes Trial Run on Baltimore & Ohio Road

PHILADELPHIA, Feb. 13—A demonstration run of a rail motor car designed for branch-line railroads and for short hauls that do not produce sufficient traffic to warrant a regular train, was made between Philadelphia and Wilmington, on the main line of the Baltimore & Ohio Railroad. The railroad has under consideration the use of some of the cars on its light passenger traffic roads.

The car, which was built by the J. G. Brill Co., Philadelphia, is equipped with motor and chassis supplied by the White Motor Co. The car is of wood and steel, and has a seating capacity for 35 passengers and standing room for a like number. It has a carrying capacity of 10,500 lbs. and weighs 16,000 lbs.

The run to Wilmington, with several scheduled stops, was made in 1 hour and 16 minutes, and the return trip, without a stop, in 1 hour and 3 minutes. The distance is 26 miles.

Roads Are Greatest Need in Mexico, Caley States

CLEVELAND, Feb. 14—Fred H. Caley, secretary of the Cleveland Automobile Club, has arrived in Mexico City, where he went at the invitation of the automobile dealers, and will remain until March 1, assisting the automotive department of the Chamber of Commerce in preparing for the automobile show which will be held there from April 16 to 23.

The Mexican Post of Feb. 8 devotes a column on its first page to recounting the impressions of Mexico City gained by Caley. He voices the belief that development of a system of highways is most important to the stabilizing of Mexico. He believes Mexican roads would require comparatively little improvement beyond grading and drainage.

UPHOLDS STATE TAX LAW

ST. PAUL, MINN., Feb. 13—Judge H. O. Hanmft has handed down a decision upholding the State automobile tax law, but declaring it contains "glaring inequalities and irregularities seriously affecting a large number of individuals" and that it was "difficult to hold the act constitutional." The act taxes automobiles according to the factory prices on all models. As a result some persons owning a 1921 model are paying a higher tax than owners of 1922 models of the same cars because prices have fallen.

Competition Likely in Dirigible Work

Two Rival Companies May Be Formed to Build Aircraft for Commerce

NEW YORK, Feb. 14—Important developments in connection with the construction of dirigible aircraft in the United States may be expected in the near future. Two rival companies may be formed for the construction of aircraft of this type as commercial ventures.

Representation in the United States for the Zeppelin interests has been taken over by Harry Vissering of Chicago, a railway equipment manufacturer. His first negotiations were conducted with the interests allied with the General Electric Co., which have made a careful preliminary survey of the possibilities for the use of dirigibles in this country. It is understood, however, that these negotiations have come to an impasse and that they have been taken up with other important factors in the industrial life of the country, including a large automobile manufacturer.

Dr. Schutte of the Schutte-Lanz Co., which builds dirigibles similar to the Zeppelins, arrived in New York this week, and it is understood he will consult with the General Electric interests.

The Zeppelins are building a reparations airship for the United States Government and want it sent across the Atlantic four or five times for a thorough test before its delivery. They also have arranged with Spanish and Argentinean capital for a dirigible service between Spain and Buenos Aires.

Bids have been asked by the Zeppelins from an American aircraft manufacturing company for the construction of its new type of metal airplane.

Paige Reports 8698 Cars Shipped in 1921

DETROIT, Feb. 14—A preliminary report for 1921 made to stockholders of the Paige-Detroit Motor Car Co. shows shipments of 8698 cars last year as compared with 16,090 in 1920. Sales aggregated $15,114,200 in value against $26,864,300 in 1920. Profits from operations were $804,800 as compared with $1,422,300. Dividend payments on the preferred were $680,000 and on the common $200,000 as compared with cash dividends of $680,000 on the preferred and common in 1920. The inventory was reduced in 1921 from $6,018,700 to $3,594,701.

Schedules for the first six months of 1922 call for the manufacture of 13,170 cars, of which 7090 will be Paiges and 6080 Jewetts. This would mean shipments in that period of 4072 more cars than in all of 1921.

Directors of the company all have been re-elected and no changes have been made in the officers.

Bans All Activities That May Fix Prices

Attorney General Daugherty Gives Views Informally on Trade Associations

WASHINGTON, Feb. 15—Informal expression of Attorney General Daugherty regarding trade association activities made public to-day by Secretary of Commerce Hoover warns against the fixing of a uniform cost as to any item of expense and against co-operative advertising where producers or dealers use uniform trade labels, designs and trademarks because "the inevitable result would be a uniformity of price."

Passing upon other points raised in the Hoover questions, the Attorney General declares he can now see nothing illegal in association work, "provided always that it is not used whatever as a scheme or a device to curtail production, or enhance prices, and does not have the effect of suppressing competition."

Stabilization Mentioned

Stressing the fact that the statement is only tentative, the Attorney General pointed out the fact that "It is impossible to determine in advance just what the effect of a plan when put into active operation may be." He made it clear that he would not let this interdepartmental statement interfere with the prosecutions of the Department of Justice whenever it is found that competition is suppressed or prices are materially enhanced.

Mr. Daugherty says that it would not be possible to prejudge the effect of a plan, particularly with reference to "trade associations, whose members are vitally interested in advancing or, as they term it, stabilizing prices, and who through the medium of the associations are brought into personal contact with each other."

The inquiries were addressed to Attorney General Daugherty by Secretary Hoover, as the letter says, "not with the idea of creating a new scheme for carrying on business, but solely for the purpose of ascertaining whether or not they (trade associations) could properly be utilized in furnishing information that would be helpful not only to the Department and to the commercial world, but to the public generally, always keeping in mind that whatever activities were carried on by such associations, they should of necessity be within the terms of existing law."

Hoover Would Publish Data

Secretary Hoover made known his views on the scope of trade association activities and the desirability of making public trade data through the daily and trade press when he said:

> There has been much information collected by legitimate trade associations in which the general public has no interest whatsoever, yet information of this class has always been freely offered to the daily and the trade press, as well as to any governmental agency that might desire the information as a matter of statistical record. On the other hand, certain statistical data are collected by trade organizations that would be of vast value to the public generally if published in practical, available form.
>
> Information lawfully secured regarding trade and economic conditions made public for the information of everyone can not be harmful. Information secured solely for the benefit of members and of a character that puts the membership, by reason of the information, in a position of advantage as compared with the public without such information can not be sanctioned by sound public policy.
>
> The act of securing the information and the use of it by the members of a particular organization may be perfectly lawful in itself, but it is my belief that good morals and a sense of fair dealing require the giving of the information secured in this collective manner to the public generally, to the end that all persons engaged in commercial transactions involving the information in question will be on an even footing.
>
> If information regarding production, capacity, and distribution by districts, with average prices for grades, brands, sizes, styles, or qualities sold in the respective districts for specified periods of time could be given to the public at the same time that such information is available to the members of an association, in my judgment, great public good would result. With this information available, everyone dealing in the products of a given industry, whether buyer or seller, would have the same information regarding conditions and, in dealing with one another, would have knowledge of the same facts upon which to form their judgments as to the proper course to pursue.

While the Attorney General warned against uniform cost as to any items of expense, he stated that "there is no apparent objection to a standard system of cost accounting."

Similar Advertising Condemned

The claim of the Attorney General that co-operative advertising for the purpose of extending markets on particular articles through an association which is identified by special trade labels, designs and trademarks would establish uniformity of prices, is based upon the belief that "where two competing articles are advertised in precisely the same way, and bear exactly the same label or trademark, it certainly would be difficult for one to be sold at a higher price than the other, although its quality may be superior." Therefore, the Attorney General suggested to Mr. Hoover that it would be well to eliminate the following phraseology "and may the association engage in such form of promotion by furnishing trade labels, designs and trademarks for the use of its individual members."

TY COBB TIRE IN BANKRUPTCY

AUGUSTA, GA., Feb. 14—The Ty Cobb Tire Co., of this city, a dealer organization formed and largely owned by Tyrus Raymond Cobb, premier star of the diamond, about two years ago, has filed a voluntary petition in bankruptcy. Liabilities are $37,423.27, with assets at $21,466.72. Cobb took an active interest in the business during the winter months he spent at his home here.

Parts Makers Hear Encouraging Reports

Steady Progress Predicted with Truck Business Showing Pronounced Gains

NEW YORK, Feb. 14—More encouraging reports than have been heard in months were made by credit men of representative parts manufacturers at a group meeting last week. Almost without exception they declared business for January was greatly in excess of January, 1921, and that February is almost certain to be still better. They expect the first quarter at least to show a material gain and it is the general belief that the year will be one of gradual but steady progress.

Most of the business at present is coming from manufacturers of the more popular lines of passengar cars but many inquiries have been received recently from truck manufacturers and indications now are that the gains in the truck field later in the year will be more pronounced than in the motor car branch of the industry.

Following are paraphrases of some of the reports on business conditions made by a number of representatives of large companies.

Opinions Reflect Conditions

"January business was the best for three months and February releases are four times as large as last month. Prospects for March are fair and we expect a steady improvement throughout the year."

"January was considerably better than a year ago and better than December. February releases are running much better. We believe that business will steadily improve."

"Our production now is from 70 per cent to 80 per cent of the peak reached in 1919."

"January was 50 per cent better than last year and 50 per cent of normal. We expect February to be nearly a normal month and are quite confident of the future."

"January releases were better than in December and February will be better than January."

"January was three times better than last January and 15 per cent ahead of December. We look for a steady improvement up to April and expect to be operating at 50 per cent of capacity by that time."

"January was three times as good as last January and much ahead of November or December. February shows a considerable further improvement which we expect will continue. March promises to be better than February and April and May still better. We are running from 45 per cent to 50 per cent of capacity."

"We expect good business for the first four months of the year at least. January was away ahead of last January while February, March and April look a lot better."

"January business was 300 per cent of January last year and February will be better than January."

"Our production now is up to 45 per cent of capacity and orders now on the book will make it 50 per cent."

"January was far ahead of the previous months."

South Africa Sales Increasing Rapidly

Some Dealers Describe Condition as Boom—Much Interest in Automobiles

JOHANNESBURG, Dec. 20 (*By Mail*) Christmas in the United States means cold weather and a time of the year not best suited to motoring. In South Africa it means hot, dry weather, as a rule, and everyone wants to get out into the country. It is not surprising, therefore, to learn that the automotive business has picked up during the last two or three months. One or two dealers describe the present state of things as a "boom" and while this may be an extravagant statement of conditions there is a general feeling that things are more settled and that 1922 will mean a year of steady business for the automotive industry in South Africa.

Intensive Selling Campaigns

Dealers find that by intensive selling campaigns they can make their business pay. Reports from the country districts go to show renewed business activity. Many farmers are now buying cars because they have managed to dispose of their maize or wool, perhaps at a loss, but they have realized ready cash.

One outstanding feature in the automotive industry here is that the farmer at last has realized the necessity of owning an automobile and the result is that the car is now definitely established. Only the fact that the farmers have had no ready money has prevented a large number of car sales. But to-day farmers are making inquiries and some are placing deposits on prospective purchases. Some are buying on the "hire-purchase" plan and the banks are a little easier in respect to financing car deals than they were a few months ago.

For a colony, South Africa has a good number of cars per capita but there is room for many more, and 1922 will see a tremendous increase in the number of cars in the country districts. The Standard Motor Co. of Africa, Ltd., handling the Nash throughout the sub-continent, reports inquiries for cars in the eastern Transvaal and a large number of actual sales.

Trying Out Stanley Steam

Hupp Garages, Ltd., sold 24 cars in November, mostly for cash. The Overland four has been selling well and Dodge has sold on an average of one a day for the last two or three months and has orders booked ahead.

The first Stanley steam car arrived here a few days ago and is now being tried out on South African roads. A great deal of interest has been taken in this steam car and crowds are attracted to it whenever it stops. It is certain that a number of buyers can readily be found for it. The model exhibited is a four passenger but it is thought that the five or seven passenger will be more suitable. New model Fiats, 16 hp. and 30 hp. models, have arrived and are now being demonstrated. The 1922 Buick has just arrived as also has the latest model Reo, 7-passenger car.

The latest Hudson has also come to hand and is selling well. The sporting model appears to be most popular. Williams, Hunt & Co. has disposed of its Chevrolets and is now awaiting a new shipment. Prices are lowered on this new shipment.

There have been a large number of competitions, cars and motorcycles, lately and public interest in them is very gratifying. There is talk of building a race track three or four miles outside the city. This may be done early in 1922.

—M. EDWARD.

Ford Moves in Argentina and Doubles Old Capacity

BUENOS AIRES, ARGENTINA, Jan. 16 (*by mail*)—The local assembly branch of the Ford Motor Co. has been moved from its old quarters to a modern new plant having a capacity of 25,000 cars and trucks yearly. This practically doubles the capacity of the former branch, which consisted of several old buildings. The new plant is modern in every respect.

DETROIT, MICH., Feb. 11—The new Ford assembly branch at Buenos Aires is the most important unit of the company in South America. The assembly system in the new plant has been laid out to compare with the best of American plants. There was little car stocking in Argentina, the Highland Park factory making steady shipments of knockdown parts throughout 1921 and so far into 1922. Heavy shipments of Ford parts to Argentina began last September and has been continued. The business outlook for the branch is considered very good, this being shown by the fact that the company has moved into its new branch.

Australian Firm to Make Car from British Parts

LOS ANGELES, Feb. 14.—The Australian British Motors, Ltd., of Sydney, Australia, has been formed to manufacture the Southern Six which will be marketed in the British colonial possession in the Pacific.

The car will be assembled of British parts. The engine will be six-cylinder, valve-in-head, overhead camshaft, type with 2⅞ in. bore and 3¾ in stroke. A zenith carbureter and magneto ignition are employed. A three-speed gearset and full floating rear axle with torque tube are used. There is a Brolt starting and lighting set. The rear springs are cantilever and both front and rear springs are covered with grease-filled leather gaiters.

The ground clearance is 10½ in. The radiator and cooling system is about half again as large as that usually fitted to cars of this size. The chassis weight is estimated at 1800 lbs.

Erie Road Favors Rail Commissioner

Representative States Motor Vehicle Should Be Considered an Adjunct, Not Competitor

WASHINGTON, Feb. 10—Need for a separate, impartial, individual transportation authority or body was advocated to-day by T. C. Powell of the Erie railroad, in supporting the proposal of the Railroad Committee of the Chamber of Commerce of the United States to create a commissioner general of railroads.

Admitting that motor truck competition is a vital problem, Powell told the conference that "the automobile properly considered is an adjunct of the railroad; wrongly considered, it is a competitor." He insisted that it would be impossible for motor vehicles to force rail carriers out of business, although admitting this form of transportation rendered useless several hundred miles of short lines.

Powell stated that the influence of motor trucks on rail rates has been over estimated and that the public was generally misinformed as to this phase of the transportation system. He does not believe that the truck will ever prove a serious competitor with railroads on long haul traffic. He said in part:

> It is true the row boat is still in existence, but I doubt very much whether anybody sees very many of the rowboats. Most of them use motor boats. It is true that motor trucks will not drive the railroads out of business, but they have succeeded in driving out hundreds of miles of railroads. There are less miles today than there were in 1906 when we reached the apex of our construction. When the stage coach reached its perfection as a stage coach in England it commenced to decline, because something better came in—the railroad.
>
> If the railroad comes to a point where it cannot handle the short-haul traffic through any cause whatever, length of time occupied, cost of service, cost of handling at terminals, that is the time for the motor truck; but who is to declare in an impartial way whether the motor truck or the railroad is the one to survive on that traffic? There is no separate impartial individual or body today that can do that.

Elliott, Who Invented New Type of Gear, Dies

NEWTON, MASS., Feb. 13—Sterling Elliott, inventor of a type of automobile steering gear, died at his home here today at the age of 70. At the time of his death he was the president of the Elliott Addressing Machine Co.

Elliott invented and patented a motor tricycle, one of the features of which was a steering gear of new design. The tricycle had two front steering wheels, the ends of the front axle being yoked and steering knuckles connected to the yoked axle ends by means of pivot pins. This latter became the favorite construction for automobile front axles, and royalties were paid Elliott under his patent by axle makers.

Motor Tax Protests Flooding Washington

Industry Argues Against Class Legislation—Proposed Levy Apparently Killed

(*Continued from page* 432)

From the standpoint of officials of the National Automobile Chamber of Commerce, these taxes are unjust, because it is an effort to throw a burden of national obligation upon one or two industries. Beyond this, the Chamber officials point out that the industry is already subjected to special taxes amounting to more than 300 million dollars annually at a time when every manufacturer is searching for ways and means of cutting even a few dollars from the cost of his product in order to widen his purchasing field.

The statement that the taxes are levied because the government is returning 100 million dollars annually to the industry for better highways, is met by the statement that more than that amount is now being paid into the Federal Treasury in excise taxes, while figures recently prepared show that the motor vehicle owners of the United States are paying an annual charge of $19 a car, while the total amount appropriated for road maintenance in this country by county, state and national authorities is only $18.35 per car.

Hanch Criticizes Plan

C. C. Hanch, chairman of the taxation committee of the National Automobile Chamber of Commerce, was unsparing in his criticism of the sources of revenue proposed to meet the bonus. He said:

The imposition of the tax would be the proverbial last straw. When the present excise taxes were levied it was positively stated that they were for war emergency purposes and that they would be repealed when the war was over. Instead, we are now faced with further charges.

The only possible consequence of further taxes at this time will be further unemployment and the clogging of the wheels of business. It is a strange commentary that a Republican party having for its slogan "Less government in business" and presumably charged with the purpose of returning to normalcy as soon as possible should seek to impose confiscatory charges upon the largest manufacturing industry of finished products in the United States.

Associations Act

NEW YORK, Feb. 14—Telegrams were sent Sunday by the National Automobile Chamber of Commerce and the Motor and Accessory Manufacturers Association to all their members urging them to get in touch with their representatives in Congress, either by telegraph or telephone, to register their strong disapproval of the proposed taxes on gasoline and automobiles. It was pointed out that these additional burdens, if enacted, would add materially to sales resistance.

ST. LOUIS, Feb. 13—Telegraphic protest to Congress against the imposition of further taxes on the automobile or on gasoline to pay for the soldier bonus was made to-day by the board of directors of the National Automobile Dealers' Association at a special meeting called at headquarters.

The 45,000 automobile dealers of the country whose interests are represented by the association will be asked to use every effort to oppose levying of the proposed taxes on the industry. A general sales tax is suggested as a substitute for the special class taxes suggested.

Bankers Engaged on Plan to Reorganize Republic

CHICAGO, Feb. 15—A bankers' committee headed by Charles N. Gilbert vice-president of the First National Bank has taken a hand in Republic Motor truck affairs with a view to working out a reorganization plan. Several meetings have been held here and an announcement is expected within a few days.

The company announced late in November that it had completed arrangements for deposits and extensions of $500,000, 7 per cent first mortgage notes matured, out of a total issue of $2,500,000, and a voting trust committee was formed with which preferred and common stockholders were asked to deposit their holdings.

Its plan contemplated a five year extension of the entire amount, with rate increased to 8 per cent, the company to redeem $300,000 annually, starting Nov. 1, 1923, depositing noteholders having the privilege of purchasing common at 8 to the extent of 10 shares for each $1000 note. Approximately 70 per cent of notes have been deposited to date and bankers are endeavoring to secure the remainder.

LOCOMOBILE WORK UNHAMPERED

BRIDGEPORT, CONN., Feb. 15—Operations in the factory of the Locomobile Co., are continuing unhampered during the receivership and a steady volume of business is being received, although officers of the company had expected a lull. Managers of the branches at New York, Boston, Philadelphia, Los Angeles and San Francisco have been appointed ancillary receivers for the property in those districts. In Chicago the Central Trust Co. has been selected to administer the company's affairs.

RECEIVERS TO SELL SPACKE

INDIANAPOLIS Feb. 13—Robert M. Feustel and Chas. O. Roemler, of this city, receivers for the Spacke Machine & Tool Co., are advertising for bids for the assets of the company, which include the automobile and axle factories, machinery, equipment, inventory and accessories.

The receivers are authorized by the court to receive bids for the business as a going concern as a whole, or the axle plant or automobile factory in separate units, or any part of either.

Ford Dealers Will Sell Lincoln Cars

Branches Investigating Field Possibilities—Factory Methods Being Surveyed

DETROIT, Feb. 15—Official announcement of its sales and manufacturing policies under the Ford regime has been deferred by the Lincoln Motor Co. pending the working out of a few remaining details, but it is evident from the results thus far accomplished that sales in the larger cities of the country will continue to be through the present distributor organization.

In the smaller cities the Lincoln dealers and the Ford dealers who will be authorized to sell Lincoln cars will operate directly under factory control through the medium of the branch plants. In the big cities the present distributors will conduct retail salesrooms and will distribute to Ford dealers, whom they authorize in their cities.

Investigations are now being made by the 35 branch Ford plants of the possibilities for the sale of the Lincoln cars in their individual territories and their recommendations will play a large part in the dealer authorizations. Changes will be made in many localities, but the efficient dealers will continue to function.

Production Methods Studied

Much of the detail of the sales plan was laid before a meeting of prominent Lincoln distributors at the factory this week, which was attended and presided over by sales executives of both the Lincoln and Ford organizations. For the time being, apparently, the Ford sales organization has been allowed to function by itself, while the executives give all their study to the Lincoln problems.

Manufacturing at the plant is under the observation of Charles C. Sorensen, the Ford chief of manufacturing operations, and changes which will be made in production methods will follow his recommendations. For the present the plant is working on a schedule of 20 to 30 cars daily, which will be continued until the production changes are fully determined.

LINCOLN DELAWARE ASSETS

WILMINGTON DEL. Feb. 15—James I. Boyce of this city and the Detroit Trust Co. appraisers of the Delaware assets of the Lincoln Motor Co. have appraised the notes, drafts and accounts receivable of the company at $54,775 although their book value is $354,171. The shrinkage is the result in part of failures by dealers. No valuation has been placed on the patents and trade marks.

MOTORIZING POLICE

INDIANAPOLIS, Feb. 11—A thorough motorization of the Indianapolis police department will be sought by Mayor Lewis Shank.

Middle West Shows Reviving Interest

Country Dealers Returning to Market—Credit Conditions Seem to Be Easier

By James Dalton

NEW YORK, Feb. 14—Further evidence of public interest in automobiles is found in the unexpectedly large attendance at the Minneapolis show last week and at Kansas City this week. These sections, hard hit by the business depression, have demonstrated that the demand for automobiles will increase steadily as general conditions improve. That improvement is now under way.

One of the interesting developments at these shows was that many country dealers who have not stocked cars for months are back in the market in a small way. This shows that credit is easier and that their confidence has returned.

A better tone in the market also is reported from most sections of the South. No great improvement is expected in the next two or three months, but the general trend will be upward and substantial sales are expected later in the year.

Production Spotty

Production at the factories is somewhat spotty, especially in those which produce cars in the lower price classes. A notable exception is Dodge, which expects to be turning out 600 cars a day before March 1. Ford is working on an average of four days a week. Factories in the medium price class are coming slowly into heavier production. In the higher price class, Cadillac is running practically at capacity and Lincoln has been deluged with business since Ford took control and prices were reduced, although the reductions were not as large as had been expected.

Reports of better truck sales are becoming more general and production is increasing. This is true both in industrial and agricultural sections. The ratio of gain over the corresponding period last year probably is larger than in the passenger car field. Development of the co-operative marketing movement for farmers, which was approved by the Senate last week, will open a large truck market.

Reductions in the lower price tractor field, following the lead of Ford, are becoming general. This indicates an expanding demand and keener competition.

Developments in all the branches of the industry are enlarging the business of parts and accessory makers. Their sales for January will show a gain over December and this month is expected to be even better. Sales to jobbers, which have been good for months, are holding their own and collections, generally speaking, are satisfactory. Even if passenger car production is no larger this year than last, the business of parts manufacturers will be better because car makers have worked off their heavy inventories.

One of the engineering trends of the year will be in the direction of fuel economy and lower operating costs. Low gasoline and upkeep expense now constitute an important talking point in salesmanship.

Manufacturers have taken up in earnest plans to help their dealers solve the used car problem and substantial progress in this direction is being made.

Bank Executive Chosen to Head Braender Tire

RUTHERFORD, N. J., Feb. 14—J. K. Watson of the Rutherford National Bank has been elected president and treasurer of the reorganized Braender Rubber & Tire Co. Other officers elected are: F. L. Braender, vice-president in charge of purchase and production; W. P. Braender, vice-president in charge of sales; M. E. Morris, vice-president and general manager; Milton Damman, secretary, and Harry Breander, assistant secretary.

Morris formerly was assistant general manager of the Goodyear Tire & Rubber Co. of California.

The company now is in a strong financial position, having current assets of $299,000 against direct liabilities of $6,117. The plant, valued at $585,000, is unencumbered.

Stockholders May Dissolve Chevrolet Holding Company

WILMINGTON, DELAWARE, Feb. 13—Stockholders of the Chevrolet Motor Co. of Delaware, which has been the holding company for the General Motors Corp. stock owned by the duPont interests, will meet May 8 to act on the proposed dissolution of the company. The transaction will be merely a formality and concerns only complicated financial transaction.

It will have no effect whatever on the manufacturing activities of the Chevrolet division.

ELECTRIC SHOW IN APRIL

NEW YORK, Feb. 13.—The electric automobile show for 1922 will be held in the Irving Place show room of the New York Edison Co. from April 3 to 15. The first week will be devoted to street trucks and passenger cars while the second week will be given over to industrial trucks.

Willys Corp. Counsel Working on Claims

Will Figure in Final Adjustment —Miniger Tells of Work Done Under Receivership

TOLEDO, Feb. 13—The Willys Corp. is making good progress under the receivership, according to Receivers C. O. Miniger and Frank Kennison. Miniger has returned from a week spent in Elizabeth, N. J., and New York.

"We are operating the Electric Auto-Lite division and the New Process Gear Corp. at a profit, and have cut the charges for carrying the big Elizabeth plant down to the absolute minimum," Miniger declared.

"We are negotiating for the sale of the Elizabeth plant. J. R. Harbeck, down there, has several deals in process and it may take about sixty days for any one plan to be consummated. That's a matter of elimination.

"The audit of the books of the corporation will probably be completed in a few weeks."

Sale of Securities Indefinite

Miniger said that when the time came to lift the receivership it would probably be a question as to whether the securities held by the corporation or its operating units should be sold—a matter for the courts to determine.

He said that at the present time undoubtedly the operating units could be sold at the least sacrifice.

Attorney George P. Hahn, Toledo, is working now upon a couple of claims which the Willys Corp. will seek to have adjusted with the Willys-Overland Co., and which is expected to mean much in the final disposition of the affairs of the corporation.

It is understood that one of these claims is on a contract involving the production of the Chrysler Six model by the Overland engineers and sales of the car by the Willys-Overland Co., on which claim the corporation will seek to collect about $2,000,000.

Seek to Recover on Stock Sale

The other is a claim based upon the sale of common stock of the Overland to the corporation. The sale was made at $18 a share and a few weeks after the stock dropped in market value to $6. The corporation attorneys believe they have a claim of something in the neighborhood of $5,000,000 on this item.

There are many moot questions involved in the claims, however. The settlement of them will probably precede any re-financing on the part of the Willys-Overland Co.

It is thought the proceeds of claims and the sale of the Elizabeth plant will be sufficient to take care of the bank creditors and that securities held by the corporation may be enough to cover the claims of preferred stockholders.

(*Continued on page* 443)

Appoints Receiver for Crow-Elkhart

No Reorganization Probable — Assets Placed at Less Than $350,000

ELKHART IND., Feb. 14—E. A. Skinner, attorney for the Crow-Elkhart Motor Corp., for which former Mayor William E. Wider has been appointed receiver, said to-day there was hardly a possibility of any attempt at reorganization. The corporation's assets he estimated at between $300,000 and $350,000 and its liabilities at $750,000. Wider said he was unable to give a detailed statement of assets and liabilities, as he had not yet begun the active work of digging into the concern's affairs.

The receivership was granted by the Elkhart Superior Court upon petition of the Manrow Sheet Metal Works of Goshen, Ind., which has a claim of $1,132, evidenced by notes alleged to be overdue and demands judgment for $2,500.

Liabilities $750,000

At the time Judge William B. Hile granted the Manrow petition another petition for a receivership already was on file in the clerk's office, without the knowledge of the court. This had been filed an hour before by George W. Fleming of Elkhart, a stockholder whose interest is said to be only about $200.

The corporation's assets consist of grounds and buildings here, materials and finished stock on hand. The liabilities consist of a $600,000 bond mortgage and accounts payable aggregating $150,000. Attorney Skinner said there probably were 3400 stockholders scattered throughout the country, and there were no large individual creditors, besides bondholders and owners of stock, possibly none having claims exceeding $2,500. These creditors, he also said, were widely scattered.

The Crow-Elkhart Corp. was organized under the laws of Arizona in 1917, with an authorized capitalization of $10,000,000. The charter grants permission to issue 1,000,000 shares of $10 par value. All but $2,800,000 was issued, and turned over to stockholders of the Crow-Elkhart Motor Car Co., share for share in that company, after it became bankrupt in 1918, and it was reorganized as the Crow-Elkhart Motor Corp.

Low Prices for Stock

The holders of stock, as individuals, offered it for sale here and elsewhere. Not much of it was disposed of, it is said, although it was placed on the market at a much lower figure than its par value.

It was reported here to-day that the stock was quoted here as low as $1 per $10 share, and that, generally speaking, it did not bring over $1.10. About one-half of the sum realized on the $600,000 bond issue was used to pay creditors of the Crow-Elkhart Motor Car Co. the 25 per cent promised them in the composition which was effected between them and the company. The remainder of proceeds of the bond sale was used in the business of corporation.

The bond issue is secured by a mortgage on buildings, grounds and all personal property of the corporation. The heaviest individual bondholder is said to be J. A. Harps of Greenfield, Ohio, whose original holdings are stated to have been $160,000. It is understood he sold some of these to his friends.

Most of the other bonds are held by members of a syndicate that purchased the interest of M. E. and E. C. Crow of Elkhart in December 1919. This syndicate, it is said, includes, C. B. Lair of Greenfield, Robert Mills of Springfield, Ohio, M. F. Miller of Wadsworth, Ohio, R. B. Donaldson of Lockport, N. Y., and P. T. Longacher of this city.

Hart became president of the corporation, and Donaldson vice-president, general manager and treasurer. This organization lasted until the annual meeting in January 1921, when Austin C. Hayes of Boston, representing financiers who had become interested in an attempted bond sale for the corporation, was made president. He held the office until June of that year when he resigned and M. E. Hoshaw was elected president, in which office he continued.

MICHIGAN SALES IN 6 MONTHS TOTALED MORE THAN REST OF COUNTRY COMBINED

WASHINGTON, Feb. 14—Analysis of internal revenue receipts from the sale of motor vehicles and accessories for the six months ended Dec. 31 shows that the aggregate returns from Michigan far exceeded all the rest of the country put together. The following table shows the receipts from the states which lead in automotive production:

	Automobile Trucks and Wagons	Other Automobile and Motor Cycles	Tires or Accessories for Automobiles
Illinois	$202,572	$501,116	$1,050,018
Indiana	131,583	3,827,478	752,670
Massachusetts	22,466	129,282	1,231,498
Michigan	1,537,851	18,285,897	6,706,103
New York	646,119	2,369,093	3,088,331
Ohio	473,114	2,384,253	6,927,003
Pennsylvania	217,917	159,013	1,455,692
Wisconsin	615,181	301,399	604,095

DEERE MAKES $775 CUT

MOLINE, ILL., Feb. 14—Deere & Co. has reduced the price on its tractor, Waterloo Boy, Model N-12-25, from $1,450 to $675. This price includes the tractor fully equipped. As in other cases of tractor price reduction, the company declares that there is no justification for the reduction based upon the present cost of production.

TEMPLAR TO INCREASE PRICE

CLEVELAND, Feb. 15—The Templar Motors Corp. announces that the prices on its various models will be increased, effective March 1. The new prices have not yet been made public. President Bramley asserts that "pre-war prices, to which the Templar had returned months ago, are too low."

Packard Makes Price Cut on Twin-Six and Trucks

DETROIT, Feb. 14—The Packard Motor Car Co. has made downward revisions in the prices of its Twin-Six models ranging from $1,000 to $1,400. The prices are as follows:

	Old Price	New Price
Touring car	$4,850	$3,850
Sedan	6,800	5,400
Coupe	6,600	5,240
Limousine	6,650	5,275

The prices of the truck Model EC, 2- to 2½-ton, solid tires, has been reduced from $3,500 to $3,100 and of EX, 2- to 2½-ton, pneumatic tires, from $4,000 to $3,500.

ELGIN TOURING LOWER

CHICAGO, Feb. 11—The Elgin Motor Car Corp. has priced its new touring car at $1,695. Prices given out at the New York Show for this new Model 700 were the prices on the old line of cars. This price is f.o.b. factory at Argo, Ill.

CRAWFORD INCREASES

HAGERSTOWN, MD., Feb. 15—The Crawford Automobile Co. has increased the price of its 2, 5 and 7-passenger touring cars from $2,750 to $3,000. The price of the coupe and sedan remains unchanged at $4,500.

BIDDLE PRICES REDUCED

NEW YORK, Feb. 15—The Biddle-Crane Motor Car Co., Inc., has made the following reductions in prices:

	Old Price	New Price
2-passenger Touring	$3,475	$2,950
4-passenger Touring	3,475	2,950
Coupe and Sedan	4,350	3,950

CANADIAN TIRE TARIFF

OTTAWA, ONT., Feb. 14—Canadian Trade Commissioner G. R. Stevens writing from Kingston, Jamaica, on the tire and tube trade in that section, states he expects that when the Legislative Council meets, a preferential tariff on Canadian goods will be adopted giving a 5 per cent ad valorem preference over goods of American manufacture.

Ford Drops Tractor Making at Hamilton

Turns Factory Over to Manufacturing and Assembling Motor Car Parts

HAMILTON, OHIO, Feb. 14—Official announcement was made here to-day that the Hamilton plant of the Ford Motor Co. has been discontinued for the making of tractors and that hereafter motor car parts will be made and assembled. Machinery used in the manufacture of tractors has been sent to the River Rouge plant, and it is the plan of the Ford company, it is stated, to concentrate its tractor efforts in the one factory.

The Hamilton plant is being equipped for the manufacture of wheels. A number already have been turned out and it is stated that within 60 days the output will reach 300 sets daily. This total will be gradually increased until it is hoped that all wheels used for Ford cars will be made here. This will total 4000 sets, local officials said.

Former employees who were engaged in the tractor assembling division, are being called in, and about 100 are employed now. It will require, according to officials about 150 men when 300 sets are manufactured, and the indications now are that the local plant, when running full force and to capacity, will employ more than 7000 men. It is reported that other extensions may bring this force ultimately to a much higher figure.

In addition to making wheels, the local plant also will be used immediately for the making of locks for Ford cars.

Ford's investment here includes a million dollar hydro-electric plant. His total investment is about $3,000,000, and his land holdings are sufficient to allow for more than quadrupling of his present plant.

Producing 100 Daily

DETROIT, Feb. 14—Fordson tractor production of 100 daily has been entered upon at River Rouge following the reduction in price to $395. This is heavier production for the season than in any previous year. It is expected to exceed the 36,000 production of 1921 under the stimulus of lowered prices, which are said by executives to have stirred renewed farm buying.

February marks the anniversary of tractor production at River Rouge, the work having been taken over from the Dearborn plant a year ago. In the year that has elapsed, officials say many improvements have been made in production methods which are largely responsible for the lowered prices.

PYRENE MAKING CHAINS

BUFFALO, Feb. 13—The Pyrene Manufacturing Co. of New York, which controls the Off and On Chain Corp., has purchased three buildings from the Wickwire Spencer Steel Corp. and transformed them into a chain-making plant which already is in production. The special merits claimed for the chain are the rust-proof locking device, the eccentric lever on the locking device which acts as a tightener, and the detachable cross link section which can be detached and replaced without the use of tools. The chains will be marketed through the Pyrene sales organization.

ATLANTA PUBLIC BUYS, DEALERS ORDER CARS

ATLANTA, Feb. 15—Total sales at retail for the first three days of the Atlanta automobile show exceeded the total of the entire show last year by about 10 cars. The bonafide sales for the first three days aggregated about 90. The attendance is 30 per cent better than last year, and the dealer attendance from all parts of the South is 50 per cent larger. Dealers are placing substantial orders for immediate delivery in anticipation of a good volume of spring sales

Ford Car and Truck Output, 85,203, at Foreign Factories

DETROIT, Feb. 15—Ford Motor Co. reports 1921 production of foreign plants as follows: Canada and export territory under Ford, Ontario plant, 42,343 cars and trucks; Manchester, Buenos Aires, Copenhagen, Bordeaux, Sao Paulo and Cadiz, combined total 42,860.

Buenos Aires plant assembled close to 1000 cars during December, a considerable increase over November, and Sao Paulo, the report says, had an increase during December. During 1921 Buenos Aires built more than 6000 cars, Copenhagen 5517, Bordeaux more than 2000.

The greatest month's production of the Canadian Ford plant was May, when 6711 cars and trucks were produced. Cork, Ireland, tractor plant built 1347 Fordsons, the highest month being September.

The high domestic output was for the months of May, June, July and August, when 626,712 cars and trucks were produced at Detroit.

Drive Against Car Thief May Be National in Scope

ALBANY, Feb. 14—A systematized national drive against the automobile thief may be the outcome of a nation-wide survey just completed by the New York State Conference of Mayors. Data gathered from police heads of leading cities of the United States are to be used.

The general note of the communications received from police chiefs is that licensing of dealers, both in new and used cars, eliminates much of the mysterious underground network by which automobile thieves are able to remake and resell their cars through supposedly reputable dealers.

Kansas City Makes New Selling Start

Show Indicates Reorganization—Banking Situation Relieved Through Movement of Crops

KANSAS CITY, Feb. 14—The Kansas City automobile show seems to have started a reorganization of selling in this territory. Distributors and branches are planning close co-operation with dealers, and there are prospects of quite a bit of business, not only in cars, but in trucks which have been selling more strongly in January and February than in any recent period.

The show is offering, however, perhaps the strongest evidence of any yet held of the sentiment of the great grain areas towards motor car purchasing. The attendance is not up to last year, and even reduced railroad fares have failed to bring a large number of visitors from the surrounding country. It is apparent that products of the industry sold this year, up to harvest time at least, will have to be sold against strong resistance.

There are more territorial dealers at the show this year than last, which is an encouraging sign in face of the heavy mortality in 1921. It is evidenced that there will be a revival of the selling effort in many towns where it vanished when the countryside felt the full force of the stunning blow of agricultural deflation.

Grain Prices Are Higher

There is much encouragement in the rise of prices of grain and live stock, particularly corn, hogs and lambs. The higher grain prices have come after farmers have disposed of all but 20 per cent of their holdings, and there is a strong disposition to believe that the higher price is only temporary and due somewhat to manipulation.

The fact remains, however, that farm produce is moving out of the territory and money is flowing in. The psychological as well as the financial effect on the farmers will promote some buying, particularly in states of the North and East. The movement of crops and live stock has started a trend toward liquidation on farm indebtedness which is relieving the banking situation and paving the way for easier credit.

SEEK ACTION ON HICKS BILL

WASHINGTON, Feb. 15—Every effort will be made to obtain favorable report in the House on the Hicks bill which would create a bureau of aeronautics in the Department of Commerce. The Wadsworth bill, a similar measure, was approved by the Senate Tuesday after it was amended by striking out a section which would have recognized as pilots in interstate flying those pilots who had been licensed under State laws. The effect of the amendment would be to require a Federal license.

MEN OF THE INDUSTRY

George C. Morgan, who has been assistant general manager of Earl Motors, Inc., Jackson, Mich., has been promoted to sales manager. **D. Minard Shaw**, in addition to his duties as advertising manager, will assume those of assistant general sales manager. Morgan has been in the automotive field since 1910, when he became a field man for the old Thomas B. Jeffrey Co. of Kenosha. He was manager of truck sales for Jeffrey when he resigned to join Willys-Overland as office manager. He later became manager of the Overland branch at Toledo, after which he joined the Citizens Motor Co. of Cincinnati, distributer for Packard and Willys-Overland in three states. Shaw entered the advertising field in 1897, but in the fall of 1917 switched to the selling end as manager of the Herff Motor Corp., distributer of Briscoe and Fiat cars at Memphis and Nashville. Early last year he became division manager and later advertising manager.

Arthur T. Stanton, associated with Dodge Brothers nearly half of the 17 years he has spent in the industry, has joined the executive staff of the Maxwell-Chalmers organization as director of service. He left the Dodge factory organization to become Dodge distributor in Akron and attributed his success there to the quality of service given owners. Prior to that time he was assistant to Arthur E. Barker, the present Maxwell-Chalmers sales manager. Early in 1915 Stanton was given complete supervision of Dodge affairs in England with headquarters in London. He returned to the United States when the British placed an embargo on motor cars and served as Dodge representative in the Cleveland district. In his new position he will concern himself with standardization of dealers' service to owners.

W. J. Rennick has been named secretary and treasurer of the McKone Tire & Rubber Co., with headquarters at Millersburg, Ohio. For many years Rennick was associated with the Miller Rubber Co., more recently as assistant to the general sales manager. His appointment means the removal of the general offices to Millersburg, although the sales offices will continue to be in Chicago.

E. E. Warfield has been appointed sales manager of the Gill Manufacturing Co., Chicago. He has had a long experience in sales work with the industry, having been connected with Post & Lester, Motor Car Equipment Co., Wetmore Savage and other jobbing houses. For the last two years he served with the Boston branch of the Gill company.

Gilbert U. Radoye, director of advertising of the Haynes Automobile Co., has been appointed to the additional position of director of sales promotion. Radoye, who has been associated with the Haynes company for some time, has had a varied and extensive experience in the sales promotion and merchandising field.

E. H. Priebe, until recently one of the general foremen in the manufacturing building of the main plant of the Cadillac Motor Car Co., Detroit, where Cadillac bodies are built, has taken over the duties of superintendent of plant there. He has been associated with the company for the last eighteen years.

George F. Lord has been appointed advertising manager of the Chevrolet Motor Co. **J. H. Newmark** of General Motors Corp., formerly handling this work, will devote his attention exclusively to general advertising of the corporation.

W. H. Stevens, handling the Earl and National in New England, who was joined recently by James C. Clarke, formerly sales manager of the National at Indianapolis, has secured distribution of the Rickenbacker for New England.

A. W. Sawyer, advertising manager of the Hart-Parr Co. for the last three years, has become associated with the Cramer-Krasselt Co., Milwaukee, and will assume his new duties within the next ten days.

Rex Glasson has been placed in charge of advertising of the Gray Motor Corp.

Reach Few Conclusions in Agricultural Report

WASHINGTON, Feb. 15—Windsor D. White, representing the National Automobile Chamber of Commerce, will confer with transportation experts here Thursday and Friday preparatory to writing the final draft of a survey of motor transportation for the Joint Committee on Agricultural Inquiry of Congress. The report will be submitted to Chairman Anderson on Feb. 27, and will contain data on all phases of motor transport and transportation. It is almost exclusively statistical findings of facts and few conclusions are mentioned because of the desire to avoid controversy.

The survey covered relative costs of hauling farm products from farm to market; store door delivery by motor truck; use of motor truck at terminals and commercial uses. Data has been gathered from reliable sources and compiled under the direction of the advisory committee of the transportation section of the joint commission. This information will be used by the committee in its report on transportation questions as relates to agriculture. The Bureau of Public Roads also assisted in this work. It is stated that the report will not be available for publication until April or May.

Tractor Demonstrations to Be Held by British

LONDON, Jan. 30 (*By Mail*)—The Agricultural Machinery Section of the British Society of Motor Manufacturers & Traders is organizing a series of tractor demonstrations to be held in various parts of England.

The first is to take place in the southwest, near Exeter, on March 1 and 2, and the regulations are very similar to those which in previous years have applied to the trials. The main difference is that there will be no official observation of the machines in use, no records taken of work done and fuel used and no officially compiled report issued subsequently.

URGE ACTION ON PATENT BILL

NEW YORK, Feb. 13—The Rubber Association of America, Inc., has sent to its members a bulletin urging that they telegraph Senator Hiram Johnson, chairman of the patents' committee, urging that the Senate give precedence to consideration of the Lampert patent office bill which has passed the House and has been favorably reported to the Senate.

Overland Reinforced with New Directors

Toledo Business Men Fill Vacancies—Seen As Part of Refinancing Opposition

TOLEDO, Feb. 15—Important developments preliminary to any attempt by bankers to force a re-financing program upon the Willys-Overland Co. were seen here to-day when four Toledo business men were elected to membership on the board of directors at a special meeting of the board.

President John N. Willys said the new directors were named to comply with an Ohio law, which provided that a majority of the directors of an Ohio corporation must reside in the State.

Henry L. Thompson, president of the Bostwick-Braun Co. and of the W. Bingham Co., Cleveland, W. L. Milner, head of a large department store here; George M. Jones, coal operator and president of the Ohio Savings Bank & Trust Co., and Gordon M. Mather, president of the Mather Spring Co., were elected to the board.

Willys Opposes Bond Issue

These directors take places made vacant through the resignation of Walter P. Chrysler, executive vice-president; C. E. Killenger, superintendent of the Elmira, N. Y., plant; Edward F. Swift, Chicago, and C. B. Mertz of the Willys-Overland Co.

The new board will link the Willys-Overland closer to the general business interests of the community.

Willys has actively opposed the efforts of bankers to impose a bond issue upon the Willys-Overland Co., and it is believed that the new Toledo connections may have some bearing on this point. He has left for the west to confer with sales branches.

Willys Corp. Counsel Working on Claims

(*Continued from page* 440)

The Electric Auto-Lite Corp. at Toledo is now operating on an excellent basis. It is employing about 1500 persons and has been selling its products to a diversified list of passenger car and truck manufacturers in many parts of the country.

TO DETERMINE WILLYS DEBT

SYRACUSE, Feb. 14—Claims of creditors in New York state of the Willys Corp., which three years ago purchased the New Process Gear Co. plant in this city, will be heard by James C. Setright, an attorney of this city, who was named special master by Federal Judge Cooper. The amount of indebtedness of the corporation which is now in receivership is not known, but an effort will be made to determine it in a series of hearings to be held by the special master within the next few weeks.

FINANCIAL NOTES

J. G. Brill Company, Philadelphia, manufacturer of motor truck and omnibus bodies in addition to street cars, reports for 1921 a profit of $163,399, or 3.56 per cent on the $4,580,000 preferred stock, as against 7 per cent on the preferred stock and 22.7 per cent on the $4,810,200 common stock in 1920. Sales and other income totaled $7,647,898, a decrease of $17,537,293, and operating expenses, including depreciation charges, $7,484,498, a decrease of $8,637,473. The surplus after preferred dividends at the close of the year aggregated $2,904,251, a decrease of $446,941. Samuel M. Curween, president, in his report to the stockholders, stated that the company's Canadian plant now has sufficient work to keep it operating at full capacity, and that while the company enters the year with a comparatively small amount of work on hand, there has been great improvement since the first of the year in inquiries received and in the prospects for business which should be placed during the current year. Retiring officers and directors were re-elected.

Deere & Co.'s annual report for the year ended Oct. 31, 1921, shows a loss of $2,752,801 for the year, against net income of $4,636,717. Sales last year dropped 63 per cent from 1920, and it was found impossible to reduce expenses in proportion. During the war period and the years 1919 and 1920 the company created a reserve of $9,409,733 against expected inventory losses due to falling markets. Against this reserve the company has charged off $6,317,059, which represented the decline in inventory values during 1921. The loss from operations plus the reduction in inventory amounted to $9,069,860. President William Butterworth states that owing to business conditions and the fact that the farmers will require longer credits it has been deemed advisable to fund $10,000,000 of the company's current indebtedness into ten-year gold notes.

American Rubber & Tire Co.'s annual statement submitted to the stockholders shows total net assets of $1,781,859 and total owing, in notes and accounts payable, of $523,393. The sales in dollars and cents are reported to equal those of the previous year. The same scheduled rate of production was maintained throughout the year. The losses during the early part of 1921 were more than offset by the profit during the latter half. Dividends have been paid regularly on the preferred stock. Henry L. Houk, general manager, states that although he views the outlook with greater enthusiasm than at any time since 1919 the company would continue to follow a conservative policy.

H. H. Franklin Manufacturing Co. has established a sinking fund, as of Jan. 1, 1922, under the terms of which 15 per cent of the previous year's earnings, after the payment of preferred dividends and taxes, must be set aside. This money may be used to purchase preferred stock shares offered for sale in the open market, or, at the company's option, it may call for retirement shares to the extent of the amount available at the premium price of $110 per share. If any portion of the stock is called for retirement, such shares retired may be drawn by lot. This will have a tendency, the company expects, to stabilize the stock, since the company itself will be in a position to create and establish the market, or at least to purchase any and all stock which is offered at or below par.

International Motor Truck Co.'s net earnings, after charges and taxes, for 1921 did not cover approximately $1,137,000 dividends on both preferred issues. Officials, however, regard it as a satisfactory performance, in view of conditions, that something was earned on the preferred. The company ended the year with $18,000,000 working capital, including $3,500,000 cash. Inventories up to the third quarter had been reduced $3,000,000, to $12,000,000. The final statement may show them less by another $3,000,000. The company has no funded debt or bank indebtedness. A statement covering the operations for the year may be delayed several months by the completion of inventories.

Emerson-Brantingham for the year ended Oct. 31, 1921, reports net loss, after taxes, charges and inventory adjustment, of $3,308,726, which compares with a surplus of $872,703 in the preceding year, $1,322,420 in 1919 and $1,282,268 in 1918.

Favorable Report Is Made of Gramm-Bernstein Affairs

NEW YORK, Feb. 13—A committee representing the merchandise creditors of the Gramm-Bernstein Motor Truck Co. has made a careful investigation at Lima, Ohio, of the company's financial affairs and has made a favorable report. All the banks in Lima spoke in the highest terms of both Gramm and Bernstein, and the City Bank, which holds a considerable amount of the company's paper, does not feel the slightest uneasiness over it and is not urging payment.

A judgment recently taken against Gramm and his wife by the Old National Bank of Lima was merely a technical procedure and was promptly adjusted. The bank now is carrying Gramm's personal notes for the same amount.

The committee also found that no significance could be attached to the fact that Bernstein, who owns nearly $500,000 worth of real estate, recently placed a mortgage for $140,000 on the Harper block. This loan was exclusively for the benefit of the company, and a portion of it was used to pay interest on gold notes. The balance of the amount is being held for emergency use by the truck company.

TO DISCUSS AVIATION LAW

WASHINGTON, Feb. 13—A joint meeting of the special aviation branch of the committee on uniform State laws with the aviation committee of the American Bar Association will be held here Feb. 25 to discuss the requirements of aviation law. The meeting will be open to those interested in the subject of uniform and comprehensive aviation law.

CHEVROLET PLANT FOR BUFFALO

BUFFALO, Feb. 13—Ground will be broken here this week for the assembling plant of the Chevrolet Motor Co., the specifications calling for the completion of the building before May 1. There will be about 40,000 square feet in the structure. It is the purpose of the company, according to Elwood M. Garris, manager for the district, to make Buffalo a distributing center of Chevrolet parts.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During last week call money ranged from 4½ per cent to 5½ per cent, as compared with 4½ per cent to 6 per cent in the previous week, and funds were in fair supply. The time money market was dull and nominal. The quotations for sixty days' to six months' maturities remained unchanged at 4¾ per cent to 5 per cent. The rate for prime commercial paper also remained unchanged at 4¾ per cent to 5 per cent.

The Federal Reserve statement as of Feb. 8, 1922, showed an increase of $1,111,000 in total reserves, this being due to the following changes: An increase of $9,824,000 in gold reserves and a decrease of $8,713,000 in other legal reserves.

The New York institution showed a decrease of $31,938,000 in total reserves and an increase of $37,407,000 in total bills on hand. Total earning assets increased $62,165,000, while deposits showed a gain of $11,306,000.

The United States Treasury Department has announced that the approximate $400,000,000 outstanding of Victory 3¾ per cent Notes will be called for payment at par and interest on June 15, 1922. This is part of the refunding operations to be carried out in connection with the refinancing of the Government's short-term debt.

The Cleveland Federal Reserve Bank has announced that its rediscount rate on all classes of loans will be 4½ per cent, effective as of Feb. 14. The rate in the Southern and Western districts still remains 5 per cent.

The value of American exports of merchandise for the month of January dropped to the lowest level recorded since August, 1915. The reported value of $279,000,000 shows a decrease of 25.6 per cent from the amount reported for January, 1921.

The unfinished business on the books of the United States Steel Corporation at the close of January, 1922, amounted to 4,241,678 tons, a decrease of 26,736 tons from the total on hand at the close of December, when 4,268,414 tons were reported. This rather unexpected decrease in forward business is explained partly by year-end cancellations. The peak of unfilled tonnage was reached in April, 1917, when bookings amounted to 12,183,083 tons.

TRACTOR CHAIRMEN NAMED

CHICAGO, Feb. 11—The following committee chairmen have been appointed by the tractor and thresher department of the National Association of Farm Equipment Manufacturers: Tractor demonstration show and publicity, H. H. Bates, Bates Machine & Tractor Co.; foreign trade, J. B. Bartholomew, Avery Co.; tractor tests, R. C. Brewsough, Allis Chalmers Manufacturing Co.; educational work, John R. Myers, George O. Richardson Manufacturing Co.

INDUSTRIAL NOTES

Goodyear Tire & Rubber Co. has added 500 men to its working forces and will increase production from 20,000 to 22,000 tires daily. The company went to the previous mark the first of the month, but constantly increasing business makes the increase to the second figure necessary. The proposed output is 2000 tires a day in excess of the program which was expected to be maintained for the balance of the winter. The company is selling surplus machinery which has been made available through increased efficiency of plant operation. Both new and used machinery is being offered for sale.

Stewart-Warner Speedometer Corp.'s volume of business this year is reported the largest on record for the period. The working force of the company is approximately 1600, as compared with 800 last October. Orders have increased materially since the New York automobile show. Heavy orders, it is planned, will be placed for raw materials. It is said that the company is developing several new accessories, including an indicator for the dashboard to register accurately the amount of gasoline received at a service station.

Kelsey Wheel Co. body building plant located in Memphis has started operations after being idle since completion nearly a year ago. The plant was erected under the stimulus of a $1,750,000 contract from the Ford Motor Co. The contract was subsequently canceled owing to the business depression. The company has now concluded negotiations with the Studebaker Corp. Operations start with 50 employees, a number that will be augmented until it reaches 350. C. A. Hooker is in charge.

Asphalt Association has moved its Canadian offices from Toronto to Albany, N. Y., and has placed Germain P. Graham, formerly deputy city engineer of Albany, in charge as district engineer. Graham's territory will include New York State as well as Canada. The association recently opened branch offices at Raleigh, N. C., with Harry P. Grier in charge and at Atlanta, which is under the supervision of James R. Valk.

National Tire & Rubber Co., East Palestine, Ohio, is now operating with its full force and manufacturing tires and tubes to its capacity. The company has its distribution practically all arranged for this season through its distributor organization. From orders already booked and the trade prospects through close affiliation with its distributors it anticipates an active and profitable season.

Wire Wheel Corp. of America has opened up new headquarters in Chicago in the Splitdorf Building, 2900 South Michigan Avenue. Oscar Moll is the manager in charge of the branch, assisted by E. A. Kuhl. The factory representative for the central Western territory, making his headquarters in Chicago, is Ralph D. Webster.

C. W. Arnold Co., Wellsville, Ohio, has purchased the **Cleveland Carburetor Manufacturing Co.** plant and machine shop, together with the rights and all patents for the manufacture of the carburetor, which at present is designed for small cars. The Arnold company expects to operate the plant in the near future.

Resta Motors, Inc., New York City, of which Dario Resta, racing driver, is president, has had a petition in bankruptcy filed against it by three creditors. Resta admits insolvency. The liabilities are reported to be $54,148 and the assets $30,000.

Jordan Motor Car Co. has gone into capacity production with prospects that it will remain so for several months. In the last quarter of 1921 it is reported the business of the company showed an increase of more than 40 per cent.

Greenfield Tap & Die Corp. reports that incoming orders for January, domestic and export, showed an increase of 50 per cent compared with January, 1921.

John Obenberger Forge Co. assets at West Allis will be sold at public auction in the Federal Building, Milwaukee, March 1 by J. W. Gerdis as trustee.

Just Motors, Ltd., has been incorporated with a capital of $400,000. Headquarters will be in Montreal and a branch will be established at Ottawa.

Acme Wire Co., New Haven, reports that it has received an order for 150,000 coils of wire from the **Ford Motor Co.**

Milburn Electric Adds Two Commercial Models

TOLEDO, Feb. 14—A 1-ton and a ½-ton model have been added to the commercial electrics made by the Milburn Wagon Co. The line of passenger electrics remains as before, a brougham, coupe and roadster.

The smaller model, ½-ton capacity, is known as Model 43 and is priced at $1,585 in chassis without battery. The wheelbase is 115 in. and tires 32x4½ in. Pneumatics are used both front and rear.

The 1-ton model, known as Model 40, sells for $1,985 in chassis without battery. It has a wheelbase of 128 in., 32x4½ tires in front and 33x5 tires in the rear.

Central America Using More Denatured Alcohol

NEW YORK, Feb. 11—The growing use of denatured alcohol as an automobile fuel is reported in advices reaching here from Central America and the West Indies. The Republic of Panama has named a commission to work out plans for creating a national fuel, the commission estimating that alcohol for motor use can be produced locally at a cost of about 20 cents per gallon, compared with 45 to 50 cents per gallon for gasoline. The commission estimates that more than 1500 automobiles are in use in Panama.

Wide use of this fuel already is being made in Cuba, where a daily production of from 12,500 to 15,000 gallons is being carried out under a recent decree authorizing the manufacture of a motor spirit containing 95 per cent alcohol and 5 per cent gasoline, with coloring added to make it easily distinguished. Many Brazilian motorists are reported to be employing this fuel, and one of the entrants in a recent tractor demonstration near Rio de Janiero successfully used it.

BRITISH FIRM'S LOSSES

LONDON, Feb. 4 (*By Mail*)—S. Smith & Sons, Ltd., accessory manufacturers, after paying a steady 10 per cent dividend for the year 1918-19 dropped to 3½ per cent for 1919-20, free of income tax, when a net profit of £98,337 was declared, reports a net loss of £203,985 for the year ended July last.

METAL MARKETS

Compared with the lackadaisical buying of a few weeks ago, the demand for iron and steel that is now before the market may almost be said to have turned brisk. Several 5,000 ton lots of sheets are being inquired for by Michigan automotive interests and there is far more pep to pig iron purchases by automotive foundries than there has been in some time. For all that it would be obliquity of vision to behold in this demand even the remotest justification for any change in the easy tone that characterizes the price situation in general. In fact, every single ton of steel orders now added to the much depleted unfilled tonnage reserve of mills should enable the latter to make a more favorable showing in the gross profit on their operations which are still far from capacity, in most instances representing about one-half of the latter.

There may possibly come to pass an upward revision in the prices of bars, shapes and plates, if the demand for structural steel should broaden, for the simple reason that these products are now selling at what is in many quarters looked upon as the dead line. To be more precise, however, these products are not selling to any great extent at the levels now quoted, for no representative amount of orders is ever placed for any steel product at minimum prices. When these prices undergo upward revision, there is danger of loose talk about "the steel market advancing."

Formerly a certain percentage of defective sheets was accepted in an order by the purchaser but most consumers now insist upon their sheet purchases being 100 per cent perfect and, as a result, sheet mills are bending every effort to eliminate waste in production as the result of carelessness on the part of mill operatives. In the long run producers will be fully as much benefited by this attitude of consumers as will the latter, for it makes for efficiency of the right sort.

Pig Iron.—Considerably more malleable and foundry iron is moving to automotive melters, but buying continues conservatively as to the tonnages involved.

Steel.—The market for cold-drawn steel bars is fairly active with producers quoting 2¢, base Pittsburgh, but orders are generally placed at 1.80 @ 1.90¢. Cold-rolled strip steel is sought in small tonnages by automotive consumers, quotations holding at 3.50¢, base Pittsburgh. Hot-rolled quotations show a wide spread, ranging from 1.80 @ 2¢, base Pittsburgh. Slightly more activity is noted in sheet bars which are quoted at $29, with rumors of transactions at $28. The sheet market, especially that for full-finished automobile sheets is firm, The Ford Motor Co. is reported to have 150,000 tons of scrap in stock. No demand of sizeable proportions has so far developed for bolts and nuts.

Aluminum.—Foundries catering to the automotive industries are more active in the ingot market, one transaction involving 1,000,000 lbs. having recently been noted. The market is steady, especially for sheets. Importers assert that all bargain lots have been cleaned up and that foreign producers refuse to shade prices at this time.

Copper.—The market continues easy. Domestic consumers show very slight interest. Copper and brass products are in somewhat improved inquiry, however.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

Feb. 18-27—Brussels, Belgium, Ninth Exhibition of Agricultural Machines and Implements, Palais de la Cinquantenaire.

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

CONVENTIONS

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Feb. 24, Mar. 24, April 28, May 26.

Argentina Absorbing Old Stocks of Cars

No Longer Serious Menace to Trade Stability—City Sales Show Improvement

BUENOS AIRES, ARGENTINA, Jan. 16 (*by mail*)—Racing here this summer has had more than the usual interest, both from a commercial as well as a sporting point of view, because of the fight for supremacy between American and European cars. So far the latter have not managed, despite their efforts, to wrest the honors away from the American cars.

A year ago the public here had worked itself up to a high pitch of enthusiasm over the reports of the wonderful cars that would shortly arrive from some of of the well known European factories, and it was generally thought by the man on the street that the American cars had "seen their day." Even some of the importers caught the fever and rushed over to Europe to secure agencies.

American Cars Helped

The result has been sadly disappointing to many of them, and the public is now beginning to realize that "all is not gold that glitters." It is perhaps just as well that this has happened, because nothing could have been more helpful in the long run to the well known American cars.

The past month or two has seen a steady improvement in the local automobile trade, especially in city sales. Farming districts, so far, have not come up to expectations, due, no doubt, to the low prices of produce, but the late summer will probably show some movement.

The old car stocks, accumulated at the end of 1920, are gradually being absorbed, and to-day they do not represent any serious menace to the stability of the trade as a whole.

Dealer Mortality Not Heavy

Dealer mortality has not been heavy among those regularly in the trade. There has been, of course, considerable weeding out among the firms that rushed into the automobile business, as a side line, during the boom, without any previous experience and without realizing the organization required for a successful business.

The Argentine automobile importers are doing excellent work in cleaning the trade of harmful practices.

In the month since the above was written, Argentine exchange has improved materially, and wheat prices have ascended at a rate similar to that in the United States markets. This improvement in wheat prices comes just as the Argentine crop is entering the market, and in combination with the bettered exchange, it is expected that the Argentine "camp" buyer will again enter the buying market.

New Company Is Formed to Buy Visible Pump Co.

FORT WAYNE, IND., Feb. 14—A company capitalized for $750,000 has been formed by local people and capitalists of Findlay, Ohio, for the purpose of taking over the Visible Pump Co., whose general offices are in this city and whose factory is at New Haven, Ind.

The new company has secured an option on the plant of a former Findlay motor car company. This plant has 76,000 square feet of floor space, a modern heating plant, a considerable amount of mechinery and is connected by a spur with a nearby railroad. Operations will be commenced in the new plant shortly. The company makes pumps which are covered by patents owned by the August Bowser estate. S. B. Rohrer will continue as the president.

MOTOR BOAT S. A. E. MEETING

NEW YORK, Feb. 14—The Society of Automotive Engineers has arranged a program for its motor boat meeting to be held at the Hotel Commodore on Feb. 21 at 10:30 a.m. inclusive of papers by Elmer A. Sperry, on Compound Oil Engines for Marine Uses, by Commander Ernest Nibbs, formerly of the British Navy, on the development and building of Diesel engines, and by Albert Hickman on surface propulsion in general and with special reference to its use with the sea sled type of hull. Joseph Van Blerck will be chairman of the meeting. The technical session will be followed by an informal luncheon, at which William Washburn Nutting will act as toastmaster.

British Prospect for Tractors Poor

Indications Point to Farm Work Being Done by Syndicates Owning Fleets

LONDON, Feb. 4 (*by mail*)—The Agricultural and General Engineers, Inc., a post-war combine of over half a score of leading and, some of them old established, British engineering firms, largely concerned with farm plants, has passed the interim dividend on its first and second cumulative preferred stock. It hopes to be able to meet this and other charges after the close of the fiscal year, March 31.

Lower Prices Made

Two or three of the companies in the combine are makers of farm tractors and tractor implements, business in which has been very dull throughout the year. Just now the prospects of the tractor industry are least promising of any among mechanical industries, largely because of the serious drop in the price of farm and land stuff, cattle and the like. Farmers say that all round they are not averaging 35 per cent of last year's prices, though in some cases those prices were not justified and, in the course of things, must have dropped with the reduced cost of labor and materials.

Recently there has been a fall in British tractor prices. The Austin is now quoted at £300. The Fordson has been marked down for some months to £205, but the output at Cork is reported not to exceed 12 to 14 machines a week, and Ford dealers, who all are required to stock one tractor, find the business irksome. Appearances point to the British tractor business, for some time at least, having to depend on syndicates of contractors owning a score or more and contracting for plowing and the rest of operations after the fashion of the steam cable-plow firms.

The first cost of tractors is but one of the difficulties of this business, probably maintenance troubles are a vastly more important factor. Automobile dealers as a class have little practical interest left in tractors, most of them declaring that there is nothing for them out of the sales.

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Domestic and Foreign Oil Reserves

Development of oil fields in Central and South America should result in wider use of gasoline propelled vehicles there and supplement our waning domestic supplies of crude petroleum. Present Mexican fields are thought to be nearing exhaustion.

By Herbert Chase

NEW YORK, Feb. 22.

THE sessions of the annual meeting of the American Institute of Mining and Metallurgical Engineers, devoted to consideration of domestic and foreign oil possibilities, which were concluded to-day, contained much that is of vital interest to the automotive industry. It is a well-recognized fact that the intensive development of automotive transportation is largely dependent upon an adequate supply of cheap liquid fuel. Without such a supply in this country, the use of all automotive apparatus would have been greatly restricted, as it has been to date in nearly all countries except the United States and Canada. Consequently the prospect of oil developments in South and Central America seems certain to help mightily the automotive market there.

Beyond this, and perhaps of greater importance to the industry, is the prospect that a supply of oil from countries to the south of our own, and including Mexico, which has recently supplied nearly one-quarter of our domestic oil requirements, will in time produce oil in sufficient quantities to materially augment our present domestic production. The cloud on the horizon is the probability that the most wonderful oil deposit the world has ever seen, that known as the Southern Mexican Field in the vicinity of Tuxpam, will soon cease to produce oil in considerable quantities, a large percentage of the pools in this field having already gone to salt water. This, of course, does not mean that Mexico will not still contribute great quantities of oil to the supply which this country and the world require, but the indications are that Mexico will fail to produce, at least for a period of uncertain length during which new Mexican fields are developed, anything like the proportion of the world's supply of oil which it has produced for the past few years.

In opening the symposium, Ralph Arnold, the chairman, stated that the aims of that session included:

1—The recording of as accurate an appraisal of the oil possibilities of the various countries as is possible, with information as to the immediate availability of their supply.

2—The furtherance of the efforts of the industry in securing governmental assistance in foreign oil development: (a) along the lines of a modification of our domestic oil policy, so that we can go to foreign countries and consistently ask fair treatment as to royalties and bonuses, and (b) by a closer co-operation between the State and Commerce departments and the oil industry.

3—The calling of attention to the unjustifiably drastic action of the price-fixing group of the oil in-

dustry during the last year or so, with the hope that it will use gentler methods in the future.

Continuing, Arnold said in part, "None of these subjects is new, and some of them have been up for discussion before various organizations for years. Our justification for again bringing them forward is the hope that industry, the Government and the people who shape the destinies of this country of ours may some time, somehow realize their importance and take effective constructive action.

"It is a source of great satisfaction to many of us here that the American oil industry has been awakened to a realization that the crude oil resources of the United States are not inexhaustible; that our crude oil should not be wasted, but should be conserved and used only for those purposes for which it alone is adapted; that every energy should be bent to improve our methods of refining, so that greater and greater percentages of gasoline, lubricants and other more desirable and valuable compounds may be made from the crude oil, rather than dissipated as fuel.

"Walter Teagle has endeavored to show by statistics that the foreign imports of oil (meaning Mexican oil) have little effect on the price of our light domestic crude. Mr. Teagle's case is greatly weakened by the fact that the price-fixers knocked 70 per cent from the price of mid-continent crude when the great glut of Mexican oil loomed last winter as a menace to our domestic industry, but began raising the price again immediately it dawned on the fixers that most of the proved Mexican fields were doomed to speedy exhaustion. This erratic manipulation of the price caused the ruination of many small operators and independents with a corresponding advantage to the stronger oil companies.

"Again referring to Mexico, may we not say that the oil industry there is 'between the devil and the deep blue sea'—meaning, of course, the tax problems on one side and salt water on the other? Unfortunately, the predictions made from this platform just a year ago have proved all too true."

The Oil Reserve of the United States

Following the introductory remarks of the chairman, Dr. David White, Chief Geologist of the United States Geological Survey, presented a paper on the oil reserves of the United States, in which he gave in considerable detail the results of the survey recently completed by the Survey in co-operation with the American Association of Petroleum Geologists. A brief summary of this estimate of reserves was given in Joseph E. Pogue's article on the Trend of the Petroleum Industry in 1921, which was printed in last week's issue of AUTOMOTIVE INDUSTRIES. Some of the important points brought out by Doctor White are given below:

A review of the producing, probable and possible oil-bearing regions in the United States has resulted in an inventory estimate that 9,000,000,000 barrels of oil recoverable by methods now in use remained in the ground in this country Jan. 1, 1922.

Unlike our reserves of coal, iron and copper, which are so large that apprehension of their early exhaustion is not justified, the oil reserves of the country, as the public has frequently been warned, appear adequate to supply the demand for only a limited number of years. The annual production of the country is now almost half a billion barrels, but the annual consumption, already well beyond the half-billion mark, is still growing. For some years we have had to import oil, and, with the growth in demand, our dependence on foreign oil has become steadily greater, in spite of our own increase in output. It is, therefore, evident that the people of the United States should be informed as fully as possible as to the reserves now left in this country, for without such information we cannot appraise our probable dependence upon foreign supplies of oil, on the expanding use of which so much of modern civilization depends.

How U. S. Reserves Are Calculated

Fortunately, estimates of our oil reserves can be made with far greater completeness and accuracy than ever before. During the last eight years a large part of the territory in the United States that may possibly contain oil has been studied in great detail by oil geologists; wildcatting has spread through "prospective" into many regions of "possible" and locally even into regions of "impossible" territory; old fields have been definitely outlined and new ones discovered, and, finally, improvement in methods and special training in the calculation of oil reserves and of the depletion of oil properties have been developed to meet the requirements of the tax laws. Many oil companies also furnished confidential data for use in the preparation of estimates.

The calculations of the oil reserves in the proved and discovered fields are reasonably reliable, and those for regions regarded by the geologists as embracing "probable" future oil fields are based on all the available data and are entitled to high respect, but the committee wishes it most clearly understood that the estimates of oil in "possible" territory are absolutely speculative and hazardous and that, although they represent the best judgment of the geologists, they nevertheless may be, at least in part, wildly erroneous. The questions involved are not only how much a particular doubtful region will yield, but whether it will furnish any oil whatever. On the whole, the estimates are undoubtedly the best that have ever been made for the United States, and better than have hitherto been prepared for any oil country or district of the world.

Of the total estimated oil reserves of the United States, amounting in round numbers to 9,000,000,000 barrels, 5,000,000,000 barrels may be classified as oil in sight and 4,000,000,000 barrels as prospective and possible. Rather more than 4,000,000,000 barrels should be assigned to the heavy-oil group. These oils will be recovered mainly in the Pacific Coast, Rocky Mountain and Gulf states. The contents of the Lima-Indiana region, which yields oil of a distinctive type, are estimated at 40,000,000 barrels. In general, the so-called paraffin oils of moderate and high grade, as contrasted with the heavier oils, amount in all to about 5,000,000,000 barrels. The estimated reserves of high-grade oils of the Appalachian States are about 725,000,000 barrels.

Inadequacy of Domestic Reserve

The estimated reserves are enough to satisfy the present requirements of the United States for only 20 years, if the oil could be taken out of the ground as fast as it is wanted. Should these estimates fall even so much as 2,000,000,000 barrels short of the actual recovery, that error of 22 per cent would be equivalent to but 4 years' supply, a relatively short extension of life. However, the committee expressly decries the too frequent assumption that inasmuch as the estimated reserves appear to be sufficient to meet the needs of the country at the present rate of consumption for 20 years, therefore the reserves will be exhausted at the end of that time or, at most, a few years later. This assumption is absolutely misleading, for the oil pools will not all be found within that length of time, drilling will be spread over many years, as the pools are found, and the wells cannot be pumped dry so quickly. Individual wells will yield oil for more than a quarter of a century,

and some of the wells will not have been drilled in 1950. In short, the oil cannot all be discovered, much less taken from the earth, in 20 years.

Our Dependence on Foreign Oil

The United States is already absolutely dependent on foreign countries to eke out her own production, and if the foreign oil can be procured, this dependence is sure to grow greater and greater as our own fields wane, except as artificial petroleum may be produced by the distillation of oil shales and coals, or some substitute for petroleum may be discovered.

All the estimates except those for one region, noted below, include only the oil recoverable from the ground by present methods, but it is practically certain that the percentage of oil to be recovered from the American oil fields will be vastly increased by the application of new and improved methods of recovery. At present, however, this phase of production may be regarded as in the experimental stage. Little has been definitely determined as to the applicability of "air pressure," "water drive," "gas pressure," "vacuum extraction" and other new methods to different regions, with their variation in conditions, or to the increase in production to be counted on from the use of these methods. The committee, therefore, feels that at present any estimates of such possible additional recoveries would probably contain errors enormously greater than those inherent in the estimates made on the basis of methods now in use. In only one region are the geologic conditions so well known and the experience with improved methods on a commercial basis so extensive and so long continued as to justify the formulation of estimates based on the results obtained. This is the region in northwestern Pennsylvania and southwestern New York, where the "water drive" is now employed to obtain oil from the Bradford sand, which was supposed to be largely exhausted. Under the peculiar conditions there the use of this method will result in the recovery of a large quantity of oil that cannot be recovered by ordinary methods of production. Allowance for the additional oil thus recovered has, therefore, been made in the estimates. It has already been found, however, that this method is not applicable to some other districts, and accordingly no allowance has been made for possible additional recovery through its use where its suitability to the local conditions has not been actually demonstrated.

In the light of these estimates as to the extent of our supplies of natural petroleum, the joint committee points out the stern obligation of the citizen, the producer and the Government to give most serious study to the more complete extraction of the oil from the ground, as well as to the avoidance of waste, either through direct losses or through misuse of crude oil or its products.

The Mexican Situation

The paper of V. R. Garfias, which followed that by David White, dealt at length with the oil situation in Mexico and testified to the fact that the last of the producing pools in the great Southern Field, pools which to-day are producing about two-thirds of the total Mexican output, will in all probability run to salt water in about three to five months, thus taking from our domestic market, almost over night as it were, some 10 to 15 per cent of its supply of crude. This prospect, of course, makes it exceedingly important that every effort be made to supplement our domestic supply from other foreign sources, and it was largely because of this that the meeting was held.

There are few who doubt that large supplies of oil will still be brought to the surface in Mexico, but the possibilities of finding another field which will be such a phenomenal producer as that which has now largely gone to salt water is extremely remote, and even if such a field be found it will require years for its development. It appeared from Garfias' paper that there are excellent possibilities of further discoveries of oil in Mexico, but, as David White pointed out, these fields are quite likely to be more like the average field in this country in which the yield per well is usually relatively small, so that much time is consumed in drilling, even when the field has been discovered and is in a relatively accessible location, as the Mexican fields of the future are not apt to be.

Estimates of Reserves Are Speculative

In the case of Mexico, as with practically all other countries, except the United States, and even to some extent with our own country, there is a considerable element of speculation in figures given in connection with oil reserves. This is due in part to the fact that such estimates are dependent to a very large extent upon careful geological investigations which, in the case of the South and Central American countries, have been made only in limited areas, if at all. For this and other reasons it is largely guesswork to attempt to give figures for the oil reserve of these countries. It is a well-known fact, however, that the geological formation and some other surface indications, in respect to Mexico, indicate that much oil will still be found there, although the time required for its development will be, as pointed out above, very considerable, owing to the inaccessibility of the potential supplies and the fact that much time is required for drilling operations, the construction of pipe lines and the development of other transportation facilities, even after oil in commercial quantities has been definitely located.

The sharp decline in Mexican production which is expected to occur by or before the middle of this year is practically certain to be reflected in the American market conditions, even though such an occurrence has already been discounted to a considerable extent.

Mexico produced in 1921 approximately 200,000,000 barrels, of which about 86 per cent were exported, the bulk of this export, or about 73 per cent, was brought into the United States.

Owing to the enormous production of the two or three remaining pools in the Southern Mexican field, Mexican production for the present year is continuing at a high rate. It was pointed out by Garfias that efforts are now being made to open new pools in the southern field, but Arnold stated that such developments are apt to decrease rather than increase the time which will elapse before the southern field is exhausted, since the various pools are operated on a competitive basis and are thought to tap the same general reservoir.

Canadian Oil Possibilities

The situation with respect to oil production in Canada was covered in a brief paper by Chairman Arnold, who stated that the figures given are of a decidedly speculative nature, being based upon the assumption that the Canadian fields may be expected to produce in quantities approximately the same as those produced in American fields in which the territory is of a similar geologic formation.

Arnold stated that there are now two areas in which oil is produced in Canada. The first is located in Southern Ontario and produces in the neighborhood of 200,000 barrels annually. The other producing district is in the southern part of the Province of Alberta, which is in reality a continuation of the Montana oil fields in this

country. This district has only a few wells, which have produced about 12,000 barrels of oil annually for the last five years. The chief hope of Canada, however, lies in the reserves of the western provinces, including in particular Alberta and British Columbia, but since these reserves cannot be accurately estimated from the relatively meager information available at the present time Mr. Arnold requested that the figures he gave be not quoted.

In discussion of Arnold's remarks one of the speakers who had had considerable experience in Canadian fields brought out the fact that investigations to date indicate the presence of oil over an area of some 300 miles wide from east to west and extending northward from the American border practically to the Arctic circle. The possible production from this area cannot be even roughly estimated owing to the fact that only extremely small portions have been drilled. It is probable, however, that Canadian reserves are large as compared to most other American countries except the United States, although even approximate information in respect to reserves is not available for many areas in Central and South America which are thought to have potential possibilities.

West Indies and Central America

Papers on the possibility of oil production in the West Indies and Central America (Mexico and Trinidad excluded) prepared by A. H. Redfield were read by others in the absence of the author. These had to do largely with the geological formations supposed to contain petroleum deposits, since little if any production of petroleum is now obtained from these regions. Oil is thought to exist in relatively negligible quantities in Cuba, but the prospects for development there are remote. Some wells have been drilled in Santa Domingo and Hayti, but none of these have reached any considerable depth and do not show any great possibilities, although small quantities of oil have been obtained.

Concerning Central America, it is impossible to give even the roughest approximation. Guatemala and British Honduras are thought to contain petroleum deposits, while Costa Rica and Panama include certain territory from which more or less oil may be obtained at some future time. The tropical conditions which exist in these regions, however, render prospecting difficult and enormous expenditure of capital will be required to develop oil fields and transport the crude product to the seaboard even when oil has been found to exist in commercially available quantities.

There was considerable discussion as to the likelihood of oil production in quantity in Colombia, which is considered by some to have great possibilities. This is due in part to the fact that oil seepages occur over a considerable area. While this no doubt indicates a certain oil reserve, some speakers took the view that the seepages had resulted in the loss of considerable oil which might otherwise be recovered by the drill. Others considered that Colombia is one of the greatest potential oil producing countries of the world, although the problems of production and transportation, and the present prohibitive laws in reference to development, are serious handicaps. One speaker stated that the Standard Oil Co. has built a railroad into one oil promising section and shipped enormous quantities of material for use in development work.

Venezuela and the Guianas

Ralph Arnold and B. Bryan presented a brief paper outlining the possible future production of oil in Venezuela, which is thought to contain some of the most extensive petroleum deposits in South America. Enormous tracts of territory are believed to overlay deposits which will no doubt in time be developed, but the cost of securing oil from most of this territory is now too great to enable serious competition with more accessible fields. Quite a number of wells are already producing oil, both in Venezuela and Trinidad, but the total production is insignificant as compared with that of Mexico and the United States. The authors of this paper stated that the Guianas may be eliminated from consideration at the present time, although detailed geological studies in the future may bring to light the existence of oil in commercially recoverable quantities.

Other papers dealing with oil possibilities in Bolivia, Brazil, Argentina and Chile were scheduled for presentation at a session held too late for a report to be here given.

Future Demands for Petroleum in U. S. A.

Joseph E. Pogue, at a session devoted to a Symposium on Petroleum and Gas, presented a paper entitled, Future Demands on the Oil Industry of the United States, in which he uses the same method of predicting the future demand for gasoline developed and used by R. B. Prescott, of the Class Journal Co., in an article on the future growth in the use of passenger cars in the United States which appeared in AUTOMOTIVE INDUSTRIES for Nov. 17, 1921. The following conclusions are taken from Pogue's paper:

1. The demand for crude petroleum for the next ten years will be determined by the growth of automotive transportation and the motor-fuel requirements resulting therefrom.

2. Future consumption of crude petroleum and its products may be estimated by methods of empiric projection, and the results attained by such methods are given, but such methods are not regarded as satisfactory.

3. Two rational methods of forecasting the demand for gasoline are described and applied, and a method involving the principle of diminishing returns is advanced as the most satisfactory approach to the problem.

4. By means of the method involving the principle of diminishing returns, the domestic demand for gasoline is estimated to be 6800 million gallons in 1925 and 8300 million gallons in 1930.

5. The ratio between the quantity of crude petroleum consumed and the quantity of gasoline produced is empirically projected by fitting a straight line to the data by the method of least squares, and according to this method 27.7 per cent of our crude petroleum consumption will be converted into motor fuel service in 1925 and 33.9 per cent in 1930, as contrasted with a percentage of 19.9 for 1920. This projection is subject to a greater probable error than the estimate of gasoline requirements.

6. Combining the results mentioned in the two preceding paragraphs; the estimated demands for gasoline in 1925 and 1930 are converted into demands for crude petroleum. The results attained indicate that 585 million barrels of crude petroleum will be sufficient to support automotive transportation in 1925 and 580 million barrels will be sufficient for 1930, on the basis of a continuation of recent progress in technology.

7. The results attained are subject to more accurate determination on the further development of the methods followed, but the present results are advanced as having sufficient probability to be of practical value as a basis of present planning.

ACCORDING to German patent No. 314,175, purification of used oil is effected by producing a syrup-like solution of glycerine pitch (a by-product of glycerine production) and water (4:1) and mixing 100 parts of the used oil with five parts of the solution and ten parts of water. Upon boiling this mixture, a sort of milk is produced, on top of which the purified oil separates out while impurities and water sink to the bottom.

Tractor Show Marked by New Designs

Many new engineering features were presented at the tractor show. Activity in creeper tractor construction. Road building and maintenance tractors are prominent. Corn belt and grain belt tractor requirements contrasted. New machines and parts described in this analysis of recent tractor show. Tractor session of S. A. E. develops interesting discussion.

By P. M. Heldt

IF this year's tractor show was not a striking success from the standpoints of representativeness and attendance, it at least offered a considerable percentage of new designs. Most of these designs were the products of new firms. Older firms with an established business could perhaps afford to ignore the show, in view of the low ebb in the buying power of the farming community, but firms just entering the industry could not afford to miss the best opportunity of the year to bring their products before the public.

Considering the relative number of creeper type tractors on the market and the number sold in the course of a year, this branch of the industry was better represented than the wheeled tractor branch. Creeper type tractors exhibited included the Holt, Best, Monarch, Cletrac, Bear, Bates, Henneuse and Avery. These machines, at least the heavier models among them, are largely used for road building, a line of work in which there is a great deal of activity just now. The use of creeper tractors in road construction and road grading was played up in the moving picture exhibits connected with the show and was also emphasized during the road construction session of the S. A. E. Another field in which the creeper type of tractor is extensively used is that of snow removal, and a somewhat novel type of snow plow was shown on the stand of the Monarch Tractor Company. The tractor was a quite large one and was fitted in front with a snow plow having the appearance of the prow of a battleship. This was of slightly greater width than the tractor itself. In addition to this plow the tractor carried wings on both sides, which could be either swung out to form extensions of the two sides of the regular plow, thus clearing a path through the snow 18 ft. in width, or else could be drawn in close to the tractor so as to be ineffective. The idea is to use the wings in newly fallen, light snow and the plow alone in packed and frozen snow.

Few Motor Cultivators

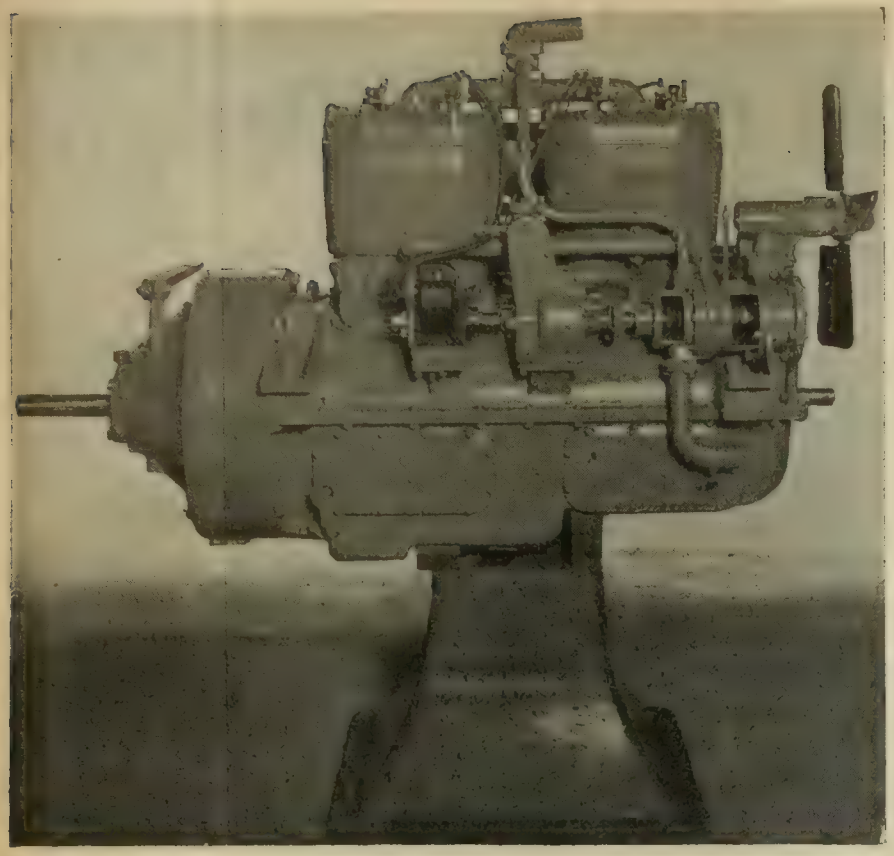
There was an almost total absence of the motor cultivators which have been such a conspicuous feature of recent tractor shows. This may be partly accounted for by the fact that the show was held in a center of the grain belt, where row crops are not raised to any great extent. On the other hand, there were two representatives of what may be regarded as a new type—a machine primarily designed for cultivating, but which can also be used for plowing. The two machines referred to are the Cletrac Model F and the Parrett Cultor. The field which these small tractors are to serve was discussed in a paper by G. D. Jones, engineer of the Cleveland Tractor Co., read at the technical session of the S. A. E. meeting. Mr. Jones pointed out that the big volume of sales must come from the small farms, those between 50 and 200 acres. In the corn belt the average farm contains only about 150 acres, and the farms in the East are still smaller. These are diversified crop areas; in the corn belt, for instance, the farmer always grows some grain, as well as potatoes and hay. This means that he must use many types of implement. Mr. Jones pointed out that this situation—the small size of the average farm combined with the great variety of implements required—made it necessary for the tractor manufacturer to thoroughly study the implement problem. Farmers must not be overburdened financially with the purchase of implements, and Mr. Jones expressed the view that the tractor makers would have to produce the implements to go with their tractors themselves, which his firm has already started to do.

Multi-Purpose Machines

A somewhat similar argument is advanced by the Parrett company, which also realizes that the necessity of buying a long list of expensive implements is likely to be a great deterrent to the would-be purchaser of a tractor. Parrett's solution of the problem, however, is not to go into the implement business himself, but to make use of the implements already on the farm. His Cultor is designed to fit the 2-horse plow found on practically every farm, and it also fits the ordinary horse cultivator.

In the discussion at the S. A. E. meeting some of the speakers took a long range view of tractor development, while others limited the bearing of their remarks to the possibilities and probabilities of the immediate future. One speaker, for instance, mentioned that there were other more efficient methods of loosening the soil and preparing it for the seed than the moldboard type of plow; this implement, he claimed, was designed to fit the horse, a draft animal, which could do mechanical work most efficiently when pulling in a straight line. There were other examples in tractor work where we did not take full advantage of the possibilities of our power source. In grass mowing and in grain harvesting, for instance, we started with mechanical power transmitted by a revolving shaft, then converted this into a straight-line draft, and obtained rotary motion for the operation of the sickles by the use of bull wheels on the implement.

This line of argument did not seem to meet with a sympathetic reception, however. It was pointed out that there had been tilling machines with rotary tools developed in the past, but that in every case they had proven commercial failures. The trouble was that it was too difficult to get the farmer to give up his accustomed method of doing his work.



Climax tractor engine adapted for industrial purposes

On the other hand, the idea that it is necessary to make the tractor a machine of greater utility to the farmer, to make it more nearly universal in its applications, is getting possession of the minds of tractor men. One of the speakers at the S. A. E. discussion said that 45 per cent of the total acreage of the country was planted to row crops, and this gave a good idea of the necessity for multi-purpose machines. Our present conventional tractor was a plowing and belt-work machine, and while it was suitable for the wheat belt it did not meet the requirements of diversified farming. So long as we failed to develop a universal machine we would not get very far in motorizing the farm.

Other speakers brought out the fact that there is room for both types of machine—the large tractor for the bigger farms on which most of our staple grains are produced and the small, multi-purpose machine for the smaller farms devoted to diversified crops. On the big grain farms a single purpose tractor is required. One of the engineers taking part in the discussion even went so far as to say that there is a decided demand for a larger unit in the grain belt—as large as one man can handle. This argument was countered by the other side with the statement that farms of this class were relatively few in number, and that volume sales must come from the small farms.

Contract Plowing on the Coast

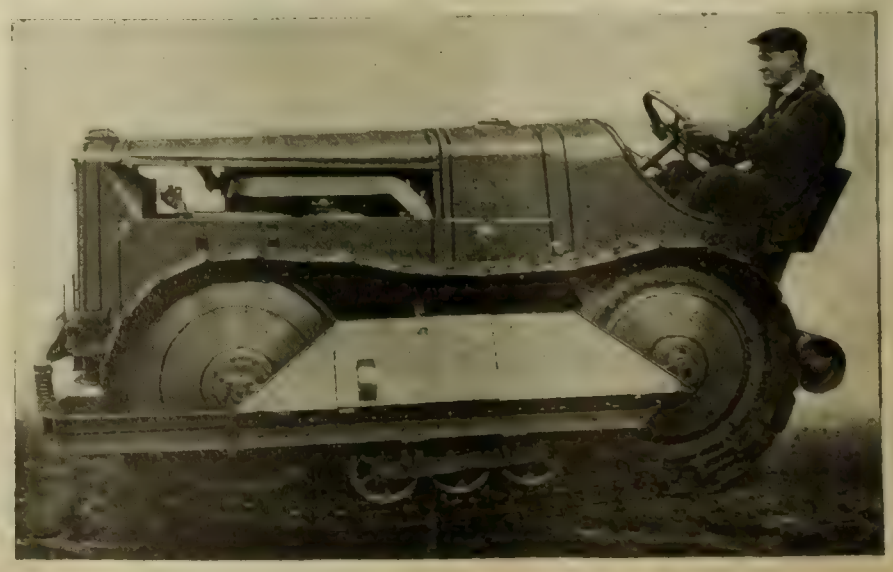
The suggestion was made that if plowing constituted a relatively small fraction of the work in the corn belt and in the East, why didn't the farmers in these sections form co-operative organizations which could buy one large tractor each, with which to do the plowing of the community. A call for the relation of any experiences along this line brought no response, but it was stated that contract plowing enterprises had met with considerable success in California.

The importance of the correct hitch in plowing was emphasized in a paper read at the meeting by Oliver B. Zimmerman of the International Harvester Co.'s engineering department. This paper was of an analytical character and also contained the results of a good deal of experimental work. It was shown that the plow draft can be increased by as much as 25 per cent by having the drawbar hitched to the tractor at the wrong point. For instance, by connecting the drawbar too far to the left, the plow is forced against the land slide with considerable force, and the friction is greatly increased. The height of the drawbar hitch is of equal importance.

Interviews with farmers at the show threw a number of interesting sidelights on the present agricultural situation. It must be obvious to every one that the high prices of agricultural products during the five years previous to 1921 brought great wealth to the agricultural community; but they also brought an inclination to speculate. The same as in the stock market trading is always brisk as long as the market is rising to higher levels, so people were tempted to buy farms or rent farms, almost irrespective of the prices or rents asked, as long as the prices of farm products kept on soaring. During those years many of the older farmers retired, making way for younger men who thought they could see a long period of prosperity ahead and were willing to assume the risk necessary to capitalize the situation as they saw it. "Land hunger" grew so strong that farm values were forced up to three or four times the figures quoted for the same land only a decade earlier, and in some sections the bankers refused to take further mortgages on farms because they foresaw that when the slump came the security would not protect them if the loans were based on the prices then paid.

Reasons for Depression in Tractor Market

It is not hard to see why many of the people who started farming during the inflation period should have quickly come to grief when deflation set in and the prices brought by farm products slumped abruptly. The situation of many of the older renters is probably not much better. When the prices of farm products began to tumble, it was not long before those who had entered farming under the conditions outlined were financially embarrassed, because their expenses decreased but slowly or not at all. One result of this was that many farmers were compelled to sell their cattle without fattening them and sometimes only half grown, in order to raise cash that was badly needed. In this way the country's supply of livestock has been materially reduced, and the consequences are already making themselves felt in increased prices of hogs and cattle. The prediction was made by one farmer at the show that this would mark the turning point in the economic situation of the farmer. Better prices will be paid for livestock during the next few years, and, besides, as it will be necessary to feed much corn, etc., in order to bring back the country's stocks of hogs and cattle to their normal size, the outlook is that cereal products, too, will not long remain at their present low prices.



Bear creeper tractor

The writer has been informed that the agricultural college of a leading Western State recently made a report on the comparative fuel value of corn and coal, on the basis of the ruling prices, and in this the conclusion was reached that a bushel of corn would yield just about as much heat as the amount of coal the farmer could buy for it. The comparison was made some time ago when corn sold in that state at less than 20 cents a bushel. It is hardly necessary to point out that when coal cannot compete with corn as a source of energy, gasoline does not stand very much chance.

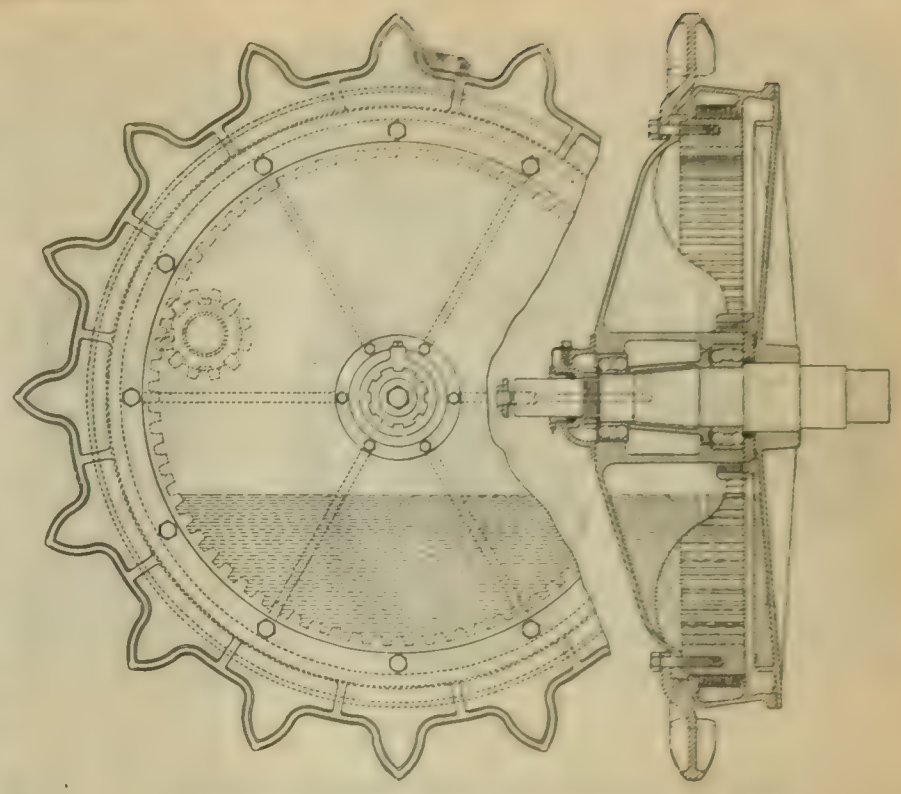
The above depicts the dark side of the present situation affecting the farm tractor industry. Fortunately, there is also a bright side. As pointed out by one tractor farmer returning from the show, every farmer's boy in the country between the ages of 16 and 21 wants his dad to get a tractor, because it would shorten his hours of hard work, and because he likes to tinker with machinery, particularly power-driven machinery. The older generation of farmers are conservative and cannot be easily induced to give up their old ways of doing their work, but the younger generation, who are growing up in daily contact with gasoline engines and automobiles, have a natural bend toward the tractor and will give it every chance.

Following are brief descriptions of new machines exhibited at the show and notes on improvements made by manufacturers who continue their old models.

Bear Creeper Tractor

Among the new tractors exhibited was the 25-35 hp. Bear, a creeper type manufactured by Bear Tractors, Inc. The special advantages claimed for this design are its low weight as compared with other creeper tractors of similar capacity, high mechanical efficiency, compactness and accessibility. The net weight is 5500 lbs., and the weight in operating condition, 6000 lbs., which results in a ground pressure of from 3.5 to 3.9 lbs. per sq. in. An efficiency of 75 per cent is claimed, that is, 75 per cent of the engine brake horse power is available in drawbar horse power. The compactness may be judged from the following overall dimensions: Length, 118 in.; width, 60 in.; height, 54 in. The turning radius is given as 6 ft.

An interesting feature resides in the track and roller construction. The weight of the tractor is transferred to the track by means of three rollers; these rollers, however, are not rigidly held on the track frame, as is usually the case, but support the frame through the intermediary of

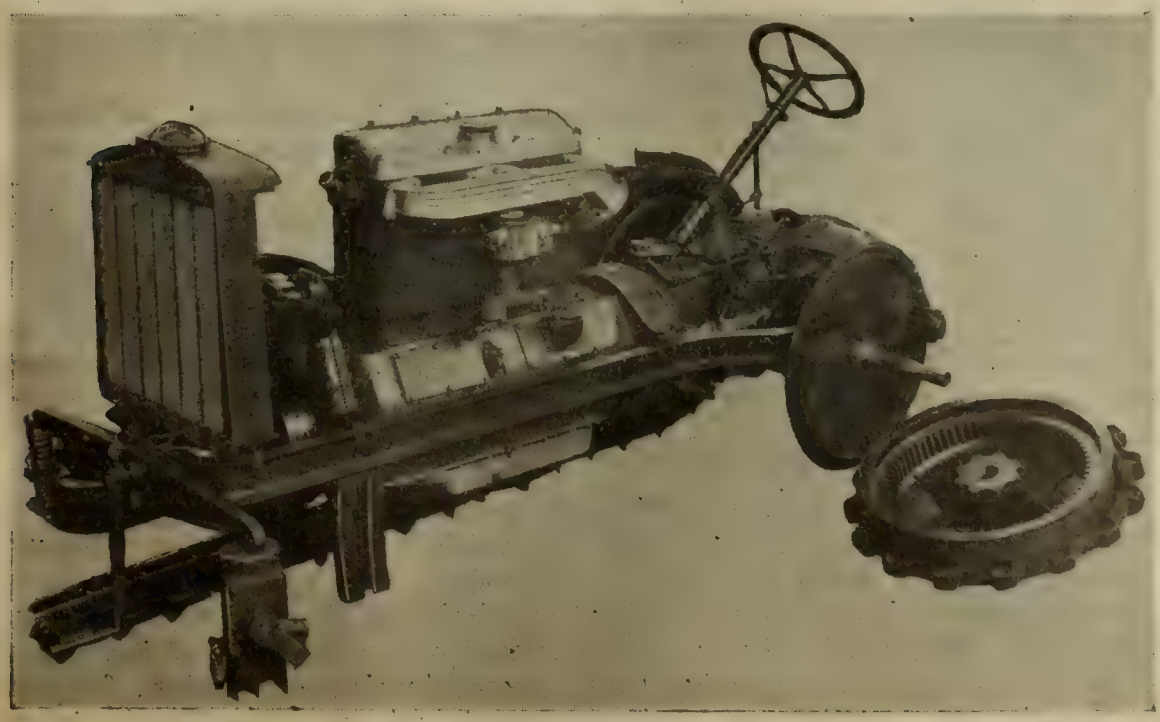


Drive gear lubrication of Bear creeper tractor

levers and coiled springs. This results in a more or less equal distribution of the pressure on the track as well as in relieving of shocks over the tractor. At the forward end the track frames are connected through double coiled springs to a cross bar pivoted at the center of the tractor frames.

The engine is a Stearns 4¾ x 6½ in., operating at a governed speed of 975 r.p.m. Engine accessories include a Bosch magneto with impulse starter, a Stromberg carbureter, Simplex governor and Spirex radiator. A tank capacity of 45 gal. is provided. Through a Borg & Beck clutch the power is transmitted to the 2-speed and reverse sliding gear transmission with chrome nickel steel, coarse pitch, wide faced gears. Each track is controlled individually through a dry multiple disk clutch of Bear design. These clutches are 19 in. in diameter. All transmission mechanism is completely inclosed and all shafts are mounted on ball bearings, to which is ascribed the high mechanical efficiency claimed.

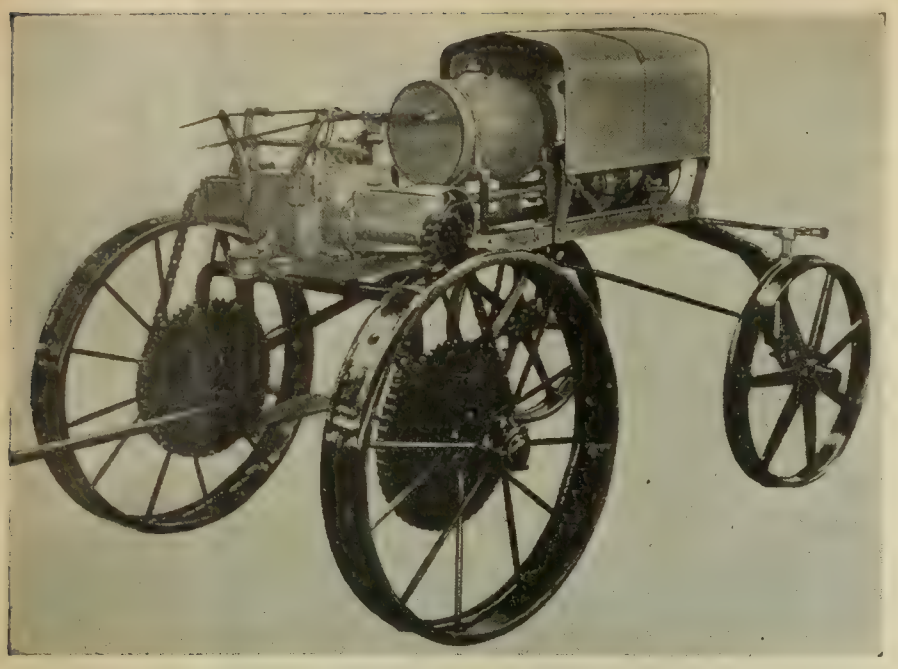
Drop forged units constitute the track. They are claimed to be easily detachable and they run dry or without lubrication. Knife-edge, drop forged grousers are attached for road work. The ground contact area of each track measures 64 x 12 in., this giving the unit pressure previously mentioned. The machine is geared for speeds of 2¾ and 1½ m.p.h. forward and 1.2 m.p.h. reverse. Steering is effected by means of a handwheel which connects to the track clutches. It is claimed that a very light effort on the wheel suffices to control the machine. A standard belt pulley of 9 in. diameter and 9 in. face is mounted on the rear of the transmission case.



Mechanical parts of Bear tractor

Parrett Combined Tractor and Cultivator

A most interesting machine is the new Cultor of the Parrett Tractor Co. It is a small machine designed to do all farm operations with implements already on the farm; that is, horse-drawn implements. Several conversion features are embodied in the design. Thus, it is either made with a high ground clearance suitable for cultivating corn when quite high, or as a "low down" tractor with 17 in. clearance which is preferable where the conditions



Parrett Cultor

of the work do not require any greater clearances. This is not a conversion feature in the sense that the farmer can change the machine from one type to another, but rather in the sense that the manufacturer takes the same power plant and frame and provides it either with arched axles and a vertical chain drive to the rear wheels for high clearance, or with straight axles and an internal gear drive to the rear wheels. The "low down" type is especially suited to orchard work.

The other conversion feature referred to relates to the steering mechanism. Either a line drive can be used or the ordinary wheel steering with seat directly on the tractor. Both the line drive and the steering post with wheel are furnished as standard equipment and can be quickly interchanged in accordance with the type of implement used.

The machine can be used as a cultivator for corn and other row crops and a one-plow tractor. An ordinary horse cultivator is hitched to the rear of the transmission box. There is also furnished as regular equipment an adjustable drawbar hitch which bolts to the inner ends of the stub rear axles or the axle spindles on the high clearance job and also fastens to the rear of the transmission housing. This adjustable hitch attachment comprises a vertical bar or tube on which the hitch clevis can be moved up and down, and be locked at any height by a set screw.

Has Mar-Tan Air-Cooled Engine

The engine is a two-cylinder Vee air-cooled type known as the Mar-Tan engine, a product of the Mar-Tan Motor Mfg. Co. It has a 3⅜-in. bore and a 3⅞-in. stroke, giving it just under 70 cu. in. displacement. The valves are located in the detachable cylinder heads parallel with the cylinder axes. The heads being detachable, the cylinder castings, which are provided with deep and thin cooling flanges, are symmetrical with respect to their axes, which tends toward uniform expansion and contraction. Cylinder castings as well as heads are interchangeable. The cylinders are cast of semi-steel, having a Brinell hardness of 220 to 250, and the heads of a special grade of iron known as Mayria iron, which has special heat resisting qualities.

The crankshaft is supported on three ball bearings while another bearing is used on the crankpin. Between the two ball bearings on the rear main crankshaft bearing is located the centrifugal type governor which connects by a simple linkage to the carbureter throttle. The valves are operated through push-rods extending up the front of the cylinders from a cam mechanism inclosed in a housing at the forward side of the crankcase.

Fuel is carried in a cylindrical tank mounted on strap iron supports between the engine and transmission. Ignition is by a magneto mounted on a pad on the engine and driven by a train of spur gears from the crankshaft. Cooling is assisted by an airplane type fan mounted midway between the two cylinder heads.

A three-plate clutch of Parrett design is combined with the engine. The central driving plate is secured to the flywheel rim and the two driven plates to a spider carried by the clutch shaft, which latter has a ball bearing pilot on the end of the crankshaft. The clutch is ordinarily held in engagement by a spring but can be disengaged either by a lever or by the steering lines. The ends of the steering lines fasten to levers on a shaft connected through a lever and link mechanism to the clutch throwout collar and the lines pass over pulleys at the ends of the steering lever, with the result that the motion of the hand in line steering is reduced by one half at the end of the steering lever and only very little pull on the lines is required for steering. If the operator pulls fairly hard on both lines the anchorages of the steering lines are pulled forward and the clutch is thereby disengaged. A certain amount of slack is provided in the clutch throwout collar so that the ordinary pressure on the steering lever does not cause friction at this collar. There is also a connection between the clutch throwout collar and the throttle valve so that whenever the clutch is opened the engine is automatically throttled down.

Only One Forward Speed

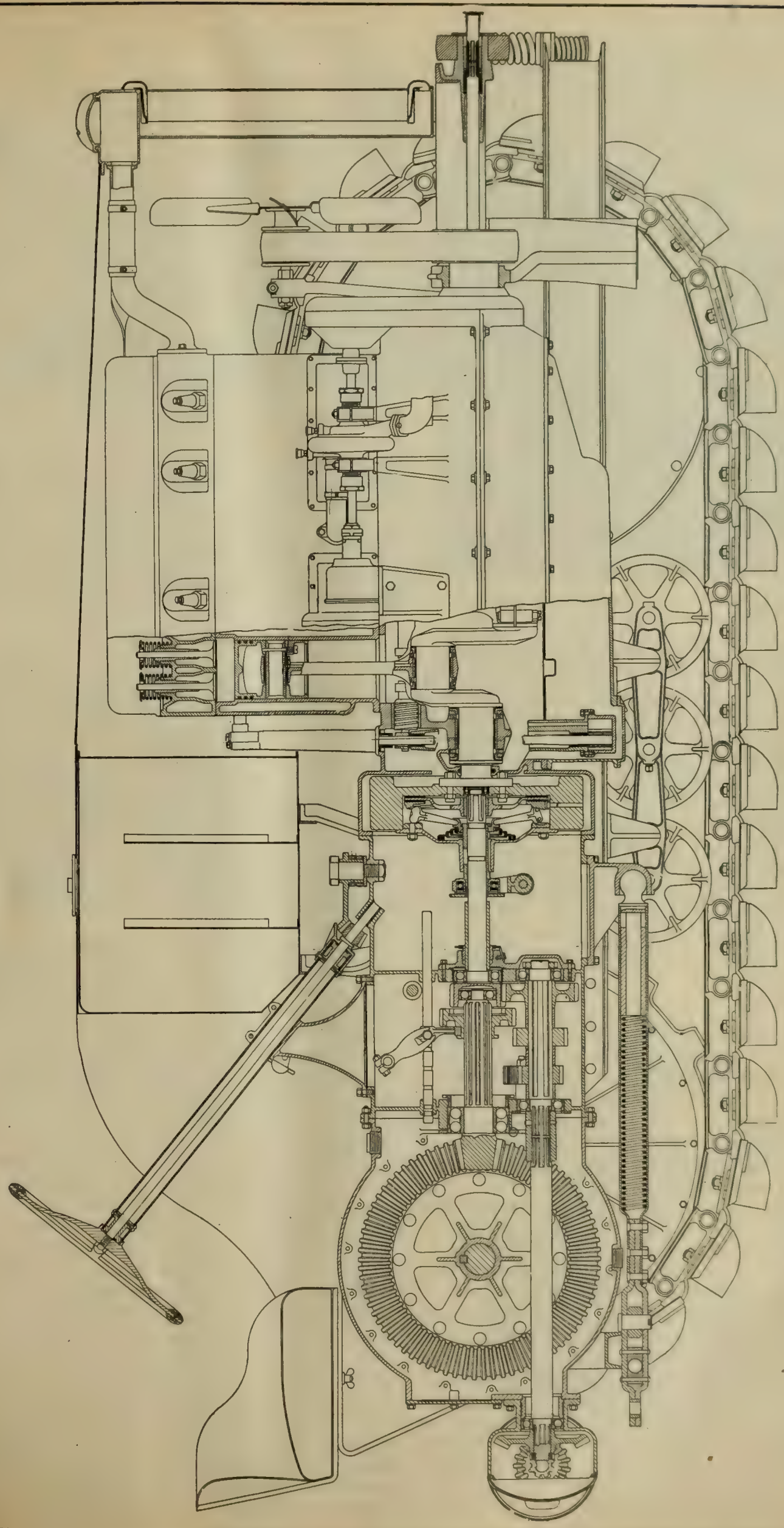
Directly above the rear axle is located the transmission case which is really a reversing gear case, as only one forward speed and one reverse are provided. Where the conditions of the work make frequent reversing necessary an extra pair of lines is provided for reversing in connection with the line drive. Otherwise the reversing gear is controlled by a lever on the transmission housing. The tractor is geared for a speed of 2.6 m.p.h. Changes in the gear speed can be easily made by interchanging the bevel gears in the transmission housing or in the high clearance model by changing sprocket pinions. The transmission case also encloses the gearing for the belt pulley on the right hand side. All bearings in the transmission are ball bearings.

The Cultor has a bar steel frame and is fitted with 36 x 5 in. rear wheels and 28 x 3 in. front wheels. The rear wheels are mounted on flexible roller bearings. Handy tool boxes are cast on the tubular extensions of the transmission case enclosing the sprocket shafts. While on the subject of tools it may be mentioned that the engine is so designed that two wrenches will fit all nuts and bolt heads.

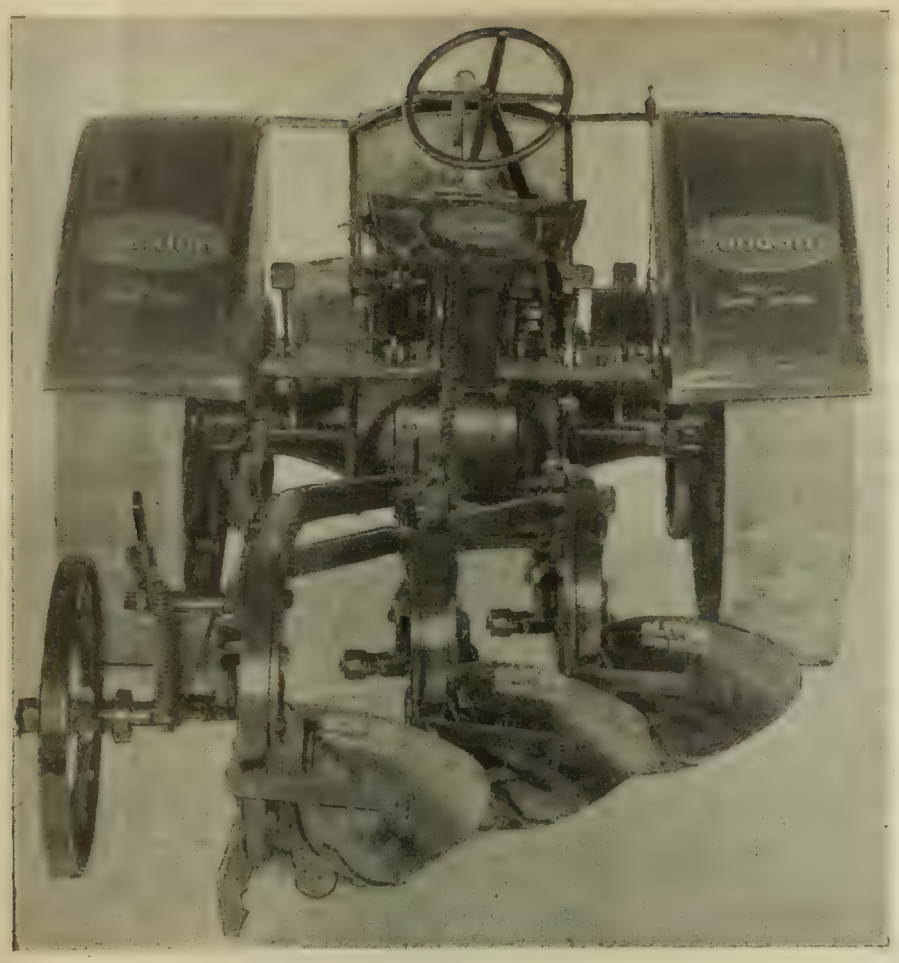
In addition to the uses already mentioned the Cultor is adapted for pulling disk harrows, mowing machines, a 6-ft. grain binder and a corn binder. Its clutch-controlled belt pulley makes it suitable for such lighter belt jobs as feed grinding, wood sawing, pumping and grain elevating. The manufacturers plan to furnish cultivator beams to attach directly to the tractor. It is claimed that the machine can be switched from one implement to another in less time than it takes to harness a team.

Improvements in Parrett Model M

A number of improvements have recently been made in the Parrett Model M which is fitted with a Midwest engine and rated at 16-28 hp. It is now equipped with a leather-lagged belt pulley which tends to prevent belt slippage. The radiator is now set cross-ways of the frame and is provided with a combination of shutters for controlling the cooling effect in winter. The fan is driven through spiral gears and a short belt from the pump shaft.



Longitudinal center section of Bear creeper tractor



Rear view of London tractor, showing details of plow-lifting mechanism

of the engine, and the pump is now gear driven. In the cab there is a spring-supported wooden platform, the object of which is to take some of the jar off the operator's feet when driving over hard ground. A spring seat is provided which is adjustable fore and aft and also up and down to suit drivers of different size. The comfort of this seat is further increased by supporting it on the spring platform alluded to. A spacious sheet metal tool box is located in the cab platform on the opposite side from the seat. The sides of the cab are provided with inwardly turned flanges to provide the necessary stiffness, and these sharp flanges were apt to dig into the driver's sides when he leaned against the cab. To obviate this discomfort filler boards are now provided at the points in question, these being so arranged as to come flush with the edge of the flange.

Changes in Old Models

The Gray drum type tractor has now for some time been fitted with the new design of Waukesha engine. The cone clutch, which is of the company's own manufacture, has been redesigned and is now operated by a large volute spring without adjustment. This clutch can be removed from the tractor without disturbing either the engine or the transmission. The steering gear also has been redesigned with the object of increasing its life.

Various changes have been made in the Whitney tractor, a two-plow machine. The frame has been materially strengthened. The fuel tank has been removed from in front of the radiator and placed over the engine. This undoubtedly resulted in increased cooling capacity, but the radiator has been enlarged in addition. The fan is now driven by a short belt from the gear-driven pump shaft. On the former model the belt was very long and ran forward from the engine crankshaft and then passed over an idler pulley on which it turned through a right angle to pass crosswise of the frame to the fan pulley at the center. Forged gears and taper roller bearings are now used in the transmission. The engine is provided with larger valves and ignition is by a K. W. magneto. Improvements in the manifolds are claimed to have improved distribution and consequently the combustion of kerosene.

Slight changes have been made in the All Work Second, the smaller model of the Electric Wheel Co. This was originally brought out in 1919 as a California orchard tractor. An oval throttle disk is now used, so that the throttle shaft needs to rotate only through an angle of 60 deg., instead of 90 deg. as required with a circular throttle disk. This has permitted a simplification of the throttle connections. On the All Work model the engine output has been increased by enlarging the valves and changing their timing. Economy in oil consumption has been effected by drilling oil return holes in the piston skirt and changing the oil level so that the connecting rods do not dip so deep as formerly.

On the Rumely Oil Pull tractors a sheet iron shield now encloses the final drive gears, so that the transmission is completely enclosed from the crankshaft to the rear wheels. The reatomizer bushing in the carbureter, which is in the form of a second venturi tube, is now provided with a shelf or an inside flange at its lower end, which has the effect of throwing any kerosene condensing on the carbureter walls back into the center of the air stream. Both the fuel and the water nozzle in the carbureter, which formerly were provided with a series of round spray holes, are now provided with a single straight saw slot each. The new Bosch impulse coupling is used, and as this eliminates danger of back kicks in starting, the magneto is arranged for fixed ignition, being set with about 35 deg. advance.

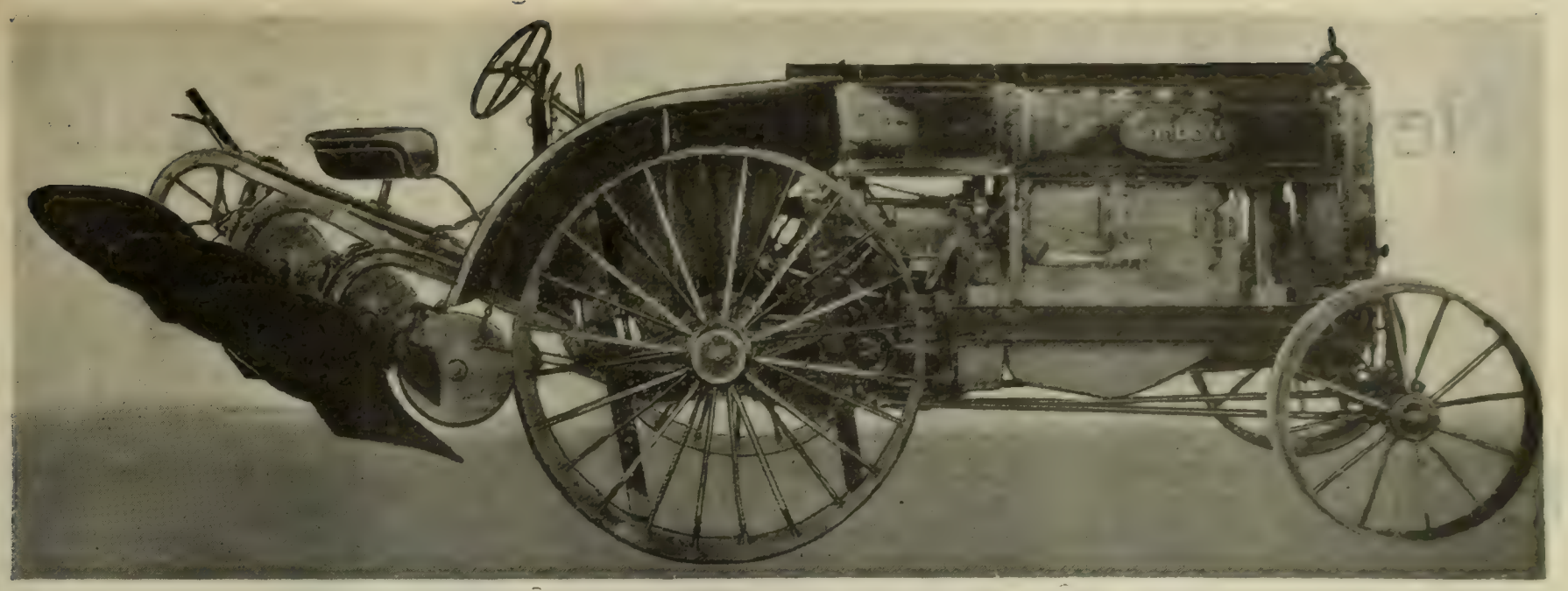
Creeper Attachments for Fordson

The Hatfield-Penfield Steel Co., which has taken over the manufacture of the Henneuse tractor described in AUTOMOTIVE INDUSTRIES of October 21, 1920, also exhibited a Fordson tractor equipped by it with "rigid rail tracks." It is claimed for this attachment that it doubles the drawbar pull of the tractor, eliminates slippage, lowers and narrows the tractor (of importance in orchard and vineyard work) and enables it to work on soft and sandy ground, as in rice fields. The increase in drawbar pull is no doubt obtained largely at the expense of speed, as the bottom diameter of the track driving wheel is materially less than the diameter of the regular Fordson rear wheels.

The track consists of cast steel links so designed that they will interlock when on the ground, forming a smooth, rigid track. There is said to be no movement of the pins while under load, whereby the wear of the pins is decreased. No provision is made for lubricating the track joints, the feature just described being claimed to render this unnecessary. The track links are made of manganese steel. Increased working capacity and decreased fuel consumption per acre plowed are claimed as advantages of the attachment.

Another attachment for converting the Fordson tractor into a creeper type or at least to impart to it some of the advantages of the creeper construction, is known as the Miller Tractread. It consists of seven flat surfaced links joined together so as to form a closed or endless chain which is wound around the tractor wheel. A ring in four segments is bolted to each side of the regular Fordson wheel. These rings are provided with equally spaced pins which insure a positive drive for the wheel as it rolls on the track. The weight of the tractor is carried by the rings as they roll on the inside of the track links, and there is no weight on the driving pins.

To convert the wheel, the flexible track is laid on the ground, the same as a tire chain, and the tractor is then backed onto the track. The pads are lifted around the wheel and the ends of the track are then joined by inserting two pins, one on either side of the wheel. The



London 3-plow tractor with plow

operation is claimed to require only 5 minutes and to be within the ability of any one who can drive a tractor.

Some tests with these tractreads on a Fordson were made at Purdue University and showed an increase in the average drawbar pull from 1400 to 1800 lbs., and of the maximum drawbar pull from 1800 to 2300 lbs., accompanied by a decrease in speed from 2.70 to 2.09 m.p.h. and a decrease in slippage from 13.9 to 0.05 per cent.

London Tractor With Power Lift for Plow

The London Motor Plow Co. exhibited a medium size tractor rated as capable of pulling three 12-in. plows. It is an assembled job, comprising a Midwest four-cylinder 4⅛ x 5¼ in. engine, its original feature being that the plow is in a way a part of the tractor and is raised and lowered by power. One advantage of this is that when the plow is lifted it is suspended from the tractor and has then no influence on the turning ability of the outfit, making it possible to turn in a much smaller circle and thus to get better into the corners of fields.

Other components besides the engine include a Columbia 1¼-in. carbureter, a Siphon air washer, Taco governor, K. W. magneto with impulse starter, S. & J. radiator, Hy-Duty fan and Detlaff dry disk clutch. The transmission, which is of the sliding pinion type, gives two forward speeds of 2.7 and 4.1 m.p.h., the latter being intended for road work. The final drive is by enclosed spur gears at the center of the live rear axle. Ball and flexible roller bearings are used in the transmission and axle. From the rear axle shafts the power is transmitted to the rims of the rear wheels through spring arms which relieve shock and jar.

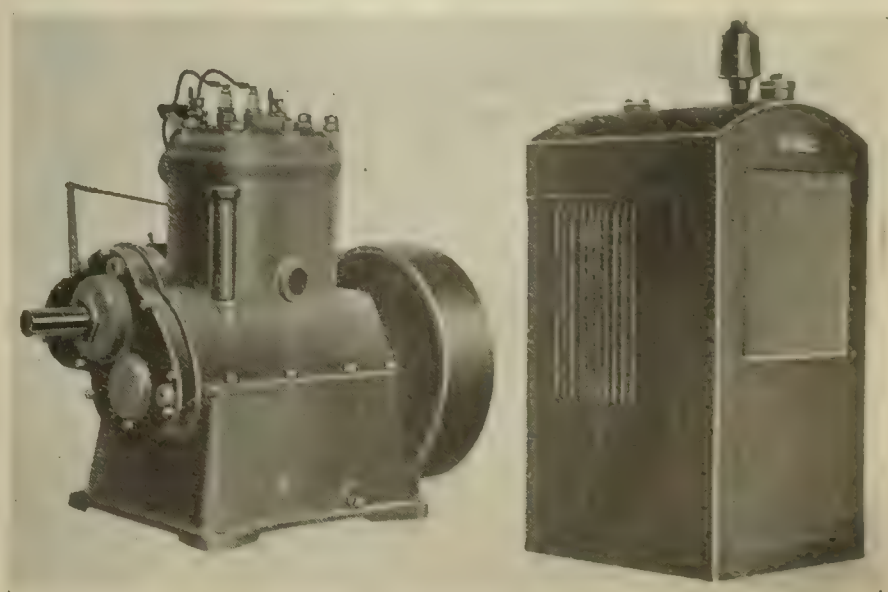
The belt pulley, which is 14 in. in diameter by 8 in. in width, is mounted on the left hand side, 6½ in. above the crankshaft axis, so that the belt will clear the front axle by about 7 in. The pulley speed is 1000 r.p.m. The belt power unit is fitted with flexible roller bearings and is lubricated by splash. There are three pedals on the driver's platform, for the clutch, brake and power lift respectively. The plow is so designed that by the removal of five bolts the third beam can be taken off, thus making it a two-bottom plow for use in extra heavy soil.

Le Roi Stationary Engine

A TWO-CYLINDER engine for general power purposes has been brought out by the Le Roi Company. It has the same cylinder dimensions as the Le Roi four-cylinder engine, which is widely used for motor cultivators and light tractors—namely, 3⅛-in. bore by 4½-in. stroke, and 87 per cent of the parts in the new engine are interchangeable with parts in the four-cylinder. This not only makes for economy in manufacture but simplifies the service problem, as 56 manufacturers in different parts of the country use the Le Roi four-cylinder engine.

A novel feature of the engine resides in the fact that the drive may be taken off at three different points, viz., at either the forward or rear end of the crankshaft or at the camshaft, at one-half crankshaft speed. The camshaft is mounted on ball bearings and is driven through machine cut gears.

The engine is furnished complete with all accessories, including fuel tank, radiator, fan and fan belt. It is fully inclosed and may be run on equipment without the necessity of building a house over it. Equipped and inclosed in this manner it weighs 325 lb. It may also be purchased without accessories and other equipment, and then weighs only 260 lb.

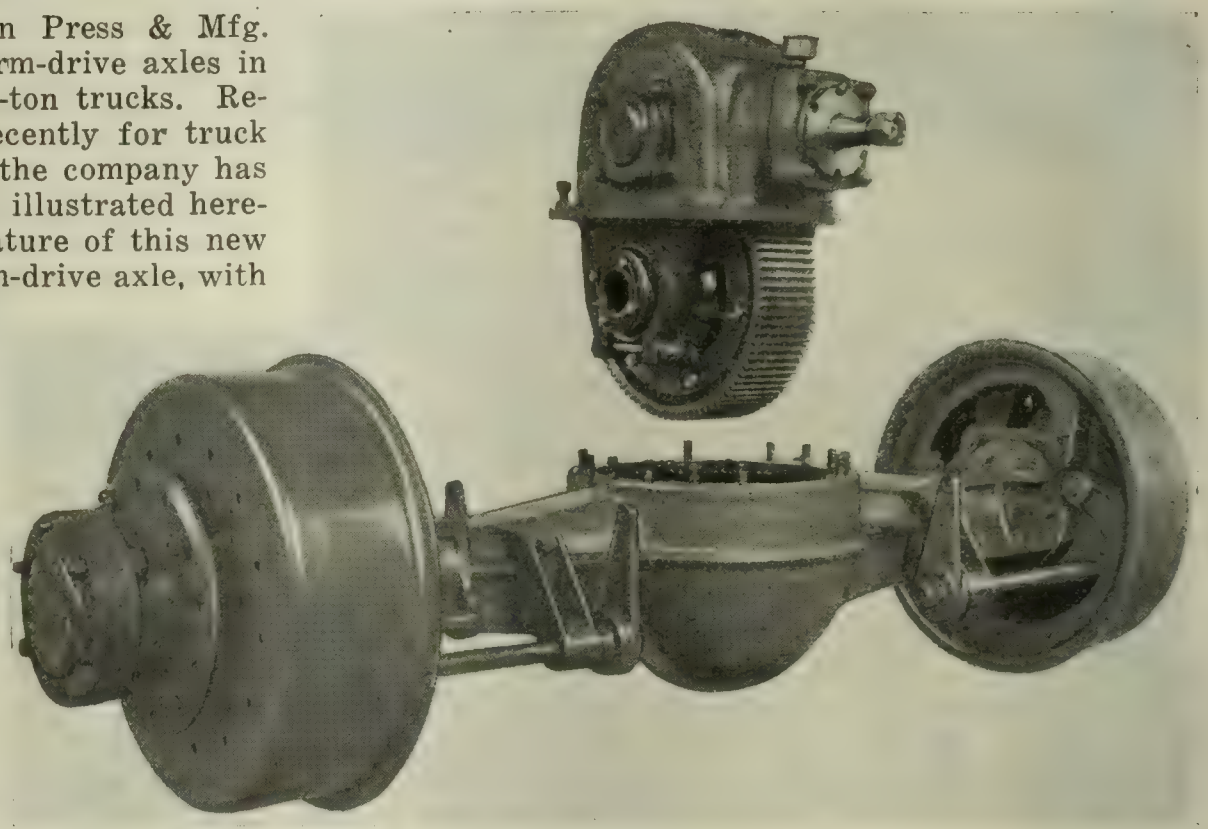


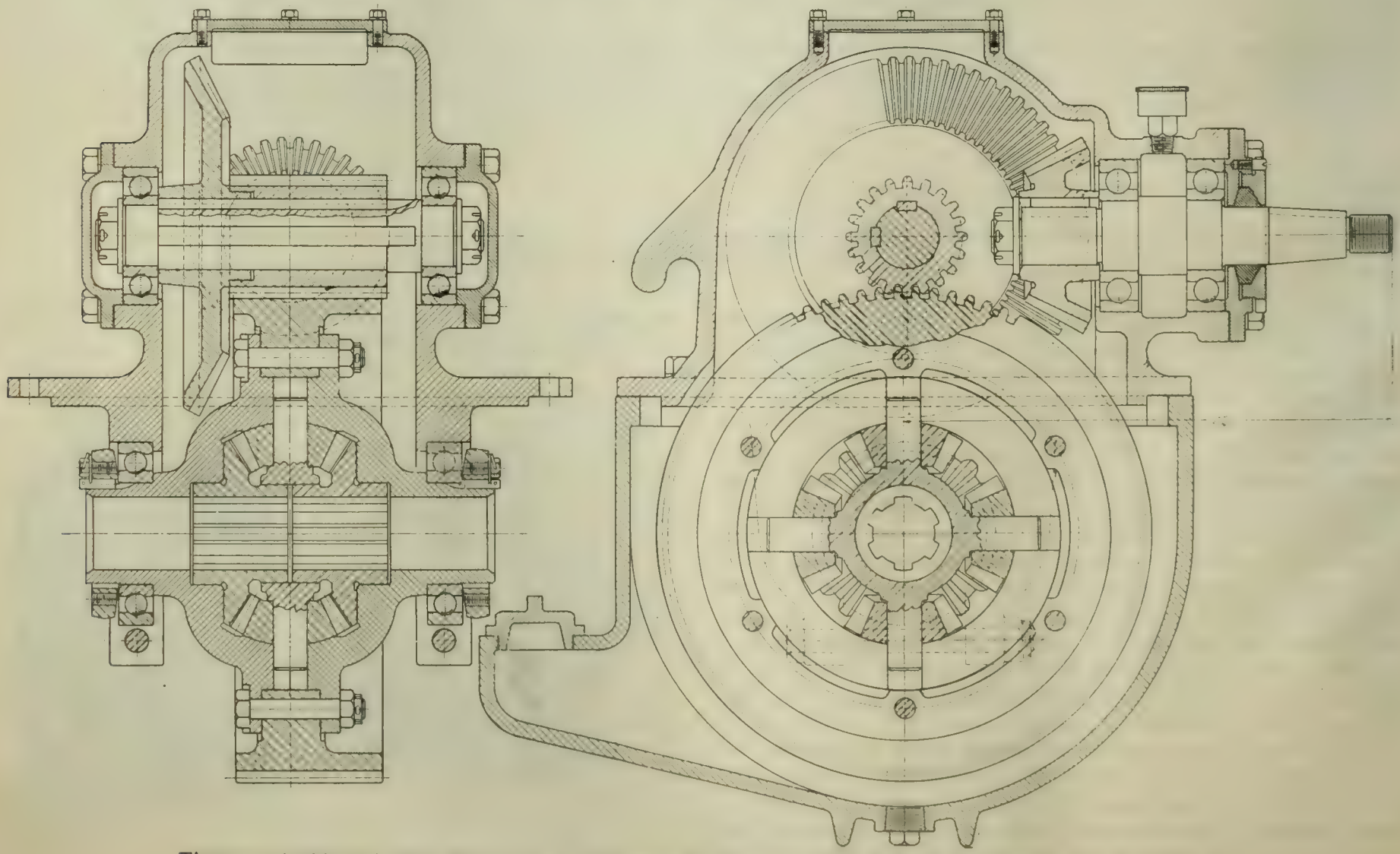
Le Roi stationary engine and cover

New Double Reduction Truck Axle

Manufacturer of worm drive axle adds double reduction design, the two types being identical except for the driving gears in the central housing. The two types of gear carries interchange on the same housing. Double reduction type said to be more efficient than the worm.

HERETOFORE the John Thomson Press & Mfg. Co. has been manufacturing worm-drive axles in sizes suitable for 1-, 2- and 3½-ton trucks. Realizing the demand that has arisen recently for truck axles with other than the worm drive, the company has brought out a double-reduction axle, as illustrated herewith. Perhaps the most interesting feature of this new axle is that it is identical with the worm-drive axle, with the exception of the parts supported by the gear carrier. As shown by the photograph, the housing of cast steel has an opening in the top to which the gear carrier is fitted which carries the differential, worm and worm wheel in the case of the worm-drive axle, and the differential, spur and bevel gearsets in the case of the double-reduction axle. The center distance between axle and driving shaft is the same in both cases. This enables the company to offer customers a choice of either the worm drive or the double-reduction drive; in fact,





Thomson double reduction truck axle. Above—Axle complete with driving gear lifted out of housing. Below—Transverse and longitudinal section through gear housing

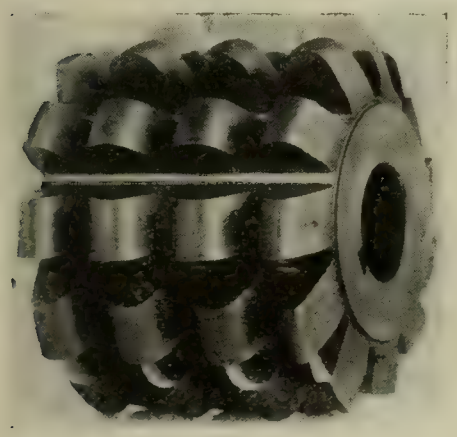
they can supply any customer with axles of both types.

The John Thomson Press & Mfg. Co. claims for the double-reduction axle a higher efficiency than can be obtained from the worm-drive axle in regular operation. An advantage of no mean importance of the double-reduction axle is that the heavy end thrust of the worm drive is eliminated. It will be seen from the illustration that the spur gear of the drive has a very wide face, which should result in long life of the gear as well as quieter operation.

Universal Hobs for Sprocket Teeth

THE principle of generating the teeth of interchange-involute gears from a rack with straight sided teeth is well known, and the application of this principle to the hobbing of such teeth is also well known and well established. Sprocket teeth, however, are still cut almost entirely by the ordinary rotary cutter, the reason being that up to the present time it has been generally supposed that only a limited range of teeth could be correctly cut by a single hob, and that a large number of expensive hobs would be required to properly equip one's shop for sprocket cutting by this means.

The engineering department of the Diamond Chain & Mfg. Co. has worked on this problem for the past year and has succeeded in developing a set of hobs, each of which is capable of cutting all sprocket wheels of a given pitch and roller diameter, irrespective of the number of teeth. This will effect a considerable saving in cutter equipment wherever hobbing machines are in use, since a single hob will do the work that has hitherto required a set of from six to nine cutters. Further advantages result from the greater rapidity with which sprocket can be cut out on a hobbing machine, and the accurate indexing which is characteristic of such machines.



New design hob

These hobs are designed to cut sprocket teeth in conformity with the new "American Standard" tooth form, which has been described in AUTOMOTIVE INDUSTRIES. This tooth form lends itself peculiarly to the hobbing method of cutting, since it neither requires a constant "space angle," as in the British system, nor a constant tooth angle as in some systems in use in this country. Its space angle gradually decreases as the number of teeth increases, and its tooth angle (and hence its pressure angle) gradually increases. The generating action of a hob tends to produce these same changes, although not at the same rate.

The problem of hobbing sprocket teeth differs from that for gear teeth in several respects:

(a) With spur gears the circular pitch is constant for all numbers of teeth. With sprockets the circular pitch decreases as the number of teeth increases.

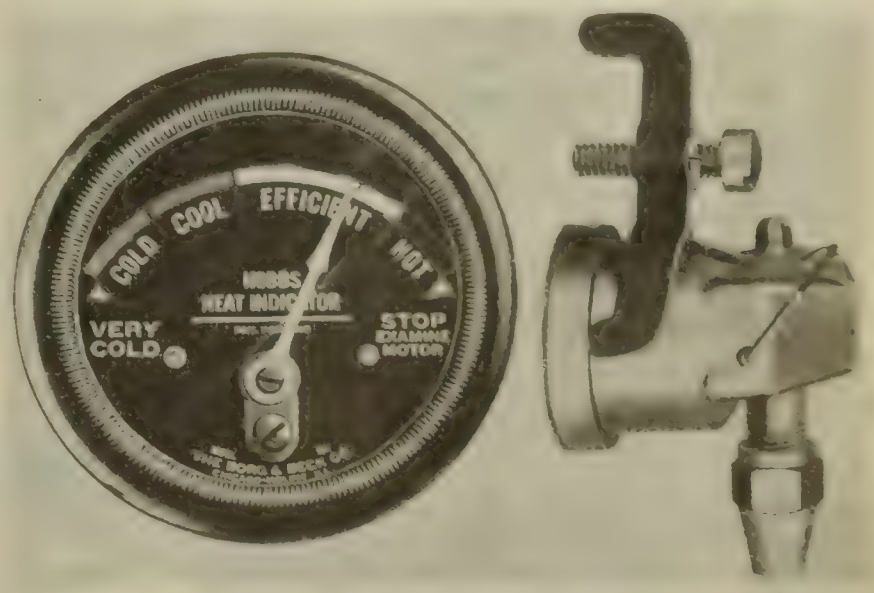
(b) With spur gears the curvature of the teeth becomes sharper as we approach the base circle. With sprockets, it is desirable to increase the radius of curvature as we approach the lower, or acting part of the tooth, and finally to change the curve from convex to concave.

(c) With spur gears, the pitch of the hob is always equal to the circular pitch of the wheel. With sprockets the pitch of the hob is greater than the circular pitch of the sprocket for all over a certain number of teeth, and is less than the circular pitch of the sprocket for all under that number. The imaginary circle which rolls upon the theoretical pitch line of the rack is sometimes larger and sometimes smaller than the pitch circle of the sprocket.

A Theft Proof Heat Indicator

A TEMPERATURE indicator which is mounted on the dash and shows the temperature of the cooling water in the engine jacket is being marketed by the Borg & Beck Co. It consists of three main parts—the main actuating unit, which clamps to the engine cylinder, a flexible shaft and a gage. The actuating unit contains a small, sensitive thermostat, which expands and contracts in direct proportion to temperature changes. Through a gear sector and pinion this thermostat rotates a flexible shaft of the dental type which connects directly to the pointer of the gage.

On the scale of the gage the temperature ranges are indicated by contrasting colors. Thus the operator is enabled to observe the heat condition of his engine at a glance. Among the advantages claimed for this indicator are that it indicates the temperature of the water in the engine jacket rather than in the radiator, that the instrument is adjusted to each individual engine, that it is not exposed to the weather, that the gage is close to the driver and can be easily read by day and night, that by reason of its location it is theft-proof and not liable to breakage and that the instrument is simple and durable. The heat indicator is applicable to the engines of all classes of automotive apparatus and its adaptability to farm tractors is particularly stressed by the makers.



The dash dial and actuating unit of the Hobbs Heat Indicator

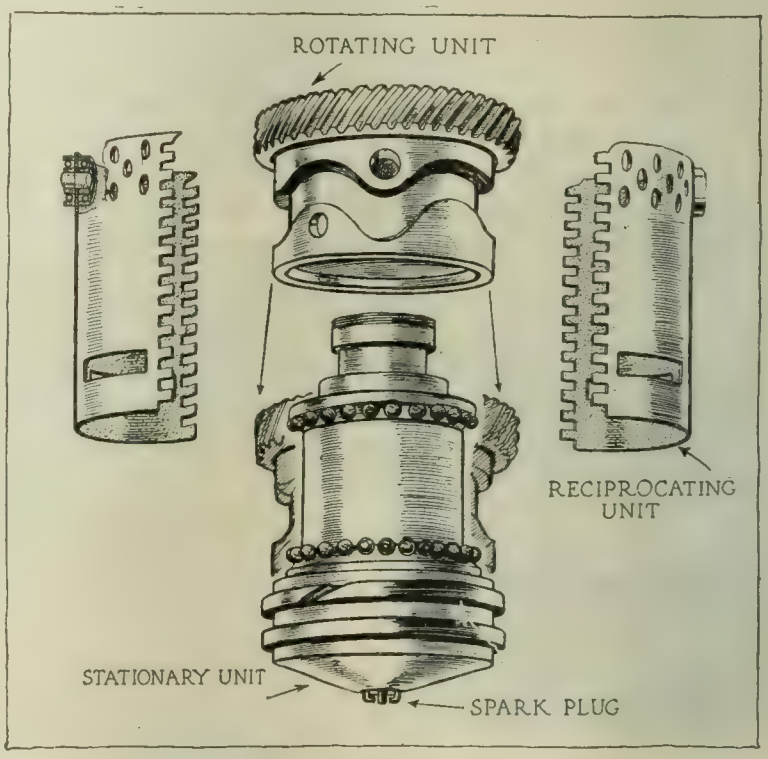
British Maker Adopts New Slide Valve Engine

Has split sleeve 4 inches long, weighing 8 ounces. Located in cylinder head and operates at one-fourth engine speed. Design embodies many unorthodox features. Uniform cooling is a feature. Apart from the valve system the engine has unconventional features which are described here.

By M. W. Bourdon

AT the Olympia Show there was exhibited a new 20-hp. Vulcan chassis having the Howard slide valve engine. The design of the latter embodies many unorthodox features, so many, in fact, that surprise has been expressed that an otherwise so conservative concern as the Vulcan should have entertained the idea of making experimental engines with a view to testing out the system.

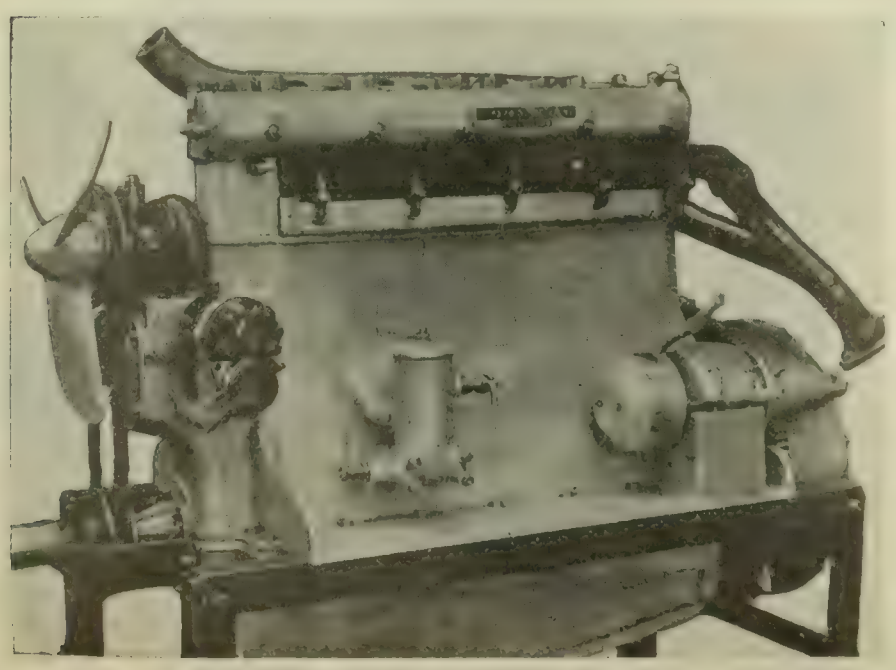
The Howard valve is approximately 4 in. long and is located above the top end of the piston stroke. Referring to the accompanying sketch, the two units forming the valve consist of a light steel open-ended cylinder split vertically and tongued together by square teeth. When the halves are brought together they form an extensible tube capable of expanding in two directions at right angles to its axis. Obviously the halves must be made as separate castings and the first machining operation is the forming of the teeth; next the latter are meshed, the halves are soldered together and they are not separated again until all machining and grinding operations have been completed.



Details of Howard sliding valve and operating mechanism.

Valve Has Reciprocating Motion

The sleeve thus formed weighs 8 oz., is 3/32 in. thick and has ports cut near its lower end, two in each half, 9/32 in. deep and extending all round the whole unit excepting for the ½-in. wide lands between them. The valve has a purely reciprocating motion attained as follows: Driven from the front end of the crankshaft by skew gearing is a vertical shaft rotating a horizontal valve-operating shaft running along the top of the cylinders on the left. This valve shaft has four worm gears each engaging with its fellow riveted to a rotating unit in which is cut a cam groove providing two cycles of valve operation, the gears therefore having a ratio of 4 to 1. The cam sleeve rotates on ball bearings, with races at top and bottom of a fixed head plug, the plug being water-cooled with internal webs supplemented by baffles in the cylinder head jacket to ensure circulation through what would otherwise be a dead end.

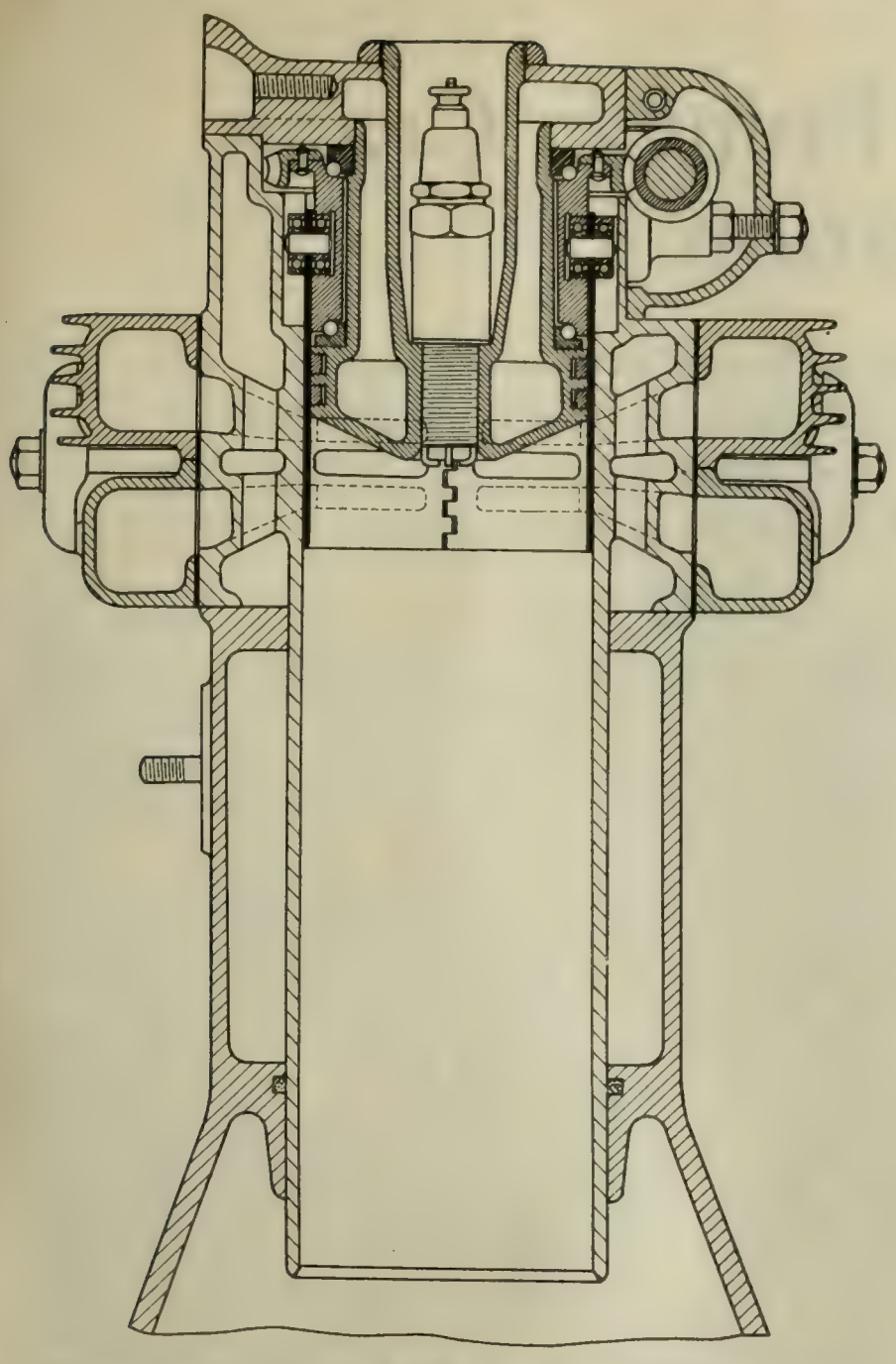


Howard sliding valve engine.

Valve Actuation

On each half-valve are two small ball bearings, one inside and the other outside; the inner one engages with the rotating cam groove, the outer one moving vertically in a short groove formed in the cylinder extension and preventing the valve as a whole from rotating. Around the walls of the combustion space are two rows of four ports corresponding with the single row on the valve, the upper row forming the exhaust outlets into a manifold at each side, while the bottom row are inlet ports also coupled to two manifolds with internally cored passages in the cylinder jackets uniting them and leading to a single carbureter on the right.

The total travel of the valve is ⅝ in., the land between the cylinder ports being 11/32 in. wide, thus allowing of a slight overlap of the 9/32 in. sleeve slots on



Vertical section through cylinder and head of Howard engine.

the compression and firing strokes, when the valve is central and stationary. When the valve ports commence to open on the completion of the firing stroke, there is a residual pressure in the cylinder of approximately 50 lb. per sq. in., and this pressure has effect, it is claimed, in raising the valve for the opening of the exhaust ports without assistance from the cam groove, a claim based upon the fact that the corresponding part of the groove has shown no sign of wear after lengthy use.

Lubrication of the valves and their driving gears is maintained by a lead from the main pressure system to the overhead drive shaft bearings; some of the excess oil exuding from the latter serves for valve, etc., the remainder being returned to the crankcase. The head plug has the usual junk rings to prevent leakage of mixture outward. Piston travel and valve movement overlap slightly at different periods, so assisting in the lubrication of the lower end of the valve by a transfer of oil; but direct overhead lubrication is really depended upon.

Engine Is Unconventional

Apart from its valve system, though necessarily to be considered in conjunction with it, the engine is more or less unconventional in construction. The cylinder water jackets and the upper half of the crankcase are cast as a unit in aluminum, the actual cylinders—a cast iron block—being entered from above with a gasket at the head joint and a rubber ring joint at the base of each water jacket; thus the cylinder barrels have contact with the water.

The Vulcan chassis to which this valve system is applied has four 3½ x 5⅛-in. cylinders. Apart from silence in operation and the other features of merit (absence of valve grinding, springs, etc.) usually associated with sleeve valves, high efficiency is claimed for this design, and far higher piston speeds than are usual with long sleeves. Uniform cooling is said to be a feature, and to permit of compression ratios up to 5 and 5½ to 1 and an m.e.p. up to 114 lb. per sq. in. without detracting from such characteristics as tractability and smoothness in operation under normal driving conditions. As a result a fuel consumption of 0.47 lb. per b.h.p.-hour is claimed, and a power curve running as a straight line from 32 b.h.p. at 1000 r.p.m. to 82 at 3200, with a safe maximum speed of 4500 r.p.m.

The valve timing is as follows:

Inlet opens 15 deg. late; closes 30 deg. late.
Exhaust opens 30 deg. early; closes at top dead center.

This timing, it will be seen, provides a period represented by 15 deg. of flywheel rotation between the closing of the exhaust and the opening of the inlet. The total port area of the inlet as well as the exhaust is approximately 2.7 sq. in.

Oil Pump Operated by Chassis Vibration

A RATHER peculiar form of servo motor has been patented in France by J. B. Barbarou. Referring to the illustration, two sector-shaped weights, which are pivoted on a common axis, are connected together by two coiled springs and also by a balance lever and two connecting links, which compels them to move in unison. Formed integral with the central shaft is a ratchet wheel with which two pawls are adapted to engage. These pawls are pivoted to the two weights respectively and are pressed against the ratchet by small springs.

If the case of this device is secured to a vertically oscillating body, such as the frame of an automobile, the inertia of the weights prevents them from following when the frame drops. The result is that the lower edges of the weights separate, and the motion of the weight on the left through its pawl causes the ratchet wheel to move ahead one or two notches. On the reverse movement, when the spring distends, the other pawl, connected to the right-hand weight, functions in the same way. Thus the ratchet wheel receives an intermittent motion, always in the same direction, from the oscillating weights. If some device which does not have to be operated permanently is keyed to the shaft, such as an oil pump, it will be operated by the oscillations of the chassis.

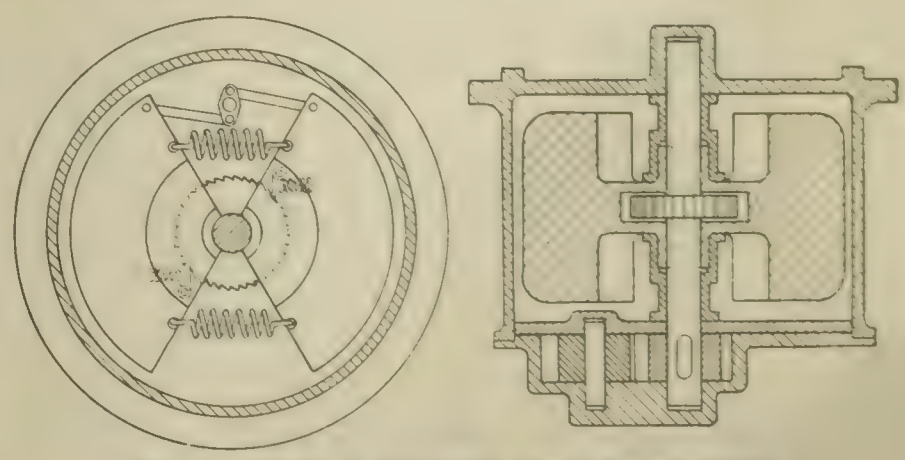


Diagram of Barbarou servo-motor for operating oil pump

An Analysis of a Point in Crank Lubrication

An analytical investigation was made recently to determine the best location for crank pin oil holes. Four aircraft engines, a twelve cylinder and a six cylinder passenger car engine were considered in the work. This article describes in detail the methods used and the results obtained.

AN exhaustive study of the subject of crank lubrication has been made recently by the Engineering Department of the Packard Motor Car Co. By means of an analytical method the best location for the crank pin oil holes was determined. This method was applied to two Packard and two other aircraft engine types and to the Packard twin six and single six automobile engines.

The connecting-rod bearing is subject to the action of three important forces. These are the gas pressure on the piston, which is transmitted through the connecting-rod; the inertia forces which arise from the acceleration or change in velocity of the reciprocating parts, and the centrifugal forces due to the rotation of the large ends of the connecting-rod.

To transmit these forces to the crankshaft properly the connecting rods must be designed to maintain the proper form, operate with minimum friction and have maximum wearing qualities. The method of determining the best oil hole location consists in studying the pressure distribution on the crank pin. Bearing loads are determined for 24 evenly spaced crank positions covering a whole cycle or two crank revolutions. Diagrammatic representation of these loads for various engines are given in Figs. 1, 3, 5, 7 and 9. The pressure distribution on the crank pin is indicated by Figs. 2, 4, 6, 8 and 10. These diagrams are polar diagrams, and the radii from the center points indicate both the direction and magnitude of the pressure on the crank pin.*

The study of six different engines operating under various conditions of speed gives a very clear idea of the nature of crank-pin pressures.

Figs. 2, 4 and 6 show the results obtained for four different aircraft engines. The first two figures mentioned refer to V-type engines and the latter to ordinary designs in which there is only one connecting rod to a crank pin. In these engines the gas pressures are the dominant forces; consequently, the highest pressures on the crank pin occur during the power stroke, and on the trailing side of the crank pin.

In the V-type engine the crank-pin pressure distribution during this period of the cycle is more nearly uniform than in the straight engine. For the latter, the maximum pressures occur at the beginning of the power stroke, and gradually diminish toward the end of the stroke to between 1/3 and ¼ of the maximum value. For the remainder of the cycle the pressures are confined to a region on the under side of the crank pin, and are comparatively small.

In Fig. 8 is shown the pressure distribution for the Packard twin-six engine. Although this engine is of the V-type, so far as crank-pin distribution is concerned, the effect is the same as in the ordinary single six, on account of the side-by-side mounting of the connecting rods.

These pressures obtain at comparatively high speed (2750 r.p.m.), which give somewhat of an inverse condition to that for the aircraft motors. Here the inertia and centrifugal forces are so great that during the power stroke the gas pressures are almost entirely neutralized, with the result, as shown in the diagram, that the maximum pressures occur on the under side of the crank pin.

With a decrease in speed, the pressure distribution becomes similar to that for the six-cylinder aircraft engine.

In Fig. 10 is shown the crank-pin pressure distribution for the Packard single-six engine when running at a speed of 2400 r.p.m. In this case the proportion of gas pressures to inertia and centrifugal forces is somewhat greater than for the twin-six, and, consequently, a more uniform pressure diagram obtains during the power stroke.

It will be noted that in every case there is a region on the crank pin which is not loaded during any part of the cycle. The extent of this unloaded portion varies somewhat with the different engines, but its position on the crank-pin surface is always substantially the same.

Theoretically, placing of the oil hole anywhere in this region should give the results sought. In the aircraft engine it has been observed that the maximum pressures occur during the power stroke, and inasmuch as the direction of load changes at the point of explosion, the point of contact between the connecting rod and its bearing is then transferred from the under side of the crank pin to the upper side.

During this change, the clearance in the bearing is naturally transferred to the opposite side, which results in a trapping of the oil present between the surfaces where the clearance becomes a minimum. It is, therefore, essential that the oil hole should be so located that a plentiful supply is present in the bearing just previous to explosion. This location for aircraft engines of the V-type is probably in the neighborhood of that shown in Figs. 2 and 3, which is 45 deg. from the vertical. For the six-cylinder aircraft type 30 deg. from the vertical is probably a more suitable location. Passenger-car engines operate under somewhat different conditions from aircraft engines, and for such engines 45 deg. from the vertical is probably the most suitable position for the oil hole.

*The relation between the two diagrams of each set may not be directly apparent. The first diagram indicates by the length and direction of its radii the magnitude and direction of the load on the crankpin bearing. If the radius extends vertically upward, for instance, the load on the crankpin bearing is vertically upward. In the second diagram the direction of the load is shown with relation to a certain point on the circumference of the crankpin. Owing to the fact that the crankpin turns, that portion of its circumference in any particular direction from its axis is constantly changing, and it is this that accounts for the difference between the two diagrams of each set.

In the case of the Vee engines, point 1 indicates the dead center position at the end of the compression stroke of a cylinder in the left hand block (looked at from the front, or from that end from which the crank appears to be turning right-handedly), while in the case of the six cylinder engine point 1 marks the dead center position at the end of the compression stroke.—Editor.

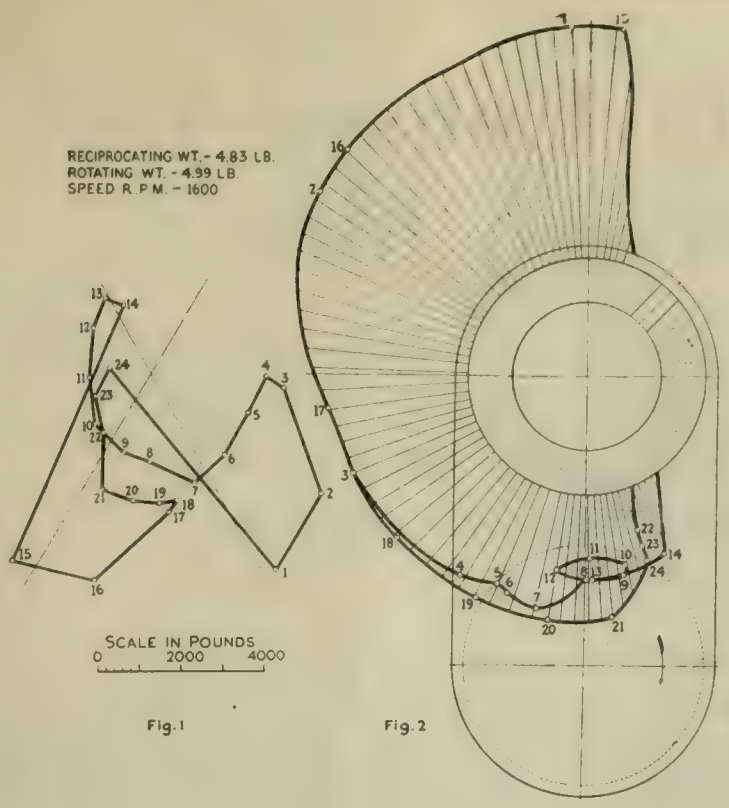


Fig.1

Fig.2

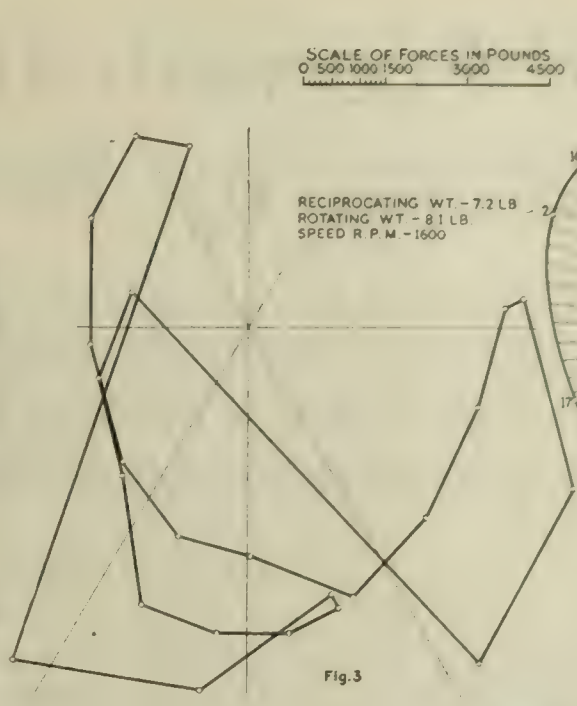


Fig.3

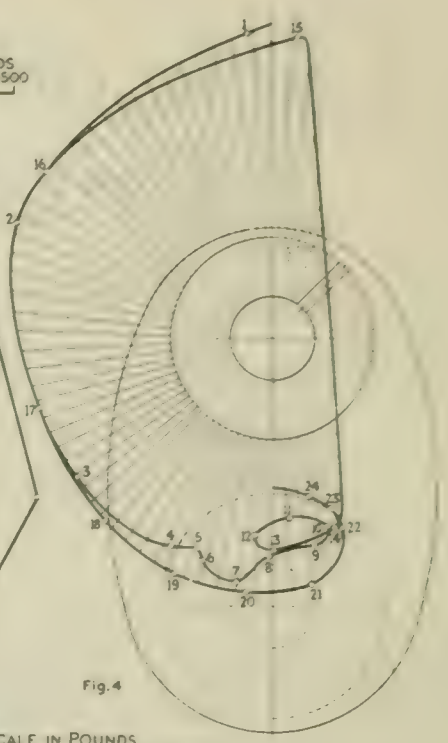
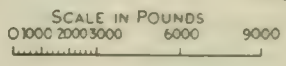


Fig.4



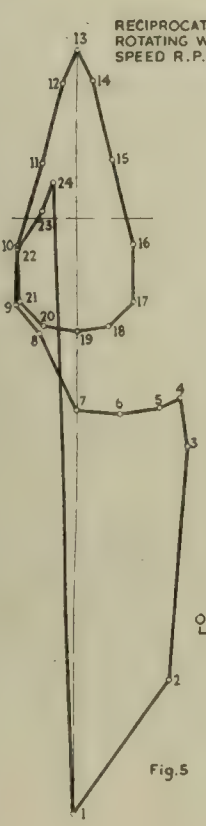


Fig.5

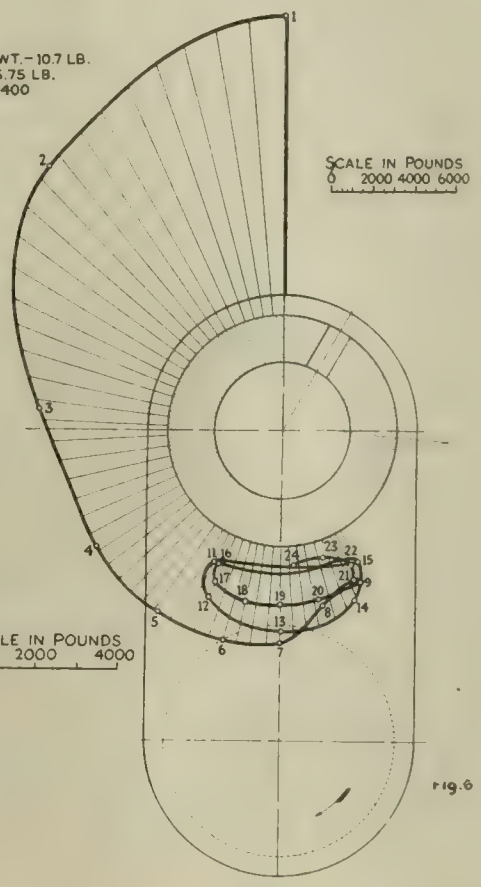


Fig.6

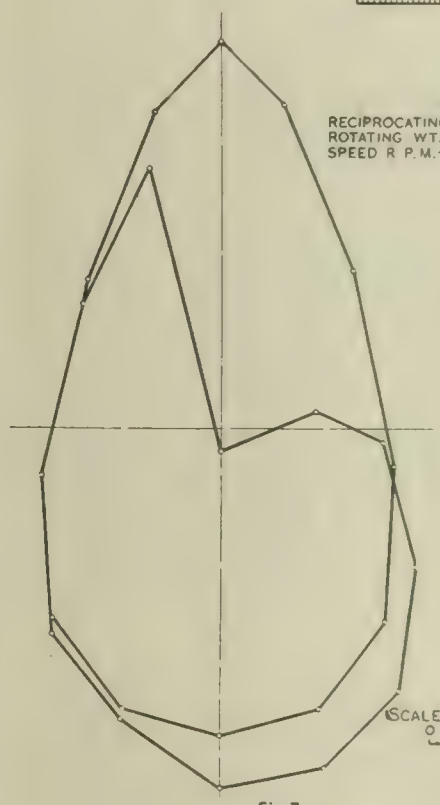


Fig.7

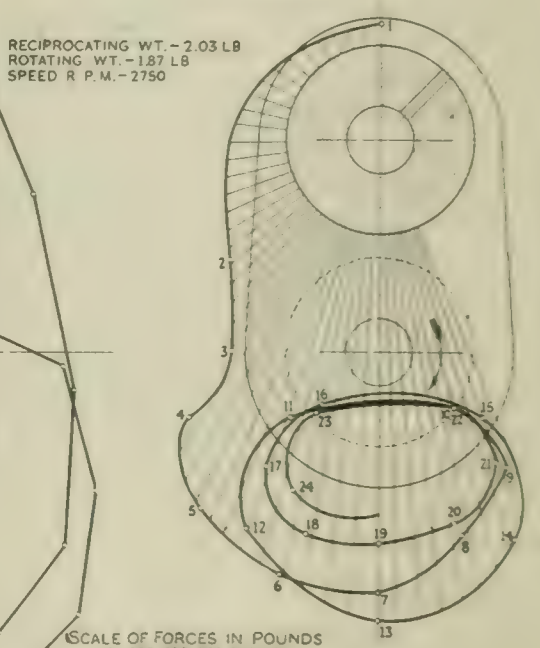


Fig.8

Fig. 1—Total combined loads due to all forces acting on Crank pin--Packard 1A-744 and 1A-116 Aircraft Engines.

Fig. 2—Distribution of pressure on Crank pin—Packard 1A-744 and 1A-1116 Aircraft Engines.

Fig. 3—Total combined loads due to all forces acting on Crank pin—Packard 1A-2025 Aircraft engine.

Fig. 4—Distribution of pressure on Crank pin—Packard 1A-2025 Aircraft engine.

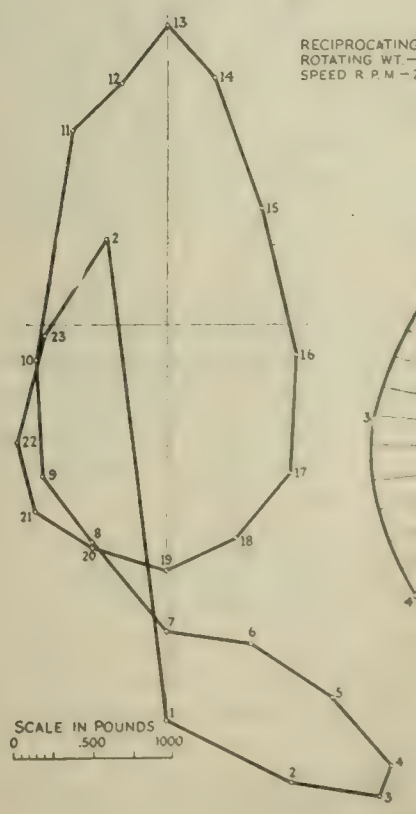
Fig. 5—Total combined loads due to all forces acting on Crank pin--Packard 1A-1551 Aircraft Engine.

Fig. 7—Total combined loads due to all forces acting on Crank pin—Packard 325 car engine.

Fig. 8—Distribution of pressure on Crank pin—Packard 325 car engine.

Fig. 9—Total combined loads lue to all forces acting on Crank pin—Packard 116 car engine.

Fig. 10—Distribution of pressure on Crank pin—Packard 116 car engine.



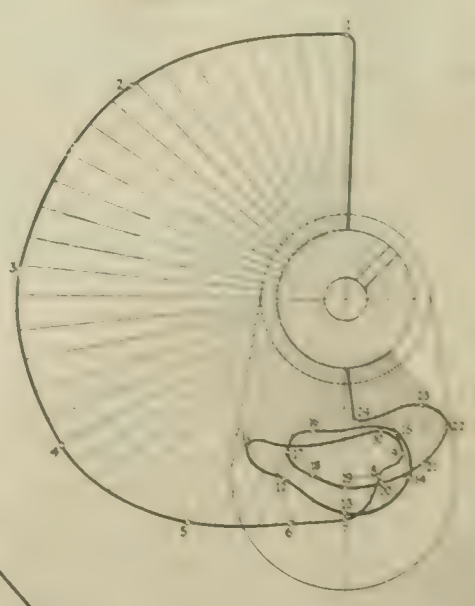


Fig.10

Lack of Accessibility Causes Just Criticism by Service Men

Failure of manufacturer to appreciate the need for accessibility and convenience in facilitating repair work renders service expensive and causes corresponding dissatisfaction to user who must pay the bill. Many concrete examples of increased cost due to inaccessibility are pointed out.

By B. M. Ikert*

IT is gratifying to those engaged in the maintenance of automotive vehicles that designers are giving more attention to accessibility of the units in the modern motor car. We are beginning to see the day when car parts will be so accessible that one unit can be removed readily without necessitating the disturbance of other units. The time will come when a car owner will not be required to pay a bill of some $35 to have a 10-cent Woodruff key put into a shaft and gear. Cars now are being built so that a relatively inexperienced mechanic can make a coupling replacement on a magneto or distributor drive without danger of upsetting the timing. It must be made possible for a mechanic to get at a repair job in a normal working position in the cars to come, as against a condition requiring him to twist his body and arms into almost unbelievable shapes. Operations that formerly required 4 hours to do must be cut in half. It may mean only the changing of the position of a bolt to make it more accessible, or the provision of a little more room between any two units to allow a mechanic to get at the parts.

Flat Rate Service

Much has been said and written of late about the fixed-price or flat-rate system of selling service to the car owner. It is not within the province of this paper to discuss the flat-rate system, except perhaps to mention that it is rapidly getting a good foothold throughout the country and it would not be surprising to see it used universally within the next 3 or 4 years. However, it is certain that the general adoption of the flat-rate system can be hastened greatly if automotive engineers and car builders will design and build their cars so that justifiable prices can be established readily for any given operation.

One of the chief difficulties with many of our cars at present is that on a comparatively insignificant repair job many hours of labor are required to remove and replace units before the job itself can be done and the car turned over to the owner. Under such conditions it is extremely difficult for a service station to establish a fixed price that seems commensurate with the nature of the job. How, for instance, can a service man explain to a car owner that 23 hours of labor was necessary to take up the wear in a rear main bearing on one of the popular-priced cars, whereas it should be but a matter of about 3 or 4 hours ordinarily? The time element in making repairs is important. Very often the parts to be installed cost only $1 or $2, but the time required to install them is so great that the price for the work is out of proportion. One finds frequently that car makers could materially reduce the time element for service operations on their cars by spending a few cents more per car. Interference of parts has been the chief obstacle in getting certain repair jobs down to a reasonable time basis, and many a service manager has had to make an endless amount of explanation for this to some irate car owner. Someone has said that "knowledge of the other fellow's job leads to a better mutual understanding." Perhaps there is a direct application of this in the case of the automobile engineer and the automobile dealer's service man. The easiest thing for the service man to do is to antagonize the product of the engineer and, likewise, it is easy for the engineer to criticize the service man for his apparent lack of ability to do repair work properly. Both are right at times.

All of us realize that there are many intelligent service mechanics in the automotive business, men to whom automobile dealers are indebted for holding the good will of their customers. Many of these men have enough engineering knowledge to be able to analyze the faults in a car intelligently and do it in such a way that the owner of the car will not be completely disgusted over having bought it. Service mechanics have to tear down and rebuild cars day in and day out, and in the course of their work they naturally come in contact with certain things in the construction of cars that are troublesome. A mechanic of great experience said a short while ago that the best thing the factories ever had done for the dealers' service departments was to make good liars out of the men employed therein. Perhaps this man overstepped the mark somewhat; his point was that the mechanics, while they realized well enough the faulty construction or inaccessibility of certain units, would not and could not tell the car owner about them for fear of putting future sales in jeopardy.

Accessibility

It is impossible in a paper of this kind to consider the entire structure of a motor car and attempt to cite good and bad points of design as they affect accessibility in repair work. It is realized fully that to change existing constructions on some cars would mean almost a complete retooling of the factory; the installation of new jigs, fixtures, dies and the like. Therefore, any criticism in the following paragraphs which may be directed at engines or cars is offered with this point in view. The major thought is to indicate the things of which service station mechanics complain most frequently, when they

*Condensed from a paper presented at a recent meeting of the Society of Automotive Engineers. The author is Technical Editor of *Motor Age*.

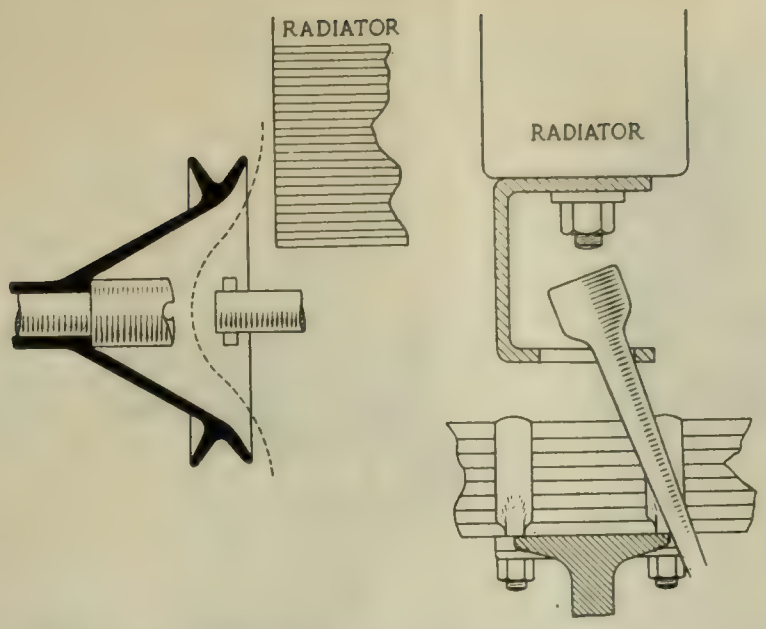


Fig. 1—Two difficulties frequently encountered in making repairs on the front end of a car

have to tear down or reassemble any of the units. It is likely that we shall never have 100 per cent accessibility in our cars. A motor car is made up of just so many necessary units and, if we make some certain one accessible, this probably will have been done at the expense of the accessibility of some other. Also certain units may seem accessible at the time of assembling the chassis in the factory, but when body and fenders are added the reverse is true. It is this condition with which the service station has to deal. Recently I looked at an engine that was very accessible out of the car and when in an engine-stand, but when in the car the engine was hung so low and had so many accessories heaped around it, such a multitude of wires, control rods, carbureter hot-air pipes and the like to obstruct the movements of the mechanic that all the efforts of the engine designer to secure accessibility were nullified.

Some 25 items peculiar to a considerable number of American cars are touched upon in the following paragraphs. These were chosen at random and exist in varying degree on other makes of car. Some of the things discussed cannot be classed under the general head of either accessibility or inaccessibility, and yet they are problems with which the service mechanic must come into contact more or less every day.

Aging of Castings

Opinion has been prevalent among repair men, service mechanics and cylinder regrinders during the last year or so that cylinder block castings have not been allowed to age enough before machining them. The same is true of cylinder heads. Naturally, the result is a warping of these parts when the car is put into use. The chief offenders along this line seem to be the six-cylinder engines, wherein the blocks are fairly long and therefore apt to distort more than would be the case with a shorter block. Those who are called upon to do much cylinder work in service stations state that one of the chief difficulties with the small six-cylinder engine is the ineffective cooling of the cylinder walls at certain points. Cylinders are apt to become hotter and wear more due to distortion when a Siamese joint is used than when so cast that the water is in contact with the walls all the way around. This condition is made more aggravating in a green block, and a service station mechanic obviously has much difficulty in trying to solve such a problem when the car probably has not gone over 1000 miles. This, then, is a case in which the manufacturer must do his part, either by sufficient aging of the blocks or by heat treating them, which is costly. A service station mechanic may be ever so good a workman, but he can do little with a twisted or distorted cylinder block and, what is worse, he has a harder time trying to explain matters to the customer.

In some engines the pistons do not overrun the bores at the top and bottom positions of the stroke, and there is then a tendency for the pistons to wear shoulders in the top and the bottom of the bores. The wearing of these shoulders is accelerated when the piston cocks in the cylinder, due to warpage, misalignment and other causes. Some engine designers are fitting longer pistons to offset this and, in addition, they design the engine so that the piston over-runs the bore top and bottom. Further, it is claimed that bringing the piston below the bore offers a good chance for excess oil to be whipped off of the piston skirt. Naturally, the service mechanic is not in a position to change existing design conditions in an engine, but if the maker gives the right thought to cylinder blocks, pistons and rings, the service man is much better able to cope with so-called oil pumping engines, fouling of spark plugs and the like.

Bolts, Capscrews and Nuts

In tracing out some of the more flagrant cases of inaccessibility we find that thousands of dollars and hours of labor could be saved annually in the upkeep of cars if makers would locate bolts, capscrews and nuts so that mechanics could use speed wrenches on them more readily. A double end wrench generally will do better work than a monkey wrench, but the speed wrench that has a socket incorporated in it to fit over a nut or capscrew completely is best of all, not only in securing a good hold but in reducing the time required to remove or replace the part. The most common difficulty in this connection is that bolt heads or nuts are placed too close to fillets or to surfaces running at right angles to the top and the bottom of the nut. This means that a mechanic cannot get at the nut or bolt with a socket wrench and therefore must use something else. This is made especially difficult where nuts are exposed to mud and water, as they are on front axle spring-clips. A recent test on the removal of nuts, which had become more or less rusted to the clips, showed that it required almost 2 minutes to remove the nut with an open-end wrench. On another car, where the layout permitted the use of a socket wrench, the same size of nut was removed in less than one-half minute. There are other places on the chassis where nuts and bolts are placed

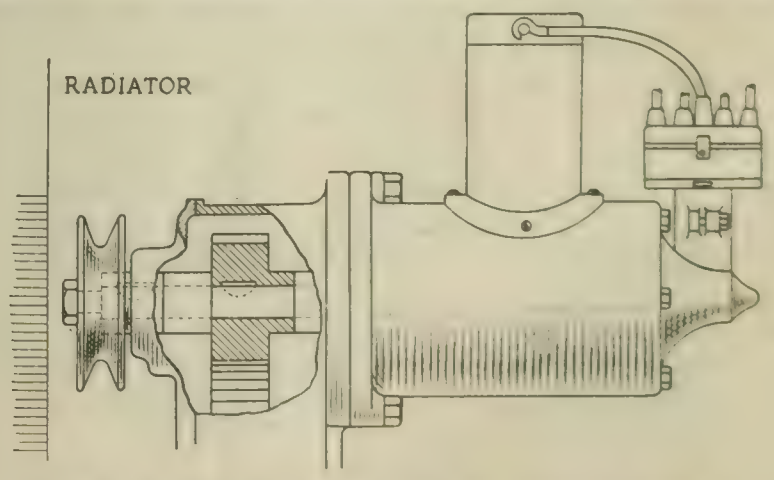
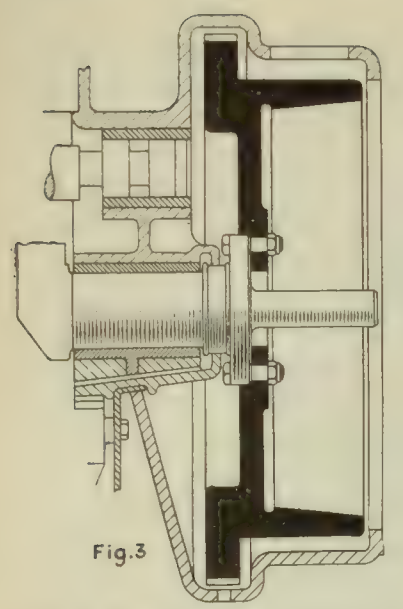


Fig. 2—In this particular case the radiator must be taken off, the fan pulley and the timing gear-case cover removed and the gear pulled before the generator and the shaft can be removed

in positions awkward to reach. Thus, cases are on record where spring bolts cannot be reached with either an open-end or a socket wrench because of the interference of mufflers, brake-operating rods and the like. In one instance the maker had not provided sufficient open-



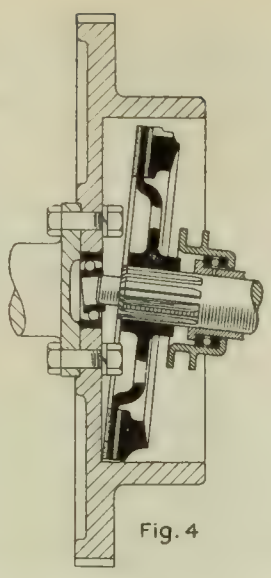
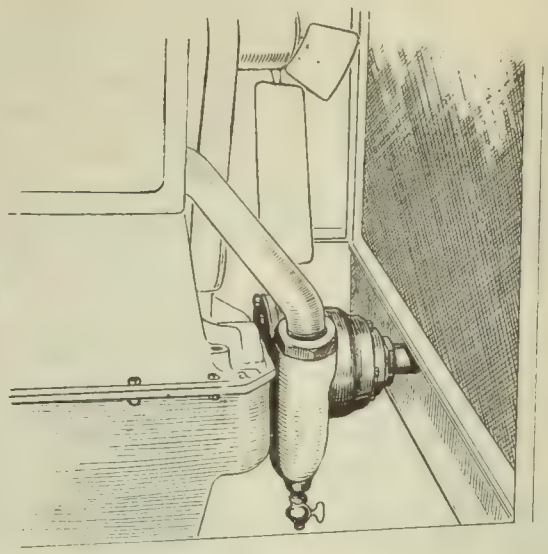


Fig. 3—Sectional elevation of a flywheel which cannot be removed until the crankcase is dropped, the connecting rods disconnected and the main bearing caps removed. Fig. 4—It is difficult to insert the clutch pilot shaft in this case because the bearing tilts in the flywheel



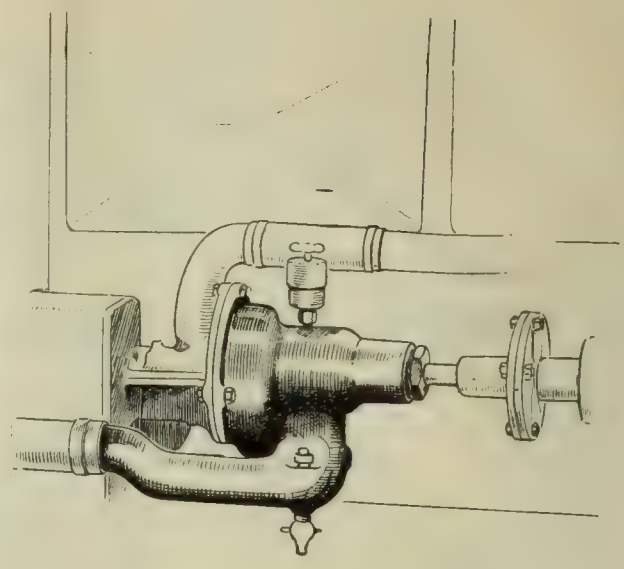


Fig. 5—Two examples of pump installation. The pump at the left placed on an extension of the crankshaft is difficult to get at when the gland requires repacking. The pump at the right is readily accessible

ing in the running-board splasher; so to remove the bolt in the front of the rear spring it was necessary to take off the running-board and splasher. The hole in the splasher was just large enough to permit lubrication; it would not allow the complete withdrawal of the bolt! How can a repair man explain to a customer that it is necessary to charge him for removing and replacing the running-board and splasher to install a new bolt?

One of the most frequent jobs in a service station is that of valve adjusting or grinding. Valves are accessible in general, except that the valves at the extreme ends of the set on some L-head engines are so close to the walls of the valve chamber that adjustment is difficult because the mechanic cannot give a good swing to the wrenches. Fitting a longer valve chamber cover would allow the wrenches to sweep over a wider range.

Dashboard Instruments

When the word "inaccessible" is mentioned to a service mechanic, among the first things he thinks of are the disposition of the instruments on the dash and the manner in which they are connected. It would cost but a few cents more per car to install somewhat longer wires on the switch, ammeter and fuse block, slightly longer copper tubing on the oil gage and longer choke wire; but this would mean a vast saving of time in the service station, because it would permit the mechanic to remove the panel usually having the instruments mounted upon it, withdrawing the whole assembly to a comfortable working position. As it is now, a mechanic must twist his body into every sort of a shape to get behind the instrument board. It is even worse when there is a tank in the cowl because very often the tank must be removed. It seems that a hinged instrument board is worthy of consideration by the car builder, because it would make it unnecessary even to remove the instruments to inspect them. It would not be necessary to have the entire board on hinges; in fact, part of it probably would need to be kept stationary to support the steering column as is done in most cars now.

In connection with making the wires more accessible, mention is made of the desirability of allotting definite colors to certain electric circuits, so that the same circuit can be identified readily on every make of car, once a man knows which circuits the colors indicate. As it is now, it is difficult for a mechanic to trace out a circuit when there are from 5 to 8 wires coming out of a piece of circular loom, all wires having the same color and appearance. Wiring diagrams are not always available and the problem often becomes acute in shops where all makes of car are worked upon. For instance, if a mechanic knew that all black wires designated the starting motor circuit; red wires, the ignition; green wires, the lamp circuits; yellow wires, the generator, ammeter and battery circuits, and blue wires the horn circuit, his problem would be lessened immeasurably. Many will recall that in former years one maker of an ignition system used red, yellow and green wires on the magneto and coil, and that the units were marked with the letters R, Y and G to show just where the connections were made. Some makers are using colored insulation on the wires for the various circuits, but no attempt has been made to standardize the colors for all cars.

General Take-up Adjustment

Much of the work in a service station is devoted to eliminating squeaks and rattles, some of which are difficult to locate at times. One car has a tube extending across the frame at the rear of the car. On the inside of this tube is a rod threaded at both ends so that the whole assembly can be tightened by drawing up on the nuts on the outside of the frame. The tube also supports the tire carrier. There is just enough play between the rod and the inside of the tube so that the rod vibrates at certain car speeds, strikes the walls of the tube and, because the tire carrier acts much like a sounding board, sets up a decidedly unpleasant rattle that is very difficult to locate. A slight kink given to the rod overcomes this.

Body squeaks are common, but frequently they can be overcome by tightening the body bolts. Here, however, difficulty sometimes is encountered in that the maker has used common carriage bolts sunk into the body sills. The nuts on these bolts often become rusted in place and, when the mechanic attempts to tighten or slacken the nut, the entire bolt turns and there is no way to get hold of the head of the bolt. Sometimes the bolt can be reached, but in such cases nothing is gained unless a square or hexagon head bolt is used. In most cases, also, the body bolts extend through the top flange of the frame only. This often makes the use of a socket wrench impossible, especially when units such as the muffler are placed alongside the frame at this point. Where a body bolt is extremely difficult to get at, a hole drilled in the bottom flange probably would allow quick access to the nut.

To overcome rattle in the brake operating shafts the shaft can be placed inside a sleeve, the shaft operating one set of brakes and the tube the other. A coiled spring

placed between the arm attached to the shaft and the tube takes up any end play automatically.

Removal of the steering gear is not the easiest job on most of our cars. The redeeming feature here is that this job is not often necessary. The job of removal becomes relatively easy when the gear is mounted on top of the frame, but when mounted between the frame and the engine, the engine does not permit the withdrawal of the gear housing and the drop-arm shaft. The latter can generally be removed by loosening the engine in the frame or dismantling the gear.

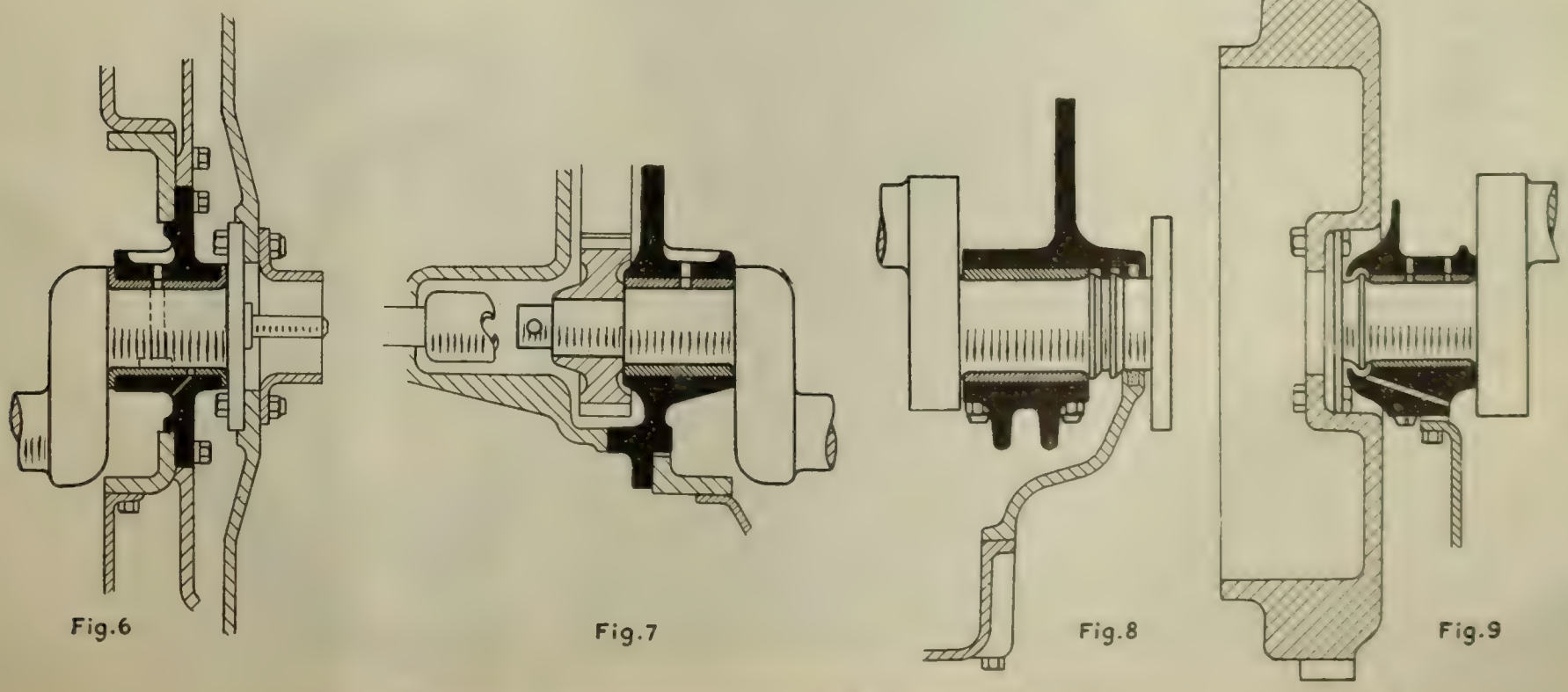
We have seen much better brake layouts within the last year or so, and much has been done to make adjustments easier. However, one criticism of brakes is that some makers are inclined to use stock for the contracting band that is too light. This does not hold its shape as well as a heavier band; often, when brake lining is riveted to such a band, the band will assume the shape of a polygon, caused by the hammer blows at each point of riveting. Obviously, such a brake band will not be as satisfactory as one which is bent to a true circle.

Inaccessible Parts Necessitating Dismantling

It is difficult for service men to understand why any maker should hide the vacuum tank in the cowl. Although vacuum tanks give very little trouble, there are times when they must be removed and there does not seem to be any good reason why the tank should not be mounted on the engine or at least on the engine side of the dashboard. The tank on one car is mounted in the latter position, but the bolts have been located so inaccessibly that it is virtually impossible to remove the tank. The plan of mounting the tank on the engine seems to be working out very well, inasmuch as the tank vibrates with the engine in this case and there is little danger of having the fuel lines crack off because of differences in vibration that often occur when the tank is located on the dash. Also there might be a more general use of coils in the copper tubing to prevent breakage due to vibration. Probably the greater proportion of service work is on engines. A few cases will be cited in this connection in which a little thought on the part of the engine designer will be of great benefit to the service station mechanic. The job of installing a fan belt very often runs into considerable cost because of the slight clearance allowed between the fan pulley and the radiator. Fig. 1 shows this situation as it exists on one of the popular cars. The dotted line shows the course which must be followed by the fan belt when installing it on the pulley. This car uses a heavy V belt and there is insufficient room between the radiator and pulley to allow it to pass. This means the loosening of the radiator, which mechanics are loath to do on this particular car because of the difficulty of getting the nuts back on the radiator studs. The illustration shows why. A hole is provided in the bottom flange of the cross member carrying the radiator, but a socket wrench cannot be used because the hole is in a direct line with the I-beam of the axle. Consequently, the wrench enters at an angle and cannot strike the nut. The remedy seems to lie in using a longer bolt extending through the bottom flange, with a spacer between the two flanges.

On still another make of car the radiator must be drained, the hood removed, the radiator stay rod disconnected, the hose connections broken and the radiator removed to take the generator off. This is necessary because the generator is mounted on the back of the timing gear case with its shaft extending through the case and has the fan pulley mounted on the other end, as shown in Fig. 2. The fan pulley must be pulled off and the generator drive gear removed before the generator can be slipped out of position. It appears that something in the nature of an Oldham coupling should be used between the generator and the drive gear, so that the generator could be slipped out of position without affecting the other units. The reason the radiator must come off is that there is not enough room between it and the end of the shaft to allow the fan pulley and the gear to be slipped off.

On one engine used in a number of light cars, the main and connecting rod bearing caps must be removed and the crankshaft and flywheel dropped as a unit before the flywheel can be taken off. This was observed recently in a service station where a car using this engine came in with several of the flywheel teeth stripped. Fig. 3 shows why the lower crankcase has to be removed, the bearings disturbed and the shaft and the flywheel taken off together. The flywheel housing follows the contour of the wheel too closely and is further dropped at the open end, evidently to accommodate the No. 5 S. A. E. bell housing. Even if flywheel bolts are removed, there is not enough clearance to slip wheel through housing.



Examples of good and bad practice in main bearing installations

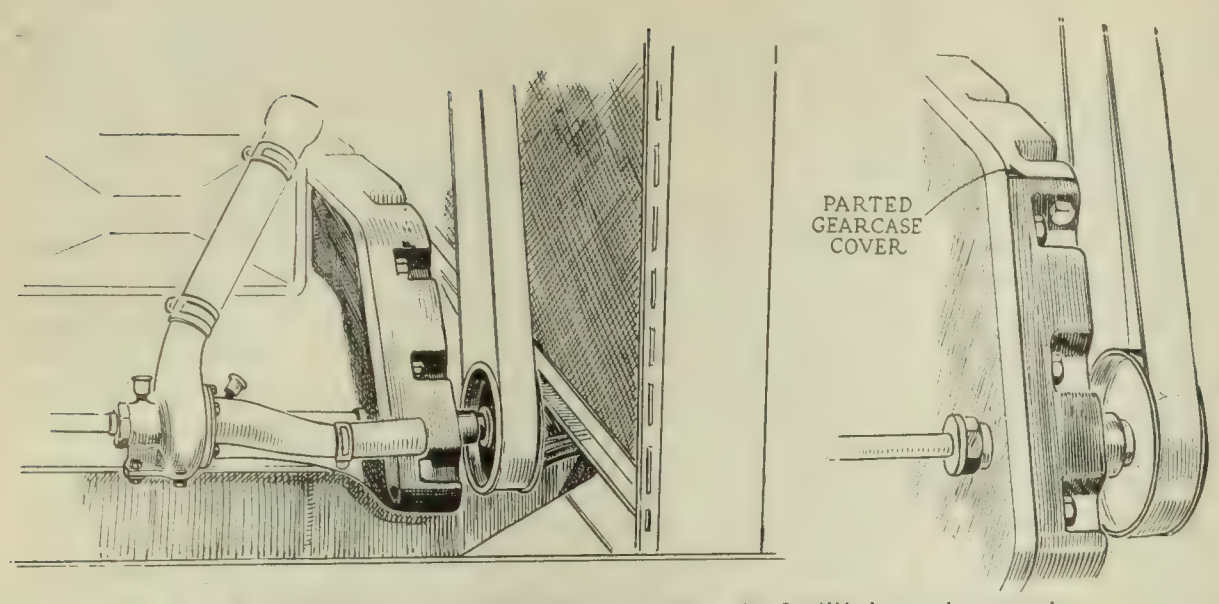


Fig. 10—Providing a parted gearcase cover to facilitate replacement of the pump drive gear key has reduced the maintenance cost materially in this case

There is an instance of a maker using a self-aligning bearing in the flywheel as a pilot bearing for the clutch shaft. It so happens that when a repair man has to slip the clutch assembly into place, he cannot lift the rear end sufficiently to allow the clutch shaft to enter horizontally into the pilot bearing. The self-aligning feature of the bearing makes the job difficult because the inner member cocks and no amount of coaxing will help. Mechanics say that when this job is necessary they simply file the end of the clutch shaft enough to make a loose fit. This construction is shown in Fig. 4.

Some car makers apparently try to hide the water pump as much as possible, thus making the job of repacking the glands difficult. Pumps often are placed too low on the engine, as in the left view of Fig. 5. Here the radiator really ought to come off to permit a good job when repacking the pump. The location of the pump shown at the right is good. The gland is very accessible and the unit has been mounted high enough on the side of the engine to make for ease of maintenance.

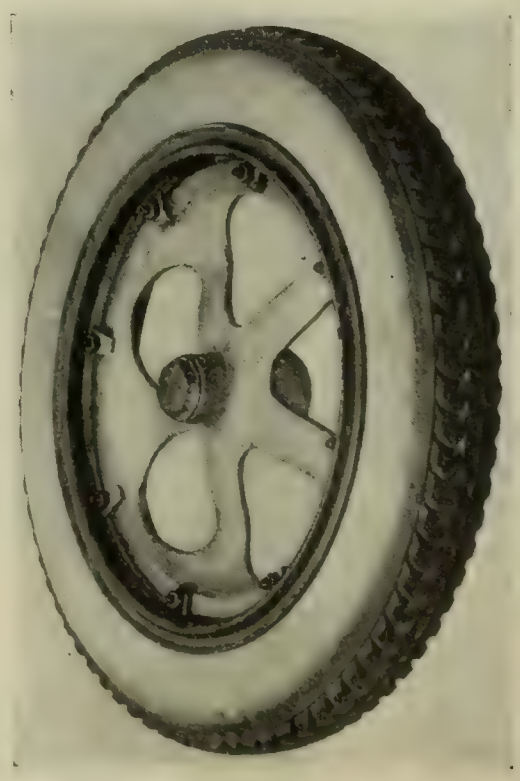
The job of getting at the main bearings on some engines is easy, but it is exceedingly difficult on others. For instance, it costs about $35 to take up the wear in the rear main bearing on one popular make of car. The reason for this is that the bearing is of the split type (see Fig. 6) and is held in an end plate on the rear of the engine crankcase. To remove the bearing halves for filing, the entire engine has to be taken from the car, the timing gear case cover removed, the crankcase gear pulled, the rods disconnected, the flywheel removed and the plate holding the bearing taken off. The crankshaft and rear bearing can then be taken out through the back of the crankcase, and the bearing can be dismantled. It is small wonder that this job is expensive. No provision is made on this same engine to take up wear in the front main bearing. This is a solid bushing (see Fig. 7).

Fig. 8 shows the very accessible rear main bearing layout used on another popular car. It will be noticed that the removal of the lower half of the crankcase brings the bearing cap into as accessible a position as could be desired. Another bearing layout that is difficult to get at is shown in Fig. 9. Here the flywheel shape and bolts do not allow the cap to come off unless the bearing bolts are raised sufficiently. The real job, however, lies in getting the bolts back into the holes, because a wire must be bent to take the heads of the bolts and the bolt heads must be juggled into position. Some type of flathead bolt on the flywheel would help.

Fig. 10 shows how one builder made it possible to save many hours of labor on the job of putting in a new key on the water pump gear. In the old construction it was necessary to take off the radiator, the entire timing gear case cover and several other parts to get at the key eventually. The newer models are made with a parted gear case cover so that only one end of it need be removed to get at the gear. This was a distinct step toward the saving of time and money on service.

Cast Steel Wheel for Pneumatic Tired Trucks

THE West Steel Casting Co. has brought out a light express wheel for pneumatic tired trucks. The wheel is adapted to 34 x 5 in. tires and employs the demountable rim. It is of cast steel, weighs 37 lb. without tire and rim, and has its material so disposed as to give considerable lateral strength. The wheel is dished and has reinforcements at the hub and periphery. The outside appearance gives the impression of a solid spoke. This wheel has been adopted for a new high speed truck put out by a prominent Cleveland company, while other truck manufacturers have the wheels on test at the present time.



A new cast steel truck wheel

AN announcement from the Engineering Experiment Station of the University of Illinois states that applications for appointments to Research Graduate Assistantships must be received before March 1. The assistantships are maintained to extend the field of engineering research and preference is given applicants who have had some practical engineering experience following completion of their undergraduate work. Ten vacancies exist at the present time. Additional information may be secured by addressing C. R. Richards, director of the station, Urbana, Illinois.

A Simplification in Making Sheet Metal Pressings

By the use of an hydraulic bag the need for a male die is obviated. For making fenders and similar parts the female die can be made of cast iron, with only sufficient tooling to remove the roughness of its surface.

IN the manufacture of such sheet metal parts as automobile fenders by the conventional methods it is necessary to have both a male and a female die, or a die and a punch as they are sometimes called. For such large pressings the expense of the dies is naturally a big item, especially if only a moderate number of the pressings are required, and numerous attempts to reduce the cost of the dies have been made recently.

A process of making such pressings which seems to hold out promise of material savings on the cost of dies has been worked out in Australia and is known as the Hydro Press process. Efforts are now being made to introduce it into this country. While it is obvious that the saving on the cost of production due to the elimination of the male die looms larger in countries where cars and bodies are produced on a smaller scale than they are here, nevertheless the process should be of interest to our manufacturers.

In the Hydro Press system the female die is of cast iron and requires only to be tooled sufficiently to remove any roughness in the casting so as to give a smooth and even surface. The place of the male die of the old system is taken by another cast iron die containing the bag-cavity; this only requires to be shaped sufficiently to insure that the surface of its top edge shall fit truly to the surface of the bottom edge of the female die; and, in place of an accurately fitting male die, there is placed in the bag cavity a reinforced rubber bag capable of being expanded by the injection of water under high pressure.

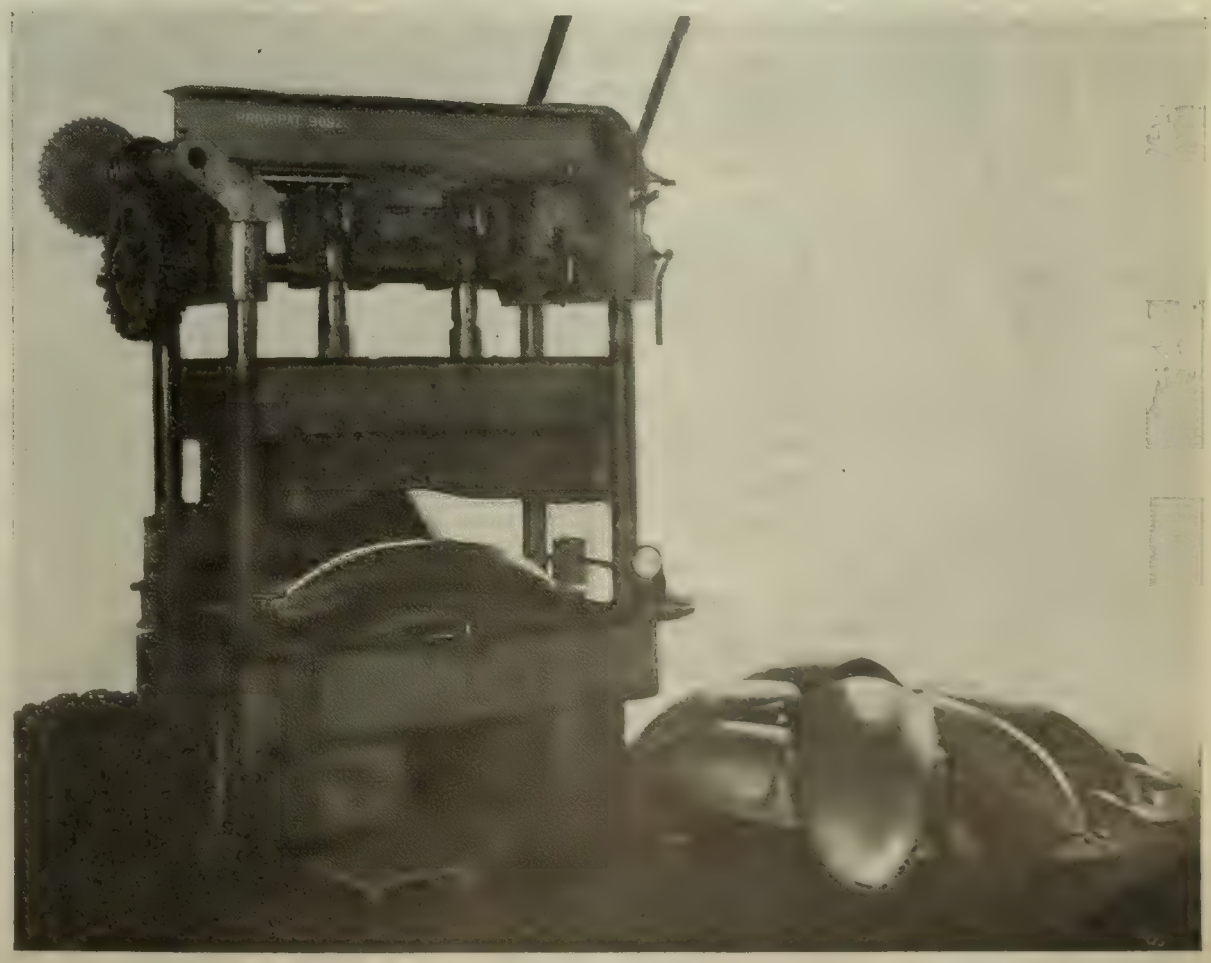
The necessary plant for the Hydro Press system is said to be cheap and simple, and it is claimed that certain types of machine at present in use in many factories can be adapted readily for the purpose.

The Hydro Press Company's machine consists of strong uprights, carrying overhead gear which operates a shaft with two eccentrics or cranks to which the female die is attached by two connecting rods. The female die is thus raised and lowered by the movement of the shaft; when lowered it closes on the bag-cavity die, the re-inforced rubber bag being in position.

The sheet of metal to be pressed to shape is laid on the rubber bag. The metal female die, which grips the edges of the sheet between itself and the edges of the bag-cavity, is lowered by the operation of the cams. The tap of the single pressure main is then turned on by the operator, and the resulting expansion of the bag forces the metal to the shape of the female die. (The normal working pressures used in Melbourne by the Hydro Press Co. vary from 300 to 750 lb. per square inch.) The pressing to shape of the metal sheet is a matter of moments, and the release of water and the separation of dies enables the completed work to be replaced by another sheet of metal.

We understand that the Hydro Press Co., Pty., Ltd., the proprietor of the patents, has been operating the system in Australia for about two years. For the first 18 months it confined itself to the production of automobile body panels, of which it turned out 5200 for one firm. Lately it has taken up the manufacture of aluminum kitchen wear by the same process.

ACCORDING to German patent No. 307,611, a cheap absorbent material for cleaning and polishing purposes can be produced by treating spinning paper waste with alkali and letting the alkali solution dry on the paper. The absorbent capacity of the waste is thus improved and the paper waste, moreover, has a rust-preventing effect on iron. Generally such paper rags facilitate the recovery of oil, because, when boiled, they form lye, and the impurities of the oil are absorbed by the lye and the paper fibers, while the oil floats.



Press of the Hydro Press system, with some of its products

Initial Milling Operations Speeded Up

Development of continuous milling has enabled manufacturers to proceed with initial operations on cylinder blocks and other heavy castings as rapidly as with other work in the plant. The following article describes one machine which has been developed for this special purpose.

By J. Edward Schipper

IN any production layout there is usually one machine or one process that is slower than the other processes. The rate at which the work can proceed through that machine or process is what determines the rate of production of the entire shop. In automobile engine manufacture this has generally been the initial milling operation. This has been particularly true on cylinder blocks where it is necessary to take, even off the most closely molded casting, a rough and finish cut on three and sometimes four sides of the block. Once having passed through the rough and finish milling operations, which really rough out the cylinder block and start it on its way through the production line, the other operations, which are far lighter in the amount of material taken off and far more susceptible to simple jigging and location, proceed rapidly.

Within the last two or three years, however, this condition has been changed. The development of continuous milling has brought the initial operations on cylinder blocks or other heavy castings to a point where the work proceeds as rapidly in this department as it does in others, and a material increase in the production possibilities has been made, although the space required has actually been decreased. There are several reasons for this increase in efficiency. The first is the use of the continuous principle which enables the machine to be constantly operating in one direction, with reloading proceeding while the machine is cutting on another piece. This has, of course, been made possible by the use of the rotary type of miller in place of the planer type, which carried the blocks on a long table and required a quick return mechanism during the period in which the machine went back to its initial position for a new cut. The rotary type of miller is applicable in a great many instances, and, where it is possible to use it, it cuts down the floor space required to an enormous degree. This is apparent by an inspection of the illustrations herewith.

Another development has been the use of double cutters, one taking the roughing cut and the other the finish cut on the same machine. Thus, one setting up of the machine and one clamping of the piece is all that is necessary for the double operation. A number of these milling machines have been made by the Davis & Thompson Co. of Milwaukee. These have been made with milling cutters up to 16 or 18 in. in diameter and are adaptable to a great variety of purposes. Fig. 1 shows one of these machines in operation on the Herschell-Spillman six-cylinder blocks. As will be seen, the rotary table on this machine carries nine six-cylinder blocks. Both ends are milled at the same time.

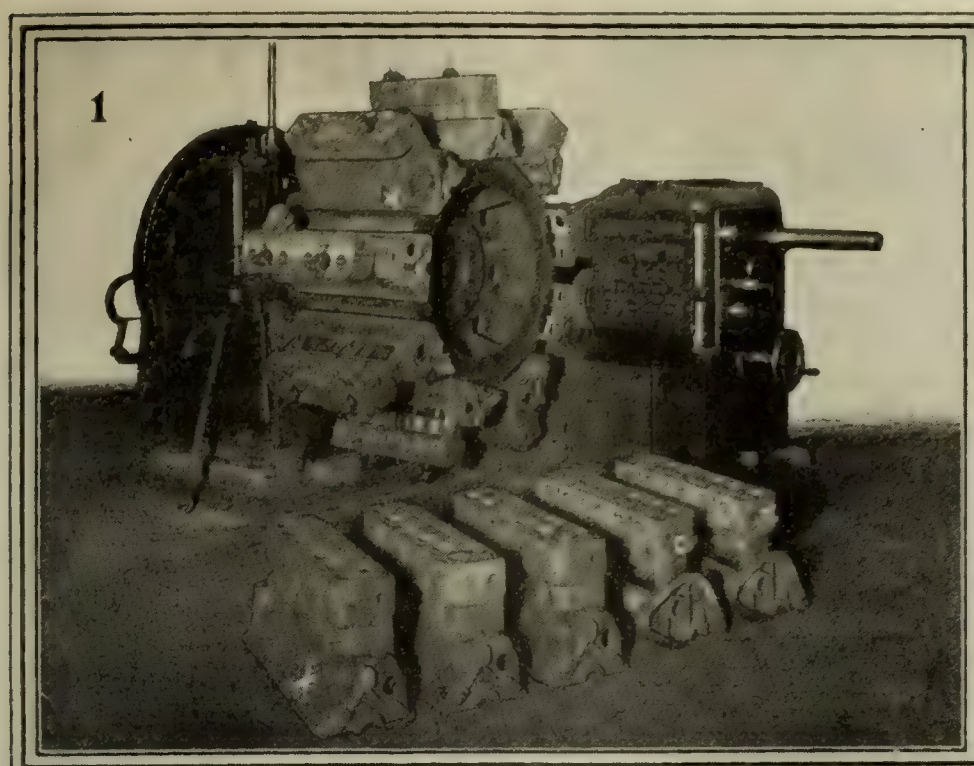
This same type of milling machine is used on the Ansted engine for the Lexington cars and, in the latter factory, is so arranged that nothing will interfere with the use of an overhead crane to apply the work to the work drum. An installation of this same machine is used at the Chevrolet factory to mill the ends of the Chevrolet blocks. This is a similar type of installation, the end fixtures being steel, hardened and ground and act as pistons, entering the cylinder block to locate it accurately. The operator simply slips the slotted clamp in place, tightens the nut and the blocks can be milled to micrometer measurement. On this type of installation the production runs 60 to 80 an hour.

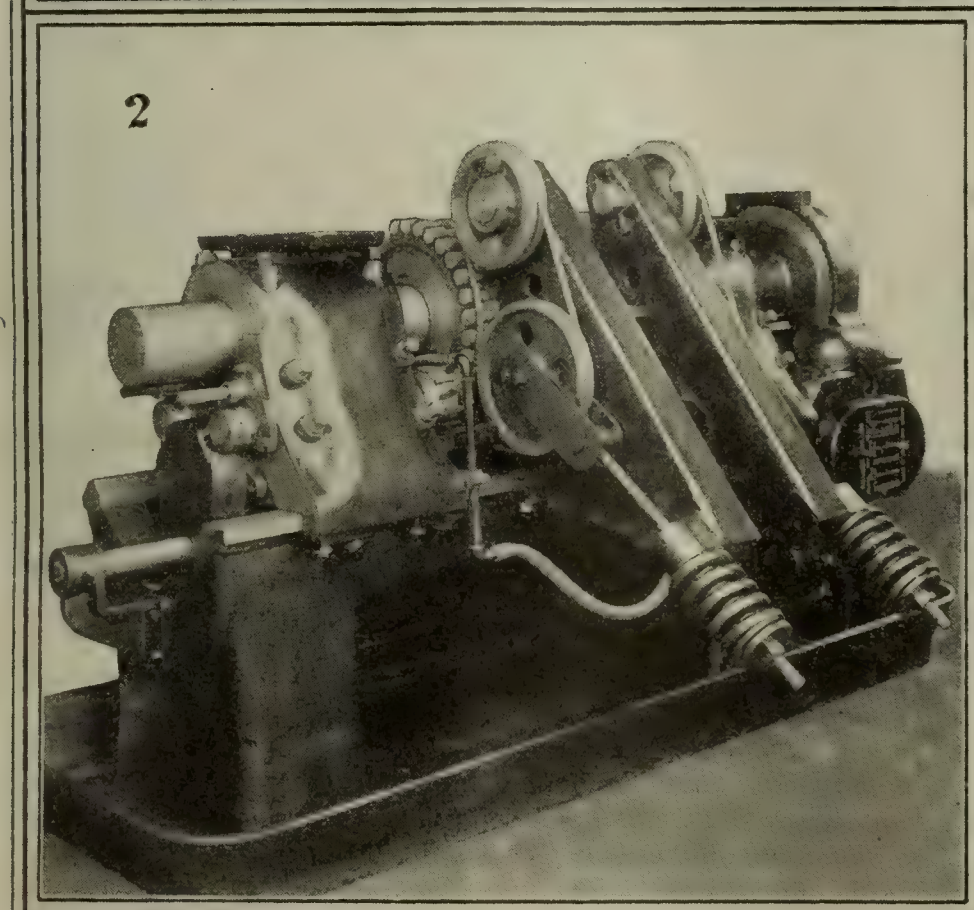
One of the features of this type of machine is that a large variety of work can be done, particularly on the No. 3 machine, by having extra work drums which can be changed in a few minutes. It is only necessary to remove six bolts to take off the work drum and, consequently, this replacement is easy. An adaptation of the Davis continuous milling machine is used for milling simultaneously both ends of the Fordson tractor crankshaft. The holding fixtures on this particular installation are extremely simple. The shafts are laid on the work mandrel flange and crank-handle end alternately and are centered by hardened steel blocks. One set of slotted clamps holds each shaft. The operator, consequently, needs only to tighten the nuts when the shafts are ready to be milled. The production runs from 75 to 95 crankshafts per hour on this installation.

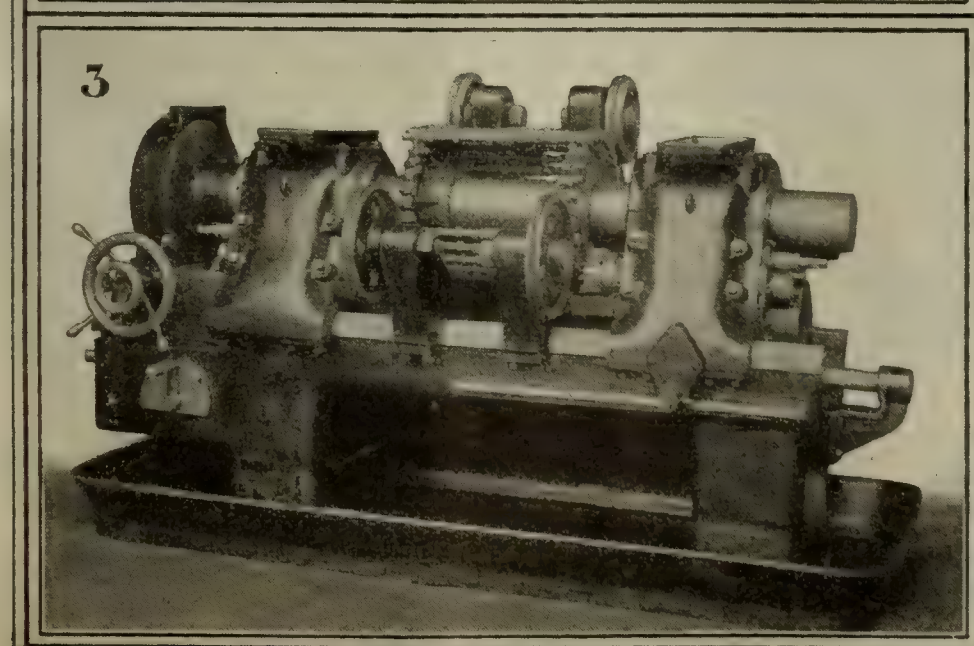
One of the most interesting developments which has been made recently is the use of rope clamping on this machine. Figs. 2 and 3 show the rope clamping method as applied to the end milling of the Chevrolet camshaft. With this installation it is possible to go as high as 360 camshafts per hour. The machine is at present turning out 300. As will be noted, all the operator has to do is to drop the camshaft into the V block and the clamping is taken care of automatically by the wire cable which is under tension around the pulley. The heavy coil springs shown in Fig. 2 hold the tension on the rope cable and, consequently, firmly hold the camshaft in the V block while the milling operation is taking place. A great many adaptations of this machine have been made.

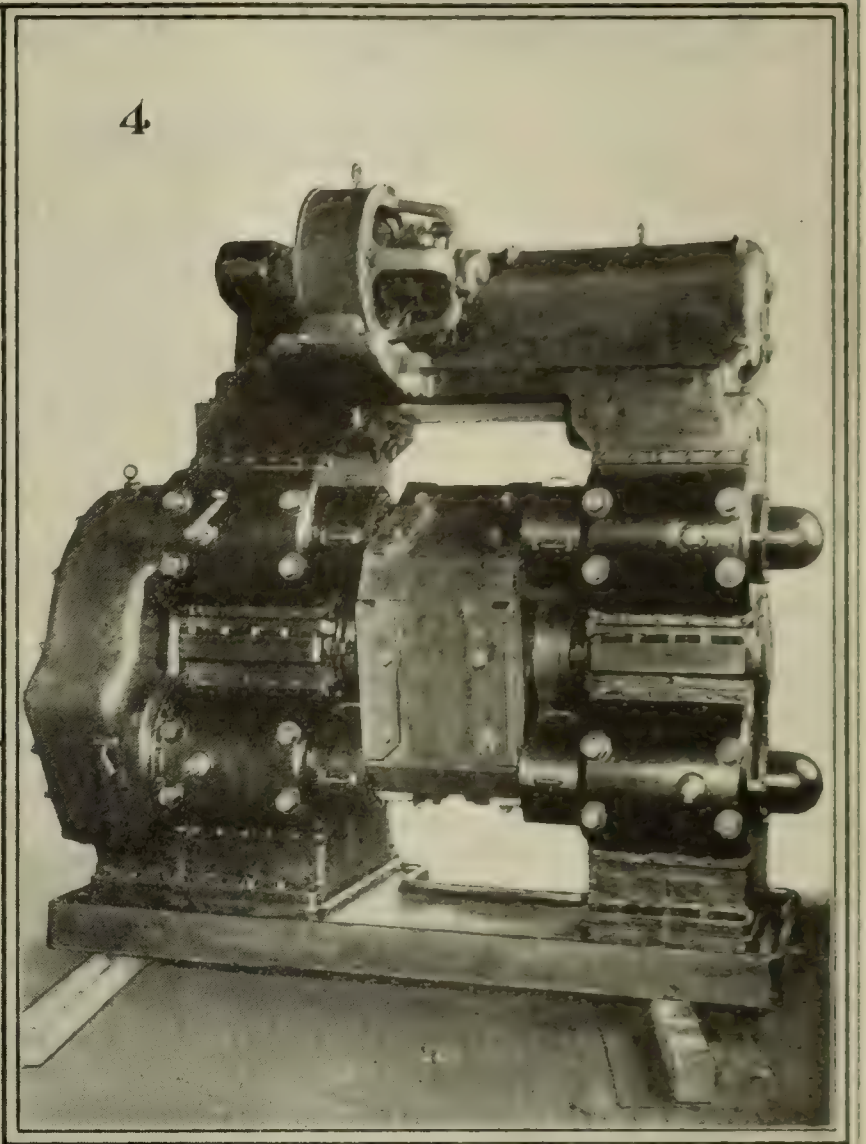
Fig. 4 shows a new model known as the 2½, which is adaptable to crankcase, cylinder head or other similar work. This machine will take 16-in. cutters or larger and is self-lubricated, the oil being carried in the base and circulated by oil pump. Micrometer adjustments of each spindle are provided. The same machine from the operator's side is shown in Fig. 5. All of these machines are designed to be truly continuous, with the operator placing work to be milled in the fixtures without delaying the cycle, and the milling time, consequently, becomes the chucking time. A feature of the machine is that all cutter spindles have micrometer adjustments, are mounted on opposed cone bearings and are solid from end to end. Gears are provided to give a change of feed of from 3 in. to 30 in. per min. past the cutter.

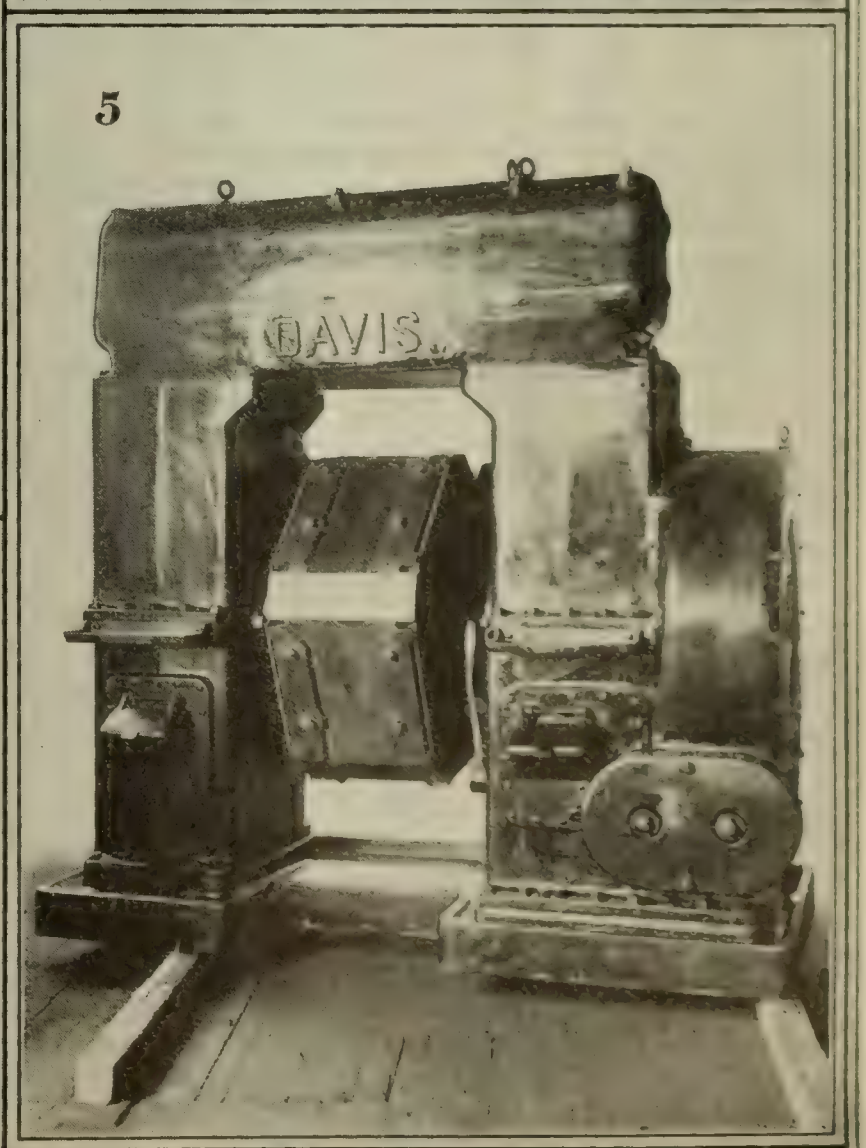
New Machines for Rapid Milling Operations











1—Davis continuous milling machine, rough and finish end milling Herschell-Spillman six-cylinder block. 2—Wire cable clamping method used on Davis continuous miller operating on Chevrolet camshaft. 3—Chevrolet camshaft operation showing simple location of shaft in V-block with wire cable clamps. 4—Davis continuous miller No. 2½ model, capable of taking 16-in. or larger cutter. 5—Operator's side of model 2½ Davis continuous miller.

Knowledge of Operating Costs Will Increase Truck Sales

Such data should be determined by accurate records obtained from actual operation under every conceivable condition. The manufacturer who gives prospective purchasers this information and helps him determine costs in advance will perform a service to himself, customer and industry.

OPERATING cost is one of the principal factors in determining the efficiency of a motor truck. The manufacturer who can furnish his salesmen with accurate and all-truthful data along this line will be tearing down one of the highest barriers to sales, for the automotive market now contains fewer men who buy on chance. Facts as to what a motor truck will do and how much it will cost to do it are demanded by the prospective truck customer. The mere statement that a motor truck will increase the efficiency of any business is not enough. Figures must be presented to show how efficiency will be increased.

The subject of operating costs is gone into rather thoroughly in a book by F. Van Z. Lane, C.E., Lecturer on Motor Truck Transportation at New York University. While the author takes up the question from the viewpoint of the owner rather than the manufacturer, the points he brings out should interest the latter and cause him to see how and why he should be prepared to show customers what they may be prepared to expect in the way of expenses after they have purchased a truck. Fixed, or definite costs cannot be determined, it is true, for under varying conditions there will be varying costs. It is quite possible, however, to obtain cost data from trucks operating under various conditions and thus pass on to the prospective owner the knowledge as to their results, and let him decide which condition best coincides with his particular business.

The result of a questionnaire published in AUTOMOTIVE INDUSTRIES about three months ago showed that most truck manufacturers conduct some sort of tests before their vehicles are placed on the market, but there was nothing to indicate that any single manufacturer attempts to determine actual operating costs so he can tell the purchaser what he may expect to spend per year, and thus help him to efficiently organize his motor transportation system.

Information as to the operating costs of a motor truck should be all-truthful. Confidence cannot be established or maintained if only a part of the truth is told. It would be quite possible for the motor truck manufacturer to furnish figures that would tell a part of the story without going into details as to other expenses, but such a program could only prove disastrous in the end. On the face of things it might seem that competition would forbid setting forth all the facts available, but truck purchasers are intelligent enough to see that the salesman who includes in his figures all the factors that enter into operating costs is not trying to "put something over," and he will place his confidence in that salesman.

What are the factors entering into operating costs? Mr. Lane divides them into three headings, which are subdivided as follows:

Investment	Fixed	Variable
Chassis	Interest	Fuel
Body	Insurance	Lubricants
Cab	License	Maintenance
Freight	Driver's wages	Tires
War tax	Garage rent	Sinking fund
Special equipment		

There are probably others, and if the manufacturer can find them and include them in the items he presents to a customer so much the better. It will be noted that the item of overhead cost is not included, but this can only be determined by the part a truck plays in the business as a whole and would have to be considered separately for each case. The factors mentioned apply directly to truck operation while engaged in transportation service.

Does it not seem plausible that the truck salesman or dealer would gain the confidence of his prospect if he were able to show his prospect what these costs have been under conditions similar to those under which the truck is to be used? Would he not gain more confidence if he could sit down and figure fairly with the customer just what the truck would have to do under normal conditions and show him what it was going to cost? After that the truck manufacturer would do well to supply the purchaser with cost sheets that he might keep an accurate record of the cost of operation. These records would furnish real information both for the manufacturer and for future prospects.

There are certain laws governing motor truck transportation that should be known to every truck owner, for a knowledge of them might have an important bearing upon the efficient and economical operation of the vehicle. Mr. Lane sets these laws down as follows:

1. The cost per day will vary with the miles operated per day. This cost will increase as the daily mileage increases.
2. The cost per mile will vary with the miles operated per day. This cost will decrease as the daily mileage increases.
3. The daily cost unit (per ton, per bag, per gallon, per bale, box, or whatever unit is used) will vary with the different truck capacities and the distance hauled. This cost will decrease with an increased truck capacity and it will increase with an increase in daily mileage.
4. The cost per unit mile (per ton mile, etc.) will vary with different capacities and the miles of truck haul per day. The cost will decrease as the capacity increases and it will decrease with an increase in daily mileage.

These laws apply only, of course, when other conditions are equal, such as road and traffic conditions, efficiency of drivers, mechanical operation, etc. They form a working basis, however, for the manufacturer to obtain actual operating costs and pass that information on to the man

who buys a truck. A knowledge of them will clear up many apparent inconsistencies in comparing the cost of operating one truck with another. Such knowledge is necessary if the prospective truck operator is to determine correctly what capacity of truck he should use. They make comparisons possible with other means of transportation, and enable the operator to ascertain his actual cost of operations with his truck.

The importance of furnishing cost records cannot be over-emphasized. In no other way can an operator accurately determine what his motor transportation system is costing him. It is estimated that of some 900,000 trucks in operation, only about 50,000 have their operating costs determined by records. This situation is one that should be overcome. The business man keeps accurate records of the cost of his production, labor, advertising, selling and all other departments, but disregards his transportation, hauling and delivery costs, yet they play an important part in his business. A systematic analysis of these costs, together with a study of the laws with a view to decreasing them, would go a long ways toward increasing efficiency and opening up a larger motor truck market.

The motor truck is now recognized as an all important factor in the transportation system of the nation. Its system of operation is not perfect, but it could be made more nearly so if the operations were carried on in a more scientific manner. The manufacturer is the logical person to take the lead in a movement to make this possible and those who are the first to take steps along this line are apt to be the ones who will profit most. Mr. Lane's book is an interesting one from many other standpoints, but his chapters on operating costs show the need for such studies, and bring forcibly to mind the fact that the manufacturer has done too little to educate the buyer along these lines.

A New Single Plate Clutch

IN the new single plate type of clutch shown in the accompanying cut there are twelve springs acting directly upon the friction surfaces. The springs are so proportioned that the decreased pressure produced when the friction mats are worn is still sufficient to make the clutch operate within the recommended capacity. The springs for each clutch are calibrated and held within a tolerance of two and one-half pounds at normal load. Springs with a normal load of 130 lbs. up to 170 lbs. are provided as required.

The pressure plate is connected to the levers and is positively drawn away from the friction mats to prevent dragging upon disengagement.

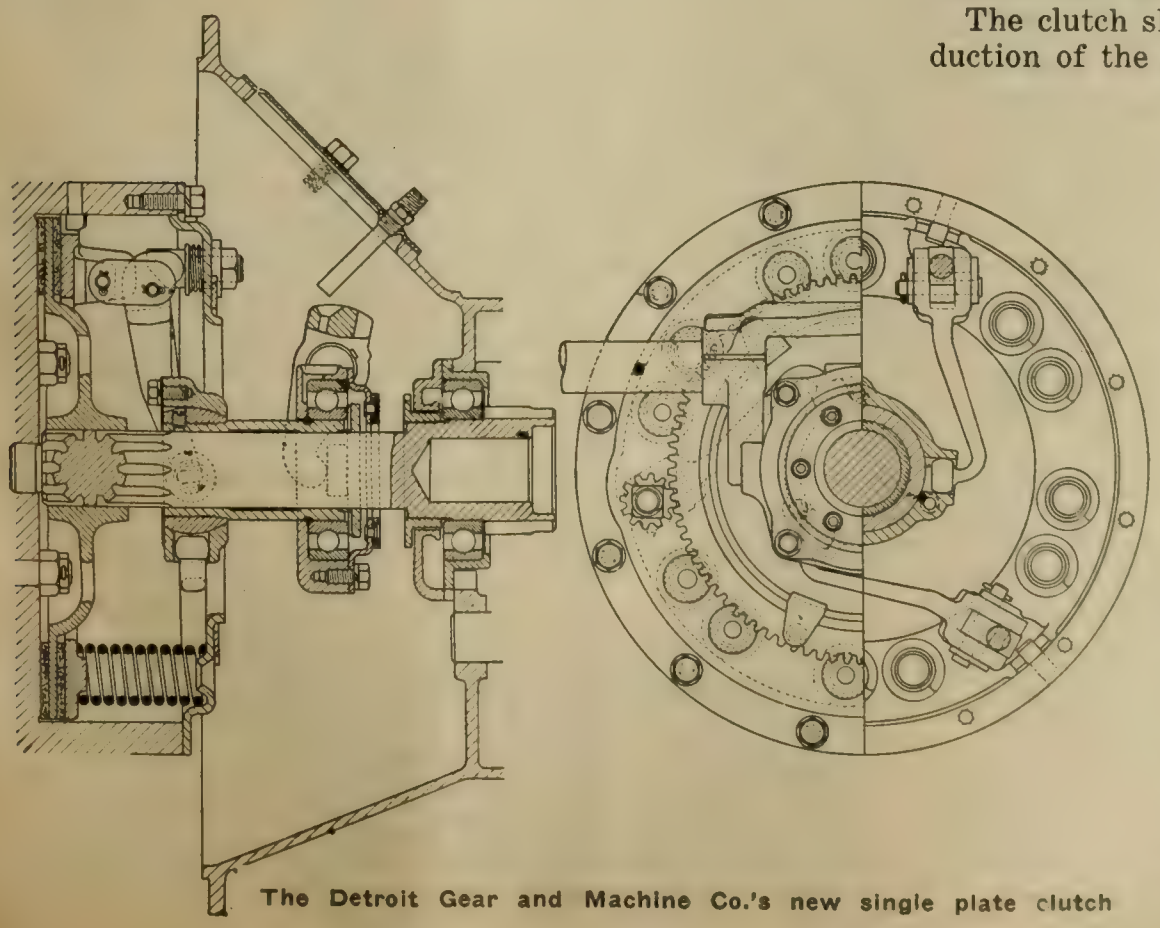
The friction mats are of woven asbestos 6⅞ in. inside by 9⅞ in. outside diameter and 5/32 in. thick. They are of the floating type with a total area of wearing surface of 158 sq. in. The pressure per square inch of friction surface is 20 lb. for the 130 lb. springs and 26 lb. with the 170 lb. springs. The clutch is made in 10-in. size to fit a standard S.A.E. flywheel.

The toggle levers used to disengage the clutch are held firmly in both engaged and disengaged positions to prevent rattle. The inner ends of the toggle levers are held in a ball and socket hub which adjusts itself automatically to equalize the pull on the levers. This prevents the sleeve from binding on the shaft when the balls of the toggles are not in the same plane or when the pull on the levers is not equal.

The throwout bearing is a special deep grooved annular thrust bearing held in a container with ample lubricating capacity. The lubricant is fed to the container through a tube arranged to connect with a cup conveniently located on the floor boards of the car. The throwout sleeve is of hard bronze grooved for lubrication. Oil holes along the side of the shoulder of the sleeve connect with the grooves through which the oil from the reservoir passes.

A clutch brake is provided and is effective until mats have worn enough to require adjusting of the clutch. The adjustment is made by turning any one of the three adjusting nuts, which in turn raise or lower the three fulcrums and bring the sleeve to its proper position. All three adjusting nuts have gear teeth which engage with mating teeth in a ring of sheet metal which operates them simultaneously. The ring is held in place by three spring clips. No loosening or tightening of screws is necessary for making an adjustment. The adjusting nuts are accessible and take a standard open-end wrench.

The clutch shown is known as model N and is the production of the Detroit Gear and Machine Co.



The Detroit Gear and Machine Co.'s new single plate clutch

A Tractor Export Chart

A CHART showing the quantities, value and destination of all farm tractors exported is being prepared in the statistical section of the Agricultural Implements Division of the Department of Commerce. Statistics of exports will be added to the chart each month for the month preceding, so that figures will be available at all times showing the exports for any period.

The Agricultural Implements Division will now handle all tractor statistics, instead of merely farm tractors. Under a former arrangement the section was only concerned with farm tractors, while others designated as commercial tractors were in the hands of the Automotive Division. The Agricultural Implement Section has on file valuable information for the tractor manufacturer or exporter.

Hoover and Daugherty Discuss Status of Trade Associations

In correspondence recently made public, the Attorney-General gives informal approval to the collection of statistics concerning production, stocks, wages, etc., if they are made public at same time they are received by members. Discussion helps define legitimate trade association functions.

THE Hoover-Daugherty controversy concerning trade associations has a definite interest for every manufacturer, regardless of the industry in which he is operating. The last issue of AUTOMOTIVE INDUSTRIES being the annual Statistical Number, it was impossible to devote to the recent developments of this controversy the space necessary for a proper understanding of the present situation. The correspondence between Hoover and Daugherty about trade associations has just been made public and is worth close study.

The correspondence begins with a comprehensive and sound analysis by Hoover of the entire trade association situation. Hoover points out the necessity for legitimate trade association activity and presents the reasoning leading to his conclusions. His opinion is a bit too long to print here in full, yet it presents so excellent a résumé of the situation that certain parts are necessary to a proper understanding of any analysis. Hoover wrote in part:

"Commercial progress in industry has always been measured by the advance in knowledge of those engaged in industry. It is impossible for men to acquire or secure all possible knowledge at one time. Its acquisition is a growth resulting from continuous, intelligent inquiry. The knowledge of an industry that is necessary and essential to its success must embrace all facts and circumstances that will in any way influence that industry. These facts and circumstances must include economic conditions as well as scientific facts to the extent that science is called into play in its operation and all commercial conditions that make for efficient production, merchandising and distribution. No one will dispute the foregoing statements; they are fundamental and necessary to the life of trade and commerce.

"Trade associations have been in existence for many years. The great majority are legitimate, both in form of organization and in activity. The minority, while lawfully organized under articles expressing lawful purposes, may engage in activities that are evidence of purpose contrary to and outside of the declared purposes in the articles of organization.

"Again, a trade association may have lawful form of organization and the activities of its officers may be clearly within the purposes declared in the association charter, and yet members of the organization may, by unlawful confederation, use the information lawfully secured for unlawful purposes. It may, therefore, truthfully be said that the line dividing the good association and the bad, the proper activity from the improper one, and the lawful activities of the officers of an association from the unlawful acts of the membership cannot be determined, in every instance, with singular ease.

"It is with much earnestness that I claim there is propriety, generally speaking, in trade associations. Their lawful field of endeavor is large, and their activities work for promotion and advancement of the public welfare and for progressive economic organization. In making this statement I am not unmindful of the fact that the impression exists with a small minority that individual prohibited acts may be accomplished by organization under the disguise of a trade association.

"Information lawfully secured regarding trade and economic conditions made public for the information of everyone cannot be harmful. Information secured solely for the benefit of members and of a character that puts the membership, by reason of the information, in a position of advantage, as compared with the public without such information, cannot be sanctioned by sound public policy.

"The activities of trade associations that have received the greatest criticism involve the collection of statistics relating to volume of production, capacity to produce by districts of production, wages, consumption of products in domestic and foreign trade, distribution thereof, including volume of distribution by districts, together with figures as to stocks on hand, wholesale and retail, by districts, coupled with information as to price, either in the form of individual reports of each member distributed to every other member or the individual prices reported to the association and by the latter compiled and averaged by districts for certain specified periods.

"If information regarding production, capacity and distribution by districts, with average prices for grades, brands, sizes, styles or qualities sold in the respective districts for specified periods of time could be given to the public at the same time that such information is available to the members of an association, in my judgment great public good would result. With this information available, everyone dealing in the products of a given industry, whether buyer or seller, would have the same information regarding conditions and, in dealing with one another, would have knowledge of the same facts upon which to form their judgments as to the proper course to pursue.

"A majority of the associations collecting data of the nature indicated have distributed same only to members of the association, while others have undertaken to give the information to the public through the daily and trade papers. Publication of the information by these associations in the daily press has not been general, and its availability to the public has been largely through the medium of trade papers, and through the daily press to the

extent that the latter may have been utilized. When published through trade papers this information should be released to members only after such publication."

Hoover then goes on to ask the Attorney-General 11 questions dealing with the following subjects:

1. Uniform cost systems.
2. Standard nomenclature.
3. Standardization in quality and grades of product.
4. Collecting of credit information.
5. Insurance.
6. Co-operative advertising.
7. Co-operative welfare work.
8. Co-operative handling of legislative questions.
9. Co-operation with Federal Government.
10. Collection and dissemination of statistical data concerning production, wages, stocks, distribution, etc.
11. Exchange of price information.

The tenth item is specially important. The fundamental purpose of statistical data concerning industry is constructive. It is to enable organizations within an industry and those allied with an industry so to analyze their markets and correlate their various organization activities that the industry may be conducted on the most efficient basis, eliminating as much waste as possible and making the conduct of the business render greater service to the public and greater returns to the various independent organizations.

Hoover's tenth question, in detail, was as follows:

(A) May a trade association collect statistics from each member showing his volume of production, his capacity to produce, the wages paid, the consumption of his product in domestic or foreign trade, and his distribution thereof, specifying the volume of distribution by districts, together with his stock, wholesale or retail?

(B) And may such trade association, on receipt of the individual reports of each member, compile the information in each report into a consolidated statement which shows the total volume of production of the membership, its capacity to produce by districts of production, which, in some instances, include a State or less area, the wages by districts of production, the consumption in foreign or domestic trade by districts, the volume of distribution by districts and the stocks on hand, wholesale and retail, by districts?

(C) And if, after compiling the information as aforesaid, the information received from the members, as well as the combined information, is not given by the association to any other person, may it then file the combined statement with the Secretary of Commerce for distribution by him to the members of the association through the public press or otherwise and to the public generally and to all persons who may be in any way interested in the product of the industry, it being understood that the individual reports for the members should cover either weekly, monthly, quarterly or longer periods as may be deemed desirable by the members, and, when a period is adopted, the report for each member shall cover that period, and the combined report shall be for that period?

The rather brief and somewhat indefinite reply of the Attorney-General, however, apparently finds no objection to the activities of the associations covered by Hoover's questions as regards standard nomenclature, standardization, credits, group insurance, co-operative welfare work and co-operative handling of legislative problems.

Only in two instances did the Attorney-General find any specific objections. These had to do with the clause regarding uniform cost systems and a part of the clause about co-operative advertising. The questions involved read as follows:

1. May a trade association provide for its members a standard or uniform system of cost accounting and recommend its use, provided that the costs so arrived at by the uniform method are not furnished by the members to each other or by the members to the association and by the latter to the individual members?

6. May a trade association, in co-operation with its members, engage in co-operative advertising for the promotion of trade of the members of that association engaged in the particular industry; and may the association engage in such form of promotion by furnishing trade labels, designs, and trade-marks for the use of its individual members?

The comments of the Attorney-General on these questions were as follows:

"With reference to the first paragraph, there is no apparent objection to a standard system of cost accounting, but I think associations should be warned to guard against uniform cost as to any item of expense.

"Furthermore, I have serious doubts about the advisability of the latter part of the sixth paragraph. I can see no objection to co-operative advertising designed to extend the markets of the particular article produced or handled by the members of an association, but when the several producers or dealers use uniform trade labels, designs and trade-marks it seems to me the inevitable result would be a uniformity of price."

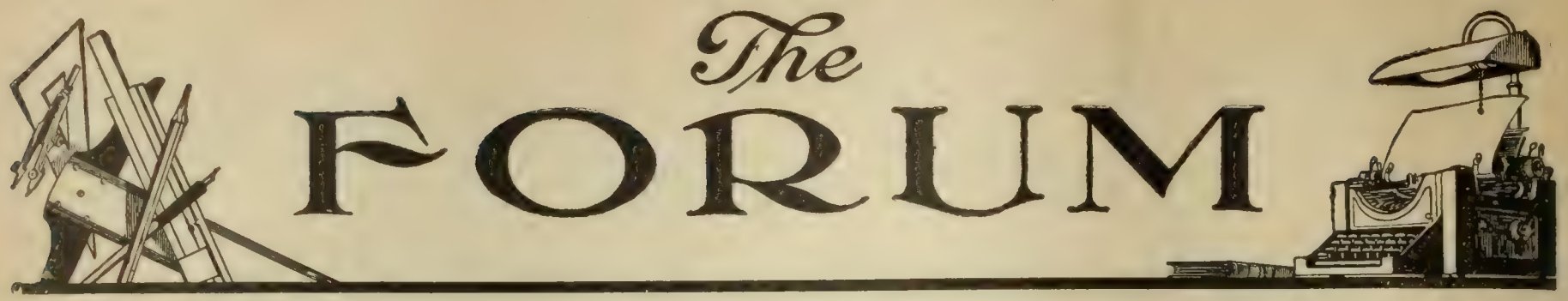
The last paragraph of this letter covered all of the other questions raised, and clarifies the discussion to a certain extent, although it cannot be said to give any very definite conclusions, taking into consideration the lack of positiveness which characterizes the language used and the fact that the expression of opinion is only informal in nature. The final paragraph is as follows:

"I can now see nothing illegal in the exercise of the other activities mentioned, **provided always** that whatever is done is not used as a scheme or device to curtail production or enhance prices, and does not have the effect of suppressing competition. It is impossible to determine in advance just what the effect of a plan when put into actual operation may be. This is especially true with reference to trade associations whose members are vitally interested in advancing or, as they term it, stabilizing prices, and who through the medium of the associations are brought into personal contact with each other.

"Therefore, the expression of the view that the things enumerated by you, with the exceptions stated, may be done lawfully is only tentative; and if in the actual practice of any of them it shall develop that competition is suppressed or prices are materially enhanced, this department must treat such a practice as it treats any other one which is violative of the anti-trust act."

In reply to Daugherty's letter, Hoover makes a brief explanation of the meaning of the clause in his question regarding co-operative advertising which indicates that what Hoover has in mind is really in accord with what Daugherty believes necessary. Hoover then ends his letter of reply by saying, "With this explanation I feel sure you will agree with me that our views on the matters presented are in complete accord."

Apparently no reply denying this final statement has been received, so it would seem that for practical purposes it can be assumed that trade association activities are legitimate so long as conducted within the limits indicated by Hoover's questionnaire. Thus the case seems to rest for the present.



Advantages of Grease as a Chassis Lubricant

Editor, AUTOMOTIVE INDUSTRIES:

We have carefully read the very interesting article written by Mr. Cornelius T. Myers, appearing in AUTOMOTIVE INDUSTRIES for Dec. 1, 1921, entitled "Various Methods of Chassis Lubrication." We thoroughly agree with the author of this article that failure to properly lubricate automotive chassis is one of the greatest causes for the depreciation of the entire vehicle, leading, of course, to unnecessary and highly expensive repairs. Notwithstanding the very able way in which the benefits of oil lubrication were presented, it is our belief that not enough space in this article was devoted to the unavoidable difficulties standing in the way of its practical application on open bearings.

The question is not so much which is theoretically the best lubricant, oil or grease, as it is which of the two has given the best results in the past and is, all things considered, the best adapted for the job in hand. Mr. John Rome Battle in his book, "Industrial Oil Engineering," says:

"When the bearing load is heavy and the bearing surfaces are forced together, an oil is forced out of the bearing and metallic contact will occur. With a grease, as the surfaces approach, the shearing action decreases until a point is reached, when 'flow in the film' ceases, and the film will not become any thinner. Thus metallic contact is prevented. This feature of grease lubrication is an important factor governing the selection of greases for lubrication, particularly for those bearings which are operated at low speeds and high pressures, especially where the bearing may be at rest for some time. Here the starting friction must be overcome when the bearing surfaces are again given relative motion.

"The importance of the effect of the thickness of the lubricating film must be emphasized. If all surfaces in bearings were perfectly smooth there would be no tendency for the projections to interlock. Since this is not possible, however, it must be appreciated that with oil lubrication the lubricating film may become so thin that when the relative rubbing motions of the surfaces are low, or when the surfaces are at rest, while they do not actually touch, they do to some extent interlock. This causes the starting friction to be larger than the friction of motion.

"When grease is used as a lubricant under the above conditions the film between the surfaces of the bearing will not allow its being pressed to thin enough dimensions to permit interlocking. The starting friction with grease is, therefore, a factor depending upon the shearing resistance offered by the film."

The foregoing we have quoted in full, as it seems to us to be a very concise statement by a recognized authority on the superiority of grease over oil as a chassis lubricant, as the conditions above described exactly fit those obtaining in an automotive chassis bearing.

In contradiction to this, the article above quoted dismisses grease in most summary fashion. In fact, it states that most greases contain a soap or other inert matter which makes them more or less heavy, but which have a negative qualification as a lubricant. In other words, this article gives the impression that the only value of a lubricant is the mineral oil in it, while, as a matter of fact, the excellence of the vegetable or mineral oil out of which the soap base is made determines in a number of cases the excellence or deficiency of a grease.

Any chemist who has analyzed any of the good greases on the market at the present time, particularly those recommended for chassis lubrication, knows positively the infinitesimal percentage of non-lubricating matter in them. In fact, I have in mind a lubricant made by the Sun Oil Co., as well as one manufactured by the Texas Co., which contains no non-lubricating matter whatsoever, which is true, likewise, of many lubricants manufactured by the Warren Co., Fisk Co., etc.

So much for a brief discussion of the benefits of grease as a chassis lubricant, a subject on which there will always be much difference of opinion. However, the fact remains that over 400 separate and distinct automotive engineering departments in this country, containing perhaps the best theoretical and practical engineering minds in the profession, have adopted grease as the proper lubricant for automotive chassis.

The article goes on and condemns grease by the statement that handling a grease container about a car is always a dirty job. The question might be asked. What of the oil that slops from the can? That too is a dirty job, and this spilling is absolutely avoided by the use of grease. But in order to insure cleanliness there are at the present time patented cans on the market which permit the filling of pressure system compressors without the lubricant touching the hands.

Compare, if you will, the picture of an unsightly oil cup—the dirty oil oozing from the bearing seeping down on the leaves—with the nickel plated Alemite fitting. These fittings make the lubricating points of a car not mud heaps, but symmetrical and highly polished points, which assist rather than nullify the labor spent on the rest of the car to make it as pleasing to the eye as it is efficient to operate.

The statement that fittings and hose sooner or later accumulate dirt which is forced into the bearings is unwarranted, for there is in each fitting a little check valve sealing the entrance against the dirt even when the dust cap, an added precaution, which fits snugly over the fitting, is not used. Dirt, of course, can be forced into the hose, but even this is difficult because the hose is generally full of grease, which in itself prevents the entry of dirt particles.

That water will enter the fittings, we believe is an exaggeration. In fact, the writer has lubricated the chassis on his car for the last year with nothing but a grease that will emulsify. He has continually washed his car with a hose, and in each case if water entered the bearing it would have been immediately noticeable; whereas, as a matter of fact, no such accident was observed.

We do not desire, however, that the case be settled by theory, even though we believe theoretically grease is

fully established as being superior to oil as a chassis lubricant. It is on actual performance for the purpose intended that the controversy should be settled. Countless automobile engineers who have tried oil, some if not all of whom must have been fully cognizant of the virtues attributed to oil for chassis lubrication and who must have had presented to them all the various types of oil cups, have discarded them and come to grease as the logical, practical and most efficient method for chassis lubrication. J. HENLY FRIER, JR.

Transmission Gear Losses and Wear

Editor, AUTOMOTIVE INDUSTRIES:

Supplementing the communication of G. A. Ungar in the issue of Jan. 26, it is evident that transmission efficiency is almost wholly dependent on the character of the lubricant. Invariably semi-fluid grease lubricants are used in order to produce quiet operation of the gears. As indicated in the communication, the lower efficiency of the transmission is particularly evident under winter driving conditions when the temperatures are low, and it is easily understood how the lubricant affects the efficiency by the gear shifting difficulties that are experienced.

Under ordinary operating conditions, the high gear or direct drive is used 90 per cent of the time, under which conditions it certainly is not desirable to have any of the other gears in mesh.

From experiments conducted over several years, with a transmission having a stationary countershaft in high gear, a considerable increase in efficiency and an easier operating transmission have resulted. A relatively light oil can be used and perfect quietness obtained in high gear and the fact that the lubricant is not continually churned, the viscosity is well maintained. A. A. BULL, Ch. Eng.
Northway Motor & Mfg. Co., Div'n General Motors Corp.

Farmer Buying Power

THE following figures, compiled by the National Bureau of Economic Research, are indicative of the general trend toward attempts at compilation of accurate and comprehensive statistical data for use in practical planning. The figures concern the buying power of the farmer and are the result of a long investigation.

In analyzing these figures, however, in their relation to the automotive industry, it must be realized that many factors, other than potential buying power, affect that actual potential farm market for automotive products. As total buying power decreases, of course, total buying will decrease, but this does not mean that the farmer will cease buying all products to an equal degree. In so far as cars, trucks, tractors and other automotive products constitute a necessary part of the farmer's business and operating equipment, such products will suffer a comparatively slight decrease in farm sales. Necessities will always be bought. Thus, automotive products will be sold to the farmer in proportion to their demonstrated value as economic necessities.

It is essential, then, that the following figures be used in planning with a proper perspective as to their significance. They tell an important part of the story of the farm market, but not by any means the whole story.

The farmers of the United States in 1918 and 1919 reached an unprecedentedly high level of total income, as compared with the rest of the gainfully employed. This is true, whether comparisons are made on the basis of absolute income or of purchasing power in terms of the dollar's power in 1913. Then, suddenly, in 1920, the farmer's share in the national income, in terms of pre-war price levels, dropped to a point below that of any previous year in the decade 1910-1920. This fact is disclosed in the report of the National Bureau of Economic Research, now in press. The farmers, who represent about 6,450,000, or 16 per cent of the gainfully employed, have received during the past decade a share in the total national income varying between 12.3 in 1911 and 17.4 in 1917 and 1918, until 1920, when it dropped to 10.9.

The farmer's share, in billions of dollars and per cent of the total, is estimated by the Bureau to have been in each year beginning with 1910 as follows:

	Aggregate of Individual Incomes (billions)	Farmers' Income (billions)	Per Cent of total received by farmers
1910.....	$30.0	$3.95	13.2
1911.....	30.2	3.70	12.3
1912.....	31.5	4.00	12.7
1913.....	32.5	4.20	12.9
1914.....	32.2	4.20	13.0
1915.....	34.3	4.70	13.7
1916.....	41.8	5.80	13.9
1917.....	50.7	8.80	17.4
1918.....	60.2	10.45	17.4
1919.....	64.7	10.85	16.8
1920.....	65.8 (approx.)	7.20	10.9

The final figures for the total income in 1920 can at present be given only roughly, since the income tax returns have not yet been published.

When these figures are translated into terms of the purchasing power of "1913 dollars" it is again seen that the purchasing power of the farmers was at its lowest ebb in 1920. Here are the comparative figures in billions of dollars:

	Farmers' Income in billions of dollars at the uniform purchasing power of 1913
1910.....	$4.01 Billions
1911.....	3.78 "
1912.....	4.04 "
1913.....	4.20 "
1914.....	4.17 "
1915.....	4.59 "
1916.....	5.10 "
1917.....	6.45 "
1918.....	6.50 "
1919.....	6.10 "
1920.....	3.50 "

The per capita income in the country as a whole and the per capita income of the farmers, both measured in dollars of 1913 purchasing power, were as follows:

	Average income in 1913 dollars of all gainfully employed	Average income In 1913 dollars of farmers
1910.....	940	631
1911.....	923	593
1912.....	939	624
1913.....	955	657
1914.....	932	652
1915.....	1005	717
1916.....	1068	795
1917.....	1025	1004
1918.....	941	1011
1919.....	938	947
1920.....	850 (approx.)	543

It will be seen that in the first years of the decade farmers' incomes were considerably less than the average of the gainfully employed. In 1917-19 they were about the same. The farmers were, however, hit much harder by the 1920 fall in incomes than were the rest of us.

Improving the Dealer Contract

Necessity for stability in car dealer organizations is discussed. N. A. C. C. and N. A. D. A. working to eliminate present contract evils. Mr. Tipper shows problems and suggests methods for improving contracts which will be beneficial both to the manufacturer and to the retailer.

By Harry Tipper

THE difference between the retailer of automobiles, their accessories and service, and the retailer of ordinary commodities is nowhere more clearly demonstrated than in the character of the contracts between the manufacturer and the retailer or between the distributor and the retailer. Discussions which have occurred regarding these contracts and the present confusion existing between the practice of the manufacturer, the demands of the dealer and the general large tendency to change all indicate the difficulties connected with the proper scheme of development between manufacturer and retailer where the commodity is not sold but is to be kept running during its life.

It has been estimated from various sources that the mortality in car dealers during the year 1921 ran from 40 per cent to 50 per cent of the total number. This mortality is a serious matter in connection with the distribution of the automobile, much more serious than in the case of the ordinary commodity for the reasons previously mentioned. It is not very important to the individual toilet goods manufacturer if 30 per cent of the drug stores in that particular locality go out of business. The reputation of the manufacturer is not involved particularly in these changes, and the units of his distribution do not affect the market to the same degree.

In the business of distributing cars, the character, stability and operations of the dealer are bound up with the manufacturer of the car he is selling. They have a very important influence upon the position of the manufacturer in that locality and this influence has a tendency to grow as the business settles into its long stride and takes its place in the social and industrial fabric. No other product owned by the individual in social life requires so much attention. No other product is so complicated in its mechanical requirements and there is no other product used by the general public which has emphasized its own values and difficulties so thoroughly.

This point must be thoroughly understood if the position of the retailer is to be determined accurately. No other complicated machine has been sold to the public to be operated by amateurs. No product becomes a necessity so quickly as this convenient means of going about, and there is no other commodity which is expected to meet the calls upon it in the same way.

In all of these respects the retailer is the key man in his locality. His business methods, his capacity to deliver good service, the character of his establishment—all these seriously affect the reputation of the manufacturer in that locality. As the car becomes more and more clearly a necessity, as its novelty wears off and it takes its proper place this influence of the local retailer becomes more important. Consequently, it is to the manufacturer's interest to develop his stability, to arrange to aid his capacity along various lines and to see that he is in a position to conduct his business effectively.

Much discussion has developed among manufacturers and also among the retailers' associations concerning the contractural arrangements between the two, the methods of the manufacturer, and the dealer's efficiency in his business. There has been a good deal of mutual dissatisfaction with the situation which has expressed itself in the character of this discussion. A form of contract has been suggested by a combined committee of the N. A. C. C. and the N. A. D. A. designed to do away with a considerable part of the difficulty at present involved. It is important, of course, that the actual character of the contract and its wording should be equitable to both parties under all possible circumstances. It is equally important that the responsibility of both parties to the transaction should be understood by them and the contractural arrangements include a full understanding and a full discussion of all these matters.

It is to the manufacturer's interest to foster a stable, intelligent and thorough dealer organization in this field. It is up to him to study and understand the dealer's situation better than the dealer himself, because his future is involved in the stability and the business conduct of a number of dealers, whereas the individual is concerned only with his own conditions.

The statement has been made several times that there are not more than a few thousand dealers in the field who are thoroughly established and properly competent in all lines of their business. Similar statements have been made regarding the standing of dealers from a financial standpoint. These statements might be questioned, but they are indicative at least, and there is no doubt that the number of stable and efficient dealers is a comparatively small proportion of the total in the field. This is not the fault of the dealer but a necessary accompaniment to the rapid growth of the business and the constant entry of new dealers in the field, who have not yet had the opportunity to develop themselves to the highest point of efficiency and stability.

The problem before the manufacturer, therefore, is one of:

First—Securing those dealers who are capable of making a good outlet for his product and safeguarding his reputation, or those dealers whose intelligence, initiative and local standing indicate that they are capable of becoming stable and strong factors in their locality and, therefore, of value to the manufacturer.

Second—To consider carefully from his standpoint the investment which the dealer must make, the problems which the dealer must face and the importance of entering into contractural arrangements which will provide reasonably for contingencies and, at the same time, prove equitable to both parties in case of changes either in the manufacturer's organization or the dealer's position.

Third—To provide such organization developments as will put the full knowledge of the manufacturer at the disposal of the dealer in the effort to improve the dealer's position as the manufacturer's representative in that territory, with the full responsibility for keeping the market in good shape at all times in that locality. The contract, of course, is a matter upon which these items hinge, and it is likely that the form of contract will have to change as the business grows older, stabilizes itself and develops its characteristics more fully.

At the end of 1921 there was a good deal of grumbling among dealers because some of the manufacturers had obliged them to take their quotas of new cars and had made no appreciable effort to aid them in the solution of their used car problems. There was some grumbling because manufacturers had changed their policy with regard to exclusive or non-exclusive agencies without giving the dealer sufficient opportunity to arrange his business and investments in accordance with the new policy.

These items indicate that the present contracts do not fulfill the purpose thoroughly and that many important problems affecting the relations of the manufacturer with the dealer are not considered in the contract as it is determined at present. It is probable that many of them will be outside the limits of the written contract at all times. For this reason it is all important that the manufacturer should understand the position of the retailer very thoroughly so that the contract may express the spirit of the understanding and the other problems of importance be solved in accordance with that spirit.

IT is to the manufacturer's interest to foster a stable, intelligent and thorough dealer organization in the field. It is up to him to study and understand the dealer's situation better than the dealer himself, because his future is involved in the stability and the business conduct of a number of dealers, whereas the individual is concerned only with his own conditions.

It is necessary to appreciate thoroughly the fact that retailing automobiles calls for the development of business functions that were not previously a part of the operations of the retailer. Generally speaking, it has been the business of the retailer at all times, in all other lines of industry, to get people to his store, provide a good selection of commodities and to sell them at a reasonable price, to deliver commodities in the locality which he serves and to undertake these matters promptly and effectively. The retailing of the automobile includes not merely bringing people to the store, but going out of the store to them. It means not merely selling the car, but providing the right kind of service, looking after the running of the car to some extent and the character of the service and providing the supplies and accessories that go with the car. Some of these are new functions of retailing which have grown up pretty rapidly. They are not yet developed into a stable system and the understanding between manufacturers and dealers is not as thorough as it should be. The dealer has not been cognizant of all his responsibilities to his customers and his manufacturer, and the manufacturer has not fully recognized either the difficulties of the dealer or his obligations to him.

The tendency in the business of retailing automobiles is for the automobile itself to be changed more and more by the character of the local service rendered by the dealer, and the reputation of the automobile itself is intimately involved in the character of this service. On this account it is not sufficient for the manufacturer to select dealers from among the present dealer population, but it is necessary for the manufacturer, individually, and the manufacturers as a whole to give freely of their information, understanding and co-operation to the dealers, so that there will be a constant improvement in the character of the service rendered by the dealers and their ability to conduct their business along sound lines.

Whatever the form of contract entered into between the manufacturer and the distributor or the dealer, that contract must provide an equitable arrangement for both parties covering the ordinary contingencies of the business. The provisions of a contract should call for, among other items:

First—A settlement of the allotment to the dealer in reasonable accord with the possibilities of his market and the rearrangement of that quota under proper requirements to safeguard the dealer without injuring the manufacturer.

Second—It should include simple consideration of the elements of service to be provided by the dealer and the standards upon which such service could be arranged.

Third—It should recognize the dealer's position in case the agency is taken away from him and the manufacturer's rights in case the dealer desires to change from one car to another.

Fourth—It should include a consideration of the manufacturer's position in a used car problem and an equitable method of considering this under given conditions of sale.

It is obvious that a full and simple consideration of these matters will depend upon a pretty thorough understanding between the manufacturer and the dealer, and that such understanding will require a good deal of preliminary work so that the matters are fully determined before contracts are made.

These four items, however, represent the important elements in the stability of a manufacturer's market in any locality. In other words, the number of cars to be sold and the conditions of the sale, the service to be rendered on the cars that are running, the termination of the contract and the conditions involved, plus the character of allowances to be made for used cars, represent the fundamental elements upon which the manufacturer's market depends, and those elements are so intimately connected with the future market of his car that they should be the subject of full understanding and agreement.

DUTIES on automobiles and engines imported into Czecho-Slovakia have been changed by a law which recently went into effect. Under the new law chassis, with or without bodies, separately imported, are required to pay a duty of 65 per cent ad valorem. Engines for either automobiles or airplanes, separately transported, are taxed the following per 100 kilograms:

	Szecho-Slovak kronen
a—Engines for airplanes	15,000
b—Other engines—	
Piece-weight up to 50 kilograms	6,000
Piece-weight from 50 up to 250 kilograms	5,500
Piece-weight from 250 up to 500 kilograms	5,000
Piece-weight more than 500 kilograms	4,500

In addition to these duties a luxury tax of 12 per cent ad valorem has been placed upon all passenger cars and motorcycles and their parts and accessories. This tax must be paid by the importer, however. Motor trucks and ambulances are exempt from this tax.

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World Registrations

THE possibility of business men utilizing more fully government information sources has been emphasized on numerous occasions. The success of the recent census of world automobile registration made by AUTOMOTIVE INDUSTRIES brings this point again into prominence. The consular service of the United States was responsible to a considerable degree for the success of that survey, reports being obtained on many obscure parts of the world with a promptness and accuracy that was extremely gratifying.

In a number of cases, of course, it was necessary to go to other sources for the information desired, and the very hearty co-operation extended both by individuals and organizations of various kinds throughout the world indicates the importance which motor transportation has assumed in every nation.

We are glad to take this opportunity to express our very hearty appreciation of the aid rendered by U. S. consuls, by the Automotive Division of the Bureau of Foreign and Domestic Commerce, and to the many individuals and organizations both here and abroad which have combined to make possible the very comprehensive survey of world motor vehicle registrations published in the recent Statistical Number of AUTOMOTIVE INDUSTRIES.

The Year-Around Chassis

WE have heard a great deal about the car for use the whole year through and have nothing but commendation for efforts to develop body types which are equally comfortable in all kinds of weather. It is certainly not less important to develop a chassis which is just as convenient to use in cold as in warm weather, yet far less attention is being given this matter.

It is, however, a matter of common knowledge that a considerable percentage of passenger cars are laid up for the winter months, largely because of the fact they are far less convenient to use in cold weather. One of the chief difficulties in this connection is the cooling system and there are few who will not concede the advantages of the air-cooled engine in weather sufficiently cold to make trouble for the water-cooled type. Appreciation of this situation is, in fact, very largely responsible for the expenditure of vast sums in development work now proceeding on several air-cooled cars.

Water cooling is by no means likely to lose its virtual monopoly of the field in the near future, but it is well worth while for the many advocates of this type to consider wherein it too can be so improved as to be the source of less annoyance to the user. The first item to be considered in this connection is the development of the best possible non-freezing solutions. At first thought this may seem to be a problem with which the car manufacturer should not concern himself, but he can and should at least give encouragement to its solution, for it is generally agreed that a wholly satisfactory non-freezing solution is not now generally available. The Bureau of Standards has done considerable work in this connection, and has reached the following conclusions:

1—Calcium-chloride compounds should be used with caution, if at all, on account of their corrosive action.
2—Kerosene or similar oils should not be used on account of their inflammability, high boiling point, and effect on rubber.
3—Solutions of alcohol, or alcohol and glycerine with water, can be used, but have certain disadvantages in respect to cost and need for replacement of the alcohol content as the latter evaporates. (If wood alcohol is used care must be exercised to see that it is free from acid).

More research should be conducted with a view to finding if possible less expensive, more easily procured, and generally more satisfactory non-freezing solutions, and car makers will help themselves by giving substantial encouragement to work along this line. The Bureau of Standards should be asked to continue its work and ample funds be provided for pushing it to the earliest possible conclusion. When the desired result is obtained, it should be given wide publicity by all interested in promoting the most general use of automotive vehicles.

Means for easier starting in cold weather should also be considered. Many troubles result from the

failure of cars to start promptly when cranked. Among them are battery failures and dilution of the lubricating oil by fuel with their consequent troubles, annoyance and expense.

Every manufacturer of water-cooled cars and trucks should interest himself in matters of this kind, for in so doing he will increase the satisfaction of the user, and the satisfied user is the best customer as well as the best booster of any product.

The Industry Investigates

THE searching analysis which is being directed toward distribution systems is perhaps the outstanding development of the automotive industry during the last few months. The first reaction to industrial depression over a year ago was to increase efforts along the marketing lines which had always been pursued. This was followed by the necessity for reduced costs, which came to a large extent simply in reduced activity, rather than in any change of methods or increased efficiency.

Casual conversations with men in all lines of the automotive business, however, indicate that the third period has been reached, in which the fundamental soundness of various automotive distribution systems are being questioned and in which a study of basic principles is being made with a view to rendering marketing effort more efficient and more productive without increasing its cost. The necessity for such analysis has long been apparent and the degree to which it is being carried forward is one of the most encouraging signs of the times.

Car manufacturers are examining the entire system of distributing cars; are wondering whether distributors or factory branches are the most effective; and are carefully studying, in many cases, the various data which will enable them to determine the facts of the case.

The truck industry is trying to find out the best and most efficient way to market trucks; whether in combination with passenger cars; in combination with tractors; as separate units; through distributors or factory branches, etc.

The jobber problem has assumed maximum importance in the eyes of many accessory manufacturers. Some of the accessory group think it will be necessary to have jobbers or middlemen of some kind who will act as territorial representatives for the factory; others think that many jobbers in a territory can be allowed to handle the product. Methods of parts distribution have played a prominent part, of course, in recent news of the industry.

Thus, all along the automotive line, the efficiency of distribution methods is being questioned and carefully studied. A few people are already willing to give a definite answer to most of the questions involved. Those who understand the problems most thoroughly, however, are convinced of the necessity for further investigation and study before final decisions are made.

The automotive industry is young. The necessity for a study of marketing problems has arisen only recently. The period of serious investigation and experimentation has been reached. Certain fundamentals of future action are apparent, but final solution of the problems involved will come through further analysis.

Developments in Public Transport

A NEW factor in public transportation is looming up in the moving platform. Such a system, if at all practicable, would naturally be best suited to the most congested portions of metropolitan cities. The great advantage of the system is that it obviates congestion, as passengers can enter and leave at any point along the line, and at any time, the platform is moving continuously without stop. They are, in fact, very similar to the escalators installed at the main elevated and subway stations in New York.

Shortly after the war the Department of the Seine, which comprises the city of Paris and its suburbs, took over the transportation system of the district, which had been unprofitable for a long time and had depreciated greatly during the war. Since then various plans for reorganizing the system have been considered, especially with respect to relieving congestion at various junctions, and serious consideration is being given to the proposal of a moving platform system for the most crowded sections of the city. This system is not entirely new to Parisians, having been in use on the Champ de Mars during the World's Fair of 1900. As there constructed, the system consisted of three moving platforms side by side of successively increasing speeds. The passenger would step from a stationary platform or walk at one side of the moving system, to the lowest speed platform, the speed of which was so low that it could be entered upon without any risk. In a similar way he would pass from the first to the second platform and from the second to the third. Of course, even the speed of this third platform was comparatively low, but when it is considered that there is no waiting for cars and that the distances covered by such a system is short in any case, it will be agreed that a speed of perhaps 9 or 10 m.p.h. is within the limits of practicability. At the World's Fair the platforms were erected on an elevated structure, offering a fine panoramic view.

In order to obtain designs (or at least ideas) for such an installation the Prefect of the Department of the Seine has written out a prize contest covering the "development of a mechanical system with continuous delivery adapted to public passenger transport." A first prize of 100,000 francs and two other prizes are offered for the best designs. Foreigners and syndicates comprising even a single foreign member must obtain special permission if they wish to compete.

The development here considered is of some interest to the automotive industry in that the adoption of transportation by moving platforms would cut into the field now served by the motor bus. It is obvious, however, that the system has any chance only in sections where there is heavy traffic practically all day long and therefore would be confined to limited areas, so that it could not greatly detract from the business of the motor bus and street car.

Durant to Build for Parts Makers

Plan Calls for New Low Priced Car to Compete with Ford

That Is Understood to Be Basis of Cryptic Contract Announcement

NEW YORK, Feb. 21—There has been much speculation within the industry for the past week concerning the exact meaning of the announcement made last week that "W. C. Durant, president of Durant Motors, Inc., has accepted a contract to build in quantities a 4-cylinder 5-passenger automobile to retail at $348."

Fuel Economy Feature

While Durant headquarters steadfastly adheres to its determination not to elucidate this somewhat cryptic statement until March 9, there is reason to believe that when the explanation is made it will constitute a somewhat sensational chapter in the development of the industry.

When the facts are made known, according to the best information available, they will disclose that a group of prominent parts manufacturers have banded together to enter the automobile building field with an assembled car that will compete with Ford.

It is from these parts makers, if this information is correct, that Durant has accepted the contract to produce in quantities a car with electric starter and demountable rims that will undersell Ford. The chief talking point of this car will be fuel economy. Tests are said to have shown it will make many more miles per gallon of gasoline than will a Ford.

Details of the plan of operation are purely speculative. The terms of the contract are not known. It is assumed the merchandising as well as the assembling will be left to Durant. Neither is there any information as to where it will be put together, but it is asserted that a production of 1000 a year will return a profit.

Identified with Servicing Group

Specifications have not been disclosed, but it will be powered with a Continental engine, it will have Timken axles, and the electrical equipment will be Electric Auto-Lite.

The presumption is that the companies which have signed the contract with Durant are the same which recently announced the establishment of a chain of service stations throughout the country. This group included Continental Motors Corp., Timken-Detroit Axle Co., Brown-Lipe Gear Co., Borg & Beck Co. and Spicer Mfg. Co.

While the tremendous demand for such a car as has been developed in the Durant experimental laboratories at Long Island City would assure a heavy demand for parts in its assembly, this is only a part of the story.

If a car can be produced which will compete successfully with Ford, and that is the entire purpose of the plan, there will be a large and steadily increasing demand for replacement parts. This demand would be filled through the chain of service stations which this group of manufacturers is establishing.

Henry Ford has been quoted as saying that he could afford to give his car away if he could get the parts replacement business. While this statement is exaggerated, it is based on truth.

May Build Truck Also

With this fact in mind, the men who will provide the unit parts for the new car are said to feel that they can afford to supply them at a price which will make possible a profit with sales made at retail at $348.

It is understood a similar announcement may be expected in the near future in regard to a truck and light delivery wagon which are being developed at Flint by a widely known engineer and designer. This line, it is said, will combine mechanical merit with low price.

When the new Durant enterprise is launched some interesting announcements are expected in relation to additions to the personnel of his organization.

Franklin Not Considering Willys Elizabeth Plant

SYRACUSE, Feb. 21—Reports that the H. H. Franklin Manufacturing Co. is considering the purchase of the Elizabeth, N. J., plant of the Willys Corp. from the receivers are authoritatively denied. An inspection of the property was made by H. H. Franklin at the request of the receivers.

As a result of this inspection it has been said that the Franklin company might buy the Elizabeth factory to manufacture its four cylinder air-cooled car. The company already has begun preparations for the erection of a plant for this purpose near East Syracuse.

NEW COTTA CORP. FORMED

ROCKFORD, ILL., Feb. 20—The Cotta Transmission Corp, reorganized, has been granted a charter showing capital stock of $750,000. B. W. Maguire holds $90,000 stock; T. E. Swords, $60,000, and John H. Camlin, Frank G. Hogland, Charles Shanhouse, A. C. Woods, C. E. Woodward and Stanton A. Hyer, each $35,000.

Dealers Stock Cars As Optimism Grows

Greater Confidence in Fair Spring Business Evident—Shows Reflect Feeling

By JAMES DALTON

NEW YORK, Feb. 21.—Some improvement in actual sales at retail has been apparent in February as compared with January. Most of the undeniable betterment in tone has been based, however, on the increased confidence of dealers generally in a fair spring business, beginning the latter part of March. This confidence is reflected in the stocking of cars. This is true, especially, in agricultural districts where none have been carried in some dealer showrooms for months.

Cotton Belt Outlook Better

Another indication of the greater optimism of dealers has been found in the large numbers who have attended shows this year, particularly in Kansas City. At the show there last year dealers in the outlying districts were so discouraged over the outlook that they did not think it worth while to attend. This year the dealer attendance numbered between 800 and 1000.

Companies which are watching conditions in the South found comfort in the fact that retail sales at the Atlanta show ran materially ahead of last year. In fact, the outlook throughout the cotton belt is more cheerful.

While sales of passenger cars thus far this year have not been large enough to cause wild enthusiasm, they have been so much better than they were for the same period last year that the prediction of a considerably better business for the first quarter of 1921 already is vindicated.

Truck Market Improves

The tone of the truck market continues to improve. Reports not only from rural but from industrial centers state that there is a considerable demand for light delivery vehicles. Aggregate sales of this type of truck this year will be large.

Business of parts and accessory makers, which has been materially better since the turn of the year, is

(*Continued on page* 487)

Optimism Pervades Detroit District

Follows Dull Season Time of Speculation

While Few Factories Work Full Time, They Are Pressed by Demands

DETROIT, Feb. 20—There is a general air of optimism in the ranks of Detroit automobile manufacturers which is refreshing after the several months of morbid speculation between the closing of the active buying season last November and the opening of the 1922 shows.

Few of the factories are working full time yet, but they are hard pressed to meet the demand for cars in the part time weeks now in force. By March 1, practically all should be on a five and half day weekly basis, this being especially true in the cars retailing in the $800 to $1,000 class.

Cadillac and **Lincoln** both claim orders far ahead, and the former is on full time. Lincoln is on full time but with a small force pending determination of permanent operating methods. Releases on materials for Lincoln cars have been advanced one month, and releases by many other manufacturers are being made ahead of time. There is a gradual opening up in the tool equipment end of the business, manufacturers seeming to be preparing for the heavy production months about to open and finding much of the former equipment requiring replenishing.

Dodge Brothers are known to be starting the laying out of the factory for the manufacture of a new model which will sell at the same price as the present car, but will be a lower built car with sharp, streamline effects. The new car will probably be ready for the early summer market, coincidentally with the new bodies which will be built at the factory for the first time.

Reo Motor Co. has presented figures which show that 1000 more speed wagons were sold in January than were shipped from the factory, indicating that not only are dealer stocks undergoing rapid depletion, but that buyers of commercial cars are coming into the market, and, therefore, that general business is improving strongly.

King Motor Car Co., of which little has been heard since the receivership, has announced a schedule of 2000 cars for the year. This will be almost five times the number manufactured last year. King prospects are considered bright, many new dealers having been added to the organization in the past few months and finances are in good shape.

Kess-Line Motors, which announced a new eight cylinder car some months ago, is now about to go into production. The list price of the touring has been fixed at $2,250. The feature of the new car is the engine which has eight small cylinders cast in bloc, which is claimed to develop 100 horsepower.

Gray Motors will make its first shipments in April, according to Frank L. Klingensmith, president. The price of the car is still unrevealed. There is a report that contracts for equipment are about all closed and that the price will be forthcoming shortly.

Page Elected President of New American Motors

PLAINFIELD, N. J., Feb. 20—Carl L. Page will head the reorganized American Motors Corp., which has taken over the assets of the original company, recently acquired from the receivers by a syndicate of stockholders. At a meeting of the board of directors Page was elected president of the new company and will assume active charge of the plant immediately with headquarters at the plant here.

Although he has been identified with the younger element in the automobile industry, Page is a veteran in service, having begun his career more than 20 years ago with the White Motor Car Co. of Cleveland, which appointed him manager of the New York branch while he was still a young man. Subsequently he became the head of his own organization as distributor for the Chalmers and Mitchell cars. Later he acted for Jordan and more recently undertook a factory connection with the Saxon Motor Car Co., where he served as vice-president in charge of sales.

Operations have been resumed at the plant here with enough orders ahead, it is reported, to warrant a production of 100 cars a month for some time to come.

G. M. May Handle Trade in Europe Through London

NEW YORK, Feb. 21—The volume of business which now is being received by the General Motors Export Corp. is highly gratifying and indicates steady improvement of conditions in the foreign field. Without the expenditure of large sums in sales efforts, the export orders now being received at Oshawa, Ontario, for Buicks and Chevrolets are averaging 125 a day.

Little effort is being exerted to make sales on the Continent and the company may decide in the near future to handle that business through London until there is a material improvement in conditions.

Chrysler Gives All His Time to Maxwell

Condition Likely to Be Only Temporary—No Definite Plans Announced

NEW YORK, Feb. 21—Walter P. Chrysler whose resignation as a director and executive, vice-president of the Willys-Overland Co. was announced last week, said to-day that he had no announcement to make at this time concerning his plans for the future except that for the present he would devote all his time to the Maxwell Motor Corp. of which he is chairman of the board. It is not believed, however, that this situation will continue permanently.

It is known that Chrysler has several projects and propositions under consideration but he has not determined what one to take up. Since his resignation became known, the industry has been filled with rumors about impending announcements of his affiliation with one company and another. The most popular of these has been that he would join the General Motors Corp. It can be stated, however, that no such connection is imminent.

Another favorite report is that Chrysler will head a company which will be organized and backed by banking interests to take over the Elizabeth plant of the Willys Corp. and build there the Chrysler six which was ready for production when receivership proceedings were instituted. It also can be stated that there appears to be little basis for this report and the chances are that the Elizabeth factory will be sold to some manufacturer already in the field.

Chrysler will leave in a few days for a long rest at Palm Beach.

Illinois Body Company Creditors Name Committee

DANVILLE, ILL., Feb. 21—Creditors of the United Automotive Body Co., which has a plant at Tilton, have appointed a committee to inspect the plant and prepare a report recommending a course of action. The parent company of the United Automotive Body Co. known as the L. C. Graves Corp. of Springboro, Pa., was forced into a receivership three weeks ago by the failure of a bank in which L. C. Graves was interested.

The liabilities of the United Automotive Body Co. are estimated at $41,000, while the assets include the plant, materials and bodies under construction. The original plan of the L. C. Graves Corp. was to operate forty branches in various states.

Machine Patent Suit Lost by Seiberling

New Jersey Defendant May Start Infringement Proceedings Against Tire Makers

AKRON, Feb. 20—F. A. Seiberling, inventor of the first tire building machinery and now president of the Seiberling Rubber Co., has lost his patent infringement suit in the United States District Court of New Jersey against the John E. Thropp & Sons Co. of Trenton. N. J. The Thropp company manufactures tire building machinery for about 60 tire companies in the United States.

Considerable significance is attached to the outcome of the Seiberling suit, as it is understood that the Thropp company, unless Seiberling appeals, may possibly institute infringement proceedings against Seiberling and numerous other tire manufacturing companies, on the ground that their patents, which Seiberling claimed constituted infringements upon his, antedate Seiberling patents and all others on the specific tire building machinery involved.

Brought on Cotton Spinner

Seiberling brought his suit on claims of infringement on two of his patents on machines designed to spin the cotton fabric into the tire carcass by use of spools and high speed cores. Prior to the final argument in the case Seiberling withdrew his infringement claim on the earlier of his two patents involved. A disclaimer filed sought to read into the latter patent the particular process of tire building in dispute.

The district court of New Jersey in its decision decrees that the latter patent as modified by the disclaimer is invalid on the ground that the process or method specified in the disclaimer was nothing more than had formerly been followed by hand in tire construction. The Seiberling suit is similar to that filed by Seiberling over a year ago against the Firestone Tire & Rubber Co., of Akron, and which the latter won in the appellate court at Cincinnati, O.

The New Jersey court's decision in the Seiberling vs. Thropp case is:

This case involves letters patent 941,962 for a tire making machine, granted, Nov. 30, 1909, upon the application of Will G. State (Chief engineer at Goodyear under the Seiberling regime), his interest assigned to the plaintiff. The bill also claims an infringement of patent 762,561 granted on the application of Messrs. Seiberling and Stevens. This patent has been withdrawn and a decree is asked under the State patent alone.

Process Used Before

The plaintiff's patent was before the Circuit Court of Appeals for the Sixth Circuit in the case of the Firestone Tire & Rubber Co. vs. Seiberling, 257 Fed. Reporter, 74. The claim is urged however that the record in the present case is so distinct from the record in that case that a different result is inevitable, the distinction being that a disclaimer having been filed Feb. 14, 1919, claims 1, 2, 3, 18, 19, 20 and 21 are not in the suit and claims 8, 9, 10, 11, 14, 15, 16 and 17 have been erased. The effect of the disclaimer is broadly to limit the patent to a combination in a tire making machine of a forming or spinning roll with a high speed core. The method or process used is the same which the proofs have showed had for many years prior to the patent been used in the making of tires by hand.

The Circuit Court of Appeals for the Sixth Circuit considered the case as though before them in its present aspect. If further authority is necessary see Conroy vs. Penn Electrical & Manufacturing Company, 155 Fed, 421, affirmed 159 Fed., 943. The result reached makes it unnessary to pursue the the many other grounds urged for the invalidity of the patent.

The relief sought will be denied.

Industry Pays Huge Tax on Its Income

WASHINGTON, Feb. 20—Analysis of corporation returns by the Bureau of Internal Revenue shows that of 302 corporations engaged in the manufacture of motor vehicles, airplanes and spare parts, 285 reported a net income aggregating $233,814,078 during the calendar year of 1919. On this sum they paid an income tax of $17,875,652 and a war profits and excess profits tax of $56,172,491, making the total taxes paid $74,048,143.

Seventeen corporations reported a deficit aggregating $328,213. Under the classification of cab, livery, jitney-buses, automobile cartage, etc., 2271 corporations filed tax returns amounting to $2,031,169 on a net income of $11,247,571. The income taxes amounted to $657,258 and war profits and excess profits taxes amounted to $1,373,911.

A. E. A. Plans to Take Up Service Question

CHICAGO, Feb. 20—The merchandising department of the Automotive Equipment Association, under the direction of Ray W. Sherman, which has been waging a nationwide "Ask 'Em to Buy" campaign for several months, is ready to broaden its activities and include the service stations of the country in its educational work.

The new work will carry the campaign for better sales into the back end of the shop, where it will seek to better service. Equipment, operations and everything that will better the service to the owner is to be included. The same earnest effort that has gone to better the retailing of accessories will now include the mechanic and the service he has for sale.

DAWSON MAY CONTINUE GARY

GARY, IND., Feb. 20—Property and assets of the bankrupt Gary Motor Truck Co., with assets of $407,846 and with liabilities equalling or surpassing that sum, will be sold to the highest bidder at public sale Feb. 24. It is believed that Frank Dawson, president of the company, will head an organization to purchase the property and to continue under the old management.

Bureau Co-ordinates Anti-Theft Efforts

Interstate Commission Organized in Chicago for All Law Enforcement Bodies

CHICAGO, Feb. 20.—Organized to give service and effect co-operation and not to sell service, the Interstate Motor Theft Commission, chartered under the laws of Illinois, has established headquarters in Chicago, where it hopes to furnish a national clearance test to be applied to all cars registered in the United States as a means of co-ordinating the efforts of police departments, insurance companies and others, in reducing the theft of automobiles, recovering stolen cars and prosecuting the thieves.

The commission, which is fashioned somewhat after the style of the Chicago Crime Commission, is governed by a board of seven, assisted by national advisory boards composed of police officials, insurance men and business executives. Joseph A. Farout, deputy police commissioner of New York; Charles W. Peters, sheriff of Cook county, Ill.; Dan Beard, national Boy Scout commissioner; J. A. Hall, educational director of the Associated Advertising Clubs of the World; Gutzon Borglum, president of the International Sporting Club; E. M. Allen, member of the insurance committee of the United States Chamber of Commerce, and Harvey G. Badgerow, president of the Illinois Insurance Federation, are members of the advisory committee.

Fees Will Support Commission

The commission will endeavor to keep itself going through fees from memberships. Any service that may be rendered any member is wholly secondary to the main issue, which is to establish a national clearance bureau for the free use of law enforcement bodies. Co-operation is asked from all kindred organizations and every effort will be made to aid in destroying the stolen car market.

This organization was decided upon after a year's study of the situation and conferences with leading police officials, insurance representatives and business heads closely associated with the automotive industry.

Champion Ignition Co. Now A. C. Spark Plug

FLINT, MICH., Feb. 20—The Champion Ignition Co., manufacturers of the A. C. spark plug, will be known as the "A. C. Spark Plug Co." after April 1, according to an announcement made by B. DeGuichard, vice-president and general manager of the company.

The reason for changing the name is to bring a closer tie-up between the company's name and the nationally known trade name, "A. C.," with which the firm's advertising is labeled, as is the spark plug itself.

Goodrich 1921 Loss Reached $8,983,401

Assets Reduced to $89,031,229—Inventories Suffer Big Downward Revision

AKRON, Feb. 20—Assets of the B. F. Goodrich Co. were reduced from $138,910,112 in 1920 to $89,031,229 at the close of the past fiscal year on Dec. 31, 1921, according to the company's annual audit and balance sheet. Assets in 1919 were listed at $175,715,000.

The company's inventory has been brought down from $54,184,000 in 1919 and $72,631,142 in 1920, to $29,618,938, while the surplus has been reduced from $22,706,499 in 1920 to $10,194,527. The loss sustained by the company in 1921, of $8,983,401, carried to surplus account, is responsible largely for the heavy surplus shrinkage. In addition 7 per cent preferred stock dividends of $2,626,470 and one common stock dividend of $1.50 per share, totaling $902,100, were paid out of the surplus. The Goodrich surplus in 1920 was listed at $41,203,046.

Falling Off in Sales

Sales for the year approximated $87,000,000, as compared to $150,000,000 in 1920 and $141,000,000 in 1919. Practically the entire loss, officials state, is due to the decline in the 1921 market values of raw materials and finished goods carried forward from the previous year.

The balance sheet shows Goodrich plant investments of $32,115,758 as compared to only $19,486,065 in 1919. Assets include investments of $4,446,545; treasury stock certificates of $230,600; accounts receivable of $19,307,518; Liberty bonds of $43,266 and cash of $2,573,696. The tangible capital assets of $32,115,758 which include plants, real estate, equipment, etc., are listed less a reserve of $10,032,494 for depreciation and obsolescence. Deferred charges to future operations total $593,906.

Current liabilities include accounts payable and sundry accrued liabilities of $3,413,128; Five year 7 per cent gold notes due April 1, 1925, of $30,000,000; seven per cent preferred outstanding stock of $37,224,000; reserves and other contingencies of $4,123,547; and employees credits on stock subscriptions, of $526,862.

U. S. Sales Drop 35.79 Per Cent

NEW YORK, Feb. 20—The United States Rubber Co., in its annual report for the year ended Dec. 31, 1921, shows net sales of $164,470,368, a decrease of $91,679,762, or 35.79 per cent as compared with the previous year.

After absorbing approximately $10,000,000, representing the excess cost of finished goods carried over from 1920 and sold in 1921 as compared with the average cost of producing similar goods in 1921, but before adjustment of inventories, all of which adjustment is definitely allocated to 1920, the net profits for the year amounted to $470,817 after all interest and other current charges. This showing was made notwithstanding a reduction of approximately $18,000,000 in the income from sales caused by the price reductions made after Jan. 1, 1921.

In 1920 the company, before adjustment of inventory, reported net income of $21,220,983. Adjustment of inventories in both years was charged to profit and loss surplus with the result that this item was reduced from $47,325,380 at the close of 1920 to $30,031,633 at the close of 1921.

The general balance sheet as of Dec. 31, 1921, shows net current assets of $134,766,062, of which $13,816,477 was in the form of cash, $41,543,883 in accounts and bills receivable, $51,248,659 in finished goods and $25,443,118 in materials and supplies. Current liabilities aggregated $49,232,561, of which $36,210,000 were in the form of notes payable.

Kelly-Springfield Loses $506,960

NEW YORK, Feb. 20—A substantial loss in the last year was sustained by the Kelly-Springfield Tire Co., according to the annual income account for the year ended Dec. 31, 1921. After all charges the company had a loss of $506,960, whereas in the preceding year there was a net profit of $1,959,294, before taxes but after all other charges.

The company's balance sheet as of Dec. 31 shows total current assets of $10,775,715, against which are current liabilities of $863,595. Cash on hand totaled $2,357,977 and inventories were carried at $5,525,739. Current liabilities consisted almost entirely of accruals of interest, dividends and balances due customers, with only $332,576 in trade accounts payable.

In his annual statement to the stockholders, President Alfred B. Jones reported that although the value of sales declined in the year by reason of price reductions, there was an increase of more than 20 per cent in the volume of units sold. Extraordinary charges were due to the decline in the market value of materials and to expenses incident to the operation of the new plant at Cumberland, Md., all of which has been charged directly against the year's operations.

Ford Denies Seeking More Motor Plants

DETROIT, Feb. 2—Henry Ford asserts there is "absolutely not a word of truth" in the reports that he is negotiating for the purchase of the C. H. Wills & Co. or any other motor car plant.

An official of the Dodge Brothers Motor Car Co. asserts that sale of the plant to Ford or any other interest is not contemplated.

A dispatch from Buffalo quotes M. E. Forbes, vice-president and general manager of the Pierce-Arrow Motor Car Co., as saying that there is no foundation for the report that Ford is buying control of that company.

SIGNS LAMPERT BILL

WASHINGTON, Feb. 18—President Harding to-day signed the Lampert patent office bill, increasing salaries of patent office employees and expanding the force there in order to relieve the congestion of work.

Cleveland Getting More Parts Orders

Better Business Comes With Turn of Year—Continued Gains Expected

CLEVELAND, Feb. 20—Buying started by the automobile show has brought many orders to parts and accessory manufacturers here. There was a spurt in orders just after the opening of the year, and business has continued since on the level then established. Manufacturers are strong in the belief that further gains may be expected within the next two or three weeks.

Makers of parts and accessories say that never within their history has buying been done so closely by automobile makers. Orders placed carry provisions for speed in delivery. Steel makers in this district have had the same experience. Four-fifths of the orders for steel are for rush delivery, but steel makers assert that the automobile industry is doing more than any other single line to put back the fires in the steel mills.

Orders have been much better in January and February than in several preceding months, but they are not normal, according to executives at the plant of the Willard Storage Battery Co. At this plant they are looking for a general increase up to the middle of June. Other statements follow:

Grant-Lees Gear Co.—Planning to work on capacity basis on orders that are sufficient to keep the company going the entire year.

Sherwin-Williams Co.—(Paints)—The business in the automobile parts department is better than in any other branch. The volume is better than it was at the same time a year ago.

Columbia Axle Co.—There has not been much change in this factory since about Jan. 10 when orders picked up. Steady improvement expected until the middle of June.

Interstate Foundry Co.—This factory is now working six days a week instead of five days as was the case two weeks ago. Before that the men were employed only three days a week. The outlook is good for the men to continue on the six days a week schedule.

National Acme Manufacturing Co.—There has been a considerable improvement in the demand for automatic machines. Outlook is good for continued up turn.

K-W Ignition Co.—The demand is better than it was two weeks ago and a gradual increase is expected until June. Jobbers' stocks are low.

Ohio Body-Blower Co.—The automobile business is now taking about 25 per cent of the plant's total, compared to the usual 60 per cent.

BRAZIL BUILDING ROADS

SAO PAULO, BRAZIL, Jan. 26 (*by mail*)—The highway connecting Sao Paulo and Rio de Janeiro is being actively developed, the authorities here making every effort to complete their part of the work so that the road may be opened for the Centennial Celebration in September.

Congress May Allow Bonus Plans to Rest

Predictions Made That No Legislation Will Be Enacted at This Session

WASHINGTON, Feb. 21—Predictions are freely made in official quarters that there will be no bonus legislation enacted at the present session of Congress. It is apparent that the interminable controversy will be passed on to the next session and the legislation indefinitely postponed. At present there are indications that the House may jam the measure through at the current session purely as a matter of supposed political expediency, realizing that the Senate and the President favor postponement of action.

There is a strong element in the House, manifestly at variance with the Administration, who would like to return to their constituents at the forthcoming fall election as sponsors of a bonus, regardless of how the money should be raised.

Sales Tax Suggested

The Administration is insistent that the bill shall include a plan for obtaining the revenue and has recommended a sales tax. The Chief Executive has announced himself in favor of a production tax to be collected at the source because of its so-called simplicity of collection and equitable distribution. The agitation for a retail tax apparently has not impressed the President, for he has expressed the belief that it would be too complicated and would involve more expense in collection than a manufacturer's tax.

The President refrained from suggesting the rate which could be levied at the source, but it is said that he would approve a 1 per cent tax on wholesale sales of manufacturers' products. It is estimated that approximately $350,000,000 could be obtained annually from this source, and this would be sufficient to meet the demands of a cash bonus plan.

The agricultural bloc in Congress is strongly opposed to the sales tax plan. It is supported in this view by the American Federation of Labor. Business interests of the country, as Congress is well aware, are opposed to any kind of bonus legislation because of its serious economic effects.

Harding Opposes Excess Profits

The President is unalterably opposed to the restoration of the excess profits tax, which proved so burdensome to business and industry. It is generally conceded that a levy on manufacturers' products could not be added to prices paid by ultimate consumers. Business men feel that it is not feasible to raise prices at this time. They also realize that they are the first to feel the effects of extra pressure from taxation in diminution of profits and would undoubtedly be compelled to absorb this assessment through narrowing of the margin of profits. Judging from the volume of protests received by Congress from business interests, it is evident they are convinced that the study of the economic effects of a bonus by the legislators is exceedingly superficial and that the political side only has been considered.

President Samuel Gompers of the American Federation of Labor, in a statement to Congress, declared that organized labor favors a bonus, but "recognizes in the proposal to attach the sales tax to the soldiers' adjusted compensation bill a subterfuge intended either to defeat the bonus or to create a feeling of resentment against the veterans of the World War by placing the burden upon those least able to bear it and by permitting the escape of those who profiteered so relentlessly during the period of the war and since the war."

The farm bloc has refused to be placated in its opposition to a sales tax and is marshalling its forces in favor of an excess profits tax, and there is talk of it being joined in its campaign by organized labor. Even in the event of such legislation passing Congress through the activities of these groups, the President undoubtedly would veto it, and it is not at all probable that the veto could be overridden.

Denby Sees Indications of Greater Truck Buying

DETROIT, Feb. 20—The Denby Motor Truck Co. at its annual meeting here reported that a decided improvement in truck buying is indicated for 1922 and that it has received as many truck orders for the first six weeks of this year as came in during the first three months of 1921. The demand is especially good on the ¾-ton and the 1½-ton models. It reports sales as promising on new model 35, 2½- to 3-ton.

Despite the dull year in the industry, the company reported that it is now in a better financial position than a year ago with all inventories charged down to current replacement values.

The same management was continued in office and the following directors were elected: E. R. Ailes, treasurer, Detroit Steel Products Co.; Hon. Edwin Denby, J. Walter Drake, chairman, Hupp Motor Car Corp.; C. H. L. Flinterman, vice-president, Detroit Pressed Steel Co.; H. L. Lyster, A. S. More, president, Denby Motor Truck Co. and T. M. Simpson assistant secretary, Continental Motors Corp.

STEWART-WARNER TAX WINNER

CHICAGO, Feb. 20—Stewart-Warner Speedometer Corp. has made a settlement with the government in an income tax controversy that has been pending for several years, by which the company is saved payment of $2,000,000. The tax question involved the amount of exemptions carried by the item on patents and good will and the classification in earnings paid each year to the Stewart interests.

Court Finds Kelley Tire Offer Too Low

Newman Group Bid $200,000 for Plant—Receivers Aim to Get at Least $100,000 More

NEW HAVEN, CONN., Feb. 18—The reorganization proposition of the A. Newman group of New York City to take over the plant of the bankrupt Kelley Tire & Rubber Co., in West Haven for $200,000, that amount being $50,000 less than their first offer, is rejected by Judge George E. Hinman in a decision handed down this week in the civil side of the superior court here. The decision denies the application of the stockholders' protective committee to sell.

Some time ago, the receivers, Attorney Albert H. Barclay of this city and the First National Bank of Bridgeport, opened negotiations with the Newman group of financiers relative to the sale of the plant. The first offer was for $250,000, it being estimated that this would leave $200,000 for the creditors and stockholders, $50,000 being needed to pay litigation and receivership. The time limit expired without acceptance, and thereupon Newman made a new offer of $200,000, good until Feb. 17. The offer was commended by the stockholders' committee, but objected to by the receivers, who desire to see if they cannot get at least $300,000.

The decision of Judge Hinman says: "While it is probable that, considering the interests of the stockholders alone, the benefits accruing to them under the Newman offer, though small, is as much or more than can be reasonably expected from a sale for cash without concessions in stock to the stockholders contemplated by such offer, the duty of the court and its representatives, the receivers, is to obtain as large a price as possible, in order to provide funds toward satisfaction of the claims allowed."

G. M. C. SELLING HOUSES

FLINT, MICH., Feb. 20—A sweeping price reduction aggregating more than $1,000,000 on houses of the Modern Housing Corp. is announced by General Motors Corp. through H. H. Bassett, president of the company which built 950 homes in Civic Park and Chevrolet Park. The price slash will place the sale price of a modern five-room stucco house on a paved street at $4,000. Six-room houses may be had from $4,500 to $5,000, with larger homes proportionately higher in price.

ORDERS SALE OF TEXAS MOTORS

FORT WORTH, Feb. 20—Judge R. E. L. Roy in the United States District Court has authorized a receiver's sale of the assets of the Texas Motor Car Association. Bids will be received not later than March 13 and will be opened at the court house in this city the following day.

Mason Incorporates New Truck Company

Will Make 1-Ton Model at Flint —Is Capitalized at $500,000

FLINT, MICH., Feb. 21—The Mason Motor Truck Co., headed by Arthur C. Mason as president and general manager, has been incorporated in Michigan with a capital of $500,000. The secretary of the company is Melvin C. Day, who has been closely associated with Mason for eighteen years, and the treasurer is A. G. Bishop, a vice-president of the General Motors Corp. The new company will manufacture in Flint a 1-ton truck to be known as the Mason Road King.

While the complete specifications are withheld, it is known the truck will be powered with a Continental engine and will have Timken axles. It will sell around $1,000. The plant, which has been purchased in the south end of Flint, has a capacity of 40 a day, and the company expects to be running at capacity by midsummer.

The new corporation is completely financed and no stock is on the market.

Mason built the first motor used in the first Buick car, and was the first man on the Buick payroll. He developed and built motors now running in the Chevrolet F B and 490 lines.

He organized in 1911 the Mason Motor Co., of which he was president and general manager. This company manufactured Chevrolet motors until 1915, when it was taken into the Chevrolet company. Mason then became a consulting engineer for the General Motors Corp. and developed for it the Samson tractor. He continued with the corporation until December, 1920, when he came to Flint and took over the plant where he has developed the new truck.

Employment 135.5 Per Cent Better Than January, 1921

WASHINGTON, Feb. 20—Comparison of employment in 47 identical establishments in the automotive industry reporting a payroll for a period of one week for December, 1921, and January, 1922, gives a decrease of 5.9 per cent in the number on the payroll and a decrease of 35.8 per cent in the amount of payroll for these months. Study of employment in these places for January, 1921, and January of the present year shows an increase of 135.5 per cent in the number on the payroll in January, 1922, and 45.4 per cent in the amount of the payroll. These figures and other industrial statistics were compiled by the Bureau of Labor Statistics from reports concerning the volume of employment from representative establishments in 13 manufacturing industries.

The comparison for the one week period covered in January of last year and January, 1922, shows that in January, 1921, 36,588 were on the payroll and for the same month this year, 86,166. The amount of the payrolls for one week in January, 1921, was $1,042,144, as compared with $1,515,399 for January, 1922. These identical establishments in December, 1921, had 91,682 on the payrolls and 86,282 during January, 1922. The amount of the payroll was $2,363,481 in December, 1921, and $1,518,331 in January, 1922.

A survey by the Bureau of Labor Statistics stated that a decrease of 15 per cent to all men was reported by one establishment. Two plants reported a wage rate decrease of 10 per cent, affecting the entire force in one, and 60 per cent of the force in the second. Sixty per cent of the men in one plant were cut 8 per cent in wages.

Financial Position Strong Gardner Statement Shows

ST. LOUIS, Feb. 21—The balance sheet of the Gardner Motor Co. as of Dec. 31 shows the company in a strong financial position notwithstanding the substantial loss taken during the year on inventories and increased overhead resulting from smaller production. The company has no current liabilities except dealers' deposits amounting to $23,448. Cash on hand amounts to $514,180, accounts receivable to $244,238, and inventories, at cost or market, to $519,604.

The report to stockholders states that since the price of the company's touring car was reduced to $895 sales have been greatly stimulated and many new dealers have been added.

Dealers Stock Cars As Optimism Grows

(*Continued from page* 482)

holding up well, and there are indications of continued improvement. They now are getting the full benefit of inventory deflation by vehicle manufacturers.

There is much speculation within the industry over the mysterious announcement of W. C. Durant that he had accepted a contract for quantity production of a four-cyclinder, five-passenger car to sell at $348, with electric starter and demountable rims. This price would be nearly $100 under the price of a five-passenger Ford with the same equipment. One of the questions most frequently asked is where the car will be built, for production in large quantities will be necessary if the new car is to be manufactured at a profit.

BENZ-RUMPLER MERGER

LONDON, Feb. 10 (*by mail*)—The Benz and Rumpler companies have joined hands with a view to turning out a car containing all that is best in the two companies' present types. Until the utility of the projected car is proved, Benz will continue to manufacture their own models.

Consolidating Work, G. M. to Sell 6 Plants

Former Cadillac Factory Included —Will Also Dispose of Site at Grand Rapids

DETROIT, Feb. 21—The General Motors Corp. will sell, through its real estate department, six plants formerly occupied by divisions of the corporation, as part of its plan of consolidating activities. The plants listed for sale are:

The former Cadillac plant, Detroit; the Frigidaire Corp. plant, Detroit; Michigan Crankshaft Co. plants at Lansing and Saginaw; the International Arms & Fuse Co. plant at Bloomfield, N. J., and a plant built by the Champion Ignition Co. at Brantford, Ont., which never was occupied.

A statement by the company relative to the sale says:

> In readjusting its business to conform with new plans providing for still greater efficiency in production the General Motors Corp. has found it desirable to consolidate some of its manufacturing operations. As a result of this development, six plants formerly operated by the corporation are now being placed on the market. The number is small when viewed in relation to a business consisting of seventy-eight divisions, subsidiaries and affiliated companies.
>
> The plants now being offered, subject to prior sale, are all in good condition and were operated successfully within the last year. They provide a wide range of selection with respect to location, size, character of construction and cost.
>
> To avoid holding factory property in a non-productive condition the corporation is prepared to sell any or all of the six plants at prices below carefully made appraisals.

The floor space of the plants aggregates 418,712 sq. ft.

In addition to the plant sale, the corporation will sell a factory site of 60 acres in Grand Rapids.

E. S. Hare, Inc., Announces Additions to Personnel

NEW YORK, Feb. 21—A. G. Hare, a member of Hare & Chase and a brother of Emlen S. Hare, president of E. S. Hare, Inc., has been named vice-president of the latter organization, which succeeds Hare's Motors and which will act as manufacturers' agents, sales and engineering experts. W. G. Toland, formerly general sales manager of the truck department of Hare's Motors, has been appointed secretary and treasurer and has been placed in general charge of the sales of the organization.

Frederick Miller, at one time connected with the Packard Motor Car Co., serving as its eastern district manager and later as head of Packard New York sales, becomes field representative. William Carl Chapman, who has been with the Hare organization practically since its inception, will act as advertising manager. Victor Bensch has been named to act as a member of the operating staff of the organization.

Akron Tire Output Steadily on Upgrade

Industry Above Peak of Last July —Ford Places Order with Mason

AKRON, Feb. 20—Tire production steadily is on the upgrade in Akron, although there has been no outstanding spurt. All tire companies report spring orders up to expectations, but are not planning any substantial production increases, for there is always a seasonal buying slump to follow the first spring buying spurt, and finished goods inventories are to be held at rock bottom and will not be materially expanded.

Akron, according to estimates of the rubber companies, is in better shape economically and financially than at any time since the beginning of the business depression in the early part of 1920. The tire industry itself is slightly above the peak reached in July of last year, just prior to the second precipitate slump. Actual producing wage earners in Akron's major tire plants now number in excess of 30,000, as compared to a peak employment of about 28,000 reached in July, 1921, following the drop from 71,000 employees in May, 1920, to 18,500 in December, 1920.

Miller 75 Per Cent of Normal

Goodyear within the past two weeks has added 500 men and increased production to 22,000 tires daily. Miller is operating about 75 per cent of normal, and Firestone continues its production ticket of about 20,000 tires daily. The General tire plant is running up to capacity. The Mohawk Rubber Co. officials report plans for increased production this spring.

The Seiberling Rubber Co., controlling the Portage plant at Barberton and the Lehigh tire plant at New Castle, Pa., now has a combined production of 800 casings and 1500 tubes daily. Production includes the old line of Portage cord and fabric tires and the new Seiberling cord tires on which the sidewall is eliminated and replaced by tread stock running from bead to bead.

F. A. Seiberling, president, announces that his company will go extensively into the rubber heel manufacturing business this spring. H. J. Thompson, for years sole and heel sales manager for the Goodyear company, has resigned to join the Seiberling company in a similar capacity. R. H. Lyons of Goodyear has also joined Seiberling as a special heel sales representative. W. H. Oburn, for several years secretary of the old Goodyear board of control, has become manager of credits and collections for Seiberling.

Seiberling Moves Offices

All general offices of the Seiberling company have been moved from Akron to Barberton. Seiberling's new cord tire is ready for shipment for spring delivery. Officials of the company report heavy orders for the new casing.

The Mason Tire & Rubber Co. of Kent confirms reports that it has booked orders from Henry Ford for from 15,000 to 20,000 tires a month. Under present plans the Mason plant's production will be doubled and will go to 5000 casings daily on March 15. The company's annual report due next month is expected to show sales for the fiscal year of approximately $9,000,000, as compared to $7,000,000 in 1920. Net profit is estimated at $600,000. The Ford order is the first original equipment business undertaken by the Mason company.

Columbus Business Considerably Better

COLUMBUS, Feb. 20—With the coming of milder weather demand for passenger cars in Columbus and central Ohio territory is increasing. Dealers in Columbus, following the very successful show, report a larger business with prospects more easily handled. Quite a few sales of cars have been made, both for immediate delivery and for delivery in March and April. The tone of the trade shows a decided improvement in many ways. The public is coming to a realization that prices are now pretty well stabilized.

Truck business is still slow, although there are signs of improvement. The demand for light delivery wagons is the best and far in excess of that for the heavier lines of trucks.

Light Cars and Cycles Sell at Glasgow Show

GLASGOW, Feb. 10 (*by mail*)—The third post war Scottish automobile show here was one of the most successful ever held in Scotland. There were 230 exhibits with gasoline cars, gasoline trucks and one battery truck, as well as motorcycles, runabouts and a fair variety of accessories.

The American display, especially of trucks, was not so numerous as that at recent shows, but even more noteworthy was the absence of any steam truck or land tractor.

Generally speaking, sales were poor, but there were some inquiries for certain classes of light cars and motorcycles.

NEW GILLETTE PRESIDENT

EAU CLAIRE, WIS., Feb. 20—F. C. Hermann of Springfield, Mo., one of the heaviest stockholders in the Gillette Rubber Co. of Eau Claire, Wis., has been elected president of the corporation. R. B. Gillette continues as vice-president and general manager. L. A. Fosse of Chicago, who has been in charge of affairs in behalf of a bankers' committee for the past year, has relinquished his duties. Mr. Hermann recently disposed of most of his extensive business interests at Springfield to retire to California to live, but he has changed his plans and will take an active part in the management of the Eau Claire concern.

Trade in India Lost by English Makers

American Motor Vehicles Gain Supremacy—High Fuel Price Checks Sales

LOS ANGELES, Feb. 20—The extent to which the United States has displaced Great Britain as a supplier of motor vehicles to India is shown in the latest official statistics announced during the recent motor exhibition held in Calcutta under auspices of the Motor Trade Association, Eastern India Section. The year before the war 2800 motor cars were imported into India, of which 1669 came from Great Britain. In 1920-21, a total of 15,432 motor vehicles were imported into India, of which only 2541 came from Great Britain and 10,120 from America.

While the display of American cars at the Calcutta show could not be described as comprehensive, there nevertheless was a good American representation. The automobile manufacturers of Great Britain, who are now making a vigorous effort to regain trade lost to America, were well represented.

Aside from the lack of good highways, the chief obstacle to the development of the automobile trade in India is the high price of gasoline. During the month of December, the average price per gallon stood around 75 cents. India is largely served with fuel from Burma.

In speaking of the fuel price situation in India, the *Times* of India (Calcutta) said:

"The only avenue of escape is the provision of an alternative fuel, such as benzol, if necessary under a purely official agency. If the price of gasoline can be lowered and the road system is improved we would have only touched the fringe of the use of the internal combustion engine in India. The plain fact is that the bullock, which was always inefficient, has ceased to be economical."

Taxes in Philippines to Maintain Roads

LOS ANGELES, Feb. 20—A substantial increase in the tax on automobiles and a special tax on tires and gasoline in the Philippine Islands will soon be placed in effect, according to a scheme worked out by the governor general, the secretary of commerce and communications, and the director of the bureau of public works.

The primary object of the increases, according to information received here, is to provide a permanent fund for the maintenance of roads and bridges in the Philippines. It is hoped to make the highway system almost self-sustaining and virtually independent from annual appropriations by the Philippine legislature.

The plan calls for a complete revision of the motor vehicle laws.

Full Data Submitted in Transport Survey

Great Care Indicated in Report Made by Industry to Agricultural Commission

WASHINGTON, Feb. 21—Reports on motor truck transportation and highways were submitted to the transportation section of the Joint Commission on Agricultural Inquiry, to-day, by a sub-committee composed of representatives of the automotive industry and highway departments. The complete data will be held as confidential until the publication of the Commission's report on transportation, in April.

Analyze Traffic in States

One of the most interesting features of the report filed by the sub-committee is the analysis of motor truck traffic. in Maryland, Connecticut, New York, Tennessee and California. The Bureau of Public Roads conducted these traffic surveys and has just completed a study of highway transportation in Connecticut. The data, when it is made available, will show the volume of motor traffic on one of the principal highways leading into New York City.

Tables covering the type and weight of vehicles, percentage of overload, speed, kinds of tires, horsepower, character of commodities, and other phases of the motor traffic question, will be exhibited. The information represents months of study by representatives of the Bureau of Public Roads, in co-operation with officials of the State Highway Department of Connecticut.

A considerable portion of the data now in possession of the Congressional Commission has been published from time to time by the National Automobile Chamber of Commerce and other organizations. The Joint Commission is particularly desirous of knowing in its study of physical property the number of passenger cars and the aggregate investment represented; commercial trucks; number of private and public, separately classified as to heavy and light weight, and amount of investment in each instance; also capacities of these trucks in tons and the horsepower of each class in the years 1912 to 1921.

Highways Studied

The study also includes public highways, mileage, streets, whether paved or dirt, etc. Information was given as to the total number of highways, and total investments, and investments by individual states, and the cost of maintenance. The Commission received data as to express transportation and, in the analyses of physical property, wanted to know the total equipment and investment, as represented by motor vehicles and horses, separately owned by express companies during the years of 1912 to 1921, and the investment in each item.

In a detailed study of motor transportation the data submitted covered a study of traffic by passenger and commercial cars. The information is given as to the number of passengers carried by passenger cars. The use of commercial cars was divided into private and public. There was a discussion of private operation, distribution of commodities, and the extent of urban or other deliveries by this means. The report covered public operations and lists of commodities and number of passengers handled and rates, together with the classification of commodities as to industrial products and others. Whenever possible, information was obtained to show the revenue of motor carriers and the effect on less than carload lots freight of rail carriers.

As to public trucks, the research included commodities, persons employed and carried, and the percentage of rates; industrial products and other commodities; and the total amount of revenue derived. The analyses of operation included both passenger cars and trucks. Under passenger cars were included maintenance costs, tires used and cost, amount of gasoline and oil consumed, and cost of oil and gasoline used.

Considers Farm Product Distribution

Another study was made of the effect of motor trucks on the distribution of the various commodities, particularly grain, hay, green fruits, vegetables, cotton, sheep, cattle, dairy products, hogs, poultry and coal. Information was given as to co-operative transportation rates by rail, water and motor, and the radius covered by motor trucks in distributing farm products.

Committees representing shipping interests have been at work for several weeks throughout the country, and through the medium of questionnaires have obtained basic information for analysis by the Joint Commission. An Advisory Committee will consider the data on motor transportation this week and determine their conclusions for the report and recommendations to be submitted to Congress.

The study of the economic relationship of agriculture and industry is not confined to farm products, but covers manufactured commodities as well.

The study of finances of motor transporters embraces organization, capitalization, profits, dividends and receiverships. Under the designation of Government regulations of transportation systems, the study of its effect on motor transportation is confined to good road amendments and the number in effect in the various states. There is also a discussion of state regulation of motor truck companies and private bus lines.

To Discuss Store-Door Delivery

The question of store-door delivery of l.c.l. freight by carriers will also be discussed by the Commission in its report, which will cover the subjects of cost, advantages, disadvantages, necessity for such practice and reasons for adoption.

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Commerce Prepares for Big Production

Its New Model Adapted to Special Service for Transfer Work

DETROIT, Feb. 18.—Commerce Motor Car Co. is preparing for heavy production in the spring of its Charabanc model, first shipments of which have been under way for three months. A dealer convention will be held during the coming week at which orders covering almost all sections of the country are expected to be placed.

The Commerce Charabanc is a ten-passenger vehicle with four rows of seats. The body is equipped with two sets of curtains, one set of storm curtains for use in warm, inclement weather, the other fitted with crystal glass, constructed to open with doors for use in cold weather. The top is of permanent construction and can be removed as a unit or folded back.

Chassis is of 127-in. wheelbase and the specifications include disk wheels, 35 x 5 cord tires front and rear, Continental engine, Timken axles, thermo-syphon cooling, Eisemann magneto and Brown-Lipe transmission. The body is of sheet steel with three doors on each side. The price is $2,350 f. o. b. Detroit.

Special Service Urged

Factory plans will urge the adoption of the charabanc for special services in which touring cars are too small and buses too large. Depot and hotel transfer work and service on general passenger transportation, both in small cities and large, will be its principal field.

DORRIS ADDS 1-TON TRUCK

ST. LOUIS, MO., Feb. 20—The Dorris Motor Car Co. has added a 1-ton model to its line of trucks, this being shown for the first time at the automobile show in this city. The new model is known as K-2 and has a 4-cylinder engine, 4x5½, valves in the head, multiple disk clutch, Bosch magneto and Westinghouse starting and lighting system. The wheelbase is optional at 120, 138 and 150 in. Cord tires, 33 x 5 in., are used all around.

NEW DAVIS MODEL

RICHMOND, IND. Feb. 20—A new Model 71 has been added to the Davis line and will make its appearance March 1. It will be smaller in some respects than the Model 61-67 which is continued. The price is $1,195 as against $1,795 for the current model. The new model includes Continental 6Y engine, 3⅛x4¼ in. Timken axles, Delco starting, lighting and ignition. Stromberg carbureter, Warner gearset, Borg & Beck clutch, Peters universal joints and a Borg & Beck steering gear. The wheelbase is 114 in. For the present only the phaeton will be produced, but later a phaeton-sedan will make its appearance.

May Follow Ford Lead in Foreign Assembly

Overland Likely to Take Step in Britain, Ultimately Building Car There

LONDON, Feb. 10 (*by mail*)—Following the lead of Ford with his cars, trucks and tractors, it now seems probable that Overland and at least one other American maker of a popular car and light truck will soon begin the assembly of complete vehicles here, with the idea ultimately of having them produced entirely in England.

The Overland chassis has been assembled for some time at the Willys-Overland-Crossley Works near Manchester. This will be in line with the decision of Ford to have his products for the British and certain export markets built entirely at Manchester.

It is believed there is a substantial basis for reports that General Motors, Ltd., soon will follow in line and will concentrate its efforts at an assembly plant on the outskirts of northwest London. This company has just listed its Chevrolet light truck chassis at £190 and its four seated car at £260. There is a tariff of 33 per cent on cars and parts imported from the United States, but the duty on Canadian imports is very small. There is no duty on trucks and truck parts irrespective of their origin.

Austin Creditors Meet

Following the recent statement that financiers had offered to supply $1,000,000 additional working capital to the Austin Co., a meeting of unsecured creditors was held to consider the company's future. It was stated that the debts exceeded $5,000,000. The addition of the new money, it is estimated by Sir Herbert Austin, would give a total of $4,250,000 as work capital in stock, cash and accounts receivable before the end of March.

Dunlop Financing

The report of the stockholders of the Dunlop Rubber Co. states that the corporation's holdings in the Dunlop Tire & Rubber Corp. of America have been increased from 92.34 per cent to 96.34 per cent, but it is added that "so far no definite arrangement has been possible for the permanent financing of the American subsidiary company."

S. T. D. Net Profit $756,910

The S. T. D. (Sunbeam, Talbot and Darracq) motors report as of Sept. 30 shows a net profit of $756,910, to which has been added $288,720 brought forward. After deducting 7 per cent dividends, there remains a credit of the profit and loss account of $701,305.

Site Base of Ford Suit

The Ford Motor Co. of England, Ltd., has filed a claim for $64,020 against the Southampton Corp. for its failure to turn over the site upon which an addition to the English plant was to be erected at Millbrook, designed to turn out 1000 cars a week. It was proposed to spend $1,750,000 on the factory, and the claim is to recover money disbursed during the negotiations.

PRINCE OF GEORGIA BUYS FARM MACHINERY

MOLINE, ILL., Feb. 18—Prince Adaschidze of Georgia, an independent Balkan province, has spent a week in the Moline Plow Co. plant, purchasing supplies and interesting officials in establishing agencies there. Machinery is almost exhausted, he said, and the people who look forward to early revival of their agricultural pursuits will offer a wide market for American made goods.

Georgia, recognized by many European governments, although not officially so by the United States, established its unity with the collapse of the Romanoff dynasty. Adaschidze is member of one of the old eastern European families and was a member of the Czar's personal bodyguard.

Earl Financing Program Approaches Completion

DETROIT, Feb. 22—Clarence A. Earl, president of Earl Motors, Inc., said today that only the details of the new financing program remain to be worked out and that everything should be arranged this week. The company will be well provided with operating funds until the program is carried through. Production is now running at 20 cars a day, he said, and will be increased next month.

Ira L. Bell has been appointed division sales supervisor of the mid-west territory for Earl Motors. Further increases will be made in the field forces of the company.

North Carolina Advances In Its Road Building Plans

RALEIGH, N. C., Feb. 20—High water in the records of road construction for the United States will be sought by the State highway commission this week when twenty-three projects approximating 160 miles of new construction will be awarded. Bids will be opened in the hall of the House of Representatives and more than 200 proposals are expected.

Within less than six weeks of the decision to make awards on 1000 miles of road during the calendar year, the commission will have let more than 20 per cent. The total cost of the work for which bids will be received this week will reach more than $2,000,000.

Republic Cancels Many Commitments

Creditors to Continue to Supply Factory—Attempt at Adjusting Defaulted Bond Issue

CHICAGO, Feb. 21—After a meeting held here by merchandise creditors of the Republic Motor Truck Co., the announcement was made by Charles M. Gillett, vice-president of the First National Bank of Chicago and a member of the bankers' committee in charge of the truck company's affairs, that commitments for materials aggregating $2,500,000 had been canceled. He stated that the creditors, without exception, had accepted the situation in the finest spirit and were willing to take long time notes in payment of present debts. They also will be willing, he stated, to supply the factory with materials and parts as needed.

According to Gillett, there is only one possible source of trouble at this time and that is a suit filed on a commitment for axles by Frank W. Ruggles who formerly was at the head of the Republic company and who still owns a large block of stock.

The bank committee now is attempting to adjust a $500,000 note issue which was defaulted in November. More than $325,000 of this issue is now held by the banks. Agents are in the field taking up these notes as rapidly as possible and it is expected that the whole issue soon will be in the hands of the bankers.

The bankers have agreed to furnish $250,000 in cash to the company as soon as the notes are no longer a possible source of trouble. The company has $2,525,000 in excess of liabilities and Gillett asserted that its future was assured provided an adequate volume of business could be found to keep the plant in operation.

Portland Trade Better Since Holding of Show

PORTLAND, ORE., Feb. 21—The automobile business in Portland and vicinity has shown decided improvement since the annual automobile show, held the last week in January, according to practically all the leading dealers of Portland, and the general situation at the present time seems more hopeful for a strong resumption of business than it has for months.

Leading automobile men, almost without exception, report that both in general interest shown and in actual sales the present period is leading the similar period of last year by a substantial margin. While figures for all the dealers together are not yet available, practically all the leading dealers report they have sold more new cars at retail this January than they did in January, 1921, while February this year is also expected to exceed February of last year. This is in spite of unsatisfactory weather.

Ford Tractor Cut Surprises French

Fordson Lowest Priced in Capacity—Experiments With Heavy Oils

PARIS, Feb. 12 (*by mail*)—Ford threw a bomb shell into the agricultural tractor world by selecting the opening of the Government agricultural show in Paris, to announce a reduction in the price of his tractor of from 12,000 to 8,200 francs which is equivalent at present exchange to $715. This makes the Fordson by far the lowest priced tractor of this capacity on the French market, even if account is taken of the State subsidies granted to French makers.

The exhibition, in the Grand Palais, was the first of its kind held by Government initiative. The show was open to all classes of agricultural machinery, but tractors, farm trucks and stationary power plants produced by automobile firms were an important feature. French automobile firms paying real attention to agricultural requirements are Renault, De Dion-Bouton, Latil, Delahaye, Delaunay-Belleville, Peugeot, Brasier and Scemia, an auxiliary of the Paris omnibus company. Agricultural implement manufacturers producing tractors are in a minority.

Owing to the shortage of space, few trucks for farm use are exhibited in the Palais, although several are being demonstrated outside the hall. One of the novelties is to endeavor to adapt portable gas producers to existing types of farm trucks or to tractors for road service. Several of these are on exhibition on Latil, Pavesi and other tractors.

Peugeot is exhibiting the Tartrais two-stroke direct injection heavy oil engine for truck and tractor service. In addition to this, the same engine is shown on the Scemia stand.

Another attempt to run an ordinary type engine on heavy oils is the Maroger adapter, shown on a Samson tractor, for which important claims are made. This apparatus consists of a small cast bronze auxiliary combustion chamber with radiator fins mounted in the spark plug hole of each cylinder. This chamber has an automatic valve and carries the spark plug. A small carburetor with a separate gasoline tank is connected to these supplementary combustion chambers by a common manifold.

PREMOCAR PRICES LOWERED

BIRMINGHAM, ALA., Feb. 22—The Preston Motors Corp. has announced a downward revision in its prices as follows:

	Old Price	New Price
Roadster	$1,295	$1,095
Touring car	1,295	1,095
Coupe	1,945	1,750
Sedan	1,995	1,825

DAVIS REDUCES PRICES

RICHMOND, IND., Feb. 20—The George W. Davis Motor Car Co. announces reductions of from $200 to $500 in the prices of its various models. The schedule follows:

	Old Price	New Price
5-passenger Touring	$1,795	$1,595
4-passenger Touring	1,895	1,695
Sedan	2,595	2,195
Coupe	2,595	2,095

WARD LA FRANCE REDUCES

ELMIRA, N. Y., Feb. 20—The Ward LaFrance Truck Corp. announces substantial reductions on its truck chassis prices. The schedule follows:

	Old Price	New Price
Model 2B—2½-3½ ton	$3,590	$2,990
Model 4A—3½-5 ton	4,690	3,990
Model 5A—5-7 ton	5,590	4,590

LIVING COST TAKES DROP IN SYRACUSE

SYRACUSE, N. Y., Feb. 20—The Industrial Relations department of the Franklin Automobile Co., in a study of the cost of living in this city, as of Feb. 1, reports a net decrease of 3.7 per cent since the last report was taken on Nov. 1. An analysis of the budget shows that living costs up to the latter date had increased 63.09 per cent over the base year 1914, while the November study shows an increase of 68.67 per cent.

Every item in the budget shows a decrease with the exception of shelter which held constant.

Templar Raises Price of Its Three Models

CLEVELAND, Feb. 23—The Templar Motors Co. announced to-day the increased prices which will be charged for its various models after March 6. The schedule follows:

	Old Price	New Price
Roadster	$1,985	$2,025
5-passenger Touring	1,985	2,125
4-passenger Touring	1,985	2,175

MASTER TRUCKS LOWER

CHICAGO, Feb. 23—Substantial price reductions are announced by Master Trucks, Inc. The list follows:

	Old Price	New Price
Model JW 1½-ton	$2,690	$2,290
Model W 2½-ton	3,290	2,890
Model D 2½-ton	3,540	3,190
Model A 3½-ton	4,190	3,990
Model E 3½-ton	4,640	4,290
Model B 5-ton	5,290	4,990
Model F 5-ton	5,440	5,090

FORD WORK STARTS SOON

TROY, N. Y., Feb. 17—Engineers representing the Ford Motor Co. state that the new Ford tractor plant at Green Island will be started by the contractors about May 1, and that power in the recently completed power house will be turned on a month later. Village officials of Green Island are making preparations for the growth which is expected to follow development of the Ford plans here.

Road Work Starts In Latin-America

Need for Transportation Leads to Ambitious Highway Programs

NEW YORK, Feb. 21—In many sections of America, both north and south of the equator, important progress has been made in getting under way extensive programs for highway improvement, made necessary by the demands for adequate transportation. Much work was completed or initiated in 1921 and much more is planned for further construction so that, it may confidently be expected, the year 1922 will witness the betterment of a large mileage of roadways.

This is a significant manifestation of the growing use of automotive equipment and shows, in a striking manner, the strides being made in the economic development of numerous rich and growing territories. Interest in highway improvement has become widespread and already much of this interest is translating itself into actual road construction.

Seek to Overcome Obstacles

Attention may well be directed to the efforts being made in several countries to overcome the highway difficulties. The countries concerning which mention might be made are Argentina, Brazil, Chile, Mexico, Peru and Venezuela, among others in various parts of the world, which are seeking to build up systems of roads that will adequately serve the internal needs for modern communications. In each of these, much road improvement has either been started or is in process of organization.

Argentina will hold in May the first national highway congress, at Buenos Aires, to be attended by representatives from all parts of the republic, with governmental officials, to lay out a national plan for highway improvement. In addition, Argentina has undertaken the betterment of parts of the route of the coming international motor race from Valparaiso to Buenos Aires, through Bahia Blanca; and several of the interior states are energetically pushing their road programs. The mileage of good roads in some parts of Central Argentina would surprise many a visitor who had previously formed his impressions concerning the highway situation and it is needless to say that such roads, once started, will be completed in line with the transportation needs.

Chile Going Ahead

Chile likewise is improving sections of the transcontinental race route and some months ago passed new road laws, appropriated considerable sums for highway improvement and much work already has been done in various parts of the republic.

To tap the rich resources that have been dormant or which have scarcely

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Road Work Starts In Latin America

Need for Transportation Leads to Ambitious Highway Programs

(*Continued from page* 491)

more than been scratched, road work is being pushed rapidly in many sections of Brazil. A survey of Brazilian highway progress made in Rio de Janeiro, estimates that 1000 kilometers of motor roads were completed in various states during 1921. The most important project finished during the year was the Sao Paulo-Campinas highway, and there was various other work in the State of Sao Paulo, including the beginning of a national highway to connect the city of Sao Paulo with Rio de Janeiro.

Brazilian motorists have long held the hope that a worthy highway would be built between their two largest cities and that project seems now in process of fulfillment. With the centennial celebration to be held in the latter part of this year, Brazilian representatives are announcing that the Rio-Sao Paulo highway will be completed in time so that motorists may tour between these two great cities along a route that will be among the most wonderfully scenic and picturesque in the world. Work already has commenced, with many kilometers completed, on that part of the route in the State of Sao Paulo and, with the construction pushed from the opposite end, the Brazilians and their numerous visitors may whirl along the new highway as they celebrate the 100th anniversary of their independence.

Improvements in Interior

The interior states of Brazil, as well as those far to the south, have not overlooked the necessity of motor transportation and the survey shows numerous improvement projects under way or already completed. Thus, numerous rural bus and automotive transportation lines have already been established and in certain interior sections, the traveler may visit many towns and traverse hundreds of kilometers via bus lines that furnish the transportation not provided by railroads. A concession for construction of the much needed highway between Lima and Callao, the port city, has recently been granted in Peru. Work must start within a few months and be completed without delay, the road to be hard-surfaced and to be well enough built to uphold the heavy trucking traffic between the capital and its outlet on the Pacific. This is the most important highway project now under way in Peru but others are contemplated.

Venezuela is taking advantage of her natural riches and is seeking to link up interior points, where the various products originate, with outlets on the Atlantic so that they may be shipped throughout the world.

What all of these countries are doing, finds its counterpart in Mexico. That large republic, realizing how much the future is dependent upon adequate transportation, has commenced work on a great road plan, embracing nearly 7000 kilometers of highway and opening up a great transportation net. Twenty-nine different projects have been put before the Mexican Congress and action on some or all of them may be expected.

Mexico, perhaps, was somewhat slower, due to internal conditions, than other countries in commencing the development of automotive transportation and with it, the attendant development of highways.

N. A. C. C. Will Receive Plans for Overseas Trade

NEW YORK, Feb. 23—Following the appointment of a committee on organization, headed by A. S. More, president of the Denby Motor Truck Co., Detroit, the plans for a combine for foreign trade will be placed before the executive meeting of the National Automobile Chamber of Commerce here on March 2. The plan, which provides for co-operative effort in developing the overseas trade in automotive equipment, was announced at the annual export meeting of the Chamber in January.

The organization committee, in addition to Chairman More, includes B. C. Budd, export manager for Packard; E. G. Poxson, export manager for Dort; E. W. Headington, export manager for Haynes, and E. J. Ross, of the Ward Motor Vehicle Co. A carefully prepared booklet setting forth the combine plan is being mailed this week to all N.A.C.C. members.

Bank Creditors Submit Willys-Overland Program

NEW YORK, Feb. 23—Bank creditors of the Willys-Overland Co. have submitted their refinancing program to the Toledo directors elected last week for 30 days' examination. This would seem to indicate that the bank loans which mature March 1 will be renewed for at least a month. It is understood that two more Toledo directors may be appointed soon. The outlook now is said to be more hopeful for a satisfactory adjustment of conflicting viewpoints of the various interests involved.

FILES LIEN AGAINST WILLYS

ELIZABETH, N. J., Feb. 20—Paul L. Batty, who designed and supervised the construction of the Willys Corp.'s plant in this city, has filed a mechanic's lien for $42,379.36 against the corporation, covering fees he claims due him for designing the structure and supervising its construction from Sept. 1, 1919, Nov. 25, 1921. The lien sets forth that Batty was to receive a fee in addition to his salary for the work he performed and that his contract was made personally with John N. Willys, president of the corporation.

21,820,041 Casings Produced in 1921

December Showed Increase Over November With Greater Gain in Shipments

NEW YORK, Feb. 23—Production of pneumatic tire casings for 1921 totalled 21,820,041, according to statistics supplied the Bureau of Foreign and Domestic Commerce by the Rubber Association of America, with the figures for December not entirely exact. The estimated production for December was 1,840,000, an increase of about 100,000 over November, but shipments were 1,980,000, as compared with 1,342,519 in November. Inventories fell off about 200,000.

Tube Production Declines

Inner tube production in December was 2,070,000, as compared with 2,126,211. Shipments of inner tubes in December increased nearly 1,000,000 over the previous month, however, while inventories were reduced from 5,203,000 to 4,731,000.

Detailed figures for the year as compiled by the association follow:

PNEUMATIC CASINGS

	Inventory	Production	Shipments
Jan.	5,319,605	703,430	965,417
Feb.	5,193,018	819,892	1,073,756
Mar.	4,597,103	1,163,314	1,614,651
Apr.	4,527,445	1,651,418	1,785,951
May	4,451,668	2,100,917	2,085,882
June	4,154,456	2,313,265	2,643,850
July	3,892,037	2,570,524	2,757,581
Aug.	3,934,853	3,043,187	2,894,442
Sept.	3,340,798	1,929,268	2,047,929
Oct.	3,545,030	1,928,271	1,675,169
Nov.	3,908,342	1,756,555	1,342,519
Dec.	3,697,000	1,840,000	1,980,000

INNER TUBES

	Inventory	Production	Shipments
Jan.	5,586,163	740,824	1,042,617
Feb.	5,415,464	916,627	1,129,881
Mar.	5,044,861	1,346,483	1,643,690
Apr.	4,916,772	1,762,122	1,983,571
May	4,751,880	2,210,040	2,342,567
June	3,835,098	2,359,928	3,232,673
July	3,122,815	3,020,981	3,603,248
Aug.	3,649,319	4,430,152	3,804,060
Sept.	3,827,830	3,274,822	2,645,758
Oct.	4,732,016	2,843,918	2,016,371
Nov.	5,203,568	2,126,211	1,540,299
Dec.	4,731,000	2,070,000	2,523,000

SOLID TIRES

	Inventory	Production	Shipments
Jan.	303,753	21,220	29,116
Feb.	304,374	23,365	29,599
Mar.	283,800	28,710	43,926
Apr.	269,985	28,859	42,080
May	264,633	35,156	40,122
June	240,336	28,395	49,867
July	220,003	35,123	55,678
Aug.	216,367	55,694	66,866
Sept.	161,832	37,441	50,276
Oct.	163,299	46,274	45,911
Nov.	173,451	43,537	34,556
Dec.	169,000	40,000	40,000

"Production" and "Shipments" figures covers the entire month for which each report is made. "Inventory" is reported as of the last day of each month.

"Inventory" includes tires and tubes constituting domestic work in factory and in transit to, or at, warehouses, branches (if any), or in possession of dealers on consignment basis, and as a total represents all tires and tubes still owned by manufacturers as a domestic stock.

"Shipments" include only stock forwarded to a purchaser and does not include stock forwarded to a warehouse, branch, or on a consignment basis, or abroad.

MEN OF THE INDUSTRY

Jerry Price has resigned as works manager of the Willys-Overland Co., on account of ill health, and will leave soon on a trip to Central America. Price has been at the Toledo plant for about two years.

J. C. L. Krebs, formerly identified with the Clydesdale Motor Truck Co. of Clyde, Ohio, has organized the Krebs Motor Truck Co. which proposes to establish a plant at Bellevue, Ohio.

R. S. Jemison, formerly advertising manager and sales promotion manager of the Oldfield Tire Co., Akron, has joined the forces of the United States Advertising Corp. at Toledo. He was at one time connected with the Miller Tire Co.

J. H. Ficken has joined the Howe Rubber Corp. as special sales representative. He has had a long association in the rubber industry being at one time with the United States Tire Co. and latterly with Kelly-Springfield.

Leonard Kebler, president of the Ward Leonard Electric Co., Mount Vernon, N. Y., has sailed from New York on the Adriatic for a three months' combined business and pleasure trip through the Riviera, Egypt. Italy, France, Switzerland and England.

Emmett L. Page has severed his connection with the Oakland Motor Car Co., with which he has been associated for the last 11 years. For the last year he has acted as superintendent of the engine plant and prior to that served as assistant factory superintendent.

C. F. Tollzien, factory manager of the Packard Motor Car Co., has resigned to devote his attention exclusively to the business of the Plywood Products Co., Wayne, Mich., of which he is president and which he organized two years ago. The Plywood company manufactures steering wheels.

John N. Willys is making a country wide tour of Willys-Overland branches and distributors, his trip taking him to New York, Philadelphia, Chicago, Jacksonville, Fla.; Kansas City, Denver, Portland, Ore.; Seattle, Spokane, San Francisco, Los Angeles, San Antonio, Dallas, Memphis, New Orleans, Birmingham and Atlanta. Dealer meetings have been arranged at these points.

Full Data Submitted in Transport Survey

(*Continued from page* 489)

The report covers the substitution of other means of transportation for steam railroads and the necessities of commerce leading to such substitution. It deals with the radius covered by motors, electric railways and parcel post, and the participation of each in long haul and short haul traffic. There is a discussion of the proximity of markets and facilities to handle economies of distribution costs, separated as to freight and passenger, etc., and prospects for future development.

The Commission is also anxious to know the effect of motor and electric competition upon steam tonnage and the net earnings. The information which it has deals with the utilization of public highways by motors and electric railways through franchise, and the effect of operating costs upon such carriers. It is apparent that the report of the steam carriers and electric lines and motor transportation agencies will be at variance, and it will remain with the Commission to analyze the situation in its discussion of competition between the several modes of transportation.

One of the points that the Joint Commission is endeavoring to emphasize is the evolution of transportation and its effect upon, and interdependence with, the development of the country and its basic industries. It is generally believed that the report, when made public, will have a beneficial effect upon motor transportation and will show its developments and essentiality far more effectively than might be accomplished by private effort.

Ford Fixes 50 Cars Daily As Limit of Lincoln Output

DETROIT, Feb. 21—The following copyrighted interview with Henry Ford is carried by the International News Service:

"Some people seem to have the impression," said he, "as the result of the taking over of the Lincoln Motor plant that I intend to be sort of a bull in the china shop in the automobile world. They are wrong. In taking over the Lincoln plant, my son and I agreed before we started that we would restrict output. The Lincoln plant is now making fifteen cars a day. As orders are running, we could sell 200 a day. But we shall never make more than fifty Lincoln cars a day. Such are my present plans, and, so far as I know, they will not be changed I do not believe that any one man should dominate the automobile world. I have no use for a man who wants to go to Heaven without taking anyone else along with him."

"The rumors that connect your name with negotiations to buy the Wills St. Claire and other plants are not true then?" he was asked.

"Absolutely not a word of truth in any of them," he replied. "Nor is it true that I am negotiating for the purchase of any railroad. The one railroad I have is all I want."

SET DATES FOR OWEN SALE

WILMINGTON, DEL., Feb. 20 — Charles F. Ross, Robert Penington and James P. Harris, receivers for the Owen-Magnetic Motor Car Corp., have given notice that on March 7, 8 and 9 they will offer for sale the personal property of the company, comprising machinery, fixtures, automobile parts and materials. The sale will take place at Forty Fort, Luzerne County, Pa.

GAS FATAL TO DAN R. WALLS

NEW YORK, Feb. 21—Dan R. Walls, advertising manager of the Splitdorf Electrical Co., died suddenly at his home here Saturday after having been overcome by carbon monoxide gas when he went to his garage to take out his car. Walls had been with the Splitdorf company for several years and was widely known in the industry.

Wine Growers Have New Fuel for Cars

Practical Trials of Automobiles Running on Alcohol and Benzol to Be Held in France

PARIS, Feb. 11 (*By Mail*)—Following up the work of the National Commission entrusted with the task of finding a substitute for gasoline, an important group of wine growers at Beziers, in the south of France, announces practical trials of passenger cars running on alcohol and benzol for April 2.

Although the exact nature of the fuel has not yet been announced, for the technical commission is still carrying out experiments, it is more than probable that it will consist of 50 per cent alcohol and benzol. The competitors will be given a limited amount of fuel, in proportion to the piston displacement of the engine and the weight of the car. A distance of 150 miles will have to be covered at minimum speeds varying from 25 to 38 miles an hour, according to piston displacement, the winner being the one covering the distance, at the regulation speed, with the lowest consumption of fuel.

Problem Not Solved

While existing types of automobiles can be operated successfully on an alcohol-benzol mixture, the French technical commission does not consider the problem solved, for the various mixtures employed do not give quite the same results as gasoline, while many of them have injurious effects on metals. At the present time the Paris Omnibus Company is running all its motor buses on a benzol-alcohol mixture, the only real difficulty being that this fuel corrodes valve seatings and stems.

By a law passed in the French Parliament last year the Government has the right, at any time, to cause gasoline importers to mix 10 per cent alcohol with all fuel put on the market. This law has not yet been taken advantage of, but it gives the Government power, merely by the signing of a decree, to make the use of alcohol obligatory with gasoline. This will constitute the first step towards compulsory alcohol fuel.

DISCUSS STEEL PRACTICES

MILWAUKEE, Feb. 20—Reports on annealing, core practice, facing sands, furnace practice and pouring practice were made by operating heads of plants at a meeting of the Electric Steel Founders' Research Group held in this city. The group was formed about two years ago for the systematic prosecution of cooperative technical work which could be directly applied in improving the manufacture of steel castings. It includes the Electric Steel Co., the Ft. Pitt Steel Casting Co., the Lebanon Steel Foundry, the Michigan Steel Casting Co. and the Sivyer Steel Casting Co.

FINANCIAL NOTES

H. H. Franklin Manufacturing Co. reports that in the year 1921 it improved its position in the industry by moving from eighteenth to fifteenth place in number of cars sold and from thirteenth to ninth place in the value of cars sold. These figures do not include Ford. The value of sales was $22,280,000 against $27,864,000 in 1920. During the year 8548 cars were sold representing 81 per cent of 1920 sales and 93 per cent 1919 sales. It reports that its profits for the year will approximate $500,000 and that the average yearly profit for the past ten years has been $692,000. Preferred dividend requirements for 1921 were $268,000. In addition to preferred dividends, one dividend amounting to $140,000 was paid on common stock during the year.

Continental Guaranty Corp., New York, in its comparative statement of condition, shows that on Dec. 31, 1921, cash on hand, in banks and in trust, totaled $2,282,108.97, as against $3,115,222.16 on the same date the previous year; receivables, $7,545,732.09, compared with $10,870,261.40; investments, $910,163.04, as against $309,432.10. The corporation's reserves were $165,434.16, compared with $219,595.45, and the amount due creditors, $7,463,643.25, as against $11,922,322.35. The surplus and undivided profits on Dec. 31, 1921, were $277,812.45.

Peerless Truck & Motor Corp. directors have declared dividends at the annual rate of $3, an increase of $1. Dividends are payable 75 cents quarterly, March 31, June 30, Sept. 30 and Dec. 31, to stock of record on the first of each month.

Federal Truck Co. showed on Dec. 31, 1921, surplus of $704,828, and assets of $3,533,325. Its sales were $3,268,467 and its net profit, $176,800 in 1921.

Manufacturers Maintaining Hold on Dutch East Indies

NEW YORK, Feb. 18 — Statistics giving the total imports of automobiles and trucks into Java during the first eight months of 1921, the latest period officially covered, show that American manufacturers continue to maintain their hold on the market in the Dutch East Indies. Of total imports of motor cars and trucks during the eight months in 1921 numbering 4597, the United States furnished by direct shipments 2552.

Europe sent a total of 492 cars direct to Java in the first eight months of 1921 as against a total of 152 in the first eight months of 1920.

Lower Prices in Peru Stimulate Business

LIMA, PERU, Jan. 31 (*by mail*)—Prices have fallen in Peru. The Dodge agents advertised a reduction; the Firestone agents announced lower prices. These reductions, which are sure to be followed by others, will increase automotive business. Already the Ford agent has advertised reductions on springs.

Turning to general business conditions, there is an increasing though not strong activity in building. After the centenary anniversary celebration of Peruvian independents last July, building fell off rapidly. It is now being slowly resumed.

The smaller number of ships arriving and departing from Peruvian ports reflects the general business situation. Compared with a year ago exports and imports are much less to-day. Compared, however, with a period of six months ago, say last August, at about which time the crisis came, the showing to-day is much more favorable.

The returns of the Lima clearing house for Jan. 1922 will show a slight improvement over the latter half of 1921. Cotton, copper, curry, rice and sugar are to some extent being exported.

Should the government succeed in getting a loan and should the loan be followed by an improvement in Peruvian exchange, automotive products could be offered at very attractive prices.

Brazil Wishes Tractors Operated by Alcohol

WASHINGTON, Feb. 20—The use of alcohol as a fuel for farm tractors is the subject of a special report just made by the agricultural implement division of the Bureau of Foreign and Domestic Commerce. The suggestion is made by George B. Bell, chief of the division, that American tractors using this fuel would find ready acceptance in Brazil. The statement says:

The use of alcohol as fuel by an American machine in the recent tractor demonstrations at Santa Cruz, Brazil, has aroused much interest in that country. The test was very successful, considering the fact that this machine had no carburetor especially designed for alcohol burning. An American manufacturer is planning to send to Brazil personnel and equipment to conduct an extensive experiment in the use of this fuel.

The cost of gasoline has been an obstacle to the wider use of motor vehicles and tractors in Brazil and this would largely be overcome by the use of alcohol, which is produced there at an extremely low cost, as a by-product of the sugar industry. The successful operation of American tractors using alcohol as fuel will undoubtedly be one of the biggest factors in the wider distribution of these machines in Brazil.

W. C. SARGENT DIES

MILWAUKEE, Feb. 20—William C. Sargent, for 22 years secretary and also a director of the Chain Belt Co., Milwaukee, died suddenly as a result of heart failure. He established many of the early business connections of the company, many of which are still among the company's jobbers. He was also a director of the Federal Malleable Co., West Allis, Wis. He was 75 years old.

R. H. STRICKLAND DEAD

NEW HAVEN, CONN., Feb. 20—Burton Hiram Strickland, from 1896 to 1901 secretary and treasurer of the Springfield Rubber Tire Co. and since then an officer of the New Haven Savings Bank, died at his home in this city, following an illness of several months. For a time and prior to entering the tire business, he was identified with Holcomb Brothers Co., carriage manufacturers.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During last week call loans ranged from 4 per cent to 5 per cent, as compared with 4½ per cent to 5 per cent in the previous week. Increased ease developed in the latter part of the week, and on Thursday and Friday all loans and renewals were negotiated at 4 per cent. Fixed date funds were in rather liberal supply, but the market was inactive. All maturities from 60 days to 6 months continued to be quoted at 4¾ per cent to 5 per cent. Prime commercial paper also remained unchanged at 4¾ per cent to 5 per cent.

The Federal Reserve statement as of Feb. 15, 1922, showed an increase of $13,311,000 in total reserves, of which the increase in gold reserves constituted $14,702,000, offset by a decrease of $1,391,000 in other legal reserves. Total earnning assets showed a contraction of $11,317,000, due to the following changes: total bills on hand decreased $53,807,000, United States bonds and notes increased $15,714,000, United States Certificates of Indebtedness, exclusive of Pittman one-year certificates, increased $29,776,000. Total deposits decreased $1,022,000, while Federal Reserve notes in circulation increased $3,774,000. The reserve ratio rose from 76.1 per cent to 76.4 per cent.

The New York institution showed the following decreases: $4,860,000 in total reserves; $33,113,000 in total bills on hand; $2,366,000 in total earning assets; $16,966,000 in deposits. Federal Reserve notes in circulation increased $6,764,000, and the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 81.7 per cent to 81.9 per cent.

Bradstreet's food index number for last week showed a gain of 2 per cent over the previous week, and a gain of 6/10 of 1 per cent over the corresponding week of last year. This is the first time since April 1920 that an increase has been reported over the year before.

The Department of Commerce has announced that the United States exports in January amounted to $279,000,000, which figure is the smallest reported since August, 1915. Imports at $216,000,000 give an excess of exports amounting to $63,000,000, which in turn is the smallest (except December) since October, 1914.

On February 16, the Bank of England cut its discount rate from 5 per cent to 4½ per cent. The rate is now at the lowest it has been since July, 1914.

Last week May wheat was quoted at $1.42¾ per bushel, as compared with November's low of $1.03¼. May corn was quoted last week at 63¾ cents per bushel, as compared with the November low of 35½ cents. This rise in wheat and corn prices is of great importance to the Western farmers in particular, as it creates a stronger feeling of optimism in regard to the future grain prices.

INDUSTRIAL NOTES

U. S. Tractor & Machinery Co. of Menasha, Wis., has embarked upon a general expansion program following the assumption of the presidency and general management by J. M. Robinson, formerly of the International Harvester Co. and other large tractor and agricultural equipment manufacturing concerns. It is planned to start work early in the coming spring on the erection of additional machine shop and assembling units, and a new foundry, so that not only the output of tractors will be increased but provision made for producing a more extensive line of tractor implements and power farm equipment.

Velguth Metal Parts, Milwaukee, has been organized by Carl Velguth, for many years secretary and sales manager of the John Obenberger Drop Forge Co. It is understood that Velguth has acquired title to the patent for a new article of equipment for open and closed car bodies. He recently purchased the business, finished and raw materials and patents of the Acme Motor Parts Corp. at a receiver's sale. In connection with this, it is said that further manufacturing facilities have been acquired for the new company.

Mason Tire & Rubber Co., states that the new factory capacity available March 15 and doubling the output of the plant will be required as soon as completed. The company reports that sales for 1921 will approximate $9,000,000 compared with 1920 sales of $7,000,000 and it is estimated the net profit for the period will aggregate $600,000. The fabric mill at Quitman, Ga., will be placed on a 24-hour a day schedule and the output has been sold up indefinitely.

Bay Verde Machinery Co. of Green Bay, Wis., an extensive jobber of machine tools, wood and metalworking equipment, transmission supplies, etc., is establishing an automotive equipment department on a large scale. It will do a jobbing business and probably will also have a retail department for local trade. Green Bay is the jobbing center for a wide territory in northeastern Wisconsin and the southeastern part of the upper peninsula of Michigan.

Briggs & Stratton, Milwaukee, are about to enter production on a large scale on a new motor-driven type of horn. The horn incorporates a number of new features such as requiring no lubrication and a simplification of the electrial as well as the mechanical construction. Manufacturers have already been provided with sample horns. The company also is planning distribution through its 500 service stations.

Hupp Motor Car Corp. reports that January 1922 shipments were the largest for any January in the last fourteen years. More than four times as many Hupmobiles were shipped and sold as in January 1921 or twice as many as in January 1918 or January 1916 or three times as many as in January 1919. From a production standpoint the company reports that January was one of the biggest months the company has had.

Percy Christian & Co., London, England, has acquired the exclusive distribution in the British Isles, South Africa and France of the product of the Dayton Airless Tire Co., a subsidiary of the Dayton Rubber Co. Capt. F. G. Fraser of Liverpool, associated in the British company, has been conferring with executives of the Ohio concern.

Eagle Mfg. Co. of Appleton, Wis., manufacturer of the Eagle tractor, feed cutters, etc., has effected a considerable increase in its production, which has been at a minimum for some time past. In so doing it is arranging to establish several new lines of power farm operating equipment which it has been developing in recent years.

Medart Patent Pulley Co., St. Louis, announces the change of its name to the **Medart Co.** because of the expansion of its manufacturing activities. This does not indicate a reorganization of the company, or any change whatever in its policies or personnel.

Nebraska Tire & Rubber Co., Omaha, is in continuous operation and working at capacity, three shifts of men being used. The company reports that it recently sold half of its entire output for the year to a California tire dealer.

McMullen Machinery Co., Grand Rapids, has been appointed exclusive representative of the Diamant Tool & Manufacturing Co., Inc., Newark, N. J., for all the northern peninsula of Michigan and portions of the southern peninsula.

Canadian Steam Motors, financed by Canadian capital, has been organized to handle the Coats steam car for the western part of the Dominion. Headquarters are at Victoria, B. C.

Storm King Mfg. Co. of Omro, Wis., manufacturing winter tops, curtains and other protection devices for open passenger cars and motor trucks, has moved its plant and business to Hortonville, Wis.

Equipment Maker Starts Intensive Sales Drive

CLEVELAND, Feb. 21—Contending that this is the time for the manufacturer to replace inefficient and antiquated machinery and other equipment so as to reduce production costs to a point where he can secure himself against competition, Warner & Swazey Co., which makes scale machines used in the automotive industry, has inaugurated an extensive and intensive sales campaign.

In making its drive, the company is proceeding on the theory that confidence in the price of the product as well as in the material is a prime requisite to normal buying and is departing from the custom of making open quotation of its list of prices both now and at the time of the peak during the war. Heretofore quotations have been made to individual customers.

Dealers in Shanghai Organize After Show

WASHINGTON, Feb. 20—The pioneer motor show of China was held in Shanghai and was attended by practically every foreigner in Shanghai, about 12,000 in all, and by a like number of Chinese from the merchant and educated classes. Probably the most noteworthy result of the show is that it led to the formation of a permanent organization of automotive men in China.

Prior to this show there was no organization of any kind, a situation which delayed the development of the roads movement—the most important single factor in the promotion of motor car sales in this country. It is now planned to hold the show every year as part of an active merchandising program.

METAL MARKETS

CONSTANT shopping on the part of buyers and a disposition among the larger automotive consumers to apportion among a number of mills orders that in former years would have gone to one producer are not without effect on the steel market's tone. Although selling prices are little affected by the pains which purchasing agents take to afford all possible competitors an opportunity to quote on their requirements, this condition serves to take the wind out of the sails of those who look upon stationary prices as a sign that the market is becalmed and who are always ready to essay an advance as a means of lifting the market out of a rut.

On the other hand, producers are not disposed to make material concessions ever though consumers offer to increase tonnages. Here and there one hears of isolated instances of prices being shaded on some specialty to the extent of $1 a ton or so, but, as a rule, this is due to intense rivalry between two individual competitors and not to any general disposition to obtain business at any sacrifice. Considering prevailing production costs and the limited demand which acts as a bar to any worth while enhancement of operations, producers look upon present market quotations much in the light of an irreducible minimum. It would require the impact of some striking development, such as a sharp reduction in freight rates, to alter this situation.

Of course, distribution of steel orders over a certain number of mills, such as is practiced these days by the Ford Motor Co., which recently split a 1500-ton sheet order for frame and crank case stock into three parts, has the advantage of eliminating all necessity on the consumer's part to commit himself except on a neck-and-neck basis with his production schedules.

Pig Iron.—It remains to be seen whether the market will sustain the effort to advance the price for foundry and malleable to $20, which a large Middle West furnace interest has announced.

Steel. — Full-finished automotive sheets continue steady at unaltered quotations. Passenger motor car builders are continually sounding mills on sundry tonnages of ordinary sheets. Most of the actual buying, however, is in rather small tonnages. The sheet bar market is a shade firmer, but still somewhere between $28 and $29, Pittsburgh. Common steel bars are in routine demand at 1.40c. @ 1.50c., Pittsburgh base, and automotive demand is still predominant in cold-drawn bars at 1.90c. @ 2c., Pittsburgh base. The strip steel industry also continues to subsist chiefly on automotive orders, with most of the business placed ranging in extent from 50 to 100 tons, and the inside quotation on hot-rolled 1.80c. while the cold-rolled is held at 3.50c. Pittsburgh base.

Aluminum.—When it comes to bids of below 17c. for 98 to 99 per cent virgin ingots holders display considerable reserve, a recent bid of 16.50c. failing of immediate acceptance. Imported sheets are held at very close to the American producer's price.

Copper.—The American Brass Co. has announced a reduction of ¼c. per lb. in its base price for copper products and of ½c. per lb. in base prices on brass products, these reductions reflecting recent declines in copper and zinc. The freight rate on Lake Superior copper from Calumet, Mich., to New York has been reduced 33⅓ per cent, or ⅛c. per lb., equivalent to $200 per car lot. This restores the freight schedule in effect prior to Aug. 26, 1920.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

Feb. 18-27—Brussels, Belgium, Ninth Exhibition of Agricultural Machines and Implements, Palais de la Cinquantenaire.

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

CONVENTIONS

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

Cleveland Reports Employment Greater

Automobile Industry Shows Largest Gain—Productivity of Employee Is Improved

CLEVELAND, Feb. 20—The labor relations committee of the Chamber of Commerce has made an employment survey and reports that industry as a whole is now running at a higher point than it has since the first of last May.

The most conspicuous gain made by any industry is that of the automobile manufacturers and parts and accessory makers who report they have increased the number of employees from 5,568 on Jan. 1 to 7,440 on Feb. 1. A year ago they had on their rolls approximately 5,500 employees.

The committee has accepted the number of employees as a fair basis for passing on the condition of the industry, at the same time the average factory has so adjusted shop arrangements that the productivity of the worker has been increased. Labor itself, under the highly competitive system that has sprung up, also has become more efficient in the last year, so that the automotive industry here is employing more men than it did a year ago and getting more out of the individual worker.

Another encouraging detail of the report is the gain that has been recorded in employees in the metal trades, which is the backbone of Cleveland industry. The gain in the number of employees is 6.4 per cent since Jan. 1.

FULTON'S LAST PAYMENT

NEW YORK, Feb. 20—The final liquidating dividend, amounting to 36 per cent, has been paid by the Fulton Motor Truck Co., which has been in the hands of a receiver since November, 1919. Total payments to general creditors amounted in all to 76 per cent. The preferred creditors were paid in full. All of the assets of the company have been taken over by the newly organized Fulton Motors Corp. of which Garvin Denby is president.

Franklin to Provide Financing for New Car

SYRACUSE, Feb. 23—Directors of the H. H. Franklin Co. decided to-day to issue 40,000 shares of no par value common stock at $50 a share and $3,000,000 of 7 per cent cumulative preferred stock with a par value of $100 to finance the production of the new Franklin four-cylinder air-cooled car. The plant which is to be erected will have a one shift capacity of 50 cars a day and a two shift capacity of 100 a day. A world wide sales organization is being developed on a 100 a day production basis.

N. A. C. C. DIRECTORS TO MEET

NEW YORK, Feb. 23—Directors of the National Automobile Chamber of Commerce will meet at headquarters here the morning of March 1. The motor truck committee will meet the afternoon of the same day. A meeting of members of the N.A.C.C., both passenger car and truck manufacturers, will be held Thursday morning. A separate meeting of motor truck manufacturers will be held in the afternoon.

HAWKINS ACKERMITE CHAIRMAN

PITTSBURGH, PA., Feb. 23—Norval A. Hawkins, a member of the advisory staff of the General Motors Corp., has been elected chairman of the board of directors of the Ackermite Co. of America which will market Achermite, a permanent amalgamation of lead and copper which is said to be the only self lubricating metal ever invented.

ACTON HEADS POWER

ST. LOUIS, Feb. 20—Leslie R. Acton has been elected president of the Power Truck & Tractor Co. William J. McGoldrick is vice-president, while Clare Acton is secretary and treasurer. Harold C. Goodwin is assistant secretary. The directorate is composed of the officers and John R. Barnes.

Government Files New Lincoln Claim

Says Company Owes $6,000,000—War Contracts Given As Explanation

DETROIT, Feb. 23—No explanation is obtainable here of the new claim for $6,000,000 filed by the United States government against the Detroit Trust Co. as receiver for the Lincoln Motors Co. which recently was purchased by Henry Ford for $8,000,000.

The only statement from Washington is that the claim arises out of War Department contracts. Neither Henry M. Leland, president of the motors company, nor Ralph Stone, president of the trust company is able to explain the claim. It was supposed that the recent adjustment made with the Treasury Department had cleaned up all the war time adjustment claims.

ITALY TO CUT TAXES

WASHINGTON, Feb. 20—After two years experience with prohibitive taxes on motor vehicles, the Italian government has realized that they not only are seriously handicapping the motor industry, but that the returns to the state are smaller than from the more moderate taxes in force prior to the war. As a consequence a technical commission representing the Department of Finance has decided on a 50 per cent reduction in the motor taxes on small and medium powered cars and motorcycles. It is proposed to abolish all taxes on electrics for five years provided the vehicles are of Italian make. There will be some reductions in the taxes on motor lorries.

TO DRIVE FIAT IN RACES

PARIS, Feb. 4 (*by mail*)—Carrying with him a 183-cubic inch Fiat racing car, Pietro Bordino sailed from Genoa this week for New York, with the intention of taking part in all the races on the Californian tracks and in the Indianapolis 500 miles speed contest.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Can Airships Be Made Fireproof?

The recent Roma disaster brings this question vividly to the fore. We have asked the foremost American authority on lighter-than-air machines to write his answer. He does so here in the most significant article that has been presented on this subject.

By Ralph Upson*

PRACTICALLY every new aircraft accident is from some new cause, yet the large percentage of cases where fire ultimately plays a part is evident to the most casual observer. Even with airplanes, fire is to many persons the most dreaded of any occurrence; and with airships, which are so very safe in most respects, fire is unquestionably the one big risk.

In the past the prevention of airship fires has been attempted mainly by attention to the original causes. This is done by confining the possibility of sparks and flames to properly protected positions. In effect we do the same thing in our houses when we surround our heating, cooking and lighting installations with proper safeguards. It may easily be claimed that almost any fire is due originally to *someone's* carelessness or ignorance. Yet it is equally true that disastrous fires are possible and will continue to occur as long as we use houses largely built of wood. The same is true of airships, unless in some practical way they can be made fireproof. The question is "Can it be done?"

In present-day airships there are three dangerously inflammable elements: gasoline, hydrogen, and the fabric of the envelope. They are particularly dangerous in combination. The gasoline, by its very nature, is in direct contact with flame in the engines; once ignited, its proximity to the envelope makes possible the burning of a hole through it; the escaping hydrogen then ignites and rapidly spreads the fire over the entire ship. Or the process may be reversed, as it was in the case of the "Roma," where the hydrogen was probably the first to be ignited through a rent in the envelope.

As the hydrogen is in any case the greatest *potential* source of danger, the most obvious remedy is to substitute a non-inflammable gas—hence the development of helium. In proper combination with other safeguards, there is no question as to the ability of helium to do what is claimed for it in any single-envelope airship. Here it is not only non-inflammable itself but will also check any spreading of an envelope fire. In a typical "rigid" airship, however, there is still the liability of the outer cover to burn away and with it enough of the inner gas cell fabric to allow a quick escape of most of the gas.

Helium also has the following practical disadvantages, particularly applying to its commercial use:

*Chairman of Lighter-Than-Air Division, Aeronautic Safety Code Committee.

Limitation of supply to certain natural gas fields, of which there are only 11 or 12 known in the entire world.

The small percentage available, almost never more than 2 per cent by volume, of the natural gas in which helium is found.

The difficulty of separating the helium from other constituents. The only satisfactory method so far discovered is by liquefaction and partial distillation.

Expense of Helium

The above three items make helium *extremely* expensive. The production cost alone is fully 100 times the cost of hydrogen in similar quantities. Add to this the bottling and transportation over long distances with attendant leakage, and it becomes simply prohibitive for practical commercial use.

But still there is another disadvantage that is almost as serious — its deficient lift compared to hydrogen. The accepted standard of quality for helium gives it about 10 per cent less lift than a good commercial hydrogen. This means that the average paying load on a commercial airship would be reduced by nearly half, or the fares, etc., would be practically doubled from this cause alone. In this I have not considered the possibility of a slight admixture of hydrogen, nor, on the other hand, the probable greater weight of fabric and equipment on a helium ship.

Among the remedies that have been proposed for some of these difficulties may be mentioned the following:

1. The sale of various by-products from the original natural gas in order to bring down the cost of the helium. Such products exist, but in most cases they are not true by-products because their extraction is a very simple process compared to that of helium.

In other words, the "cost" of helium may be reduced by applying to it the profits made in some lucrative side business.

2. The use of hydrogen for the main part of the volume, with a layer of helium used only around the outside.

The only things this would help would be the gross lift and the provision of a cheap gas for occasional maneuvering purposes.

The gain in lift would probably be more than offset by the extra weight of the envelope and balloonets, and the loss of gas by diffusion and contamination would be approximately doubled.

3. The use of purification plants at every terminal to keep up the quality of the gas and to avoid the necessity of occasional reinflation.

There are many cases where this would certainly be less expensive than getting all new gas from a distant point.

4. Use of ballast recovery and temperature control apparatus on board to avoid the loss of gas for counterbalancing fuel loss and for maneuvering purposes.

I have been assuming, in any case, the use of some form of ballast recovery equipment.

Temperature control would usually be worth while only on a helium ship, but would, of course, cut down still further the useful lift.

5. In a helium ship the engines might safely be put within the hull, and it is claimed by some that this would permit great savings in resistance and weight, but a thorough analysis of the proposition fails to show the probability of *any* net gain. In other words, we would leave our engines outside on most helium ships as well as on hydrogen ships. The principal exception is in cases where reducing gears are to be used. Then the engines can be mounted inside the hull without so much additional weight.

Summing up the possibilities of helium, we may say that it offers one solution to the problem which should be very effective for military purposes. But there are serious difficulties attending its commercial use for which there seem to be no immediate remedies. As to what alternatives are available, we must again consider the three main inflammable elements: fuel, lifting gas, and envelope. Generally speaking, the ship will be safe from destruction if any two of these can be rendered non-inflammable. The only alternative not involving a change in the gas is to make non-inflammable the fuel and envelope.

It may seem paradoxical to talk about a "non-inflammable" fuel, but heavy fuel oil, to take the best example, *is* non-inflammable, so far as requirements for safety are concerned. It is not readily vaporized and can only be ignited in finely divided form, such as is provided for in the engines themselves. Even kerosene is a comparatively safe fuel. Several promising developments of kerosene and heavy oil engines for aircraft are already under way, and it is practically certain that something satisfactory will be worked out along this line in the rather near future.

Non-inflammable Envelope

The remaining problem is to produce a non-inflammable envelope. Practically, this means the development of an all-metal ship. In such a ship hydrogen would be as safe as helium. For, even assuming a gas leak were ignited in some way, it would only burn as a jet, the same as any gas jet, with no effect on the operation of the ship.

Many other advantages of an all-metal construction are only too obvious and need not be listed here. But there are many difficulties to be overcome to make it a reality. In the meantime prevalent designs of fabric or fabric-covered airships can and will be used with increasing safety, due to accrual of knowledge and experience. In this several of the European countries are in the lead. But the biggest development is yet to come, and opens a wonderful field for American ingenuity and perseverance.

PRACTICAL, commercial problems, as well as theoretical engineering problems, must be met in the development of civil aviation. The substitution of helium for hydrogen gas will render airships far less inflammable, but limitation of supply and high cost render such substitution impracticable from a commercial standpoint at the present time.

Mr. Upson points out as well that the lifting power of helium is about 10 per cent less than that of hydrogen. He outlines the remedies proposed for the difficulties involved in the use of helium, and discusses the possibility of rendering airship fuel and envelope non-inflammable.

If the envelope can be made non-inflammable, hydrogen could be used as safely as helium, since a gas leak, if ignited, would simply burn as a jet.

New Engine Designs at Motor Boat Show

Marine engine development during the past year has been confined chiefly to the very large and the very small sizes. Electric lighting and starting has become a standard feature on larger engines. Some designs are suggestive of aircraft practice. Several 2-cylinder outboard types shown.

TO judge by the marine engines exhibited at this year's motor boat show, which closed in New York, Feb. 26, recent developments in that field have been confined mainly to very small and very large sizes. There has been a considerable increase in the number of small outboard engines, and there were also many large Vee type Otto engines as well as several Diesel engines. Steam also is making its appearance in the motor boat field, and two complete steam power plants, including boilers and engines, were exhibited. Taking the engine exhibits as a whole, a notable improvement in design and in quality of finish is noticeable. Marine engines some years ago were generally quite crude, and this appearance of crudity was emphasized the last few years by the makeshift mountings of electric generators and starters, but most of the engines at this year's show employed one or the other of the S. A. E. standard mountings and therefore presented the appearance of well thought out jobs. In outside finish there also has been a great improvement.

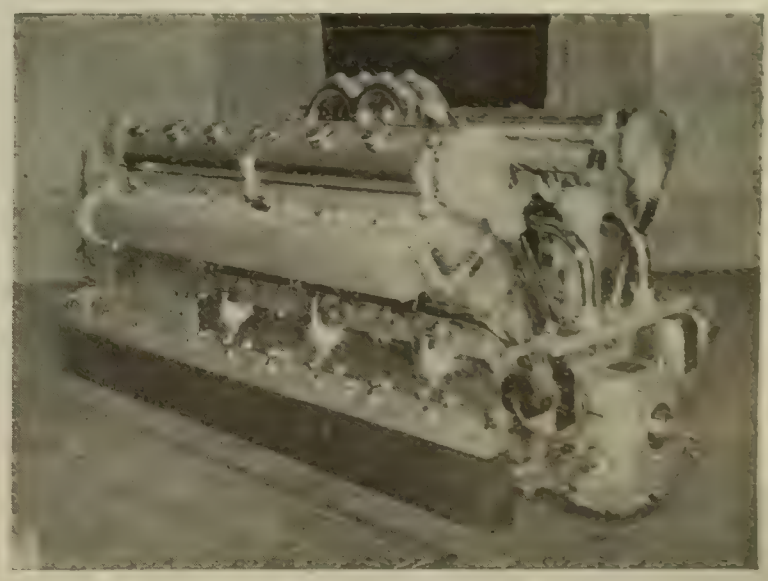
Designers of marine engines seem to be going in for overhead valve engines more strongly than automobile engine designers, and practically all of the overhead valve marine engines have overhead camshafts. Automobile engineers are going rather slow on overhead camshaft engines, because they realize the difficulty of making such engines operate quietly, but in marine work quiet operation does not seem to be considered essential, at least not in the same degree as in automobile practice. These overhead camshaft engines are mostly of large size. They include all of the twelve-cylinder and most of the six-cylinder models shown.

Electric lighting and starting has become a standard feature on boats of the larger types, and practically all of the engines with four or more cylinders were fitted with generators and starters. The makeshift mountings of these units, so conspicuous at former shows, are a thing of the past, and practically all of the installations observed were well carried out. In connection with this trend to provide generators and batteries as regular equipment in boats, there is a noticeable tendency to adopt battery ignition, this tendency being especially apparent in connection with the engines in the lower price range.

Diesel engines were exhibited by Winton, Sperry and the New London Ship and Engine Co. The engines on the Winton and Nelesco stands were large six-cylinder machines, the Nelesco having been built for use on a canal boat. The New London concern also showed a 100-hp. German M. A. N. Diesel engine, for which make it holds the American manufacturing license. The Sperry engine shown has a rating of 20-hp. and is of the compound type. This engine has been under development for a number of years and has been built for the Government in several sizes. We expect to print a description of this engine in an early issue.

A matter that has caused considerable disturbance in the marine engine industry recently is the refitting of discarded or surplus aircraft engines for marine purposes. On the one hand such converted engines with reversing gear were offered to purchasers at the show, while on the other hand purchasers were being warned against all engines not specially designed for marine work. The argument in favor of the converted aircraft engine is that it can be purchased at a comparatively low price. It is further argued that the engine has been designed to deliver a certain fixed horse power, and as long as it is in good condition it will deliver that horse power no matter where it is installed. The engine, it is said, does not know where it is mounted and furnishes power equally well in an airplane, a boat or an automobile. The warnings referred to emphasized the running cost and alleged that the airplane type of engine was not as reliable and durable as a marine engine should be.

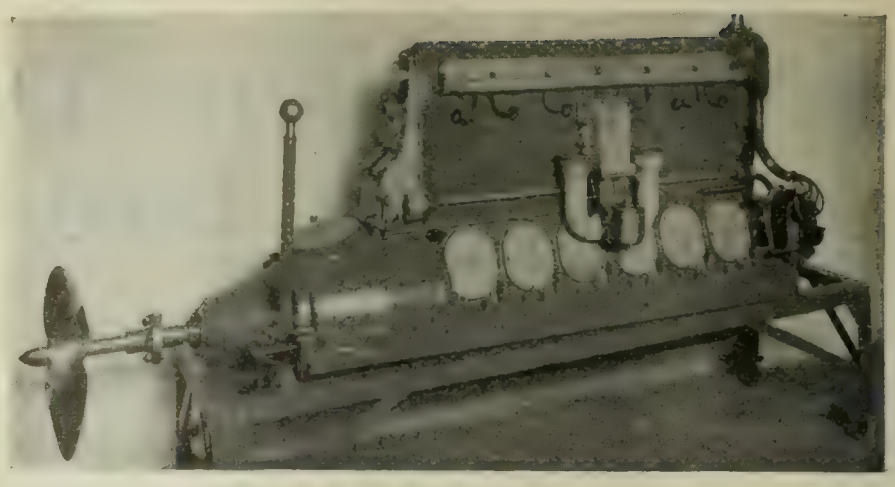
There were several engines shown which, while suggestive of aircraft practice, are still strictly marine engines, being much heavier than would be permissible in aircraft work. An example of this class is the Allison engine manufactured by the Allison Engineering Co. This is a twelve-cylinder Vee engine, delivering 300 hp. at 1000 r.p.m. and 425-hp. at 1500 r.p.m. The cylinder dimensions are 5½ x 7½ in. and the engine complete weighs 4400 lbs. The crankshaft is of the seven bearing type, 3½ in. in diameter and hollow. Crankshaft and connecting rods are forged of chrome nickel steel and machined all over, which gives an idea of the quality of design and construction. In fact, it will be observed from the brief description here given that aircraft engine practice has been followed to quite an extent, but the speed has been kept down and special attention has been paid to the requirements of rigidity and durability in marine practice. The cylinders are cast of semi-steel, the upper half of the crankcase is an



Allison twin six Vee engine



The new Sterling Viking six-cylinder engine



The six-cylinder, completely enclosed Isotta-Fraschini

aluminum casting and the lower half a manganese bronze casting. This lower half carries the crankshaft bearings. There are four valves in the head of each cylinder. The two overhead camshafts are driven through shafts parallel with the cylinder axes at the forward end of the engine. There are three spark plugs in each cylinder. Two of these plugs are connected up to magnetos, the engine being fitted with two six-cylinder dual spark magnetos, while the third plug is connected to a battery ignition system. As might be expected, lubrication is by the pressure system, and an electric starter and generator are fitted. The price of this engine with reverse gear is $25,000.

The same company exhibited a marine generating set comprising a four-cylinder vertical engine direct connected to a generator. Outputs of either 3 or 4 kw. can be obtained from the same unit, evidently by varying the running speed, and the generator can be wound for either 32 or 110 volts.

The Sterling Engine Co. exhibited two new six-cylinder models, of 150 and 300-hp. rating respectively. Both of these have overhead valves and overhead camshafts, the larger engine having dual valves. A feature of this machine which is found in very few marine engines so far is removable cylinder sleeves. The advantages claimed for the sleeve construction are that in the event of wear a sleeve can be easily replaced, and that, since the sleeves are machined both inside and out, there is less chance of distortion in service and consequent leakage and inefficiency. One point that is not being mentioned but which very likely has had considerable weight with the manufacturers is that this method of construction greatly simplifies the foundry problem in connection with producing the cylinder casting. The cylinder block—or water jacket, whatever one wants to call it—is a single casting extending the whole length of the crankcase, and this, of course, tends to greatly stiffen the crankcase. The lower half of the crankcase, which supports the bearings, is made of aluminum for express cruisers, and of cast iron for heavier boats. The upper half is in every case made of aluminum. The crankshaft is made of chrome nickel steel, with seven bearings. This same steel is also used for the connecting rods, which are of the tubular type. It will be noticed that these engines also embody the highest grade construction practice. Pressure feed lubrication is used, the oil being fed under pressure even up to the piston pin bearings. The system employed is that known as the dry base system, which was developed in connection with aircraft work, and which should have advantages in marine work also, especially in rough weather. Aluminum pistons are used in these engines. Ignition is by the battery system. The cylinder dimensions of the two engines are 4-11/16 x 6 in. and 7 x 8½ in.

A 400-hp. engine with overhead valves was shown by the Peerless Marine Motor Co. It is a 12-cylinder Vee type and weighs only 1400 lb., according to signs displayed, which is a remarkably low weight. This company also exhibited a 125-hp. 4-cylinder engine said to weigh only 750 lbs. and claimed to be the world's lightest marine engine. On the twelve-cylinder the starter and generator are mounted behind the engine proper on the reverse gear housing.

Another big engine known as the Smith marine twin six was exhibited by the New Jersey Motor Sales Co. It has Liberty 5 x 7 in. cylinders and weighs 1250 lbs. The rating is 450-hp.

A pair of very neatly designed engines, a six and a four, were shown by Isotta-Fraschini. They are completely enclosed and have very trim lines. At the front end of these engines there is a cross shaft which drives the magneto from one end and the generator from the other. The starter is fitted to the side of the engine and is geared to the fly wheel. At the rear end of the engine there is an aluminum casting which apparently serves as a jacket cover and which also forms the instrument "board." On it are mounted a tachometer, an oil circulation gage and an oil pressure gage. The camshaft drive is symmetrical in front of the engine. The water pump is of the eccentric type and is mounted on the forward extension of the crankshaft.

Murray & Tregurtha showed a pair of overhead camshaft engines. One of these was obviously a racing engine of very light design. There are two camshafts on this six-cylinder engine, one for the inlet and the other for the exhaust valves. Each camshaft is enclosed in a cylindrical camshaft housing and operates the valves directly through the intermediary of pushrods having their guides in the housing, so that the usual valve rocker levers are dispensed with. Means for the adjustment of the valve clearance are provided on the projecting portions of the push rods. There being push rods between the cams and the valve stems, the camshafts naturally are located a considerable distance above the cylinder heads. Their housings (of aluminum) are supported on the cylinder heads by means of steel studs or columns. This makes a rather light and simple construction.

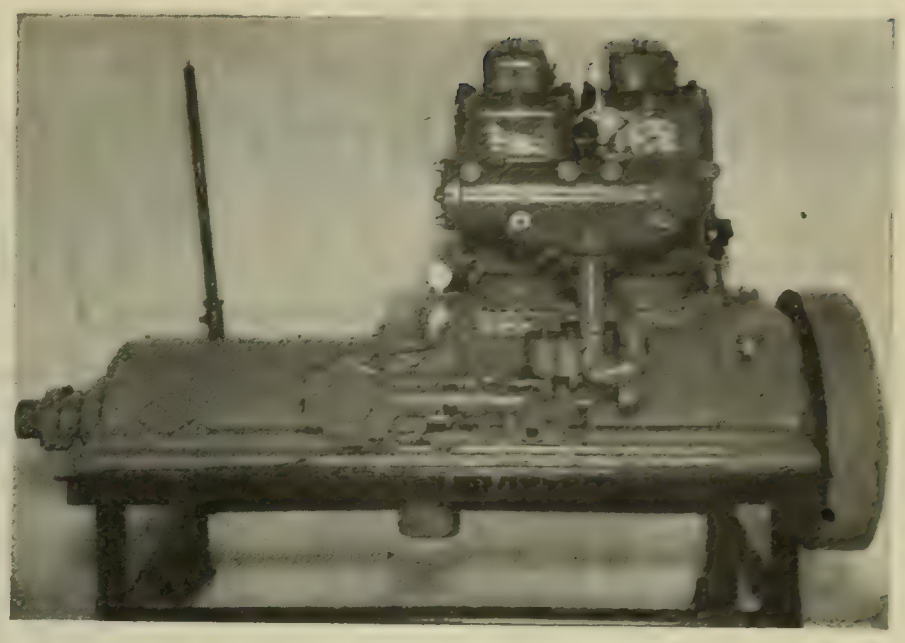
In outboard engines several two-cylinder types are now being offered. These engines are of the two-stroke or two-cycle type and the object in making them in two-cylinder form, notwithstanding their small output, is to improve the balance. The cylinders being arranged horizontally on opposite sides of the crankshaft, to gain this end it is necessary to use a two-throw crankshaft and to have the two cylinders fire at the same time. Formerly flywheel magnetos were the almost universal equipment on these engines, but now an option on either battery or magneto ignition is given by most makers.

Strong efforts have been made to reduce weight of outboard engines. The new 2-cylinder Elto, rated at 3 hp.,

weighs 48 lb. The Johnson outboard engine weighs only 35 lb. and is probably the lightest engine of this type made. A material reduction in weight has also been made by the Evinrude Motor Co. in its new 2-hp. outfit.

Motor-boat service is very similar to tractor service, in that the engines have to operate at nearly full load practically all the time, and it is therefore not surprising that a number of firms which specialize in tractor engines should also build marine engines. When Joe Van Blerck got out his new J. V. B. engine he at once offered it in both a tractor and a marine type, and now the Stearns Motor Mfg. Co., another manufacturer of tractor engines, has also entered the marine field.

An historical exhibit of interest was shown by the Consolidated Shipbuilding Corporation in the form of a naphtha launch built about 35 years ago, before the advent of the gasoline motor boat. Its powerplant operated on the same principle as a steam power plant, but low boiling point naphtha was used as the working fluid. Sectional diagrams of the working mechanism were shown mounted on a board, and it was stated that these launches enjoyed considerable vogue for several years, but that when the gasoline launch appeared on the scene the demand for them decreased.



Two-cylinder model of the new Frisbie heavy-oil type engine

A New Motor Operated Horn

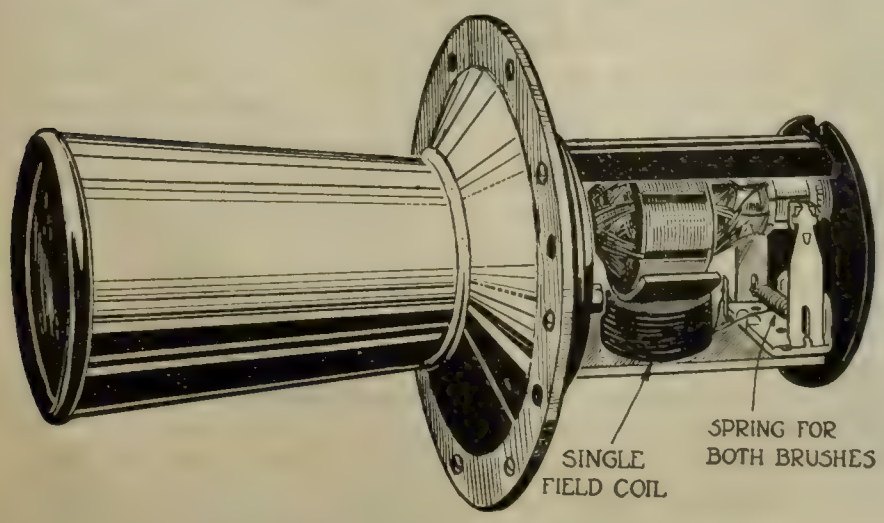
BY the use of a novel construction for the motor, the Briggs & Stratton Co. have been able to use a single field coil in the new motor-driven horn which they have recently brought out. The new construction has so simplified the manufacture of the horn that, based on a quantity-production basis, the horn will have a list price of but $5. There is a minimum of interior wiring. The horn is a concentric type.

In the design of the horn an effort has been made to remove the necessity for attention on the part of the owner or service station. It has been found that a large percentage of horn trouble usually encountered is due to either too much or too little lubrication. On the new horn a specially impregnated fiber is used which eliminates the necessity for lubrication and also is designed to exclude moisture.

An unusual feature in the motor is the new brush rigging which has been designed with the intention of making it impossible for the brushes to stick. The brushes are not lubricated, as there is one carbon and one copper brush. By the design of the brush rigging with a single coil spring between the two brushes, which are mounted on a sub-assembly, equal pressure is always exerted on the brushes. As shown by the sketch, the brush replacement is very simple.

The horn has been so designed that the cover can be easily removed and parts disassembled by removing two nuts, making it a simple matter to replace any worn parts. The horn can be taken apart so quickly that the customer can be informed at once exactly how much it will cost to make any replacements. This quality permits the service station to make the profit on the merchandising of material rather than on labor, and at the same time cuts down the amount of time the car is tied up for horn service.

Adjustment of the horn can be made externally by the use of a screw driver. The slot is so sized that a coin can be used if no screw driver is available. Two types of brackets are provided so that practically any car can be fitted. There is only one type of horn manufactured, but provision is made for a 12-volt circuit by putting on an external resistance. This eliminates the necessity for carrying more than one type of horn in stock. An important claim which is made for the horn is that the design is such that changes in weather conditions do not affect it in any way.



Detail of the new Briggs & Stratton motor operated horn

Auditing, Theory and Practice

THE third edition of "Auditing, Theory and Practice," by Dr. R. H. Montgomery, has just been published by the Ronald Press Company. The present edition is in two volumes and the second will not be ready for distribution for a few months.

This book, which has long been recognized as an authority on matters of auditing and accounting, has been brought up to date. Changes in economic conditions brought about by the war necessarily led to changes in systems and methods, and these are all brought out by the author. It is for this reason that the book is actually a new book rather than a new edition. Fully 200 of the pages are entirely new text.

The first volume of the book deals with the general principles of auditing and the second to the application of these principles.

THE weight of Haskelite Mfg. Corp. quarter-inch body panels is given as .073 pounds per square foot in the Feb. 16 issue. The weight should have been given as 0.73.

Cooling Capacity Increased in Samson Tractor

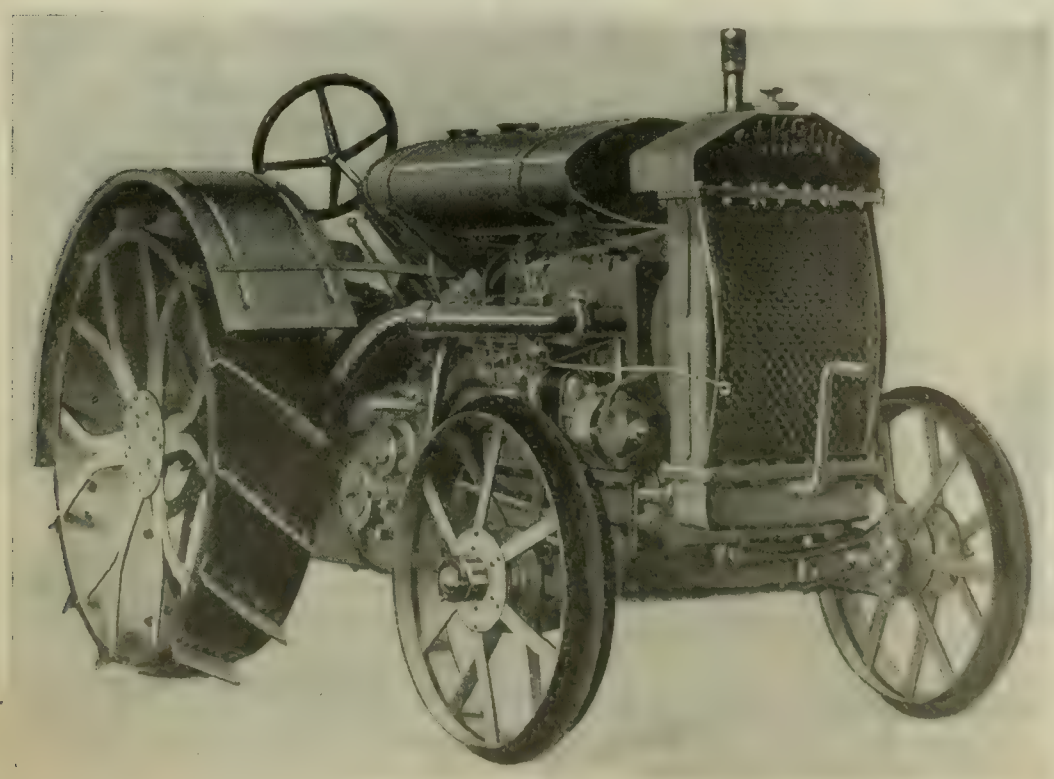
Improvements in lubricating and cooling systems have recently been made in the Samson Model M tractor. Cooling capacity is materially increased by enlarging radiator and fan. Here is the first detailed engineering description of this tractor with sectional view of chief components.

By P. M. Heldt

ALTHOUGH the Samson tractor is not a new product, a technical description of the machine at this time should prove of interest because no sectional views of the chief components have ever been shown in the past and very little is known concerning the internal construction of the tractor except possibly to service men and some users. Since it was introduced in the fall of 1919 this tractor has been widely distributed, and it has been decided to continue the same model for another year, with improvements as indicated in the course of this article.

As shown by the photographs, the tractor is of the frameless type, the engine being bolted with its bell housing to the forward flange of the transmission, which latter forms a unit with the rear axle housing. The tractor is of the lighter and more compact type and is geared to operate at slightly over 3 m.p.h. in light soil.

The engine is a four-cylinder block-cast type of 4-in. bore and 5½-in. stroke. Its cylinders are of the L-head type, the valves being seated directly on the cylinder casting, which tends to insure effective cooling. The compression chamber, which is made comparatively large so as to permit of the use of kerosene as fuel, is formed by the union of the removable head and the cylinder block. There are communicating passages between the jackets of the cylinder block and the cylinder head, so that the heads, too, are effectively water-cooled.



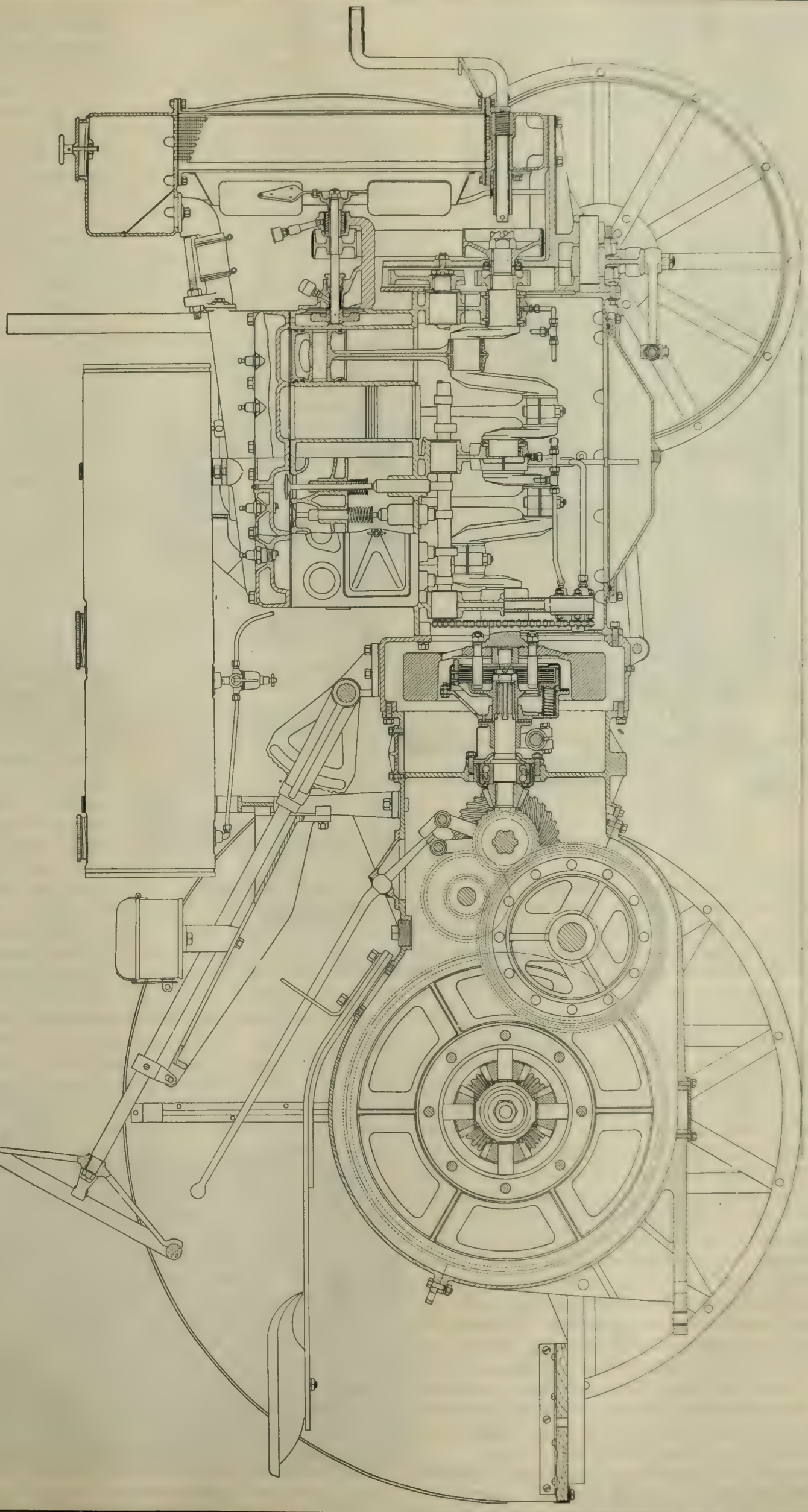
Samson Model M tractor

The crankshaft, camshaft and connecting rods are heat-treated steel forgings. All bearings on the crankshaft are of a dense babbitt alloy, brass-backed, while the camshaft runs directly on the cast iron of the cylinder casting. The pistons are made of cast iron and are fitted with three compression rings above the piston pin and an oil scraper ring near the lower end of the skirt. The timing gears are of cast iron and are cut with helical teeth.

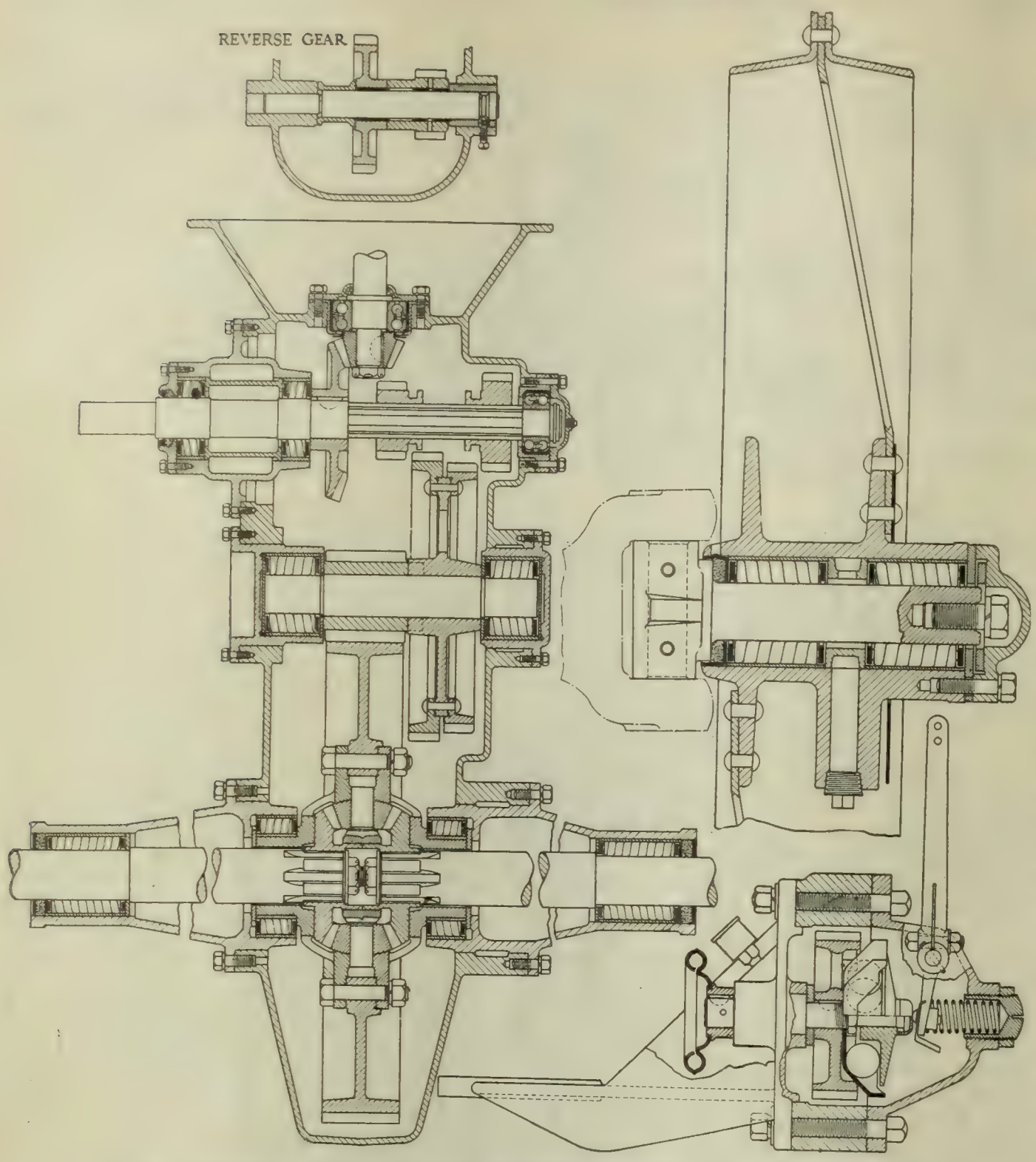
Lubrication of all engine bearings is accomplished by pressure feed from a gear pump located in the bottom of the crankcase, and oil thrown from the crank arms and connecting rod cheeks furnishes lubrication for the pistons, piston pins and valve tappets. A removable cast iron oil pan permits easy access to the interior of the crankcase for inspection and minor repairs. There are no oil line connections or other attachments to this pan. An improvement made to the lubricating system during the past year consists in the provision of an oversize oil pump with a by-pass valve, which results in a degree of uniformity of oil pressure on all bearings regardless of the temperature or fluidity of the oil. The overflow from the bypass valve is used to lubricate the timing gears and governor mechanism.

Circulation of the cooling medium is effected by means of an impeller of the type used in centrifugal pumps, which operates in a housing cast integral with the cylinder block. A large diameter pressed steel fan is mounted directly on the pump shaft and the pump and fan are driven from the crankshaft by a single belt. The cooling system, too, has been redesigned during the past year, with the object of adding to its cooling capacity. A radiator of increased capacity, though of the same general type as the previous one, has been adopted, and the fan has been considerably increased in size and its speed has been raised to give increased air flow. Formerly a plain bearing was used on the fanshaft, which now has both a plain and a Hyatt bearing. A flat belt has replaced the vee belt and is kept taut by a spring tension idler. The radiator consists of cast iron top and bottom tanks and cast iron side columns, which parts enclose a finned tubular core. Water is used as a cooling medium in warm weather and kerosene in winter in cold climates.

An air cleaner of the wet type is furnished, which was specially designed for this particular tractor. The necessity for frequent carbureter adjustments is said to have



Longitudinal section through tractor



On left—Horizontal section through transmission and rear axle. On right above—Section through front axle, showing roller bearing mounting. On right below—Section through engine governor

been eliminated. Particular interest attaches to the manner in which the heat of the exhaust gases is utilized for vaporizing the commercial kerosene used as fuel. A combined exhaust and intake manifold is provided, the construction being such that at the will of the operator all or only a small part of the exhaust gases can be passed over the surfaces enclosing the intake passage. The control device by which this is effected comprises a pair of manually operated butterfly valves. A single carbureter, adjusted to operate in conjunction with the heat control system, serves to meter and spray the liquid fuel. Gasoline carried in a small compartment of the large fuel tank is used for starting. After a few minutes' operation, sufficient to heat up the walls of the intake passages, kerosene is admitted to the carbureter by means of a three-way valve. By the same movement of the operator's hand the gasoline is automatically shut off, and the operation continues with kerosene. Gasoline may also be used as operating fuel, all that is required to that end being a slight adjustment of the carbureter needle valve.

The governor is of the centrifugal type and is entirely enclosed. The flyball unit is driven by a spider which is combined with the magneto drive gear. Adjustment over a range of speeds from 900 to 1500 r.p.m. is accomplished by means of an adjusting screw in the front of the governor housing. The governor lever is direct connected to the inlet throttle, the lever and connecting link being the only exposed parts.

A high tension magneto is standard ignition equipment, and a fine-toothed adjustable coupling is furnished. An impulse coupling is offered as an extra.

A cast bell housing unites the powerplant with the transmission, enclosing the flywheel and clutch unit. The latter is of the multiple disk type, steel on steel, and runs in a bath of oil supplied automatically from the engine base. The clutch disks are made of sawblade steel. The operating thrust is absorbed by the pinion bearing mounted in the forward end of the transmission, thereby relieving the crankshaft of any thrust duty from that source. Operation of the clutch is by a conveniently located pedal. No means for adjustment of the clutch are provided, but the clutch action is said to be smooth and positive.

The transmission is a spur gear type, with an initial reduction from the clutch shaft to the splined shaft through a pair of coarse pitch spiral bevel gears. Sliding gears on the splined shaft mesh with corresponding gears on the countershaft, and the final reduction is by a 12-tooth pinion meshing with a 72-tooth bull gear. The differential is of the conventional bevel gear type. Two forward speeds, of 2.3 and 3.2 m.p.h., respectively, and a reverse speed of 1.06 m.p.h. are secured at normal engine speed. A selective type of gearshift with guide plate makes possible the selection of the desired speed.

The bull pinion is cut from alloy steel and is heat-treated to stand severe duty. The bull gear is cut from semi-steel. Being symmetrical, it can be reversed on the differential housing, thus presenting a new working face on the teeth. All other gears are cut from carbon steel and oil-hardened, as are all the shafts.

The clutch shaft and one end of the splined shaft are mounted on high duty ball bearings. All other shafts are carried on high duty roller bearings running directly on hardened and ground journals.

All gears, shafts and bearings are enclosed in a dust proof, oil tight, cast iron case, the bottom half of which may be removed for inspection or repairs to the mechanism therein. The gears operate in a bath of heavy steam

cylinder oil. The splined shaft passes through the left-hand side of the case and carries on its outer end a belt pulley of 18 in. diameter and 6-in. face. This supplies power for belt work of practically any nature.

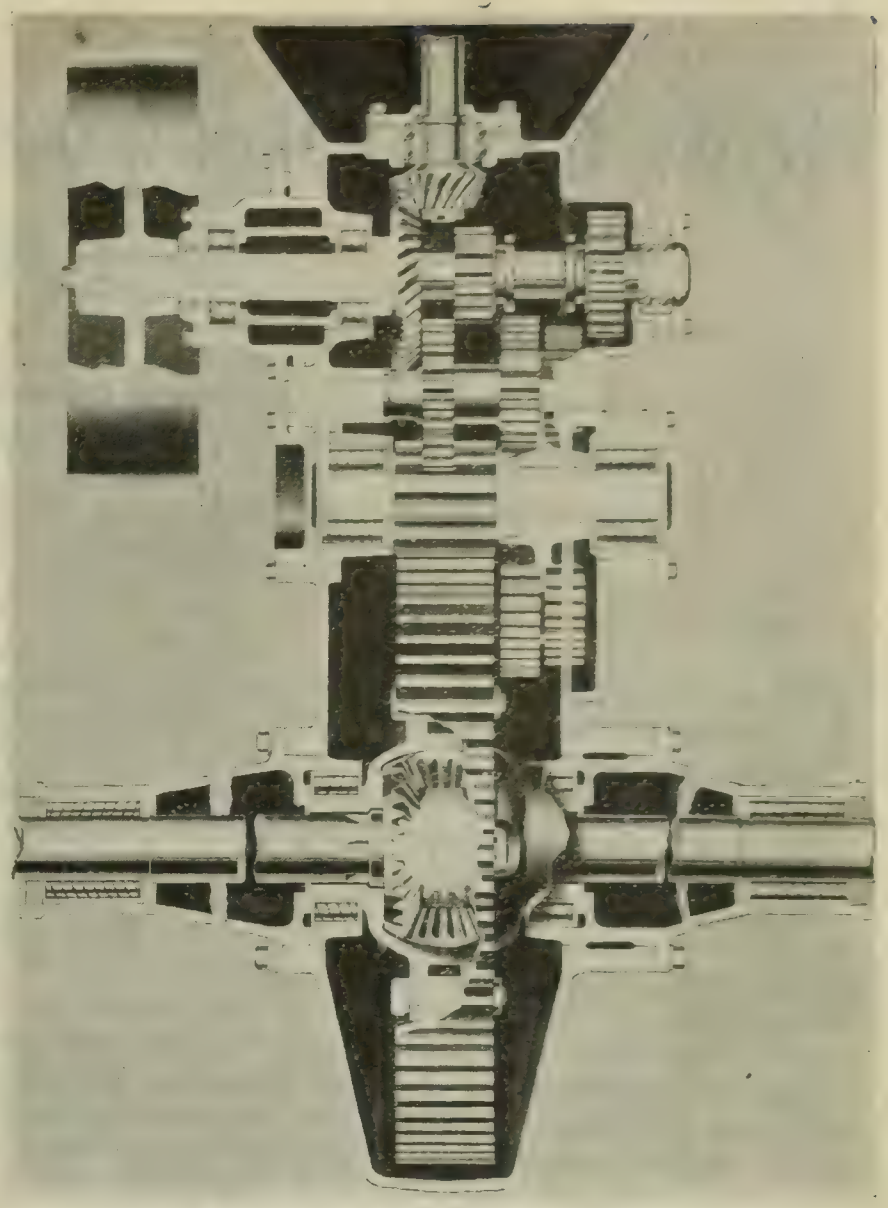
To opposite sides of the transmission case, at the bull-gear center, are bolted cast axle arms in which are carried the wheel shafts and their bearings.

Both front and rear wheels are of rolled and stamped steel construction, fabricated and riveted. Hubs are cast and machined for bearings and shaft fits. The front wheels are carried on drop forged steering knuckles, case hardened and ground. The rear wheels are 45 in. in diameter, have a 12-in. face and are provided with twenty-eight 2 x 2½-in. angle cleats. Special rice field and sand equipments are furnished as extras where required.

The front axle is a malleable iron casting of I-section and is pivoted at the center to permit travel over rough or uneven ground. Radius rods pivoted at the flywheel housing transmit the thrust of the tractor wheels to the front axle. Cushioned connection relieves the operator to a certain extent of undue shocks when negotiating rough or stony ground.

Among other recent improvements has been the replacement of plain bearing front wheels by wheels of the same general design, but fitted with roller bearings. These latter are fully enclosed and protected from dust and dirt. Heavy oil lubricating means are provided and the volume of oil carried in the bearing chamber is said to be ample for several months' constant operation.

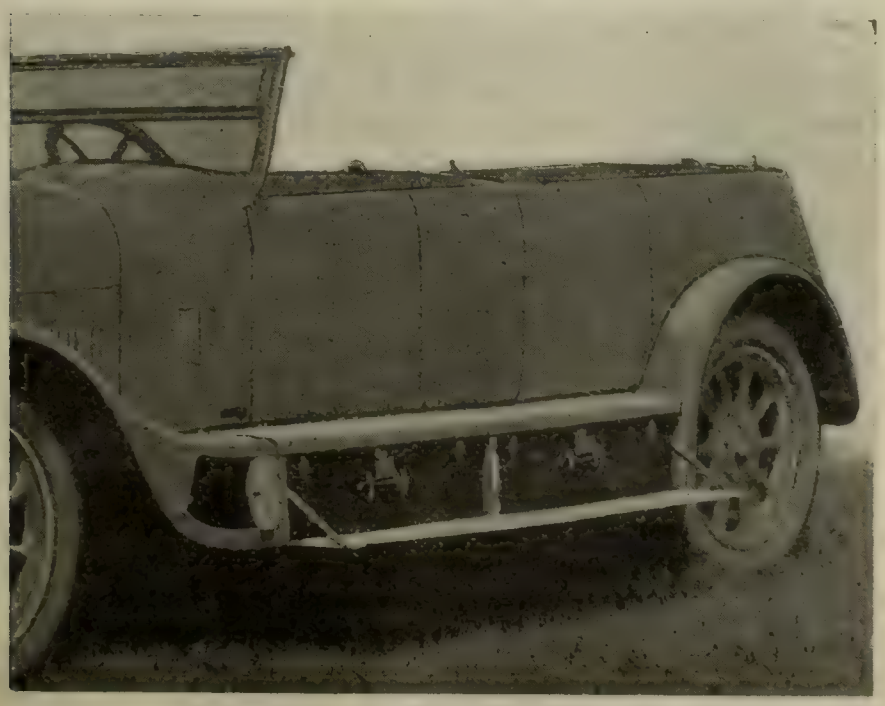
The wheel bearings operate on case-hardened and ground spindles, and side thrust of the wheel is taken on a plain thrust washer, which is inserted between the end of the hub and the hub cap. The thrust bearing surface is thus located where it is protected against dirt and can be thoroughly lubricated.



Halftone view of Samson transmission in section

New Running Board Construction

A GOOD example of sheet metal panelling and the disposal of tool boxes and baggage grips so that they do not form accessories hung on to the car, is presented in a new model designed by the d'Ieteren Body Building Company of Brussels and built on a 6-cylinder Fiat chassis. The two spare wheels are set in a well on the rear panel, the edge of the wheel being flush with the panel.



Running board to carry tool boxes and suit cases

The running boards are made use of to carry tool boxes and suit cases. There are really two running boards, the bottom one being at the usual height and the upper one flush with the floor of the car, the space between the two forming a locker into which specially designed tool boxes and suit cases are fitted. The face of the locker is hinged, thus giving a very neat appearance and allowing the cases to be pulled out as required. This arrangement gives complete protection with great accessibility. The running board locker is very neatly run into the domed front fender, with a battery box built into the base of the fender. The car is fitted with a concealed top.

Des Moines Leads in Home Ownership

THE Division of Building and Housing of the Bureau of Standards has recently completed a chart showing graphically the percentage of home ownership in 1920 in cities of the United States having a population of over 100,000. This chart is based on statistics compiled by the Bureau of Census and also includes a table giving the same values as the chart and in addition the percentage of ownership in the years 1910 and 1900.

In 1920, the lowest percentage of ownership in the country was in New York City, having 1,278,341 homes of which 12.7 per cent were owned by the occupants. At the other end of the list is Des Moines, Iowa, with 31,644 homes of which 51.1 per cent are owned.

How One Observer Views the Garden Tractor

A large market foreseen, but considerable diversity in types to meet varying service conditions is considered necessary. The mounting of implements is discussed, and some statistics regarding production are given.

By Fred C. Ziesenheim

TO complete the motorization of the farm, the small tractor has been evolved to replace single horse and hand operated implements in the preparation of the soil and in planting and cultivating row crops. The small tractor is the newest important development in motorized farm equipment.

The potential market for the small tractor is seemingly tremendous in that it can be used on every farm, irrespective of size, down to the small garden patch.

There are over 6,500,000 farms in the United States. About 2,673,000 of them are of approximately 100 acres and nearly 1,000,000 are of less than 20 acres. More than one-half of the total area devoted to all crops is devoted to crops requiring cultivation. The peak load in hours of horse labor on the average farm comes during the cultivation period and not in plowing and fitting the soil, which is work that the present type of large tractor is designed to do. Large farms devoted to general farming have, in addition to row crops, vegetable gardens and large lawns. Thousands of acres are devoted to specialized farming like that of cotton in the South, onions in the Mississippi Valley, beets in the Middle West and West, and tobacco in the Middle Eastern States.

The market gardener near the cities needs the small tractor to complete the motorization of his farm since he uses a motor truck, instead of horses, to carry his produce to the city markets. Usually, he does not grow his horse feed but purchases it. With motor trucks and good roads, the market gardener is not forced to locate near his market on high priced land, but can locate at a distance where land values are lower. Larger acreage can be purchased, which, through the use of motorized equipment, will give greater returns on the investment. Florists and nurserymen operate under conditions similar to that of the market gardener, and they have been quick to realize the advantages of the small tractor.

Specialized farming and market gardening require considerably less investment and are much more profitable than general farming. Intensive farming will come about as a natural sequence to an increasing population. If the relative increase in population of city over country continues at the same rate as during the past decade—and there is every reason to believe that it will—those remaining on the farm must increase their production of foodstuffs by the greater use of improved power farming machinery.

Markets for the garden tractor in addition to that of the farms are the innumerable greens such as golf courses, parks, cemeteries and large estates where a power lawn mower can be used, since a power lawn mower can be easily attached to the small tractor. There are millions of homes with a lawn and garden patch where the small tractor will lighten the menial task of pushing the lawn mower and the garden cultivator.

The lower operating costs of small tractors, as compared with that of horse-drawn implements, are attributable to factors similar to those which make the large tractor more economical. The tractor makes possible a greater productivity per man hour; there are no operating expenses when the machine is idle, it consumes fuel only when it is working. A machine does not have to be humored on a hot day but will work at full capacity. In cultivating row crops, there is no loss from horses nipping or stepping on plants. A comparison of costs with that of hand-operated implements is evidence that a motor cultivator makes it possible for a man to do more work than when he has to supply the motive power himself. Man power is the most expensive form of power. The greater utility and flexibility of the small tractor is an advantage in that it can do one-horse tasks, hand cultivator work, push a lawn mower, and it can also do a variety of belt work.

A 9-in. plow is the minimum width of moldboard plow that will satisfactorily turn a furrow and plow deep enough to give a good seed bed. A narrower moldboard plow cannot turn under and cover up the crop remains, weeds, loose material or whatever else is on the surface of the ground. The engine power required to pull a 9-in. moldboard plow set at a depth of 5 to 8 in. and at a reasonable rate of speed, will be approximately 5 hp. The tractor must have sufficient weight and wheels wide enough to secure positive traction. The wheels must have sufficient tread and the center of gravity of the tractor must be low enough that in plowing with one wheel in the furrow, the tractor will not tip over readily. Plowing on side hills aggravates the tipping condition. The conditions imposed on the plowing type require that it be a heavy, powerful machine with large wheels set at a considerable tread.

The garden tractor can be divided into plowing and non-plowing types. The functions of a plow are fourfold in that it must turn over the soil to present a clean surface for planting the new crop; it must bury the remains of the previous crop; it must plow sufficiently deep to bring to the surface subsoil that has not lost as much of its plant food as the surface soil, and it must, during the plowing operation, break up and pulverize the soil so that the amount of fitting required in the preparation of the seed bed shall be a minimum.

The tractors which cannot pull a 9-in. moldboard plow should be definitely designed and marketed as a non-plowing type, until such time as some other form of plow is available which will permit narrower furrows. Considerable sales resistance has already been created by unsatisfactory plowing demonstrations. It is difficult enough to

sell farmers any radically new equipment without trying to show them that the machine can do work for which it is manifestly unsuited.

The curved disk type of plow holds possibilities worthy of development in that it can satisfactorily cut and turn over any width of furrow desired. The development and marketing of a satisfactory disk plow would eliminate the non-plowing classification and would greatly increase the utility of the smaller garden tractor.

The plowing type can be divided into the riding and the non-riding types. The riding type has been developed to secure a greater ease and facility in operating the cultivation implements, particularly in eliminating the lifting or carrying of implements in making a turn. To quote a professor of farm engineering: "The day of walking farm machinery is past. Modern power farming equipment sets too severe a pace to require that the operator tramp after the machine. The operator must conserve his energy so that he may give his undivided attention to the implements and the tractor." Implement manufacturers have recently developed riding cultivation equipment which is adaptable to many of the present types of walking garden tractors.

The manner of attaching implements to the tractor depends upon the size and class of the tractor and the type of implements used. In present designs, the implements are attached at the rear of the tractor proper. The center of gravity of the tractor itself is usually forward of the axle center line in order to counteract the torque reaction. The torque reaction, however, assists in keeping the implements imbedded.

A proposed method of attachment for small tractors is to place the cultivation implements in front of the tractor where there is an unrestricted view of the row crop being cultivated, since it is desired to have the implements cultivate close to the plants on each side of the row. With the implements suspended in front, shorter handles can be used, the operator walks nearer the axle center line, the tractor's maneuvering ability is thus increased by lessening the arc through which the handles must be swung for a given change of angular direction. With reference to Fig. 1; for a change in direction of the tractor, the arc on *B* is considerably less than a similar one on *C* when using longer handles.

In the plowing type, implements other than plows are attached so that their center of draft coincides with that of the tractor, the point of attachment being preferably on a vertical line equidistant between the traction wheels and passing through the axle center line but located below it so as to counteract the torque reaction. The engine and transmission assembly, however, usually dictate the location of the draft attachment. The implements are set as closely as possible to the center line of the traction wheels so that the radius from this center line to the implements will be as short as possible, as for instance the radius of the arc *A* in Fig. 1. This decreases the arc of movement of the implements for slight deviations in the direction of the tractor; it permits the use of shorter handles and increases the maneuverability of the tractor so that it is possible to cultivate closer to the plants and to make shorter turns.

In cultivating row crops by straddling, the tractor must have considerable clearance from the ground to avoid pushing over the plants, but the tractor's center of gravity must be kept low to prevent the tractor from becoming top heavy and tipping over easily. Cultivating two or more rows at a time is possible only when the planting has been done by a multiple row seeder with fixed center distances of the rows. A number of these seeders have been developed for use with garden tractors.

The depth at which the implements operate is varied by raising or lowering the point of draft attachment by means of a lever within easy reach of the operator, thus changing the relative height of implements and wheels. Provision is usually made for lifting and holding the implements entirely clear of the ground when turning around at the end of the row.

The center distance of the two traction wheels can usually be adjusted for different treads and provision is made for fitting on extension rims. In one design the extension rims are very heavy and are used to secure additional traction for plowing. The wheels can be mounted on live axles or can be driven through gearing, chain, or belt. Steering may be accomplished in a number of different ways; steering with the handles, operating with independent clutches in each drive wheel, and on the riding type by changing the direction of the caster wheels either through foot bars or a hand operated steering wheel.

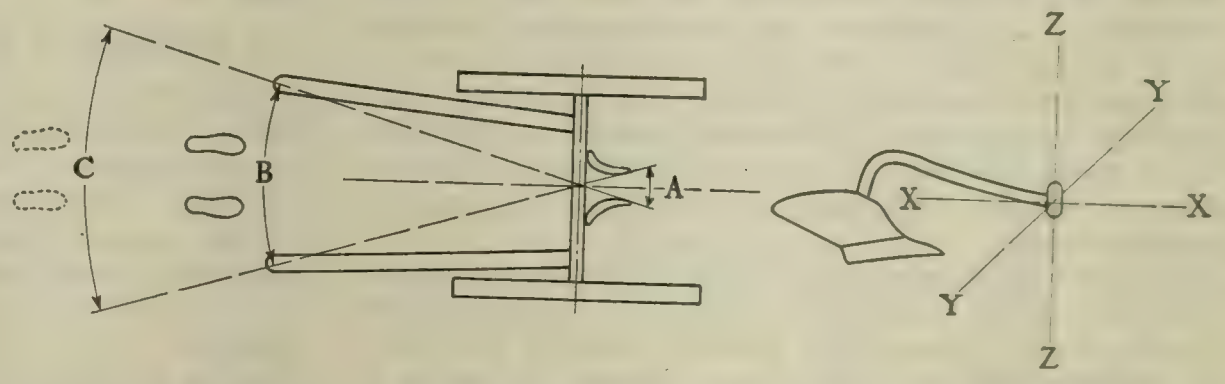


Fig. 1—With implements in front, the operator can walk closer to the axle; the handles are shorter and need be swung through a shorter arc for a change in direction of the tractor.
Fig. 2—A garden tractor plow has freedom of movement about the YY and ZZ axes, but is fixed about the XX axis to prevent rolling

Plow Mounting

The center line of draft of a plow is not parallel to the line of movement of the tractor, but is at a slight angle, so that the plow is held into or against the land. The point of attachment should be at the center of tractor draft, as previously mentioned. However, with one traction wheel in the furrow, the location of both tractor and plow is fixed, hence the point of draft attachment must be that compromise which will give the minimum side draft.

Referring to Fig. 2, the plow is fixed so that it cannot turn or roll about the horizontal axis *XX*, *XX* being the direction of plowing. When in the plowing position, the plow sets square and level and it can not roll, but must cut a smooth vertical surface for the land side of the furrow. If the tractor plows with one wheel in the furrow, an adjustment should be provided for changing the plow's vertical setting, so that in plowing the first furrow with both traction wheels level and on the land, the plow can be set to cut a square furrow. On the next round, with one wheel in the furrow, the adjustment can then be changed to bring the plow back into the level position.

The plow has freedom of movement about the horizontal axis *YY*, at right angles to the direction of plowing. The draft attachment floats about a pin in the *YY* axis, the plow thus seeks its own depth, depending upon the height of draw bar attachment. The height can be varied to give different depths of furrow and for removing the plow from

the ground. If it is possible to vary the height of hitch while running, the plow on starting can be set to reach full depth in a very short distance.

The plow has freedom of movement about the vertical axis *ZZ* in order to seek its own width of furrow, depending upon the transverse location of the point of draw bar attachment. This point can be varied along a line parallel to the axle center line, thus giving a means of controlling the width of furrow turned over.

Plowing with one traction wheel in the furrow tips the small tractor considerably; if the wheel on the land strikes an obstruction, the tractor may tip over. In one design this tipping condition is obviated by lowering the wheel in the furrow relative to the other one so that the tractor is maintained level. The wheels can thus secure full width, flat contact with the ground, insuring maximum traction.

There are about twenty firms making garden tractors in the United States; some have been in business for eight years, but the majority have been in but the last four years. According to bulletins of the United States Department of Agriculture, there were sold during 1919 about 3760 tractors of 6 hp. and less rating. In 1920 six firms manufactured 7678 tractors of 8 hp. and less rating, their total value being $2,091,000. The total output of all tractors during 1920 was 203,207 machines with a total value of $193,563,000.

About 15 per cent of the country's total tractor output is exported. The number of gas tractor engines exported slightly exceeds that of the tractor, the total volume of engine exports amounting to $22,000,000 during 1920. The export possibilities of the small tractor and of their engines appears better than for the larger machines, inasmuch as there are practically no European firms making garden tractors.

Practically all garden tractor firms purchase standard implements from established implement manufacturers, but only 28 per cent of them purchase engines for assembly, probably because there are a number of makes of standard implements available, whereas there are only a few engines which can be adapted to the service.

The tremendous development in automobile production during the past 10 years is due to a certain extent to the fact that a large percentage of the cars marketed have been assembled from standard parts. Over 3 per cent of the passenger car firms purchase engines for assembly. The motor truck industry is a more recent development and has made a greater use of standard parts. Of the 139 manufacturers of large tractors 73 per cent purchase engines and other parts. The garden tractor industry will undoubtedly develop along similar lines when suitable engines and parts are available for assembly.

Many of the firms assembling and marketing large tractors may expect to meet with considerable sales resistance for the next few years. These firms have production and sales organizations established, and since implements can be secured from several sources, when suitable engines and parts are available, they will be enabled to market a garden tractor, as it will not require a large investment to enter the business, and the smaller cheaper tractor will not meet with as great a sales resistance.

The small tractor is not strictly a general purpose machine, as it can be designed to meet only a limited class of service. This condition will lead to the development of particular types of small tractors for specific purposes. Many of the small tractors thus developed cannot hope to achieve national distribution, for there will not be a national demand for their particular class of machine. It will follow, then, that small companies will develop tractors suitable for the conditions in their immediate territory, as for instance in the onion growing district of the Mississippi Valley. These firms will not have the resources, nor will they desire, to undertake the development and manufacture of engines, implements and major parts. Their function will consist in assembling standard parts and developing a tractor which is suitable for their conditions. In comparison with the large tractor, the small tractor will require a much smaller investment for development and for the establishment of a limited production and sales organization. Many small firms can thus enter the garden tractor business if the principal burden of development and manufacture is assumed by the parts maker.

The Marketing of Garden Tractors

The retail marketing of garden tractors has usually been through the same channels as that of small cultivation implements. The implement dealer may have a seed and feed, a hardware or a general implement store, or in smaller communities, a combination of all three. Some automotive sales companies have added the garden tractor to their line, which includes passenger cars, trucks, large tractors, and, in some cases, home lighting sets, small gasoline engines and the like. The latter firms can be called power farming equipment dealers and are, from an engine service standpoint, the logical dealers for the garden tractor in the larger centers of distribution. However, the successful application of the garden tractor to the individual requirements of the prospective user requires an intimate practical knowledge of farming implements not possessed by the usual automotive equipment dealer. The garden tractor must be demonstrated and sold on what it can do and not on what the buyer and salesman would like to have it do.

When both manufacturers and dealers have acquired a more thorough and complete knowledge of the capabilities and limitations of garden tractors; have ascertained its particular sphere of usefulness; and have determined to sell them strictly on a performance basis, then the industry will be ready to realize on its potential market.

A New Model of Light Truck

THE Service Motor Truck Co. has added to its line a smaller and lighter speed truck to be known as Model 12. This is of ¾ ton capacity and is considerably smaller than the Model 15 described in AUTOMOTIVE INDUSTRIES issue of Feb. 3, 1921. The latter was originally rated at ¾-1 ton capacity, but has since been strengthened in some respects and fitted with larger tires and is now rated 1¼ tons.

The new model is, however, similar in general design to the older one. It has, for example, the characteristic three-point suspension of the frame made possible by the special design of front axle and cross spring pivoted to the frame at its center. It is equipped with a 3¼ x 4½ in. Midwest engine which develops 32 hp. at 2000 r.p.m., single dry plate clutch, three-speed gearset, tubular propeller shaft with metal universal and slip joint at front and fabric joint at rear, Timken spiral bevel axle with both sets of brake inside the drums, Ross steering gear, pressed steel frame of ⅛ in. stock 5⅞ in. deep with 3 in. flange heavily reinforced at cross member at front end of rear springs. The latter are of semi-elliptic type and take both drive and torque. The gear ratio is 6 1/9 to 1, with 5½ to 1 or 6⅞ to 1 optional. The wheelbase is 128 in. and the tread 56½ in. Chassis weight is given as 2720 lb.

A System for Complete Fuel Gasification

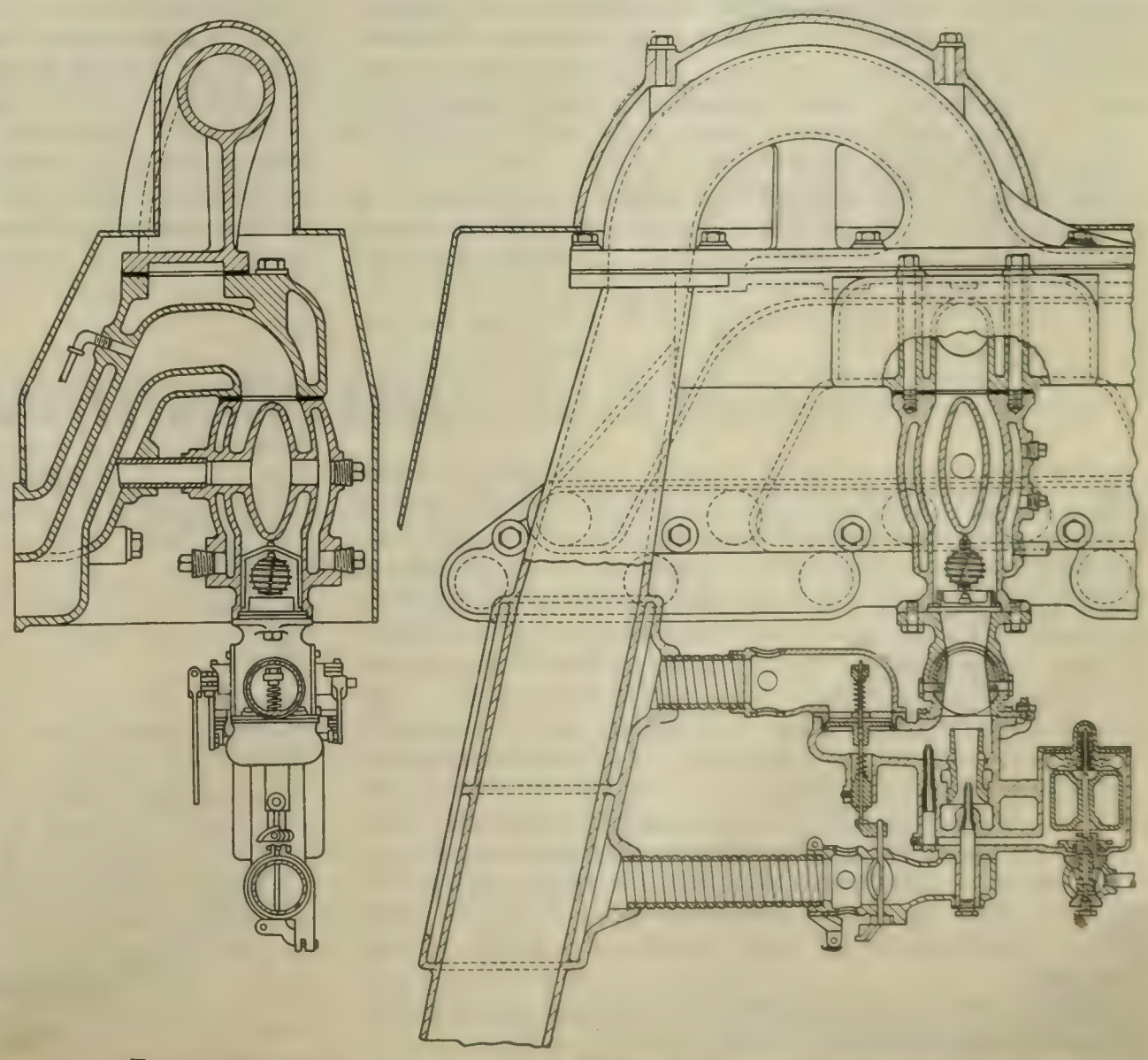
Involves the use of several elements including a device for the mechanical agitation of the mixture, a retort for heating the entire charge above the vaporization temperature of the least volatile elements and means for admixture of small quantities of exhaust gas to prevent detonation.

THE fuel charge preparation or fuel gasifying and mixing system invented by Wm. P. Deppé has been before the public for some years. The system now embodies a number of elements added as a result of experience in its use. We understand that the Deppé system is now furnished on a stock engine of well-known make, if desired.

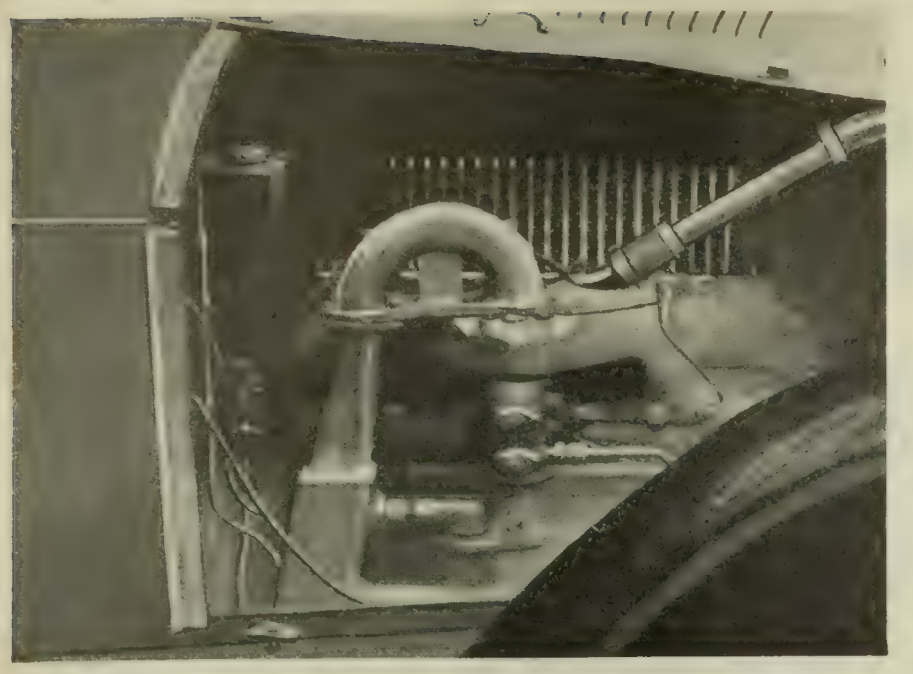
The aim pursued in the system is to so handle the mixture of fuel and air that when it enters the combustion chamber it is in the form of a dry, superheated, homogeneous gas. In order to accomplish this sufficient heat is supplied to raise the entire mixture to a temperature above the boiling temperature of the least volatile fraction of the fuel. In the case of the average American gasoline this is about 425 deg. F. To heat the fuel the liquid particles of the charge are brought into direct contact with surfaces subjected to the exhaust heat. Preignition must be prevented, and as there is not a very wide margin between the volatilization temperature of the least volatile fraction and the ignition temperature of the most easily ignitible fraction, the rate of flame propagation, which affects the tendency to knock, is lowered by the injection of a small amount of burned exhaust gas into the incoming stream of fresh charge.

The apparatus of the Deppé system is inserted between the carbureter and the engine valve ports. In an experimental car built to demonstrate the system in its latest form, use is made of a Stromberg carbureter, and this is also shown in the drawings herewith. Both of the air inlets, the primary and secondary, are connected to air heaters of conventional type cast onto the exhaust pipe, so that only hot air enters the carbureter. The principal part of the system is the charge heater or retort, which is located above the throttle valve. It is quite common to provide a part of the inlet manifold with an exhaust jacket or hot spot, but Deppé goes one step further and makes the riser in the form of an annular passage of comparatively small radial depth, both the inside and outside walls of which are exhaust-heated. The exhaust gases first enter the central heating chamber of elliptical section and then pass to the outer jacket from which they are exhausted to the atmosphere. Deppé argues that when heat is applied to the walls of a cylindrical inlet pipe, owing to the high speed of the charge through the inlet passage and to its relatively low heat conductivity, only the outer layer of the stream will be heated and the fuel particles carried by the central part of the stream will remain unvaporized. With the arrangement used by him, not only is the area of the surface from which heat can be absorbed increased, but the depth to which the heat must penetrate the gas stream from the heating surface is greatly reduced.

The retort is a separate member, connected to the top outlet of the carbureter and the inlet of the combined inlet and exhaust manifold. The manifold also is designed with flat section inlet passages at certain points surrounded by the exhaust passages. At other points the inlet passages are of a fuller form. The variation



Transverse and longitudinal sections of Deppé dry superheated gas system



External view of engine to which Deppé system is fitted

in the form of the section naturally tends toward increased turbulence and to bring all of the charge into contact with the hot walls successively.

One of the causes of deposition of fuel in the passage above the carbureter is the throttle valve. The ordinary butterfly valve when partly closed deflects unvaporized particles in the charge against the wall of the inlet passage, to which they adhere. To overcome this difficulty Deppé has devised a special form of throttle located above the carbureter. This, as shown in section in the illustration, comprises two shutters which move toward the center of the inlet passage from opposite sides so that the opening through the throttle valve is always central.

In the lower part of the retort there is located a revolving agitator made up of a helicoidal structure of copper wire mounted on bearings carried by cross bars in the inlet passage.

In order to prevent knocking of the engine, small quantities of exhaust gas are admitted to the inlet passage at three points—on the side toward the carbureter of the two air heaters, on the exhaust pipe, and at the top of the central heating chamber of the retort. In the wall of the lower air heater chamber there are two small drill holes through the exhaust pipe wall, in the wall of the upper air heater chamber there is one, and in the wall of the retort there are five. The admixture of a certain amount of spent gases with the new charge is said to materially raise the compression at which knocking begins and higher compression ratios than with the ordinary manifold construction are said to be practical without water injection to reduce the rate of pressure increase.

An Electrical Primer

THE design of the Master Electrical Primer has been changed so that there are no live wires under the hood of the car, except when the primer is actually in operation—a period of approximately 7 sec. The switch on the dash now makes electrical contact and at the same time opens the vapor cutlet to the manifold, making the operation, it is said, as safe from fire as the horn or ignition. Other refinements have been made which cause the electrical resistance coil to produce within 4 sec. a lighter and dryer vapor.

The primer is an electrically heated vaporizer acting as a kind of auxiliary carbureter designed to assist starting, especially in cold weather. It takes the gasoline direct from the carbureter, vaporizes it by drawing it over a red hot electric coil and discharges the vapor into the manifold.

It is operated by pulling a button on the dashboard. Contact having been made and the needle valve drawn into its seat by the same movement, the suction of the motor is applied to the inner chamber of the primer. Releasing the button automatically breaks connection.

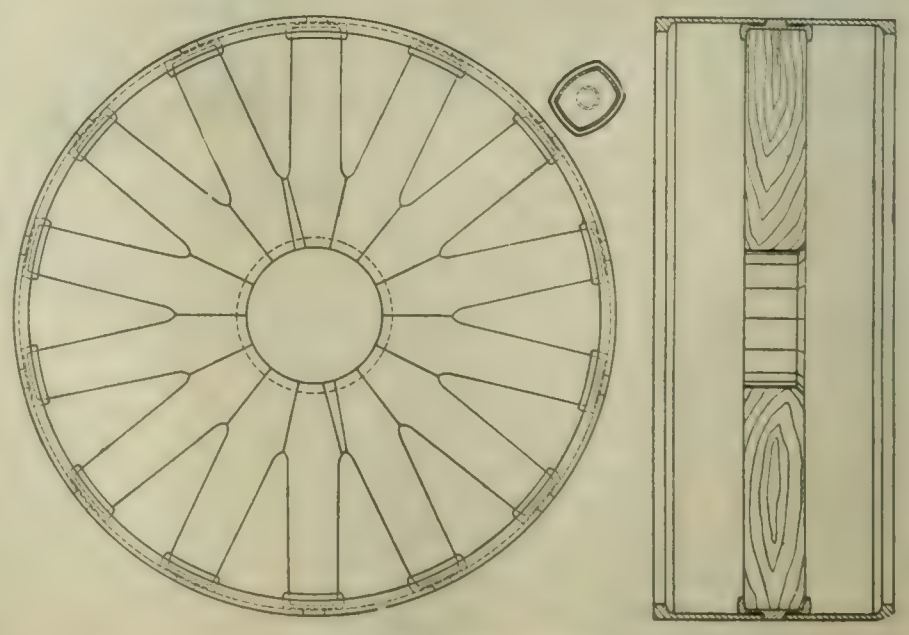
The valve needle is made of monel metal and the resistance coil is made of Nichrome alloy. The heating coil requires 24 amp. The primer is standard equipment on the Franklin, National, Cunningham and some other cars.

A Steel Felloe Wood Spoke Truck Wheel

A NEW design of motor truck wheel which weighs materially less than the conventional wood wheel is being manufactured by Hoopes Bro. & Darlington and has been adopted as standard equipment by one prominent truck manufacturer. As will be seen from the drawing herewith, the wood spokes are retained but no wood felloe is used. The inverted channel section takes the place of an S.A.E. band as well as that of the wood felloe. The manufacturers claim that the spoke has a complete bearing of the end grain on metal. The weakest point of the wood wheel, the seating of the spoke shoulder in the felloe, is done away with. It was at this point that practically all failures of wood wheels originated.

By retaining the wood spokes, the manufacturers assert, they maintain the shock absorbing possibilities of wood, and the new construction adds strength due to the feature described.

The new wheel weighs from 25 to 30 per cent less than the regular wood wheel.



New type truck wheel

Improvements in Gear-box Design

This article discusses gear-box design in detail. It points out some of the usual defects and outlines methods of improvement. The author tells how he would eliminate the bad qualities of the gear box.

By H. F. L. Orcutt*

WHILE it has been demonstrated that accurate gears are necessary for quiet running, it has also been proved that even with quiet-running gears satisfactory results are often quite impossible on account of defective design or workmanship on other components of the box. Certain defects are common to all gear-boxes. They vary in degree, and it is doubtful if any maker of motor cars would say that he is perfectly satisfied with his transmission box. These defects may be roughly summarized as follows: (1) Design; (2) workmanship; (3) material.

Rigidity and Stability of Casings

The design of gear mountings has been the subject of special attention from those who make use of gear-tooth transmission where comparatively high speeds and heavy loads are necessary. It has been found that unless specially designed bearings and adequately stiff shafts are used, gear troubles are common. Undoubtedly, in many designs of motor car gear-boxes the troubles experienced are due largely to lack of rigidity. The box itself is often shaved down to the smallest dimensions. In nearly all cars it is made of aluminum, a metal easily twisted, deflected, expanded or contracted. It is also well known that aluminum has little elasticity and easily "sets" in almost any position into which it may be forced. Further, it has little stability and often changes shape to a degree that is enough to throw bearings out of line. It is doubtful if there is a motor car gear-box made with a casing which has the full theoretical rigidity called for by the loads passing through it.

Size of Shafts

It is really astonishing (especially in some of the so-called "light cars") to note the design of the gear-box shafts. Even in some of the larger cars the tendency is to employ shafts of too small a section. The designer is influenced too much by the desire to reduce weight. Shafts certainly must be large enough so that they will not spring under load. Repeated experience shows that boxes with rigid shafts are quieter than those with small shafts, with gear teeth of the same quality in each case.

Design of Shaft Bearings

The desire to reduce weight and retain simplicity has been carried to the extreme in nearly all gear-boxes. This remark applied especially to one feature of design—that is, the position and number of the shaft bearings. Theoretically, bearings should be so located as to support the shafts directly against the gears taking the load. In practice, with but rare exceptions, gears taking the heaviest loads are in the middle of the shafts and as far removed from the bearings as they can be. Unless the shafts are of large diameter and the box castings rigid, bad running is easily explainable. The alternative to central bearings is a design in which the shafts are as short as possible and of as large diameter as they can be, and run in a rigid casing.

Ball and roller bearings have been the subject of much research and study on the part of makers. They can easily be selected with proper load capacity. Roller bearings have much to commend them. They are not easily deflected by end thrust if shafts are properly mounted, but adequate end-thrust bearings should be provided. There is no reason why properly proportioned plain bearings should not be satisfactory, provided that the material is carefully selected with good wearing qualities, such as steel shafts running in bronze bushes. The designer, too, must foresee possible renewals, and give special attention to lubrication. The tendency to make the pilot bearing of the main shaft run in a bronze bush in the constant-mesh pinion shaft is correct. Makers of ball bearings advocate a more extensive use of ball-thrust bearings, and they give sound advice in respect to mounting their bearings in the casing, so that they will run with no chance of distortion or undesirable end pressures.

Reverse Gears

There seems to be no good reason for mounting reverse gears of the ordinary design on ball bearings, since proper plain bearings meet every requirement. They are also probably cheaper than ball bearings, as no specially close work is called for in making or assembling reverse gearing. In some gear-boxes reverse gears run in constant mesh. If quiet running is desired, such gears must have the same accuracy of tooth, finish and mounting as the so-called constant-mesh gears.

Forms of Shafts

In respect to splined shafts, there are now comparatively few who adhere to the practice of seating gears on the tops of the keys. The development of special hole-grinding machines in which the holes in gears can be finished at a comparatively low cost, and within fine limits, has helped to establish the practice, now common, of mounting the gears on the cylindrical surface between the keys of the splined shaft. Good practice should leave a considerable space between the top of the keys and the bottom of the splines in the gears; hence only rough machining is necessary on the tops of the shaft keys. The bottom cylindrical surfaces and the sides of the keys of splined shafts are now so accurately machined that gears can be made to run just as truly on a four- or six-splined shaft as if they were mounted on accurately ground plain cylindrical shafts.

The assembling of the sliding gears on the main shaft should be done with no fitting work whatever. Splined

*Condensed from a paper read before the Institution of Automobile Engineers.

lay-shafts are also so accurately machined that fixed gears can be assembled on them with a light push fit with no fitting or hand work. When the proper order of machine operations is followed and correct limits are adhered to, the assembling of gears or splined shafts should be an unskilled operation. A suggested order of operations is given under the description of the process of gear-tooth grinding.

Extreme accuracy in finish-machining splined shafts has been a necessary accompaniment to accurate gear-tooth finishing, as a gear with accurate tooth surfaces will not run quietly unless it runs truly. When a gear is mounted on the top of splines it is extremely difficult to finish the bottom of gear key-ways to a degree of accuracy that will insure true running. When the gear is mounted on the cylindrical bottoms of a splined shaft, every mechanical operation necessary to true running can be done at a comparatively low cost, with no hand work and low assembling costs.

Every possible precaution should be taken to fix details of design so as to reduce possible errors of workmanship to the minimum. Following this principle, it would seem that a four-splined shaft is the best form. In the main shaft with four splines, the circular portions between the keys give large wearing surfaces for the sliding gears, and the keys have ample driving strength for the heaviest loads. In the lay-shaft the surfaces give a good seating for the fixed gears.

Tool equipment (especially the expensive broaches) is simplified if both lay-shaft and main shaft have the same diameter and keys. Cheap production costs are easier to maintain if the broaches are finished with small indexing errors and the widths of the broach splines are kept within small limits. As before mentioned, splined shafts should be of as large diameter as possible to assist rigidity. The square shaft is now employed by very few makers on account of the difficulties of mounting a gear accurately on such a shaft.

Design of Gears

The requirements in the design of gears are pretty nearly the same for both sliding and fixed gears. The length of the hub of the sliding gear is often on the small side. The length of the bearing surface should not be much less than the radius of the gear. These gears should slide freely, and have sufficient bearing on the shaft so that the teeth will always mesh in correct alignment. Fixed gears should seat accurately on the lay-shaft and be locked up dead true. To prevent possible deflection it is best to provide for finishing the ends of the hubs on lay-shaft gears true with the holes. If this is done, the gears on the lay-shaft can be mounted with practically the same clearance as those on the main shaft.

The following observations on gears are based on an experience of over eight years, devoted wholly to gear-tooth grinding of transmission-box gears, after they are hardened. They are made with due humility, realizing that the subject of gear-tooth forms is a big one, and much still has to be learned.

With but very few exceptions, makers of gear-boxes blame the gear-teeth for nearly all their transmission troubles. This is largely due to a lack of understanding of the extreme accuracy in gear-tooth forms that is necessary for quiet running, and the natural corollary that a badly mounted gear with perfect teeth cannot run with good tooth contact. Designers and producers do not usually co-operate in taking every possible precaution that gears run dead true under load. They do not realize that the cheapest box is one in which quality above all should be safeguarded by good design, and that accurate machine work is the only cheap method of producing uniform results. Gears carefully mounted running at correct center distance, when quiet show contact over the whole working surface and straight across the teeth.

A 20-deg. pressure angle seems to meet general requirements. The pitch should not be too fine; there should be a sufficient number of teeth in all gears to avoid undercut and interference, and the gear-tooth section should be large enough to carry its load. To secure good wearing qualities, tooth widths should be ample; they are usually too narrow. It seems easier to secure good running qualities with the full depth tooth rather than with the stub tooth.

Without altering ratios to any appreciable extent, the variety of gears in a box could often be reduced. Two or more could be made with the same number of teeth, which would make savings in machine setting, in tooling and in inspection.

The making of so-called "cluster" gears—that is, two or more gears in one forging—or the making of a gear integral with a shaft are both questionable practice. Careful investigation will show that economy and good results are in favor of each gear being a separate forging, as making renewals cheaper and producing less scrap. In the case of a gear integral with a shaft, costs of material and machining are increased, and good heat-treatment is made difficult, since the correct treatment for the gear may be quite different from that required for the shaft.

Workmanship

The workmanship necessary to produce a gear-box at a low cost that will run quietly and be of uniform quality is not commonly understood. Too little attention is given to accurate machine operations, and too much is left for the fitter, the assembler and the tester, while limits of errors and clearances are not properly fixed and inspection is not well organized. A well-designed gear-box should be produced with practically no hand work, and it should be assembled by unskilled labor. Dismantling and reassembling, "running in" of gears or "stoning" teeth is uncalled for, and there should be no extraordinary scrap.

These statements apply to all gear-boxes, either the low-grade article where quiet running is not expected or the high-grade box where quiet, smooth running is demanded.

All mechanical operations on gear-box parts can be carried out to a limit of accuracy that should call for no corrections on the fitter's bench. These limits, as they apply to boxes where good running qualities are expected, will be briefly stated.

Casings

In the casing itself the bores for the main and lay-shaft bearings should not have an alignment error exceeding 0.001 in. in 12 in. The center distances should not have a variation exceeding 0.001 in. Where ball bearings are to be used, the limits of error in the sizes of the holes should be those laid down by the makers of the ball bearings, which, by the way, are usually not adhered to. Scraping out bores should be avoided. Forcing and hammering in bearings easily produces distortion in the soft metal housings, with all sorts of unsatisfactory and expensive results, and a variety of noises that defy classification. It would probably be well to have all casings inspected immediately preceding assembling.

Splined shafts should be finish-machined with no error exceeding 0.001 in. in length, widths and indexing of

keys, or on circular portions. The cylindrical parts can be easily ground to fit correctly in either bushes or ball races. It is hardly credible, but it is true, that many makers seem to have little appreciation of the necessity for careful, accurate centering of splined shafts. They do not seem to know that accurate grinding cannot be done when parts are revolved on inaccurate centers.

The following limits for grinding the holes in gears and on the circular surfaces of splined shafts give satisfactory results. They can be easily adhered to, and with proper inspection no fitting work should be necessary between the gear and the splined shafts.

The maximum clearance between the splines in the gears and the sides of the keys on the shafts depends on the accuracy of the broaching, and the accuracy with which the holes in the gears are ground in relation to the splines. As stated, the variation in size of the keys on shafts in length, thickness and indexing can be kept within 0.001 in.

HOLES IN SLIDING GEARS AND FOR MAIN SHAFTS FROM 1½ IN. TO 2 IN. DIAMETER

	In.
Limit for hole grinding	0.001
From minus 0.001 in. to standard.	
Limit for shaft grinding on circular surfaces	0.001
From minus 0.002 in. to minus 0.003 in.	
These limits give:	
Maximum clearance of	0.003
Minimum clearance of	0.001

HOLES IN FIXED GEARS AND FOR LAY SHAFTS FROM 1½ IN. TO 2 IN. DIAMETER

	In.
Limit for hole grinding	0.001
From minus 0.001 in. to standard.	
Limit for shaft grinding on circular surfaces	0.001
From minus 0.001 in. to minus 0.002 in.	
These limits give:	
Maximum clearance of	0.002
Minimum clearance of	0.000

To avoid fitting work, the maximum width of the shaft keys must be such that there will be no interference on the sides of the keys when the splines in the gears have their maximum errors. To assist in keeping these errors within workable limits, it is suggested that the splines in the gears be finished by a short, specially made broach to be used for finishing only. This broach should remove the smallest possible amount of stock, and the pilot should fit the finish-ground hole in the gear. It should be finish-ground after hardening to standard size, with no errors in indexing or lengths and widths of keys exceeding 0.005 in. This broach can, of course, only be used, as suggested, when the splines in gears are left soft.

The amount of play between the keys on the shafts and the splines in gears can easily be kept to less than 0.001 in. on both main and lay shafts. Alignment of holes in gears in relation to splines can be maintained if the fixture shown in Fig. 1 is used.

Gears

The following notes refer to gears which have their teeth finished after hardening or heat-treating, and which either slide or are fixed on splined shafts, seating on the bottom cylindrical part of the shafts. The bottom of the splines in the gears should clear the top of shaft keys from 0.005 in. to 0.010 in. The top of the shaft key is only rough-turned to coarse limits. The sides of the keys on the shafts are ground to the degree of accuracy already mentioned.

The holes in the gears should be ground true with the splines, using a fixture similar to the one illustrated in Fig. 1, and though no care need be taken to finish the holes true with the teeth, the ends of the hubs of the gears should be finish-ground true with the holes. The variation in diameter of holes should not be more than 0.001 in.

To give good running qualities the mating gears should show a good hand-roll on fixed centers, and the teeth

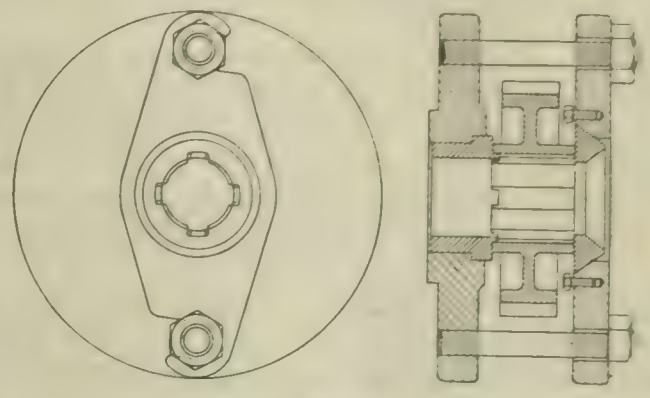


Fig. 1

should show contact over the full working surface from top to bottom of tooth and straight along the full width.

As it has been pretty well demonstrated that complete tooth contact is desirable, it naturally follows that the teeth of gears should be as nearly as possible of correct theoretical form—if an involute tooth, a pure involute—and the finish of the tooth surface should be as smooth as possible. Indexing errors should not exist; they probably do, however, to a certain extent occur in all gears, but unless so small as to be difficult to detect, noisy running will result.

Backlash

The minimum backlash should be such that the gears when under duty will run freely when the box is made with the maximum allowable errors in all its components. Properly mounted gears with correct tooth forms run quietly without regard to backlash as long as they can run freely.

Practicable working backlash limits can vary from a minimum of 0.006 in. to a maximum of 0.010 in. Inspection should be made with mating gears mounted on close-fitting perfectly parallel fixed studs, set at exact center distances, with feelers inserted between the teeth which are in contact.

Eccentricity can be tolerated to a certain extent without bad results, but should be held to fine limits, say a maximum of 0.002 in.

Materials for Castings, Shafts and Gears

Aluminum gear-box castings have one virtue, they are light in weight. But with this metal it is difficult to secure two essentials to good running, namely, stability and rigidity. It is a question whether the gear-box casing of the future will not be made of cast iron, provided that the weight would not be increased too much. Covers and bushings certainly will be made of aluminum. For gears a 5 per cent nickel case-hardening steel has been found most satisfactory. Gears made of this steel, with ample tooth surfaces and properly heat-treated, have been run for years in transmission boxes with no sign of "pitting" and showing only the slightest wear. For splined shafts a 0.15 per cent carbon case-hardening steel meets the requirements.

Future Developments

Will the gearbox of the more or less standard pattern as in the majority of cars, be the gearbox of the future? As at present made, it will probably not survive the exacting demands of the motorist, who is now accustomed to refinements in engine construction, good steering gear and smooth-working back axles. The author believes that it is possible to evolve a much better box than that now commonly made, making use of the principles that

have been demonstrated by years of experience to be good. Broadly speaking, the weaknesses of the usual gearbox are twofold, the design and the workmanship. The design is one in which stability and rigidity are difficult to realize, two qualities which are indispensable to satisfactory running.

The author believes that experiments would demonstrate that in a gearbox of which the case is made of aluminum, success will be difficult. Probably a considerable amount of development work will be necessary before a casing will be evolved in which accurately finished and accurately mounted gears will give good results.

In respect to workmanship, it must be admitted that bad workmanship is the rule and not the exception. This should be corrected for several reasons. In the first place, the costs of production in nearly all boxes would be reduced, as accurate machine work combined with good inspection is very often cheaper than handwork. The quality of most gearboxes would be improved by increased accuracy in mechanical operations.

How many gearbox makers know exactly what they have done to a defective box which finally passes the test? Gears distorted by heat-treatment are "run in." Often the teeth are "stoned." Boxes are mounted in the chassis and given a road test, condemned, dismounted and the gears perhaps "stoned" again or scrapped and replaced. Finally the box passes test. Who can say what has been done to cure the evils or exactly what was the original error? Scrap is made and costs are run up time after time, and the process is repeated, not in every car made, but in many, and in some cases many times on one car.

Gear Box Noises

Uncertain costs are tolerated and quiet running on all speeds is usually given up as a hopeless task. The box finally passes the tester with no exact knowledge of what the original defects were, nor how they were remedied.

Not infrequently a gearbox that is noisy in one chassis runs fairly well or even quietly in another. It seems reasonable to conclude from this fact that defects in other parts of the car made themselves manifest in the gearbox. This is undoubtedly the fact. Gearbox noises have been stopped when an imperfectly balanced engine has been corrected, when couplings have been altered, and when propeller shafts have been increased in size or more firmly supported. If boxes were uniformly produced with all their components made within correctly specified limits, undoubtedly defects in other car units which are now often hidden in irregular gearbox workmanship would be more easily located.

Good design may be defeated by bad workmanship; indifferent design may be moderately successful backed by superior workmanship. Fully satisfactory results are impossible unless designer and producer co-operate, which they rarely do. Details of design should not be settled without consulting those responsible for production. Advice from the production staff should be freely volunteered to the engineering officials. Before a satisfactory box is produced much development work must be done, though the difficulties to be overcome are not formidable when compared with those which have been mastered either in the engine or the axle drive. Probably the standard type of gearbox in its broad principles is worth retaining.

The following are suggested as items which should receive special consideration in experimental or test work, with the object of evolving an improved design of gearbox:

1. The selection of proper material for gears and shafts, with correct specifications of heat-treatment.

2. The design and material of the casing to be such as to give the rigidity and stability necessary to maintain good running conditions.

3. The determination of dimensions of components, including gear teeth, to meet full theoretical requirements of loads and speeds.

4. The correct specification of limits of accuracy of machine operations on all parts.

5. A careful study of the methods of production of parts so that designs lend themselves to machine operations by which low costs, accurate finish and correct mounting are possible.

6. The making of power tests of the box under load at all speeds, independently of chassis tests.

7. Tests in the chassis on the road to determine how running is affected by other units or by the method of mounting.

Gear-Tooth Requirements

It will probably interest those who wish to give the subject of gearbox development special attention, to have as much information as possible respecting gear-tooth requirements. It is quite natural that there should be a wide divergence of opinion respecting a gear-tooth specification for transmission-box gears. Most motor car gears are either finished after heat-treatment with cutters which must necessarily rapidly wear out of truth, or they are hardened after machining and either "run in" or "stoned." Each of these processes results in the production of gears of which the teeth are not of uniform dimensions. It is difficult to form a definite opinion of an article in which the most important dimensions are of an irregular nature.

It is not generally known that gear-tooth forms where quietness, high speed and high duty are called for, must have errors much less than those which are usually allowed in the finest cylindrical grinding. The errors must be so small that they are pretty well impossible to control commercially with any cutting tool except the grinding wheel, whether the teeth be soft or hard. Gear-tooth surfaces, being irregular curves, are difficult to measure, and the final test is made by running under load with theoretically correct mounting.

Gears which are of known uniformity and quiet running should pass the following inspection:

1. Satisfactory hand-roll of mating gears at fixed center-distances.

2. Power tests for noise at high speeds with mating gears accurately mounted at fixed standard center-distances.

3. Backlash so that gears run freely without jamming. Backlash need not be to fine limits when tooth forms are correct.

4. Eccentricity must be within fine limits. It should not be more than 0.002 in. in any gear in the ordinary transmission box.

5. Index errors (by which is meant the pitch spacing of the working faces) must be such that they cannot be detected under ordinary methods of inspection.

6. Tooth shapes must be as near standard as possible, showing on hand-roll or on power test with the mating gear a bearing over the whole working surfaces of the teeth.

7. The finish must be smooth. A roughly finished tooth is not as quiet as a smooth one.

Gears in which the teeth meet the above specifications should run quietly, though the box in which they are mounted may be noisy, but if it is, the symptoms should not be mistaken for the disease.

(*To be continued*)

A Discussion of Present Methods of Fuel Vaporization

How one engineer views the problems of preparing fuel-air mixtures for combustion prior to admission to the cylinder. A satisfactory system must include means for giving good pulverization and correct mixture proportions and provide separate heating for unvaporized parts of charge.

By N. Julien Thompson

WITHIN the last decade and particularly within the last three years, gasoline has shown greater proportions of high boiling point constituents, and both the initial and final boiling points have been raised. To assist in vaporization two principal methods have been used, one consisting of heat application to the intake-air supply, and the other involving the use of an exhaust heated surface or "hot spot" so arranged that the wet mixture from the carbureter will impinge on the hot surface.

As ordinarily applied neither method gives completely satisfactory results. The principal disadvantage of heating the intake-air to the point required to give a "dry" mixture is the unfavorable effect upon volumetric efficiency and engine power. Unless thorough vaporization is secured, we cannot employ mixtures as lean as desired and still obtain good performance on account of the fact that it is very difficult, if not impossible, to design an inlet manifold for engines having four or more cylinders which will give perfect distribution in the case of wet mixtures. If we try to use such a wet mixture we find that one or more cylinders will give evidence of "popping back" on sudden power demand while the others may fire quite regularly.

According to tests by Kegerreis* on a Knight engine at half load and 1000 r.p.m. in the case of a mixture producing a good compromise between power and economy, namely, 0.07 lb. gasoline per lb. of dry air, an intake-air temperature of about 280 deg. Fahr. was required to give an absolutely dry mixture, but smooth performance could be obtained at points above 160 deg. Fahr. It is extremely doubtful, however, in the case of sudden acceleration under load, that a good cylinder power balance would result at this temperature and mixture ratio. In fact, Kegerreis advocates a warmer mixture to eliminate oil dilution, which indicates that one cylinder at least is receiving a mixture so wet that it is not dried by admixture with the residual exhaust gases from the preceding cycle.

According to Kegerreis the mixture temperature corresponding to an intake-air temperature of 160 deg. Fahr. is approximately 116 deg. Fahr. It seems to the writer that the latter is somewhat low. The method used in ascertaining mixture temperature is not mentioned, but if the measurement was made by insertion of a thermometer in the inlet manifold, as was probably the case, then it is certain that the thermometer reading would be low because the thermometer bulb would be wet in a mixture of such low fuel ratio that, under conditions of equilibrium, a dry vapor would result due to the partial pressure of the fuel at the existing manifold vacuum and temperature. Accordingly, the bulb must furnish a considerable portion of the latent heat of evaporation of the wet film which covers it. In cases where the mixture is dry or practically so, measurement by ordinary thermometer should be quite satisfactory.

In some ways the hot spot of the ordinary type is a less desirable expedient than the heated air-intake. It is easy to regulate the air temperature by thermostat and hot-air stove, but close control of the hot spot temperature with relation to the demand is practically impossible. Moreover, a temperature cannot be used high enough to secure thorough vaporization at all times without producing an unduly large temperature rise in the fuel-air mixture as a whole or without danger of ignition in the manifold which occurs at temperatures approximating 550 deg. Fahr. for present low-test gasolines.

As an atomizing or fuel pulverizing device the carbureter nozzle increases in efficiency as does any other nozzle with the velocity of the liquid passing through it. The liquid velocity and, therefore, the fuel pulverization, other things being equal, increases according to the suction applied to the nozzle, or according to throttle opening and engine speed. The greatest amount of heat from the exhaust is available at high speed under full load, or at a time when it is needed the least. To offset this there are, however, two favorable factors: The lower vapor velocity at low engine speeds, which allows more time for vaporization to take place, and, under light loads with a throttled engine, the increased manifold vacuum, the effect of which is virtually equivalent to an increased fuel volatility.

It is helpful to cut down or increase the supply of exhaust heat to the hot spot by means of a valve, the position of which is changed with speed or throttle opening or both, and engines have been designed embodying these features. However, the present-day car user demands flexibility above all things, and, since he gets it, speed and load are so quickly changed under driving conditions that the temperature of the hot spot must show considerable lag behind the exhaust heat valve variations. Accordingly it is desirable to make the hot spot of good conducting metal and as thin as is allowable. A disturbing factor is the formation of sooty carbon on the exhaust side of the surface, thus decreasing the thermal conductivity and hence the efficacy of the device. Carbon in the exhaust system is proof that combustion has not been completed in the cylinders.

While pointing out the limitations of the two methods of vaporization, the writer certainly does not wish to

*Automotive Industries, Sept. 29, 1920, page 610.

give the impression that they are to be condemned. On the other hand, operation without these features would have been impossible on recent commercial gasolines. Still, we must look for a decrease in the supply of motor gasoline or a lowering of its grade, and in the latter case, which is the more likely in the near future, it will become more and more difficult to obtain good economy and satisfactory engine performance without marked decreases in power output.

Realizing the failure of the hot spot and heated air-intake methods to fully cope with the vaporization problem, the writer, due to intense personal interest, but not on account of any connection with the automotive industry, studied the various factors involved in the use of low grade gasoline and kerosene. This study and the conclusions drawn therefrom have since been substantiated by the invaluable work of Wilson and Barnard.*

It is desired to thoroughly vaporize the fuel after leaving the carbureter mixed with the requisite proportion of air, the whole assuming a temperature at which manifold condensation cannot occur. Using the figures given by Wilson and Barnard for a typical gasoline of spec. gravity 0.743 (60 deg. Baumé) and having a distillation range from 140 deg. Fahr. to 412 deg. Fahr., it is found that once vaporization is secured no condensation can take place at temperatures in excess of the following:

Vacuum, lbs. per sq. in.	15:1 Air to Gas Ratio, deg. Fahr.	12:1 Air to Gas Ratio, deg. Fahr.
0.0	95	104
3.0	86	94
4.5	81	89
6.0	76	83
7.5	70	77

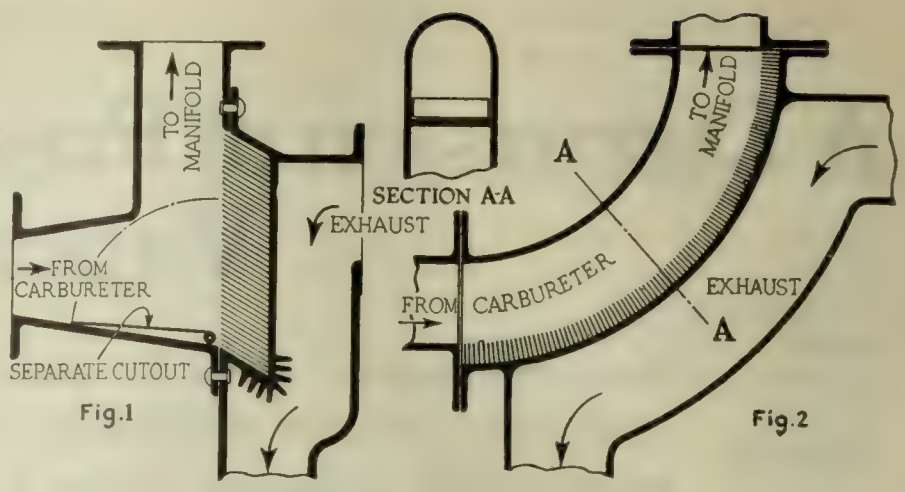
With these figures and those of Kegerreis we are at once able to draw a comparison between what might be obtained and what actually is obtained when air heating is used to effect vaporization. At a 15 to 1 ratio and assuming a manifold vacuum of at least 2 lb. per sq. inch (for the engine used by Kegerreis) at the prevailing conditions of speed and load, a temperature at 90 deg. Fahr. is required to maintain a dry mixture once secured, but an air supply at 280 deg. Fahr. resulting in a mixture at about 220 deg. Fahr. is necessary to produce a true vapor. By calculation it is found that in the latter case the weight is about 23.5 per cent less for a given charge than in the former. Using the wet mixture figure of 116 deg. Fahr., at which it is claimed smooth operation can be obtained, there is still a decrease in weight of approximately 5 per cent, although it is realized that the temperature of a dry mixture can be lowered to the point where a considerable portion becomes condensed and apparently smooth performance be secured on account of the very fine state of division of fuel particles so produced. The gasolines used by Kegerreis and by Wilson and Barnard are not the same, but a study of their characteristics as given shows that for the purposes of this argument the difference is inconsiderable.

The following conclusions were reached with respect to the production of a practically perfect vapor from gasoline-air mixtures:

1—Raising the temperature of the intake-air on account of the low thermal conductivity and specific heat of the latter, results in a large decrease in volumetric efficiency. The time for heat interchange is altogether too short, but cannot be materially increased without serious complication.

2—The "hot spot," which is also correct in principle, is subject to certain practical limitations, viz.: it is impossible to closely control its temperature; it is exceedingly difficult at high vapor velocities of wide variation to use a hot area sufficiently large for the purpose set forth without producing an unduly great increase in the heat of the mixture over the majority of the operating range.

*Journal of Industrial and Engineering Chemistry, Oct., 1921, p. 908.



Two suggested forms of vaporizers

In spite of the inadequacy of the usual "hot spot" against which the mixture is directed, it is believed that an exhaust heated metal surface will prove the most satisfactory considering the degree and quantity of heat required. However, it is recognized that if a sufficiently large hot area is employed, provision must be made to vaporize the fuel separately or to protect the vapor formed as a result of carburetion from unnecessary rise in temperature. Separate volatilization of the gasoline with subsequent admixture with air involves changes in carbureter design as well as difficulty in starting the engine. Accordingly, means were studied by which use might be made of all the available heat, if necessary, and still leave the carbureted vapor in a cool condition.

From this study it was concluded that a satisfactory system must comprise the following sequence: Efficient atomization of the fuel and admixture with the correct proportion of air by the carbureter. separation of the remaining liquid particles from the vapor stream, directing these liquid particles against an exhaust heated surface where they are volatilized, conducting the resulting gas back to the original vapor stream, the system being so arranged that the final aggregate vapor mixture temperature produced will exceed as little as possible the temperature at which condensation takes place. Means must be provided to facilitate starting with a cold engine. Furthermore, for use to the best advantage, control of the mixture temperature is advisable. This can be obtained by a thermostat placed in the final vapor stream and operating a cold air valve located between the carbureter and an air-heating stove.

Fig. 1 illustrates a device designed to act according to the scheme outlined above. The fine parallel lines represent a nest of thin metal plates or vanes. The liquid particles are thrown on to these and conducted to the heating surface. The plates are sufficiently close together so that the original vapor is protected from the heat, but still not close enough to induce capillary action. To provide for quick starting with a cold engine, the valve or "separator cutout" is designed to be raised by dash control to a vertical position, allowing liquid fuel to pass the separator plates. This device might be used with fuels of lower volatility than present-day gasoline, maintaining a very hot exhaust-heated surface.

In Fig. 2 is depicted a vaporizer which is probably more suitable for use in connection with existing motor

fuels. Since the hot surface is closer to the mixture conduit, quick response will be made to changing throttle conditions. Moreover, the mixture is deflected more gradually from a rectilinear path, thus depositing the liquid particles over a large proportion of the heating surface. This device does not permit as easy starting from a cold motor as may be desired. However, this difficulty is easily overcome in many ways, e.g., by a by-pass conduit provided with a suitable valve, independent cylinder priming, or an electric resistance heating coil in the path of the mixture as it leaves the carbureter.

It is possible to design a great number of devices which on casual inspection are not all similar, but which really may embody the same principle. For example, liquid fuel may be thrown out by a bend in the conduit, by a baffle or series of baffles, by centrifugal force, and so on; and the vapor stream may be protected from the heating medium by vanes, baffles, screens and by separated ducts, channels or chambers. Yet each one to be successful must give efficient separation of the liquid, good protection of original vapor from excessive heat rise and effective and quick vaporization of liquid fuel so as to respond almost instantly to changing throttle opening.

Electric Standards Being Formulated

THE Lighting Division of the Society of Automotive Engineers Standards Committee is considering a proposal that the tolerances for the diameters of the standard bases and sockets for headlamp bulbs should be reduced, as it is stated that they are wider than necessary and permit sufficient play to cause considerable variation in the position of the filament and consequently the illumination characteristics of the lamps. It is felt that although narrower limits are not essential, they would improve the specifications and not introduce undue restriction on manufacturers of the parts.

Breaker Contacts

At a recent meeting of the Electrical Equipment Division it was decided to consider the standardization of the hexagon stock used in making timer-distributor contact breakers. It was stated that there is considerable variation in the size of stock for mounting the breaker points, necessitating a number of sizes of wrench for adjusting this part on the several types of ignition apparatus.

It was suggested that ¼-in. hexagon stock be considered for adoption as standard, and that if this is not feasible, the standard should embody a range of two or possibly three sizes, such as 3/16, ¼ and 5/16-in. It was argued also that the proposed standard should embody the height of the hexagon and the size and length of the thread. Information on present practice is to be obtained for consideration at the next meeting of the Division.

It was reported that a thorough investigation of the patent situation in connection with spark plug hoods had been made and that it was claimed that a number of patents in the aggregate cover any practical form of construction. It was therefore decided to discontinue consideration of the standardization of spark plug hoods.

Storage Batteries

It has been felt that the Standards Committee could be of service to the storage battery and associated industries in connection with the recent development of a molded hard rubber storage battery container. As the molds and equipment for making these containers are very expensive, it seems that the logical procedure for the battery, automobile and hard rubber manufacturers is to get together and adopt standards relating to the rubber container, before too much money shall have been spent on mold and machine equipment.

A further object of the standardization proposed would be perhaps to guide the automobile builders in adapting their battery compartments to this more compact type of battery, so that they and their customers will not be handicapped in the way they have been handicapped in the past when an automobile was put out with a battery compartment of such dimensions as to preclude the use, for either original equipment or renewal, of any but one special make and type of battery.

Another point is the need of a name to distinguish the single compartment container from the present case and jar. It is stated that the word "container" is not desirable on account of its similarity to the word "retainer" and because it has been used in a general sense already. The words "case," "box," "tray" and "jar" are already used as names of battery parts.

It was decided to take up the standardization of magnet wire for automotive apparatus, including both fabric and enamel insulation types.

Electrical Equipment Nomenclature

The use of the term "timer-distributor" was thoroughly discussed at the Standards Committee Meeting held on May 24, 1921, and several negative votes were cast against the adoption of the term by members of the Society in the July, 1921, Society Letter Ballot on the adoption of standards. The comments submitted were discussed at the meeting of the Electrical Equipment Division and the opinion was expressed that "timer-distributor" is the most suitable term and should be retained. Chairman Libby stated that he had noticed that the term is used in the majority of cases in technical references and in about 80 per cent of the patent investigations that he has conducted, and that these sources indicate that the term is of long standing. It was therefore decided to recommend no change in the present nomenclature.

Generator Mountings

T. L. Lee, chairman of the Generator and Starting Motor Subdivision, reported that, after studying the suggestion to omit the dimensions for the pilot specified in the present standard for generator flange mountings, he did not consider it advisable to do so. The discussion indicated that although one large manufacturer of electrical equipment, which suggested omitting the pilot dimensions, does not use pilots on its equipment, a large number of other manufacturers do. The advantage of retaining the pilot was pointed out and the statement that when a customer orders equipment on which no pilot is desired, it is easy to machine off the pilot.

A suggestion in reference to lengthening the threaded-end of the shaft of the generator bracket molding was discussed at length and the decision reached that a change is not desirable owing to the limited space provided for the couplings, particularly in present engine designs.

The Subdivision was assigned the work of standardizing a strap mounting for generators. This had been suggested by an automobile builder, it being stated that a standard should specify a generator barrel diameter of a sufficient distance along the barrel to give a stable mounting, with tolerances of possibly plus or minus 0.002 in. applying to the diameter. It was also said that a standard should establish certain limits for the concentricity between finished part of barrel and the armature shaft.

A New Crankshaft Balancing Machine

Obviates the need for a preliminary static balance and permits of quickly determining the magnitudes and proper angular positions of correcting moments required to insure accurate dynamic balance.

By P. M. Heldt

IN balancing crankshafts and similar revolving parts by the methods in common use so far, a static balance is first obtained by placing the part on balancing ways and removing weight from the heavy side until it will remain in any position in which it is placed. After this static balance has been obtained there usually remains an unbalanced couple, that is, the part is heavy on one side at one end and on the opposite side at the other end. The axial plane and magnitude of the couple are then determined by means of a rotating balance machine. This couple is eliminated by adding or removing weight in two transverse planes, usually at or near the ends of the revolving part. The static balance could also have been obtained by removing weight in one or the other of these transverse planes, and, therefore, the two operations of statically and dynamically balancing a crankshaft or other revolving part can be combined in a single operation.

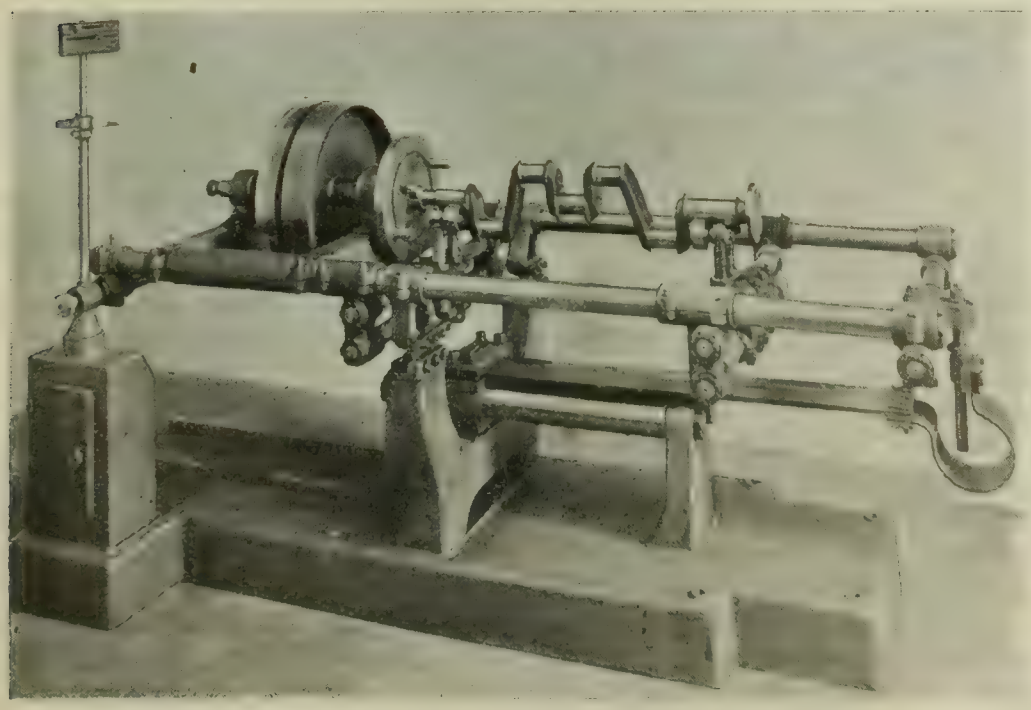
A balancing machine which permits of doing away with the necessity for a preliminary static balancing has been developed by the Precision Balancing Machine Co. The machine was invented by Dr. B. L. Newkirk, formerly of the Engineering Department of the University of Minnesota, and was experimentally developed by F. McDonough, president, and Amos F. Moyer, chief engineer, of the Precision Balancing Machine Co. As shown by the illustrations herewith, it consists of a bed on which is supported, by means of two thin vertical spring steel blades, a tubular framework upon which the body to be balanced can be supported and revolved. The framework is steadied by a horizontal cantilever spring with a scroll at its end.

The stiffness of this spring can be changed by varying its effective length, and there is also a micrometer adjustment between the scroll spring and the outer end of the tubular frame. It will be noted that one end of the crankshaft is located directly over the "knife edge" bearing support of the frame, so any vibration induced in the frame is due to the unbalance at the opposite end.

A special type of headstock is carried by the frame, as are adjustable rollers for supporting the parts to be balanced. If an unbalanced part is placed on the machine and is then rotated, it will set the freely mounted frame in vibration. This frame with any particular part has a natural period of vibration, and if the part is rotated at such a speed that the speed of rotation corresponds to the natural period of the frame with work, even a slight degree of unbalance will cause a comparatively heavy vibration. This speed is referred to as the critical speed. The method of operating the machine is as follows:

Operation of Machine

The crankshaft or other part to be balanced is placed upon the supporting rollers and lightly clamped in a chuck on the face plate. Coupled to the work are the revolving parts of the headstock, which are perfectly balanced. To take a reading, the system is set in rotation at a speed slightly above the natural period or critical speed of the



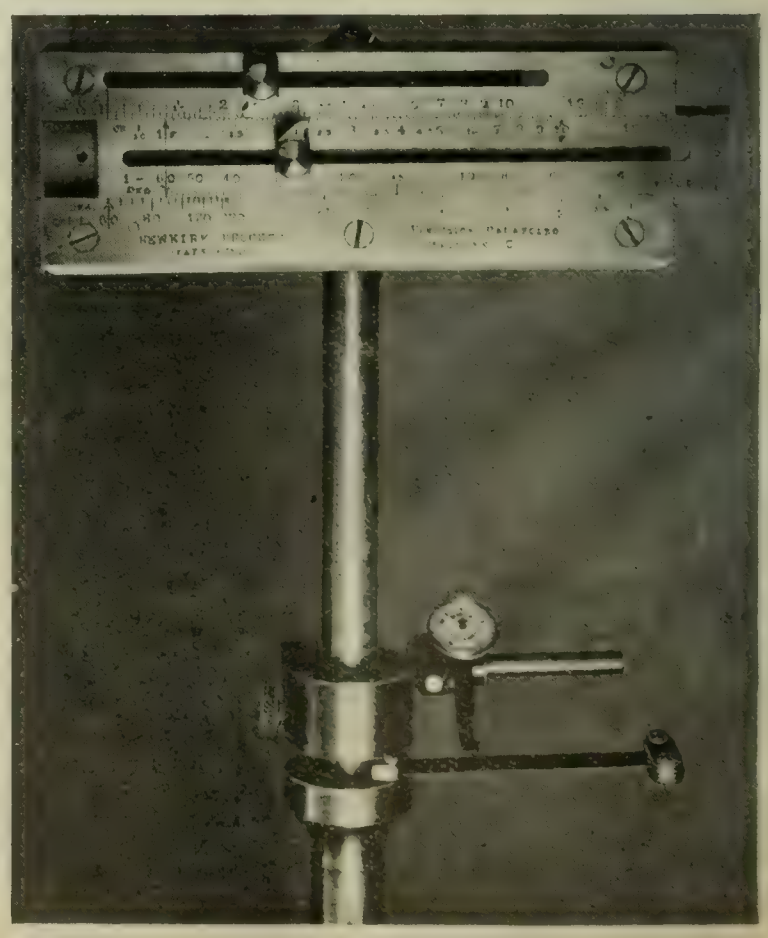


Fig. 1—(Above)—General view of Precision balancing machine. Fig. 2—(On Right)—Instrument column with slide rule for quickly determining angular position of unbalanced moment from negative magnitudes of first and second indications of dial indicator

frame and allowed to slow down by the slight friction of the ball bearings. As the critical speed of the frame is passed through, there will occur a maximum oscillation which is directly proportional to the unbalanced moment of the overhanging end of the part. The maximum amplitude of vibration is read off on a dial mounted on a standard or instrument column, to which connection is made from the vibrating frame by a steel rod or wire. It may be pointed out here that, except when making tests, the frame is held from vibrating by means of a taper plug on this standard, which enters a corresponding hole in the frame. It has been found that the best results are obtained with a critical speed of 100-110 r.p.m. and the cantilever spring is adjusted to give this critical speed. It is quite possible to impart to the revolving system a speed somewhat higher than this by spinning it by hand, but if desired, the headstock can be revolved by a small electric motor.

Magnitude of Unbalanced Moment

From the maximum amplitude of vibration as read off from the indicator and a calibration factor separately determined, the unbalanced moment in ounce-inches can be directly ascertained. A corrective moment is then applied to the rotating system in the form of a sliding weight on the headstock, which is moved out radially from the axis and clamped in position at such a distance from the axis as to give the necessary moment.

To obtain the angular position at which this correction is required, the correcting moment is arbitrarily applied on the headstock at an assumed angle, and the system is again speeded up and allowed to slow down through the critical speed as before. The maximum amplitude this time will differ from that obtained the first time, the ratio of the two readings being dependent upon the angle between the point of arbitrary application and the point required. The trigonometric value of this ratio is

$$R = 2 \cos \tfrac{1}{2} (180° - A),$$

where A is the required angle. This function plotted on a polar diagram is shown in Fig. 3, which may be used for ascertaining the angle after obtaining the ratio of the second amplitude to the first. A scale corresponding to Fig. 3 is also built into a special slide rule mounted on the instrument column. Scales are also here provided for employing the calibration factor and taking ratios, so that the operator is relieved of all computation. The angle ascertained is set off on the headstock dial and the results are checked by another run.

After the magnitude of the unbalanced moment and its angular position have been determined for one end of the revolving part, the latter is turned end for end on the roller supports and a fresh determination is made.

Limits of Precision

For revolving bodies 18 in. or more in length a limit of error of 0.2 oz.-in. is guaranteed, as regards both static and dynamic balance. In the case of short bodies, such as flywheels, the limiting error on static balance is the same, while that on dynamic balance is 1 oz.-in. The degree of accuracy represented by these figures is said to materially exceed commercal requirements. How sensitive the machine is is shown by the fact that although the vibrating frame with work weighs upward of 500 lbs., it can be set to vibrating perceptibly by simply blowing against the free end with the breath. To minimize the friction, the revolving parts are carried on ball bearings.

Parts up to 750 lb. in weight can be handled in the machine, and it is figured that the limit of error in the results obtainable would be sufficiently low for all parts weighing not less than 15 lb., so this constitutes the lower

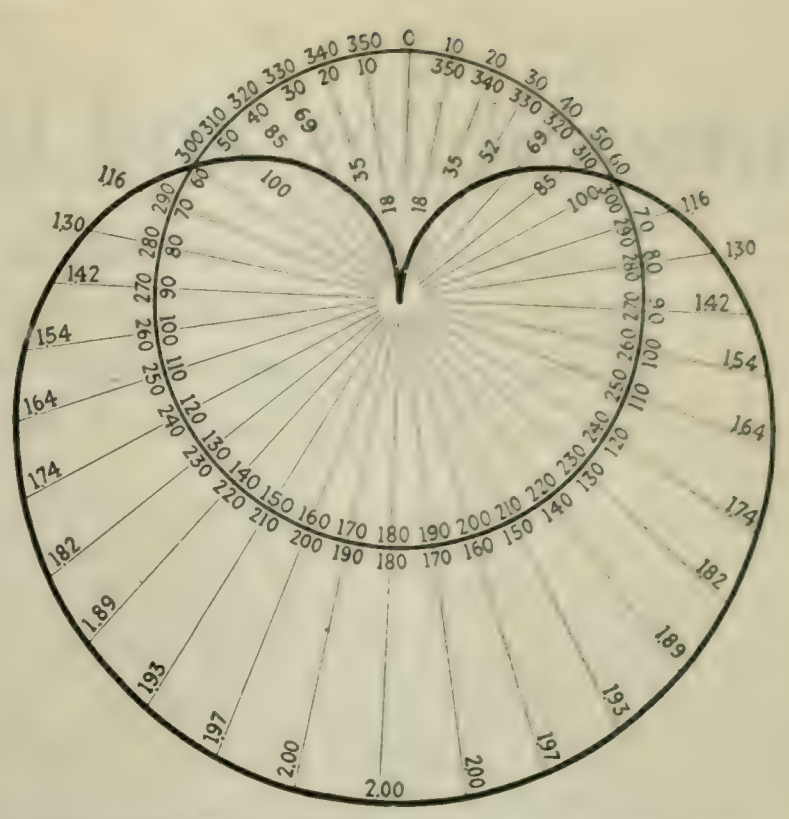


Fig. 3—Effect of the application of the so-called correcting moment according to its angular position relative to the unbalanced moment

limit of the machine's capacity. The machine is universally adjustable for any size of work up to 24 in. swing and 32 in. between bearings.

As regards the time required to balance a part, determinations are made at the rate of ten to fifteen per hour, depending on the accuracy of the result desired. Marks placed on the work direct the operation of drilling which may be done at any time later, and should not require rechecking of the result.

The machine here illustrated was described and demonstrated at the S.A.E. tractor meeting in Minneapolis recently. After outlining the principles underlying the construction and operation of the machine, Mr. Moyer took occasion to correct a misconception regarding the general subject of balance. This is the idea that a body may be in balance at one speed and out of balance at another. This conception has arisen from the evidence that objectionable vibration may occur at one speed, but not at some other speed. In such instances the speed of objectionable vibration is only a "critical speed," or a speed where the elastic period of the supporting means is in synchronism with the speed of rotation. At other speeds the unbalance producing vibratory forces is still effective, but does not meet with a periodic elastic response. In other instances, vibratory forces may be absorbed by the structure up to a certain limit, and when this is exceeded as the result of an increase in speed, violent knocking or rattling may result.

AN investigation regarding the preparation and uses of metallic zirconium and its salts has been conducted by the Bureau of Mines and the results have recently been made public.

Coherent white zirconium metal, on account of its acid-resisting properties, has been suggested as a substitute for platinum in certain cases. Crucibles prepared from zirconium oxide were proved in the experiments of the Bureau of Mines to be superior for high temperature work to any crucibles procured on the market.

The results of the investigations of the Bureau of Mines are available in Bulletin 186, "Investigations of zirconium with especial reference to the metal and oxide," by J. W. Marden and M. N. Rich, which is distributed by the Superintendent of Documents, Washington.

Automobiles and the Asbestos Industry

About one-half the total amount of money expended for asbestos materials comes from the automotive manufacturer and car user. Use of this product plays an important part in the make-up of many cars. Chemical elements are important and the different qualities mined deserve study.

FROM time immemorial men have known about asbestos, but in the days when it was looked upon as a great curiosity there was probably little thought in the minds of the men of ancient times that some day it would become a factor in the industrial life of the world. Charlemagne, for instance, in all his wisdom and with all his vision, would probably have laughed to scorn the man who told him that the material would some day become an important part of a terrifying machine that ran without any visible power. Charlemagne knew of asbestos as a sort of plaything with which to entertain guests, for he had a table cloth made from it and seemed to enjoy the effect upon his visitors when he threw it into the fire to cleanse it.

And so on down through the ages until something like a half a century ago, asbestos was looked upon as something which had no real purpose in the universal scheme of things.

About 1870, however, it was realized that commercial uses could be made of asbestos. When that fact was finally discovered new uses sprang up almost as fast as the material could be mined, and 40 years later, 1910, hundreds of ways of using it had developed. To-day asbestos mining and manufacturing processes have become so perfected that there are many large mines all over the world, the largest, however, being in Canada. And automobile manufacturers and users spend about one-half the total amount expended for this material.

First Use As Brake Lining

The principal, and probably the first, use to which asbestos was put in the automobile was in the brake lining. This is far from being the only use, however, as every manufacturer knows. The idea of using asbestos in this connection was probably first thought of by a British engineer named Hutchings who conceived its use in 1896. The idea got little further at that time, however, and until 1905 it reposed in the British Patent Gazette, unhonored and unsung. Whether or not C. W. Raymond of Worcester, Mass., who in 1905 was manufacturing parts for automobiles, came across the idea in the British Patent Gazette is not known. At any rate he wrote to a leading asbestos manufacturer about that time and explained that he was having trouble in making a suitable brake lining for automobiles. He had tried mohair, leather and various other materials, but he declared that under high friction caused by weight and speed, these materials would burn and they were not giving satisfaction. The old-fashioned "metal-to-metal" brake had proven unsatisfactory, and some substitute was necessary. He asked the asbestos manufacturer for samples of his product and his opinion as to whether or not the material would prove satisfactory in that capacity. The samples were sent to Mr. Raymond and in a short time patents were taken out and asbestos brake lining, made from a combination of woven asbestos and brass wire, began to be pretty generally used on motor cars. A recent estimate of the amount of asbestos used for this purpose alone placed the figure at 70,000,000 ft. a year. Of this figure it was estimated that 15,000,000 ft. would be used in new cars, and the remaining 55,000,000 ft. in the replacement market.

As time went on new uses for asbestos in the automobile were brought out, and in the present highly developed motor car there are a dozen or more parts in which asbestos may be used. Perhaps next to brake linings asbestos is used more for clutch facings than in any other part of the car. There are two types of clutch facings, one the woven type, similar to the material used in brake linings, and endless rings are stamped from layers of cloth. The other is the moulded type, which is made from a board of asbestos. Other uses include packing of woven asbestos for gaskets; copper asbestos for manifold, cylinder heads, spark plug washers, etc.; wicks for exhaust pipes; paper and board asbestos around the exhaust pipe for heat insulation; pads for blanketing the radiator; sheets inside the hood and many other uses. Different manufacturers, of course, use the material in different ways, and new devices, some of them novelties, are often placed upon the market.

Most of the asbestos in use in the United States is imported from Canada. True, there are large deposits of serpentine rock, which contains the veins of asbestos, in this country as well as other parts of the world, but development of the Canadian mines has thus far produced the best material. About 75 per cent of the world's supply comes from the dominion. One large mine in Canada, in the province of Quebec, near Thetford, stretches over an area of 500 acres, and about 100 acres are now being worked. Should the remaining 400 acres of this mine be capable of producing the same quality and quantity of asbestos as the first 100 there seems no possibility of a shortage for some time to come. The same company also has a large mine in Arizona, as have other companies and deposits of asbestos are to be found in Vermont. Asbestos is also found in Russia and Rhodesia in large quantities.

Chrysotile, the Commercial Product

There are also large deposits in Corsica and Italy which have not been worked to any considerable extent. The variety from these countries, in part at least, is somewhat different from that produced elsewhere. This product is known as amphibole, and has little or no commercial value. The asbestos most in use commercially is known as chrysotile. Amphibole is to be found in many sections of the United States in large quantities, but the lack of strength of its fibers prevents it being used in a commercial way. Attempts have recently been made to produce a molded material from amphibole, but its success is not assured.

The open pit, or quarry method, is the one most in use in mining asbestos. In order to get one ton of asbestos fibre it is estimated that it is necessary to blast,

mine, convey and put through the mills something like 15 tons of serpentine rock. The asbestos fiber lies in veins in the rock, and after dislodging the rock from its resting place by blasting, men known as "cobbers" go into the pits, where, with a small hammer, they break away the pieces of rock from the long fiber asbestos. This material is then carried to buildings, where it is further cleaned and sorted.

It is impossible, of course, to get all the asbestos by this method, and the balance of the rock that has been loosened by the blast is loaded in cars and conveyed to the mills. Here it is placed in immense crushers which reduce the rock to pieces about the size of a man's fist. It is dried and again crushed into very small particles, after which it is placed on a sieve where the asbestos fiber is separated from the rock. This process, in itself is interesting. The sieve, which is constantly shaking, forces the heavy rock to the bottom, while above it are great tubes through which an air suction system works. This suction draws the asbestos fiber into the tubes and it is here that it makes its final departure from the rock in which it has been embedded for centuries. The fiber is then divided into three grades, one called long spinning fiber which is used for the manufacture of textiles, and which is probably used together with crude asbestos to a greater extent than any other grade in the automotive industry; a medium length which is used in making asbestos paper, compressed sheet packings and many other materials. The third is a grade commonly used for the manufacture of asbestos cements, etc. The material is then ready to be packed in bags and shipped away to factories, where it is made into the various things that are proving exceedingly useful in industry. Most of these factories are in the United States, as very few finished articles are imported. The United States is the largest importer of asbestos, as well as the country manufacturing processes used for making the most articles from the material.

To describe the various manufacturing processes used for making various articles would require considerable space, for there is a difference in the process for each article. Even to describe them for the various parts of an automobile would require several pages. In the main, however, these processes are divided into three classes. The first is the carding, spinning and weaving of the fiber into various textile forms from which brake linings and packings are made. This process is similar to that employed in the wool and cotton industries. The second is the process of making asbestos paper or felt, and methods similar to ones used in paper mills are in operation. This product is used for roofings, pipe coverings and other insulations. The last main division includes the making of asbestos shingles and boards, a number of packings, electrical insulating materials and brake blocks of high friction value. From all these processes parts are made for the automobile.

As to what is the best material for the various parts used in a motor car, there has been some discussion. Various tests have been made with different materials, and with different grades, and a divergence of opinion has been the result to some extent. The consequence has been that practically every car manufacturer has his own idea on the subject and buys his asbestos accordingly. Incidentally, asbestos manufacturers also seem to have formulated opinions of their own along this line, and make their products accordingly. The Bureau of Standards has recently been conducting tests with asbestos as it is used in the automobile, particularly with regard to brake linings. It is known that brake linings having a high coefficient of friction are the ones which will stop a car or truck in the shortest distance, but the material of a high coefficient of friction does not possess the lasting and wearing qualities of that with a lower coefficient. Incidentally, the latter will not serve as efficiently. Naturally the Bureau has been working to strike a happy medium and set a standard for this product. Asbestos manufacturers have apparently realized the value of such tests and in some cases they have adopted the method the Bureau is using and conducting their own tests along the same line and making their product conform to the standards they themselves find to be the best for the particular material or product they manufacture. This is probably due to the fact that each manufacturer uses a different grade and he is attempting to discover the best use he can make of that grade.

The results of these Bureau of Standards tests, however, when completed, should give the automotive manufacturer a fairly clear idea as to what sort of material produces the best results and the car manufacturer can judge for himself as to what make is best suited for his particular car. Tests are still being conducted, and their results are not yet fully known. They are being conducted along two lines, however, one a test under severe service conditions and the other a long wear or durability test.

Little has been said so far concerning the use of asbestos for clutch facings. Molded clutch facing has been on the market for something over a year and is used as standard equipment on a few passenger cars and trucks. The process of manufacturing this molded material is a secret and little is known about it except that it is compressed by hydraulic machinery. After compressing the material into the shape desired it is generally ground in order to present a smooth even surface. It is claimed that this molded facing has a higher coefficient of friction and is more durable than the woven type, but experts have expressed the opinion that its results will not prove satisfactory.

The type most in use at present, however, is the woven, or disk clutch. It is estimated that 274,139,000 sq. in. of disk and plate clutch facings will have been used on passenger cars along in 1921. Approximately 40 per cent of the trucks registered use a disk or plate type of clutch, and while it is difficult to give a safe average of the number of square inches of facing used on these trucks, it has been estimated that it would run in the neighborhood of 110,000,000. One process used in the manufacture of woven clutch facings, as well as brake linings, is to weave the asbestos and brass wire into a compact mass and then to impregnate it with a water and oil-proof binder to prevent the absorption of moisture and then to shape it.

While asbestos is not absolutely indispensable to the make-up of a motor car, it has thus far proven itself to be about the most economical and efficient material to be found for the uses to which it is put. There are many manufacturers who consider other materials better for

Principal Uses to Which Asbestos is Put in the Automobile

Brake linings.
Clutch facings.
Fuse parts.
Cylinder head gasket packings.
Manifold gasket packings.
Spark plug gasket packings.
Exhaust pipe coverings.
Insulation tape.
Sound deadening sheets between muffler shells.

certain parts, and perhaps they are justified in their opinions. In the main, however, they have pretty generally agreed upon the basic parts in which asbestos should be used.

It is certain that the development of the automotive industry has done much to develop the use of asbestos, not only in automobile but in other machinery. Although there has been no concerted movement among asbestos manufacturers to study the automotive industry with a view to increasing the use of their product, it is believed that most of them, individually, have spent considerable time in planning its use in new ways.

Automotive engineers, on the other hand, have apparently paid less attention to the product. Naturally they have spent some time in studying its uses, but a well-informed engineer said recently that there had never been anp particular research work done along the lines of determining what grades of asbestos are best suited for different uses. Automotive engineers should remember that there is considerable variance in the chemical formulas of various grades of asbestos. This is true of the grades produced in different countries and different sections. These differences have a material result in the quality of the manufactured article made from them. As a matter of interest, there are shown herein Canada, Arizona and a variety known as crocidolite with the chemical properties of grades of asbestos mined found in Blue Cape, Africa.

Arizona Chrysotile Asbestos

	Per Cent
Magnesium Oxide, MgO	41.85
Silica, SiO_2	41.35
Iron Oxide, FeO	0.69
Alumina, Al_2O_3	0.91
Calcium Oxide, Lime, CaO	0.07
Water of Constitution, H_2O	11.96
Water, Hygroscopic, H_2O	1.38

Crocidolite Blue Cape Asbestos

	Per Cent
Magnesium Oxide, MgO	2.3
Silica, SiO_2	51.1
Iron Oxide, FeO	35.8
Soda, Na_2O	6.8
Water, H_2O	3.9

Canadian Chrysotile Asbestos

	Per Cent
Magnesium Oxide, MgO	40.07
Silica, $Si0_2$	39.05
Alumina, Al_2O_3	3.67
Iron Oxide, FeO	2.41
Water of Constitution, H_2O	14.48

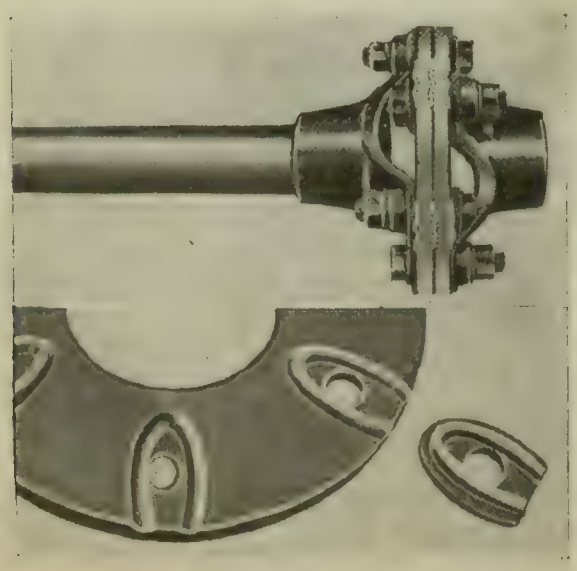
In the manufacture of brake lining it has been found necessary, as well as economical, to use a small admixture of vegetable fibers in order to secure from the asbestos producing machinery an adequate production of a properly fabricated material. The introduction of an excessive amount of this vegetable fiber will inevitably result in a finished brake lining that will give inadequate service, and which in some cases has been responsible for the loss of human life. A maximum percentage in the mixture of asbestos with vegetable fiber is 15 per cent of the latter. Smaller amounts may be used for different weights of cars and it is necessary for the engineer to determine what percentage will be required in the car he is designing. Any greater percentage, however, will burn out readily, leaving a residue of inefficient material which in a comparatively short time must be replaced. Replacement costs amount to many times the difference between the original cost of a good material and the cost of an inferior one.

The automotive engineer should also study the quality and grades of asbestos to be used for other parts of the car. While this has been done to some extent there could undoubtedly be more thought given the question with the result that advantages would accrue to all concerned.

As has been said, asbestos is not indispensable to the make-up of a motor car, but since it has been found an efficient material for the parts in which it is used, its qualities deserve consideration. The part it plays is important and an unsatisfactory automobile can result from the use of poor asbestos.

Improvement in Fabric Universal Joint

LAST summer the Merchant & Evans Co. supplemented its line of metal universal joints by a fabric type known as the Griptite, of which a description and illustration appeared in AUTOMOTIVE INDUSTRIES of July 14. Some changes in design have now been made in the fabric disks of this joint, particularly as regards the holding feature. As shown by the accompanying illustration, a secure driving connection is obtained by displacing the layers of fabric and rubber from their normal plane while in the vulcanizing mold into substantially radial folds across the surface of the disk, transverse to the line of torque, and gripping these folds with formed steel washers closely fitting this whole folded area. It is claimed that the folding of the fabric, the form of the washers and the close fit of these elements over an ample area without washer ridges or teeth to bite and chew the fabric give the combined effect of lasting tightness of assembly in road use, high torque capacity and great durability.



Griptite fabric universal joint

IN the course of a lecture before the Birmingham Metallurgical Society, E. R. Taylor described an unusual form of trouble which was experienced in the heat treatment of some small engine parts. The right degree of hardness failed to develop, although the composition was quite up to specification. The cause was discovered to be a current of air passing along the bed of the muffle, producing a film of oxidation on the surface of the steel. The matter was remedied by scattering small fragments of charcoal about the size of peas over the bottom of the muffle, the engine parts being put into the muffle on a tray. The charcoal became oxidized instead of the steel, and the trouble was corrected.

Definite Ruling on Heavy Trucks Is Urged

Bureau of Public Roads declares highway engineers must have accurate knowledge as to what loads roadbeds will be expected to support. Heavy trucks should prove their economic value if they are to be permitted to operate. A definite ruling would also materially aid the manufacturer.

THE heavy motor truck is perhaps the most formidable problem confronting the highway engineer of to-day. State and federal officials are at a loss to know how to deal with it. Some state officials are taking what they consider the easiest way out and allowing only certain sized trucks to operate in the state; other states are attempting to build roads that will withstand the assaults of these vehicles. In all cases it is looked upon as a problem. Few persons deny the economic value of the heavy motor truck to the operator, but at the same time many are not convinced that it is of such general value as to warrant expenditure of huge sums for road construction and maintenance so as to allow its operation.

The Bureau of Public Roads of the United States Department of Agriculture, in its annual report, recognizes this condition and suggests either proper regulation of these vehicles, or else restriction of their use to certain highways, built, of course, to carry them. The bureau declares that the problem grows more important each year and is one which, while not to be hastily solved, ultimately must be met squarely and disposed of.

"Whether the operation of the heavier vehicles," says the report, "shall be restricted to a class of roads especially designed to accommodate them, or whether all roads shall be strengthened for unrestricted use, or whether the third alternative shall be adopted and the operation of the heavier trucks prohibited, will depend upon the relation which is found to exist between reduced operating cost and increased cost of construction."

By reduced operating cost the bureau means that reduction that would come from improved highways.

The report goes on to say that there must be a careful weighing of the effects of the several possible solutions with a view to the selection of that one which in the end will accomplish the desired result—improvement in the nation's means of transportation.

Problem Affects All

Such a program would prove of lasting benefit to the automotive industry. The problem is one which affects everyone concerned—the manufacturer, owner and highway engineer. As conditions stand at present the manufacturer is in a more or less uncertain position as to his future program. Obviously, if legislation is to be enacted that will prohibit the operation of vehicles above a certain tonnage prospective truck purchasers will not purchase trucks above that tonnage and it will be useless for the manufacturer to plan for the production of that type. On the other hand, if these vehicles are to be permitted to operate only on specific highways then the manufacturer must learn, as soon as possible, where these highways will be and how many miles of them there are to be. If the unrestricted use of heavy trucks is brought about, and all future highway construction is designed to carry the heaviest vehicles then the truck manufacturer can be fairly well assured that there will be an increased market for heavy trucks.

Such a solution as the final one is, of course, the most desirable from the standpoint of the manufacturer. It has been proven in many instances that the economic advantages of the heavy truck offsets, by far, the increased cost of highway construction. The bureau report admits that its investigations have proven this in one instance, but "it is not by any means certain that the outcome will be so fortunate under other conditions."

Need for Coordination

It would seem, therefore, that there is need for a great coordinated effort to bring about a solution of this problem. The automotive manufacturer must prove that the heavy motor truck is a factor in the transportation system of the country and its needs must be provided for. Highway construction, it is admitted, is expensive, and is worth while only when it can be shown that the expense is justified. The laws governing truck transportation prove that the truck of greatest capacity is the one that will allow the cheapest unit cost of operation, and still cheaper operation can be secured if proper highway facilities are provided. There is a great deal of logic to be found in the bureau's suggestion that heavy trucks be permitted to operate only upon designated highways. That, however, should hold good only until all the roads of the country are designed to carry these trucks, or at least all the principal roads.

There is the possibility that heavy trucks might never pass over certain stretches of road, even though they were designed to carry them. This is also a problem to be considered in mapping out a national highway program. Varying needs are to be found in different communities, but the thought should also be borne in mind that as better highways are built their use increases. In a certain sense good roads are the result of a demand from owners of automotive equipment, but on the other hand, when good roads are built the use of automotive equipment increases. Consequently, in communities where at present there may be no heavy trucks in operation, the fact that improved roads were built might cause several to be put into operation. Thus highways designed to carry only lighter vehicles, in such localities, might soon be crushed beyond recognition as highways should some individuals decide that better roads warranted their using heavy trucks in their system of transportation. It is this danger that must be overcome in future highway construction.

Whatever the future highway program is to be, however, it is quite obvious that a decision one way or another as soon as possible is desirable. It is believed that a systematic analysis of the problem will prove that the heavy truck has won a place for itself in the country's trans-

portation system. Certainly it has done so in many localities, and if it has not in others the reason has been largely due to the fact that improper highway facilities were afforded.

One important step is now being taken by the bureau, and that is the conducting of tests to determine accurately the load carrying capabilities of various kinds of roads, of various thicknesses upon different kinds of subsoils. This study will yield valuable information in meeting the problems outlined. Comparatively little is known at the present time about what types of road are best suited for different localities. The fact that two states, having practically the same conditions, adopted radically different methods of highway construction proves that there has been no coordinated effort along this line. An accurate knowledge of these facts would enable engineers to determine the approximate cost of a highway construction program that would permit the unrestricted use of the heavy motor truck. With the knowledge of that cost it would be comparatively easy to show whether or not the economic advantages of the truck warranted the carrying out of such a program.

Brass Forgings a New Industrial Product

FORGINGS of brass and bronze, while relatively new in this country, have been used in Great Britain and on the European continent for a considerable time. A commercial line has, however, been developed by the Mueller Metals Co., at whose plant the commercial application of forged brass has been taken up on a large scale. Some idea of the various units which have been successfully turned out by this process may be gathered from the accompanying illustration of about forty automobile parts of forged brass. Nearly all the parts shown are used on well-known automobiles or trucks.

The tensile strength of brass sand castings are in the neighborhood of 30,000 lb. per sq. in., while the forgings have a strength of 62,000 lb. per sq. in. The forged bars show an elongation of 40 per cent, and break only after considerable reduction in area. The sand-cast test bars show an elongation of only 14 per cent and very little reduction in area.

In manufacturing the forgings, the blanks are heated in an oil furnace and the forgings are made in a 400-ton double-acting press. About 600 impressions are made per hour. There are also single-acting presses making 900 to 1000 impressions per hour. On small pieces, such as elbows, where several are placed in one die, more than 5000 parts have been produced per hour.



Fig. 2—Micro-photograph of brass sand casting. Tensile strength, 30,000 lbs. per square inch



Fig. 3—Micro-photograph of brass forging. Tensile strength, 62,000 lbs. per square inch

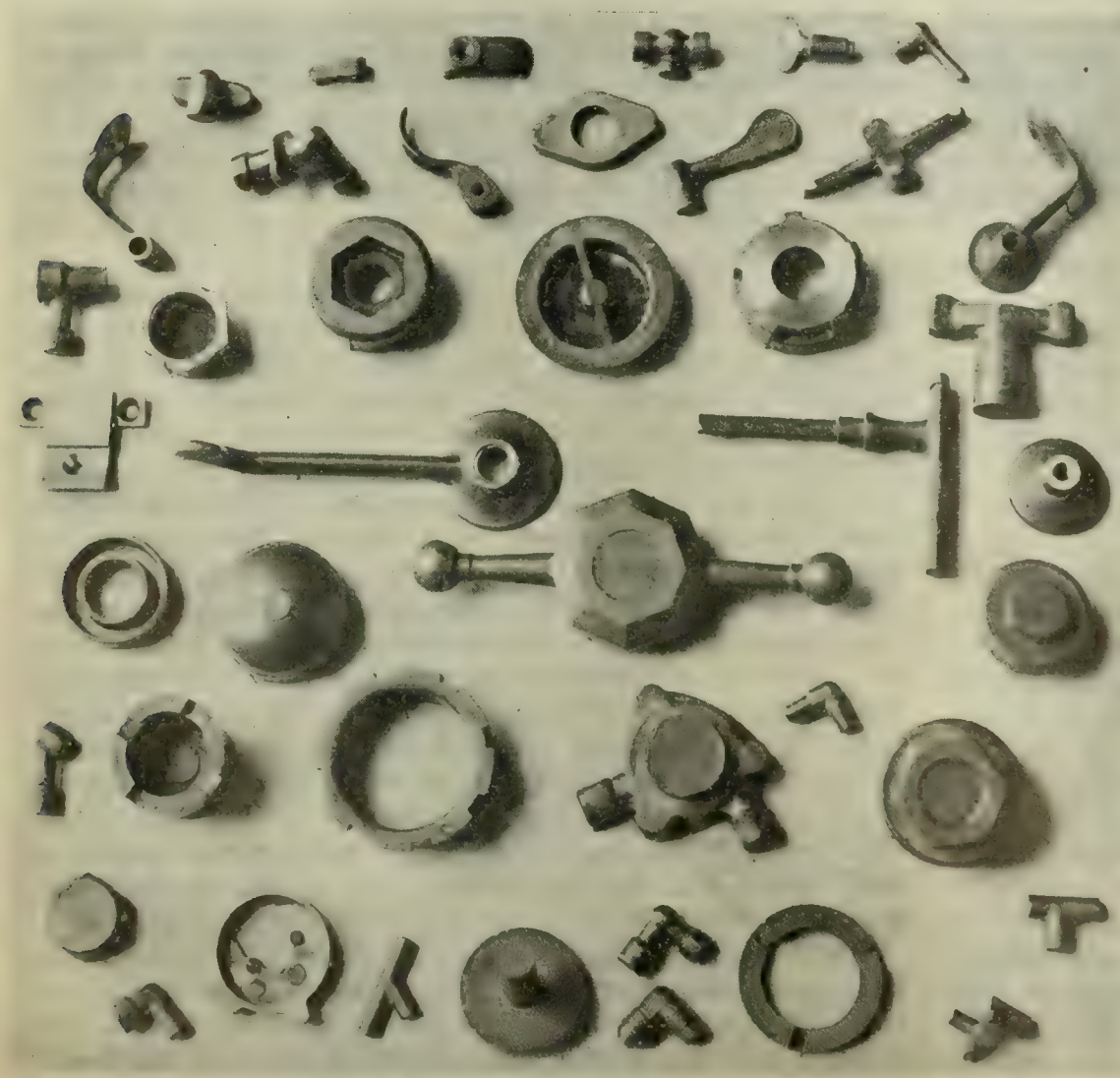


Fig. 1—A collection of forged brass automobile parts

Forgings up to 3 lb. in weight have been successfully produced by this method, and it is expected that new developments will permit of even larger units. It is stated that when necessary, the diameters of cylindrical forgings can be held within limits of plus or minus 0.002 in., but that it is not feasible to hold other dimensions closer than 0.008 in., owing to the variations in the size of the blanks to be forged and consequent springing of the press.

The forging process makes the metal more dense and consequently reduces the chances of porosity. It is claimed that in some instances it is more economical because it is possible to forge close to the finished size and consequently to avoid waste in cutting away a large amount of metal. The metal is also said to be freer cutting.

FROM U. S. A. Ireland imported in 1920, 2,269,000 gal. (British) of gasoline valued at $544,682 (without duty) and 63,145,087 gal. (British) of mineral oils (kerosene) valued at $3,420,839, and 2,269,510 gal. (British) of lubricants valued at $544,628. The value of imported tires and tire parts was £23,834 ($119,170) from U. S. A.

Buses Major Transportation Medium in Porto Rico

Motor buses are carrying more passenger traffic between the two major cities than the railroads. Trucks extensively used for freight transportation. There are now about 1000 miles of improved roads on the island and extensive highway construction is being carried forward at present.

HUNDREDS of motor buses and several thousand automobiles are in daily use in Porto Rico for the transportation of passengers, and it can be truthfully said that there is no town or village within the island that cannot be reached to-day by automobile. Buses connect the principal cities, the longest line being that from Ponce to San Juan, a distance of 131 kilometers (81 miles), while many others, differing widely in type and size, run between the larger centers and the outlying villages, so many of these lines existing, in fact, that practically all transportation of passengers within the territory is done by automobile.

This expanded use of the automobile is one of the outstanding facts of recent years in Porto Rico. The motor car is no longer considered a vehicle of luxury or pleasure, except by a small part of the population, but, rather, it has become the dependable and customary agent of transportation, performing valuable and necessary services for the island as a whole.

Some months ago a survey of Porto Rico showed a total of about 1000 miles of good roads, and the governmental department in charge of highway work is continually adding to this mileage, in addition to keeping in maintenance the roads already established. The principal highway is the road between San Juan and Ponce, across the island, and there is also a very good macadam road between San Juan and Mayaguez, passing through Arecibo and Aguadilla.

Increase in Buses

Trucks are extensively used, as would be expected, for transporting merchandise to sections, many of which are not connected with the chief centers by railroad. Also, during recent years, a remarkable increase has been made in the operation of trucks converted into passenger buses. These, with their special bodies, seat from 20 to 30 passengers, and new trucks are constantly being put into the passenger-carrying service. One large truck representative, who has been selling from two to three trucks each month for the last year or so, reports that 80 per cent of these vehicles are equipped with bus bodies.

The San Juan-Ponce line runs two buses daily in the regular service from each city, covering the 131 kilometers in from 4½ to 5 hours. Their seating capacity carries 24 passengers comfortably, with light baggage. A large number of smaller cars are in service carrying passengers between other towns all over the island, some of them operating on regular schedules, while others make their trips whenever there are passengers.

The automobile has practically supplanted the railroad for the transportation of passengers between the two chief cities. The railroad is built along the coast, thus more than doubling the distance of the cross-island road and consequently requiring a much longer time of travel than do the buses. This railroad runs from San Juan to Arecibo, Aguadilla, Mayaguez and Ponce, its distance being 274 kilometers. Another short-line railroad connects San Juan with Caguas, 36 kilometers distant, but it carries few passengers, those making the trip generally preferring to do so by automobile.

Transportation Costs

Both passenger cars and buses leave San Juan daily for Fajardo, Guayama, Juncos, Humacao and other points in the interior. The fares are considered reasonable, despite the cost of gasoline. It is possible, for instance, to hire a six or eight-cylinder car, seating five or seven passengers, for the trip between San Juan and Ponce for from $16 to $35, depending upon the make of car.

On the other side of the island from San Juan there is similar motor service from Ponce. Buses leave daily for Yauco, Adjuntas, Guayama and other interior points. From San Juan some 200 light cars and buses are in daily service to carry passengers to and from Rio Piedras and Santurce, the residential suburb of the city. The number of these vehicles increases daily.

The use of automobiles throughout Porto Rico has shown a steadily increasing number during recent years. In December, 1920, an official statement of the Department of the Interior listed 4780 motor vehicles, but in the intervening months this number has so increased that the present total is at least 5500, although some estimates place the total at from 6000 to 7000. However, the smaller number seems the more authentic and is probably a fairly accurate census.

The year 1921 showed a large decrease in the sales of automobiles in Porto Rico, the same as in practically every other country of the world. The automobile dealers, however, are feeling much encouraged at the prospects for the months to come, as sales already have improved materially. The return to normal sales conditions depends, of course, upon the sugar industry, but, according to present indications, business in the island should better itself very much in the near future.

Fiat to Enter Indianapolis Race

FIAT is expected to send two racing cars to Indianapolis next year in charge of Louis Wagner and Pietro Bordino. The Fiats are 183 cubic inch eight-cylinder-in-line engines built for the French Grand Prix of this year, but not ready in time. They have only been raced once, on the Brescia course, Italy, last September, when they established a world's road record, but were beaten by the Ballots over the total distance.



Metallurgist and Engineer

Editor, AUTOMOTIVE INDUSTRIES:

Mr. Pomeroy's letter signed "Foralum," appearing in your issue of Dec. 8, 1921, struck me at first as being little more than a semi-facetious attack upon myself prompted, perhaps, by not unnatural irritation at the fact that I did not agree with Mr. Pomeroy in regard to the desirability of employing castings for frame construction. From that point of view, I should gladly have left the matter to the sense of humor of your readers. Unhappily, however, Mr. Pomeroy raises the issue of "engineer vs. metallurgist," and while I am far from wishing to pose as the representative metallurgist, I must yet decline to accept Mr. Pomeroy as the typical engineer. I have, both personally and professionally, many dealings with engineers, both automotive and others, and always find them very ready to appreciate whatever the metallurgist can do for them. The proper relation between these two closely allied professions should surely be one of mutual help and understanding, and without any trace of such hostility as seems to peep out from Mr. Pomeroy's remarks.

In his first paragraph, Mr. Pomeroy suggests that "the metallurgist" is taking upon himself what "the engineer" dare not do—apparently to suggest the right way of employing new materials of engineering. He follows up this attack by referring to "some of the finest real engineering the world has ever seen" and having been carried out "before the metallurgist was ever heard of." I can only suppose that he is thinking of the Pyramids of Egypt or similar works, but Mr. Pomeroy would hardly regard these as useful examples from the point of view of automotive engineering. Actually, engineering and metallurgy have always progressed together.

Mr. Pomeroy gives away his whole case, such as it is, by demanding that the metallurgist should tell the engineer what test should be applied to ascertain the value of any material. Surely, in so far as the functions of the two can be really separated at all, it is for the engineer to specify his requirements and for the metallurgist to do his best to fulfill them. The engineer is in the best position to ascertain the nature and extent of the stresses which occur in his structures, and when he has told the metallurgist precisely what he requires the metal to resist, then it will be possible for the metallurgist to predict with real certainty what material will withstand the conditions. It is useless for Mr. Pomeroy to demand, vehemently, that the metallurgist should state the value of all materials in terms of the steel "which the engineer knows." How far *does* the engineer know his steel any better than he could —if he wished to avail himself of the existing data—know some of the newer alloys? One who, like myself, has frequent occasion to examine breakages and failures, soon comes to realize that the engineer, on the whole, cannot be so deeply familiar with the properties even of steel—or, if he is, he sadly neglects that knowledge at times. Here, again, it is essential that engineer and metallurgist should work in harmony and achieve progress together. It is, surely, only a step toward that co-operation for the metallurgist to put forward his views and suggestions for the utilization of new materials which he has studied, and it is a distinctly retrograde step for any engineer to attack a metallurgist in general terms because he has done so.

The more detailed portions of Mr. Pomeroy's letter are difficult to treat in any limited space. Were I to follow his methods, I should be inclined to refer to the well-worn quotation as to the considerably greater ease of asking questions as compared with answering them. However, some of his points may be dealt with seriatim. Thus, he objects to the attempt to estimate the value of materials for constructional purposes by means of the ordinary mechanical tests—tensile, impact, etc. There is much to be said for that point of view, except this—that as yet there is not only no better way, but no alternative way at all. On the other hand, Mr. Pomeroy evidently has only hazy ideas about the nature of what he calls "stress hysteresis" and fatigue generally. I might, perhaps, refer him to some of my earlier articles in your columns, and would only mention here that the standard "fatigue" tests throw the fullest light on the endurance of metals in that range of stress "before failure commences" in an ordinary tensile test. Mr. Pomeroy says that the engineer wants to know what takes place before failure begins, but what the engineer really needs to know is at what stress or range of stresses failure really will begin—and *that* the fatigue test can and does tell him. No doubt it is necessary to correlate the indications of all tests with the results of actual service—but that correlation serves to add to the value of the tests and not to eliminate them; also—in the case of new materials, it is not as yet obtainable.

Mr. Pomeroy deals with the piston and his anger is mainly directed against the suggestion that a forging rather than a casting is likely to be "the" piston of the future. In support of his view he instances the troubles of pressed steel pistons, but quite ignores the point that those failures were really the result of wrong design. In the aluminum alloy piston, there is—owing to the lightness of the material—no need to use very thin sections and thus the main difficulty of the thin steel piston disappears. As regards production—in connection with which Mr. Pomeroy brings off his concluding flash of humor—I can only say that evidently production engineers differ a good deal in their views, since the request for the development of aluminum alloy forgings for piston purposes actually came to me from an engineer who wished to avoid the loss, in production, arising from the frequent occurrence of wasters due to unsoundness in the castings with which he had been dealing.

This brings me to the main question of "castings vs. forgings," or wrought material generally, which Mr. Pomeroy raises. And here let me say that I am not by any means speaking from the point of view of the test-piece, but from a very wide experience of actual castings and forgings produced for war and other purposes. Undoubtedly much is to be said for the use of a casting where it can be really rationally applied. In it the metal can be readily brought into the desired place, and—particularly if the engineer ignores the real exigencies of the foundry —castings of delightfully complicated shape can be produced. All this would be quite conclusive, and we might

even regard a cast aluminum-alloy automobile frame as a really reasonable proposition, if two conditions could be fulfilled. The first of these is the production of castings whose actual working strength—say power of resisting shock and fatigue—was comparable with that of wrought material of similar specific gravity, and second, if we could always and uniformly rely upon the complete soundness of the castings. I would suggest, on the basis of the wide experience referred to, that neither is the case. Recent research has produced castings whose tensile strength is not far short of that of the best wrought alloys, but their resistance to fatigue and shock is still decidedly lower. Is it, then, rational to use the cast material in any position where wrought material of equal weight and greater strength can be employed? In the pre-aluminum days, would Mr. Pomeroy have suggested the use of a cast-iron frame for an automobile in preference to wrought and heat-treated steel? Yet this analogy is strictly fair unless we consider the new heat-treated castings, which might perhaps be likened rather to cast steel than to cast iron. In aluminum alloy castings it is never possible to be really sure that invisible defects may not seriously impair the strength, unless the casting is of a particularly favorable shape. Castings required for frame construction, however, if they are to be economical of weight, must necessarily be long and narrow, with comparatively thick lugs attached to them—an ideal combination for producing "drawing" and unsoundness. When the aluminum alloy has first been cast as a simple ingot or slab and has subsequently undergone rolling or forging, coupled with careful inspection, the possibility of serious internal flaws is practically eliminated, so that wrought material is definitely much more reliable than cast. Furthermore, it is not easy to produce castings of the light sections which can be satisfactorily used in wrought material. All these considerations, although they go to show the undesirability of using castings for such a purpose, by no means prove that it cannot be done.

With regard to the question of springs, I am not prepared to enter into a discussion of the theoretical formulæ of the engineer; if Mr. Pomeroy's figures are right, there is not likely to be any great saving in weight by the use of light alloy springs. At the same time, I would still advocate a trial, since the exact effect of a different ratio of density to elastic modulus may bring with it unexpected effects. Furthermore, Mr. Pomeroy's calculation seems to me to apply only to material under uniform stress and to neglect the fact that in a spring of given stiffness, the material might be quite differently distributed if it were aluminum alloy as compared with steel. This may make it possible to utilize the material more efficiently, since it is evident that in any ordinary spring only part of the material—indeed, only a small part—is stressed up to the maximum range which the metal can withstand.

It is evident that the questions raised by Mr. Pomeroy afford room for much discussion, which might be profitable if it were pursued in the true spirit of inquiry and in an effort at closer co-operation between engineer and metallurgist. To any sort of controversy in which they appear as adversaries, however, I think it worse than useless to contribute. In this I feel sure that the broad-minded engineer will agree with me.

WALTER ROSENHAIN.

Steering Creeper Tractors

Editor, AUTOMOTIVE INDUSTRIES:

The article in AUTOMOTIVE INDUSTRIES of Jan. 26, 1922, by Mr. H. C. Oliver on "Steering Track-Laying Vehicles" looks very simple on paper, but I do not believe it to be of practical value.

The power required to turn the worm wheel (13) on the differential (12) is considerable, also its speed for short turning is greater than a hand wheel could be turned conveniently.

The same principle could be worked out by friction disks, but of course the cost and poor efficiency of the scheme prohibits it.

Tractors of to-day and to-morrow must be made of the fewest number of parts that will meet the requirements and come within competition costs.

VICTOR L. DARNELL.

Brake Design and Materials

Editor, AUTOMOTIVE INDUSTRIES:

On page 243 of the February 2 issue of AUTOMOTIVE INDUSTRIES it is stated in connection with "Better Brakes" that "it is next to impossible to provide adequate brakes for long and difficult grades when these alone are depended upon for the necessary retarding effect."

As you know from former conversations, I am not in accord with this statement, which, I think, is contrary to the proved performances of the best English and European practice.

Brakes can be designed without excessively expensive production which shall be absolutely trustworthy for all uses to which they may be put, in any class of hilly or mountainous country, and it should never be necessary to waste fuel by using the engine as a brake for long distances. Neither should it ever be necessary to descend a hill in a low gear.

Brake materials are now being manufactured which will not burn out, and which do not lose in friction as they grow hot. They are being used on a large number of electric railroads in England and the continent, with a consequent absence of the "flat-wheel" bugbear which curses electric transportation in this country. They are also being used by most producers of good automobiles in Europe and nearly all large omnibus companies. Recent public trials in England have demonstrated that American cars often burn out their brakes, while the local cars do not.

I suggest that it is necessary for the American industry to fully realize how far behind it is in brake design and materials if it is ever to put right this one defective point which militates against its cars all over the world.

I, therefore, suggest the writing of a much stronger article on this subject which shall deal specifically with: (a) The form of brakes, provision for cooling, excluding dirt, etc.; (b) the material of the brake linings, and (c) the correct design of brake actuating mechanism from the lever or pedal to the drum.

MAURICE OLLEY,
Engineer, Rolls-Royce of America, Inc.

TESTS which have been carried out with a system of guiding airplanes in fog by means of the reception of impulses from a ground cable are reported to have yielded satisfactory results. The apparatus, which has been designed by Lieutenant Loth, of the French Navy, will, it is believed, enable regular commercial flights to be made under night and fog conditions which at present render air services impossible. The pilot is able by means of the receivers installed on the machine to ascertain his position with remarkable accuracy, and it is understood that a cable will be laid on a portion of the London-Paris route in the near future. Night flying in clear atmospheric conditions will be assisted by the modification of marine lights to suit the needs of aviators, by landing lights, and by the development of improved navigation lights on the machine.

Car Market Depends on Local Service

The character of the automobile is such that its usefulness is measured by the service it renders. Mr. Tipper stresses the value of giving efficient service and urges retailer and manufacturer to co-operate with service as a goal.

By Harry Tipper

WHEREVER the automotive industry has touched, whether upon production, distribution or finance, it has introduced new elements and revolutionized to some extent the functions previously associated with those departments of business. In the retailing of automotive equipment, the very necessities of the case introduced other functions which were not associated previously with retailing and which separate the business of retailing automobiles from that of any other retail business. This is the first time that any really complicated mechanism has been sold in large quantities to the general public to be used by amateurs or laymen. Wherever complicated machinery has been sold and used in the past it has been subject to the care of experts skilled in the understanding of machinery, the adjustments and the repairs. The automobile is more complicated than many other types of machinery, yet it is sold to people without any technical training and is handled by them without any particular regard to the ordinary care which a skilled operator would expect to give such a piece of machinery.

The automobile is not a piece of merchandise. It is a means of transportation and its usefulness is confined to the extent of the service which it will render continuously. During the experimental period in the development of the automobile, those who were skilled mechanically, or fond of mechanics, attempted to use the new vehicle. When the automobile passed this stage, and became thoroughly useful, the great necessity before the industry was to provide a sufficient number of automobiles to meet the needs of the population. With the present extensive population of cars we are passing into the stable period, where the service rendered by the vehicle becomes of the utmost importance. This service cannot be maintained by the users of the cars themselves without the adjustment repair incident to the use. This adjustment, etc., must be done by the retailer of the car and by other establishments created for this purpose.

The future tendency is for the car market to depend more and more upon the character of the service which is available locally for its continued operation, and less upon the car itself apart from that service. Probably 90 per cent of the people who buy cars in 1922 have owned a car previously. Consequently, they have some background upon which to estimate comparatively the value of the car, and this background is concerned almost entirely with the way in which the car delivered service.

THE future tendency is for the car market to depend more and more upon the character of the service which is available locally for its continued operation, and less upon the car itself apart from that service. Probably 90 per cent of the people who buy cars in 1922 have owned a car previously. Consequently, they have some background upon which to estimate comparatively the value of the car and this background is concerned almost entirely with the way in which the car delivered service.

Any complicated piece of machinery requires a certain amount of adjustment, cleaning and other care, no matter how thoroughly it has been built or how carefully it is handled. There is a very much heavier demand for this adjustment, minor repairs and little points of service in connection with the automobile because of the conditions under which it is used and the fact that the owner is not skilled in providing these points of mechanical care. As the car grows older, the repairs become more extensive and the required service larger if it is to be kept in running condition at all times.

In this respect the individual establishments vary in their efficiency more perhaps than in any other respect. The cost of repairing and adjustment, the length of time or actual skill and efficiency of the work vary within very wide limits, so that no car owner can be assured of getting the same character of service in two different localities or securing any reasonable expectation of cost. This problem of the service to be rendered by the retailer is one of the utmost importance to the industry. The market for any particular car in any locality is very seriously affected by the condition of the service available for the operation of that car in that locality, and so long as there is such a variation between the character of the work done and the price at which it is to be secured, the use of the car will be limited more than it should be limited.

The growth in the number of automobiles has been somewhat more rapid than the growth in the number of establishments equipped to give the thorough service required to keep the car in condition and to make the ordinary repairs.

Too many establishments in the field do not possess sufficient knowledge either from the mechanical standpoint or from the standpoint of ability to organize, so that the work costs too much and many times it is incorrectly finished. There is a disposition to charge all the traffic will bear in many cases, and to charge a different price for practically the same work in individual cases. A comparison of the cost of conditioning a motor under the same general requirements in four or five different establishments indicates the wide variation in the methods of estimating and the methods of operating on the same job.

To the car owner the retailer who affords reasonably good service represents a reliable authority and his influence upon the whole sales position is in accordance with the authority and expertness exhibited in his work.

No amount of sales work or sales promotion work to the individual owner will offset the influence exerted through the service rendered after the car is sold.

Although the average owner is not mechanically informed, and cannot check up the character of the service from a mechanical standpoint, it is obvious to anyone who watches these conditions that the retailer who is offering excellent service speedily becomes known in his locality and finds his business of servicing extending beyond the cars he may be selling because of the anxiety of the owner to secure reliable service. It is important to the manufacturer of cars that there should be a great improvement in the general average of efficiency in the service rendered and a very much better understanding of the methods to be employed in providing it at a reasonable cost. It has been customary with some manufacturers to work with the retailers for the provision of a standard service as to the cost of parts and the methods of operation, varying only with the cost of labor. It is not enough, however, that some uniformity should be secured in the matter of providing service for the particular make of car, but it is necessary for the retailer to understand the importance of service in connection with the automobile sale and the influence exerted by the character of the service upon the whole progress of the establishment. In this respect, as in other respects, the understanding and ability of the retailer needs to be amplified and developed if the service is to keep pace with the requirements for it and respond to the demands made upon it by the users of the automobile.

In no other problem connected with retailing can the manufacturer be of more benefit, through a close degree of co-operation, than in this matter of the service to be given to the car after it has been sold. The problems met by the manufacturer in experiment and production and the intimate knowledge he possesses as to the detailed construction of the car make it possible for him to co-operate with his retailers very closely in the endeavor to improve the character of the service and take advantage of its influence upon the market. The service to be rendered should be plainly visible in its value to the owner, arranged so that cost can be estimated and conducted under a fairly standard knowledge of the elements of cost, so that the user will be able to make his comparisons. The character of required service should be studied so that the importance of different elements is determined and arranged for upon a basis which will provide as nearly as possible a minimum of cost for each job.

In this connection it will be necessary for the manufacturer of an automobile to review very carefully the r placement prices demanded for parts required more or less regularly in the servicing of cars and their repair. The cost of manufacturing such parts is naturally higher than the cost of the parts going through the shop on a production schedule, but there exists a wide difference between the prices charged by manufacturers to retailers on parts which are almost similar, and unless the manufacturer is willing to bring his own servicing business into line, it will be futile for him to expect the retailer's service station to operate along standard lines with maximum efficiency. It becomes more and more obvious that service has a great bearing upon the sale of the car. The popularity of certain cars in certain localities can be traced very largely to the character of the service rendered in comparison with others in the same price group. The diversion of buying from one car to another in the same locality is frequently associated with a change in the agency. As the population of cars grows, the future of the whole business is wrapped up more and more in the service rendered in keeping the car in running condition. This is not a problem of the retailer alone—it is the problem of the manufacturer and the retailer to be worked out only in co-operation and with a careful examination of all the factors—the cost of parts, the reasonable time to be devoted to a job, the cost of labor, the allowable variation in the price, the promptitude of the service, the convenience and other matters. These things should have a consideration when the contracts are made between the manufacturer and the retailer or between the distributor and the retailer. They should be a part of the requirements, and the manufacturer should be prepared to do his part of the work in the enabling of service stations to meet these requirements and live up to them.

Specifications for Tires and Tubes

DURING the war the Bureau of Standards undertook an extensive investigation of tires and tubes, with the object of preparing specifications covering such material for military use. This work was highly successful, and as a result numerous branches of the Government adopted the Bureau's specifications.

Circular 115 of the Bureau of Standards, obtainable from the Superintendent of Documents, Washington, consists mainly of a revision of the specifications prepared by the Bureau and now used by the War, Navy, Treasury, and Post Office Departments, the Panama Canal, and General Supply Committee. These specifications were recommended by the United States Interdepartmental Committee on Specification Standardization in June of last year.

A tentative draft of the specifications was submitted to a large number of representatives of the tire industry, including the Rubber Association of America, and in the revision careful consideration was given to their recommendations.

The specifications are divided into three parts—pneumatic tires, solid tires, and inner tubes—and contain a detailed description of the physical and chemical requirements.

In connection with pneumatic tires, the character and strength of the fabric, the composition of the friction compound, width and weight of the fabric for the breaker strip, the compound from which the cushion is made, and the quality and quantity of the rubber in the tread are carefully considered. The construction of the side walls and the bead, as well as the tire sizes, are likewise specified. A mileage of 6000 and 8000 is required for fabric and cord tires, respectively.

In the case of solid tires, the composition of the tread, its strength and method of fastening to the base band, and the chemical analysis of the base band, together with its tensile strength, are specified.

Analytical and physical requirements are laid down for inner tubes which are divided into three classes—pure gum, red antimony, and compounded tubes—the latter to be used only in 6-in. or larger sizes. In connection with the tubes, minimum diameter, length, thickness, volume of rubber and inflation test for the different sizes of tubes are specified.

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U. P. C. Building, 239 West 39th Street, New York City

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Stable Markets

THE following statement was made before a convention of the National Foreign Trade Council by Guillermo A. Sherwell, a member of the Inter-American High Commission:

"We are impatient; we want immediate results; we cannot wait. We are like the child who wants to cross the street, who simply must cross even though he will be crushed by a car. Our boys want to run and to play; our university students want credits this year rather than knowledge when they leave the university; our bankers want money to-day rather than the business of the future, and our buyers and sellers want large profits right away rather than a sound, permanent market."

While the above statement was made in reference to our foreign trade, it has an application as regards our domestic business as well.

The rate of growth of the automobile business has been so swift as to make the cultivating of a sound, permanent market appear far less essential than it has actually become within a comparatively short period of time. With the transition from a condition of striving to fill the demand of the market to that of finding a market to absorb production, the necessity of cultivating a stable market appears to be of paramount importance.

Emphasis on market analysis to determine the market potentialities, and a stressing of those factors which constitute the rendering of a service to that specific market when secured, will lay the foundation for permanency and soundness. A market which is over 80 per cent a replacement one determines the direction in which manufacturers will have to travel. Soundness and permanency are no longer a question of choice but of necessity.

Improving Contracts

THE statement has recently been made that the best dealer organization is the one in which the individual dealer assumes a maximum of personal responsibility. Granting that this is so, our immediate object should be to make the relationship between the manufacturer and the dealer so satisfactory that the latter will be eager to assume the maximum of personal responsibility.

It is only just that the dealer should have the assurance of reaping the fruit from the market that he has cultivated. Sometimes there seems to be a feeling that the dealer should only be allowed to grow to a limited size before a pruning process be applied to his territory. Well-established dealerships have even been taken over and used as a prize to give to someone who has made good at the factory or is in favor with the manufacturer.

Successful building up of a market within a territory must in itself be indicative of a creative spirit and ambition on the part of the dealer. Will not the nibbling away of established territory tend to decrease the dealer's productive efforts?

Now, there are two ways of disposing of pruned territory. Either it is attached to another territory or there may be a new dealership established to handle it. In the latter case it may be joined with the prunings from other contiguous territories. Here the question arises whether the possibilities of increased business through concentration on small territories will justify the increase of numbers in the selling organization.

The taking over of dealerships entire may be a gamble. It is not easy to determine the amount of business that was secured through personal contact of the customers with the former dealer, hence in many cases where it was an important factor there is a temporary if not permanent falling away in volume of business through loss of this contact.

Turnover in the selling organization should be confined to those territories where representation is unsatisfactory. Stability of the selling organization and continuity of selling effort are growing increasingly valuable.

With an improvement in the drawing up of contracts between the manufacturer and dealer, and there is, fortunately, a movement in that direction,

there should be borne in mind not only the granting of the maximum of personal responsibility to the dealer but the making of such responsibility desirable to him.

Lessons of the Roma Crash

ONE more catastrophal accident has been added to the list which marks the progress of lighter-than-air craft to date. Like that to the ZR-2, it will not check further experiments along this line, but the lessons which it teaches should be heeded, in order that further unnecessary loss of life may be avoided. As in the case of the big dirigible which fell into the Humber, the seriousness of the accident and the large number of deaths caused by it resulted from the combination of a number of unfortunate circumstances. So far as can be judged from the information at hand, the primary cause of the accident was failure in the elevator control, which occurred at a comparatively low altitude and caused the big ship to crash to earth at an angle of about 45 deg. Here it should be noted that the machine did not drop, that it did not lack buoyancy, but that when the altitude control ceased to function it assumed a downward inclination and crashed to earth under engine power. Had it been possible to instantly shut down all of the engines, the crash could undoubtedly have been avoided, for the buoyancy of the big bag would then have asserted itself and any downward speed acquired after the elevator gear first ceased to respond would have been quickly checked. Whether the failure to instantly shut off all of the engines was due to inadequate control provisions or to mistakes of the personnel remains to be determined.

Even better than stopping of the engines would have been a reversal of the propellers. This, of course, is impossible with ordinary propellers directly mounted on the crankshafts of the engines. The destruction of the Roma, therefore, is a strong argument in favor of either reversible pitch propellers or of geared propellers with reversing gear, such as installed in the dirigible now being built by the Goodyear company for the Navy. We would not think of putting to sea with a steamer or motor ship without reversing gear, and last week's accident shows that the ability to reverse the power of the propellers is equally essential to safety in a dirigible.

That so many people lost their lives in the accident was probably due to the unfortunate circumstance that the ship, in coming to earth, struck a high tension electric transmission line. Either the contact with the wires or the contact with the ground, which occurred a mere instant later, ripped open the gas bags, and the electric flashes from the broken transmission lines then set fire to the inflammable hydrogen gas. However, if the engines were still running when the crash occurred, there would seem to have been also a considerable danger of the hydrogen-air mixtures, which must have been quickly formed, to have become ignited by the exhaust flame.

This merely goes to show anew that as long as the highly inflammable hydrogen is used as a filling gas, any violent landing is almost certain to be accompanied by explosions, leaving the occupants very little chance to escape with their lives. If any further incentive were needed to make the non-inflammable helium (or hydrogen so much diluted with helium as to be non-inflammable) available for the lighter-than-air craft of our Army and Navy, the sad fate of the Roma should furnish it. There is much greater reason to use these non-inflammable filling gases in the present stage of airship development than there will be once the mechanical problems of airship construction have been fully solved, when forced landings will probably be very rare.

Making Men and Money

IN one of his now famous "Common-Sense Editorials," Bruce Barton recently said: "I sometimes think that successful business men should add a line to their letterheads after this fashion: 'John Jones and Company, Builders of Automobiles—and of Men.'

"And that somehow the Government should discriminate in levying taxes between businesses where men are merely used and those where men are made."

There is always a necessity for trained men in industry. To be assured of such men, industry must do the training. There is frequently too strong a tendency on the part of employers to demand skilled men, when those particular employers are doing very little to provide an opportunity for increased skill or personal development within their own organizations.

The man-building organization has growing within itself potential leaders; great driving forces which will produce and market most efficiently and consequently most profitably; forces which assure the permanent progress of the organization regardless of the coming or going of any individual, however important his function.

Building men instead of merely using them not only fulfills a social and industrial obligation but brings results to the organization in dollars and cents.

Taxes and the Bonus

IN connection with the recent suggestion of Congress to provide a soldiers' bonus largely through the contributions of the automotive industry, the result of the referendum of the Chamber of Commerce of the United States on the bonus is of interest. The members of the Chamber voted decisively against the granting of a bonus for ex-service men, 72 per cent forming the opposition. The referendum was sent out six weeks ago and final results have just been announced. These results confirmed the action of the Chamber previously at two annual meetings and can properly be interpreted as indicative of the sentiment of American business men.

The automotive industry has always stood ready to bear its fair share of tax burden, but the place has been reached where it is already bearing at least that fair share. The proposals of Congress for raising a third of the bonus from those using the products of the automobile industry had no basis in justice.

Notes of Willys-Overland Renewed

Defeat Is Indicated for Bank Creditors

Held Doubtful Now if Mortgage Will Be Placed on Company's Property

NEW YORK, Feb. 28—Bank loans of the Willys-Overland Co., aggregating $16,556,000, which matured to-day, have been renewed for three months.

This development is the most important in the recent history of the company. It indicates that the bank creditors who proposed to keep control by a $25,000,000 refinancing program based on mortgage bonds have been defeated by the other interests in the company. Any refinancing program must be submitted to the preferred stockholders, and it now is considered doubtful whether any attempt will be made to mortgage the property.

Toledo Dominates Board

By the election in the past ten days of six Toledo bankers and business men as directors of the company, nine of the eleven members of the board are residents of Toledo. The only representatives of the New York and Chicago bank creditors left on the board are J. R. Harbeck and Elisha Walker of this city.

The fact that control of the company has been shifted to Toledo is evidenced by the announcement that the executive offices which have been maintained in New York for years will be removed to Toledo and that John N. Willys, president of the company, will devote practically all of his attention to Willys-Overland. When he is not on the road promoting sales he will be at Toledo.

The significant announcement also is made that Willys has severed connections with practically all his other interests. While official information on the subject is lacking, there is reason to believe that this means his early retirement from the Republic Motor Truck Co., of which he has had control, but which now is virtually in the hands of its creditors.

Wilson Chosen General Manager

No definite date has been fixed for closing the executive offices here and little is known about what will be done with the personnel of the New York organization. It is assumed that all the officers of the company will be taken to Toledo.

Another important development in the affairs of the company was the election of Charles B. Wilson, who has been vice-president in charge of operations at Toledo, as general manager. He thus succeeds Walter P. Chrysler as the most powerful influence in the company next to Willys himself.

Wilson is very highly regarded by the Toledo directors, and he was made general manager at a meeting which was not attended by Willys, who is absent on a long trip.

Extension of the bank notes for three months is something of a surprise. It was reported in AUTOMOTIVE INDUSTRIES last week that the new directors had been given 30 days in which to consider the bankers' refinancing program. The Toledo bankers, who would be glad to take over all the bank indebtedness if they could do so, are said to favor a continuance of the policy under which the loans have been reduced by 10 per cent payments in cash from time to time, and it is believed they will insist upon this plan.

Company's Assets, $100,000,000

The following statement in reference to the affairs of the company has been made by Willys:

Willys-Overland has assets exceeding $100,000,000. In addition to its Toledo plant, devoted exclusively to manufacture of Overland and Willys-Knight cars and parts, there are three other plants located in Pontiac, Mich., Elmira, N. Y., and Elyria, Ohio.

We have $78,670,381 paid-in capital stock, $22,049,500 of which is preferred and $56,620,881 common. There never has been a bond issue. It has been company's policy to provide part of its working capital by borrowing from banks. Notes payable have been as high as $34,465,000 and are at present $16,556,000. Company has $4,000,000 cash in banks and is meeting all its obligations.

Operating condition is splendid, principally because it has consumed its high-priced material inventory and practically eliminated its obligations for high-priced material.

We are entering a selling season with every reason to expect big business. We have put into operation an improved marketing plan. More than 3500 live dealers have contracted with us, and early this spring we hope to have at least 5000 dealers.

There is no mystery surrounding our financial position, and we fully expect that before the spring season is over the progress we are making will place Willys-Overland in the strong position which facts in the case justify.

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SPAIN TO INVITE U. S.

NEW YORK, Feb. 27—A dispatch from Madrid says that Foreign Minister Hontoria is about to send official invitations to the United States, British, French, Belgian, German, Austrian, Italian and Swiss governments to participate in the International Motor Car Exposition at Barcelona. The exposition will take place some time in May.

Klingensmith, Beall, Hanover to Build Cab

Nat Jacoby Associated in New Company—Separate from Gray Organization

DETROIT, Feb. 28—A company capitalized at $10,000,000 soon will be incorporated in New York State to manufacture a standard taxicab, which will sell for approximately $1,200.

Identified with the new enterprise will be Frank L. Klingensmith, president of the Gray Motor Corp., and Frank F. Beall, his associate in that company; H. T. Hanover, president of the Apex Motor Corp., and Nat Jacoby, who is now at the head of the Black and White Cab Co. of New York.

The new corporation will be entirely separate from Gray Motors.

Plant Located

The plans as outlined call for a vehicle from which will be eliminated all unnecessary equipment and attachments. The cabs will be manufactured and operated by the company. A plant already has been located. The operating end of the business will be under the direction of Jacoby.

Connected with the new enterprise will be four automotive engineers who have made a careful study of the taxicab question. It is understood that the vehicle will be an engineering product rather than an assembled one. Operations eventually will be carried on in all the large cities if the plans of the corporation mature.

Control of Guy Disc Valve Engine Acquired

DETROIT, Mar. 1—Frank L. Klingensmith and his associates in the Gray Motor Corp. are reported to have acquired control of the Guy Disc Valve Engine Co. of Ypsilanti, which formerly was a part of the Apex Motor Corp., manufacturers of the Ace car.

Originally the Apex company made both the car and the engine, but because of lack of manufacturing facilities its plant was used exclusively for making the car, which was equipped with a Continental engine.

The original plan was to manufacture the Guy engine in two types, one of four cylinders and one of six. It now is believed that the four will be used for the Gray car and the six for the Ace and the new taxicab which will be built by Klingensmith and his associates.

Harry T. Hanover, president of the Apex company, is also interested in the taxicab corporation, it is understood.

Truck Gain Shown in Growing Output

Improvement Noted in Car Business, Especially in $800 to $1,000 Price Class

By JAMES DALTON

NEW YORK, Feb. 28.—The coming of March brings reports that factories in the Detroit district are preparing to speed up production. Sales have increased to a point where it is difficult to fill orders on the present part-time basis and several plants will add a day or a day and a half to their working week.

Better business is felt particularly by the companies making cars in the $800-$1,000 price class, but Cadillac and Lincoln both declare they have orders booked far ahead. The Lincoln Motor Co. has just awarded a $1,000,000 contract for 4- and 7-passenger body models. The Gray Motor Corp and the Rickenbacker Motor Co. have placed large orders for supplies and are preparing to go into production. Other companies are releasing materials earlier than had been expected.

Greater Stress on Fuel Saving

At least two prominent passenger car manufacturers are preparing to bring out new models. It is freely predicted that before the year is over greater stress will be placed on gasoline economy and less on the initial price. High mileage per gallon of gasoline will be one of the talking points for the $348 assembled car which W. C. Durant has contracted to build.

Evidence of the increased demand for light delivery trucks is found in the fact that 1000 more Reo speed wagons were sold in January than were produced at the factory. Substantial gains also were made in January by makers of heavy-duty trucks.

Dealers Show Confidence

The optimism of manufacturers probably is a reflection of the increased confidence of dealers in all parts of the country. Reports from shows everywhere tell of more sales at retail than last year and greater interest by the public. Everything points to a substantial spring business, both in passenger cars and trucks. Unusually mild weather already has roused the motoring urge.

Business of parts and accessory manufacturers in January was materially larger than in December and the indications are that February was still better. They are now feeling the full benefit of deflated inventories. Even machine tool makers are having inquiries from vehicle manufacturers who see the need of putting their factories in better position to meet keen competition.

Production of pneumatic tire casings for 1921 reached the unexpectedly large total of 21,820,041, but there are no accurate figures for 1920 with which to make comparisons. It was little, if any, larger in that year, however.

Those companies which really are going after export business are getting it. Sales are being made in steadily increasing volume in Australia, Argentina, Mexico, Porto Rico, South Africa, India and Scandinavia. The tone of the market is better in Cuba, Porto Rico, the Philippines and other small countries. The General Motors Corp. is shipping an average of 125 Buicks and Chevrolets daily from Oshawa, Ontario, and all exporters have been heartened by the recent rise in exchange.

Both domestic and foreign sales for the first two months of the year have been so far ahead of the same period in 1921 that there is danger of rousing exaggerated expectations for the remainder of the year, but the difference in volume will grow smaller as the year progresses.

No Change in Bosch Force Following Kern's Leaving

SPRINGFIELD, MASS., Feb. 27—Arthur T. Murray, president of the American Bosch Magneto Co., declared emphatically to-day that no further changes in the organization were in prospect as a result of the cabled resignation of Martin E. Kern as a director, which was received last week.

Kern, a former Allentown, Pa., banker and organizer of the Bethlehem Motors Corp., figured prominently in the purchase of the Bosch property from the alien property custodian. This sale is being investigated by the Department of Justice. Kern is now abroad.

Murray said he did not know whether or not Kern had disposed of his stock holdings in the company, but asserted that they were not large. He added that the affairs of the company were progressing satisfactorily and that a steady increase is being shown in the volume of business.

SENATE GETS HIGHWAY FUND BILL

WASHINGTON, Feb. 25 — Senator Standfield of Oregon has introduced a bill to extend and carry out the provisions of the Federal Highway Act, providing for an appropriation of $100,000,000 for each fiscal year from 1923-1927, to aid the States in the construction of rural post roads and other purposes.

Wholesale Business for Lincoln Dropped

Sales Will Be Handled Through Dealers—Ford Executives to Co-operate at Plant

DETROIT, Feb. 25—Completed plans for the distribution of Lincoln cars by the former Lincoln dealer organization and the Ford dealer organization find wholesale business eliminated, all transactions with retailers now being handled directly through the Lincoln factory here or through the 35 Ford factory branches.

Dealers in the metropolitan cities of the country do business directly with the factory, carrying their own stocks of cars and parts. In the smaller cities of the country the Lincoln dealers will deal with the nearest Ford branch and will carry small stocks of cars and parts. In the rural districts the Ford dealers will sell Lincolns on commission, getting their cars from the branches as they sell them, but carrying no parts.

Dealers Work Together

In the cities where there are both Lincoln and Ford dealers, the latter will for the most part act as salesmen for the Lincoln, commissions being fixed to make this attractive. All servicing and the handling of trade-ins involved will be by the Lincoln dealer. Where the Ford dealer would handle the sale and trade-in, a large commission is provided.

Production at the factory will be under the co-operative direction of Lincoln and Ford executives, Wilfred C. Leland, general manager, said to-day. It is not expected to name a new production head specifically for Lincoln he said. This same co-operative idea applying to sales and production has been worked out to apply to every department of the two companies, he stated.

The impression that Ford would dominate the new Lincoln organization and that Ford men would be installed to take over the active management of affairs has not been borne out. All inquiries at the offices of Henry and Edsel Ford as to Lincoln affairs have been referred to Wilfred C. Leland, and any official information on developments has come exclusively from him.

To Amalgamate Plants

One of the first steps of the reorganized company is to amalgamate the Holden avenue plant with the main plant. This step was contemplated before the receivership and is now being put into effect. The Holden avenue plant formerly embraced the screw machine and frame departments. These are now being fitted into the scheme of progressive manufacture at the main plant and will result in large annual economies. As soon as all equipment is moved, the Holden avenue factory will be offered for sale.

Production will be increased so that by March 15 it will reach 30 a day. This rate will be continued until a sufficient

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United Auto Stores Put in Receivership

Similar Application Filed Against Subsidiary—President Claims Company Is Solvent

PHILADELPHIA, Feb. 24—The United Auto Stores, Inc., a chain system of tire and accessory stores, incorporated in Delaware but having its headquarters here and operating fifty-eight branches in four states, has been thrown into receivers' hands. The United Guaranty Corp., organized to sell stock in the United Auto Stores, will soon follow, if an application made in the United States District Court is granted. Steps are being taken to have receivers appointed in every state where the two organizations do business. A deputy sheriff now has charge of the office of the Guaranty company here.

Receivers Make Application

The application for the second receivership was made in the name of Francis F. Burch, a councilman of this city, and Major Samuel A. Whitaker, the temporary receivers named to take over the affairs of the United Auto Stores. The liabilities of the Stores company are stated to be $1,250,000 and the assets are asserted to be in a much tangled condition. Book assets are given as $4,000,000. Actual assets are said to be $281,000 in merchandise and stock in a local foundry.

Attorneys for Edward B. P. Carrier, the president, have issued the following statement:

Edward B. P. Carrier, head of the United Auto Stores, Inc., and also president of the United Guaranty Corp., declares the company is absolutely solvent. It has fifty-eight stores in active operation and the good will of thousands of customers. He closed the stores which were dead wood.

The branch at 131 South Broad Street was closed to reduce overhead expenses. Up to the time that a receiver was appointed no creditor had filed a petition in bankruptcy and no stockholder had filed a petition for receivership.

Some adverse business interests, it seems to Mr. Carrier, are engaged in deliberately conspiring to embarrass him and the company and to seize the company. The company's affairs are embarrassed solely by the financial depression and a dull season in the sale of automobile accessories and had it not been for the business enemies of Mr. Carrier the company would quickly be put on a sound footing.

Carrier Owns Most Voting Stock

Carrier, who is 28 years old and who started in business a few years ago in the tire sales and repair line, is said to own 490 of the 500 voting shares of the Stores company. His attorney also states that $50,000 liabilities recently had been cancelled.

In the opinion of A. E. Williamson, expert accountant, about $3,750,000 which is valueless is charged in with the assets. He reports that the concern had heavy overdrafts at local banks.

Joseph L. Kun, assistant United States Attorney, whom Williamson is assisting and who is going over the companies' affairs, asserts that there was an operating loss of $1,000 a day on accessories and a net deficit of more than $1,000,000. Kun also asserts that the company lost $1,385,770 from December, 1919, until the present. The Stores company, which had been operating a short time prior to 1919, was recapitalized for $1,000,000 in September of that year. The Guaranty company was not formed until April, 1921.

Kun Says Large Profit Made

According to Kun, during the stock increase of the Stores company in 1919, Carrier, through the Guaranty company, underwrote 40,000 shares of common stock at $1 a share and then sent his salesmen out and sold the stock for $42 a share, and returned the sum of $1 to the Stores company and the balance he retained after paying commission to the salesmen. Kun states that agents in charge of Stores company shops were required to buy $2,000 worth of stock each.

The United Guaranty Corp., it is said, had a contract to sell United Auto Stores, Inc., stock for $50, receiving a commission of $26 a share. This gave the chain stores $24 out of every share sold to go into the treasury. More than 160 stock sales men of the corporation are reported stranded in various cities throughout twenty states, and many have appealed for funds to the local District Attorney's office. The agents for the corporation, it is said, were also employed by Carrier to promote the sale of stock in the Hydro-United Tire Co. of Pottstown, Pa. This fiscal agency is said to have sold through its corps of salesmen $2,392,280 worth of Stores company stock to between 10,000 and 11,000 men and women, chiefly residing in the East.

New Jersey fishermen are reported to have been heavy purchasers of stock in the Stores company. Many of the employees also were stockholders. Stock purchasers in Reading, Pa., where the

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Voorhis Directs Nash Sales; McCarty, Manager

KENOSHA, WIS., Feb. 27—Charles B. Voorhis has been appointed vice-president and director of sales of the Nash Motors Co., and Earl H. McCarty, formerly assistant sales manager of the Studebaker Corp., has been appointed sales manager.

McCarty joined the Studebaker organization in October, 1902, when he was just out of school. After occupying various positions in the sales department he was appointed manager of the Portland branch of the vehicle division in 1914 and a year later was transferred to Dallas, Tex., in a similar capacity. In 1917 he was taken into the automobile division, going back to Portland as assistant branch manager. Eight months later he was promoted to branch manager and in 1919 was called to South Bend to become assistant sales manager.

New Stock Provided Under Midwest Plans

$4,500,000 Preferred Will Be Held by Creditors—Working Capital to Be Obtained

INDIANAPOLIS, Feb. 25—Plans for the reorganization and refinancing of the Midwest Engine Co. of this city have been announced by Oscar Stevens of New York, secretary of the creditors' committee of local and outside banks that have had charge of the management of the organization since July 17, 1921.

The plans in brief call for the reorganization of the company into the Midwest Engine Corp.; issuing of $4,500,000 of preferred stock which will be held by the creditors of the Midwest Engine Co.; issuance of 125,000 shares of common stock; 75 per cent of which will be awarded to share holders of the preferred stock of the Midwest Engine Co.; and flotation of $3,000,000 of 7 per cent refunding bonds, of which but $1,000,000 are to be sold immediately and to be applied solely as working capital of the reorganized concern.

Stockholders Approve Plan

One-half of the bonds to be issued now are said to have been subscribed for by holders of preferred stock, and the balance is to be placed with present share holders. About $1,200,000 of the bonds are to be held in the treasury to provide for the refunding of the present issue, and $800,000 will be used to satisfy claims of bank and trade creditors. It it said that 85 per cent of the holders of preferred stock have approved of the reorganization plans.

It is believed that the reorganization plan will not affect the personnel of the company and that John Wood will continue as manager. The company is said to have engine contracts with the makers of truck, tractor and bus companies that with normal conditions might run to $2,000,000 worth of engines a year and that there are prospects of additional contracts that might double this demand under normal requirements.

Voting Powers Depend Upon Dividends

Under the reorganization plan, the holders of the common stock of the Midwest Engine Co. are to drop out of the organization as far as their holdings are concerned. Holders of the new preferred stock will be given voting powers in the corporation after the concern has paid dividends for two consecutive years.

S. A. E. MEETING IN JUNE

NEW YORK, Feb. 27—The Society of Automotive Engineers will hold its 1922 summer meeting at White Sulphur Springs, West Virginia, June 20 to 24. There will be the usual sports and entertainment in addition to the technical program. The S. A. E. expects to get a round trip railroad rate of a fare and a half for the convention.

Dirigible Airship Line to Be Opened

General Air Service Will Operate Craft Like Zeppelins and Use Helium

WASHINGTON, Feb. 27—The General Air Service has been incorporated in Maryland as a successor to the American Investigation Corp. which was organized to investigate the practicability of establishing in this country a commercial dirigible air service. Plans for establishing this service and details of the preliminary investigation were recounted in AUTOMOTIVE INDUSTRIES of Aug. 11 last.

Crowell an Incorporator

Benedict Crowell, former assistant Secretary of War, who headed the American aviation mission to Europe and who is president of the Aero Club of America, is one of the incorporators of the General Air Service. Other men associated with him are: L. V. Benet, president of the Hotchkiss Co.; Owen D. Young, vice-president of the General Electric Co., New York; Marshall Field, 3rd; Col. Charles DeForest Chandler, U. S. Army, retired; Snowden A. Fahnestock; E. M. Herr, president of the Westinghouse Co.; Samuel McRoberts; R. B. Mellon of the Mellon National Bank of Pittsburgh; Theodore Pratt of the Standard Oil Co.; Franklin D. Roosevelt; Benjamin Thaw of Pittsburgh and David Goodrich of New York.

Dr. Johann Schuette of the Schuette-Lanz Airship Co. will be associated with the new corporation. The incorporation papers were filed two weeks after Dr. Schuette returned to the United States. Negotiations with the Zeppelins are understood to have been dropped definitely, but the type of airship which will be used will be similar to the Zeppelin.

New York to Chicago First

Promoters of the company say that the first line to be put into operation will be from New York to Chicago, and that it will be extended to the Pacific Coast when additional ships have been built. Preliminary operations will be begun with two ships, which will be fabricated in Germany but assembled in the United States. They are designed to provide accommodations for 100 passengers and 30 tons of mail and express matter.

The company proposes to use helium instead of hydrogen gas in the operation of dirigibles, which will embrace the latest modifications of both the Zeppelin and Schuette-Lanz patents. It is asserted also that gasoline, another source of fire and explosion, will not be used and that the motor power will be furnished by oil fuel.

Promoters of the company believe that the government will permit the use of the navy hangar at Lakehurst, N. J., or at Cape May for the assembling of the dirigibles while its own housing and terminal facilities are under construction. Careful consideration has been given to sources of helium supplies, and the government is deeply interested in this question.

"Our aim is to supply dirigible airship service to America," Crowell said, "and as time goes on to link this continent with the rest of the world by aerial routes, a service supplementing existing methods of transportation, one which will traverse space in a minimum of time and supply a means of travel both safe and comfortable."

Court Finds Burdick Tire Assets Exceed Liabilities

INDIANAPOLIS, Feb. 24—Judge Anderson in Federal Court here has denied the petition of alleged creditors of the Burdick Tire & Rubber Co., a Delaware corporation with a factory at Noblesville, Ind., that the company be thrown into bankruptcy and a receiver appointed. Judge Anderson declared that the testimony showed the corporation has assets in excess of its liabilities. He added, however, that it was evident some of the stockholders had been "flim-flammed."

The petition was filed some time ago by Calvin C. Miller and Joseph Lowman of Peble County, Ohio, creditors of the tire company, who charged mismanagement of the company, insolvency and efforts to defraud stockholders.

Root and Pavey Become Officers in Parts Firm

COLUMBUS, OHIO, Feb. 27—The Automotive Parts Co., capitalized at $250,000, has been organized by Columbus capitalists to operate a wholesale business in parts and accessories. H. C. Root, for the past eight years general manager of the Westcott Motor Car Co., is president; Ernest E. Pavey, receiver for the Monitor Motor Car Co., is vice-president. Root will also be general manager of the business.

The concern will have exclusive selling rights in Ohio for Continental Motors, Timken axles and bearings, Warner transmission systems, Borg & Beck clutches, Spicer universal joints and other parts. The headquarters will be in this city.

GILSON BUYS GLOBE PLANT

MILWAUKEE, Feb. 27—Harry W. Bolens, president and general manager of the Gilson Manufacturing Co., Port Washington, Wis., has purchased the plant and equipment of the defunct Globe Metal Products Co. of Sheboygan, Wis., at receiver's auction, for $65,700. The property consists of a foundry and machine shop. The Gilson company manufactures gas engines, farm implements, tools, etc., and recently developed a power hoe and lawn mower tractor, which, it is said, probably will be placed in production in the former Globe works. The implement is a combination cultivator and lawn mower and sells for $180.

"Pittsburgh Plus" First Hearing Held

Steel Corporation Seeks to Show Consumers Prosper Despite Alleged Handicap

MILWAUKEE, Feb. 27—The Federal Trade Commission has just completed the first of the series of hearings it will conduct in various steel consuming centers of the West upon its complaint against the United States Steel Corp. and its subsidiaries, seeking the abolition of the alleged practice of selling rolled steel material on a Pittsburgh base and charging freight from Pittsburgh to fabricators' plants, regardless of the point of origin of the shipment. The practice is commonly known as "Pittsburgh Plus."

The testimony of witnesses generally aimed to show that western fabricators are unable to compete with competitors east of Chicago in the eastern territory, because shops located nearer Pittsburgh than Milwaukee are able to lay down products cheaper because of the advantage of freight rates.

Rates Higher to Milwaukee

The freight rate from Pittsburgh to Milwaukee is 41.5 cents per 100 lbs., while it is much less from Pittsburgh to Cleveland, Detroit, Cincinnati, Indianapolis, Toledo and other competitive points, so that competitors at these points, due to the Pittsburgh basing point practice, are able to acquire their raw steel at a lower cost than Milwaukee or other western plants must bear.

Since Milwaukee is one of the leading centers of the automotive parts industry, and the passenger car as well as motor truck industries are centered largely in points east of Chicago, the effect of "Pittsburgh Plus" as brought out at the hearing was shown to be particularly disadvantageous to manufacturers of this class of rolled steel product of a standard character. On patented articles the disadvantage was shown to be less severe because of the obvious fact that manufacturers of patented articles have more definite control of selling prices on such goods than on standard articles.

Counsel for the Steel corporation laid emphasis on the fact that the hundreds of invoices, purchase orders and letters of quotation introduced into the record by Milwaukee consumers invariably showed that sales were billed f.o.b. Milwaukee, to prove that there is no Pittsburgh basing point in existence. Their cross examination of witnesses usually followed the line of drawing out testimony to show that Milwaukee consumers have prospered and grown in a normal way despite any handicaps they might claim they were under.

CONCENTRATES ON 8 H.P. TALBOT

LONDON, Feb. 20 (*by mail*)—The S. T. D. Co., maker of Sunbeams, Talbots and Darracqs, is concentrating on the output of the light 8 h.p. Talbot.

Seeking Way to Deal with Dunlop Assets

English Director Comes to America on Investigation, Szarvasy Tells Stockholders

LONDON, Feb. 20 (*by mail*)—The following statement in reference to the American Dunlop Co. was made by F. Alexander Szarvasy, chairman of the board, at a recent meeting of shareholders:

"In accordance with the program outlined to you at the last annual general meeting, we made an offer to the Dunlop American Pool Certificate holders of two Dunlop Ordinary shares for every three pool shares, and, as shown in the report, our company now holds, including the £1,000,000 invested by ourselves some time ago, a 96½ per cent interest in the equity of the American company.

Large Sum Owing

"In addition, the American company owes us on open account £806,000, our total investment at the date of the account thus being approximately £3,780,000 to which must be added the £560,000 advanced last month."

He stated further:

The American company created in January, 1920, a one year bond issue of $6,000,000 guaranteed by ourselves, of which $4,545,000 were placed and a further $600,000 were used as collateral security against advances from local banks. These bonds were held partly by a number of trade creditors of the American company, partly by local bankers, and partly by firms and individuals in this country who are largely interested in this company.

We made arrangements last month with our bankers whereby the whole of the bonds held by creditors in America was purchased from them for our account at a cost of approximately £560,000, and we succeeded in making arrangements with the local bankers in America, and with the holders of the bonds in England, to postpone the date for the repayment of their bonds for a period of 12 months. Our own holding of these bonds, therefore, is now more than 50 per cent of the total, and we have 12 months before they become due, within which we can deal with the assets at our leisure.

Three Suggestions Made

There appear to be three ways of dealing with these assets. First, by making arrangements with banking interests in America for effecting the finance—this would involve raising $12,000,000 to $14,000,000 in order to repay the existing bond issue, provide working capital, and enable the works to be started on a moderate program of production, and, if trade conditions permitted, to gradually work up to the full production program of 44,000 tires per week.

This plan has proved to be unattainable for the moment. My colleague, Mr. Tait, made a special journey to America in October last in order to explore all the possible channels, and he was successful in inducing two very important firms of bankers to consider the proposition. They arranged to send their expert over here to investigate the position of the home company, whose guarantee, as an essential condition, was to have been attached to the bonds proposed to be issued in America.

I have not seen the report of this expert, but I am informed on good authority that the report was quite favorable regarding our position here, and I may tell you that I had a long interview with this gentleman and found him greatly impressed with the thoroughness with which we were carrying through our internal reorganization, and with the manner in which we dealt with all our difficult problems.

I am confident, therefore, that the reason why this permanent finance was not carried through must be looked for in the general conditions of the tire trade and in the prevalent disorganization of industry in America. We all know that America is suffering even more severely than we, owing to the trade depression, and the latest statistics show that the largest American tire companies are only operating up to 60 to 70 per cent of their capacity.

In this respect, therefore, our prospects for turning the large amount we have invested in the American enterprise to a profitable use is delayed for the time being.

The other way of dealing with these assets would be by realizing by way of sale, and here the value of the property is naturally of the utmost importance. The actual amount of money spent, directly and indirectly, on this asset is approximately £6,000,000; therefore, considerably more than the figure at which it stands in our balance-sheet. Neither must we lose sight of the fact that this investment includes a cotton mill, which is operating today at its full capacity, and is a valuable asset.

The third and most promising avenue seems to be in a combination with existing interests in America, and in order to see how far we can proceed on this line, one of your directors, Mr. Proctor, has just left for America. He was out there a year ago, and is fully conversant with all the circumstances so that we are hopeful as to the success of his mission.

Seiberling to Introduce New Tire to Public April 3

AKRON, OHIO, Feb. 27—The new Seiberling cord tire, perfected by F. A. Seiberling and now being manufactured by the Seiberling Rubber Co., of which he is president, will be formally introduced to the American motoring public during the week of April 3.

The Seiberling company expects to sign up 1000 dealers scattered throughout the United States by that time and to hold a simultaneous Seiberling dealers' opening week. The same window display will be used during the week by all Seiberling dealers.

Combined production of the two Seiberling plants, at New Castle, Pa., and Barberton, Ohio, including the Seiberling tires and the old line of Portage cords and fabric tires, now exceeds 800 daily.

Sandusky Syndicate Buys Maibohm Motors

TOLEDO, Feb. 28—A syndicate of Sandusky business men has purchased the assets of the Maibohm Motors Co. subject to the approval of the creditors. The purchasers hope to go forward under the present plan of operation. The creditors' committee believes consent of the stockholders to the sale may be obtained soon.

Bigger Output, Plan of G. M. of Canada

New Schedule Calls for 175 to 200 Cars Daily—Plants on Full Time

OSHAWA, ONT., Feb. 27—Plants of General Motors of Canada, Ltd., at Oshawa and Walkerville, are operating full time, and a number of the departments are working overtime in the production of the McLaughlin-Buick, Chevrolet, Oldsmobile and Oakland motor cars. The daily output for the past three months has been 150 finished automobiles, and the schedule for the next two months calls for a daily output of from 175 to 200. This will be the largest schedule in the history of the Canadian company.

The payroll for the month ending Feb. 15 was at the rate of $440,000 a month. The reason, of course, for the size of this payroll is that very few parts are brought in from the United States. It is an established policy of the company to manufacture every possible part of the car from Canadian material and with Canadian labor.

President R. S. McLaughlin is optimistic with respect to Canadian business. The past three months have seen a healthy increase in the domestic market for motor cars.

Production schedules for the various units have been arranged to take care of an increased home demand, as well as the large foreign demand. The fact that General Motors factories are running to capacity to supply Canadian and overseas business has enabled them to distribute overhead expenses, thus effecting economies represented in recent substantial price reductions. Canadian purchasers of General Motors products in this way secure a direct advantage as a result of the big production, made necessary by export demand.

Yeomans Named Receiver for Illinois Body Company

DANVILLE, ILL., Feb. 27—Victor Yeomans has been appointed receiver for the United Automotive Body Co. which operates a plant at Tilton near this city. Judge English of the Federal Court made the appointment following the presentation of a petition from a committee of creditors. The corporation was formed in Delaware, but, it is said, had not been authorized to do business in Illinois.

It is understood that the company was merely a sales organization for the parent company, the L. C. Graves Corp., located in Lansing and Detroit.

The question of ownership of three carloads of finished bodies and supplies has not been settled, but claim has been filed by the creditors here on the grounds that the corporation has no standing in Illinois and that they were consigned simply to the local branch. Receiver Yeomans has taken charge.

Seek Lincoln Data from War Department

Attorney General Conducting Inquiry Into $6,000,000 Claim Filed by Government

WASHINGTON, Feb. 28—Attorney General Daugherty to-day advised AUTOMOTIVE INDUSTRIES that Assistant-to-the-Attorney General Goff is conducting an inquiry into the affairs of the Lincoln Motors Co. to determine the effect of immediate prosecution of the Government's claim for $6,000,000 against the Detroit Trust Co. as receiver. Senator Townsend of Michigan and James Murfin, attorney for the creditors, advised the attorney general that pushing this claim would prove disastrous for many business men and banks who are creditors of the Lincoln company.

Mr. Daugherty stated that he was also investigating the grounds upon which the War Department bases its charges. He stated that the questions at issue involve matters of taxes, manufacture of motors, and other details which he refused to make known. The attorney general insisted that nothing definite could be given out at this time until the Department of Justice had reached its own conclusions on the representations made by the War Department. Murfin conferred with the attorney general personally on last Friday, relative to the claims of creditor banks and merchandise creditors and set forth their position.

It was indicated by Mr. Daugherty that the matter hinged on changes in contracts with the Government.

Sale in Delaware

WILMINGTON, DEL., March 1—The patents, rights, interests in patents and applications therefor; trademarks, trade names and all interests therein; bonds, obligations, bills of lading shipping, receipts, promissory notes, drafts and accounts receivable, as well as all other rights or causes of action arising upon contracts or from the alleged unlawful taking or detention of, or injury to property of the Lincoln Motors Co., and also the corporate franchise of the company, were sold here yesterday by the receivers to George B. Perry of Detroit, Mich., for $10,000.

Whom Perry represented could not be learned, but it was believed here he represented the Ford interests. The property sold was that of the company held to be in the jurisdiction of the United States District Court for Delaware.

Aeronautical Chamber Elects Its Governors

NEW YORK, Feb. 28—An annual aeronautical institute conducted by and for engineers and designers to exchange thought on the scientific development of aviation has been proposed by Samuel S. Bradley, temporary president of the Aeronautical Chamber of Commerce. The organization also will promote flying meets, demonstrations and aeronautical shows in addition to co-operating with the various departments and bureaus of the Government.

The following governors have been elected by the membership: C. C. Witmer, president of the Airship Manufacturing Co. · Frank H. Russell, vice-president, Curtiss Aeroplane & Motor Corp.; John M. Larsen, president, J. L. Aircraft Corp.; Grover C. Loening, president, Loening Aeronautical Engineering Corp.; Samuel S. Bradley, general manager, Manufacturers Aircraft Association; F. B. Rentschler, president, Wright Aeronautical Corp.; B. E. Bushnell, director of sales, Stewart Hartshorn Co.; Charles H. Colvin, general manager, Pioneer Instrument Co.; Sherman M. Fairchild, president, Fairchild Aerial Camera Corp.; Lawrence Sperry, president, Lawrence Sperry Aircraft Corp., and Charles F. Redden, president, Aeromarine Sales & Engineering Co. and Aeromarine Airways, Inc.

Court Fixes Upset Price for Sale of Pan-American

DECATUR, ILL., Feb. 29—Judge Baldwin in the circuit court has issued an order for the public sale of the Pan-American Motors Corp. Edward Danner, president and receiver, denied that the corporation was insolvent and that efforts of the directors to dissolve the company were unsuccessful because they lacked the necessary two-thirds vote.

Judge Baldwin ordered the receiver to obtain at least 75 per cent of the inventory value in selling the chattel property. The inventory shows the net value of the corporation to be $313,835. Of this $21,479 is in notes given in payment for common stock and $2,172 for preferred. It is estimated that holders of common stock will realize twenty cents on the dollar, while holders of preferred will receive the full par value of $10 per share.

There are 34 finished motor cars, valued at $37,000, and other supplies totaling $154,000. Service cars, trucks, machinery, tools and equipment are estimated at $22,000 more. A mortgage on the real estate of $81,000 is held by a local bank.

FRENCH LOOK TOWARD IRELAND

LONDON, Feb. 20 (*by mail*)—The value of motor vehicles imported into Ireland increased from $4,200,000 in 1919 to $15,000,000 in 1920. The formation of the Irish Free State has caused French manufacturers to realize the value of this market, and a campaign is to be launched with a view to creating demand for French products.

BUS HOLDS 51 PERSONS

OTTAWA, ONT., Feb. 27—The Ottawa Car Manufacturing Co. has completed the first motor bus for the Toronto Transportation Commission. Accommodation has been provided for 51 persons, the second deck being reached by means of a stairway leading from the rear platform.

Full Time Program Growing in Detroit

Factories Increase Production Incident to Steady Improvement in Business Conditions

DETROIT, Feb. 27—Steady improvement in business conditions during the week has found a number of Detroit manufacturing companies going upon full time schedules for the first time this year. Notable among these is the Maxwell Motor Corp., the demand for whose new line is running higher weekly, with consequent stepping up almost daily in the number of cars manufactured.

Maxwell is working steadily toward the improvement of service conditions and has several plans toward this end under contemplation. It is probable that a number of factory controlled service stations will be located in important cities of the country, so that owners may never be more than a few hours away from genuine replacement parts.

Ford Orders Increasing

Ford Motor Co. has not entered upon a full time manufacturing schedule yet, but orders are reported steadily increasing and full time probably will start early in March. Dodge Brothers is working at full capacity, the schedule being approximately 600 cars daily.

Though Ford officials deny the probability of the early announcement of a new Ford truck of 2 to 3-ton capacity, it is not denied that the company has a new truck fully developed which is to be introduced. Only market conditions are considered to be keeping the new vehicle under cover. A betterment in general business conditions by the late spring or early summer probably will lead to an announcement then.

Reo Motor Co. has improved its line by adding many refinements, among which are new fenders and a new frame, drum type headlights and polished aluminum dashboard controls and finishings. The cars thus equipped were not shown at either of the two national shows.

6000 Jewetts by July 1

Jewett Motors will go into production March 10 on its phaeton model and will build about 500 the first month. This production will be increased to about 1800 in April and will continue at that number until July 1, by which time 6000 cars will be completed. A new schedule will be laid out at that time.

The company will confine its building operations to the phaeton for the first few months and will start the sedan about May 1. The other models, roadster and coupe, will be added later. The phaeton is priced at $1,065 and the sedan at $1,395. Prices on the other models have not been fixed.

Manufacturing of the Jewett line will be carried on at the Paige factories. Two new assembly tracks will be laid out for

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Full Time Program Growing in Detroit

Factories Increase Production Incident to Steady Improvement in Business

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the Jewett line. There is sufficient room at the factory for both Paige and Jewett production in 1922, according to factory engineers. Forty thousand dealers will be circularized on the new Jewett line this week.

Dort Motor Car Co. has been given permission by the Michigan Securities Commission to sell 25,000 shares of no par value common stock at $20 a share. In granting the stock issue, all outstanding stock of the company, which heretofore has been practically a closed corporation, was ordered escrowed with the commission. This includes 45,067 shares in the hands of F. A. Aldrich, as trustee, and 125,000 other outstanding shares, including 2100 shares deposited with Flint banks as collateral. The trustees' stock, the property of J. Dallas Dort and F. A. Aldrich, which was issued for the assets of the old Dort Carriage Co. at the time of the organization of Dort motors, was ordered turned into the treasury of the company as a gift, making 75,000 shares in the treasury.

Rickenbacker Motor Co. is now producing 10 cars daily and has contracts with 25 distributors. The company is selling $3,000,000 of its authorized $5,000,000 common at $10 par. Two hundred thousand shares went to the promoters in consideration for development work and property turned over to the new corporation. Experimental work is estimated to have cost $450,000. Half of the $2,000,000 stock issued for development, plant, etc., and held by the officers is in escrow with the Michigan state treasurer until the company has earned 6 per cent on all stock outstanding for a year.

Stevenson Installs Plant

DETROIT, Feb. 28—The Stevenson Gear Co. will install a plant for the manufacture of gears by its multiple shaper method in the factory of the Michigan Pattern Machine Co. Substantial orders are reported from a number of companies, and production will be started at once. By its lease the company will have the use of $200,000 worth of machinery, in addition to its multiple shaper equipment.

SHEFFIELD WORKS CLOSED

LONDON, Feb. 20 (*By Mail*)—The Sheffield works of the Sheffield Simplex Motor Car Co., in which Earl Fitzwilliam holds a predominating interest, have been closed, because production is in advance of sales. The manufacture of cars, motorcycles and commercial vehicles has been continued until all the storage accommodation is occupied.

Business Better!

SOUTH BEND, IND., Feb. 24—From Jan. 1 to Feb. 10 the Studebaker Corp. of America manufactured 10,683 cars, as compared with 3528 in the same period a year ago. Production for the month of January was 7243. Studebaker expects during 1922 to produce 93-000 vehicles, as compared with 68,-000 in 1921 and 53,000 in 1920.

The New York City area shows the largest increase in business over a year ago, the increase being 135 per cent. Boston has an increase of 84 per cent, and the Philadelphia territory, 61 per cent. Studebaker production is running on a basis of 40 per cent among the three models of Light Six; 40 per cent Special Six and 20 per cent Big Six.

DETROIT, Feb. 25—The Packard Motor Car Co. is selling about 25 per cent more trucks than in the same period last year. Among the purchasers are large business organizations which have just come into the market, and a substantial truck replacement business is expected by Packard this year. There also are indications of an increased demand for trucks in highway construction, as well as in the passenger transport business.

ELGIN, ILL., Feb. 25—The Elgin Motor Car Corp. reports that its shipments for January were 200 per cent better than for December and that February shipments have been 35 per cent better than January. The production schedule for March calls for 300 cars. The company recently has closed contracts with five large exclusive distributing organizations and seven direct dealers.

DETROIT, Feb. 27—The Ford Motor Car Co. of Canada has increased its manufacturing schedule to 5 days a week of 8¾ hours each. It is turning out 218 cars a day. There also has been an increase in the parts business.

CLEVELAND, Feb. 27—The Jordan Motor Car Co. reports that its production for the month of February was 350 per cent better than for February 1920

U. S. CHAMBER OPPOSES BONUS

WASHINGTON, Feb. 24—Seventy-two per cent of the membership of the Chamber of Commerce of the United States oppose cash bonus for soldiers, according to the result of the referendum vote recently taken. The vote was intended to put the Chamber's membership definitely on record and to supplement a declaration by resolutions adopted previously at two annual meetings.

Gain in Parts Trade Mounts to 30 Per Cent

Improvement in Conditions Is Reported from All Sections of the Country

NEW YORK, Feb. 27—Further evidence that motor and accessory manufacturers are receiving substantial orders was given at a group meeting last week of credit men from representative companies. The increase over recent months probably averages about 30 per cent. Following are paraphrases of some of the reports made at this meeting.

"Small local truck builders appear to be very active, especially in the East. We have received many small orders from builders of this type."

"One of our customers in the South who had a large account with us and whose notes we had carried for a year and a half recently paid us 20 per cent on account."

"New business is being placed for future delivery. We believe orders will increase from month to month."

"We have been very much surprised in the last month at the great number of inquiries we have received for new plant equipment and at the quantity of replacement business we have been able to get. These orders have not come from companies which are just going into the field but from old line plants which are replacing worn out machinery."

"We are going to have a good month this month and March will be a good month."

"Our schedules up to July are about 50 per cent."

"We are very much more active than we have been. As far as our automobile business goes we have specifications from practically all our customers up to July."

"We think we see a little change for the better in the western agricultural districts and we are looking for different conditions than have prevailed in the past year."

RUSHING DODGE, FORD FORGINGS

SPRINGFIELD, MASS., Feb. 27—Manufactures of automobile parts are going forward at an increased pace. Moore Drop Forging Co. is rushing forgings for Dodge Brothers and Ford cars. Bausch Machine Tool Co. is producing gears for Ford trucks and tractors at the rate of 300 a day, and is entering this week on the making of demountable rims of new design for the Franklin. The reorganized Harley Co. has its parts production under way. This seasonal activity shows a marked advance over a year ago.

FORD OPERATING IN JAPAN

DETROIT, Feb. 27—The Japanese assembly plant of the Ford Motor Co. at Negishi is now equipped to turn out 15 assembled chassis each working day of eight hours. Three former Detroit employees are in charge of the force of 46 Japanese laborers. Standard Ford methods have been adopted throughout.

The company estimates that there are 10,500 cars running in Japan, of which 4500 are Fords.

Milwaukee Parts Business Quickens

Passenger Car Builders Report Increased Production—Truck Prospects Encouraging

MILWAUKEE, Feb. 27—The automotive parts industry, which to a large extent marked time in January, experienced a quickening in February which was particularly noticeable in the last two weeks and is due to the more definite delivery schedules submitted by manufacturers, who through the national, district and local shows have been able to get a line on the possible demands of their market.

Passenger car builders in Milwaukee and vicinity also brought up production in the period now closing, compared with January. Tire manufacturing and distribution are far more satisfactory than last year at this time. The manufacture of trucks is making slow progress, but prospects are regarded as being more promising than a year ago.

Public Attitude Changing

Local dealers feel that the attitude of the public on passenger car prices has started to undergo a change which is taken to mean that a great many prospective buyers are satisfied that the bottom has been reached and little if anything is to be gained by waiting longer to buy.

There are, of course, many people who feel that before spring manufacturers will be forced to make further concessions in order to meet competition. The trade is engaged in combing prospect lists built up from patronage of the recent annual winter show and is meeting more and more success in closing sales. Business, however, is quiet, as might be expected at this period of the year.

Bassick Is Operating at 70 Per Cent of 1920

BRIDGEPORT, CONN., Feb. 25—Greater demand for automobile and cabinet hardware manufactured by the concern is credited as responsible for the fact that January orders of the Bassick Co. of this city showed an increase of approximately 100 per cent over the amount received during the same period last year, bringing the plant's production up to 70 per cent of what it was during the year 1920.

The man-hours per week at the local factory have been increased 20 per cent since the first of the year, as a result of the increased orders. A similar expansion in production is underway at the Newark, N. J., factory. The export business there is reported for the month of January as having increased by 10 per cent over exports for the month of January, 1921.

NEW STUTZ REFINEMENTS

INDIANAPOLIS, Feb. 27—A number of refinements have been made in the Stutz cars, particularly in the engine. It is claimed that the new manifolding system adopted gives a 50 per cent greater power output from the same cylinder dimensions. According to Chester S. Ricker, who has been employed as consulting engineer by the Stutz company during the past year, the new manifold is so arranged that changes in water jacket temperatures of 100 deg. do not seem to affect the operation.

The chassis weight remains the same as on the previous series, and the acceleration of from 10 to 60 miles per hour is claimed to be quicker than from 10 to 50 in the previous series. Complete specifications and details of the new product will be announced to dealers in the near future. It is stated that the Stutz company is about to enter an intensive merchandising campaign.

Says Industry Leads in Deflation Process

DETROIT, Feb. 27—The process of deflation has gone farther in the automotive industry than in any other, in the opinion of William Robert Wilson, president of the Maxwell Motors Corp. Discussing the general situation in the industry, he said:

The automobile manufacturer realizes that competition is keener than ever, that there must be no doubt about his product, but that the good car, correctly priced, need have little fear of a satiated market. Also, that conservative marketing and expert fingers on the pulse of demand will establish the automobile business on a more stable basis than ever.

The automobile dealer is, of his own wise, converted to a firmly conservative business policy. He knows that the day of the telephone order is gone for good—for the good of all concerned. He is in a frame of mind amicable to present conditions. He knows that he must go after business and is fully aware that the offer of real service is a genuine sales need. He is prepared to follow these dictates for on them his 1922 success is assured.

I believe the public is more deeply interested in the automobile than ever, but more critical. It is selecting cars more carefully and is more insistent on quality as evidenced by the New York and Chicago shows. The New York show drew record attendance, but not record sales, yet those manufacturers who offered a product of evident value found an agreeable amount of business.

Efforts to Reorganize Kelley Tire Abandoned

NEW HAVEN, CONN., Feb. 27—As receiver for the Kelley Tire & Rubber Co. of West Haven, Attorney Albert H. Barclay of this city has petitioned Judge George E. Hinman of the superior court here for authorization to expend $500 in advertising the concern's assets for sale. Efforts at reorganization have been abandoned, and the receiver will attempt to dispose of the plant and fixtures to the highest bidders, indicating that there is little likelihood that the many stockholders throughout the state will get anything out of the proceeds.

Hudson, Essex Sales Increase 100 Per Cent

Gain Over Year Ago—March Will See Plant on Practically Full Time

DETROIT, Feb. 28—February business of the Hudson and Essex companies will exceed that of the same month last year by 100 per cent, it was stated today by President Roy D. Chapin. Production in March will be increased to a point where it will run 200 per cent in excess of 1921 and will place the factory on practically full time operation, Chapin added. Releases on parts have been almost tripled in some instances.

Other manufacturers with whom he has talked declare business to be far in excess of early expectations, he said. Prospects for a strong spring and summer demand are excellent. All the shows thus far held have been more successful than expected and attendance has been record breaking in most cities. This is regarded as a positive indication of public interest in automobiles.

Financial Position Strong

Chapin said the sale of its new coach by his company has been large and that the campaign for business in enclosed cars has been successful. Dealers have been gratified at having a lower priced enclosed model.

The financial position of the Hudson Motor Car Co. is exceptionally strong. Its quick assets as of Nov. 30, 1921, were $5,804,630 and its current liabilities, $2,340,145. The total assets were $14,955,692. With a capital of only $1,987,260, the company had a surplus of $10,508,287.

Legislator Would Increase Truck Rates in New York

ALBANY, Feb. 27—A proposal to increase the rates for registration of automobile trucks in New York State has been introduced in the Legislature by Senator Seymour Lowman of Chenung County. The proposed rates would be identical with those now in force in Pennsylvania.

Senator Lowman's schedule is as follows: For each vehicle having a combined weight and carrying capacity of two tons, or less, an annual fee of $15; of two tons and not more than three tons, $20; more than three and not more than four tons, $25; more than four tons and not more than five, $30; more than five and not more than six tons, $50; more than six and not more than seven tons, $60; more than seven tons and not more than eight, $75; more than eight and not more than ten tons, $100, and more than ten tons, $150.

The excessive wear and tear on state highways resulting from increased use of motor truck transportation is cited as a reason for the proposal to increase the registration fees for the trucks. The passenger registration fee would not be changed.

Heavy Write-Offs Cause G. M. Loss

Balance of $38,680,770 Charged Against Surplus, Preliminary Report Shows

NEW YORK, March 2—A preliminary report of the General Motors Corp. for the calendar year 1921 shows a net income after ordinary charges of $5,784,782, but after charges for extraordinary losses and adjustments aggregating $44,465,552, there remained a balance of $38,680,770 to be charged against surplus.

A statement by Pierre duPont says that a statement of 1921 earnings would be misleading if attention were not called to the losses and adjustments in units undergoing liquidation and reorganization. To make this situation clear, he divides operations of 1921 into two classes, one of which includes the divisions thoroughly established and whose product is so standardized that it does not require readjustment. The other class includes divisions undergoing reorganization and rearrangement, including some cases of complete abandonment and liquidation.

Sales in Two Classes

Net sales in 1921 for the class A, or thoroughly organized units of the corporation, were $225,261,110, as compared with $370,288,235 in 1920. The net sales of the class B units, or those undergoing reorganization last year, were $79,226,133, as compared with $197,032,368 in 1920. The total for 1921 was $304,487,243, as against $567,320,603 in 1920.

The net earnings of the class A units were $29,671,494, while there were losses of $16,431,547 on the class B units, leaving net earnings from operations as a whole of $13,239,946. From these earnings were deducted interest of $5,281,084 on notes payable and $2,174,080 for the employees investment fund, leaving a net income after ordinary charges of $5,784,782.

Charges for extraordinary losses and adjustments were: write down of inventories Dec. 31, 1921, to cost or market, which ever was lower, $16,603,073; provision for refunds due dealers and distributors on account of price reduction, effective Jan. 1, 1922, $2,441,376; cost of cancellation of commitments, rebates on sales in 1920 account of price guarantees and other miscellaneous losses charged off in 1921, $11,421,102; special reserve established Dec. 31, 1921, to cover anticipated losses and unforeseen contingencies pertaining to 1921 on prior years but not at present definitely ascertainable, $14,000,000, making a total of $44,465,552.

President du Pont pointed to the satisfactory showing of the Class A units and added that adjustments in inventories with rearrangement and improvement in the quality of its product has placed the corporation in a position to conduct its operations in 1922 with every promise of profitable results. The corporation has taken all possible losses. The capital and surplus account, after allowing an equity of $352.39 per share on preferred and debenture stock, leaves an equity of $262,278,135 on common stock valued at $10 per share. This would leave a common stock surplus of $55,814,160.

Comparative Balance Sheet

A condensed comparative consolidated balance sheet as of Dec. 31, 1921 and 1920 shows:

	Dec. 31, 1921	Dec. 31, 1920
CURRENT ASSETS		
Cash in banks and on hand	$40,057,401.53	$47,332,842.21
United States Government Bonds	5,228.04	41,262.21
Marketable securities	27,009.31	34,096.31
Sight drafts against B/L attached and C. O. D.	4,677,241,39	9,667,580.59
Notes receivable.	4,794,978.99	13,449,376.90
Accounts receivable and trade acceptances, customers and others	18,944,844.09	22,233,886.80
Inventories at cost or market, whichever is lower	108,762,625.35	164,684,678.72
Prepaid expenses	1,944,988.35	1,891,854.06
Total Current Assets	$179,214,317.05	$259,335,577.80
CURRENT LIABILITIES		
Accounts payable (and trade acceptances in 1920	$15,640,429.41	$27,160,681.23
Notes payable	48,974,996.29	72,421,451.45
Taxes, payrolls and sundries accrued not due	15,894,778.40	14,101,794.90
Accrued dividends on Preferred and Debenture stock, payable February 1	1,043,763.07	1,018,943.73
Total Current Liabilities	$81,553,967.17	$114,702,871.31

Wholesale Business for Lincoln Dropped

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back-log of orders has been accumulated to warrant an expansion. From time to time additions will be made to the plant to permit the company to make parts that are now being bought. The manufacture of its own bodies is a detail that is being studied closely by the company.

Export business of the company will be handled through the Ford export organization ultimately, Leland said, but this will be passed over until the handling of domestic business is operating smoothly.

Regarding the most recent claim by the government against Lincoln, W. C. Leland expressed confidence that this would be dismissed as soon as the facts were subjected to intelligent scrutiny.

CANADIAN GARY INCREASES

TORONTO, ONTARIO, March 1—Increases in the prices of all its models are announced by the Gary Motor Truck Corp. of Canada, Ltd.

$100 to $550 Price Cut on Case Tractor

Company Is Building New Model with Capacity of 8 to 10 Plows

RACINE, WIS., March 1—Price reductions ranging from $100 to $550 on its farm tractors are announced by the J. I. Case Threshing Machine Co. The list follows:

	Old Price	New Price
Case 10-18	$800	$700
Case 15-27	1,680	1,420
Case 22-40	3,100	2,550

The Case company also is building a large size tractor known as the Case 40-72 for which the price has not been fixed. It will be powered with a Case four-cylinder engine and will have a plowing capacity of from 8 to 10 plows.

"WATERLOO" REDUCED $375

WATERLOO, IOWA. Feb. 27—The Waterloo Gasoline Engine Co. announces that the price of its Waterloo Boy Tractor has been reduced from $1,050 to $675. This brings the price below the pre-war level.

Material Cut in Price Made by Acason Truck

DETROIT, March 1—The Acason Motor Truck Co. has made material reductions in prices on its heavier models. The list follows:

	Old Price	New Price
¾-ton	$1,650	$1,650
1½-ton	2,485	1,950
2½-ton	3,295	2,750
3½-ton	4,295	3,450
5-ton	5,250	4,350

The one ton model which sold for $2,260 has been discontinued.

KEARNS MAKES REDUCTION

DANVILLE, PA., Feb. 28 — The Kearns-Dughie Motors Corp. announces a reduction in its model "H" 1-ton chassis from $1,600 to $1,150 and its model "M" 2-ton chassis from $2,200 to $1,650. The price of its model "H" chassis complete with its standard hand-made post express body is $1,350.

DUPLEX 3½-TON REDUCED

LANSING, MICH., Feb. 27—The Duplex Truck Co. has reduced the price of its model E 3½-ton truck from $4,250 to $3,500. The 1½-ton truck will continue to sell for $2,775, but the capacity will be increased to two tons and considerable equipment will be added.

The announcement contained in the Feb. 9 issue of AUTOMOTIVE INDUSTRIES, in regard to the bringing out by the Packard Motor Car Co. of a new line of single six cars was a mistake, and we are glad to make correction of that item.

N. A. C. C. Discusses Used Car Remedies

Comprehensive Plan Presented by Which Dealers Would Be Given Certificates

NEW YORK, March 2—Members of the National Automobile Chamber of Commerce met here to-day to discuss problems of importance to the industry. One of the most important was the used car situation. Several specific remedies were proposed.

One of the most comprehensive was presented through C. C. Hanch by Homer McKee of Indianapolis. It would provide for certified dealers who would be given certificates stating that they had agreed to put all used cars in such condition that they could be sold as certified cars. Under the plan a committee of manufacturers would be appointed to pass on rules under which the certified dealers would operate. There also would be a committee of four dealers in each locality, three of whom would not be interested in the car passed upon, who would be called upon to inspect each vehicle before it was offered for sale.

Advertising Values Favored

It developed at the meeting that there is opposition to attempts by factories to recondition their own product although the idea of having dealers do so is generally supported. Used car exchanges are favored, but some doubt was expressed of their success. General approval was given to the proposal to have factories advertise the values of old models.

Both manufacturers and dealers favor co-operative used car advertising, selling cars with a guaranty and used car shows. Appraisals by individual companies in each locality are favored.

The directors were supplied with a mass of information on the used car question provided by questionnaires sent to 2500 representative dealers. Reports from practically every section of the country were that there has been a marked improvement in the demand for used cars and that the shrinkage in the number on hand has been rapid in the past two or three months. Nowhere is the used car problem more acute.

A survey of trade conditions presented to the directors of the N. A. C. C. at their monthly meeting yesterday showed that sales were considerably better for February than for January, while March and April prospects are much better. Generally speaking, credits for dealers are much easier, particularly on the Pacific Coast. Truck sales also are picking up.

Gasoline Taxes Taken Up

The directors discussed at length the effort being made by various state legislatures to impose taxes on gasoline. It was the general feeling that a gasoline tax is not proper unless it takes the place of other fees.

The directors decided to adopt a standard safety code to be supplied motor car purchasers with their instruction books. Motor car operators will be told that they are engineers and that they have all the responsibilities of engineers.

A committee will be appointed to work with the Bureau of Simplified Practice of the Department of Commerce in standardization work as it relates to the elimination of needless sizes.

United Auto Stores Put in Receivership

(*Continued from page* 534)

concern has a fiscal office, and in West Chester, where there is a branch store, are reported to be many.

The petitioners in their prayer aver that to the best of their information and belief the contracts and transactions between the Stores company and the Guaranty company are void and fraudulent, and a temporary injunction is asked to restrain the further sale of stock and an injunction to prevent the distribution of any cash or property of the Stores company.

The court is asked to have the Guaranty company take all cash and other assets of the Stores company and make a complete accounting.

Well known Philadelphians were on the directorate of the Stores company as Carrier insisted on "minimizing risk" by strictly localizing each unit of the organization and establishing the policy that the manager and assistant manager of every branch must be stockholders. Many of the directors resigned last summer. The present directors are Carrier, president; H. J. Stokes, vice-president; Harry G. Coxe, treasurer; Rubens H. Peale, chairman of the finance committee of a bank in Schuylkill Haven, Pa.; M. H. Fox and W. A. Beisacher.

Gray Plans Unchanged by Durant $348 Car

DETROIT, March 1—President Frank L. Klingensmith of the Gray Motors Corp. said to-day that the plans of that company would not be changed in any way by the production of a $348 car by W. C. Durant. Practically all the equipment for the manufacture of the Gray car is now ready, and it is expected shipments will start about April 10. The price will be announced before that time.

"There is room for a number of manufacturers in the low priced field," Klingensmith said, "and we are looking for about 10 per cent of the business."

NO CHRYSLER ANNOUNCEMENT

NEW YORK, March 1—Walter P. Chrysler has not yet made any announcement of his plans for the future. He left last week for Palm Beach. W. C. Durant also is at the Florida resort. It is not considered probable, however, that Chrysler will join forces with Durant Motors.

Notes Are Renewed for Willys-Overland

Defeat Seen for Bank Creditors—No Mortgage on Property Now Likely

(*Continued from page* 532)

TOLEDO, Feb. 24—Charles B. Wilson was elected vice-president and general manager of the Willys-Overland Co. at the meeting of directors to-day. Two of the former Willys directors were also displaced by two more Toledo business men. William W. Knight of the Boswick Braun Co., a director also of the Fourth Federal Reserve Bank, Cleveland, replaces George W. Spencer, who resigned as secretary of the board.

Charles E. Bunting, president of the Bunting Brass & Bronze Co., replaces James E. Kepperly as a director.

Linwood A. Miller, who has been assistant to Vice-President Wilson, has been elected secretary to the company.

Together with Henry L. Thompson, W. L. Milner, George M. Jones and Gordon M. Mather, named last week, this new board will have nine of its eleven members representing Toledo banks and business interests.

Suit Filed Against Overland

TOLEDO, Feb. 27—An echo of the reduction of commitments from $46,000,000 in the spring of 1920 to about $19,000,000 at the close of 1921 came last week in the filing of a suit for $257,482 against the Willys-Overland Co. by the Dura Mechanics Hardware Co., a Toledo corporation.

Alleged failure on the part of the Overland to comply with an agreement and accept a number of window lifters, an automobile accessory, is given as the cause for the action in the petition.

The suit is filed in Common Pleas Court of Lucas County.

Willys Corp. Receivers Combat State

TOLEDO, Feb. 27—Receivers for the Willys Corp. have asked Judge Killits here for authority to combat the State of Ohio on the matter of an annual assessment against the corporation which, they allege, is levied and collected under a statute that is unconstitutional.

The claim of the State against the company is for $89,556.40.

The receivers want an injunction or restraining order against the State officials to prevent any action now to collect $77,875.13 of actual fee and $11,681.27 which is a 15 per cent penalty.

RUBBER FROM ISOPRENE

BEAUMONT, TEXAS, Feb. 27—It is now practical to manufacture artificial rubber from isoprene, a recently discovered product of petroleum, according to J. W. Newton, petroleum engineer and assistant superintendent of the local refinery of the Magnolia Petroleum Co.

2047 Cars Exported, G. M. Shipments High

Corporation Sent from Its Plants in Canada More Than 1200 Automobiles in January

NEW YORK, March 1—Export shipments by the General Motors Corp. from its Canadian plants to all parts of the world except England totalled 736 motor cars during January. This was announced to-day by the General Motors Export Co., following the issuance in Washington of the January shipments from the United States.

Additional shipments from Canadian plants to England, not included in the figure of 736, for sale in the British Isles were between 500 and 600, the exact number not being available here. None of these exports shows in the figures published at Washington yesterday. Thus, the General Motors shipments during January were from 1200 to 1300 cars, as compared with declared shipments from the United States of 2047.

The destination of the Canadian exports was announced as being Australia, Argentina, Brazil, India, South America, Mexico, some parts of Continental Europe and various countries of Latin-America. In December General Motors shipped 1338 cars from Canada, as compared with the declared exports from the United States for that month of 2652.

WASHINGTON, Feb. 28—The international shipment of American made automotive equipment continued throughout January at practically the same levels set in the closing months of 1921, when the impetus of new buying was begun as a result of the liquidation of overseas stocks. In announcing the January export totals to-day the Bureau of Foreign and Domestic Commerce instituted new classifications that have been so long desired by exporters.

The totals on the major items were as follows:

	January		December	
Pass. cars	(2047)	$2,025,974	(2646)	$2,349,282
Com. Vehicles	(464)	461,193	(511)	461,193
Parts, not including engines and tires		2,061,619		2,683,850
Tires, automobile only		1,412,602		1,391,635

The chief interest that will attach to these figures, in view of the fact that one of the largest producers, General Motors, has diverted its export shipments to Canada and that these do not appear in the United States totals given here, is in the classification of the different price and tonnage ranges of passenger cars and motor trucks. These are given in an adjoining table, but in recapitulating them, it is shown that the medium priced car class by far outranks in value either the lower or the higher priced categories and that the medium sized truck also held the center of the stage. This will be received with a distinct surprise by those executives of the industry who have held that the low-priced cars and the low capacity trucks were taking all of the present foreign business.

Passenger car exports are shown in three classifications, those valued at less than $800, between $800 and $2,000 and in excess of $2,000. The first classification shows 1330 cars valued at $691,065, the second 994 cars valued at $1,055,879, and the third 83 cars worth $279,030. Thus, the medium priced cars were something like a third less in number than of the low-priced class, but something more than 50 per cent greater in value. The cars included in these classifications will be readily comprehended, but it must be remembered that the declared valuation applying here represents the dealer's price, with discount and, in somes cases, chassis price only.

The truck classifications likewise are three, up to 1 ton, from 1 ton to 2½ tons and above the latter figure. The export statistics show 222 of the 1 tonners, with a valuation of $114,067, against 220 of the medium sized models with a value of $287,531. The higher capacity trucks were 22 in number, valued at $59,595.

Throughout the export figures there will be seen the result of the new classifications that have been put into effect by the reorganized Bureau of Foreign and Domestic Commerce, with its new commodity divisions. These classifications are shown in a table herewith, excepting for tires. An advance statement, however, on the tire exports shows the January shipments to have been as follows:

	No.	Value
Automobile casings	80,511	$1,148,616
Other casings	1,577	4,875
Automobile tubes	48,935	116,385
Other tubes	1,134	1,158
Automobile solid tires	3,890	147,601
Other solid tires	22,610	8,231
Tire repair material		10,293

Exports, Imports and Reimports of Automotive Products for January, 1921 and 1922, and for Seven Months That Preceded

	Month of January				7 Months Ending Jan. 31			
	No.	Value 1921	No.	Value 1922	No.	Value 1921	No.	Value 1922
Automobiles, including chassis	7,378	$9,409,920	2,897	$2,528,292	87,411	$114,855,029	19,332	$17,544,094
Electric trucks and passenger cars	....	.....	26	41,125	....	.....	26	41,125
Motor trucks and buses, except electric	1,539	2,516,379	....	.....	14,404	24,543,664	2,727	2,851,223
Up to one ton	....	.....	222	114,067	....	.....	222	114,067
Over 1 and up to 2½ ton	....	.....	220	287,531	....	.....	220	287,531
Over 2½ ton	....	.....	22	59,595	....	.....	22	59,595
Total motor trucks and buses, except electric	1,559	2,216,379	464	461,193	14,404	24,543,664	3,191	3,312,416
PASSENGER CARS								
Passenger cars except electric	5,819	$6,893,541	....	.....	73,007	$90,311,365	13,708	$12,164,576
Valued up to $800	....	.....	1,330	$691,065	....	.....	13,330	691,065
Valued over $800 and up to $2,000	....	.....	994	1,055,879	....	.....	994	1,055,879
Valued over $2,000	....	.....	83	279,030	....	.....	83	279,030
Total passenger cars, except electric	5,819	6,893,541	2,407	2,025,974	73,007	90,311,365	16,115	14,190,553
PARTS, ETC.								
Parts, except engines and tires	...	$9,679,181	Lbs. 7,934,879	$2,060,619	...	$52,272,569	...	$16,303,166
Station and warehouse motor trucks	98	81,699	6	7,590	408	233,772	69	76,749
Trailers	...	....	33	21,003	..	.....	33	21,003
Airplanes and Seaplanes	17	114,775	1	5,000	53	386,955	19	126,165
Parts of airplanes, except engines and tires	...	24,999	47,374	11,479	..	108,310	..	57,958
BICYCLES, ETC.								
Bicycles and Tricycles	....	$533,967	69	$9,460	....	$2,907,056	....	$424,519
Motorcycles	4,322	1,473,390	1,010	284,883	20,870	6,529,051	4,054	1,127,415
Parts, except tires	....	.....	Lbs. 229,918	131,677	....	.....	229,918	131,677
Gas engines	148	48,734	172	36,494	2,507	460,342	799	167,128
Traction engines, except agricultural	44	60,532	1	2,425	250	440,611	10	27,252
Automobile engines	231	65,691	1,182	143.397	9,007	1,641,046	5,417	877,069
Aircraft engines	....	.....	3	5,275	....	.....	3	5,275
Complete tractors, except agricultural	2,513	2,866,172	2	8,851	17,436	17,085,020	135	205,718
Other internal combustion engines	1,741	334.697	383	29,551	10,566	1,581,000	2,761	360,278
Accessories, parts	490	375,176	....	....	4,571	2,835,111	631	688,472
IMPORTS								
Automobiles	54	$94.653	36	$62,543	860	$905,093	313	$485.038
Parts, except tires	....	93,841	....	60,307	....	860,122	....	346,779
All other	....	12,428	....	4,955	....	380,931	....	87,428
RE-IMPORTS								
Automobiles (free of duty)	62	$90,258	137	$254,835	2,132	$3,223,888	2,089	$3,188,002

MEN OF THE INDUSTRY

Major Mark L. Ireland has been detailed by the Secretary of War to represent the army on the technical committee of the Lincoln Highway Association to determine the design for the Ideal Section, which the association will construct this year for object lesson purposes. Major Ireland is a director of the Tractive Resistance of Roads Research being conducted by the army with the aid of the Massachusetts Institute of Technology, at Cambridge, Mass.

William E. Betts has been made advertising manager of the Studebaker Corp. He was formerly engaged in advertising and sales promotion work for Willys-Overland and the Overland Harper Co. of Philadelphia. He goes to Studebaker from the Olds Motor Works, where he was engaged in special sales promotion work.

Guthrie Shaw has been appointed manager of the Accessory Products Corp., now located in its new headquarters, 519 West Twenty-third Street, New York City. The company has been appointed metropolitan distributer for genuine replacement parts of the Arvac Manufacturing Co., the Oakes Co. and the A. J. Detlaff Co.

Henry Harnischfeger, one of the founders and president of Pawling & Harnischfeger Co., Milwaukee, and also head of the Associated Machinery Corp., has left with his wife for a trip around the world, and will be gone from six to eight months. He will visit branch offices and look over general business conditions.

Charles Hughes Connelly, formerly western sales manager of the Miller Rubber Co., has been appointed general sales manager of the Carlisle Tire Corp. He has had fifteen years' experience in factory work and the merchandising of tires. His headquarters will be at the company's general office at Stamford, Conn.

Fred D. Williams has been appointed assistant to President John S. Broughton of the United & Globe Rubber Co. Williams has been general manager of the L. H. Gilmer Co. of Philadelphia for the last three years and prior to that was associated with the Johns-Manville Co. and the U. S. Rubber Co.

William G. Brown has been appointed general sales manager of the A. H. Petersen Manufacturing Co., Milwaukee. For the last eight years Brown has been with the American Bosch Magneto Corp. and resigned as western manager, with headquarters at Chicago, to take up this new connection.

Paul L. Battey, formerly vice-president of the Arnold Co., Chicago, and for years chief engineer in charge of various industrial enterprises, including the Willys Corp. plant at Elizabeth, has established himself at 123 West Madison Street, Chicago, as consulting engineer for industrial plants.

Harrison H. Boyce, general manager of the Moto-Meter Co., Inc., and E. V. Hennecke, sales manager, are making a tour of the country investigating trade conditions in the automotive accessory field. The investigation will extend over a period of approximately two months.

B. F. Metcalf has resigned as employment manager for R. & V. Motor Co., East Moline, and will leave in a few days to take up duties in Mexico in connection with the Rockefeller Foundation, with headquarters in Vera Cruz. Metcalf has been associated with R. & V. Motors for six years.

Frank S. Bradley, formerly secretary and general manager of the West Haven Manufacturing Co. since its inception in 1896, has accepted the management of the Robert Manufacturing Co., New Haven, Conn., as its president.

J. F. Kelly, Jr., export sales manager of the Electric Storage Battery Co., Philadelphia, is now on his way to Mexico, where he will remain for a month, visiting the automobile show and returning by way of Cuba.

Albert Hirst, Inc., has given up his Ford agency in New York City to become distributer of the Gray car. His territory includes the states of New York, New Jersey, Connecticut and Rhode Island.

John McConnell has again affiliated himself with the United Alloy Steel Corp. as vice-president in charge of operation. He has been associated with the steel industry for a number of years.

C. H. Tyler has been appointed district sales supervisor of Earl Motors, Inc., with headquarters at Indianapolis. He has had eighteen years' experience in the automobile business.

A. M. Leoni, who until recently was connected with the Steinmetz Electric Car Co. of Baltimore, has joined the Electrocar Corp. of New York as consulting mechanical engineer.

Lake Jones has been appointed district manager of the southeastern territory for the Ajax Rubber Co., Inc. His headquarters will be in Atlanta.

January Output Reached 90,486, Including Ford

NEW YORK, March 2—Production of passenger cars and trucks in the United States for January aggregated 90,486, including Ford. The total for December was 78,995 and for November was 116,349. The relative gain over December for January by manufacturers excluding Ford was 40 per cent on passenger cars and 38½ per cent on trucks. Ford's relative gain for January over December was considerably below this figure.

There are no production figures for January, 1921, with which to make comparisons, but the output this year was much larger than for the same month last year. Most of the increase for January over the preceding month was in passenger cars ranging in price from $500 to $1,250.

Canadian Plant of Durant Motors Turns Out First Car

NEW YORK, March 1—The first car was turned out to-day in the plant of Durant Motors of Canada, Ltd. When W. C. Durant announced on Sept. 2 that he had purchased the munitions plant at Leeside, near Toronto, he promised that it would be in production by March 1 and operations have been begun exactly on schedule. The Canadian plant makes the fourth Durant factory now in production. The others are at Long Island City, Lansing and Muncie. All of them are working up to quantity production.

No announcement has been made yet as to where Durant will produce the new $348 car he is to manufacture for a group of parts makers, but it is probable they will be produced at first in one of his present plants, probably that at Long Island City.

Pierce-Arrow Lost $8,763,712 in 1921

Balance Sheet Shows Net Current Assets of $13,651,323; Liabilities $8,665,522

NEW YORK, March 2—A total loss of $8,763,712 for the year 1921 is reported by the Pierce-Arrow Motor Car Co. after all interest charges, depreciation, inventory adjustments and operating expenses. As a result the balance sheet on Dec. 31, 1921, showed a profit and loss depreciation of $4,422,165 against a profit and loss surplus of $4,541,646 at the end of the previous year.

The general balance sheet shows net current assets of $13,651,323 against $19,754,535 in 1920 and net current liabilities of $8,665,522 against $7,332,138. The current assets on Dec. 31 last were divided as follows: inventory $11,246,697, receivables $1,930,662, cash $473,963. The current assets for Dec. 31, 1921, were: Inventories $1,647,662, receivables $195,773, cash $1,338,100.

The current liabilities for 1921 were: notes payable $7,150,000, accounts payable $1,393,322, dealers deposits $122,200, making a total of $8,665,522. For 1920 the current liabilities were: notes payable $5,750,000, accounts payable $1,450,538, dealers deposits $131,600, making a total of $7,332,138.

Lincoln Places $1,000,000 Order with Body Company

BUFFALO, Feb. 24—The Lincoln Motor Co. has awarded to the American Body Co. of this city a million-dollar contract for the construction of bodies for its new four and seven passenger cars.

Filling of the contract is expected to take at least six months. The work will call for an additional force of about 300 expert body builders. The Buffalo plant is at present working on the first lot of orders.

The product manufactured by the body company will consist of the body enameled, upholstered and equipped ready for attaching to the chassis.

Liberty Motor Creditors Agree to an Extension

DETROIT, March 2—Bank and merchandise creditors of the Liberty Motor Car Co. have agreed to an extension of credit and the company has obtained $300,000 new money by giving a mortgage on its real estate and equipment. The new funds will be used to develop a popular priced model to pay off small creditors and further liquidate inventories.

In the 18 months preceding Dec. 1, 1921, the company reduced its bank loans by $333,975 and paid merchandise bills amounting to $434,973. President Owen states that sales now are ahead of production. The creditors who entered into an extension agreement have appointed an advisory committee through which it is hoped to obtain additional permanent capital.

FINANCIAL NOTES

India Tire & Rubber Co. reports that during 1921 without refinancing in any way and without issuing new stock the company materially reduced its bank loans, wrote off losses on raw materials and finished merchandise on hand exceeding $400,000 and greatly improved its financial position. D. A. Grubb, secretary and general sales manager, states that the company now has 340 per cent more new accounts than the year before and that compared with the half of 1920, sales from July to January in 1921 show an increase of 130 per cent, while the value of the December business was the largest in the history of the company, being 181 per cent larger than the same month the previous year.

Motor Wheel Corp. operating profits for the year ended Dec. 31, 1921, were $599,590. The company has $1,058,807 cash with total current assets of $3,752,105. Current liabilities aggregate $273,691. Inventories have been depreciated $266,249. With reductions for inventory deflation and Federal taxes the net profit for 1921 is $301,340. Preferred stock of $75,000 has been retired and additional purchases have been made from the sinking fund on the open market of $169,000, beside the purchase of a small amount of common stock. New business on the books is reported as the largest in the company's history.

Edmunds & Jones Corp., in its balance sheet as of Dec. 31, shows total assets of $1,995,582.28 and a surplus of $1,046,466.29. Assets include cash, $293,272.21; accounts and notes receivable, $203,906.48; inventories, $455,783.63. Plant accounts, less depreciation, are $967,996.92. Profits for 1921, less Federal taxes, are $97,580.79. Dividends paid on the preferred stock in the four quarters totaled $58,219. In a report to stockholders, President Edmunds states that despite heavy losses in the first six months of the year due to inventory inflation, the net profit for the year approximates that for 1920.

S. F. Bowser & Co., Inc., Fort Wayne, Ind., announces that forty-six executives are to be allotted portions of the common treasury stock of the company in a total amount close to $500,000. It is the plan to permit key men in the organization to purchase this stock on a basis that will enable them to pay for it easily in the next few years. S. F. Bowser and Allan A. Bowser who have held the greater part of the stock for years are releasing it in this manner as a reward for good service and to stimulate the men's interest in the business.

Republic Rubber Corp. operating costs have been greatly reduced, according to Receiver G. H. Booth. He states that important distributing connections are being made despite the sentimental handicap of the receivership and forecasts an increased volume of business which will make the company show an operating profit. The company is said to be employing 1,000 men.

Mason Tire & Rubber Co., Akron, reports sales of $8,986,000 for the 14 months ended Dec. 31, 1921. Current assets as of Dec. 31 are placed at $2,675,606; current liabilities, $859,863; surplus account, $11,139; inventory, $1,363,458. Cash account is stated to be $240,000; accounts and notes receivable, $1,071,767; notes payable, $774,613; reserves, $115,882.

Timken-Detroit Axle Co. has declared a regular quarterly dividend of 1¾ per cent on preferred stock, payable March 1, to stockholders of record Feb. 20. Resumption of common dividends was considered, but action was temporarily postponed.

Advance Rumely Thresher Co. has declared a regular quarterly dividend of 75 cents on the preferred stock, payable April 1, to stock of record March 15.

Goodyear Tire & Rubber Co.'s income account for the eight months ended Oct. 31, 1921, shows net profits after all charges of $3,273,845.

Hays Endorses Wells' Transportation View

WASHINGTON, Feb. 27—The time is not far distant when motor vehicle transportation will be universally recognized, in the opinion of Will H. Hays, postmaster general. His belief is expressed in the following statement:—

"A little while ago I read an article by H. G. Wells that I wish might be read by every business man; in fact it could be read with advantage in every school house in America. Wells traced the development of civilization to two factors, transportation and communication. These have been the vital factors that have enabled human beings to develop so marvelously and so rapidly in the last few hundred years.

"The Post Office Department is the government department of communications. We are all glad and proud to be associated with one of the vital factors in civilization. But we also touch upon transportation, and I look forward to a time not far distant when motor vehicle transportation will be universally recognized as one of the vital factors in the development of civilization."

AUSTIN OUTLOOK GOOD

LONDON, Feb. 17 (*By Mail*)—In a circular letter to shareholders of the Austin Motor Co., Birmingham, England, the chairman, Sir Herbert Austin, announced that the necessary agreements have been reached with bankers, creditors and the Government to a plan which provides sufficient working capital for carrying on the business successfully. It is stated that the prospects at the present time are very encouraging and the contracts entered into for the home market total well over £3,000,000.

U. S. TRACTOR BOND ISSUE

MENASHA, WIS., March 1—A bond issue of $250,000 was decided upon at the annual meeting of the United States Tractor & Machinery Co. and the capital was increased to $2,500,000. The bond issue, it is stated, is to provide for an immediate increase in factory capacity and equipment. J. M. Robinson was re-elected president of the company and G. D. Harris vice-president and general manager.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During the past week call money rates ranged from 4 per cent to 6 per cent, as compared with 4 per cent and 5 per cent in the previous week. Funds were in fair supply and brief periods of flurry, due mainly to withdrawals by out-of-town institutions, were succeeded by a firmness which developed toward the latter part of the week. In the time money market the rates ranged from 4¾ per cent to 5 per cent for all maturities from 60 days to 6 months. The rates for prime commercial paper remained unchanged at 4¾ per cent to 5 per cent.

The Federal Reserve statement as of Feb. 21 showed an increase of $4,900,000 in total reserves, which was the net result of an increase of $10,780,000 in gold reserves and a decrease of $5,880,000 in other reserves. Total earning assets showed an increase of $89,652,000, while total deposits decreased $85,293,000. Federal Reserve notes in circulation increased $3,561,000, while the reserve ratio also increased from 76.4 per cent to 78.1 per cent.

The total reserves of the New York institution declined $43,429,000. Other decreases noted were the following: $36,086,000 in total bills on hand; $74,522,000 in earning assets; $34,662,000 in total deposits. Federal Reserve notes in circulation, on the other hand, increased $4,753,000, and the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 81.9 per cent to 87.1 per cent.

On Feb. 27, sterling exchange at $4.43¾ reached a new high record for the upward movement which has been in progress for some weeks. On Feb. 28 the discount on Canadian funds was only 2 per cent, which was a new low and marks an approach toward normal.

According to the Bureau of Labor Statistics index number, wholesale commodity prices for the month of January declined 7/10 of one per cent, as compared with no changes a month ago. With the exception of farm products, which showed a small gain, every group of commodities showed some recession. The general level still stands 48 per cent above the level for 1913, although it is approximately 45 per cent below the peak reached in the spring of 1920.

WILLS MAKE NEW CLOSED BODIES

MARYSVILLE, MICH., Feb. 27—C. H. Wills & Co. is now in production on three new closed bodies for the Wills Sainte Claire line, these being an imperial sedan, a town car and a limousine. The sedan is $3,575, and the town car and limousine, $3,850. The sedan has features of both a limousine and a sedan, having a glass partition which can be raised or lowered to divide the car into compartments. The limousine and town car have the same dimensions as the sedan, except that the space between seats varies.

INDUSTRIAL NOTES

Auto Body Co. has recently increased operations at its plant in Lansing, due to a contract with Durant Motors for open car bodies. January production was 85 per cent more than January, 1921. About 400 men of a normal force of 1000 are working. W. V. C. Jackson, vice-president, reports the company's indebtedness reduced greatly during the year.

Motor Wheel Corp. will open a Detroit office with M. W. Taber special representative in charge. R. I. Miner, in charge of the pressed steel division activities in Detroit, will occupy the same office. Taber's duties include the handling of both the manufacturers and distributor's end of the work. For the last year he has been in charge of steel wheel distribution in the Michigan territory.

American Brass Co., Kenosha, Wis., works, now owned by the Anaconda Copper Co., will add a new department for producing fine copper wire. The Kenosha branch has available a large group of buildings adjoining the main plant and formerly owned by another industry which is readily convertible for the wire mill.

Buckeye Manufacturing Co.'s plant and equipment at Anderson, Ind., has been sold at receiver's sale to James W. Sansberry, a local banker, for $45,100. The property was appraised at $170,000. The company formerly made automobiles, tractors and engines. The liabilities of the concern are said to approximate $200,000.

Rainbow Tire & Rubber Co., Delaware, Ohio, reports that, at the present rate of financing, production should start within the next few months. The factory is practically completed at a cost of $175,000 and is free from indebtedness. All directors were re-elected at the annual meeting.

Franklin Automobile Co.'s report to the Federal authorities shows that the number of employees who earned $1,000 or more during 1921 was only 10 per cent less than the number who earned that amount during 1920.

Visible Pump Co., Fort Wayne, Ind., which is moving to Findlay, Ohio, has leased the former property of the Grant Motor Co. in that city and will begin operations there within a month.

Ashtabula Tire & Rubber Co. has purchased the plant erected by the Pierce Tire & Rubber Co. at Niles, Ohio, some years ago and will rehabilitate it for operations not later than March 15.

Kirkland Bros. Machine Co., Detroit, has organized a company of the same name in Springfield, Mass., to act as a factory branch. Incorporation is for $250,000.

Storm King Manufacturing Co. has moved its factory equipment and offices from Winneconne, Wis., to Hortonville, Wis.

American Bushings Co., Marysville, Mich., is operating with two shifts, due to the receipt of a large volume of orders.

India Tire & Rubber Co. has established a branch warehouse at 250 West 54th Street, New York City.

DUAL TRACTOR PLANT SOLD

DECATUR, ILL., Feb. 27—Bondholders of the defunct Dual Tractor & Truck Co. have purchased the company's plant and have changed the name to the Decatur Machine & Specialty Co. A charter has been granted by the secretary of state to operate a machine shop with the capital stock fixed at $50,000. All bondholders of the old company were given the privilege of exchanging their claims against the old company for stock in the new. Most of them accepted the offer and the plant has been re-opened. It will specialize in motor vehicle work of a special or engineering type.

Argentina Harvest Returns Satisfactory

BUENOS AIRES, ARGENTINA, Jan. 17 (by mail)—Returns from the present harvest are quite satisfactory and the demand for wheat seems more active. This also applies to livestock, and the sales of wools and hides have almost reached a normal volume. The tendency is upward, and each week sees further advances

Most car stocks have been liquidated, and new orders will be required commensurate with present day requirement. The truck market, however, remains dull, but tires and tubes are more active than for many months past, especially in the smaller sizes.

The belief is that within a few months the present progress of Argentina on the road to recovery will be speeded up considerably, and that by the latter part or end of 1922, business will again be booming.

Studebaker Denies Report of London Factory Branch

SOUTH BEND, IND., Feb. 28—In the absence of President A. R. Erskine, N. R. Feltes, treasurer of the Studebaker Corp., declares there is no truth in the rumor that the corporation is negotiating for the purchase of the Ensign car factory near London, England, to be used as a factory branch.

Report from London

LONDON, Feb. 14 (*By Mail*)—The Studebaker Corp. is reported to have bought the recently built Ensign car factory at Willesden Green, London, N.W. It is stated that it is not intended to assemble cars at this plant but to use the facilities available for repairing and distributing Studebaker products. At the same time the company, it is said, will continue to occupy its present showroom on Gt. Portland Street.

HANSON ABSORBS COMPANY

ATLANTA, March 1—George W. Hanson, president of the Hanson Motor Co., announces that the company has absorbed the American Motors Export Co. of Jacksonville, Fla., and that the two industries have been merged. The joint company, which is to be known in future as the Hanson Motors Co., will maintain headquarters in Atlanta and also operate a plant at Jacksonville.

METAL MARKETS

ONCE more steel mill operations have attained a rate which, if it can be slightly enhanced, will permit of reductions in the cost of production that should enable the majority of mills to make a fair profit at prevailing market levels. It is axiomatic of most steel mills that when three-fifths of their capacity is engaged in production the balance will come out on the right side of the ledger. Sheet mills are operating at a rate of two-thirds to three-quarters of capacity, in some instances even higher. The leading interest is reported to be operating at 70 per cent of the capacity of its sheet mills.

Taking the industry as a whole, however, it is operating at somewhere between one-half and two-thirds of its capacity and the goal of those mills which are now turning out slightly more than one-half of what they could produce, if their entire capacity were engaged, is to get enough orders on their books to permit of operating their plants at three-fifths of their capacity. Amid this intensive effort to speed up the momentum of the demand upward changes in prices would defeat their own purpose, while reductions would upset the ultimate aim of producers; i.e., modest profits based on the prevailing market.

Individual concessions of a minor character, when specifications are attractive, fit, however, very nicely into this scheme of things. Here and there buyers have voiced uneasiness because of the recent advance in the pig iron quotations of some of the larger interests. In a large measure this attempt to lift the pig iron market to a higher level was the result of increased demand for steel. As a direct consequence of this latter condition steel mills are now working up all of their pig iron production, whereas up to a short time ago they competed for business with the merchant furnaces. The latest market letters of the leading pig iron sellers paint a glowing picture of the better feeling that has come over the market. Undoubtedly there has been a perfectly natural increase in the demand concurrent with the increased melt by foundries.

Pig Iron.—Thousand-ton sales to automotive foundries are few and far between. Those that have been made carried prices somewhere between the old and new asking prices. Most of the automotive buying is in carloads.

Steel.—As the result of improved automotive demand, alloy steel producers are operating on a much more satisfactory basis Demand for skelp for automotive purposes had broadened impressively, a Detroit interest being reported to be in the market for a large tonnage of strip skelp. Some sales of sheet bars at $29 appear to have been made recently. Very little change is to be noted in the sheet situation, prices holding steady with slightly less fresh business in full-finished automobile sheets. Automotive interests are placing more liberal orders for forging bars, and cold-drawn steel bars continue in active demand. Pittsburgh strip steel producers report sales of attractive tonnages to automotive interests. There has also been a slight revival in automotive demand for bolts and nuts.

Aluminum.—While the sheet market is fairly steady that for virgin ingots, 98 to 99 per cent pure is still debatable ground with odd lots of imported metal changing hands at slight concessions from prevailing quotations.

Copper.—The market continues weak.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, **Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria**

Sept. 15-20—The Hague. Automobile Show.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

CONVENTIONS

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24 — White Suplur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Kansas Sales Pivot Is Small Town Bank

Public Wants to Buy, Credit Is Ample, But Financiers Halt Procession

KANSAS CITY, MO., Feb. 27—The public wants cars and is ready to buy them. The dealers are ready to sell them. Credit facilities are ample. The bankers in smaller towns stop the procession.

Therefore, the chief effort of many distributors here is to see that bankers adjust themselves to the other conditions —and let dealers and public have money for cars.

The campaign to sell the idea of motor cars to bankers is not confined to this personal contact of travelers and dealers with bankers. The distributor himself keeps in close touch with each of the bankers in his dealers' towns. The wholesale manager himself knows most of them and sends letters to them occasionally.

One type of letter has proved of very great value. This is the letter announcing new developments in the motor car field; sometimes a factory circular letter with appended note from distributor, sometimes a personal letter from the distributor giving or calling attention to the information. In this way the banker is kept posted on the industry; and when dealer or traveler makes some statement the banker knows what he is talking about and responds the more cordially.

Cleveland Business Men Interested in "Glenwood"

CLEVELAND, Feb. 27—Most of the officials of the Glenwood Motor Car Co., which has purchased a fifteen acre tract at Youngstown on which will be erected a factory for the production of a car to be known as the "Glenwood," are Cleveland business men.

B. J. Cline of this city is president of the corporation. He was associated with the Pierce-Arrow Motor Car Co. at one time and later was production manager for the Chandler Motor Car Co. During the war he served with the Aircraft Board. T. D. Lamb, president of the Hess Body Co., is treasurer; Captain R. L. Queisser of R. L. Queisser Co., is secretary, and William H. Graham, a florist, is a director.

The Glenwood company is a $5,000,000 corporation with 50,000 shares, $100 each, of preferred stock and 200,000 shares of no par common. The company has under control an engine which has developed what is said to be unusual power, but, for the present, Cline has no announcements to make about the car.

McDonald Is Honor Guest at N. A. C. C. Road Dinner

NEW YORK, March 2—Thomas McDonald, chief of the Bureau of Public Roads, was the guest of honor at a dinner given by the Highways Committee of the National Automobile Chamber of Commerce at the Hotel Ambassador last night. Most of the guests were representatives of newspapers, trade and business papers.

The purpose of the meeting was to discuss the present status of highways in the United States and to enlist widespread co-operation in highway construction and maintenance work which will be carried on in the next few years. Edward F. Jordan, president of the Jordan Motor Car Co., president. George M. Graham, vice-president of the Chandler Motor Car Co., emphasized the essential character of motor vehicles.

FORD BUILDING 3400 DAILY

DETROIT, March 2—The Ford Motor Co. is operating at the rate of 3400 cars a day on a four day a week schedule. The March schedule calls for between 60,000 and 65,000 cars.

PAYS JACKSON CREDITORS

NEW YORK, March 2—Associated Motor Industries, Inc., has made a small payment to the creditors of the Jackson Motors Corp., which was taken over a few months ago by the Delaware corporation as part of a proposed automotive merger.

Clouds Overhanging Iowa Start to Break

Improvement in General Business Conditions Reflected in Outlook of Trade

DES MOINES, Feb. 27—There is a break in the rather dark cloud which has hung over the motor car horizon in Iowa during the past year. The month of February sees the most cheerful outlook which Des Moines dealers and distributors have encountered in many a moon, and there is evidence that at last the corner has been turned and that business conditions are on the upgrade.

As a concrete evidence of the improvement, it is noted that in the first fifteen days of February 102 new passenger cars were registered with the state automobile department for Polk county, in which Des Moines is located. There were nine new trucks registered during this period.

Prices Advancing.

Improvement in business conditions in general and better prices for farm crops in particular are credited for the better outlook of the trade. During the past six weeks prices of wheat, corn, oats and hogs have shown a steady advance, and as Iowa is a leading corn and hog raising state this improvement is bound to put the farmer in a much better position. Corn has practically doubled in price within the last ninety days.

While the recovery of the farmer and his return to the market is to be a slow process, there are evidences that he has already started back. An inquiry conducted by one automobile dealer among 689 farmers in his territory elicited the information that of that number 87 made a definite statement that they would buy a new car this spring. Last year a similar inquiry was conducted by this dealer, and of 712 farmers interviewed only 13 made such a definite statement.

The condition in the truck business would also seem to show some improvement, particularly in the eastern cities of Iowa. This condition is, however, confined almost entirely to city business.

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Market Analysis Essential to Used Car Sales

Knowledge of markets essential in solution of used car problem. New car market and used car market must be considered as a unit. Service of used car has important effect upon reputation of manufacturer. Dealer quotas must be established fairly.

By Harry Tipper

THE market for the automobile is affected by the entire consideration from the time the automobile is produced to the time when it reaches the junk pile. The size of the total car population in any locality is directly affected by the service rendered by the automobile and the valuation placed upon it at different stages in its usefulness.

So long as the possession of a car was the most important reason for the distribution of automobiles there was no great tendency to consider intimately the cost of its operation nor the depreciation in its value. As the car population has grown, however, until the car has become familiar and most of the new car buyers have previously owned vehicles of this kind, the cost of operation and the depreciation in value become more important. For the great majority of the people in this country the original investment in the price of a car is not so important as the amount of money which must be paid out each month in order to keep the car running. This relates not merely to the new car but also to the second-hand car and its operation.

The total volume for new cars is related to the life of the vehicle, and also to the second-hand valuations. It is obvious that the market for new cars of any particular manufacture is affected by the life of that particular car and the service it will perform in comparison with its valuation when it is transferred second-hand.

The manufacturer of automobiles, therefore, is intimately interested in the problem of valuing and disposing of used cars. The flow of new cars into the market must be regulated to agree with the flow of second-hand cars from buyer to buyer until they are junk. If there is any hesitation in the transfer of the vehicles at any point along the line, this will show itself in a lessened market for the new product, sooner or later, as a consequence.

It was stated in a previous article that the market conditions had not required a valuation on the part of the public as to the new car in relation to its service. Only lately has the buyer of a new car compared values with services for his particular purposes. The same thing has been true in the used car market. So long as the production was not sufficient to meet the demand, the used car sale was an individual matter between the buyer and the dealer. It represented no great comparative examination from the standpoint of service and it was not subject to the conditions of depreciation imposed by such valuation.

The general tendency must be for used cars from any given price group to come within a reasonable

comparative value—type, make and model considered. At present this is visible only as a tendency. The prices asked for used cars show an unstable market and a variation in valuation which does not aid the flow of the product, but which has a tendency rather to slow up the progress through which the automobile must complete its usefulness and reach the junk pile.

Every car that is being used by an individual owner, whether he has bought it new or second-hand, brings him into the business as a probable permanent customer for cars, or tends to drive him out of the business because of the difficulties imposed upon him by his first adventure. No matter what price may be paid for the used car, it is of no value unless it is in a condition to give service. No matter from whom it is bought, some of the difficulties that may be experienced reflect back upon the maker of the car and affect his market for the new product. It is obvious that the trade-in feature of the used car problem has affected the values and left the dealer in a position where he has paid more for such cars than it is possible to secure for them. It is obvious, in other words, that the trade-in has created a fictitious value in many cases for the used car and has slowed the progress of used car sales because of the loss entailed in moving them rapidly on to the market.

While this problem, of course, is a problem of the dealer, in the usual interpretation the manufacturer's market for new products is so intimately affected by the conditions operating in the used car field that it is necessary for him to advise with and co-operate with his dealers in the endeavor to put this proposition upon a more stable foundation, so that the market value can be determined within reasonable limits and the conditioning done on a reasonable basis.

Similar problems have been met in other fields in their history of development, notably in the typewriter field, where exchange has persisted for a great many years. In the course of its development the typewriter field has progressed to the point where a typewriter has a valuation in proportion to its age and model, without much regard to its particular condition. It is likely that the tendency in the automotive field will be to establish valuations more in accordance with the year and type of a car, the make, etc., and less in accordance with the particular conditions of the individual car taken in.

It is unlikely that trading will decrease to any great extent in the near future, but it is probable that such trading will have to be done on a basis of more accurate general valuations which will permit of the proper conditioning so that the used cars will be serviceable when they are bought. So long as a car is being run with the maker's mark on it, to be recognized as the production of a certain factory, the service of that car is important to the manufacturer because it is affecting the opinion of some car buyer and reflecting upon his possible new sales. In the history of its progress any individual car passes out of the control of the manufacturer or his dealer, although its influence upon his future sales continues until it is junk. As a consequence the manufacturer is closely concerned with the ability of the dealer in the automotive field, the repair shop and the service station to value a used car properly, to sell it in such a way as to permit conditioning and to give a reasonable amount of service.

The present acute condition in the used car field is due mainly to the anxiety of the dealers to sell new product without considering sufficiently the character of the trade and its effect upon the total cost of the business. The fact that the used car would be affected by the same causes which affect the sale of new cars does not appear to have been thoroughly understood, and the further fact that backing up of used car sales must affect the new car market was largely overlooked. The present acute problem will be solved partly by the necessities of the dealer and partly by the effort of alert manufacturers, through co-operation, aiding the dealers to relieve themselves of this difficulty. It is likely to remain a difficulty, however, for some time until the manufacturer and dealer thoroughly realize that the market for automobiles is inseparable and that the conditions affecting the market affect the whole market whether the product be used cars or new cars.

It will be a difficulty until the manufacturers and dealers realize that the used cars must be conditioned before being sold if they are to exercise proper influence upon the future sales of new cars of similar make, and it will be a difficulty until the character of the service and the extent of the service in repairs, rebuilding and adjustment are sufficient to take care of the requirements of the field in this respect, so that the used cars may be bought upon a known basis of value and without the suspicion attaching to much of this business at the present time.

This part of the automobile market, although it has been discussed as a separate proposition, really affects the whole question of new car sales, the question of service, the repair shop equipment and car values. It should have a considerable place in the discussions leading up to the contract between the manufacturer and the dealer, and, in the course of time, it is likely that it should have some kind of a place in the contract itself where it relates to those cars affected by the contract conditions. The used car problem is a problem because of the following conditions:

1. The absence of established values so that no buyer is sure that he has received a proper value when he buys a used car.
2. Trades made without reference to the legitimate value of the car to be turned in and upon the individual condition of the car.
3. The sale of used cars without a proper amount of allowance for conditioning so that they would be in serviceable shape when they are bought.
4. The lack of proper facilities, sufficiently widespread in all parts of the country, for the general repairing and rebuilding of used cars so that the service can be extended to them whether they are in or out of production, until they no longer pay for repairs and are ready to be disposed of at the junk pile.

(*Continued on page* 550)

THE used car problem is acute. It will be solved partly by the necessities of the dealer, and partly by the effort of alert manufacturers through co-operation with the dealers.

It will remain a difficulty, however, until the manufacturer and dealer thoroughly realize that the market for cars cannot be divided; that the conditions affecting the market affect the whole market, whether the product be new or used cars.

The dealer cannot maintain his business in new cars unless he can see his way clear to dispose of the used car involved in the first transactions. Manufacturers must take this fact into account when planning production and establishing quotas.

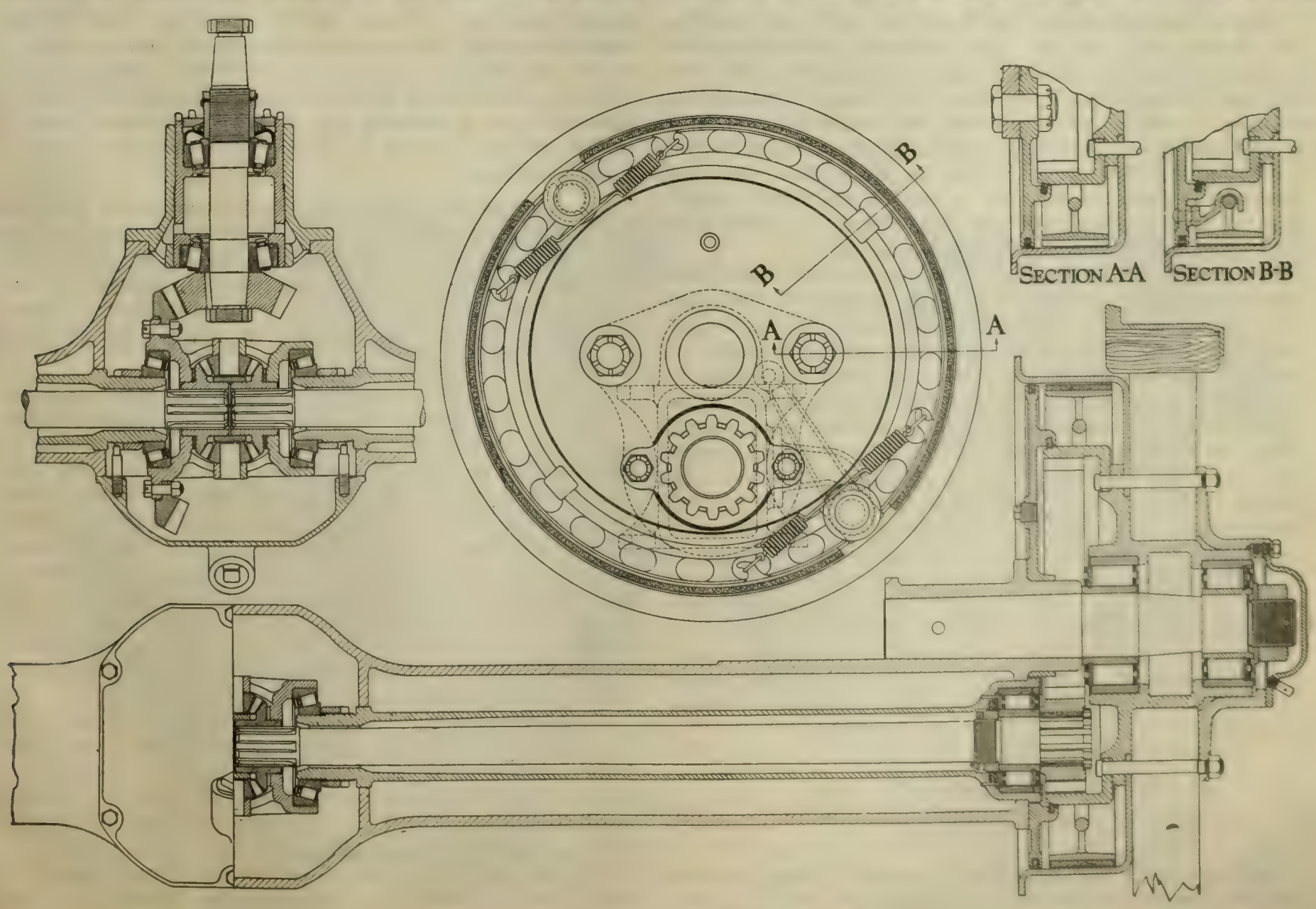
An Axle Designed Especially for Bus Applications

Is of internal gear type with differential and axle shaft below instead of in front of wheel spindle. It is thus possible to mount the chassis frame several inches lower than with conventional types. The design is quite simple, affords good accessibility and incorporates a number of refinements.

By Herbert Chase

TWO sizes of internal gear axles intended primarily for use on bus chassis have recently been designed by the Britton Axle Co. In general design the axles are similar to Britton truck axles, but in this case the live axle shaft is placed directly under instead of in front of the wheel spindle. By the use of this type of construction it is possible to make the frame of the chassis several inches lower than is otherwise possible, a considerable advantage so far as bus construction is concerned. The top of the differential case is slightly over 18 in. from the ground and the outside diameter of the case is only 10⅝ in. when 34-in. tires are employed, while the spring seats, which do not require the use of separate chairs, are 1⅛ in. lower than the axis of the wheel. The ground clearance under differential is 7-7/16 in. In addition to these features the axles incorporate certain refinements in design which are readily seen by reference to the accompanying cut.

The differential is carried on the inner ends of a tubular member which surrounds the axle shaft and projects into the central differential chamber. These ends are threaded to receive collars which permit side adjustment and hold the differential against motion parallel to the axle. The collars are locked in turn by pins which project from the inner wall of the case cover into slots cut in the collar. The cover cannot be put in position without locking the collars. The tubular members are recessed to carry the pinion bearing at their outer end,



Sectional views of the new Britton bus axle

and are held in place by two bolts which when removed permit the tubes to be slipped axially outward after which the differential can be withdrawn.

The live axle or jackshaft is of high-grade alloy steel and is splined at each end. The arrangement is such that the pinion is very close to the bearing.

The brake anchorage plate is recessed on its outer circumference to receive a packing intended to prevent water and dirt from entering the brake drum, and carries a second packing set on an angle and arranged to retain oil within the polished tapered surface of the internal gear against which it bears. The latter is of 3½ per cent nickel steel rolled or spun into shape from a flat integral piece. The teeth only are carbonized. On the model 30 axle there are 48 teeth of 4/5 pitch, 20 deg. pressure angle and 1½-in. face. The gear is secured to the wheel hubs by twelve ½-in. alloy steel bolts which pass through the gear flange, hub flanges, brake drum and wheel. This construction permits replacement of the gear more easily than when the latter is riveted to the hub flange.

The pinion, which is also of carbonized alloy steel, is held in place by a threaded collar which is screwed onto the axle shaft and turns against an oil-retaining washer. The latter, together with the washer referred to above seal the gear chamber, which is said to remain tight when containing three pints of thin differential grease which lubricates the internal gear and the three bearings of the wheel and pinion. The taper roller bearings used on the bevel pinion shaft are mounted in an adjusting cage which can be moved axially without disturbing the bearings, but the latter can be adjusted by turning the integral hex sleeve and nut mounted on the shaft after which these are positively locked in place by a tongued washer between the two. This construction avoids the use of two nuts and a plain spacing sleeve which, if the packing is made oil tight, is apt to hold the sleeve stationary and allow the nuts to wear and thereby destroy the bearing adjustment.

The bevel gears are of 3½ per cent nickel steel, with 4-pitch carbonized teeth, 30 deg. lead angle and 1¼-in. face. The ring gear has 37 teeth and the pinions from 13 to 22 teeth, giving total reductions, including that in the internal gear of 9.76 to 5.77 to 1. Spring centers on the model 30 axle are 42½ to 45¼ in. The tread is 70 in. and the load capacity 8000 lb. One set of brakes is provided. These are of the internal expanding type and are easily removed by simply disconnecting the springs seen in the drawing.

The high-section modulus of the box-shape section of the axle is said to give it unusual rigidity with moderate weight. The makers claim that the axle contains a smaller number of both manufactured and standard (purchased) parts than any other similar axle on the market. With one exception right and left hand parts are the same, and the axle is so designed that it can be produced with the same tool equipment used on Britton truck axles.

Market Analysis Essential to Used Car Sales

(*Continued from page* 548)

The car dealers in any particular locality must analyze the market for cars for the particular period covered by the contract so that the market analysis takes into account the probable number of new cars, the probable number of trades required and the outlet for the used cars involved in the trades. This requires a much keener analytical consideration of the territory than we have been accustomed to give to it, and it requires a more careful consideration of the movement in individual ownership to be observed in that locality.

The dealer cannot maintain his business in new cars unless he can see a clear way to dispose of the used cars involved in the first transactions. New cars may be forced upon the local market by aggressive means of selling, to some extent; but this additional sale will involve a larger percentage of trades and will result in the dealer's failure to dispose of his used cars at a proper rate. In proportion to the number of cars in a community or a territory, the tendency of the increase in registrations and the condition of the cars owned in that locality would indicate the probable market for new cars. As the increase in registrations becomes smaller in its percentage against the total registrations, the virgin market for new cars becomes correspondingly smaller and a larger proportion of the market must come from those who own cars at present. Both new and used cars will be sold increasingly to people who have owned cars previously, and the total car market in the locality is confined:

First—To those who come in as new buyers of cars.
Second—Those who replace worn out cars.
Third—Those who desire to change an older type of car for the improved current type.

In general, in the country this year a great many of the car buyers will be in the second and third classes, and in each case of this kind the used car must be disposed of, either by trade or by individual sale. In any case there must be an adjustment of the new car buying to the disposal of the used cars. There must be a reasonable adjustment of valuations between the two or there will be a backing up, either in the used cars or in the new cars, with a final effect upon the manufacturer's market.

The quotas established in the contracts between the manufacturer and the dealer must recognize the conditions in the locality, and should be established upon a fair analysis of the probable number of new cars required in order to permit the dealer to carry on his business effectually and to keep the business properly balanced.

From the manufacturer's standpoint, this establishment of a fair quota basis is of great importance because every new car sold without the corresponding flow of the used cars toward their destination as junk will obviate a future sale of the new cars until the choked condition of the used cars on hand is removed. This means, of course, a reasonable valuation, upon a more stable basis, of the used car so that it will not involve greater service value than the new product nor materially less service value in proportion. It is a more difficult matter for the dealer to finance himself on used cars, and they must flow in and out regularly if he is to maintain a sound business condition.

To the manufacturer a stock of used cars in the hands of various dealers is a menace to his future new sales. This is bound to happen unless the quotas are established on a careful and reasonable analysis and not merely upon the ability of the manufacturer to force the dealer into accepting the conditions.

In this problem, as in the question of new car sales, the thorough analysis of the territory looms up in importance.

Weidely Producing a New Engine

Is six-cylinder overhead valve type, intended for light and medium weight cars and is built in two sizes having respectively 3¼ and 3⅜ in. bore. Force-feed lubrication is used throughout and the crankcase and cylinders are cast in block. Is said to develop 1 h.p. per 3.95 cu. in. displacement.

By J. Edward Schipper

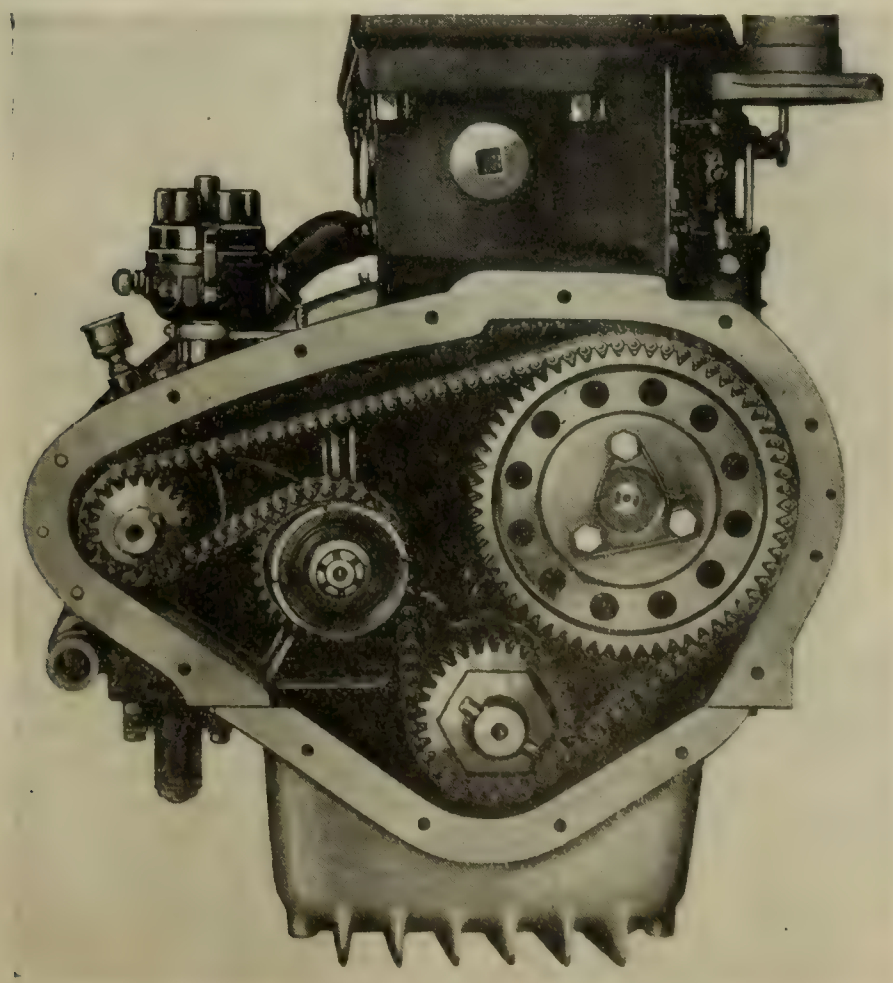
A NEW six-cylinder engine for light and medium-weight passenger cars has been brought out by the Weidely Motors Co. It is to be marketed under the name of Forty Point Bulldog and will be immediately put in production.

The new unit is an overhead-valve type, 3¼ x 5 in., developing 63 hp. at 3000 r.p.m. With a displacement of 248.9 cu. in., this is 1 hp. per 3.95 cu. in. displacement. The unit is also provided in 3⅜ x 5-in. size and is furnished with a No. 3 bell-housing for a unit power plant. The six cylinders, together with the crankcase, are a single casting, a detachable head and an aluminum underpan completing the engine structure.

It is claimed that high torque is developed throughout the entire range of speed. The compression is 77 lb. absolute at 200 r.p.m. with wide-open throttle. Considerable attention has been given to balancing of the engine; to reduce vibration to a minimum a large diameter crankshaft is used, and reciprocating parts are kept light and equalized. The pistons, including the wrist pin and three rings, weigh 1 lb. 8.7 oz. each. With the connecting rod the assembly weighs 4 lb. 3.7 oz., and the piston alone, without wrist pins, 1 lb. 2.3 oz. The clearance of the cast-iron piston ranges from 0.002 in. to 0.003. The pistons are dome topped and are 3⅜ in. in length. The piston pin is fastened in the piston, the bearing being in the upper end of the rod. S. A. E. steel No. 1020 is used for the piston pin, which is hardened and ground. The pins are 1 in. in diameter and weigh 3.10 oz. The piston castings are made with finish allowance for grinding only, and it is claimed that this results in a much harder and closer grained unit than is secured when more material is left for removal in machining. The piston rings are a deep, narrow type.

The crankshaft has three bearings and is forged of No. 1045 S. A. E. steel; it is 2⅜ in. in diameter and weighs 79 lb. The main bearings are of the bronze-back, babbitt-lined type. The front bearing is 2⅜ in. in diameter by 2¼ in. in length, while the other two bearings are 2⅜ by 3 in. End thrust is taken up on the front bearing. The connecting rods are I-section drop forgings, of 11 in. center-to-center length, and weigh 4 lb. 3.7 oz.

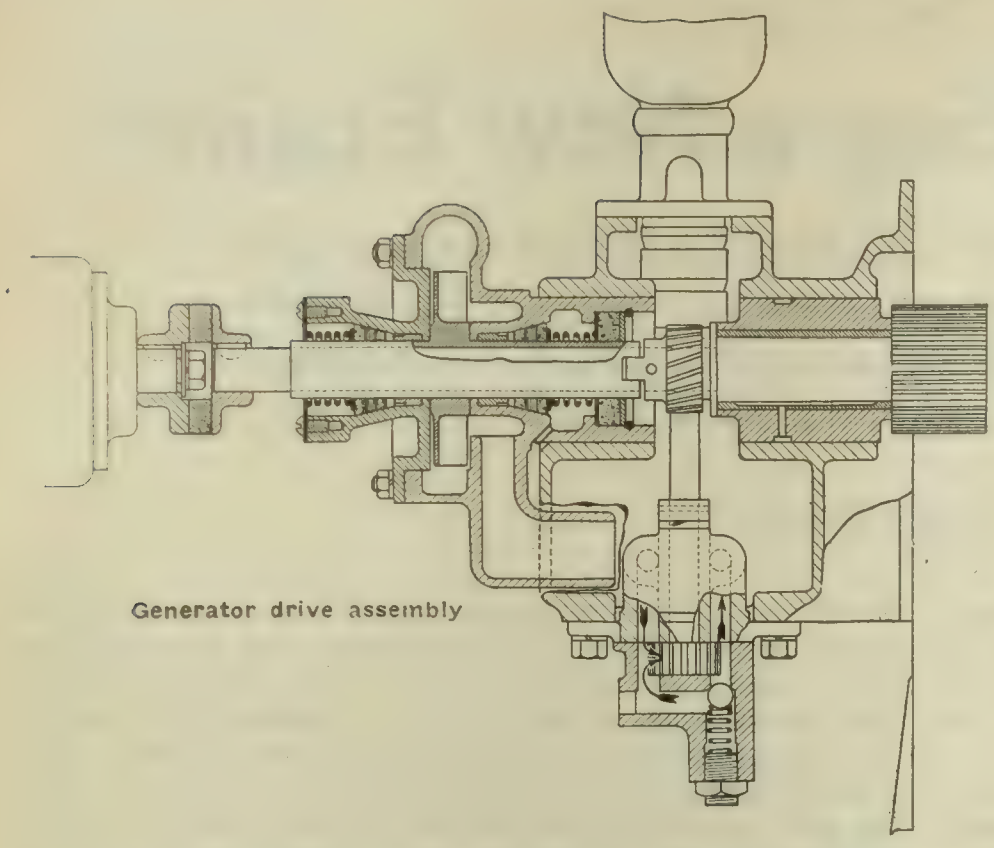
The timing drive is by chain. This is a Link-Belt unit having an automatic adjuster which takes care of the chain stretch. The take-up is on the flat side of the chain, as shown in the illustration herewith. The camshaft is drop forged from S. A. E. No. 1020 steel and is



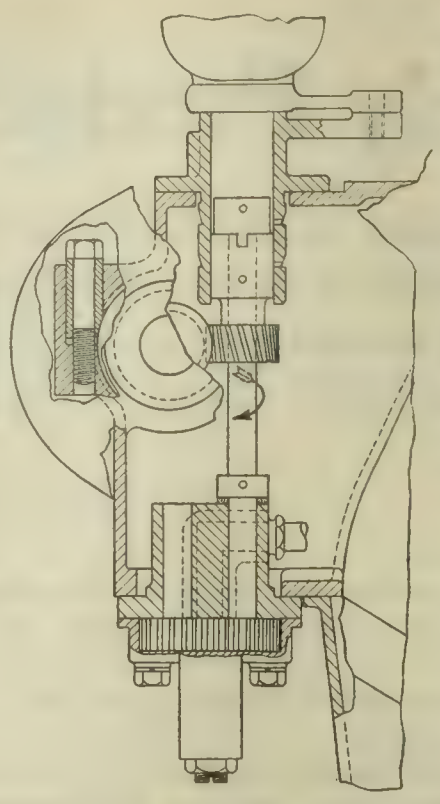
Front view of engine showing automatic take-up acting on reverse side of timing chain



Three-quarter front view of new Weidely six-cylinder engine, designed for passenger car application



Generator drive assembly



1 3/16 in. in diameter. It is mounted in three bronze bearings of the following dimensions (front to rear): 2⅜ x 2⅛ in., 1¾ x 1¾ in. and 1⅝ x 1⅜ in.

To secure a quiet valve mechanism, the rocker arm, push rod and tappet are held light in weight. The normal clearance between the rocker arm tips and the valve stems, when the valve is seated, is 0.004 in. The cam is so laid out that for 30 deg. before the point of valve opening the clearance is very gradually taken up, until the tip of the rocker arm is just in contact with the valve stem at the point where the valve begins to open. From this point on the valve opening is rapid. The closing incline of the cam is the reverse of the opening incline.

The intake valves are of chrome-nickel steel and the exhaust valves of Silchrome steel. They have a 1⅝-in. clear diameter, 5/32-in. head thickness, 5/16-in. stem diameter and 11/32-in. lift.

Lubrication is by pressure. The oil pump is a self-priming, gear type mounted on the side of the crankcase where it can be removed without disturbing any other units. It is arranged to pump into the oil line only such oil as is required at a set pressure. The pressure relief valve is located in the pump and so arranged that all excess oil is by-passed within the pump to the suction side, so that only so much oil is taken from the sump as is required for circulation through the distributing line at any time. An advantage claimed for this plan is that the breakdown of the oil, due to emulsification, is very much reduced. It is claimed that when oil is whipped around at high velocity and forced through small openings under high pressure it is broken up and quickly loses its lubricating qualities.

The oil is forced through a distributing tube to the three main bearings. The crankshaft is drilled so that the oil can pass freely from one end to the other, and the connecting rod bearings are supplied with oil from the inside of the shaft. This eliminates the possibility of the system being made inoperative by the accidental plugging of one of the lines, or even of two, as any one of the three will feed all the bearings on the shaft. From the front main bearings oil is forced to the accessory shaft bearings and to the drilled shaft forming the bearing for the automatic chain adjuster, from which latter shaft the oil finds its way to the chain proper.

By means of another line and holes drilled through webs in the upper part of the crankcase, oil is fed intermittently under pressure to the camshaft bearing and to the inside of the follow rocker arm shaft, from which it is forced to the rocker arm bearings and, through a hole in the rocker arm, to the top of the push rod, which is cupped to hold this oil. It then travels down the push rod to the valve tappet, lubricating the ball on the bottom of the push rod. The valve tappet is hollow and is cross-drilled to allow the overflow oil to escape, lubricating the valve tappet guide as it returns to the crankcase. The piston and cylinder walls are lubricated by oil thrown off by the connecting rods. On the down stroke of the piston the top edge of the oil relief groove scrapes the excess oil from the cylinder walls into the relief, from which it is carried to the piston pin. With this system, it is claimed, the entire overhead-valve action is working on a cushion of oil.

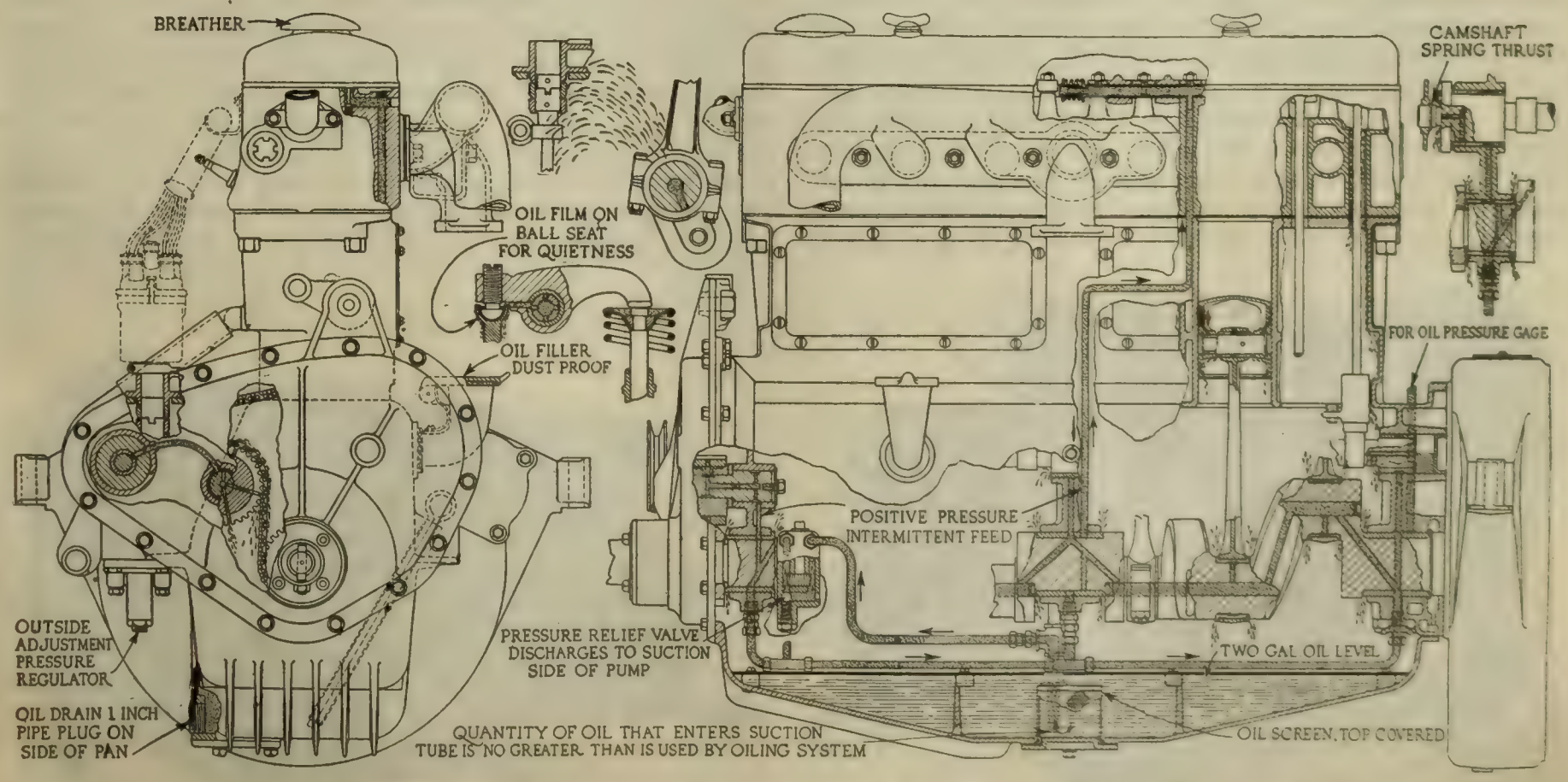
The major part of the inlet manifold is cast inside the cylinder head and is water-jacketed. That portion which is outside the head is integral with the exhaust manifold and thus acts as a vaporizer for the heavy fuel; it is entirely surrounded by the exhaust jacket, and any liquid fuel which may be creeping along the walls of the intake manifold stands a good chance of being vaporized there. The wall in the heated portion of the intake manifold is pocketed, so the liquid gasoline will be held until it is vaporized. The converter, as the exhaust-heated portion of the intake manifold is called, is comparatively short, so that the gas is carried through it quickly and the heat cannot penetrate the whole air stream in the short time of its passage. After leaving the converter, the gas passes directly through the middle of the head to the opposite side, where upon changing direction any unvaporized particles of fuel are again attacked by coming in contact with the unjacketed exhaust ports of cylinders Nos. 3 and 4.

Water circulation is by a centrifugal pump. The entire pump assembly is a unit which can be taken from the engine by sliding it off the rear end of the accessory shaft. On each side of the impeller is a babbitt bushing to keep the shaft central, and beyond this bushing on each end is placed the packing. There is a ⅜-in. water space between adjacent cylinder barrels. The spark plug bosses are entirely surrounded by water, which is claimed to be unusual in overhead-valve engines.

An interesting feature affecting ease of repairs is that if the oil pan is taken off, the piston and connecting rod assemblies can be removed from the bottom of the engine. The oil pressure relief valve can be adjusted from outside the engine. The oil drain plug is located on the side of the oil pan where it can be conveniently reached.

The engine is arranged for a two-unit electrical system with S. A. E. standard mountings. For foreign orders a magneto can be mounted back of the generator, taking its drive from a double-ended generator shaft. A barrel mounting is provided for the starter, which is ordinarily located on the right side, but for right-hand-drive cars for the foreign trade it is just as convenient to locate it on the left side, as provision has been made for both locations. The weight of the engine without accessories is 575 lb.

Assembly view, in part section, of new Weldely engine



Oiling diagram, showing lubrication of crankshaft, overhead valve system and other units

A Four-Wheel Drive Tractor from the Pacific Coast

Wizard 4-Pull tractor transmits power to all four wheels by roller chains and steers by disconnecting power from wheels on one side. Engine of company's own design and manufacture. All transmission members enclosed in oil-proof cases. Tractor of unit construction without frame.

AMPLE traction being an important requirement in tractor work, it is not to be wondered at that a number of tractor designers have turned to the four-wheel drive. As compared with the conventional design, driven through the rear wheels only, it has the advantages that the maximum traction is increased and that all danger of the tractor being overturned by the torque reaction is eliminated. The usual four-wheel drive construction with live front and rear axles is rather expensive to manufacture, and as low cost of production is essential in the tractor industry, designers have been endeavoring to evolve new types of four-wheel drive which should be simpler and cheaper to build than the conventional form.

An interesting four-wheel drive tractor, known as the Wizard 4-Pull, has been placed on the market by the Kroyer Motors Co. In addition to the advantages of the four-wheel drive stated above, the ability of turning in a very short radius is claimed for this tractor, as not only does it drive by all four wheels, but it also makes use of the driving members for steering in much the same manner as a creeper tractor.

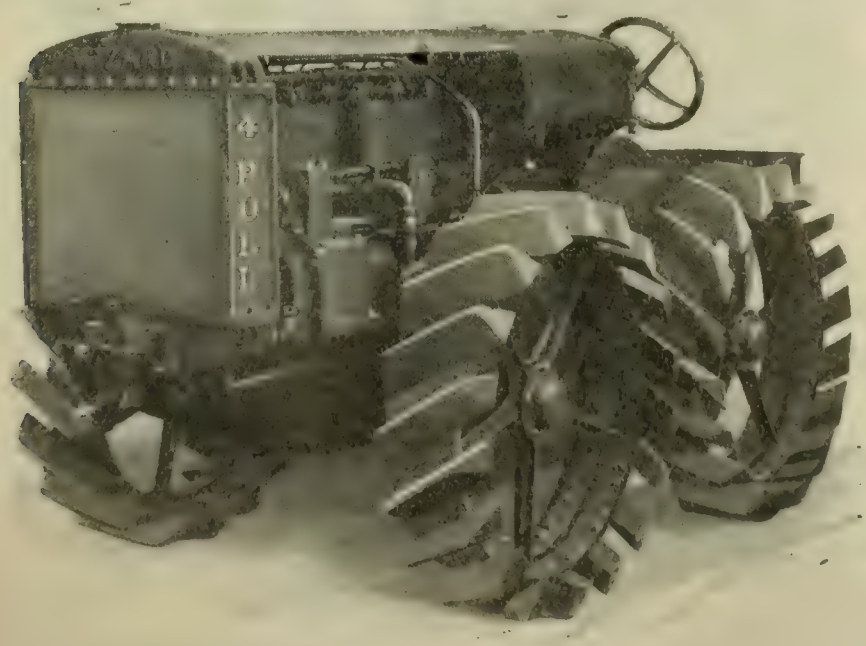
The four cast steel wheels run on 5-in. roller bearings mounted on stationary axles. The final drive is by roller chains direct from the transmission to the front wheels. The rear wheels are driven by separate roller chains from the front wheels. The two wheels on one side operate as a unit, independent of the wheels on the other side, and are driven through multiple-disk clutches controlled directly by the steering wheel. The method of mounting the wheels on the axles and the direct application of the power to the front wheels through the chain drive are clearly shown in one of the accompanying illustrations. The drive chains, operating at low speed, are inclosed in a dust-proof case and run in oil.

Grease cups and oil holes have been eliminated and lubrication is entirely automatic. Two oil filler plugs are provided, one on the transmission and the other on the engine crankcase.

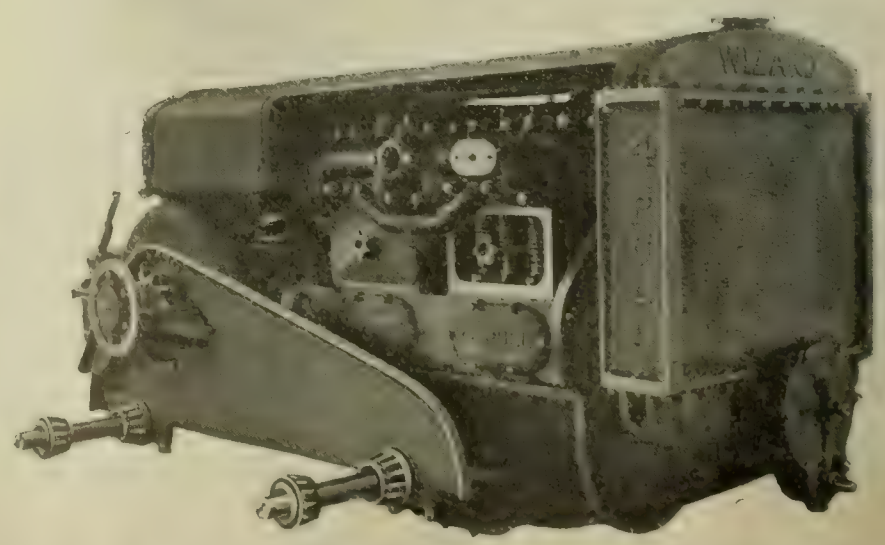
The engine is equipped with a gear-driven, gear-type oil pump that forces oil under pressure to the crankshaft, camshaft, connecting rod and piston pin bearings. Surplus oil from the bearings is showered over the timing gears and fan bearings, while the cylinders, pistons and valve mechanism are lubricated by the oil thrown from the connecting rods. The master clutch, the two steering clutches and the transmission gears and bearings work in a bath of heavy oil. An oil level gage is provided to show the oil level in the reservoir and an oil pressure gage is placed in plain sight of the operator.

The engine was specially designed by the Kroyer Motors Co. for heavy-duty tractor work and is of the L-head type. It has four cylinders, cast in pairs, with removable heads. The bore is 5¼ in., the stroke 6½ in. and the engine runs at a normal speed of 850 r.p.m.

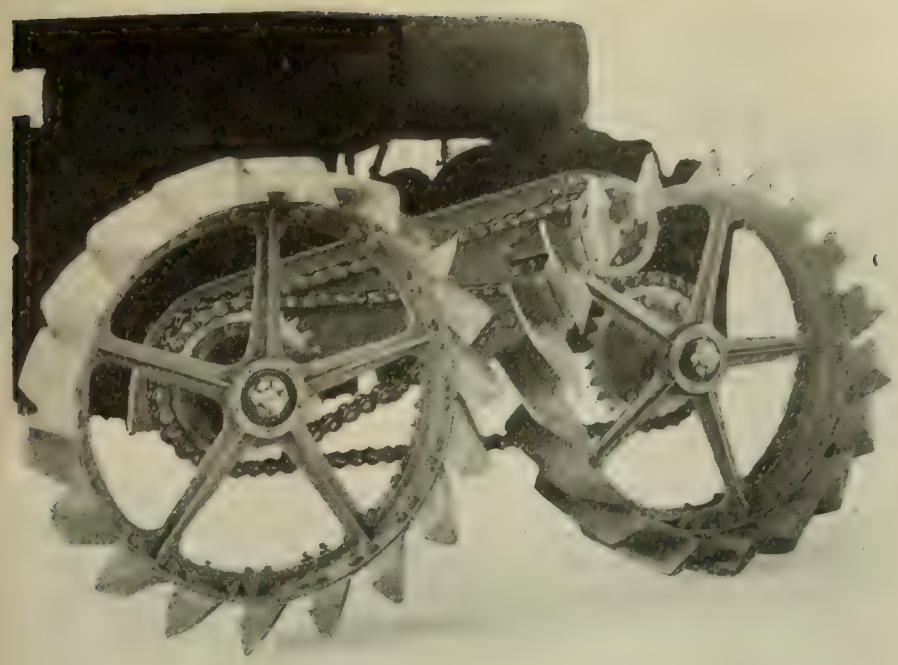
The crankshaft, which is 2¾ in. in diameter on the bearings, is drop-forged from open-hearth steel, heat-treated, and is supported by three main bearings, 4, 4 and 5 in. in length. The connecting rod bearings are 3¼ in. long each. The connecting rods are of I-beam section and are drop-forged from open-hearth steel. The cap is secured by four nickel steel bolts. All bearings on the crankshaft are hand-spotted to obtain a perfect fit. After the bearings are hand-spotted and fastened to their supports, the crankshaft, connecting rod and camshaft bearings are reamed to accurate size and centers. The working parts of the engine are assembled and the bearings are then run in cold on a power-driven running-

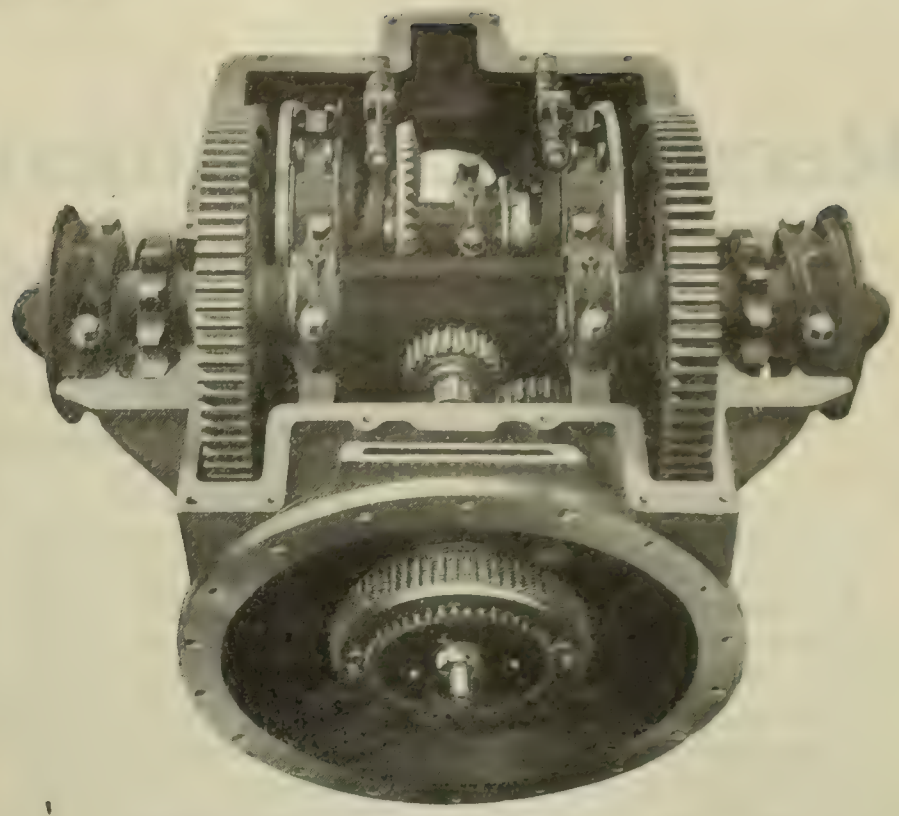


Wizard 4-Pull tractor



Side view of tractor with wheels removed, showing axle ends, chain sprocket pinion and engine details





(Above)—Chain drive to front and rear wheels
(Right)—Clutch and transmission with cover removed

in stand. All bearings are grooved, but not cut for oil clearance. The 0.002-in. allowance in reaming and the method of cutting the grooves is claimed to insure a film of oil on the bearing surface.

The camshaft is drop-forged and is supported by three bearings of different diameters, which allows the shaft to be removed from the front end of the engines.

The water space around the cylinders is said to be much larger than in the usual practice, and special provision is made for the circulation of water around the valves and spark plugs. The radiator is of the tubular type and water is circulated by a pump. The fan is gear driven.

The engine is equipped with a Bosch high-tension magneto with automatic impulse starting coupling. Provision has been made for dust-proofing the impulse starting coupling. The magneto is dust- and water-proof. The spark control and throttle are operated by one lever which is located within easy reach of the driver.

The engine is equipped with a flyball throttling governor acting on a butterfly valve in the inlet manifold. The governor is fully inclosed, yet it is readily accessible and can be quickly adjusted. The normal operating speed is 850 r.p.m.

Cranking of this large engine is said to be easily accomplished by means of a four-to-one geared starter on the front end of the tractor, which is clearly shown in the accompanying illustration. This starter disconnects automatically as soon as the engine starts, eliminating danger of back-kicks.

The engine is regularly equipped to burn either gasoline or distillate, but special equipment is provided to burn kerosene. Sufficient fuel-carrying capacity is provided for a day's work.

The transmission is of the selective, sliding-gear type. Gears and sprockets are forged from chrome nickel steel and are machine cut and oil tempered. The shafts are of nickel steel and are supported on large ball and roller bearings. All work is done on a direct-drive speed at 2½ m.p.h. A geared speed of 4 m.p.h. is provided for transportation and commercial work. The reverse speed is 2 m.p.h. Both the flywheel clutch and the steering clutches are of the multiple-disk type, being composed of bronze and steel plates.

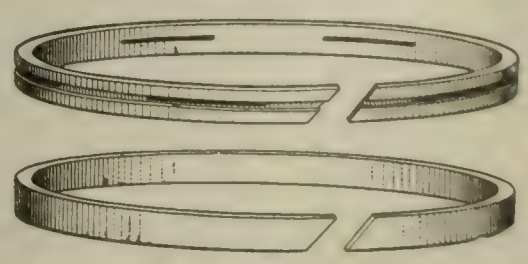
The belt power drive is a unit in itself and is attached to the rear of the tractor. It can be readily removed or attached by removing a cover plate and putting the belt drive unit in its place. The drive is direct from the crankshaft, through the flywheel clutch and through a spline coupling. The belt pulley runs parallel with the tractor and turns at the same speed as the engine crankshaft. Roller bearings are used on the pulley shaft.

The tractor is of unit construction without frame. Its normal drawbar pull is 3000 lb. at a speed of 2½ m.p.h. With standard leader shoes the machine is 66 in. in width, 110 in. in length and 67 in. in height. For vineyard use leader shoes are provided, giving a width of 58 in., while for peat or swamp land shoes of greater width are provided, giving a tractor a width of 72 in. For a machine of its drawbar capacity the Wizard is of very compact design and comparatively light, weighing only 6800 lb.

A New Design of Piston Ring

PISTON rings in sets of three, of which two are to hold the compression while the third is designed to distribute or regulate the oil, are being marketed by the Indiana Piston Ring Co. The compression rings are of the usual form with scarfed joint, the process of manufacture being such as to assure accuracy to within 0.010 in. when tested in a flexible gage and the shutting out of all light when tested in a round gage. These rings are also said to be entirely free from edge warp.

The oil-regulating ring is machined with a groove around its circumference midway between its edges. This groove acts as an oil reservoir. Any surplus oil collects in the groove and is drained into the piston ring groove through slots through the ring which are about equally spaced over its circumference. From the ring groove the oil can be drained back to the crankcase through holes drilled through the piston wall at the bottom of the ring groove in the usual way.



Rings manufactured by the Indiana Piston Ring Co.

Recent Development in the Railcar Field

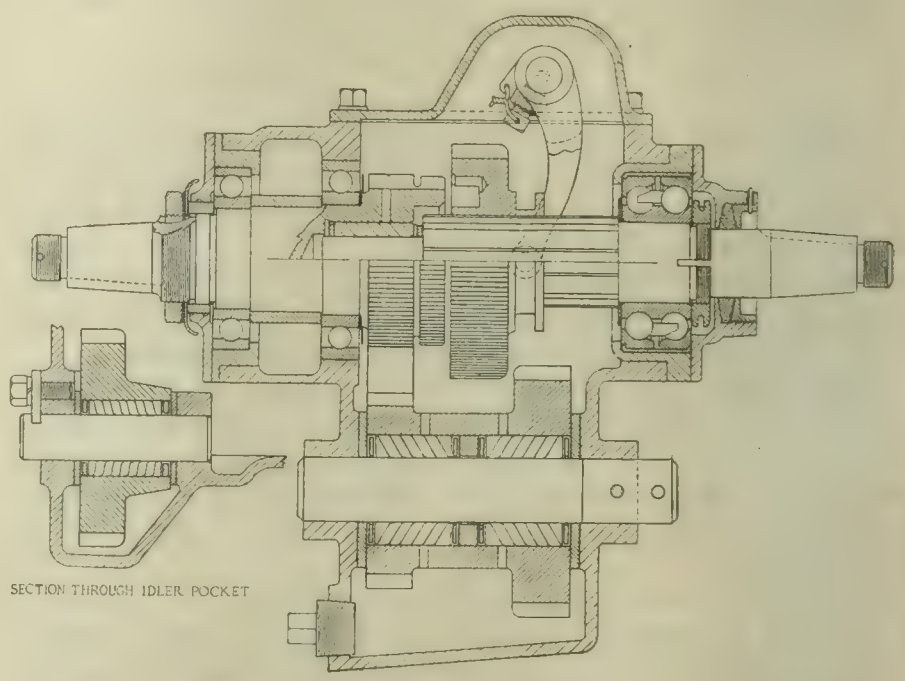
Both cars here described are fitted with regular and special reverse gearsets which make possible high speed operation in either direction, and both employ four-wheel leading trucks with live axles running in plain bearings. Other special features described include cushion wheel.

AMONG the truck manufacturers who are turning their attention to the construction of truck chassis especially equipped for use on rails is the Indiana Truck Corp., which has modified its 2½-ton chassis for this purpose. This chassis is equipped with a four-cylinder 4⅜ x 5½ in. engine which drives through a dry plate clutch to a conventional four-speed gearset. Between the latter and the rear axle is mounted a special reverse gearset made by the Warner Gear Co. and shown in the accompanying cut. The main shaft of this gearset is divided and has a positive internal-external gear clutch arranged in similar fashion to that employed in the usual type. The rear portion of this shaft is splined and carries a sliding gear which in its forward position engages the positive clutch and drives directly through to the propeller shaft to the rear axle. When the gear is in its rear position, the drive is through the constant mesh gears, one of which is an idler, to the lay shaft and thence back to the sliding gear, which drives the tail shaft in a reverse direction. This arrangement is similar to the drive through reverse gears in conventional transmissions, but the pinion in this case is carried on a Hyatt bearing and runs on a stationary shaft supported at both ends.

The use of this auxiliary transmission enables the railcar to operate at full speed in either direction. The propeller shafts between the two gearsets and between the reverse gearset and the axle are tubular and are fitted with metal universal joints.

The rear axle is a Sheldon worm drive semi-floating type and is fitted with two sets of internal brakes operating on wheel drums, one set being hand-controlled and the other operated by pedal. Rear wheels are artillery type wood with fourteen 2 in. spokes and cushion rims fitted with flanged rolled steel tires of 37 in. diameter.

The front axle is replaced by a four-wheel leading truck built up of structural shapes hot-riveted together. The bolsters are fitted with top and bottom plates through which pass the kingpin and are provided with swing links. The wheels are of cast iron, 20-in. diameter, with chilled face and flange. They are forced on the live axles which run in bearings in cast steel journal boxes. Cast iron



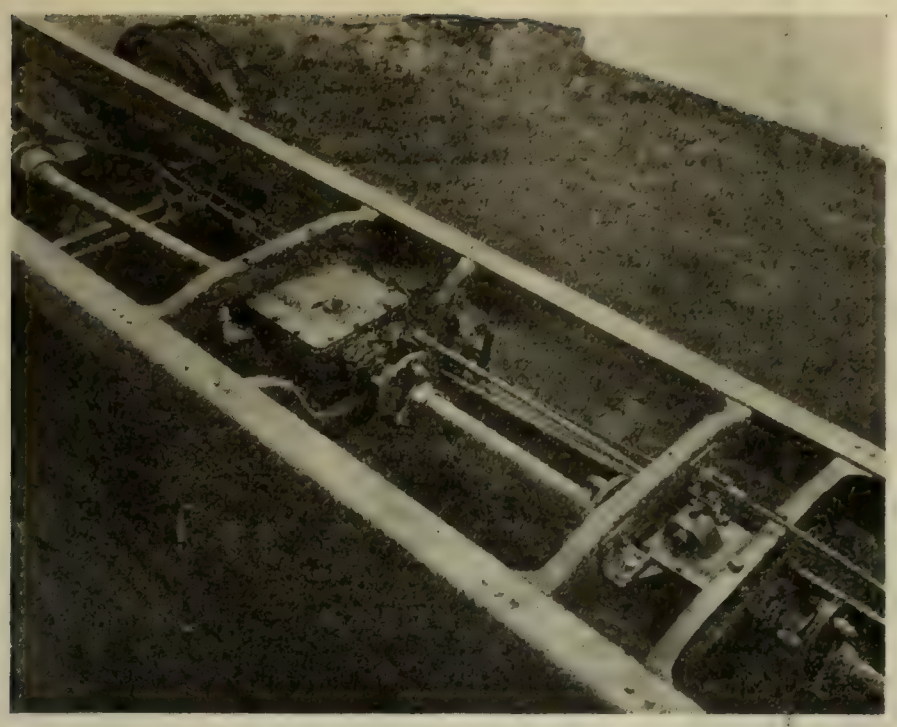
Warner high speed reverse gearset for use on railcars

brake shoes are arranged to bear on each front wheel and are applied by turning the steering wheel. The chassis frame is made of 6-in. structural channel weighing 8 lb. per ft., is hot riveted and reinforced by gusset plates. The wheelbase is 180 in. Front springs are 40 in. long by 2½ in. wide and have nine leaves. Rear springs are 50 x 3 in. and have eleven leaves.

The body is of oak and is arranged to carry thirty passengers. The equipment includes electric starting



Side view of Indiana railcar



Rear half of Service chassis showing mounting of high speed reverse and regular gearsets

motor and lighting generator, sanders in front and behind each rear wheel, steel pilot and fenders over front truck.

The Service Railcar

Another concern which has done considerable work in the development of trucks suitable for use on rails is the Service Motor Truck Co. This company has had in operation for several years a railcar based upon its standard 2½-ton, long-wheelbase model and will soon place in service a larger railcar of special design. The 2½-ton railcar is provided with a body seating 32 passengers and is capable of speeds of 25 to 30 miles an hour, depending upon the gear ratio employed. This, in turn, depends upon the grades which are to be negotiated. The car is fitted with 4¼ x 5½-in., 4-cylinder engine which drives through a single flat clutch to the Warner high-speed reverse gear, a section of which is shown herewith, and the reverse gear ordinarily used in the standard gearset is omitted.

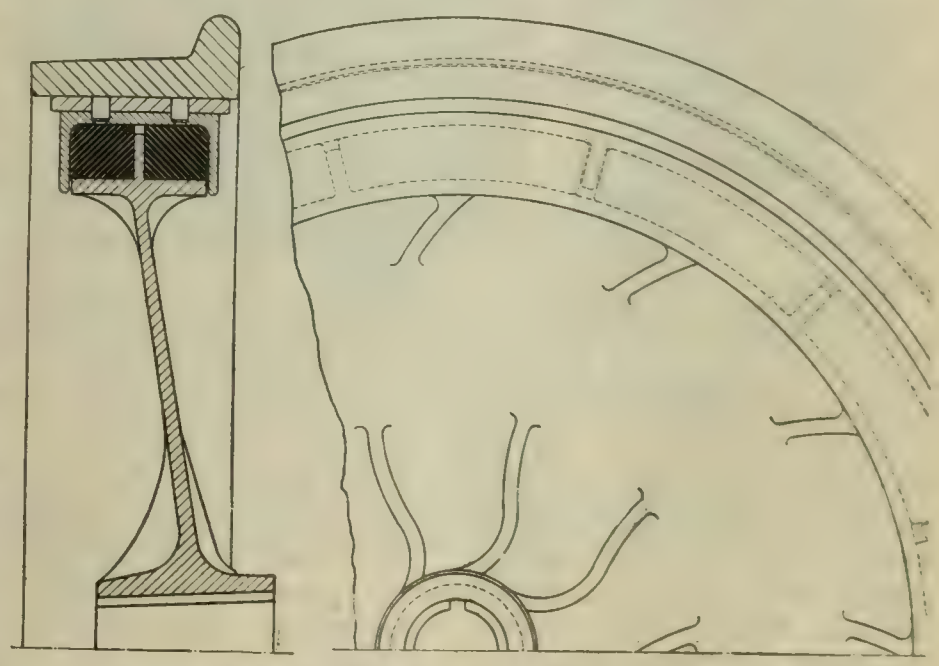
The special reverse gear is located between the engine and the standard gearset and is mounted between two frame cross-members in the manner shown in the accompanying cut.

The front axle is replaced by a standard four-wheel loading truck, manufactured by the J. G. Brill Co. This is provided with solid axles with pressed-on wheels of chilled iron. The axles are carried in plain brass bearings of the railway type, running in oil. The framework of the leading truck is a combination of structural and cast steel, to which are bolted the front springs of the regular chassis. A full-swing motion bolster, which facilitates steady riding on curves, is incorporated.

Cushion Driving Wheels

Another feature which departs from standard practice, so far as truck chassis in general is concerned, is the use of a special cushion wheel, a section of which is shown in one of the accompanying cuts. It will be noted that this wheel has incorporated between the rim and the central portion a series of rubber blocks which tend to prevent the transmission of shocks, such as those caused by passing over rail joints, to the chassis and body. The design of this wheel is such as to prevent transverse motion which can occur in some other types of cushion wheels and result in unpleasant oscillation of the rear end of the chassis frame. In this case stresses which would tend to produce such motion are taken up by contact between the side member of the box-like section containing the rubber blocks and the ring to which the spokes or disk carrying the hub are attached. In the case of the smaller railcar, wooden spokes are substituted for the metal disk shown in the cut.

The rear axle is of the worm-drive type and is fitted with the special wheels described, the latter being supplied with M. C. B. standard rolled steel tires of 32 in. outside diameter.



Sectional view of cushion wheel used on Service railcar



Service railcar fitted with entrance doors at each side

The Service railcar described is said to have traveled over 25,000 miles, during which the following data was secured: Normal speed, 30 m.p.h., will take 2 per cent grade on high gear and haul a trailer weighing about 6 tons, loaded, up a 4 per cent grade at 15 m.p.h. on third gear. Gasoline consumption is given as 10 miles per gallon and oil consumption at rate of 400 miles per gallon. The cost per day on a round trip of 84 miles, including crew, gasoline and oil and maintenance, is said to average less than $10, while the earnings are given as over $30.

Equipment includes electric starter and lighting generator, storage battery, fenders for front truck, steel pilot and hand-operated sanders front and rear of driving wheels.

Air Cleaner Applied to Truck Engines

Severe tests show effect of air cleaner on power output, fuel consumption and inlet manifold vacuum at different speeds. Five times more dust in air taken from under motor hood than from air drawn from inside driver's cab. Results and details of the experiments are given in this article.

THIS report on experimental work to show the effect of air cleaners on truck service in general, and the effect on the power and economy of engines in particular, was carried on by A. A. Bull, chief engineer of the Northway Motor & Mfg. Co. and should be of interest to truck manufacturers and operators.

Four distinct lines of research were embraced in the experimental work:

1. An air cleaner was installed on an engine in the company's dynamometer room, and the power output determined before and after installation.

2. Means for agitating dust were provided in the dynamometer room, the amount of dust provided being about the same as might be expected in normal operation, and power output, fuel consumption and increase in the inlet vacuum recorded.

3. An air cleaner was installed in the Northway Company's factory truck and records of performance obtained periodically.

4. Another air cleaner was sent to the General Motors Truck Co., for installation in a territory where dust was bothersome. In this case observations were recorded at intervals.

Following is a report of a road test with a 3½-ton G.M.C. truck with air cleaner installation. The air cleaner was mounted on the forward side of the dash, a hole being cut through the dash to provide for taking air from the driver's cab. A piece of 1¼-in. flexible tubing 20 in. long was used to connect the air cleaner to the carbureter. Air passed through a 60 mesh copper screen before entering the cleaner. The inner drum of the cleaner was covered with sheet felt, through which the air was drawn. The driver's compartment was open at the sides, but the wind-shield was closed.

The truck, with air cleaner, was driven 17.5 miles on a dirt road at speeds of from 8 to 18 m.p.h., averaging 10 m.p.h. A touring car was driven a few feet ahead of the truck, in such a manner as to stir up a heavy cloud of dust. The inner drum of the cleaner with felt was weighed before and after the road test, to determine the weight of dust collected by the felt, the results of the weighing being as follows:

Weight of drum, felt and sand after test.....1 lb. 5.97 oz.
Weight of drum, felt and sand before test.....1 lb. 5.81 oz.

Sand .....0.16 oz.

No sand passed through the felt.

Next a test was made in which the air for the engine was taken from under the hood. A new cleaner, exactly like the one used in the previous test, was installed in the same location but with the air intake facing forward, to take air from under the hood instead of from inside the driver's cab.

The test was then repeated under the same conditions except for source of air, and the weighing gave the following results:

Weight of inner drum, felt and sand after test ..1 lb. 5.81 oz.
Weight of inner drum, felt and sand before test..1 lb. 5.01 oz.

Weight of sand collected on felt.....0.80 oz.

This was five times the amount of sand collected when air was taken from the driver's cab. After each test, a heavy coating of sand was observed on the truck and engine, testifying to the severity of the tests. Inside of the inner drum there were no indications of any sand having passed through the felt.

The following table shows the effect on the power output, fuel consumption and inlet manifold vacuum at different speeds, of the clean air cleaner and the same loaded with dust.

R.P.M.	B.H.P.			Fuel Consumption Pts. per Hp.-Hr.			Negative Pressure in Intake—In. of Hg.		
	Without Cleaner	Cleaner without Dust	Cleaner with Dust	Without Cleaner	Cleaner without Dust	Cleaner with Dust	Without Cleaner	Cleaner without Dust	Cleaner with Dust
400....	8.7	8.5	6.6	0.920	0.942	0.970	0.1	0.1	0.15
600....	14.2	13.9	13.9	0.900	0.959	0.981	0.3	0.3	0.1
800....	19.8	19.5	19.2	0.843	0.933	0.947	0.6	0.25	0.1
1,000....	24.6	24.2	23.5	0.842	0.827	0.912	0.77	+0.2	+0.2
1,200....	29.4	28.3	27.4	0.928	0.848	0.876	1.075	+0.2	+0.2
1,400....	32.2	31.5	29.8	0.848	0.828	0.876	1.7	0.0	+0.2
1,600....	34.7	33.4	32.0	0.824	0.856	0.938	2.1	0.0	1.5
1,800....	36.2	34.7	32.4	....	0.824	0.926	2.6	0.3	0.6
400....	4.0	4.0	4.0	1.210	....	....	9.2	4.65	2.75
1,000....	10.0	10.0	10.0	1.101	....	....	11.35	9.6	8.4
1,600....	16.0	16.0	16.0	1.071	....	....	11.75	10.0	8.4

Water temperature, 120°–150° F.

The dynamometer tests with reference to the effect of the cleaner on the power, fuel consumption and inlet manifold pressure were made primarily to determine the advantage of taking the air from the driver's compartment instead of from beneath the hood, in order to minimize the amount of dust drawn into the engine.

It was further decided to demonstrate whether an air cleaner of the felt filter type could operate satisfactorily under severe conditions, as a result of taking the air from the driver's compartment. This type of cleaner has been used with apparent success on the Government military trucks. It undoubtedly has a disadvantage—that it cannot handle great volumes of dust without affecting the operation of the engine.

The design of the cleaner used in these tests was similar to that employed on the class "B" military trucks, with the exception that it was mounted vertically and in such a manner that vibration of the truck would automatically clean the filter.

The usual method of testing this filter has been to introduce large volumes of dust in such a manner that ultimately the filter felt would be choked, creating a high depression in the intake manifold, resulting in loss of power and increased consumption.

It is obvious, however, that this method of testing does not represent service conditions, in that the amount of dust introduced in a short time is probably considerably in excess of that which would be obtained under ordinary

operating conditions, and it is probable that such a cleaner would fail in the test indicated and yet be satisfactory where the amount of dust handled was relatively small and it operated under such conditions that it would have a chance to clean itself. Therefore, the tests conducted were made with the idea of reproducing the very worst conditions that the truck might be expected to operate under in actual service.

From the results of the tests, it is clear that the amount of dust drawn in by the motor is five times greater when the air is taken from under the hood than when it is taken from inside the driver's compartment, and, therefore, it is preferable to take the air from the driver's compartment, whether a cleaner is installed or not, as in that case less dust will get into the engine.

Power and fuel consumption tests evidence a slight reduction in power output, together with an increase in fuel consumption when the cleaner is covered with dust. It is believed that the maximum amount of dust adhered to the filter felt, and though this test represents the worst condition that would exist under ordinary circumstances, if the carbureter were properly adjusted to provide for the added depression, there would be no increase in fuel consumption.

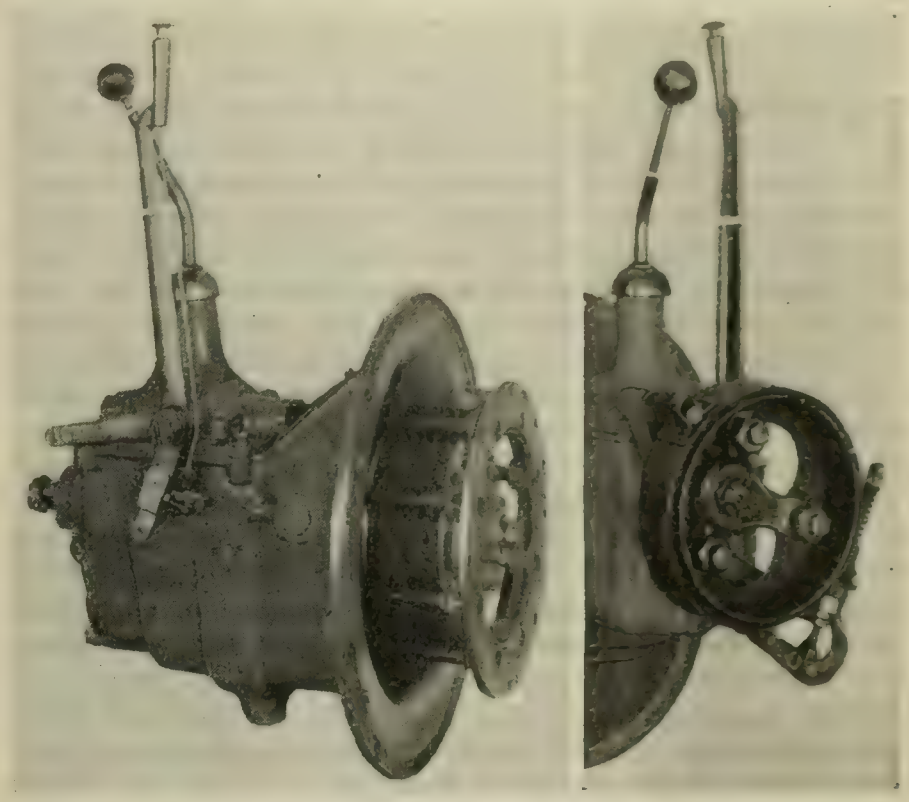
New Passenger Car Gearsets

TWO new passenger car gearsets for medium size cars and for larger cars have been brought out by Fuller & Sons Mfg. Co. Both have three speeds forward and one reverse. Short and heavy construction of the mainshaft and countershaft is intended to prevent springing apart when there is a heavy pressure on the gear teeth and to give durability, less vibration, and a quieter transmission. Provision is made on both models for attaching a tire pump if desired. A transmission brake bracket can also be attached to the rear of the transmission to accommodate Norwalk or similar transmission brakes.

When the oil level is brought to the top of the filler hole the oil level in the transmission is correct. The clutch throwout bearing is lubricated automatically by the gearset oil.

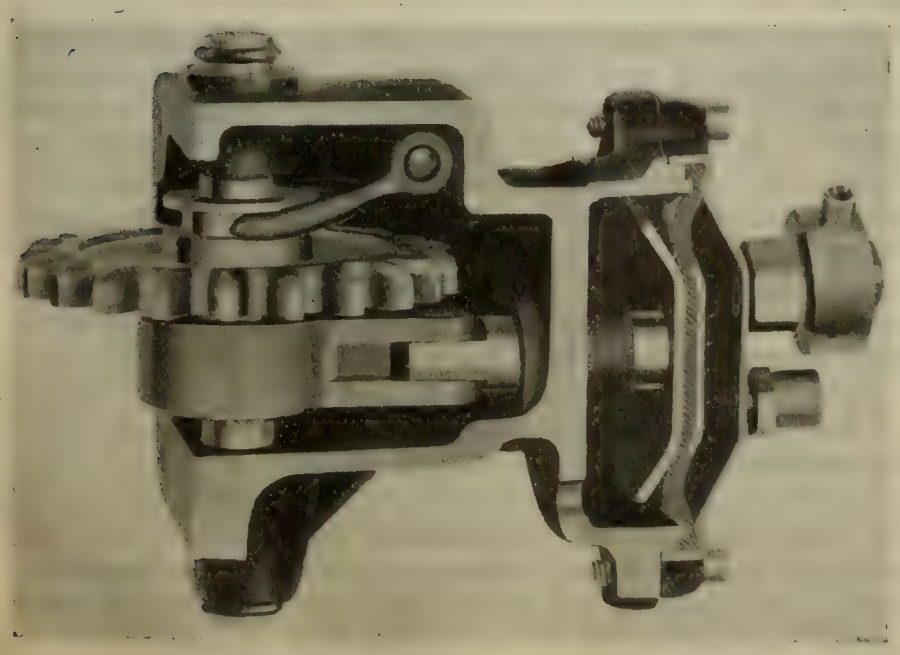
The countershaft of the Model F for medium size cars has different construction than heretofore used in Fuller transmissions. The countershaft gears are cut in one piece from bar stock, 3½ per cent nickel steel. These gears revolve on a stationary countershaft with Hyatt roller bearings. After hardening, the bore of the gears and the countershafts are ground true to assure true centers, quietness and long life. The mainshaft gears and mainshaft are also 3½ per cent nickel steel, with shafts and gear bores ground.

Model TU-5 transmission is for six-cylinder engines up to 400 cu. in. piston displacement. The clutches used with both models are the standard Fuller multiple disk construction which is standard equipment on a number of makes. The drive is through hardened steel pins to hardened saw steel disks faced with asbestos fabric on both sides.



Two views of new Fuller gearset showing also the Fuller multiple disk clutch and method of mounting transmission brake

Motor-driven Tire Pumps



Sectional view of pump

A NEW, motor-driven tire pump suitable for transmission or other type of installation in which it is claimed that the air chamber requires no oil has been brought out by the Detroit Carrier & Manufacturing Co. The pump is a diaphragm type, in which the diaphragm is driven off the pump shaft by a crank and connecting rod arrangement. The pumping is effected by the reciprocation or pulsation of the diaphragm and, consequently, requires no lubrication. The pump is so manufactured that replacement of the diaphragm is a simple matter should it become necessary and consists of but very few moving parts. It is shown sectionally herewith.

THE Province of New Brunswick, during 1921, spent a total of $400,000 on construction and improvements of roads. The total amount collected in automobile fees was but $276,322. Much of the new construction was on the road connecting the North Shore with Montreal and Quebec.

Standardization Necessary to Tractor Industry Progress

Mr. Heldt points out in this article the fundamental necessity for standards in the tractor industry and suggests certain lines for immediate action. The number of belt speeds and screw sizes might well be reduced, while uniform lug fastening would be advantageous. An interesting analysis.

By P. M. Heldt*

PERHAPS the best example of the value of standardization that could be cited to the tractor manufacturer is that of magnetos and magneto mountings. The location of fastening holes in the base, the height of the shaft center, the shaft end dimensions and the overall dimensions of magnetos were standardized by the S.A.E. a good many years ago, and this standard is generally adhered to by the magneto manufacturers. The advantage to the tractor manufacturer lies in the fact that, with possibly a few exceptions, any magneto on the market will fit his engine without special adaptation. If his regular source of supply should fail for any reason, such as a fire, strike or flood, he could arrange with any other factory to supply him temporarily with its product. Provided the mounting arrangements were in accordance with the S.A.E. specifications he would have no difficulty whatever in mounting the new magneto. I believe that every tractor manufacturer using high tension magneto ignition makes use of this S.A.E. standard—and there could be no better indorsement of its value.

Now, how does this plan of standardization look to the magneto manufacturer? We can imagine him arguing: "If it is so easy for my customers to substitute another magneto for mine, it is certainly not to my advantage; my hold on my trade will be loosened, and it is not for me to encourage standardization."

There undoubtedly has been in the past in some industries a feeling of this kind with respect to standardization, which has been the cause of much of the opposition which the movement has had to contend with. It is easy, however, to prove that this attitude has a very weak foundation. The same standardization which makes it easy for the customer to change from your own to a competitor's product also makes it easy to change from your competitor's product to yours. Therefore, unless you already control the whole of the business and have no chance of getting any more, you have nothing to fear from standardization on this score. This point is borne out by the fact that all makers of high tension magnetos are using the S.A.E. standard.

Standardized Magneto Mounting

There is, however, also a very direct advantage in mounting standardization to the magneto manufacturer. It relieves him of the necessity of manufacturing his machines separately for each customer. There are still slight variations in the demand, in respect to direction of rotation, position of timing lever, etc., but these can be readily met. With the exception of a few parts, the machines are all alike, which reduces manufacturing costs and permits of working for stock.

Another set of most important S.A.E. standards that are being used by the tractor industry are the steel standards. There is now a general tendency in tractor design to reduce weights, and this means the increased use of alloy steel in shafts, gears and similar parts. Now, the alloy steel industry has grown up with the automobile industry and is very much dependent upon it. There is no other industry that uses alloy steels to anything like the extent of the automobile industry, and the statement was recently made that 70 per cent of all the alloy steel produced in this country goes into automotive plants.

Value of S. A. E. Specifications

Alloy steels are made almost exclusively to S.A.E. steel specifications, and the parts manufactured from them are heat treated according to the S.A.E. specifications. The standardization of steel specifications and of heat treatments is among the most valuable work the Society has done. In connection with the tables of physical properties published some years ago, it enables the engineer to pick out the steel best suited to any particular purpose and to specify a heat treatment that best meets the requirements of the case. The work has not been limited to alloy steels but covers carbon steels as well, and most of the drop-forged crankshafts and connecting rods used in tractors are made of an S.A.E. specification steel. It is unnecessary to dwell upon this particular item of standardization, as the more extensive use of S.A.E. steel specifications by the tractor industry will come about naturally as the more primitive methods of construction typified by the use of structural steel and cast gears are abandoned.

The greatest need for standardization always exists at the points of connection between the products of different plants. The tractor connects by drawbar to the plow and other implement, and by belt to the separator or other power driven machine. Every tractor should be capable of connection to any plow or other implement, which necessitates standardization of the hitch; and every tractor should also be capable of driving by belt all the usual agricultural power machinery at proper speeds, which necessitates standardization of belt speeds. The height of drawbar hitch has been standardized and this standard is used by a good many manufacturers, but not by all. A moderate variation in the height of hitch is perhaps of no great moment, as the drawbar connections will take care of it. On some tractors, of course, the height of hitch is adjustable, but where this is not the case it would be an advantage to have the hitch a certain standard height.

*Paper read at the Minneapolis tractor meeting of the S. A. E.

Belt speeds also have been standardized, and, in fact, the original standard has been revised already. The belt speed was first fixed at 2600 ft. p. m., but it was found that a single speed did not meet all requirements. At the present time the S.A.E. has four standard belt speeds and the N.I.V.A. has even one more. It is possible that temporarily this number of different speeds is necessary because of the requirements of the various types of power driven machinery now on the market. The designers of these machines had nothing to guide them in determining the size of their pulleys, and the result is that there is absolute lack of agreement as to the required belt speeds. But in the future this condition could be remedied, and I believe that eventually there will be no need for more than two standard belt speeds. The situation here is somewhat similar to that in the pneumatic tire field, and I believe the problem could be solved in the same way as that tried there.

Pneumatic Tire Sizes

Some years ago, when a standard list of pneumatic tire sizes was first given out, it contained a certain number of sizes which were designated as definite standard sizes, and a number of others which, it was explained, were to be continued by the manufacturers only while the replacement demand for them continued. This served as a sort of warning to car designers that new cars should be equipped only with the definite standard sizes.

In the determination of standard belt speeds there should be co-operation between the manufacturers of tractors and stationary farm engines on the one hand—because the same agricultural machinery that is driven by tractors is also driven by stationary engines—and the manufacturers of this machinery on the other. If, say, two definite standard belt speeds were agreed upon, then the designers of agricultural machinery in future would equip all new types of machines with pulleys calculated for one or the other of these speeds, and the situation would gradually become simplified.

One class of standards relates to materials of construction or basic machine elements. Of the standards of this class that were adopted originally for the automobile industry many are now in use in the tractor industry. I need only mention the S.A.E. standard steels, non-ferrous alloys, tubes, screws, washers, pipe fittings and ball bearings. Some of the standards of this class deserve wider use, however, as, for instance, the standard forged rod ends and yokes.

Then there is a class of standards relating to the joints or connections between parts that are often made in different plants. To this class belong the magneto standard already referred to, the carbureter flange standard, the bell housing standard and others. The value of these standards is so obvious that they have generally been adopted without hesitation. As a matter of fact, most of these standards were formulated at the request of parts manufacturers, and tractor makers had little to do with their adoption.

Fewer Tractor Screw Sizes

There has been in the past some talk of reducing the number of screw sizes for use in tractors. Why this would be an advantage is easy to see. One of the difficult problems in connection with farm tractors is that of maintenance. A tractor cannot easily be transported, and all ordinary repairs must be made right on the farm with the facilities available there. Now, it often occurs in the use of tractors that screws and nuts are lost or broken or have their threads stripped, so that they must be replaced. It would evidently be much easier for the farmer to keep a good stock of screws on hand if only a few sizes were used. In all the ordinary screw standards the sizes vary in steps of 1/16 in. Why not cut out the odd sixteenth sizes in tractor manufacture? The direct benefit of simplification would not be limited to the farmers but would also be shared in by the manufacturer and the repair shop. There is, of course, one objection to the elimination of certain screw sizes. For instance, in places where a 7/16-in. screw would just suffice, a ½-in. screw would have to be used and thus the weight would be slightly increased. However, this disadvantage is far from offsetting the advantages to be gained, especially when it is considered that in some cases, by reason of the use of heavier screws a smaller number would serve the purpose. Very likely, different manufacturers of tractors are now following this plan individually, but if it has general approval, why not make it a standard or recommended practice?

Another item that deserves the attention of the tractor industry particularly at the present time is the methods of fastening lugs. Attention has already been called to the tendency to reduce tractor weight; now, in order to get sufficient traction with less weight it is quite important that the lug equipment be made as efficient as possible. Different operating conditions call for different lug equipment, and the farmer therefore finds it necessary to change lugs occasionally. With a standardized method of fastening, not only would the interchange of lugs by the farmer be facilitated, but inventors of improved lugs would find is easier to market them.

There is at the present time considerable research going on with respect to the best form of lug for different soil conditions. It is obvious that the minimum tractor weight permitting a given drawbar pull to be obtained depends to a large degree upon the lug equipment, and as reduction of tractor weight without reduction of drawbar pull spells increased efficiency, this development ought to be encouraged in every possible way.

Need of Co-operation

A few remarks of a general nature may not come amiss here. Standardization really signifies co-operative effort on the part of members of the industry, and no industry, perhaps, needs this co-operative spirit more at the present time than the tractor industry. During the war and the two years following it this industry enjoyed a sort of hot house growth, the direct result of high prices of farm products and scarcity of farm labor. Now conditions are practically reversed. Farm products sell at abnormally low prices and help is plentiful. The farmer has very little money to spend and he has no longer a prospect of an almost unlimited market for his products to encourage him to widen his scale of operations. In the past the desire to work an increased acreage was often the reason for the purchase of a tractor. Tractors retain all the advantages they ever had, such as ability to work to full capacity in all kinds of weather, lack of need for feed and care during periods of non-use, etc.; but their first cost and operating cost must be brought down in conformity with the changed economic conditions on the farms. Every manufacturer is equally interested in this problem and all should co-operate to solve it.

Standardization, while not a panacea for all the present woes of the tractor industry, will prove a powerful aid in solving its problems. It may be permissible to point to the automobile industry in this connection. There is no other branch of the mechanical industries to-day that is producing as efficiently as the automobile industry. It is not a mere coincidence that this industry also has carried standardization further than any other. Efficient production really means large scale production, because it is only in large scale production that really efficient methods are applicable. It is for this reason that a large proportion

of firms which have entered the automobile industry in recent years confine themselves to assembling. Their own output may not be so very large, but all the components which they use—the engine, transmission, axles, steering gear, etc., are made in parts factories on a generally much bigger scale. This plan of assembling would be greatly hampered—in fact, it would be almost impossible—if it were not for the standardization work of the S.A.E. To these parts factories belongs a great deal of the credit for the rapid advance in automobile design and for the efficient production methods in the automobile industry.

Summing up, there are three outstanding facts which should convince every tractor manufacturer that standardization is of value in the tractor industry:

1. This country's largest industry of manufactured products has standardized to a large extent and is keeping up the work.

2. During the late national emergency, the Government compelled standardization in many lines, because of the economic advantages to be gained.

3. European industrial countries, impoverished by the war, are turning to standardization as one means of re-establishing their economic balance.

The standardization movement would have been much further along by this time if it hadn't been for the more or less natural tendency among members of an industry to regard one another with distrust. As a rule, it requires some event of catastrophal nature to bring them together and make them see that they can accomplish more by pulling together than by each working for himself regardless of the others. The automobile manufacturers were first brought into a close union by the Selden patent situation, which was a real bogy during the early years of the industry. Many other industries learned the value of co-operation during the war. The slump in farm values is undoubtedly the greatest shock that the tractor industry has had so far, and it is to be hoped that out of the misfortune at least some good will come, that the tractor makers will see the advantage of co-operative effort, and of mechanical standardization as one of its expressions.

Four-Wheel Servo Brake

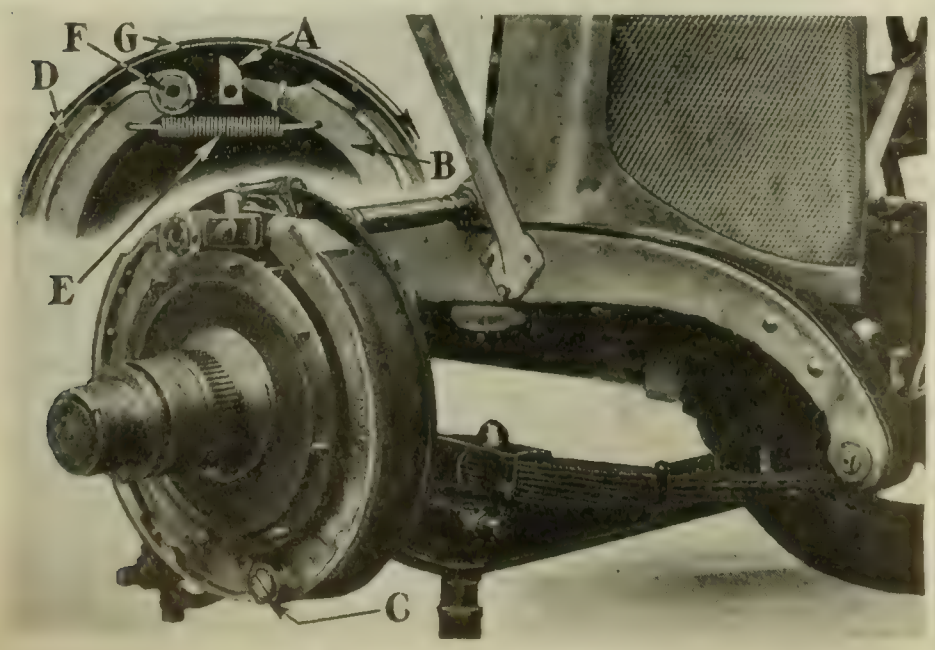
AN interesting and simplified form of servo-brake is used on the latest type of high grade six-cylinder chassis produced in the works of Farman Brothers, Paris. This car has four-wheel brakes operated simultaneously by means of a pedal, the control being on the Perrot principle. There are brake drums on each wheel, the inner brakes being hand-operated. This arrangement gives two independent braking systems, but without any braking effort going through the transmission.

The foot-operated brakes are internal expanding type, but are not mounted in the usual way, with a fixed point for each shoe and a cam to bring them in contact with the inner face of the brake drum. The brake cam A—as shown in the sketch—operates on only one shoe B, bringing it in contact with the face of the drum C. This brake shoe, which acts on the servo principle, is pinned to one extremity of the second brake shoe D, this latter having a fixed point at F. When brought into contact with the drum through the action of the brake pedal, there is a tendency for the first shoe to follow the rotation of the drum, thus pushing the second shoe and assuring the braking effort. This arrangement takes advantage of the inertia of the revolving parts without the use of any additional mechanism.

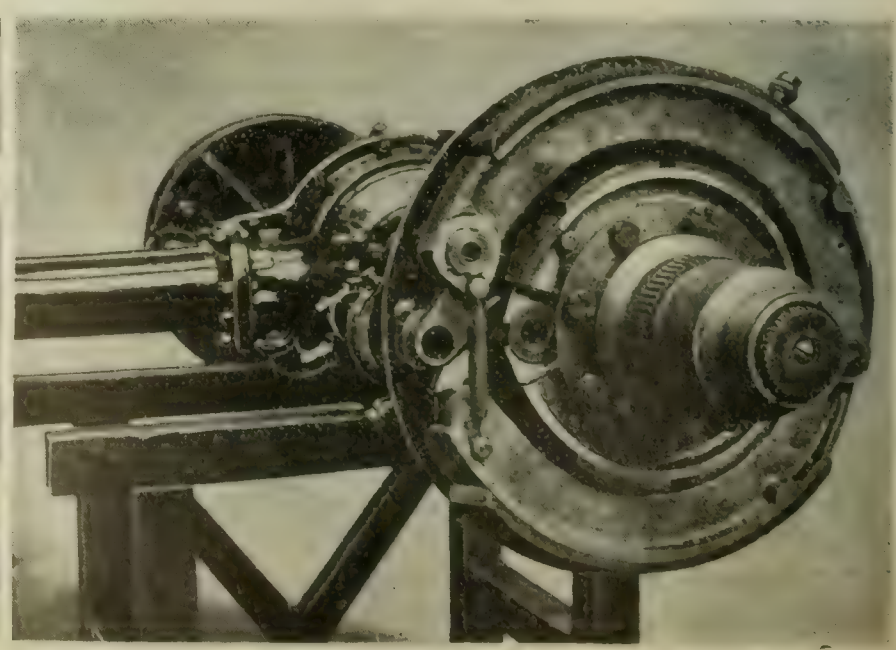
By mere alteration of the area of surface of the servo-brake it is possible, with uniform size drums front and rear and uniform brake shoes, to secure more progressive braking on the rear than on the front wheels. As the rear is less heavily loaded than the front when the brakes are applied, this prevents any tendency to skid and increases the life of tires.

An Encyclopedia of Airplane Engines

ONE of the latest books devoted to descriptions of airplane engines has been compiled by Glen D. Angle under the title "Airplane Engine Encyclopedia." In this book an effort has been made to briefly describe or at least refer to every airplane engine which has ever come to the author's attention. Most of the descriptions are necessarily very brief, but in a majority of cases a photograph and in many cases sectional line drawings of the engine are reproduced, while some of the major dimensions, the weight and power output are given in nearly all cases, and the special features of the engine are mentioned. The engines are listed in alphabetical order for ready reference. The book is published by the Otterbein Press.



Details of four-wheel brake—front



Arrangement of four-wheel brake—rear

Improvements in Gear-Box Design

Part II.

In this second article Mr. Orcutt tells the methods he employed to carry on special gear-box gear experimental tests and draws his conclusions. A detailed account is given of a new gear-tooth grinding process.

By H. F. L. Orcutt*

CONCLUSIONS drawn from some tests made on gear-box gears extending over a period of nine years in connection with the development of a special process of finish-grinding the teeth of hardened gears may prove of interest.

The number of gears dealt with runs into hundreds of thousands, including the so-called constant-mesh pinions. The sizes vary from a 15-tooth pinion to 60-tooth gears, the diametral pitches from 8 to 4, and the face widths from ⅜ in. to 1½ in. The materials include case-hardened, oil-hardened and air-hardened steels to varying specifications. The forms of teeth include the standard depths, and the stub tooth of varying pitches, with pressure angles from 14½ deg. to 25 deg.

The tests were specially for quiet running, and were made as a part of production inspection. The gears were in each case tested with only one pair running, which were mounted on spindles set to exact center distance, secured on bushes or plugs which were hardened and ground, running dead true, great care being taken in all cases to have the two spindles dead parallel. The speed selected for the driving spindle was about 900 r.p.m. The spindles of the testing fixture are 4 in. diameter, of good length, running in bearings with very small clearances, all fittings being made with special care. The driving belt is 4½ in. in width. A band brake, 3 in. wide, was applied to the driven spindle. The gears under test were run dry as well as lubricated by splashing with thin oil. The fixture itself ran without noise, and there can be no question but that any noise produced by these tests was purely a gear-tooth noise. Many of the tests have been made in direct comparison on the same fixture under identical conditions, with gears finished as accurately as possible before hardening.

The results of these tests can be briefly stated. The gears were made to run in all cases so quietly that if the same results could be secured in a gear-box it would be called noiseless on all speeds. Some of these gears ran remarkably quietly in boxes, but in very few boxes were they perfectly silent under running conditions on the road. In nearly every case they were more quiet than unground gears under load in the road test. In some cases the gears with perfectly accurately ground teeth are apparently just as noisy in the box as gears unground. In this comparison, however, the unground gears have always been subjected to special selection, stoning and very costly hand work on the teeth.

The conclusions submitted are as follows:

1. That gear-box gears which are hardened after finishing are always noisy.

2. That gears with teeth accurately finished after hardening are quiet.

3. That gears with teeth finished as accurately as possible may be noisy in the best finished gear-boxes.

4. That gears with teeth roughly finished may be under some conditions comparatively quiet.

5. That the accurately finished gear is just as essential to cheap and uniform production as the accurately finished cylindrical shaft or bearing.

6. That in a quiet running pair of gears the limits of accuracy on the teeth are the finest possible, much finer than are required in any other conjugate surfaces in the gear-box.

7. That in the ordinary gear-box the gear-teeth are usually the least accurate of any of the working surfaces.

8. That thorough development in gear-box design will not be possible unless all parts, including gear-teeth, are of accurate finish within known limits.

9. That some ratios run more quietly than others, tooth load and quality of finish being equal.

10. That the stub gear to run quietly must have extreme accuracy in tooth form, especially in pitch spacing. Consequently this gear is more difficult to finish to a degree of quiet running than the full depth tooth gear.

The tests recorded and the production work connected with them have demonstrated conclusively two things which are important to the motor car engineer. First, that in a gear giving the service required in the ordinary gear-box, if it is expected to run quietly, a perfection of tooth contact is necessary which it is hardly possible to secure by any of the ordinary gear-cutting methods. Second, that in the usual motor car gear, if it is hardened after the teeth are finished, the perfection of tooth contact necessary to quiet running is not possible. Further, in a gear with the teeth hardened after finishing the full possible tooth-wearing surfaces do not exist.

Unless these details are given full recognition, it is safe to predict that substantial progress in gear-box improvements will not be made, improvements which are desirable to put this unit in line with other parts of the motor car, and which, sooner or later, will be demanded by the public.

Much research work is necessary to determine minimum areas and sections of straight spur-gear teeth which, accurately finished and properly mounted, will run quietly under maximum loads. The known qualities so far demonstrated by test and usage are, that heat-treated gears made of special material with comparatively small straight spur teeth will stand high peripheral speeds and heavy loads, and have long life. Further, that such gears are, at a moderate cost, materially improved in running qualities when the teeth are accurately finished after they are hardened.

The following is an analysis of the sources of gear-box noises commonly observed:

1. Inaccurately finished gear-teeth impacts.

*Paper read before the Institution of Automobile Engineers, Dec. 15, 1921, condensed.

2. Ball or roller bearing influences.
3. Influences outside the gear-box, but which are manifest in the gear-box and come through either the front or rear connection.
4. The shape of the gear-box casing.
5. Weakness of gear shafts and weakness of casing.

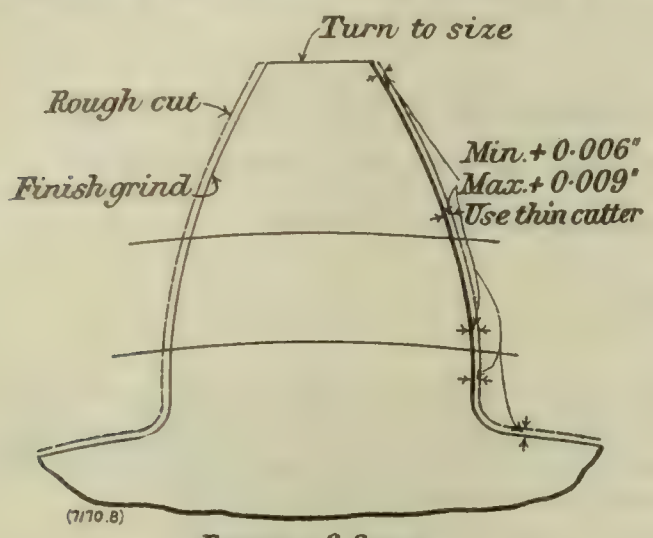


Fig. 2

6. The gear teeth being too small for the load.
7. Badly-mounted gears.
8. General bad workmanship in the box.
9. Periodic speeds in the engine.
10. Gear-box distortions caused by chassis movements.

The Gear Tooth Grinding Process

The process of gear-tooth finishing to which reference has been made is an entirely new mechanical operation, and a short description will probably be of special interest to the automobile engineer. The subject of finishing gear teeth is such a large one that it can only be dealt with in the briefest possible manner. Some of our best mechanical engineers have devoted years to the problems of machining spur-gear teeth and many of the mysteries of gear-tooth action still have to be solved. Some of the uncertainties have been cleared up in the development work which has been carried out in connection with the process to be described.

Gear-tooth grinding takes the place of the usual finishing cut on the milling, hobbing or generating machine. The cutting tool is an abrasive wheel correctly shaped to grind out the tooth space after the gear is hardened. The stock left for finish-grinding the teeth of the usual motor car gear should be enough to allow for the removal of all hardening distortions and such inaccuracies as may occur when the roughing cuts are reduced to the lowest cost. The teeth are finish-ground as a last operation with the gear truly mounted on bushes or mandrel which exactly fit the hole in the gear. The operations on a motor car gear are as follows:

Operation 1. Bore and turn.
Operation 2. Broach.
Operation 3. Rough mill teeth.
Operation 4. Round teeth.
Operation 5. Harden or heat-treat gear.
Operation 6. Sand blast.
Operation 7. Grind hole to finished size, registering the hole from the bottom of the splines.
Operation 8. Grind the ends of the hubs of the gear.
Operation 9. Finish-grind the teeth.

In Fig. 2 details are given of stock to be left on the gear teeth for finish-grinding. With these allowances rough cuts for the tooth spaces need be nothing more than a fast milling operation, and the highest possible distortions are allowed for.

(The author here describes the machine with which his experience has been had, which is an American product and has been previously described in these columns.—Editor.)

The form of tooth made use of is a pure involute, with no modifications whatever. Experience shows that the approach to accuracy in tooth finish coincides with the approach to silence.

A pair of gears with theoretically correct teeth should run silently unless overloaded or inaccurately mounted. It is found by many tests that the ordinary motor car gear which is hardened after the teeth are finished, is never accurate. It may be fairly quiet under certain conditions, but it is never of uniform quality.

The gear with ground teeth can be produced in quantities with a higher degree of accuracy and uniformity than by any other method, for several reasons. Firstly, on account of the fact that the tooth-form is controlled in the machine in which the gears are ground. Secondly, the refinements of tooth-finishing called for in a high-class gear must be within such very fine limits that no other cutting tool but the grinding wheel is capable of producing these refinements (these refinements include tooth forms, tooth-positioning and tooth-spacing). Of course, in the case of the hardened gear there is no cutting tool except the grinding wheel that can be used to give a uniform finish to the teeth. Further, the process lends itself to methods of inspection which are quite useless applied to the products of ordinary tooth-cutting machines.

In respect to the high-duty spur gear, the tooth-grinding process is specially important By a high-duty gear is meant a gear which, with comparatively small tooth area, must carry a heavy load, run at high speeds, and have exceptional wearing qualities. Such a gear calls for a combination of material with special physical properties, with a finish of tooth form to a high degree of accuracy. The physical properties are at present only obtainable by using material which may be heat-treated or hardened, and this material can only be finished by a grinding wheel. When this cutting tool is used to finish tooth surfaces, the engineer has an unrestricted choice of material. He can specify physical properties which are impossible when the steel cutter is used as a tooth-finishing tool. The choice of material is important, as the action of mating gear teeth is at high speeds, under pressure, on a line only and always sliding. Under these conditions tooth abrasion will be rapid on any material if it does not have special physical properties.

Tests and actual running indicate that high peripheral speeds on straight spur gears can be adopted when they are made from high-grade material and with specially accurate teeth. It has been recorded that a peripheral speed of 10,000 ft. per minute is now being used on a certain service with satisfactory results. The maximum peripheral speeds usually recommended for straight spur gearing are not much over 2000 ft. per minute. Even with moderately high speeds the number of tooth contacts per minute is enormous. A sixty-tooth gear of five pitch, running at 1000 r.p.m., would have a peripheral speed of about 3000 ft., and 186,000 tooth contacts per minute. It is easy to understand that satisfactory running in such a gear could only be expected when the tooth contacts are as nearly correct as possible. Any variation whatever from correct tooth form adds to tooth contact, tooth impact—a vast difference at high speeds. Correct contact means silence;

impact means noise, varying with speed and force of blow.

A gear hardened after the teeth are finished loses a large percentage of its tooth contact through distortion alone. The larger the gear the more the distortion. Measurements have been made of numbers of such gears about 2 ft. diameter, 3 pitch, 5-in. face, in which the tooth contact was not more than 50 per cent of the full area. With the teeth ground after hardening the full tooth contact is secured, giving the gear a much longer life.

Beyond these general statements there are very few data available for high-duty spur gearing. What the engineer wants to know is the minimum tooth section which can with safety be adopted to carry a certain load at a specified speed, and the materials from which the gear must be made. Tests with gears with inaccurate teeth cannot be conclusive, and reliable data cannot be compiled from such tests. It is claimed that a complete investigation of gear-tooth phenomena on straight spur gearing is impossible through any other process than one in which the abrasive wheel is used for tooth-finishing. Further work is now being undertaken on ground gears, from which records will be compiled as fast as possible.

At present the gear-tooth grinding process can only be made use of in a centralized plant, and to this there is on the part of some motor car makers an aversion. This aversion is perfectly natural and reasonable, and the attitude of the owners of the patents covering the gear tooth and splined shaft grinding machines should be explained. Ten years' work in production for the trade and in the development of the process has proved one thing which is not easy to understand, that is, that the plain spur gear, as used in the ordinary gear-box, will not run quietly unless the teeth are finished with refinements which cannot be maintained by the tooth-cutting methods commonly in use. These refinements are so extreme that even with the process now employed in gear grinding, special experience and a special staff are necessary to maintain a proper standard of workmanship on the gear teeth and the splined shaft. Further research work is necessary. This work is necessarily linked up with production, and for the time is naturally the occupation of a special staff and a specially organized equipment. The principle of working in a centralized plant has been accepted as the only one by which success could be assured in developing a new mechanical operation.

It is particularly interesting to note that the indispensable qualifications of a good high-duty gear and a good ball bearing are exactly comparable. Both must be made with a high degree of accuracy, with very fine limits of error and of specially selected and treated material. They must be correctly mounted to give good running results. A large amount of educational and instructive work has been done in connection with ball bearings before its economies were understood. The same work must be done for the accurate gear before the full possibilities of the high service it will give are commonly accepted.

(*To be continued*)

Steinmetz Double Reduction Spur Gear Axle

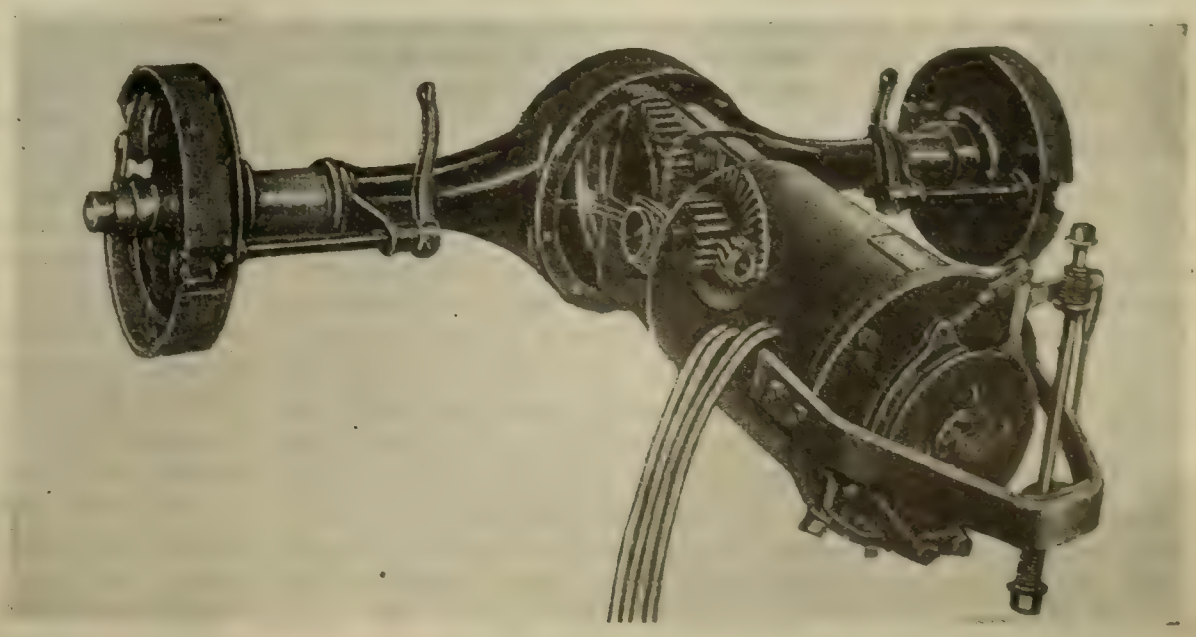
PRODUCTION will soon begin on the Steinmetz electric truck. The present model has a capacity of 1500 lb. and is simple in design and has an abundance of power. The motor and rear axle are of special design. Other parts of the car are of a conventional design.

Since he first became interested in the electric vehicle, Steinmetz has attacked the motor and gear reduction problems as those which were the most poorly adapted parts of the chassis. The high speed at which the electric motor operates efficiently makes it necessary to have a high gear reduction, which is objectionable in this kind of a vehicle. His first designs called for a revolving field rotating in an opposite direction to the armature. This was found to be impractical from a service standpoint, and the gear reduction is accomplished in this latest design in a double reduction spur gear axle of which the motor is a unit part.

While no definite price has as yet been set on the vehicle, it is said that it will probably be near $1,600 for the chassis. One of the innovations in electric truck merchandising will be the adoption of a standard battery, so that when the price is determined it can be quoted. Past practice has been to have so many options in battery and equipment that no very definite price can be held in the mind of the purchaser or prospect.

The truck is fitted with pneumatic tires, 33 x 5 in. There is a hood in front of the driver's seat resembling very much the hood on a gasoline truck. A portion of the battery is contained under this hood and another portion is under the driver's seat. Both sections of the battery are contained in trays and can be rolled out of the car in a very few minutes by simply disconnecting the leads and loosening the clamp bolts.

A PRACTICAL correspondence course in the efficient use of coal, gas and liquid fuel is now being given by the Hays School of Combustion. As we understand it, this course is primarily intended for those interested in steam power or various classes of heating plants, in which the fuel is frequently burned in a most inefficient manner.



Detail view of Steinmetz rear axle and motor unit, showing double reduction drive

Correlation Between Metallurgical and Service Tests

Prominent British metallurgist discusses the need for greater co-operation between those of his profession and automotive engineers with a view to developing tests the result of which can be used with greater certainty of success in selecting the most suitable metals for various purposes.

By Dr. Walter Rosenhain

THE recent and present advocacy of the employment of various aluminum alloys in automobile construction has raised anew a fundamental question which must always enter into consideration when a new and comparatively unknown material is suggested as a substitute for an old well-known and well-tried one. The question is, how does the proposed new material compare with the old in regard to those qualities which "count" for the particular purpose for which it is to be used? And it is the answer to this question which must decide, in the first place, whether the new material is to be used at all and, if so, in what quantities it is to be used—i.e. the dimensions of the parts to be made of it. Yet, frequently as such a question must have arisen in the past, there is none more difficult to answer, and the difficulty is by no means confined to the metallurgist who has explored the properties of new alloys.

After all, the answering of our question must depend in the first instance upon a knowledge of what are the physical properties of the material which really do "count" for a given purpose, and that is a question which the engineer or designer is rarely able to answer in really precise terms. On the other hand, the metallurgist in investigating a new material is confronted with equally serious difficulties of his own; methods of testing which appear reliable and exhaustive with one type of material prove far from satisfactory when applied to another, and sometimes the only way to bring out the real value of a new material is to devise some entirely new form of test. When this is done, the difficulty arises of how the results of such a test are to be interpreted. It is obvious, therefore, that in this, as in so many matters, what is required is the closest possible co-operation between metallurgist and engineer.

Present Test Methods Inadequate

Looking at the whole matter broadly, it appears that this very difficulty of estimating the relative values of widely different materials for a given purpose of construction in reality constitutes the severest indictment of the efficiency of our current methods of testing materials. If those tests were really sufficient to tell the engineer precisely how a material would behave in service, then such difficulties would not arise. In practice it must, unfortunately, be admitted that even exhaustive tests of the types now in vogue do not furnish all the desired information and the engineer must still, to a considerable extent, rely upon the test of actual service.

If the nature of mechanical tests is considered, it is not really surprising to find that they do not, and in their present form, cannot, furnish all the information needed. There is, first of all, the vital question of the reliability of a given material to be considered. Of this, the testing of a comparatively few samples chosen at random can scarcely give more than a vague indication. An internal defect here or there may easily escape detection or notice in any series of tests. When such tests are made upon material which has been experimentally produced for purposes of investigation, the occurrence of occasional defective test-pieces would naturally be regarded as an inevitable incident of experimental work. But the vitally important question arises, when a new material comes to be taken into practical use, whether it can be consistently manufactured with reasonable freedom from such defects.

From the metallurgical point of view it is probably true to say that materials produced in the wrought condition—i.e. as rolled sheets or bars or as forgings, freedom from internal defects can be assured by proper manufacturing precautions, mainly because defects generally make themselves felt during the manufacturing operations themselves. With castings, the problem is much more difficult. Some alloys present very great difficulties where the production of sound castings, particularly of difficult shapes, is desired. Where the skill of the founder is aided by rational design which does not demand castings of unfavorable form, these difficulties can generally be overcome.

Reliability Determined by Service Tests

It is, however, very difficult to see how any test other than the costly one of service experience can be devised which can furnish the engineer with data on this point of reliability. It follows that, from this point of view alone, the use of new materials must involve a certain speculative element. It is the intelligence and enterprise displayed in taking these risks that mark the progressive engineer; had they not been taken in the past, the present development of engineering practice could never have been attained. The step involved in passing to an entirely different type of materials, such as an aluminum alloy as compared with steel, is of course, very considerable. But it is quite probable that the progress of the metallurgy of the light metals and alloys will shortly confront the engineer with new types of material even more startlingly different in their properties than are the aluminum alloys already available.

This consideration adds urgency to the other aspects of our question, which may be summed up in the single

query: "What do our mechanical tests really mean?" We are told that a new material which is offered for constructional purposes gives certain tests. If it has been exhaustively studied by the available methods, we shall be furnished with data on tension tests, shear, compression, single and multiple-blow impact, fatigue, hardness and similar matters. When a metallurgist investigating a new alloy has obtained these data, he has done —from that point of view—very nearly all that can be done with existing methods.

Engineering practice, which relies upon a few tests selected from this list for the routine acceptance testing of its materials, confirms this conclusion. Yet, with all these data, can the engineer be really sure how the material will behave when used for a given purpose? The answer is, in the majority of cases, "no." If the tests are good all round, one will naturally feel some degree of confidence in the material and its tentative application will be encouraged, but a quantitative comparison with an old material of known service capacity is still not possible. Two widely different materials giving similar tensile tests and impact-test figures may yet behave very differently if exposed to shock or vibration. In most cases, too, the test data of a new material will not appear entirely "good all round"—there is frequently a price to be paid for an advantage gained in one direction by a lower test-figure in another. Can any one say at the present time what the true "exchange value" of these figures is, even for a single well-known type of material?

The controversy which is not yet at an end in regard to the relative importance of high elastic limit and high notch-bar impact figure in alloy steels shows very clearly that exact knowledge on such a point has not yet been achieved—and this, be it noted, is a joint and equal responsibility as between the engineer and the metallurgist. It is futile for either to suggest that it is the business of the other to settle these matters.

One reason why our knowledge of the fundamentals in these matters has not progressed as far as could be desired is that the attention of engineers and metallurgists in regard to mechanical testing has to a very great extent been concentrated hitherto upon one material or group of materials which possess a fairly definite correlation of physical properties. Ordinary steels, which for so long a time constituted the main materials of the great mass of engineering construction, have been very extensively studied and long experience has set up a certain amount of knowledge as to the relation of service behavior to mechanical test results. It must be admitted, however, that a good deal of this correlation is rather of the nature of tradition than real definite knowledge. Otherwise, how comes it that there is, at this time, a definite divergence of opinion upon so simple a question as the proportion of sulphur and phosphorus which can be safely admitted in certain types of steel? American and British practice differ widely in this matter, and neither is based upon any really definite data. The same remarks apply in other directions, and the insufficiency of our knowledge of this matter is reflected in widely differing specifications and in the occasional failures of parts arising from causes other than specific defects or wrong treatment of the steel.

We may sum up the matter in regard to steel by saying that through enormously extensive testing and the gradual accumulation of knowledge and impressions in regard to the service behavior of the material, we know something of the correlation of mechanical tests to service behavior in the case of steel, but even this knowledge is by no means complete.

The extensive use of alloy steels of various kinds has served to open up this question very acutely, and particularly in regard to the construction of light machinery such as the internal combustion engine intended for use on automobiles or airplanes. Here it became a question—particularly in regard to aeronautical engines —of utilizing materials to the fullest possible extent and the cost of more extensive testing and fuller investigation could well be borne. It very soon became evident, however, that the somewhat vague correlation between mechanical tests and service behavior which forms the basis for the existing use of ordinary steel, could not be extended without careful consideration and investigation to alloy steels of, apparently, much higher strength. An alloy steel showing more than twice the tensile strength of a given carbon steel, could not be exposed to anything like twice the working stresses. The rapid rise in importance of fatigue and shock tests has been due very largely to this factor, which led to the realization that it had now become necessary to know a great deal more about our various materials.

A whole series of empirical mechanical tests has consequently been developed and the results furnish the metallurgist and the engineer with a mass of data which they find it difficult, if not impossible, to interpret in any really exact manner. When, as at the present time or in the near future, we have to extend our vision to include light alloys of aluminum or of still less-known metals, the step is a much larger one. The correlation between test and service in the case of ordinary steels is adequate for working purposes; in passing to alloy steels we find it far less complete and our use of those materials remains correspondingly tentative until experience has gradually furnished us with adequate knowledge or tradition. In passing to light alloys we have to take a still longer step and need not be surprised to find ourselves in territory which is more difficult to explore. Metallurgist and engineer must therefore move forward together, with some degree of caution and using such knowledge as they both possess by way of guide.

Out of the very real difficulty which exists in interpreting the results of current mechanical tests, two schools of thought have arisen. The followers of one seek to overcome the difficulty by trying to devise tests which shall imitate service conditions as closely as possible in the hope that the imitation may be made close enough to furnish data which can be translated with approximate accuracy direct from the testing machine to service conditions. If this aim could really be achieved, the method might well serve as a temporary bridge to cover the existing gap in our real knowledge. It is, of course, at best little more than a method of trial and error. Its

WHAT physical properties of the various metals used in automotive construction render them most suitable for the service to which they are put? This pertinent question and others of a closely related character are not easily answered, largely because tests now in common use do not fully simulate service conditions. On the other hand, actual service tests are expensive and seldom lead to conclusions applicable in other cases. The author here discusses the problem from various angles, but admits that its solution is far in the future, though steps in the right direction are being taken through research work and co-operation between the engineer and the metallurgist.

advocates say, in effect, that they do not care in the least why or how a given part stands up to its work, so long as they can be sure that it really will stand up.

For immediate practical purposes such an assurance would no doubt be extremely valuable, but—it leads no further. Every modification of design or use which alters the conditions must then demand a new "imitation" test. We see this type of experimenting carried to a very high pitch in the use of the model tank for ship-design and of the wind-channel for the testing of airplanes and airship models. There, however, the laws of similarity allow of a scientific interpretation of the results and not only tests of immediate empirical importance, but systematic data leading to the formulation of fundamental principles can be obtained. Unfortunately, the difficulty of the "model" or "imitation" type of experiment are enormously greater in the case of materials and parts of construction.

The real difficulty lies in the time factor. Any "model" or "imitation" test must, if it is to be of real service for practical purposes, furnish its results in a few hours or at most a few days. Yet actual service conditions, which it is desired to imitate are such that failure does not occur, at all events until after the lapse of many thousands of hours, or—ideally—not at all. It follows, therefore, that any such "imitation" test must also be one in which the destructive forces are accentuated in order to bring about failure in reasonable time. This accentuation of the forces, however, completely destroys the value of the test, because it does not in the least follow that a given part which fails somewhat rapidly under intense forces in a test will therefore be less serviceable under the lower stresses of actual service. The apparent order of merit of a whole series of materials may be entirely reversed by merely altering the conditions of test in such a way that in one case failure occurs in a few minutes while in the other many hours are occupied. Therefore, although it is not suggested that tests of the "imitation" type are not at times useful as giving indications of behavior under complex conditions, yet they cannot be regarded as furnishing a satisfactory bridge over the gap between the testing machine and service behavior. The closeness of the imitation is not, and in the nature of things can scarcely be, sufficiently good to furnish reliable data.

The recognition of this conclusion forms the basis for the views of the other school of thought, which considers that progress along two closely related lines is required in order to bring about the desired advance in our knowledge of materials and their behavior in test and in service.

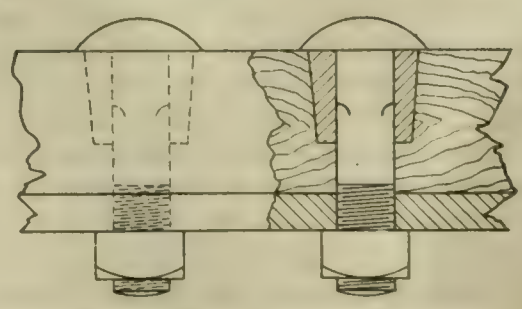
In the first place there is needed advance on the purely engineering side toward a closer analysis of the actual forces operative in the various structures and parts employed. This analysis is, of course, only possible with a concomitant advance in our knowledge of the exact behavior of our materials under moderate and medium stresses, lying not only well within but upon the border line of the elastic limit of proportionality.

On the other hand, advance in testing methods is equally required, and this should take the form of their simplification with a view to the determination of individual physical constants of the material rather than —as is done in many current tests—determining the behavior under some complex system of stresses. This is, of course, a counsel of perfection, since the advance required in both directions is very great. None the less, research activities are now so keenly active that rapid advance might be anticipated were the real value of such work realized. At the present time, a large amount of time and energy are, from this point of view, wasted upon the carrying out of complex systems of testing which do not really advance our fundamental knowledge of materials to any appreciable extent.

In view of the long distance to be covered before the desired end can be obtained by the fundamental methods just outlined, it may well be asked how the immediate difficulties are to be attacked? It is obvious that neither metallurgist nor engineer can await these developments, and immediate practical policy must be determined. This must be left, to a great extent, to the judgment and experience of the individual. That "vague correlation" which has been referred to in connection with steel, has —after all—done excellent practical service. Although it is not to be regarded as ultimately satisfactory, and though its present limitations are sometimes very evident, yet it serves for most purposes—the gap being covered by large "factors of safety" applied consciously or unconsciously in practice. And until the deeper fundamental knowledge becomes available, this same method must remain the only one which can be applied to new materials. Their use can, at first, be only experimental and tentative. Engineer and metallurgist must work together, exchanging all the information at their disposal. The application of new materials is necessarily an experimental matter; the experimental work must be regarded as beginning in the laboratory or the works of the metallurgist, but it must look to its completion at the hands of the engineer. It is not until the engineer has determined whether the material can be used for certain purposes and how it is best used, that the joint achievement of metallurgist and engineer in the development of a new material can be regarded as crowned with success.

Steel Bushings for Bolts Passing Through Wood

TO overcome the difficulty of bolts passing through wood turning in the wood a steel bushing may be used, with a squared hole where the bolt head or the squared part below the head comes. Such bushings are being marketed under the name Harbuck bushings and are made in sizes suitable for from ¼- to 2-in. bolts. They may be used in connection with carriage bolts, countersunk head carriage bolts, deck bolts and machine bolts or cap screws. The action of the bushing on all types of bolts is the same. A flush surface is obtained with all but the common carriage bolt construction. The use of these bushings is said to be particularly advantageous where the part or mechanism is subjected to shock or vibration or where it is necessary to take the bolt out and replace it frequently. Where the bolts and bushings are subject to corrosion, non-corrosive metals are used.



Harbuck bushing on carriage bolt

Results of the Nebraska Tractor Tests, 1921, Conducted by the University of Nebraska—Department of Agricultural Engineering—Lincoln, Nebraska

No. of Test	TRACTOR Name	Rating	Weight	MOTOR Cylinders	Size	R. P. M.	Make	BELT TESTS — RATED LOAD TWO HOURS Average H. P.	Average R. P. M.	Fuel Kind	Fuel Gallons Per Hour	Fuel H.P. Hours Per Gallon	Water—Gallons Per Hour	Temperature Air	Temperature Rad.	MAXIMUM LOAD ONE HOUR H. P.	R. P. M.	Fuel Kind	Fuel Gallons Per Hour	Fuel H.P. Hours Per Gallon	Water—Gallons Per Hour	Temperature Air	Temperature Rad.	Var. L. 1 Hr. R. P. M. High	Low
70	Minneapolis	17-30	6,400	4	4¾x7	775	Own	30.07	775	K...	3.46	8.70	1.00	75	208	31.95	782	K...	3.91	8.18	3.96	80	210	861	776
71	Avery	12-25	7,500	2	6½x7	700	Own	25.20	704	G...	3.12	8.08	8.00	70	210	25.08	703	G...	3.46	7.25	8.00	79	210	893	695
72	Avery	8-16	4,900	2	5½x6	750	Own	16.66	758	G...	2.15	7.76	5.50	76	210	16.76	753	G...	2.29	7.33	4.00	71	205	815	740
73	Wetmore	12-25	3,000	4	4 x5½	1,265	Weidely	25.27	1,253	K...	3.65	6.95	0.00	72	195	27.94	1,264	K...	3.46	8.08	0.64	70	206	*1,280	1,246
74	Huber "Super 4"	15-30	6,090	4	4½x6	1,000	Midwest	30.34	1,010	G...	3.29	9.23	0.08	82	181	39.79	1,014	G...	5.00	7.95	0.18	81	183	1,090	1,006
75	Lauson	12-25	4,900	4	4⅛x5¼	1,200	Midwest	25.21	1,214	G...	2.96	8.53	0.42	75	164	37.38	1,219	G...	5.17	7.23	0.52	64	158	1,269	1,213
76	Best "60"	35-55	17,500	4	6½x8½	650	Own	56.09	656	G...	6.97	8.05	5.00	90	209	56.33	655	G...	6.90	8.16	7.00	94	209	974	650
77	Best "30"	18-30	7,400	4	4¾x6½	800	Own	30.40	810	G...	4.55	6.68	1.50	77	201	30.43	806	G...	4.31	7.06	2.50	86	203	1,227	796
'A'	Shawnee {Power Patrol}	.....	4,250	4	3⅛x4½	1,400	Le Roi	For Highway Grading Only										No Belt Pulley							
78	Russell "Giant"	30-60	22,180	4	8 x10	525	Own	60.35	534	K...	11.98	5.04	7.63	100	200	66.13	532	K...	16.18	4.09	6.00	107	200	600	529
79	Hart-Parr	—20	4,110	2	5¼x6½	800	Own	20.12	808	K...	2.27	8.86	1.00	87	190	23.01	811	K...	2.56	9.00	1.29	84	183	858	808
80	Eagle	16-30	7,210	2	8 x8	500	Own	30.25	505	K...	3.65	8.28	2.35	95	185	31.80	503	K...	4.24	7.50	2.68	87	172	605	496
81	Eagle	12-22	6,090	2	7 x8	500	Own	22.41	507	K...	2.83	7.92	2.00	81	191	23.35	503	K...	3.18	7.34	2.12	90	191	555	501
82	Allis-Chalmers, 12-20	14-27	4,550	4	4⅛x5¼	1,100	Midwest	27.28	1,102	G...	2.81	9.71	0.26	98	180	33.18	1,105	G...	3.86	8.60	0.34	85	181	1,238	1,074
83	Allis-Chalmers, 18-30	22-38	6,640	4	4¾x6½	930	Own	38.62	942	G...	3.94	9.81	1.16	87	169	43.73	937	G...	4.72	9.27	0.97	77	173	1,080	937

No. of Test	TRACTOR Name	Rating	Weight	DRAWBAR TESTS — RATED LOAD TEN HOURS H. P.	Pull Lbs.	M. P. H.	Engine Speed R. P. M.	Wheel Slip % Pt. of Lugs	Wheel Slip % Face of Rim	Gear Used	Lugs Used	Fuel Kind	Fuel Gallons Per Hour	Fuel H.P. Hours Per Gallon	Water—Gallons Per Hour	Temperature Air	Temperature Rad.	MAXIMUM Pull Pounds	M. P. H.	Miscellaneous Total No. Hours	Lub. Oil. Gal.
70	Minneapolis	17-30	6,400	16.88	3,065	2.06	790	11.90	2.02	Low	Angle	K	3.46	4.87	0.50	64	179	3,921	1.88	35	8½
71	Avery	12-25	7,500	13.77	2,441	2.12	684	9.60	1.50	Low	U-Cleats	G	3.87	3.56	5.00	83	210	2.500	2.02	35	8½
72	Avery	8-16	4,900	8.23	1,366	2.26	783	12.00	2.40	Low	Spuds	G	1.92	4.28	3.55	71	209	1,690	2.22	42	10¾
73	Wetmore	12-25	3,000	13.28	1,477	3.37	1,235	14.00	5.60	Inter	Angle	K	2.88	4.61	0.04	62	176	2,260	2.67	32	5
74	Huber "Super 4"	15-30	6,090	17.27	2,264	2.86	1,004	9.10	—2.70	Low	Cone	G	3.14	5.49	0.14	76	173	3,645	2.76	32	4¾
75	Lauson	12-25	4,900	12.81	1,599	3.01	1,175	8.70	—2.60	High	Spade	G	2.75	4.64	0.22	71	152	2,985	2.63	32	3
76	Best "60"	35-55	17,500	35.31	5,093	2.60	692	1.25	.....	High	Crawler	G	5.66	6.24	0.16	86	187	7,500	2.44	45	23½
77	Best "30"	18-30	7,400	19.75	2,537	2.92	810	0.70	.....	High	Crawler	G	3.77	5.24	2.55	82	202	2,445	3.11	47	19
'A'	Shawnee {Power Patrol}	.....	4,250	5.85	1,293	1.70	1,492	17.80	9.30	Low	Angle	G	2.21	2.65	0.03	80	202	1,648	1.71	32	3½
78	Russell "Giant"	30-60	22,180	30.60	5,656	2.03	574	5.10	—0.60	Low	Angle	K	11.94	2.56	5.45	79	166	8,800	1.85	40	22¼
79	Hart-Parr	—20	4,110	11.23	1,406	3.00	760	7.04	—6.98	High	Spade	K	2.07	5.42	0.56	87	190	1,690	2.97	30	2½
80	Eagle	16-30	7,210	17.15	2,116	3.04	460	4.74	—7.64	High	Spade	K	3.12	5.49	1.10	87	194	2,200	3.00	38	4¼
81	Eagle	12-22	6,090	12.81	1,553	3.09	469	5.10	—6.80	High	Spade	K	3.10	4.13	1.90	83	180	1,665	2.92	47	4¾
82	Allis-Chalmers, 12-20	14-27	4,550	15.13	1,771	3.20	1,094	7.58	—4.46	High	Spade	G	2.60	5.32	0.23	91	168	2,560	3.14	41	7½
83	Allis-Chalmers, 18-30	22-38	6,640	23.72	2,780	3.20	951	10.80	0.15	High	Spade	G	4.00	5.92	0.27	79	167	3,075	3.10	41	9

*Hand controlled.

Test No. 70. Minneapolis 17-30. Own governor, "Dixie" "H T 46" magneto, Kingston "E" carbureter. Fan belt adjusted. Clutch and valve rods adjusted once.

Test No. 71. Avery 12-25. Own governor, K-W "T K" magneto, Kingston "E" dual carbureter. Ground one exhaust valve. Replaced original plugs by long skirted plugs. Pistons were turned down 0.005 in. Compression low on rear cylinder. Changed from kerosene to gasoline tractor.

Test No. 72. Avery 8-16. Own governor, K-W "T K" magneto, Kingston "E" dual carbureter. Pistons turned down 0.006 in. Ground all valves. Ground exhaust valve front cylinder. Relieved all piston rings. Changed to gasoline tractor. Kerosene gasifiers replaced by gasoline adapters.

Test No. 73. Wetmore 12-25. Weidely governor, Splitdorf Aero magneto, Schebler "AT" carbureter. No adjustments or repairs.

Test No. 74. Huber Super Four. Taco governor, Kingston "L D 4" magneto, Kingston "L" carbureter. Cleaned carbureter. Replaced magneto; old one had poor contact points. Changed all plugs.

Test No. 75. Lauson 12-25. Taco governor, Dixie "46 C" magneto, Kingston "L" carbureter. Replaced all spark plugs. Tightened clutch. Broke clutch shoe.

Test No. 76. Best "60." 35-55. Own governor. Bosch "Z R 415" magneto, Ensign "G" carbureter. Valves were ground. Air cleaner removed. Changed carbureter horn from 2 in. to 3 in.

Test No. 77. Best "30." 18-30. Own governor, Berling "E Q 41" magneto, Ensign "G" carbureter. Magneto timing advanced 5 deg. Inlet in carbureter drilled to standard size, original opening too small. All valves were ground. Steering clutches adjusted. Steering arm broke.

Test No. 78. Russell Giant 30-60. Pickering governor. Bosch "D U 4" magneto. Kingston "E" dual carbureter. Fan belt replaced. Tightened fan belt. Belt lagging came off pulley. Radiator replaced by larger one. All valves were ground. Clutch adjusted. Valve spring broke and was repaired.

Test No. 79. Hart Parr 20. Own governor, K-W "T K" magneto. Stromberg "M" carbureter. Fuel line cleaned. Breaker points on magneto readjusted.

Test No. 80. Eagle 16-30. Own governor. Dixie "462" magneto. Schebler "A" carbureter. Adjusted clutch. Cap came off connecting rod grease cup. Burned out right connecting rod bearing.

Test No. 81. Eagle 12-22. Own governor. Dixie "462" magneto. Schebler "A" carbureter. Magneto timing advanced. Carbureter float adjusted. Pistons replaced by higher compression type. Cotter key in end of transmission drive shaft sheared off. Connecting rod grease cups came loose unless tightened with pipe wrench. Bolt came loose on shift bar. Air intake pipe diameter increased to 3 in.

Test No. 82. Allis-Chalmers 12-20. (14-27.) Own governor. Dixie "46 C" magneto. Kingston "L" carbureter. Gasoline feed line broke at tank. Carbureter cleaned. All valves ground. Magneto timing retarded. Two spark plugs replaced and all plug points adjusted. Cylinder blocks removed and top rings on pistons 1 and 2 found sticking. Oil pipe line broke.

Test No. 83. Allis-Chalmers 18-30 (22-38). Own governor. Eisemann "G 4" magneto. Kingston "L" carbureter. Carbureter float adjusted. Clutch fork replaced. Carbureter replaced. Air washer redesigned and air space increased. Water tank connected to air washer.

Test A. Shawnee power patrol. Road grader. LeRoi governor. Berling "E 41" magneto. Schebler "AX 66" carbureter.

The Future of Commercial Aviation

Views of two authorities which were expressed at the recent British Air Conference. In this article one gives an outline of what must be done if commercial aviation is to progress, while the other shows a comprehensive survey of civil aviation in the different countries.

"IF civil aviation is to have any future there is only one way and that is to carry more passengers and yet more passengers. Given even a moderate percentage of traveling public, civil aviation could be made to pay its own way within five or six years." This is the immediate future of civil aviation as expressed by Lieut.-Col. W. A. Bristow in his address before the British Air Conference, Feb. 7, 1922.

Col. Bristow goes on: "On a basis of a week of seven days the minimum number of passengers necessary for the profitable operation of any one company engaged in aerial transport is not fewer than 500, and these must be carried in the most efficient machines operated by an exceedingly skilled and highly organized personnel. There are many who will consider this figure excessive, but probably few will dispute the statement that the present number of passengers must be increased several times over before the business of aerial transport can be carried on at a profit without the assistance of subsidies."

Col. Bristow has in mind, of course, aerial transport between London and Paris, where three French and two British aerial transport companies operate, but all with subsidy assistance, which alone has made a continuation of the service possible. Drawing attention to the impossibility of any aerial transport, carrying few passengers, and attempting to operate without a subsidy, Col. Bristow adds: "What other transport company could afford to keep a staff of such proportions for fewer than fifty passengers per week, taken as an average over the entire year? In some aerial transport lines the persons employed on the working of the fleet number more than the passengers carried. No other form of transport could live long under such conditions, however efficient the vehicles or methods."

Col. Bristow is firmly convinced that the lack of passengers in sufficient numbers to make aerial transport a financial success, is due to a fear of accident by the traveling public, and that a broad educational program is essential before subsidies can be discontinued. Here are his views:

"By what means are we to attract the far greater number of passengers necessary? At present no real concerted effort is being made by the operating companies to attract the public. Much of the advertising and propaganda of the operating companies is aimed at securing as big a share as possible of the numbers already traveling by air, but little if any to encourage the general use of the air way. Before we could answer the question as to how to increase the number is to be done, it will be necessary to try to form some idea as to the main reasons that keep the public back.

"It is considered that the chief reason lies almost wholly in the fact that insufficient attention has been concentrated upon the problem of making flying really safe, and secondly we have not made it look and feel as if it is. I am now not speaking of any one company, or of even any one country, but as a result of a close examination of the commercial air fleets of the world, and after talking with hundreds of passengers and timid inquirers after knowledge, I am forced to the conclusion that the question of safety is the most important, and the one most urgently calling for treatment, if even a moderate proportion of the traveling public is to be converted.

"We are rather apt to think that the public know little of the factors determining safety in flight, and that to them all airplanes are very much alike. Experience has shown this idea to be completely erroneous. The author has heard many conversations that show the contrary to be the case, and on more than one occasion has witnessed passengers refusing to travel in a machine which they did not consider safe or sufficiently comfortable.

"The experience of last year has revealed several points that require serious attention, even although the number of fatalities and injuries are low, and in the case of the British the cross-channel service was actually nil. As, however, all companies have to suffer if anything impairs the confidence of the public, it is necessary to survey the European services generally, and the operations of some have undoubtedly given cause for considerable misgivings. Probably the most serious cause of accidents has been lack of skill and judgment on the part of the pilots, although it is necessary to except the British pilots from this generalization.

"On the Continent and in America, however, there is considerable room for improvement, not only in the flying methods but in the qualification deemed necessary by the operating companies for pilots that are to be entrusted with passengers to be taken on long and difficult routes. It seems almost impossible, but it is a fact, that pilots are sent off with passengers on long routes over which they have never flown before to land on airdromes they have never seen. It is considered by many that the question of training of suitable pilots is one calling for the most serious attention by all those concerned with the control and operation of commercial aerial transport."

Commercial aviation as carried on up to the present can scarcely be taken as a criterion of what the future of it will be, and Col. Bristow considers "it a probably fair statement that commercial aviation has up to the present been little more than a full scale experiment with apparatus largely of a makeshift and temporary character."

He goes on: "In spite of these limitations the results have been of an extremely interesting and valuable character, and the greatest credit is due to those who have in face of serious difficulties carried ever-increasing loads with factors of regularity and safety of a high order."

In the first place, he continues, "We have to recognize that at present it is not possible to carry on the business without a subsidy in some form or another, and therefore the character, allocation and working of the subsidy system, will have a most important effect on development. . . . The London-Paris route has been one of the best in Europe to experiment with and operate on a subsidy basis. It possesses inherent advantages not to be found

elsewhere. It is about the right length for severity of test, the wide strip of water necessitates a high standard of reliability, and the rapidly fluctuating weather conditions along the whole route compel the rapid development of the two great guardian services of aviation, namely, meteorology and wireless telegraphy and telephony. In addition, the two termini, London and Paris, and the general operations on the route are controlled by different countries with different ideas and methods, and no doubt much of the progress that has been made is due to the mutually instructive effect by such an arrangement. Regarded as an experimental laboratory for the instruction of designers, constructors and operators, an international route is almost bound to be of greater value than any purely national one.

The London-Paris Route

"From a commercial standpoint, the London-Paris route has great advantages. The actual journey by land and water, with its changes, delays and vexatious examinations, is rendered far more troublesome than its mere length would indicate, and very few people who have experienced the convenience and speed that can be obtained on this route, in any reasonably suitable airplane, will feel inclined to revert to the old means of travel. The number of passengers is enormous, and in addition to the subjects of the two countries there are scores of travelers and visitors from every country in the world who yearly pass between the two capitals.

"There are hundreds of routes that could be opened up to air traffic to advantage but it is considered that success in these will best be assured by first hammering out the many technical and commercial difficulties on our own doorstep, and the Paris-London route is especially suitable for this purpose."

Col. Bristow is firmly convinced that commercial aviation will have a greater influence on military air craft than the latter will on commercial development. He believes that progress in flying generally and especially in connection with the design of machines and engines, depends largely upon actual flying experience, and already most of the flying all over the world is done by commercial aircraft. Progress in designing military aircraft is, therefore, to an important extent, directly dependent upon the rate of evolution of commercial aircraft. Further, and this is of vital importance, it is considered that progress can only be continuous if the ranks of aeronautical engineers are constantly replenished with new blood.

Commercial Aviation Aid to Military

On this Col. Bristow says: "It is hardly possible that the profession of aeronautical engineering can be built up on the requirements of military aircraft alone, so that it may well be that the future superiority of British naval and military air fleets will depend mainly upon the growth of commercial aviation, although the actual differences between civil and military aircraft may be as great as that between a Hood superdreadnaught and a Mauretania."

Col. Bristow does not believe that the new designs of the aircraft engineer for commercial aviation will be able to so increase the earning capacity of the machines that present losses in operation can be turned into profits. He says:

"The first item that has to be recognized is the impossibility of at present making anything but a financial loss from the operation of commercial aircraft, although on paper it can be shown with comparative ease that the conveyance of passengers and goods by air can be attended with the happiest financial results even without the assistance of a subsidy. It is so tempting to work out the cost of gasoline and oil for four trips, London to Paris, per machine per day, deducted from gross receipts, calculated upon the assumption that machines are always full, and out of the handsome balance provide for maintenance and depreciation, and a dividend of 200 per cent per annum. In practice it works out differently. With the aid of the present subsidy schemes in Europe, some air transport companies may be showing a profit, but in analyzing the real position, it is necessary to omit the subsidy items from the accounts. It is clearly impossible to wipe out all aerial transport losses by improvements in thermal and aerodynamic efficiencies. . . . Improvements in equipment, organization and methods of operation are all most valuable, and must on no account be neglected, but the sum of them all will not be sufficient to turn the scale."

Col. Bristow believes that a very severe form of testing planes is necessary to show their stability before the public will lose its present sense of fear in aerial transport. He suggests that before a commercial airplane could receive a certificate of air worthiness it would have to make ten forced landings on a given route, immediately upon receiving wireless instruction from the ground, and that moment selected entirely by the wireless operator. Few might care to accompany the machine on such a test, but the majority of pilots in the course of a year will probably have to make forced landings under difficult conditions. He further believes that airdromes must be much more thoroughly equipped than at present, and declares, "there is not a single public airdrome properly equipped with apparatus by which loaded airplanes can be weighed, or the position of their center of gravity determined, and it is nothing short of remarkable that more accidents do not occur, as a result of ignorance as to these two vital factors."

Practical Suggestions

Col. Bristow has many other suggestions of a practical character that should be carried out before civil aviation will be as attractive to the public as it must be in order to insure patronage to make it a success. Here are some of the suggestions:

On each aerial route there should be a wireless operator who acts solely as a watcher and guide to the machines in the air. He should not be engaged in transmitting other messages, but engaged solely in serving the machines in transit.

At present on the London-Paris route the weather reports are often many hours late and unsatisfactory, with the result that on many occasions passengers have been landed in all sorts of out-of-the-way places.

Silencers should be fitted as their absence prevents the operator making full use of the wireless telephone, the engine noise adversely affects the safety of the machine in that it prevents the pilot hearing any unusual noises in his engine, and most passengers complain of deafness after a flight, and also of not being able to talk, except with greatest difficulty while on the route.

Aerial cabins are either too hot or too cold, and no serious endeavor has been made for ventilation. Traveling from London to Paris recently the temperature in the cabin was 32 deg. Fahr. for over two hours in addition to which there was a draft of about 500 ft. per minute. Frequently no passengers have food between breakfast and 4 o'clock in the afternoon when they make this trip.

The permissable 30 lb. of baggage carried free has been a great source of trouble. This is only a relatively small proportion of the baggage that passengers carry. In many cases it is impossible to take excess baggage on the plane, and when done it is a very expensive luxury. Baggage divided this way has given no end of trouble, and many times aerial passengers spend three or more days in the hotel waiting for their baggage to arrive. There is.

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sometimes plenty of room in the fuselage for baggage, but the doorway is too small to permit of using the space.

Life assurance companies should be persuaded to allow ordinary flying under the terms of the standard life and accident policies. It is not likely that people who have paid premiums for years are going to travel by a route on which their policies are rendered null and void in the event of their death. It is a very bad advertisement for civil aviation that almost every life and accident policy in the country places a complete ban on flying. It will be a red-letter day in the history of commercial aviation when this restriction is removed.

Col. Bristow would have flying a part of the curriculum in every school in the country in order that the rising generation may be taught to regard air travel not as a romantic novelty, but as one of the sober facts of life. He would have the history of flying, the development of commercial aerial transport, and the engineering and scientific aspects of flight taught. He would use the movie as a factor in aerial education. Lastly he suggests an educational propaganda among industries.

Col. Bristow recommends a very big reduction in rates for aerial travel. The old price for a ticket from London to Paris was ten pounds sterling, and when this was reduced to eight the number of passengers increased very considerably. He believes the single fare will have to be reduced to four pounds sterling before the necessary increase in passenger traffic can be obtained.

A revised policy for research and experiment in connection with the problems associated with the development of civil aviation is needed. There is immediate need for machines of the latest types and a large number of engines.

Most important is an establishment for the adequate training of commercial pilots, which training must be much more comprehensive than that needed for pilots during the war.

Information of a valuable nature on the present and future state of commercial aviation was given at the Air Conference by Lord Gorell, Under-Secretary of State for Air.

The relationship between military and naval aviation, which may be designated service aviation for convenience, and civil aviation, was well established when he expressed the thought that service and civil aviation complement each other, and that the closest parallel is that of the relationship between the Mercantile Marine and the navy. The navy maintains peace and order on the seas; the mercantile marine transports passengers, goods and mail, and in case of need assists the activity of the navy. The parallel may be regarded as holding good in another respect: The development of the mercantile marine was by direct government action, and it did not depend on subsidies for its expansion, but rather on fundamentally sound commercial principles. Such, Lord Gorell believes, is the true view of civil aviation.

The one great essential for civil aviation is that of constant scientific research; in fact, research is the essential length between service and civil flying.

In commercial aviation the incorporation of the airship must not be overlooked. In this field the best hope of successful development lies in private enterprise conducting the service for profit, just as the mercantile marine has been developed on a business basis. Aerial transport has been hindered a little by what may be termed the exclusive enthusiasm of advocates of airplanes and airships respectively. It is a mistake to concentrate regard wholly upon one or the other; the functions of both, though rather different, are concerned with transport through the air, and the capabilities of each should supplement those of the other. The airship can be employed most economically over long distances, and the airplane most economically over distances which, though of considerable length, are yet much shorter. Lord Gorell reminded the Air Conference that a recent airship report stated that if airship service were maintained for a minimum period of inauguration of one year the establishment of the route from England to Egypt could be definitely begun and tentative flights made beyond Egypt in the direction of India and South Africa at an estimated cost of £540,000. If the service were to be maintained for a two-year period a regular monthly service to Egypt could be established, the definite extension to India begun, and demonstration flights carried out toward South Africa at an estimated cost of £1,339,000. . . . If it were decided to establish an Imperial Service on a definite basis, the construction of new airships, and of fully equipped permanent basis in South Africa and Australia would be necessitated. It is considered that this establishment could not be completed under five years and that estimated cost would be £8,000,000.

Lord Gorell gave a comprehensive survey of civil aviation in different countries.

Germany is fostering airship development by the means left at her disposal by the Peace Treaty. Her scientists are probing the constructional problems connected with large airships, and every effort is being made by financial and other assistance to maintain her technical staffs and air bases in existence. German commercial interests are negotiating with foreign countries with a view to the development of airships and airship services abroad. Plans are being discussed for an airplane service between Spain and Argentina.

France has decided to provide six airship stations, two in France and four in North Africa.

Italy is discussing plans for maintaining an airship service between Rome and Tripoli, Africa, first for mails and later for passengers.

In Italy aircraft is leased temporarily to private aviation companies for training purposes, and the budget for 1922 included grants to Swiss companies to assist them in purchasing modern airplanes. Aerial transport lines receive further subsidies based on the number of pilots they keep in training. An airdrome is to be established at Constance for international traffic with Germany.

Aviation in Holland

The 1922 budget of Holland includes 1,315,000 florins for civil aviation, of which 370,000 florins were set aside for subsidies for air transport companies. During the summer of 1921, 289 flights were carried out between Amsterdam and London, 278 between Rotterdam and Hamburg and 433 between Amsterdam and Paris. There were 1511 passengers, 30,856 kg. of various articles, and 1395 kg. of mails carried.

In Czecho-Slovakia the vote for civil aviation in 1922 was 9,080,000 kroner as compared with 6,850,000 kroner for 1921. One company will receive a subsidy of 6000 kroner in connection with the Paris-Prague air service.

The total civil aviation vote in France for 1921 was

184,500,000 francs, or 55,000,000 francs more than in 1920. Of this, 33,000,000 francs were allocated for subsidies and 25,500,000 francs for two rigid airships, airship bases and supplementary equipment. For 1922 the aerial budget is 152,000,000 francs, of which 46,000,000 is for subsidies.

In Canada the $700,000 voted for 1921-1922 has been used for the survey of air routes, regulation of flying, acquisition and maintenance of civil air stations and work has been carried out for forest patroling, fisheries protection, surveying, anti-smuggling operations, etc. The Air Board lends airships and airplanes to commercial companies free of charge under certain conditions. Between April and July, 1921, there were made 518 flights on civil government aircrafts, 73,000 miles being covered. No direct subsidies for commercial air services have been given.

Australia allocated £54,000 to be spread over three routes: Geraldton to Derby (Western Australia), 1195 miles—subsidy £25,500; Sidney to Adelaide, 795 miles—subsidy £17,500, and Sidney to Brisbane, 590 miles—subsidy £11,500. The saving in time to passengers traveling from Sidney to Brisbane and Adelaide is 18 and 14 hours respectively.

During part of the summer of 1921 an air transport service was maintained between Stockholm, Sweden, Reval and Riga. In all, 31 trips were made in each direction, and 17 passengers, 575 pounds of merchandise, and 1480 lb. of mail carried. The average time from Stockholm to Reval was 2¾ hours as compared with 24 hours by boat.

Belgium in 1921 voted 10,000,000 francs for civil aviation, of which 1,600,000 francs were for subsidies. The subsidies were equivalent to a 200 per cent addition to the receipts from passenger fares. There was a big increase in aerial traffic between Belgium and England during the summer of 1921, as compared with 1920. In the 5 months, May to August, inclusive, in 1920, only 49 passengers were carried in Belgian machines between Belgium and England, 38 journeys being made. During the same 5 months in 1921 there were 597 passengers carried and 339 journeys made.

Civil Aviation in France

There has been a very great development in civil aviation in France in the last few years due to its subsidies.

In 1919 there were only 3 companies operating on 3 routes, but in 1921 regular and frequent services, worked by 7 different companies, were in operation from Paris to London (3 services each way daily); Amsterdam via Brussels (once each way daily in addition to direct services 3 times a week to Amsterdam), Warsaw via Strassburg and Prague (once daily), and from Toulouse to Casablanca (four services each way weekly), Bordeaux to Toulouse and to Montpelier (once daily), from Montpelier to Nice (twice a week each way), from Bayonne to Santander (daily), and there was also a service from Paris to Le Havre to connect with transatlantic steamships, operated by the Compagnie des Messageries Aériennes, which is also responsible for the greater part of the journeys between Paris and London. The services between Paris, Prague and Warsaw are carried out by the Cie Franco-Roumaine de Navigation Aérienne, which is subsidized by the Czecho-Slovak Government as well as by the French, and also receives important privileges from the Roumanian and Polish governments. In a period of about 12 months ending last September the company's machines covered 156,520 miles and carried 500 passengers, 80 tons of goods and 300 mail bags. An extension of the service in the spring from Prague to Constantinople is proposed.

Arrangements have been made by the Government for civil pilots liable to mobilization to have opportunity for one hour's flying a month free of charge at any one of

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five training centers for reserve pilots, which are organized under the control of the Service de la Navigation Aérienne.

The following statistics illustrate the total work carried out by French civil aircraft from Jan. 1 to Sept. 30, 1921:

Number of flights	5,115
Number of machine-hours flown	14,100
Average duration of each flight	2 hr. 45 min.
Approximate machine mileage	1,145,500
Number of passengers carried	8,761
Weight of goods carried, in tons	126

The French air traffic between Paris and London showed a considerable increase last year. Between April and September the number of departures and arrivals of French machines to and from the Continent amounted to 1058, compared with 408 for the corresponding period in 1920, while the number of passengers carried in French machines was 3449, as against 312.

The development of aviation in French colonies must also be noticed. A mail service is operated in Syria three times a week, which covers the 75 miles between Aleppo and Alexandretta in 1 hour, whereas the only alternative means of transport—a combination of rail and steamer—occupies between 8 to 10 days.

A proposal is also on foot for linking up Paris, Marseilles and Algiers by an airship service, and to establish airplane services between Algiers and Biskra and between Algiers and Casablanca. For subsidizing these routes 1,000,000 francs was included in the Algerian budget for 1922.

In the United Kingdom the greatest activity in civil aviation was during the summer months. During August, 1921, 155 flights in British machines to the Continent carried 920 passengers. During the summer months—April-September inclusive, two daily services were operated between London and Paris, when 4006 passengers were carried. The British machines carried 500 more passengers than the French machines, but the French carried the greatest proportion of merchandise, 53 tons as compared with 11 tons in British machines. The British service showed a high efficiency as 93 per cent of the flights made during April-September were completed within 4 hours, as compared with 82 per cent being completed within 4 hours in 1920.

Accident Statistics

The number of accidents has been encouragingly small; for each flying accident during the 29 months from May, 1919, to September, 1921, the average number of machine-miles flown was 33,000; of the 142,241 passengers carried, 12 were killed and 17 injured. The rate for the six months ended Sept. 30, 1921, was less, and only one passenger was killed and one injured during that period.

During the 12 months ending Sept. 30, 1921, imports into the United Kingdom were carried by air to the value of £512,060 and the value of exports (including re-exports) was £278,131; the bulk of the goods were carried between this country and France, but the major portion of them on other than British machines.

Automotive Market in Argentina

Keen competition requires study of local problems. Service vitally important. The writer, engaged in selling in the Argentine, gives his opinion about choosing representatives and offers suggestions to American manufacturers as to method of procedure necessary for sales success.

THAT the American manufacturer of motor cars, trucks, accessories or tires may fully understand the market of Argentina, he must realize at the outset that Buenos Aires is the most difficult and intensely cultivated market for any kind of product, whether automotive, dry goods or perfume. As the South American seems to believe that New York is the center of the United States, so the citizens of other countries believe that in South America all things commercial center around Buenos Aires. Hence the manufacturer selling goods in South America concentrates on this city.

This concentration of effort brings the merchants of Europe and the United States into keen competition. Unheard of sacrifices as to terms and prices are sometimes made, and the Argentine is a close buyer, very experienced in dealing with merchants of other countries.

There is very little manufacturing done in Argentina. In some cases, however, local factories have attempted to imitate American products, such as lamps and small parts. The few repair shops that do exist are equipped, in many instances, with American machinery. There is one large manufacturer of storage batteries located at Buenos Aires, known as the Fabrica Nacional de Acumuladores, the product called "Nacional," of good quality and giving satisfactory service. This firm purchases many of its parts in the United States.

To sell motor cars in Argentina, one should know something of its geographical situation. It is a vast country with many good roads and several very large cities in the interior. There are three principal ports of entrance, Buenos Aires, the largest; Rosario, situated on the Parana River, capable of accommodating vessels of 18,000 tons and over, and where the banks of the river are so situated that ships unload on the land without the aid of wharves; and further south lies the port of Bahia Blanca.

Many hundreds of miles southward, in Patagonia, other ports are found, giving entrance to the sheep raising country and the great oil fields of Rivadavia. At the foot of South America lies the important port of Punta Arenas, which is open about six months out of the year. This port handles the sheep raising country, where motor trucks are greatly needed for the transportation of wool, as there are no rivers large enough for that purpose in that section of the country.

There are two important factors to be considered in conjunction with selling cars in the Argentine. They are:

(1) To send out the right sort of man for the work,
(2) To select the proper kind of representation without putting too much stress on credit reports.

American manufacturers are prone to forget that it costs many times more to travel and do business in South America than it does in the United States. To be successful, a man must know the people and have some knowledge of Spanish, which he can pick up quickly if he keeps away from English-speaking people as much as possible. The manufacturer will find it advisable to send out an experienced man, for he will secure better results and be able to get in touch with influential people.

Too often manufacturers close contracts with foreigners on the strength of fine words and a large letter of credit. This type of person may even have letters of introduction from influential people and officials and give an initial order for ten or more cars.

It is better not to depend wholly on these favorable signs, but before closing a contract to spend $50 on cables to ascertain whether the prospective dealer runs a repair shop; what standing he has in the community; whether he has ever refused a draft drawn on him by an American firm, without a cause which can be considered honest, or whether he has taken advantage of exchange conditions, as many have during the past year, and refused to accept shipments.

No manufacturer should give any firm an agency that is not willing to place an order for at least two of each model of cars. In instances where a factory makes but two models, the initial order should be for not less than six cars, and in every case 20 per cent of the purchase price should be spent for repair parts. Service must be given and it cannot be given unless the dealer is prepared to furnish repair parts.

It is a mistake to give an agency to any firm not equipped with a "taller" or repair shop. A firm in Buenos Aires, for instance, handling one of the leading American cars, once took the position that they did not wish to see the car after it left the salesroom. This firm was worth $1,000,000, but it had no repair shop. To-day it is out of business, as might be expected. If service is not given, the resale is apt to be lost to a concern that does give service.

The vast size of Argentina has an important bearing upon the type and number of agencies a manufacturer will need to market his product most efficiently. There are over 8½ million people in the country. In the city of Buenos Aires there are 1,750,000. There are five cities outside of Buenos Aires with populations of over 60,000, and each an important point of distribution; Bahia Blanca, a seaport city of 348,000 inhabitants, located on the south shore; La Plata, thirty miles from Buenos Aires, where some of the largest packing plants are located. Many ships load freight and take on passengers here and it is a noted university city; Rosario has 222,600 people and is a shipping point for a vast province; Tucuman is the center of the sugar industry; Mendoza, while it has only 50,000 inhabitants, is the center of the wine country, very wealthy and at the foot-

hills of the Andes through which the Transandine road passes over the mountains into Chile. Sante Fe and Cordoba, a favorite summer resort in the foothills of the Andes, are both important cities.

An American motor car builder making a contract with a Buenos Aires dealer who wishes the entire Argentine as territory should so word the contract that the dealer will be obliged to place sub-dealers in the principal cities, that if this part of the contract is not carried out, the manufacturer will have the right to go after the business in the neglected provinces himself, giving the Buenos Aires dealer the commissions due him.

Advertising as an aid to Argentine dealers has been neglected by American manufacturers. Manufacturers must learn to give the same advertising aid that they do in their own country in order to develop business.

Successful advertising requires that the medium used be written in the language of the country. The biggest part of all cars entering the port of Buenos Aires are sent inland for distribution, and advertising matter must also go inland to bear results. The type of advertising used in the United States cannot be applied to local conditions in the Argentine.

Federal Income Tax Amortization

THE new Federal Income Tax Law provides for a reasonable deduction for the amortization of buildings, machinery, equipment or other facilities constructed, installed or acquired on or after April 6, 1917, for the production of articles contributing to the prosecution of the war against Germany.

A recent compilation of this law with relation to amortization has been made by Mr. T. W. Dinlocker, assistant comptroller, S. K. F Industries, Inc., and the most important features of the law are well worth studying now, as claims cannot be filed later than March 15, 1922.

Mr. Dinlocker states that:

"Under the law, amortization is permitted in case buildings, machinery, equipment or other facilities were constructed, erected, installed or acquired on or after April 6, 1917, for the production of articles contributing to the prosecution of the war. Reference to the Revenue Act of 1918 makes it clear that the differentiation between those industries to which amortization shall or shall not apply is as between essentials and nonessentials. The fact that any industry was allowed to operate under priority is evidence sufficient of its essential character. It is not necessary that the product was sold to the Government, nor even to Government contractors, to bring the manufacturer of essentials within the rule."

"Under the regulations amortization is divided into two distinct classes, the first known as Class I, dealing entirely with buildings, machinery and equipment which have been already discarded or will be at a known date previous to March 3, 1924. The second, or Class II, deals with buildings, machinery and equipment which have and will undoubtedly continue to have a certain value in use to the taxpayer in his going business."

"Class I amortization is relatively simple to determine. This covers buildings, machinery and equipment that have been discarded or will be discarded at a known date. Class II, the more difficult of determination, covers property which still has and probably will continue to have a value in use in the going business, when the useful value is not to be taken at less than the salvage value. Salvage value was ruled to be the value ruling during the first part of 1919, but this value is abnormally high; later interpretation and application of the law and regulations has become more reasonable and liberal."

"In support of all amortization claims, it is necessary to submit a statement showing the calculation of amortization in the following form:

A —Description of property.
B-1—Date of acquirement or date when construction, erection or installation was begun.
B-2—Date on which construction, erection or installation was completed for operation.
C —Reference or Voucher Number.

TOTAL COST

D-1—Expended prior to April 6, 1917.
D-2—Total subsequent to April 6, 1917.
D-3—Depreciation or losses sustained prior to Jan. 1, 1918.
D-4—Depreciated cost on which amortization is based (D-2) less (D-3).

RESIDUAL VALUE

E-1—Apportioned to period prior to April 6, 1917.

APPORTIONED TO PERIOD SUBSEQUENT TO APRIL 6, 1917

E-2—Estimated value in use in going business.
E-3—If property has been sold, amount received.
E-4—If property has been discarded, estimated salvage value.

Amount to be amortized (D-4) less (E-2), (E-3) or (E-4)

Roads and Dollars

REPORTS which have reached the President's Conference on Unemployment since Jan. 1 indicate that highway construction in the various states will provide work for 200,000 men during 1922.

Under the provisions of the Federal Highway Act, 30 states have informed the office of Col. Arthur Woods, chairman of the Emergency Committee in Washington, that plans are under way to build 6261 miles of good roads.

This act was one of the recommendations of the conference as an emergency measure to provide jobs for the nation's unemployed. A fund of $75,000,000 was created, to be apportioned among the states taking advantage of the act, each State to have its own allotment for road construction matched by a similar amount from the Federal Government.

Estimates by governors show that $40,000 will be the average amount per mile expended. When the work is approved by Federal inspectors, the State will receive from the United States about $20,000 per mile.

"The Federal Highway Act," said Colonel Woods, "ought to result in a large extension of good roads mileage throughout the country. At the same time it is helping to solve the unemployment problem until our various industries pass through the present crisis and take up the slack that puts every willing worker in the country back on the payroll. In addition, the taxpayer will benefit, as well as his unemployed neighbor, by the opening up of new districts and the improvement of existing highways."

Relationship of Bus Transportation to Electric Railways

Need for a better understanding as to the merits of each method of transportation is apparent. In this article is shown the attitude of the electric railway companies toward bus transportation as clearly evidenced in the recent semi-annual meeting of the American Electric Railway Association.

By Harlow Hyde

THE undercurrent if not the main theme of the semi-annual meeting of the American Electric Railway Association, held in Indianapolis recently, was to the effect that co-ordination of all trackless transportation is necessary, and that the co-ordinating must be planned and carried out by the electric railways and the interurban lines. The morning session was given over entirely to this discussion in papers presented by C. D. Emmons, president of the United Railways and Electric Company of Baltimore, Md.; E. B. Whitman, member of the Maryland Public Service Commission; Paul Shoup, president of the Pacific Electric Company of San Francisco, and Harry Reid, president of the Interstate Public Service Company (interurban) of Indianapolis. Three of these papers voiced the view that there must be co-ordination of street and highway electric transportation and of buses, jitneys and trucks, and that "urban and interurban transportation is a natural monopoly and that the public will best be served where the needs of a particular city or community are met by a united system."

Mr. Emmons, who had made a study of London bus transportation and of the transportation phases of other British cities, together with the tubes and trams, presented facts as well as conclusions which the truck and bus manufacturer, as well as their sales departments and organizations, might study to advantage. He shows that during the normal hours buses are very popular in London, carrying 30 per cent of the total. While the underground and inter-suburban railways carry 40 per cent, trams haul about 30 per cent of the total. The amount of trackage in cities in the British Isles is far below that found in American cities. One mile of track to every 6000 people represents the largest trackage of any of the British cities cited. He states that the trackage varies from one mile to every 1500 people to one for every 2500.

In another portion of his paper Mr. Emmons makes the statement that, "There is probably not a city in the United States that would not have a different layout and distribution if it were laid out anew to fit conditions as they now exist, resulting in much less mileage to operate and the ability to give better service to the car rider." In light of the street car companies' demands that they have the right to earn "6 per cent" dividends, and their constant fight to abolish jitneys and buses if they are not co-ordinated by the street car lines, this is enlightening. Electric railway revenue difficulties enter into almost every fight against buses, and have been one of the main sources of restriction in this growth.

Mr. Emmons' paper has this statement: "In many places these jitneys and even operators of buses of a higher type of transportation than that given by the so-called jitneys themselves have been permitted to operate in such a piratical manner that they actually steal from the established transportation company—whose aim is to give all-round city service—sufficient to continue an existence, and at the same time to cause a starved condition of the transportation system." His final conclusion is that "in American cities a complete, comprehensive and satisfactory transportation system at a minimum cost can only be secured by means of control of all city transportation agencies in the hands of one management." His proposals, if adopted, would abolish jitneys and buses, unless the electric railway lines could control and operate them.

Even more in favor of this sort of control was Ezra B. Whitman, Public Service Commissioner of Maryland. He began with this statement: "It is probably not necessary for me to argue before you gentlemen that urban transportation is a natural monopoly, and that the public will be served best where the transportation needs of the particular city or community are met by a unified system." That this is not the only attitude of some electric systems toward buses may be gleaned from a later statement of fact that appeared in his address.

Speaking of the fight against the jitneys and the buses in Baltimore he said:

> **The street railway company, fighting fire with fire, or rather buses with buses, started a competing line on Charles Street, and when the independent line had been forced to retire from the field, sought permission to discontinue the service. This permission the commission refused to give, although according to the figures submitted by the company the line had been operated at a loss. It is evident from this that the bus or truck maker cannot consistently count upon the "co-ordination" of buses and other trackless transportation that the electric companies urge. In this case there was a deliberate attempt to blot out the bus lines.**

That the truck maker can expect a similar antagonistic attitude from the interurbans can be gathered from the paper of Harry Reid of Indianapolis, president of the Interstate Public Service Company (interurban). His entire paper would be more than worth reading by every truck maker and sales department of commercial vehicles. Mr. Reid said: "Probably many of you know that I am opposed to these transportation agencies as competitors of the electric railway interurban, and that I feel they should be disposed of by legislation which would result in the regulation of their business by the

Public Service Commission or by some other agencies, on the same theory that two electric or two water companies are not allowed to operate in competition . . . **believing that our interurban business, to be successful, must operate as a natural monopoly, the same as any other class of utility service."** As interurban forerunners Mr. Reid thinks that trucks and buses may be of service in opening up new territory that may later be tapped by the interurban. He would have the interurban use the truck or bus extensions as feeders to see if there were sufficient business in the territory to warrant extension of the tracks. In the light of his paper it would seem that he considers that the whole State, or even larger territories, form the basis of "the natural monopoly" of the interurban lines. He would have no truck lines or buses as feeders or extensions unless the interurban felt like putting them in. Meantime the makers would await the pleasure of interurban company leisure.

A little study of local motor transportation history, regulation, taxation and licensing will show the truck and motor vehicle maker that here at least the electric companies do not need the urging that was prominent at the meeting to the effect that all these electric companies and men get into politics. One of the officers of an Indiana interurban company (G. K. Jeffries, general superintendent of the Terre Haute, Indianapolis and Eastern Traction Company) has been for several years president of the Hoosier State Automobile Club. This club has taken a prominent part in motor vehicle legislation in the State, the club boasting of its success in getting the bills drawn up by it through the legislature. Among these bills is one that places the truck license fee near to the proposed Uniform Motor Vehicle Law fees, while the passenger car is assessed at about one-half of the rates that would be established by that fair rate. Another fact worth the truck makers' note is that Indiana has lagged behind to an almost unique degree in the making of hard-surface State roads. The gravel roads break down in the spring and right now trucks have to be kept off many of the main trunk lines.

Tractors on Southeastern Farms

A STUDY of the reports of 684 tractor owners in Alabama, Georgia, North Carolina, South Carolina and Tennessee which has just been completed by the Division of Agricultural Engineering, United States Department of Agriculture. The reports were made in March, 1921, and at that time 86 per cent of the number reporting believed that their machines would turn out to be profitable investments and 90 per cent stated that they intended to use them during the ensuing year.

It must be remembered, however, that most of the owners of these tractors were operating farms considerably larger than the average. Of the 684 farms, the average size was 290 acres, while according to the 1920 census of agriculture the average size of all farms in these States was only about 75 acres. Over 90 per cent of the farms reporting are more than 75 acres in size. There is no great difference between the crops raised on the farms where tractors are owned and on those where tractors are not owned.

The 2-plow tractor is evidently the size best suited to the needs of most of these farms. Seventy-six per cent of the 684 machines are of this size, and about 66 per cent of the men reporting now believe that this size is the best for their conditions.

All of the men whose reports were used in this study purchased their tractors between March, 1918, and September, 1920. The average first cost of the machines was $1,050, and the average of the owners' estimates of their useful life was 7.6 years. On this basis the annual depreciation charge is $138 per year.

Each owner was asked the number of total days' work done per year with his tractor, and the average of the replies was 53 days. The 2-plow tractors were used an average of 52 days per year and 3-plow tractors 56 days.

About 80 per cent of these men used disk plows with their tractors. The average acres covered per day with the 2- and 3-bottom disk and moldboard plows drawn by these tractors is as follows:

2-plow disk.....	4.7 acres	2-plow moldboard..	5.3 acres
3-plow disk.....	6.5 acres	3-plow moldboard..	7.3 acres

Over 90 per cent of these men stated that the quality of the plowing done with their tractors was better than that which they formerly did with horses or mules. The tractors drawing disk plows used on an average about 3½ gallons of fuel per acre for plowing, and those drawing moldboard plows about 3 gallons per acre. This difference between the fuel required when using disk and moldboard plows is due largely to the fact that the disk plows are narrower than the moldboard plows, and the acreage covered per day is correspondingly less.

The average cost (including charges for depreciation, interest, repairs, fuel and oil) per acre of using the 2-plow tractors for plowing in 1920 was $2.07 when using gasoline and $1.73 when using kerosene. For the 3-plow tractors it was $1.90 when using gasoline and $1.59 when using kerosene. These costs are based on 31-cent gasoline, 20-cent kerosene and 85-cent lubricating oil, the average prices which these farmers paid during 1920. The repair costs were computed on the basis of an annual repair charge of 4 per cent of the first cost of the machines and interest charged at 8 per cent on the average investment.

On account of the smaller acreage covered per day, and the greater amount of fuel used per acre, the cost of plowing with the disk plows was somewhat greater than was the cost when using moldboard plows.

Each farmer was asked how many days of man labor his tractor saved annually and the average of the replies was 66 days. The average of the replies of the owners of the 2-plow tractors was 63 days and of the 3-plow machines 78 days.

Nearly 50 per cent of the men reporting have increased the size of their farms since purchasing their tractors by an average of about 50 acres—from about 210 to 260 acres. At the same time they have decreased their workstock from an average of 6.7 head to 5.1 head. They kept an average of one head of workstock for each 31 acres before they purchased their tractors, and were keeping one head for every 50 acres at the time they reported.

The men who did not increase the size of their farms reduced their workstock from an average of 8.8 head to 7.4 head after the purchase of their tractors. Nearly half of the men, however, who were still farming the same acreage had made no reduction in their workstock.

A comparison of the reports of the men who were satisfied with their tractors with those who were dissatisfied showed that in some cases the failure to take advantage of the opportunity offered by the tractors to increase the acreage and reduce the workstock was probably responsible for the dissatisfaction; in other cases the poor service rendered by the tractor was responsible, and experience has shown nearly one-half of the dissatisfied owners that their tractors are not the proper size for their farms.



Front Wheel Driving

Editor, AUTOMOTIVE INDUSTRIES:

I differ in several respects with the "Front Wheel Drive" editorial in the Sept. 15 issue of the AUTOMOTIVE INDUSTRIES.

It is true that there has been renewed activity in connection with front wheel drive automobiles and commercial cars, and it is well that this is so, because the advantages claimed for this particular drive in a good many instances make it superior to the rear wheel drive now in almost universal use.

In the second paragraph of the editorial the possibility of using a low-hung platform and body is treated in such a way as to make it appear that this is the most important advantage gained by employing front drive, whether it be through the bent rear axle or by some other means. The uses cited give but little idea of the possibilities in any and all industries. So far as the possibilities of a low-hung body are concerned, this can be realized on the rear driven car almost as well as on the front driven car, but possibly not quite to the extent as with front drive.

In regard to the disadvantage of a low-hung body in that it brings the passenger closer to the dust of the road, it may be said that the 6 or 8 in. that the body could possibly be lowered as compared with the body of a rear driven car is unimportant. I believe that passenger cars, particularly, are low-hung enough in present constructions so that a front drive automobile could be built almost identical with a rear driven car without interfering with the style of bodies used at the present time, hence dust as well as road conditions would remain the same for both.

Also, in order that the body may be low-hung, it is not at all necessary to crank the rear axle, as the body accommodations are very similar to those of the rear driven car, though possibly 4 in. or 6 in. at the most can be gained by lowering the body without greatly interfering with the seating arrangements. Neither will the front seat suffer; its capacity and comfort are just as great as in the present-day automobile. The rear seat can be made much more comfortable. Both seats can be made deeper and provided with softer cushions, as is the case with present-day cars.

It is also plain that the location of the driving axle under the front end greatly favors the spring suspension. There will be less jerking when the car starts and stops. On the present-day car or truck, whether the drive is of the Hotchkiss type or whether torque tubes and arms are used, the tendency of a car is to lift or draw, and unless cushioning is excellent and the back of the rear seat is well upholstered it may become rather uncomfortable after a certain length of time on the road. This, however, is not true of the front driven car for reasons explained above. The spring need be only for suspension and not for driving; consequently, the action can be much softer.

As regards the efficiency of transmission, it can easily be shown to be greater in the front drive automobile than in the rear driven one. Reductions are different, the number of gears in mesh are different, the connections are less in number, moving parts operate at less disadvantage and bearing applications can be simplified. Two bearings necessary when propeller shafts are used can be eliminated. It has been demonstrated that it is much easier to pull a vehicle around a corner than to push it. On a front wheel drive automobile the power-driven wheels are turned in the direction one chooses to drive. In a rear driven car turning is accomplished by swinging the front wheels around. They will then encounter increased resistance in the direction they have been traveling and proceed in the direction of least resistance. At the same time the rear axle, while tending to drive straight, differentiates between the speed of the inner and outer wheel, being forced to draw a larger circle with one wheel than with another.

On a front wheel drive the exact opposite occurs, assuming that the front axle of a front drive automobile is the same as the rear axle of a rear driven car. The power is transmitted through the bevel gears and divided between the two wheels by means of the axle shafts. It is true that the inner wheel will describe a smaller circle than the outer one; nevertheless, friction between ground and tire is not used to steer the vehicle, for the differential itself takes care of the speed variation around a curve and drives to wheels accordingly, instead of forcing them to make different speeds, due to the fact that the front wheels have been set at an angle, which necessitates deviation from a straight line.

It is not necessary to dwell much upon the natural tendencies of a front wheel drive to get out of depressions and raise itself over obstacles. While a rear driven car is forced to go into holes and out of holes, the front wheels are pushed against the far wall of the depressions instead of tending to climb over them.

Regarding the universal joint connections under pivot pins of the steering axle of a front drive automobile, it is only necessary that engineers provide mechanism of some kind which will take care of the differential motion of a joint at different angles and that angular speed variations, if not entirely eliminated, at least be reduced to a minimum. Also, it is up to the engineers to see that propeller shafts or universal joints are made in such size, of such quality and of such dimensions that they will withstand all the necessary punishment given them in service on a front drive car.

The author appreciates the difficulty of finding room for both the engine and the transmission in the limited space above the front axle or under the hood. However, the rear driven car with its body, hood, dash, fenders and with its entire outward appearance is not necessarily the ultimate automobile. New ideas and designs that upset old-established standards are coming through every day, and it is not necessarily true that the hood, body, dash, seats and fenders of an automobile must be as they are made to-day and cannot be changed to accommodate possibilities that are offered by a newer construction. If there is no space above the front axle, space can be made behind it. If present-day hoods are

not long enough, they can be made longer, and some day bodies may be more beautiful, more useful and more desirable than present-day bodies. In other words, the complete outward appearance of the car may undergo change if this is necessary to admit of a better mechanical construction. We have to-day ahead of us a period of improvement in which we shall see many new things develop and become successful. We should hesitate to attempt to wipe off possibilities of a construction that has never been given the opportunity to prove itself, but which construction is bound to receive attention from many quarters in the automotive industries.

O. E. SZEKELY.

Tractor Wheel Cleats

Editor, AUTOMOTIVE INDUSTRIES:

I notice that with the exception of Fordson and Allis-Chalmers, practically all the tractor engine wheels have the cleats slant with the inner edge forward, that is the end of the cleats next to the machine touches the ground first, while with the Fordson the outer end is forward and touches the ground first.

I wish to know if there is any special reason for this arrangement. It would seem that, taking into consideration the sidewise thrust due to the angle of cleat, the wheels should crowd together instead of spreading them apart as it would be with the Fordson. For instance, on sidling places on the down hill wheel the cleats should be arranged so the thrust would be up hill and prevent the tractor from slipping down hill.

I am interested in a four wheel drive tractor development in which this thrust due to angle of cleats is a feature and would like to have any data you can furnish along this line. Is there a treatise on cleats and their action under various conditions that you could refer me to?

J. N. P.

When the cleat is so slanted that the inner end touches the ground first there is a tendency for the wheels to be forced together on the ground by the reaction between the ground and the clear, as the torque impressed upon the driving wheel tends to cause that wheel to slip. Of course, thrust washers can be provided on the outside of the wheel hub or on the inside of the wheel hub, and it would therefore seem to make little difference whether the cleats were applied one way or the other. However, since the weight supported by the driving wheels has a tendency to make them spread at the bottom, it would probably be preferable to so arrange the cleats that the reaction of the ground on the cleats forces the wheels together, as in that case the two effects would partly neutralize each other.

On side hills, if it is desired to overcome the tendency of the wheels to slide down the hill, it is necessary to have the cleats on all wheels turned so that the uphill side of the cleat meets the ground first.

So far as we know there has been no treatise published on the subject of cleats for tractor wheels.—EDITOR.

Paint Standards Needed

Editor, AUTOMOTIVE INDUSTRIES:

It has often occurred to me that the S.A.E. should take steps toward standardizing automobile painting materials and operations seem to point to this as a logical solution of the factory's problems. By this I do not mean that the different materials should be standardized by formulæ or chemical properties, but rather by their physical properties.

To illustrate: the three important properties of a primer are—penetration, drying rate and elasticity of the dried film; of a filling and surfacing material—body, drying rate and texture of rubbing varnishes—drying rate, working qualities and hardness of the dried film; and of finishing varnishes—drying rate, working and flowing qualities and elasticity of the dried film. From all of which you can see that simple tests will reveal what materials are best adapted for certain purposes without any concern as to the chemical make-up of the material—by that I mean an axact knowledge of just how it was made. This would be the first step to take in order to set the house in order. With this done every factory, job shop and painter would have reliable S.A.E. ratings upon which they could depend.

With such information at hand a number of standard jobs could be laid out and their durability accurately determined. The combination of operations will vary, of course, just as other production methods vary, but maximum and minimum durability could be determined, and this alone would serve a very useful purpose.

With such data available automobile factories could test their paints just as they are now testing their steels, etc., and definite data could be furnished the paint departments that would do away with a lot of the unsatisfactory work that reaches the dealer and has to be done over. This would automatically cause the paint makers to put their houses in order and would react for the good of the entire trade.

CHICAGO COLLEGE OF AUTO PAINTING.
G. K. Franklin.

Review of Recent Publications

A BOOK entitled "Service Station Managament," by Charles L. Jones, has just been published by D. Van Nostrand Company.

In the words of the author, the book was written with three definite ideas in mind, as follows:

1. To assist the man just entering the automobile field.
2. To assist automobile dealers and service stations.
3. To serve as a guide to the chief clerk, superintendent, service manager, shop foreman and stock man.

To those who are studying methods of labor charges, Mr. Jones's remark on Flat Rate will be of interest. He says: "Flat rate charges, if computed on the proper basis, are the most satisfactory to dealers, and at the same time a protection to customers."

While the book applies directly to Ford service stations, there are many things dealing with merchandising service, such as management, layouts and systems, which will be found of value to all who are making a study of the problem of service.

A NEW edition of the Export Trade Directory, compiled by B. Olney Hough, editor of the American Exporter, has just come off the press of the Johnston Export Publishing Co. This large volume, as its name implies, is a trade directory of firms engaged in the export and import trade. Information concerning the company, its foreign connections, the lines it handles and in many instances credit ratings are given, listing nearly 2500 concerns. Other departments give the branch houses in the United States of foreign firms, bankers engaged in foreign transactions, freight forwarders, steamship lines, marine insurance companies and brokers, export packing and trucking companies, foreign consuls in the United States and American consuls abroad.

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Sales Information

FROM the standpoint of good business management, much valuable material is neglected when the reason for the loss of a sale to a direct competitor is not secured and properly recorded. The immediate object of every retailer is to get the maximum number of sales possible in his territory and to do this he must understand the reasons for his failures as well as his successes. Ofttimes more can be learned from the former than from the latter.

Material of this nature must originate with the salesman and pass through the retailer to the distributor and ultimately to the manufacturer. In this way each unit of the selling organization may secure the specific information applicable to it. While this material may seem to deal strictly with the retail selling problem, it is nevertheless of importance to the manufacturer for three reasons, as follows: It would

1. Furnish a consensus of opinion on the product itself.

2. Tend to build up a strong, understanding selling organization.

3. Throw some light on the used car situation.

The average automobile salesman loses all interest as soon as the sale goes against him and is closed by a competitor. He makes no effort to learn why the sale went against him, believing that he learned the reasons while fighting for it. But this is not quite true, because ofttimes the purchaser is not willing to express himself freely until the sale is made.

The desire to know why a sale is lost can be fostered by the factory and if properly done should yield much information of value.

Hot and Cold

A LITTLE gathering was held the other night by representatives of the automotive industry to impress upon certain editorial molders of public opinion the great utility of the motor vehicle, its transportation efficiency, and its usefulness in the business and personal life of the nation. The passing of the "pleasure car" idea, the true utility function of the passenger car, and the utterly unjust nature of much of the taxation and proposed taxation directed against the motor vehicle were truthfully and ably presented

"All was quiet along the Potomac" until one journalist accepted the invitation to discussion and said something like this:

"Whatever general public opinion prevails in regarding the automobile as a pleasure or luxury vehicle is due chiefly to the car manufacturers themselves. We editors can never hope to mold public opinion to see the utility and transportation value of the automobile, so long as the manufacturers continue to contradict the editorial pages in almost every line of advertising copy which they write. Nearly every car advertisement stresses the luxury phases of the vehicle; the advertisements appear largely in those mediums which appeal to the luxury or amusement phases of life. The whole atmosphere that is thrown around 95 per cent of car advertising is that of pleasure, amusement, luxury, etc. Writers can not be expected to put over this new psychology of utility when those making the car forcibly and continually contradict them on the advertising pages of their publications."

The thought expressed is by no means a new one, but it is worth repeating. Its truth is not realized, apparently, in many parts of the industry. As the car market becomes more and more a replacement market, the proportion of "car-wise" buyers increases. The automobile serves a real utility function in modern life; its numbers grow because the vehicle serves a transportation need. Utility is the basis of its success.

Intelligent utility advertising is good merchandising; it is good business; it is fundamentally sound. And that is the reason for the emphasis upon the utility phase of the automobile. That phase should be emphasized because it is basic. The statement that the automobile is primarily a utility vehicle is

true and, by the same token, it is true that a large proportion of cars used are bought and used for utility or semi-utility purposes. This fact should be completely recognized.

Comparing the average car advertisement with the statements made before Congressional tax committees, it would seem that there was some difference between the facts and the statements. There is not.

Thinking Rightly

ONCE in a while some really constructive thought shines out from the mass of publicity and promotion material that reaches us daily. We received one of these gleams the other day in a bit of promotion material from the S. A. E. It was all interesting, but one paragraph is so pertinent to the solution of most of the problems confronting the automotive industry to-day that it is worth special attention.

"We must think rightly before we can act rightly. It has been observed that it is far easier to confuse human reason than the laws of gravity. The problems before us are bigger than any one man's head.

"It has been enunciated that at the root of our refusal to think things out in advance, to arrange concisely the forces adequate to attain a clearly conceived end is a sort of half belief and half feeling that it does not pay to think things out. Moreover, thinking is hard work, not to speak of formulating and executing sound plans for carrying out those things which proper study indicates should be carried out."

The longest way 'round is often the shortest way there. Actions based upon fundamentally correct reasoning are certain to bring success. Thorough analysis and thoughtful experimentation are essential to the proper solution of the marketing, engineering and production problems of the industry.

The Best Battery Location

IN what part of a passenger car chassis should the storage battery be located? A satisfactory compartment is usually provided in the modern chassis, but it is not always so placed as to be easily reached by the person who must fill the battery, and it is frequently difficult to remove the battery for repairs or recharging. Perhaps the most usual location is under the floor boards of the driver's compartment and near the right side of the frame of the car. This location avoids interference, in the case of left drive cars, with the clutch and brake control rods, but is apt to be too close to the exhaust pipe to prevent rapid evaporation of water in the electrolite unless some heat insulation is employed. Furthermore, it may interfere with the controls in the case of right-hand drive, which is often required on cars intended for export, and it involves raising the floor boards or a section of them when access to the battery is required, and this is apt to be a dirty and somewhat inconvenient operation which is postponed or often neglected by the user, who might be inclined to fill the battery more often if it were more accessible.

From the manufacturer's standpoint it is desirable to so place the battery compartment that it is easily reached regardless of the type of body furnished, since varying the location involves certain complications which are undesirable in quantity production. The life of the battery is increased by a location which minimizes the amount of jarring and vibration which the battery receives. Weight distribution is another element sometimes considered.

A battery placed under the driver's seat can often be made quite accessible, but this location also has some disadvantages, as, indeed, have nearly all locations in common use. The problem is somewhat different in the case of different types of bodies and different sizes of chassis, but there probably are one or two "best possible" arrangements which can be used in nearly all cases. The Forum of AUTOMOTIVE INDUSTRIES is open to engineers and others who have pertinent views to express in this regard.

Efficient Handling of Parts

WE have heard recently a great deal of discussion regarding the wastes of industry. It would, in many cases, be a revelation to go through automobile retailers' stock rooms. Here, unknown to the manufacturer and even to the retailer himself, exists a vast amount of inefficiency and resultant loss.

The underlying reason for this inefficient handling of parts is the lack of an appreciation of its importance. We doubt if a proper incentive is given for men to become experts in this field, with the result that the ambitious man who looks to the future enters the fields of production or selling at the first opportunity.

It may not seem necessary to the manufacturer to oversee the handling of parts as he would the selling organization, but such an action would be distinctly to his advantage as well as to that of the retailer. Some of the benefits to be derived from this procedure if properly conducted would be as follows. It would:

1. Enable the retailer to avoid tying up capital by stocking a minimum of parts.
2. Facilitate dealing with customers through accurate records.
3. Avoid tying up customers' cars through lack of replacement parts.
4. Facilitate the taking of inventories with proper writing off at frequent intervals.
5. Enable the retailer to determine his profit or loss on this part of his business.

It is not meant that there should be any heavy hand resting on the retailer, for it is desirable to give the greatest amount of freedom possible to the individual. What should be given is co-operation, and more specifically any analysis work on the proper method of handling parts which the factory is able to furnish. Assistance should be lent in establishing a system which would be applicable to the particular size of plant under discussion; a system which would operate in harmony with the factory.

Retailers who have this co-operation extended to them cannot help but be better representatives, and the result will have a far-reaching effect on the success of the selling organization.

Washington Sees New $348 "Star"

Will Be in Quantity Production by June

Durant Responsibility Ends With Completed Car—Separate Distributing Company

NEW YORK, March 9—The new low-priced car, to compete with Ford, which will be manufactured on contract by Durant Motors, Inc., will be in quantity production by June 1, it was announced to-day. It will be turned out temporarily at the Long Island City plant of Durant Motors of New York, and the permanent factory site has not been determined. The first showing of the car, which will be called the Star, was given to-day in the salesroom of Harper Brothers on Connecticut Avenue in Washington.

The distribution, sale and servicing of the car in the United States and its possessions will be in the hands of the Star Motor Car Co., which will be independently operated and financed. Details regarding the stockholders in this company are not yet available. While it is understood to have been the original intention that parts companies which supplied units for the new car would be given an opportunity to take stock, it now is stated positively that these interests will not be connected in a financial way either with its production or distribution.

Among those who accompanied W. C. Durant to Washington for the unveiling were R. W. Judson, president of the Continental Motors Corp.; A. R. Demory, president of the Timken-Detroit Axle Co.; C. B. Hayes, president of the Hayes Wheel Co., and Harry T. Dunn, president of the Fisk Rubber Co. Others in the party were F. W. Warner, former general manager of the Oakland Motor Car Co. and several executives of the Durant companies.

The responsibility of Durant Motors for the new line will end when the completed vehicles are turned out of the factory. No steps have been taken as yet towards the formation of a distributing organization, but it is understood that no exclusive territory rights will be given for the sale of the car. The sales policy will be practically identical with that established by Ford.

Detailed specifications have not been made public. The car will be powered with a Red Seal Continental engine, and it will have a conventional automobile chassis plus the Durant tubular backbone. The Hotchkiss drive is through semi-elliptic springs and the propeller shaft has Spicer universals. The transmission will provide three speeds forward and reverse.

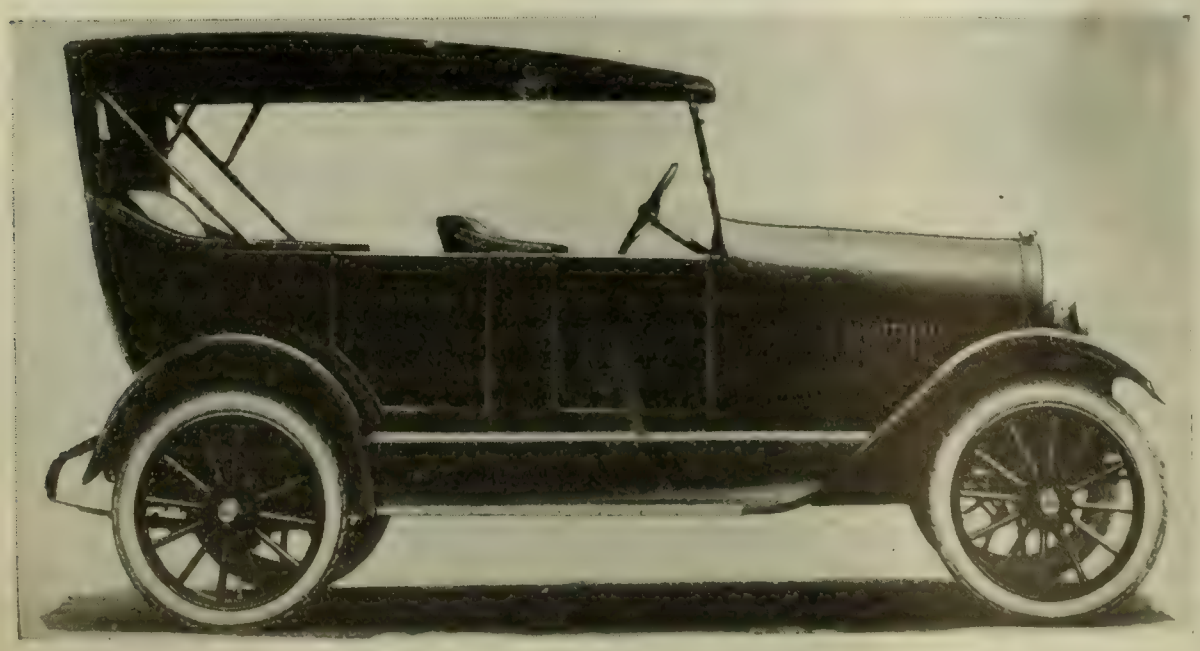
Timken axles will be used and Timken bearings front and rear. Internal and external brakes operate on the rear wheels. The gasoline tank will be located on the rear, and the Stewart vacuum tank system will be used.

There will be a one-man top with a sliding windshield. A disk clutch will be used. The wheelbase will be slightly longer than that used by Ford.

Standard parts of high grade will be used throughout and the car will have the accessibility of the Durant models, which, it is claimed, will make service easy and not expensive.

Much remains to be told of the plans for the manufacture and sale of the car,

(*Continued on page* 590)



"Star," which will compete with Ford in price

Output in February Gains Over January

Schedules of Car and Truck Manufacturers Increased During Present Month

By JAMES DALTON

NEW YORK, March 7—With the coming of March, production schedules of most passenger car and truck manufacturing companies have been materially increased. While accurate figures for the aggregate February output are not yet available, it was considerably larger than for January. Total production of cars and trucks the first month of the year was 90,486 as compared with 78,995 for December. Eliminating Ford, the gain for January was 40 per cent on passenger cars and 38 per cent on trucks. The increase was largely in the lower price classes.

Parts Business Increases

Business in steadily increasing volume is coming to the parts and accessory manufacturers as the vehicle makers give unexpectedly early releases on materials to take care of expanding business. Sales in January exceeded January of last year by approximately 200 per cent. It is probable the excess for February was fully as large compared with the same month last year.

Manufacturers, especially in the Detroit district, are professing enthusiasm over the outlook, and the same is true of dealers in all parts of the country. Wherever shows have been held the attendance has been record-breaking, evidencing the interest of the public in motor cars. Dealers have booked many live prospects, and the actual sales at retail have been far ahead of last year.

Prices on passenger cars apparently have been stabilized for some time to come. Most manufacturers have brought their selling prices as low as they can go until further cuts can be made in production costs. There is no immediate prospect of lower material prices. Revival of demand in the truck field is leading to price recessions by makers who have not made reductions recently and some sharp cuts have been made.

(*Continued on page* 591)

Templar Syndicate Will Handle Claims

Company Owes Merchandise Creditors $1,000,000—To Arrange Three-Year Extension

CLEVELAND, March 6—M. F. Bramley, president of the Templar Motors Co., announced at the annual meeting of the corporation that a syndicate is being formed to settle the claims for merchandise which creditors have against the company to the sum of $1,000,000.

Members of the syndicate are: Bramley, W. M. Pattison and J. C. Brooks. This syndicate is to arrange for the carrying of the claims for three years.

Bramley was re-elected president and general manager; W. M. Pattison, vice-president; D. C. Reed, secretary and treasurer; John Orgil, counsel, and W. O. Cooper, director.

The annual report showed there was an operating loss of $250,000 for the year ending Dec. 31, last, while the inventory was depreciated $750,000. Car sales last year were 732. The company is still working off an inventory, and business has picked up in the last two months.

Six hundred stockholders attended the meeting, and at the close of business adopted a resolution of confidence in the management.

Peed Becomes Overland Assistant Sales Manager

TOLEDO, March 6—L. G. Peed, for more than a year manager of the Willys-Overland branch here, has been named assistant sales manager of Willys-Overland, Inc. R. L. Butler, zone supervisor for Iowa, Nebraska and Missouri, will succeed Peed at the local branch. W. O. Kiracofe, formerly sales manager of the Banting Manufacturing Co. here, has been named retail sales manager of the branch, to succeed L. J. McCracken, who will have charge of the Pacific coast territory for Willys-Overland.

Peed formerly was with the New York branch of Willys-Overland. He has been a prolific originator of sales and advertising ideas, many plans which he worked out for the branches with which he was connected having been taken up by the factory organization and put into effect throughout the country.

From Factory to Owner New Monroe Selling Plan

INDIANAPOLIS, March 4—An advertisement published in one of the local newspapers to-day by the Monroe Automobile Co. tells of a new plan of selling the Monroe direct from factory to owner. The new price of $875, which is a reduction of $420, is also announced.

The announcement is judged to be the forerunner of the reorganization promised at the time that a local bank, which had been the principal creditor, bought the factory and assets from the receiver. It is understood that the detailed reorganization plan will be announced some time next week.

One sentence from the advertisement reads: "Briefly, the plan means the elimination of the distributor and dealer with their commissions and sales expense added to the cost of the car"

Hitchcock Takes Sweet's Place on Bearings' Board

NEW YORK, March 7—William M. Sweet has resigned as a director of the Bearings Service Co. and will be succeeded by A. C. Hitchcock, sales manager of the New Departure Mfg. Co., one of the concerns for which the Bearings company acts as a service department. Sweet's duties with the Klaxon company require all his time. William A. Brooks also has resigned as secretary of the Bearings company and has been succeeded by W. J. St. Onge, sales manager of the company.

Directors of the Bearings Service Co. have appointed an executive body which will be an operating committee. It will meet at the general offices in Detroit four times each year. Alfred K. Hebner, president of the company, will be chairman.

Court Limits Information to Be Given Trade Commission

WASHINGTON, March 7—Under the permanent injunction issued by Judge Bailey in the Supreme Court of the District of Columbia to-day, the Federal Trade Commission will be restrained from compelling various industries to submit monthly reports to the Commission of their costs of production and other intimate details of their business.

Conferences were held with various manufacturers several months ago in this connection, but the meetings adjourned pending the legal decision. Judge Bailey held that manufacturing is not commerce and that the Federal Trade Commission was trying to interfere with commerce.

The case at issue is known as the Claire Furnace Co. case involving twenty-two producers of iron and steel and coke.

Glass Leaves New Britain Machine Tractor Division

NEW BRITAIN, CONN., March 4—Edgar T. Glass, for the last several years sales manager of the tractor division of the New Britain Machine Co., has resigned to take up other work.

No successor has been appointed, but one of the company's officials states that he does not understand it is the purpose of the corporation to abandon the manufacture of tractors permanently. Tractor making was discontinued by the company at the time the industrial depression became pronounced.

Glass came to the New Britain company from the Stanley Works, where he had been associated with the sales force.

Smith Republic Head as Willys Successor

Complete Reorganization of Truck Company—Change in Stock Control Is Forecast

NEW YORK, March 6—Complete reorganization of the Republic Motor Truck Co., Inc., has followed the resignation of John N. Willys as president and the election of Frank E. Smith as his successor, which was announced in AUTOMOTIVE INDUSTRIES last week. Other resignations included those of H. I. Shepherd as treasurer and Walter P. Chrysler and James E. Kepperley as directors. Shepherd will continue temporarily as a director, as will W. J. Baxter and E. C. King.

New directors elected to fill the vacancies were: O. W. Hayes, vice-president in charge of engineering, purchasing and production; H. D. Minich, vice-president in charge of finance and accounting, and Charles G. Rhodes, secretary.

Offices Moved to Alma

It is understood that there has not been, up to this time, any change in the stock control of the company, which has been held jointly by Willys, Baxter and Burt, but this is forecast by a statement of the company that "these changes bring back to the West control which was transferred to New York at the time Mr. Willys and his associates purchased the stock of the company."

The executive offices of the company have been removed to Alma, Mich., where the plant is located. Shepherd will become vice-president of the Guardian Savings & Trust Co. of Cleveland.

Michigan and Illinois bankers now are taking an important part in the affairs of the Republic. As soon as the banks can obtain control of all the notes on which the company defaulted, the new money necessary for working capital will be provided. The company now has current assets of $4,600,000, after taking a loss of $1,000,000 on its inventory. While truck sales were light last year, the company made a large profit on parts replacement business. With the improvement in the truck market and with the readjustment of finances, it is confidently expected that the company will be able to move ahead on a substantial basis.

Branch Houses Established

To promote service and a comprehensive sales plan, the company has established or is establishing branch houses at Detroit, Buffalo, Albany, Boston, New York, Newark, Philadelphia, Baltimore, Atlanta, Charlotte, Pittsburgh, Kansas City, St. Louis, Chicago and San Francisco. It is proposed to establish additional branches within the next few months. New dealers are being added at the rate of approximately 500 a month.

It is understood that one of the specialties hereafter will be the building of motor bus chassis.

Detroit Factories Increase Schedules

Growing Cheerfulness in Evidence at Plants—February Exceeded Anticipations

DETROIT, March 3—Production in Detroit factories for February was notable for the number of companies which materially increased their manufacturing schedules.

Production continued on a four-day week basis. There is a constantly growing feeling of cheerfulness in every factory. Production will be largely increased in March, notwithstanding that February ran far ahead of anticipations.

Dodge, Maxwell, Studebaker, Cadillac and Hupp are the factories already near maximum production. Dodge has been running along at about 600 daily; Maxwell, 200; Studebaker, 400, and Cadillac, 100. Ford has as yet failed to get into full swing on cars, but is making a record breaking number of tractors at River Rouge, schedules now approximating 200 daily.

Hudson-Essex to Triple Output

Hudson and Essex have practically tripled their parts and material releases for March, and President Roy D. Chapin said it would triple production of March of last year. Lincoln Motors will increase its production to a 30-daily basis in March. Increases will also be made by Wills, Roamer and Handley-Knight. Rickenbacker, which shipped 250 in February, will go on a 20 daily schedule in March.

Orders are reported ahead to summer in the General Motors divisions. Buick is preparing to go on full production. Olds has laid down a schedule which will approximate 70 daily in March. Oakland will build better than 100 daily. Chevrolet has laid down a schedule which calls for 50,000 production by July.

Durant Motors has been operating during February at the Lansing plant on a schedule of 40 daily and expects to reach 100 daily by April 1. The company was handicapped by non-delivery of closed bodies in February. Five hundred closed types will be built in March.

Reo Looks for Good Month

Reo has been operating steadily and looks for heavy production in March with dealer stocks of cars and speed wagons undergoing rapid depletion. Dort has laid down a schedule of 50 daily, which will be increased as rapidly as possible. Orders are reported to run ahead to early summer.

Paige has been rounding into production slowly during February and will get going firmly on its Paige and Jewett schedules in March. Earl Motors has been building 20 daily in February and will increase this to 30 in March. Columbia Motors is speeding up things at the factory in anticipation of production in April on its new $985 line. March production will be solely of the former line.

Liberty is all ready to enter upon a heavy manufacturing schedule. Saxon is running along at 5 a day pending the determination of new manufacturing policies.

RESERVE BOARD FINDS OUTLOOK IS BRIGHTER

WASHINGTON, March 3—Commenting on financial and economic conditions for the first two months of 1922, the Federal Reserve Board states that bankers generally believe the recent advances in the value of agricultural products has tended to create conditions materially facilitating both the liquidation of loans at banks and the rapidity of movement of farm products to their markets. These changes give promise that farmers soon will be in the market for motor vehicles as their inability to market their products at reasonable prices has been the chief deterrent.

Reports from the various Federal Reserve districts show that the improvement in conditions in several basic industries has furnished a more hopeful prospect for trade.

Kelly-Springfield Adds to Its Force at Factory

SPRINGFIELD, OHIO, March 7—There is a marked improvement in general business among the motor truck and automobile manufacturers here. General Manager E. O. McDonnell of the Kelly-Springfield Motor Truck Co. states that there is a steady improvement in the motor truck business and that the company has recently added a number of men to its force. There has been special activity in the engineering department. The outlook is considered most favorabie.

The local works of the International Harvester Co. is up to its schedule of 50 light, high-speed motor trucks a day. The company is shipping its trucks about as fast as they are produced. There are evidences that the farmers are now in a more optimistic mood.

Service Truck Preparing to Start on Polish Order

WABASH, IND., March 4—Production on the new model Service truck, begun Feb. 15 on a four-a-day basis, has been maintained, and the working force at the plant is being augmented preparatory to starting work on the order received from the Polish government.

The sale of a considerable quantity of gold notes in America to Polish families will be undertaken, it is said, by the same syndicate of Polish bankers that underwrote the order for Service truck equipment.

More Optimism Felt Than in Two Years

Dealers Say Trade Is "Good," "Big," "Bright" in Reports to Manufacturers

NEW YORK, March 3—Nearly 100 representative members of the National Automobile Chamber of Commerce who attended the meeting here yesterday were more enthusiastic than they have been for two years over the business outlook. Roy D. Chapin, president of the Hudson Motor Car Co., who presided, declared conditions were better than at any time since the depression began. He based this assertion upon reports from manufacturers and dealers all over the country.

These dealer reports were practically unanimous in the statement that February business was materially better than January. One striking fact disclosed by the survey is that the situation in agricultural sections has improved. Even in the Dakotas the tone is much better. Only one of the many reports described business as not so good.

Prices Stabilized

Dealers used such adjectives as "good," "big," "bright" and "better" in describing the outlook for sales this month and next. This optimistic forecast was based on the belief that prices have been stabilized and that was the unanimous plea of the dealers.

Truck as well as passenger car sales have improved, and the demand for commercial vehicles is growing steadily.

Sales of high priced cars in the New York Metropolitan district were 39 per cent larger in January than in January, 1921. Sales of low priced cars were 259 per cent larger. Sales in the $1,000 (wholesale) class doubled in January, as compared with December, and in the $500 class they almost doubled. The greatest decrease in the January sales as compared with December was in the class above $4,000 and in the $1,500 class. Sales of ½-ton and ¾-ton trucks more than doubled.

National Shows Most Successful

A report made to the members on the New York and Chicago shows disclosed that they were the most successful ever held from the standpoint of attendance. A return of 77 per cent of their footage costs was ordered for members who exhibited at the New York show and of 91 per cent to those who exhibited at Chicago. This was in addition to retaining $25,000 in a trust fund for a show building. This fund will be used as a guarantee that a suitable exhibition place will be available in New York.

HYLAN URGING BUS VOTE

NEW YORK, March 7—Mayor Hylan has sent a telegram to every member of the Legislature asking them to vote for his bill, empowering the city to spend $25,000,000 for the purchase of city buses.

Industry Employs 11,149 More Hands

6.5 Per Cent Increase Reported During February—Instances Cited in Government Survey

WASHINGTON, March 7—General increases in employment were reported in the automotive industry during February, according to a survey by the United States Employment Service. The largest gain in employment was noted in "vehicles for land transportation industry," which consists principally of automobile and accessory manufactures. The amount of increase in employment under this classification during February amounted to 11,149, an increase of 6.5 per cent from Jan. 31.

A study of the relative weights of the 14 groups covered by the survey shows that the vehicular industry employed 11 per cent of the total reported employed in all groups on Feb. 28. As illustration of the growth of employment in the automotive industry, it is pointed out that in Springfield, Ill., a tractor plant is steadily adding to its forces; some automobile plants have reopened in Indianapolis, and the erection of a new large truck plant will start on March 16 in Fort Wayne, Ind.

8500 in South Bend Plant

A large automobile corporation in South Bend is now employing 8500 men and will have 10,000 on the payroll before the summer. In Cleveland one motor company, the city's largest manufacturer of motor cars, has given employment to hundreds of men and the production has increased 50 per cent. In Dayton, a rubber company reports 150 per cent increase over last year, and is going full time day and night.

The economic pendulum that started on a downward swing in December and continued through January took an upward turn in February. While the joints of industry are still stiff, yet there is a resiliency to business that is very encouraging and with every indication of permanency.

Employment increased in all industries with the exception of textiles, which shows a marked decrease, due to the industrial controversy existing in the New England district. The basic industries, food, iron, steel and metal products, railroad repair shops, and vehicles for land transportation, made substantial gains.

Reports from 231 of the principal industrial centers, with but few exceptions, show a general improvement in employment conditions and an enthusiastic spirit of hope and confidence in the future. Weather permitting, March will begin an era of great activity.

BEST JANUARY FOR HUPP

DETROIT, March 7—President Hastings of the Hupp Motor Car Corp. announces that shipments in January were the largest for any January in the history of the company. He reports that four times as many cars were shipped in January last as in January, 1921, twice as many as in January, 1918 or 1916, and three times as many as in January, 1919.

DETROIT FIRMS SHOW GREATER EMPLOYMENT

DETROIT, March 6—Substantial evidences of steadily increasing production in the automotive field is found in the employment reports of the 79 firms which are members of the Employers Association. The statistics for the first eight weeks of 1922 follow:

Week Ending	Number Employed	Net Change
Jan. 2	60,981	Inc. 8,795
Jan. 10	102,485	41,534
Jan. 17	109,703	7,218
Jan. 24	111,615	1,912
Jan. 31	113,099	1,484
Feb. 7	115,092	1,993
Feb. 14	118,647	3,549
Feb. 21	121,048	2,407

Liberty, with Many Orders, Enters Heavy Production

DETROIT, March 7—The Liberty Motor Car Co., with a long string of orders piled up from the early 1922 shows, has entered upon a period of heavy production that will carry it through to early summer. The output for March will exceed that of any month in 1921, and the program for April calls for production and shipment of more cars than for any month in the record year of 1920.

As an indication of the Liberty sales stimulus, the company declared that applications for retail sales rights were received from 53 dealers at the New York show alone. Nine factory territorial men have been added to the staff to handle applications for unoccupied dealer territory.

Cliff Knoble has returned to his position as advertising manager of the company after an absence of several months. The company is going in for an extensive sales and advertising campaign which will be launched about April 1.

Give Public Wide Use of Bus, Franklin Urges

SYRACUSE, N. Y., March 4—Restrictions of motor buses should be limited to safety requirements, in the opinion of H. H. Franklin, head of the Franklin Manufacturing Co.

"If the public chooses to travel by motor bus, it should have the unrestricted privilege," he said. "If the motor bus cannot give a cheaper and better transportation, it will not survive. There should be no restriction on the number of buses or bus lines even between the same points. There is no justification whatever for the excessive taxation. The motor bus or truck should not be taxed in any greater proportion than other vehicles. Let competition and experience shape the future of the motor bus, not restrictive regulation."

Investigating Auto Stores Transactions

Department of Justice Takes Hand in Affairs—Temporary Receivers Made Permanent

PHILADELPHIA, March 6—Judge Thompson in United States District Court to-day appointed as permanent receivers for the United Auto Stores, Inc., the temporary receivers, Francis F. Burch and Samuel E. Whitaker, remarking in open court that he was satisfied there was fraud and mismanagement in the conduct of the concern.

Judge Thompson's comment came in reponse to a demand from Abraham M. Rose, one of the attorneys for Edward B. R. Carrier, head of the United Auto Stores, that the company be permitted to function as a going concern.

Immediately after the receivers had been made permanent, Aarons, Winstein, Goldman & Stone, attorneys, filed a petition of bankruptcy against the United Auto Stores.

Joseph K. Kun, assistant district attorney, asserted that the only hope for the creditors was in a permanent receivership. He further said that he had figures to show that in the last two months the stores lost $55,000 and that the corporation's overhead for salaries alone came to $9,300 a week.

Washington Orders Action

Agents of the bureau of investigation of the Department of Justice have taken a hand in the affairs of the United Auto Stores. It is asserted that if there is evidence that Federal laws have been violated arrests will follow immediately. Orders to investigate the company came from Washington.

Two agents have been assigned to investigate every transaction between the United Auto Stores Co. and the United Guaranty Co., which sold stock for the former company. Postoffice inspectors also are conducting an investigation into the affairs of the concern.

Budd Wheel, with 50 Service Stations, Expanding System

PHILADELPHIA, March 6—The Budd Wheel Co., which now has more than 50 service stations located as far as possible with well established wheel dealers and repairmen in the larger cities of the United States and Canada is steadily expanding its service system.

All of these stations are carrying spare parts for both wire and disk wheels, in addition to an assortment of wheel parts and equipment. The service stations are also prepared to make repairs on wheels, and they soon will be provided with apparatus for straightening disk wheels. Inasmuch as the Budd Michelin disk is manufactured to the same dimensions as the Michelin wheel in Europe, it is possible for these stations to equip imported cars.

Factory Supervision, Show Need, Miles Says

In Report to N. A. C. C., Manager Recommends Better Salesmanship at Booths

NEW YORK, March 4—Better salesmanship is needed before the automobile shows can realize their maximum possibilities, S. A. Miles, show manager, says in his report to the members of the N. A. C. C. Conditions at Chicago were somewhat better than at New York, he states, due largely to the efforts of the Chicago Automobile Trade Association which offered daily prizes for the best salesmanship and kept up constant investigation of conditions.

In his report, Miles says:

No matter how successful the shows may have been in the matter of financial returns, I feel that we have a further responsibility in determining to what extent they have been successful in other ways and what steps are necessary to insure their permanent value. It has probably become evident to most observers that salesmanship in the automobile industry has not reached the peak of perfection.

Influence of Past Bad

For fifteen years or more we have enjoyed a condition which, in some respects, has an unfortunate influence on some of the salesmen of today. In many cases it has not been necessary to devote great energy or skill to the sale of cars. Some of our salesmen have grown into the habit of being approached rather than approaching.

Miles relates the experiences of some of the representatives appointed by the Chicago association to observe conditions at the booths during the show in that city. the manner of the salesman's approach, his general conduct and knowledge of the industry. These experiences showed lack of attention and general indifference to a prospect's wants, the salesman on occasions adopting the position of a booth attendant.

He then proceeds to state:

The lesson we may learn from these conditions is, I think, that the exhibits lack adequate supervision. Year by year the men at the top become more and more conspicuous at show time by their absence. This has been particularly noticeable at Chicago. On one day of the show, in an endeavor to obtain an answer to the question so frequently asked, whether any actual business was being produced, I made a personal visit to every exhibit in the Coliseum.

Few Factory Executives

My acquaintance in the industry is fairly extensive but I was able to find only three men of my acquaintance and only one of these was a factory representative of major importance. The same remark is true of casual visits made at other times during the week. It is also true of my visits during the New York show.

On many occasions it is necessary for us to get into communication with the gentleman named in the show contract as the official representative of the exhibitor. I think it perfectly safe to say that not once in four times did we find the representative in the building. That the Chicago investigators reports are true, I know from the fact that not in a single instance during my trip through the building was I accosted by a salesman.

It is my belief that if the shows are to continue successful in all respects, a higher order of salesmanship must be developed under the eyes of the members and their higher class representatives.

Rubber Makers Start New Plan for Meetings

NEW YORK, March 6—The tire manufacturers division of the Rubber Association of America will inaugurate its plan of holding regularly quarterly meetings of the entire division at New York, or occasionally some other city, on Tuesday, March 21, when a meeting will be held at the Hollenden Hotel, Cleveland.

The executive committee of the division believes that the practice of holding an occasional meeting at Cleveland, Chicago or some other Middle Western city will be appreciated by many dealers west of Ohio who find it inconvenient to attend meetings in New York.

The Cleveland meeting will indicate whether the plan to hold meetings away from New York will result in increased attendance and interest.

Ford Owners' Association Is Object of Ohio Attack

CHICAGO, March 3—The State of Ohio has started a war against the operation of the Ford Car Owners' Protective Association, with headquarters in Chicago.

It is declared that the insurance concern has been doing business in Ohio without the authority of the State Insurance Department and that it has defied the department to interfere with its operations. The company did business at one time in Michigan, Wisconsin and Indiana.

One of the first steps against the association in Ohio came in the arrest of S. M. Green, district manager, under an indictment charging him with selling insurance without a license and with placing insurance with an unauthorized company.

Shareholders Must Pay Pan American Stock Notes

DECATUR, ILL., March 4 — Subscribers to the stock issue of the Pan American Motors Corp. will be called upon to pay notes they gave for such stock, although it is probable that common stockholders will get less than 20 cents on the dollar. A statement to Judge Baldwin, sitting here, shows that W. A. Phares, former treasurer, for whom a warrant charging embezzlement has been issued, owed $13,465. Real estate and buildings valued at $100,035.99 would bring about $150,000, it is said, but this sale has not been ordered.

The service department of the company, which has been showing good profit, is under operation by permission of the court.

Bulletin Explains New Tire Warranty

Accompanies Poster Sent by Rubber Association of America to 125,000 Dealers

NEW YORK, March 6—The Rubber Association of America has sent to approximately 125,000 dealers a poster on which is printed the standard tire warranty and claim form. Dealers are requested to display this poster prominently. With it the association has sent to each dealer a bulletin which says:

"The unsoundness of the former tire adjustment conditions is emphasized by the fact that clothing, footwear, household appliances and innumerable articles of utility (which are subject to service under conditions which the manufacturer cannot control or ascertain) are not sold with a definite guarantee of service and an unsoundly liberal adjustment policy. There is apparently no good reason why tires should be an exception. The abuse of the former condition in the tire industry tended to increase costs and the whole purpose of the present movement is to eliminate the economic waste.

Old Policy Costly to Dealers

"Entirely too many of the adjustments formerly made were what the industry knows as "policy" adjustments. The dealer loses most by that kind of an adjustment, because each tire thus furnished prevents a new sale by some dealer. It is no exaggeration to say that "policy" adjustments annually took millions of dollars from the pockets of the dealers alone.

"Under the standard warranty and claim form, only those tires which are faulty in material or workmanship will be considered for adjustment, and then only upon the basis outlined in the second paragraph of the warranty. Tires cannot be adjusted if run on wheels out of alignment, on shaky wheels or with lugs improperly tightened, causing unusual wear, of if damaged by either cuts, jabs or stone bruises, or by underinflation or overloading.

Annoyance Eliminated

"For the dealer, the new condition will eliminate much annoyance and loss of profit, and it should remove all apprehension that some other dealer is going to do the thing that you know to be unsound and unbusinesslike. The consumer will benefit, because formerly the careful user had to carry the burden created by the careless user. Now each user will pay his own way. If the tire is defective, the owner can get fair treatment provided he makes a claim in the specified manner."

ABRASIVE COMPANY SCHEDULES

NEW YORK, March 6—Schedules in bankruptcy have been filed by the Worcester Abrasive Co., Inc., manufacturers of automobile grease valves. Liabilities are listed at $21,868 and assets at $7,700.

Vote Amalgamation of Northway Firms

Assets of Three Companies Pooled —To Issue $400,000 8 Per Cent Gold Notes

NATICK, MASS., March 7 — The Northway Motors Corp. met to-day at the factory, and with 250 stockholders present, it was voted to amalgamate the three corporations bearing the Northway name, the Northway Motors, Northway Motors Sales Corp. and Northway Motors Guarantee & Discount Corp. All the assets of the three companies were pooled with the formation of the new corporation, and it was voted to issue $400,000 8 per cent three year gold notes, and the stockholders were asked to make contributions of 10 per cent on their stock.

The plant, at present, is almost shut down, but it is expected to be opened this week and production started on incompleted trucks. There is material on hand amounting to $500,000, on which there is an indebtedness of $100,000. To complete 200 trucks nearly finished will take $120,000, and when sold they will bring $780,000. The loss last year was $217,000.

The directors elected were: Judge Henry C. Mulligan, Reginald C. Heath, Frank V. Noyes, Stephen W. Holmes and R. E. Northway. William Caswell was chosen treasurer and Robert Holmes secretary.

New Oldsmobile Model Has Added Equipment

LANSING, MICH., March 4—A new body, known as the model 37 super-sport car with a number of items as additional equipment which are standard on this model, has been put out by the Olds Motor Works. The car is upholstered and completely trimmed in maroon leather. It is painted jersey brown. The car is equipped with Tuarc disk wheels, individual cast aluminum bracket type steps with molded rubber tread and individual bicycle type fenders with splash aprons.

In addition, the following features are standard equipment: Gabriel snubbers on rear, triple bar steel bumpers, Boyce deluxe motometer mounted on a bar type of radiator cap, windshield cleaner, cigar lighter, double plate-glass windshield wing, stop signal, cowl ventilator, spotlight mounted on left front fender apron, step light for both rear doors and a bevel glass, rear-view mirror. There is a leather top boot and a carrier for two extra tires. This car, complete, as described, is priced at $1,825.

FORD IMPROVES EQUIPMENT

DETROIT, March 6—A new type headlamp lens, known as the Ford H, is now being fitted as standard equipment on all Ford cars and is being supplied to branches and dealers for service and replacement. The lens has vertical flutings and is used in connection with a 21 candlepower gas filled bulb with clear glass. The lens is said to meet the requirements of all state laws.

Other improvements that have been recently made are the improved wiring system, which meets the requirements of the Fire Insurance Underwriters, the pressed steel muffler which replaces the muffler with cast ends and brackets, the redesigned pistons and connecting rods which have been made lighter, the one-piece runningboard brackets, the improved fan assembly, the new design starting switch and the dash weather trough to keep water from the coils.

Timken Axle Denies Combination Report

NEW YORK, March 8—A. R. Demorey, president of the Timken Detroit Axle Co., has sent the following telegram to AUTOMOTIVE INDUSTRIES:

"Recent rumors concerning the Timken company cause us to feel we should clearly state our position. We are not in a combination with parts makers, either in the sale of units or servicing nor are we in any combination with any automobile or truck manufacturer. The Timken Detroit Axle Co. is in business to manufacture axles and sell them to anyone willing and able to buy and pay for them.

"It happens that for the purpose of servicing the users of our products we are selling parts to a number of parts stations, who also happen to sell the products of other well known unit makers, but this is purely an arrangement between us and the parts station, and not a group arrangement between the unit makers. We feel we owe this statement to ourselves, to our customers and the trade in general.

"Briefly our position is this: We are axle manufacturers. We own and control our business and consider every automobile and truck manufacturer as a possible customer. Every arrangement we have is a very simple contract for the sale of axles at a definite price. Our interest in the customer we sell to is purely one of servicing as a unit maker."

NEW MARMON SPEEDSTER

INDIANAPOLIS, March 6—A new 4-passenger speedster is now in production at the Marmon plant. It is a decided departure in appearance from the other open cars and gives an effect of length and lowness. Equipment differing from that of the open cars includes a trunk rack at the rear, spare wheel mounted in a saddle sunk in the left runningboard, top bows of natural wood with nickel plated mountings. The price is $3,950.

HOLLIS EXHIBITED

TIFFIN, OHIO, March 6—The Hollis electrically driven automobile model, which was constructed in Hollywood, Cal., arrived here this week and was placed on exhibition at the Hollis Tractor plant. The company, which has been working on its factory here for two years, is preparing for manufacture.

Will Capitalize New Maibohm at $500,000

Preferred Stock of Two Classes Is Provided Under Present Plan

TOLEDO, March 7—Creditors of Maibohm Motors Co. have been granted five days to authorize a new plan for the sale of the company to a syndicate of Sandusky citizens, represented by A. C. Burch as agent. The new company will be capitalized at $500,000 in preferred stock of two classes. Class A will be 6 per cent cumulative, dividends commencing two years from date of issue. Creditors will receive this pro rata with their claims as finally approved. They will be represented by three directors on the board.

The new company will raise sufficient cash to take care of court costs, tax claims and will attempt to have Federal claim deferred. Total tax claims are $76,000. A total of $160,000 of new capital will be provided by the Sandusky interests. Preliminary offer contemplates a $200,000 first mortgage and other liens not to exceed $200,000 on the property.

A $10,000 guaranty fund has been been posted by the purchasing company in the Third National Exchange Bank in Sandusky. The committee says creditors will receive 60 to 65 per cent of the face value of claims by this arrangement, and that it is the best which can be submitted. A bankruptcy sale would leave practically nothing for creditors after tax and prior claims were paid.

Two Models of London Placed on Exhibition

DETROIT, March 3—Two models of the London, a 6-cylinder car, made by London Motors, Ltd., of London, Ont., are being shown at the annual Windsor show this week. The car is assembled from standard units, Herschell-Spillman engine being used, together with Norwalk propeller shaft and universal, Warner gearset, Bosch ignition and electric equipment, Gemmer steering gear and Laminated wood wheels. The wheelbase is 126 in. Prices are phaeton $2,700, sedan $3,700, coupé, $3,500, supreme phaeton $2,900.

Production has been under way on a small scale at the London plant pending the opening of spring business. Many orders are reported to be on the books of the company. It is expected to bring out a 4-cylinder car later in the spring, the phaeton to sell at about $1,400. W. R. Stansell is president and general manager of the company, and is also the designer of the car. The stock is mostly in the hands of London business men.

Most other cars at the show are Canadian editions of American cars: Studebaker, Gray-Dort, McLaughlin-Buick, Dodge, Chevrolet, Hupp, Reo and Ford. A Lincoln shown in the Ford exhibit attracted much attention.

Overland Phaeton Price Cut to $550

In 1916 It Was $615—Reductions Made on All Willys-Knight Models

TOLEDO, March 3—Price reductions on the open models of Overland cars and on all models of the Willys-Knight are announced by Willys-Overland, Inc. The price of the Overland phaeton and roadster is reduced from $595 to $550.

The Willys-Knight list follows:

	Old Price	New Price
Roadster	$1,475	$1,350
Phaeton	1,525	1,375
Coupe	2,195	1,875
Sedan	2,395	2,095

The price of the Overland phaeton only a year ago was $1,035. It sold in 1916 for $615. The latest reductions have been made possible, it is stated, by manufacturing economies, the liquidation of high priced inventories and the elimination of obligations for materials at high cost.

New List of Prices Announced by H. C. S.

INDIANAPOLIS, March 6—The H. C. S. Motor Car Co., of which Harry C. Stutz is president and general manager, has announced a new list of prices. The schedule is as follows:

	Old Price	New Price
Phaeton	$2,775	$2,400
Coupe	3,450	2,850
Roadster	2,725	2,400
Sedan	3,650	3,150
All weather roadster	....	2,550
All weather phaeton	....	2,600

NEW DIXIE FLYER LISTS

LOUISVILLE, KY., March 6—The Kentucky Wagon Mfg. Co. announces price reductions on the various models of its Dixie Flyer, ranging from $100 to $350. The schedule follows:

	Old Price	New Price
Phaeton and Roadster	$1,195	$1,095
4-passenger Speedster	1,395	1,245
Coupe	1,895	1,545
Sedan	1,895	1,595

Rolls-Royce Phaeton Is Now Priced at $10,900

SPRINGFIELD, MASS., March 7—A new price of $10,900 for the Rolls-Royce phaeton is announced by L. J. Belnap, president of Rolls-Royce of America. This price is guaranteed and represents a substantial economy to Rolls-Royce customers. In his announcement, Belnap says that in the two years it has been on an operating basis, the company has determined its costs and perfected methods and organization in such a way as not only to equal but to excel the English-built car. He adds:

It is a fact that with the American mechanic, equally skilled as he is with the English mechanic, and excelling him as he does in enthusiasm and initiative, due to more favorable labor conditions, we are actually building the Rolls-Royce in America, not only better than it has ever been built before but more economically. We have this advantage that, with our already acquired long experience in building Rolls-Royce cars in England, over here we have not suffered from many manufacturing difficulties and problems which would be eliminated only by beginning new, as we did here in Springfield, Mass.

CLETRAC F MODEL REDUCED

CLEVELAND, March 4—The Cleveland Tractor Co. has made a reduction in the price of its new Model F from $795 to $595. The company announces that production will shortly be increased from 20 per cent of normal to 60 per cent.

BEEMAN TRACTOR, $240

MINNEAPOLIS, March 3—The Beeman Tractor Co. of this city has reduced the price of its Model G to $240. This company now makes a smaller model known as Beeman Jr., which sells for $180.

ARO PRICE DROPS

MINNEAPOLIS, March 6—The Aro Tractor Co. has reduced the price of its model E tractor from $450 to $385, f.o.b. Minneapolis.

British Exports Drop While American Gain

WASHINGTON, March 4—Analysis of British automotive exports for December, compiled by Commercial Attaché W. S. Tower at London, shows a sharp decline as compared with the previous month. American shipments for the same month revealed an increase.

Exports of British made passenger cars for December show a total of 33, valued at £25,257; 14 trucks, £11,651, and 9 chassis, £13,866. Three cars and two trucks were sold in Brazil; 4 cars and 7 trucks in Argentina, and 2 chassis in this country.

Ford Service Policy Also Will Be Lincoln's

CHICAGO, March 6—It is the intention of Henry Ford to make the service of the Lincoln car as complete as that of the Ford car just as soon as possible.

The following inquiries recently were addressed to Ford:

1—Is the flat rate system that has been so beneficial to Ford dealers and Ford cars to be put in effect for the Lincoln?

2—Is it expected that the Lincoln and Ford cars will be serviced through the same service departments?

3—Will you follow the well established Ford policy as to permitting parts of other manufacturers to be used on the Lincoln car?

4—Do you expect to make the Lincoln service as universal as Ford service?

The reply from Ford's personal office was as follows:

Answering your inquiry addressed to Mr. Ford, we desire to advise that Ford policies will gradually be put into effect in the Lincoln Motor Car Co. or as fast as it is possible to do so.

Guaranty Trust Co. Discusses Prices

Sees Industry at End of Revision Period—Pre-War Comparison Impossible

NEW YORK, March 2—The Guaranty Trust Co., in discussing automobile prices in its monthly survey, states that "approximate stabilization of automobile prices is believed in the industry to have been definitely reached."

It then goes on to say:

The average price of 49 of the principal standard touring car models is now 22 per cent below the average price on Sept. 1, 1920, but the price of the greater quantity of cars sold represents a much greater reduction, some as much as 42½ per cent. This reduction has been brought about by a series of price cuts spread over more than a year, so that we now stand at what appears to be the end of the period of price revision rather than at the beginning. In view of known improvements and refinements in the product, no comparison of present prices with those of 1913 is possible or significant.

Smaller Reductions an Indication

This conclusion in regard to stabilization is based not only upon the amount of the average price reduction that has taken place, but also upon the progressively smaller price cuts made recently by leading manufacturers. Furthermore, at least six manufacturers have raised their prices since the first of the year, and there is justification for the belief in an apparent stabilization of the costs of the chief materials entering into motor car manufacture.

Many people believe that the prices of raw materials entering into the manufacture of automobiles have reached bottom. In the case of some of these materials a renewal of the upward price trend has been manifested. The average price of metals and metal products is now nearer the 1913 level than that of any of the nine groups, except farm products, for which the Bureau of Labor Statistics compiles price data. It appears, therefore, improbable that automobile production costs can go materially lower for some time.

Inventories have been well liquidated in the automobile industry and the industry brought to a sound position, where no justification of further general price reduction appears to exist.

Pennsylvania Railroad Takes Up Use of Trucks

BALTIMORE, March 6—The Merchants and Manufacturers Association has been informed by the Pennsylvania Railroad Co. that a plan for motor truck distribution of freight is under consideration for this city.

It is the belief of Robert C. Wright, general traffic manager of the Pennsylvania, that the vast volume of less than carload traffic congests the rails of the terminals and interferes with the proper handling of carload traffic. For that reason he believes it should be eliminated entirely from important stations and provided for by the construction of a large warehouse on the outskirts of the city from which store-door deliveries would be made by motor truck at the expense of the railroad.

Lighter Cars Meet Favor in Australia

Low Fuel Consumption, Selling Factor—Market Far from Saturation Point

WASHINGTON, March 7—There is a considerable demand for low and medium priced cars of American make in Australia. A study of the situation by A. W. Ferrin, formerly trade commissioner in Melbourne, shows that American cars retail in Australia at about twice the American price on account of the recent conditions of exchange, freight and other charges. Gasoline, all of which is imported, tires, and other supplies also cost about twice as much as in the United States, consequently the car with low fuel consumption and easiest on tires makes a stronger appeal than a heavier car.

One Car to 67 Inhabitants

The fact that Australia has only one automobile to 67 inhabitants indicates that the market is far from a saturation point. In addition, the average Australian income is higher than the American or Canadian, and the proportion of the population which can afford an American car is probably considerably greater than the possible percentage in this country.

It is significant to note that 90 per cent of the cars now in use in Australia are for purely commercial purposes, and the automobile is recognized as an important element of transportation on that continent.

American exporters of automobiles will be interested to know that the high initial cost and the high cost of operation, together with the light road beds, have so far been against the large use of motor trucks. A mistaken impression as to the economy of horse transportation is probably the greatest barrier to the spread of automotive carrying.

Better Roads Will Help

The average rural operator does not appear to have investigated the question of horse versus truck very scientifically, and it is difficult to find one who can tell just what it costs him to transport his products by wagon. There is little, if any, doubt that with the improvement of roads to the point of withstanding heavy traffic in all weathers, the motor truck will win its way in Australia. The first requisite of success for the motor truck is better roads; the second, wider education as to the value of motor transport; the third, greater technical knowledge in the rural districts, where the number of men who can now operate a truck is small.

Trucks are used in fair numbers in Sydney, the undulating streets of which are hard on horses, but not to any extent in the better paved streets of Melbourne, Adelaide, Brisbane, Perth and other large cities. Initial cost is the chief objection to the commercial car in these cities.

The overstock of motor cars in Australia, which six months ago was seriously depressing the market, has been entirely cleared up, according to advices from Melbourne and Sydney, and importations of American cars have greatly increased. Australia was the third largest purchaser of American cars during 1921, and her imports of motor cars from the United States were three times as great as those from the United Kingdom.

Shipments of American cars to Australia numbered 3740 in 1921 and 3905 in 1920, a remarkable showing in the face of the adverse conditions prevailing during the first six months of the year, when the low conversion rate of Australian sterling, restrictions of remittances to foreign countries, and other factors were reducing all imports to a minimum.

Treasurer Is Appointed Miami Cycle Receiver

MIDDLETOWN, OHIO, March 8—Anthony H. Walburg, secretary and treasurer of the Miami Cycle & Manufacturing Co., has been appointed receiver for that corporation. The application was made by the company, but it was the result of a suit filed against it by the Empire Trust Co. of New York to force payment of notes. The company has outstanding $371,900 in common stock and $656,200 in preferred. The common is closely held. There is no funded debt.

The company was incorporated in 1894 to manufacture and distribute bicycles, coaster brakes, pedals, etc. The plant here covers an entire city block and contains a total floor space of 175,000 sq. ft.

Home Demand Sustains British Automotive Market

LONDON, Feb. 28 (*by mail*)—Were not the home demand for light cars exceeding expectations, Britain's motor trade would be on the verge of collapse. There is no demand for heavy types, though sales of medium cars are fairly satisfactory. Demand for side-cars, motorcycles and trucks are far below normal.

There is a possibility of further price reductions, for labor by now thoroughly realizes the position the trade is in. As matters stand, foreign sales must be accelerated if factories are ever to work at capacity.

CLEVELAND RE-ELECTS OFFICERS

CLEVELAND, MARCH 6—All present officers and directors were re-elected at the annual meeting of the Cleveland Automobile Co. held in this city. The company did not make public its financial condition, but it was stated that production at the factory is increasing. Between 35 and 40 cars were made daily in February, and Secretary J. L. Krall said approximately 1500 would be turned out in March.

French Offer Prize for Aviation Motor

Competition Open to Foreign Makers—Must Be Ready by March 1, 1924

PARIS, March 1 (*by mail*)—Two million francs are offered in competition for the best aviation engine for commercial service of either French or foreign construction. Details of the competition have not yet been decided, but it is probable that after a preliminary test of 5 hours on the bench and 2 hours on a plane at an altitude of 6500 feet, the engines will have to undergo a 240 hour bench test, in periods of 8 hours, the entire tests to be finished within 100 days. There will be penalizations for all stops, changing of parts or repairs.

The competing engines, which will have to be ready for the tests by March 1, 1924, must develop between 350 and 450 hp., and weigh less than 7.2 pounds per horsepower without accessories. The object of the competition is to develop a really reliable engine, capable of being used for long periods without overhauling for commercial flying.

Of the two million francs, one half is offered by the French Government and the other by a public committee. The Government million will be used to cover the expenses of the trials and to offer two prizes of 300,000 francs each for the most reliable French engine and for the one having the best economy with the lowest head resistance.

The million subscribed by the public committee will be used to purchase the winning engine if of French construction, or to purchase the manufacturing rights if of foreign origin. Entries for this competition are received until Dec. 1, 1923, the fee being 25,000 francs, of which half will be refunded. Foreign makers will have to deposit 10,000 francs to cover the cost of the bench tests.

Imports of Cars and Tires Declined in New Zealand

LOS ANGELES, Feb. 6—Official trade statistics for New Zealand record a substantial decrease in the imports of automobiles during 1921. The United States, which for the past four or five years has supplied fully 85 per cent of all cars imported by the Dominion, was particularly hit by the slump in the demand.

The number of motor cars imported by New Zealand in 1921 totaled 3843, compared with 11,994 in 1920 and 6100 in 1919. Imports of automobile tires also declined considerably. In 1921 tires imported were valued at £715,306, compared with £1,803,961 in 1920 and £860,048 in 1919.

The drop in the total trade of New Zealand last year amounted to approximately £19,000,000. The 1921 imports aggregated £42,942,443, compared with £61,595,828 in 1920 and £30,671,698 in 1918.

Washington Shown Low Priced "Star"

Durant Responsibility Ends With Completed Car—Separate Distributing Organization

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but many details remain to be worked out. Definite decisions have not been reached on all the parts which will be used and it is understood prices will be the determining factor. The phaeton will have a full five-passenger touring body of good appearance.

Official details still are lacking concerning the exact relations between the parts makers and Durant in the new venture. While sales plans have not been worked out, there is no reason to believe that distribution will be through the organization which Durant has built up for his own line, although the showing in Washington will be made with a background of Durant cars.

Offices for the Star Motor Car Co. have been rented at 511 Fifth Avenue. The Durant Corp., which handles stock sales for the Durant enterprises, is located in the same building. The new company has not yet been incorporated, and the names of those who will be the incorporators have not been disclosed.

Orders for June 15 delivery of the new car are being taken at Washington, and purchasers are guaranteed against a reduction of prices. The Star will be displayed in other cities before actual production is begun.

Durant headquarters characterizes as "interesting" a report that Durant has just completed arrangements for big banking connections in Wall street for his properties. The report has it that a large order for wheels was placed at a highly advantageous price because it was possible to pay cash. This report was responsible for a sharp upward turn in the stock of Durant Motors, Inc., on the curb market.

NO GERMAN FORD PLANT

DETROIT, March 8—Henry Ford denies reports that he proposes to establish a huge branch factory in Germany in which to manufacture cars, trucks and tractors. It is understood this plan was given consideration but later abandoned. An extensive business in Holland and Belgium is being done through the Antwerp assembly plant which was opened Jan. 1. The territory covered includes Switzerland and Luxembourg. The manager is Don Critchley, formerly of the New York branch.

VARNISH MEN MEET

BROOKLYN, March 6—The plant managers of the New York and northern New Jersey section of the National Varnish Association at their twenty-fifth meeting elected Frank M. Schumann chairman and E. J. Cole secretary. Both are connected with Hilo Varnish Corp. The subject discussed at the meeting was "Driers and Drier Specifications," in which Dr. Percy H. Walker of the Bureau of Standards took part. The next meeting will be held March 16 when the subject to be taken up will be "Cost of Trucking and Its Inclusion in Cost Accounting Systems."

First Engineering Details of New "Star," Car Durant Is Building

NEW YORK, Mar. 7—The first engineering details of the new Durant built "Star" were learned here today. The car is to have a wheelbase of 102 in. and will weigh about 1800 lbs. The engine will be a four cylinder Continental with bore of 3⅛ in. and stroke of 4¼ in. A number of details and engineering features are not yet definitely settled.

The four cylinders will be cast in one piece with the upper half of the crankcase, a conventional L-head construction being employed. Whether the distribution will be by gears or chain is unsettled.

Pressure lubrication will be supplied through a hollow camshaft, to main bearings, with splash to connecting rods. The electrical units will probably be of Auto Lite make, with conventional drive, probably off the water pump shaft for the generator. Bendix drive will be used on starter, which will engage with toothed flywheel in usual way.

Water circulation through a flat tube type of radiator will be by centrifugal pump. A belt driven fan is provided. The engine will be mounted by four-point support on cross members, and not attached to main frame.

The layout of clutch, gearset and frame is similar to that used in the four-cylinder Durant, the gearset being mounted as a separate unit amidship, and connected with engine by universal joints which are not of the fabric or all-metal type, but a combination of the two without metal-to-metal contact.

The clutch is almost identical with that used in the Durant, being of the single plate type with direct acting springs and multiplying levers for disengagement. Clutch facings are of the molded type and are allowed to float.

The gearset is a conventional three-speed type, similar to the Warner gearset used in Durant cars, but may or may not be made by the Warner Gear Co. A longitudinal tubular frame member which serves also as a muffler is employed to minimize torsional deflection with accompanying body troubles.

Side members of the frame are straight 1½ x 4 in. channel, arranged to accommodate light commercial as well as open and closed passenger bodies. All springs are semi-elliptic. Details of rear axle are not settled, but it will be semi- or three-quarter floating Timken, with Timken bearings and 10 in. brake drums accommodating both sets of brakes. Front axle is of I-beam type and has Timken wheel bearings. Hotchkiss drive and two Spicer joints are employed. Steering gear will probably be of worm and wheel type, but this and the make to be used are unsettled.

No special light truck chassis with longer wheelbase and heavier rear axle is contemplated at present.

Detroit Has Reciprocal Exchange Insurance Plan

DETROIT, March 7—The Detroit Automobile Inter-Insurance Exchange has been organized as a reciprocal exchange insurance plan to furnish all forms of automobile insurance at cost to members of the Detroit Automobile Club. Actual writing of insurance will begin with the issuance of a charter.

Rates of the new insurance at the outset will be 10 per cent lower than the conference rates. This will be lowered as a surplus fund is accumulated.

LOWMAN BILL ADVANCES

ALBANY, March 9—The Assembly has concurred with the Senate in the passage of the Lowman bill, which is intended to regulate the size and weight, capacity and rate of speed of motor trucks, trailers and omnibuses and authorize the state highway commission to inspect motor vehicles to detect overloading, inadequacy of the equipment and other violations.

Gasoline Consumption Greatly Exceeded 1920

WASHINGTON, March 6—Refinery statistics for the calendar year 1921, compiled by the Bureau of Mines, shows that the domestic consumption of gasoline for 1921 exceeded the previous year by 260,000,000 gal., and 1919 by 1,081,000 gal. The daily average of production in 1921 was 14.119,313 gal., with a total production for the year of 5,153,549,318 gal. The total production during 1920 amounted to 4,882,546,649 gal. Exports and shipments for 1921 amounted to a daily average of 1,511,000 gal., or 283,000 gal. less than the daily average of exports and shipments for 1920.

On Jan. 1, 1922, there were 303 refineries, with a total daily indicated capacity of 1,736,725 barrels operating in the United States as compared with 328 operating plants having a daily indicated capacity of 1,714,395 barrels on Jan. 1, 1921. These plants were operating on a basis of 80 per cent of their indicated capacity on Jan. 1, 1922, and 84 per cent on Jan. 1, 1921.

During the year 1921 the petroleum refineries of the United States ran 75,325,670 barrels of Mexican crude oil; 2,745,015 barrels of Mexican tops and 160,557 barrels of Mexican crude naphtha through the stills. The Mexican crude run exceeded 1920 by 19 per cent.

France Still Seeks Own "National Fuel"

Government's Present Substitute for Foreign Gasoline Not Proving Satisfactory

PARIS, Feb. 28 (*by mail*)—With cash prizes of $50,000 for an alcohol fuel competition, and a Government subvention of $80,000 for laboratory experiments, France is making a serious effort to produce national substitutes for foreign gasoline. There is on the market at the present time a Government mixture known as "national fuel" which is composed of 50 per cent German benzol and 50 per cent French alcohol. This is used by the Paris omnibus company with not altogether satisfactory results and has met with hardly any success elsewhere.

An important competition is about to open at Beziers, in the south of France, with direct government support, with a view to the development of a national fuel on an alcohol basis. The program provides for bench tests of different classes of fuels presented by the competitors.

Says Program Is Impossible

It is impossible for the present French program to solve the gasoline problem of France, declares Maurice Goudard, president of the Solex Carbureter Co. Goudard indicated that the efforts to enforce the use of alcohol is only an attempt of the farmers and wine growers of France to put an additional tax on automobile users. If it is made compulsory for automobiles to use alcohol fuel, this will open up a rich market for the beetroot growers of the north and will leave the southern-produced alcohol free for marketing, without competition, for human consumption.

French national fuel is very international, says Goudard, for only the alcohol is produced in France, the benzol or gasoline mixed with it having to be imported from abroad. In case of war the whole of the French production of alcohol would be taken over for making explosives and the bottom would drop out of the national fuel program.

The French automobile industry is being crippled by the high price of gasoline, which costs five times more than in pre-war days, despite improved and more economical methods of handling. The average increase in the cost of commodities in France is three times the pre-war standard, while in the case of automobiles the coefficient is less than 3. Goudard considers that the final solution of the problem will be found in synthetic alcohol and benzol.

ANOTHER ROAD SCHOLARSHIP

WASHINGTON, March 7—For the third consecutive year a four year university scholarship is being offered high school students by the Highway and Highway Transport Education Committee. The scholarship, which is being given by Harvey S. Firestone for the best essay written on the subject, "How Good Roads Are Developing My Community," is an award to encourage the study of highway economics. The essays must not exceed 700 words in length; they must be submitted not later than May 1, and all students of high school grade are eligible to compete.

Eastern Ford Dealers Are Guests of Company

NEW YORK, March 8—More than 500 Ford dealers from the Metropolitan district, New England and New York state were guests of the Ford company at luncheon at the Commodore Hotel yesterday. Several factory representatives were present, including W. A. Ryan, general sales manager; Frank Haddis and E. B. Hobart, superintendent of the parts department of the factory. They were the principal speakers.

Ryan referred briefly to the Lincoln car, saying that 15 a day now were being turned out, but that production soon would be increased to 35. He added that Henry Ford expected large sales for the Fordson tractor at the new price.

Output in February Gains Over January

(*Continued from page* 582)

Rapid improvement in sentiment is apparent in the agricultural districts, and the rising prices of farm products give every reason for confidence that farmers will be back in the market for automotive products in the near future. A questionnaire sent recently to representative farmers in the states of Washington, Idaho and Oregon brought the information that many of them intended this year to buy not only trucks but passenger cars. The farm market for light delivery vehicles is steadily improving. Export sales also are expanding.

Substantial sales of the more popular lines are being made in almost all parts of the country, and it now is certain that the first quarter will show a very large increase in business in comparison with the same period last year. It is not probable, however, that the second quarter will show so large a comparative gain because sales in those months of 1921 were surprisingly good.

While predictions are dangerous in a period of readjustment, it can be stated with reasonable confidence that passenger car sales this year will be fully as good as last, when they aggregated 1,500,000; truck sales will be considerably larger and the parts business very much better.

Conservatism Marks Outlook in New York

Metropolitan Distributors Regard Present Demands for Cars Typical of Season

NEW YORK, March 9—Metropolitan car distributors are approaching mid-March with an encouraging record of sales for the early part of the year and prospects of lively business up until about the end of June. The more experienced and farsighted merchants, however, are not letting present and immediate prospect business, even with its substantial increase over that of a year ago, lead them into anticipation of a heavy volume of sales for 1922. They see in the present condition of the market nothing more than the typical spring demand of a year that is expected to approach a little way toward what might be termed normal in comparison with the restricted business of 1921.

Distributors and dealers who can be induced to talk without putting "publicity" into their conversations do not predict that the present stimulation will go right on throughout the year. They frankly look for a quiet and, on some lines, even dull third quarter, and for a fourth quarter whose volume will be determined by the size and value of the 1922 crops and the reactions of the industrial and commercial centers to the harvest situation. Studebaker, Buick and Dodge are selling heavily, and good records are being made in a number of other lines, including Cadillac, Chevrolet, Overland and Ford.

The wholesale territory around New York is reflecting the metropolitan situation, and the general result, of course, is the placing of pretty sizeable orders with the factories. These are virtually for immediate delivery, as the veteran distributors see the need for sizeable stocks in order that they may lot lose out on the demand which will exist during the next three months.

There is nothing in the New York situation, however, to indicate that any tremendous improvement over the sales records of 1921 can be expected. A thoughtful analysis of the situation suggests that in this territory the increase in business will be only a logical one, based on the absolute necessity for some replacements postponed a year ago and on the plainly apparent better feeling of the public regarding the future of business.

ASK URSUS RECEIVER

CHICAGO, March 6—Stockholders of the Ursus Motors Co., incorporated at $1,000,000, have filed a suit for a receiver in the Circuit Court. The bill alleges that 4000 stockholders have been fraudulently deprived of approximately a million dollars. According to the bill, the company was formed to manufacture tractors and farm implements, and the money received has not been used for manufacturing purposes.

Adria Pays in Full; Factory Will Resume

Creditors Gave Consent to Extension on Payments at Meeting a Month Ago

BUFFALO, March 4—The Adria Motor Car Co. of Batavia has issued an announcement through President Vremasak that it has paid its creditors in full and is now ready to resume its manufacturing operations suspended more than a month ago, when the company faced a cash shortage.

Extension on payments of accounts was given the company by its creditors when a general meeting of the stockholders and directors was held a month ago. At that time it was stated that payment in full would be made just as quickly as a refinancing plan could be worked out. The plan has now been carried through successfully, according to the company officers, and the corporation is prepared to meet its fullest business demands.

Vremasak said that from September to November the company manufactured 15 cars and that 17 others were in process of manufacture when the factory was closed.

"Now we are prepared to go ahead fast again," he said. "One of our distributors has 15 dealers and has orders in writing for more than 500 cars. The company is about to build a new model, which we believe will be popular."

International Metal Acquired by Ternstedt

DETROIT, March 9—The Ternstedt Manufacturing Co. has acquired the International Metal Stamping Co. of this city, which occupies a modern factory building with a floor space of 110,000 sq. ft. especially constructed for the carrying of heavy equipment. All the assets have been taken over by the Ternstedt company, including plant, equipment and real estate.

The International Metal Stamping Co. has manufactured successfully automobile stampings, fenders and kindred parts. The Ternstedt company now has a total floor space of 500,000 sq. ft. devoted to the manufacture of automobile body hardware. It has operated on a full time basis during the entire period of depression.

Car Demand Continues in Southern California

LOS ANGELES, March 4—According to a recapitulation of the registration in Southern California of new motor cars and trucks for January, there is no appreciable falling off in the demand. This is the period of registration for all cars in the state, and because of congestion in the motor vehicle department new car reports have been held up. Local distributors are very much encouraged by the records. A total of 4049 new cars of all makes and 369 commercial vehicles was registered.

The report shows that the nine other counties in this part of the state registered only 26 per cent of the total, the remainder being made up in Los Angeles county. There were 1472 Ford passenger cars and 186 trucks listed. Chevrolet was second, with Buick leading the field in cars of a higher price. Among the solid-tired trucks, Mack predominated 2 to 1.

In January 1921, a total of 2003 passenger cars of all makes was registered. January 1922 more than doubled this figure. Since the first of the year business has shown an upward trend, and despite the shorter period, February probably will show a gain over January. During the 30 days ending Feb. 20, there were 64 new Chandler cars sold and delivered in the city of Los Angeles, a new record for any 30 day period.

Plate Recommendations Adopted by Truck Makers

NEW YORK, March 4—At the general meeting of the truck members of the National Automobile Chamber of Commerce it was unanimously voted to adopt the recommendations of the Truck standards Committee as follows:

That the standard caution plate adopted by the Chamber in 1912 is more suitable for present requirements than any other form of plate.

That a more general use of this plate should be made and that the space provided for weights should be actually filled in.

That the manufacturer should recommend to the State Motor Vehicle Commissioner that no license be issued for a motor vehicle unless weights are properly filled in on plate at time of application.

Roses, Cake and Statue Given Leland on Birthday

DETROIT, March 3—A miniature replica in bronze of the St. Gauden's Lincoln, standing about three feet in height, was presented to Henry M. Leland on his seventy-ninth birthday in February by the ten original Lincoln distributors. The occasion of the presentation was made one of general participation by all employees and dealers, the former contributing a huge cake to the ceremonies and the latter a bouquet of seventy-nine American beauty roses. There was a general reception, in which speeches were made by Henry M. Leland and other officers. Henry and Edsel Ford attended.

LINCOLN TIME EXTENDED

DETROIT, March 6—An extension of time in which creditors of the Lincoln Motor Co. might file claims is announced by the Detroit Trust Co., receiver. The extension from March 1 to April 1 was made, it was explained, to permit the government to file a claim of the War Department, growing out of war materials contracts, and said to amount to approximately $6,000,000. Other creditors are to benefit by the extension.

Suggests Bank Aid for Roads in China

Shanghai Editor Sees All Countries Lending Help in Highway Upbuilding

LOS ANGELES, March 4—If American, British, French, German, Japanese, Norwegian and other capital can co-operate harmoniously and profitably with the Chinese in the conduct of banking in China, it would seem that these institutions might assist in providing the much needed capital required for the construction of new roads and expanding the automobile trade in China, says the *Far Eastern Review* (Shanghai) in its special automotive number recently issued.

The field is declared to be wide and important enough for the creation of a special sino-foreign bank.

"That China offers one of the greatest fields for the expansion of motor traffic is being emphasized by the widespread demand for good roads, the organization of companies for their construction and the orders that have been placed for motor vehicles," says the leading editorial in the special issue. It proceeds to state:

Unusual Road Activity

A review of the market discloses an unusual activity in all sections of the vast country in opening up new communications for commercial and military purposes. While it is too early to say that road building in China has been taken up in that serious frame of mind that impels other peoples to gridiron their lands with arteries of communication, it may be said that a good beginning has been made, and, if funds can be found for continuous construction and maintenance, the future holds bright for the development of a huge market for motor vehicles of all kinds.

This phase of China's development can be traced largely to the fact that for eight years railway construction has been practically at a standstill, with very little hope that funds on a large scale will be forthcoming from abroad for the resumption of work. Cities and towns in the interior, which cannot hope to be connected by rail, are turning their attention to the cheaper method of road communication, which calls for little more than the use of the over-abundant local labor in grading, rolling and, in some cases, of breaking stone.

These encouraging signs are also traceable to the excellent campaign being carried on by the good roads movement in the interior. Could capital be more readily obtained for road-making purposes, a boom in the automobile trade would follow. Unfortunately, there is little security for foreign capital in such enterprises, other than that supplied by the central or provincial governments, and such advances would have to come under the scope of the consortium.

NEW NAME FOR MACK MAKERS

NEW YORK, March 9—The International Motor Truck Co. has called a special meeting of its stockholders for March 22 to vote on changing the name of the company to Mack Trucks, Inc. The annual meeting will be held the same day.

MEN OF THE INDUSTRY

William A. Henderson, until a short time ago connected with the Dort Motor Car Co. in the capacity of manager of its body plant at Kalamazoo, has become president and general manager of the Brooks-Ostruk Co., New York City. Henderson was associated with the Holbrook Co. of New York for more than seven years as factory manager and had entire charge of the designing, constructing and manufacturing ends of the business.

H. C. Smith, who has resigned from engineering work in the aviation department of the government with which he has been associated for the last four years, has been appointed district sales supervisor for Earl Motors, Inc., with headquarters at Evansville, Ind. He has had considerable automobile experience in both retail and wholesale work. His territory includes sections of Indiana, Illinois and Kentucky.

Harmon F. Fisher has been appointed as engineer, connected with Research Division, of the American Petroleum Institute. Fisher has been a consulting engineer and was previously engineer in charge of operation of the U. S. Government helium plant at Petrolia, Tex. At various times he has been connected with the Gellert Engineering Co., Research Corp., and Westinghouse Electric Manufacturing Co.

E. E. Peake, for the last ten years secretary and treasurer of the Kansas City Motor Car Dealers Association, has resigned. He was one of the organizers of the National Automobile Dealers Association and until his resignation in February had been president since its organization of the National Association of Automobile Show and Association Managers.

H. R. Hyman has been appointed advertising counsel for the Stutz Motor Car Co. of America. Hyman has had an extended experience in the handling of automotive advertising. For more than seven years he was identified with the Cole Motor Car Co.

Perry McGregor has been named superintendent of the Oakland Motor Car Co. engine plant, succeeding Emmet L. Page, resigned. He has been superintendent of the Saginaw Products Co. motor plant and held a similar position with Chevrolet for several years.

R. G. Craig has been named manager of the New York branch of the Dort Motor Car Co., succeeding F. L. Sanford, who resigned to join the Dodge Brothers field organization. Craig was formerly Dort manager of sales at the New York branch.

S. M. MacDonald and A. L. Haskell, manager and assistant manager, respectively, of the Boston office of the New York Lubricating Oil Co., have assumed active representation of the National Lubricants Co. in New England.

H. Stuart Hotchkiss, now president of the General Rubber Co. and the United States Rubber Plantations, Inc., has been chosen vice-president of the parent company in charge of all overseas activities.

Francis W. Davis has tendered his resignation as consulting engineer of the Pierce-Arrow Motor Car Co. to take effect April 1. He will probably engage in consulting work in the fall.

Edward H. Hart, formerly general counsel of the Federal Reserve Bank of New York, has been elected vice-president in charge of legal matters of the United States Rubber Co.

A. C. Galbraith, formerly with the Mason Tire & Rubber Co., is New York City representative for the Republic Rubber Co.

W. G. Kimball, vice-president of the Columbia Trust Co., New York, has been elected a director of the Pierce-Arrow Motor Car Co.

H. C. Bowen has resigned as advertising manager for the Rauch & Lang Co., Chicopee Falls, Mass.

American Truck Finishes Run in Argentina Test

WASHINGTON, March 9—Agents of American firms in Argentina anticipate that the results of the recent truck tests will have a salutary effect upon the sales in that country. The official tests for speed and economy when loaded to capacity and operated over dirt roads, as conducted by the Argentine Army, showed that the one American entered in the competitive race finished the entire course in a very satisfactory manner, running from Buenos Aires to San Francisco; from there over a dirt road to the National Encampment at the Campo de Mayo, and after various tests at the Army Camp, returning to Buenos Aires via Moron.

The three other trucks competing (Krupp, Mercedes and Opel) of German manufacture, were forced to abandon the test before reaching Campo de Mayo.

MAY BUY CHRYSLER RIGHTS

TOLEDO, March 7—Frank Kennison, one of the receivers for the Willys Corp., has been informed that Clement Studebaker, Jr., Rollin H. White, president of the Cleveland Tractor Co., and Fred Zeder, former chief engineer of the Studebaker Corp., who designed the Chrysler six, are working out a plan to finance the purchase from the Willys Corp. the rights to manufacture the Chrysler six and have taken some preliminary steps in this direction. It is reported that if they are successful in their efforts the car will be produced at the plant of the tractor company.

COMMITTEE FOR JACKSON SHAFT

CHICAGO, March 4—A committee representing the holders of the $100,000 7 per cent notes of the Jackson Motor Shaft Co., bearing a March 1 maturity date, has been formed. The stock of this company is owned by Earl Motors. As soon as the notes are deposited with the Chicago Trust Co., the bank will pay the interest and make arrangements for extensions. The company is considered by bankers to be solvent, but its affairs are entangled with Earl Motors. Both situations are expected to be cleared up in the near future.

SPEEDWAY FOR KANSAS CITY

KANSAS CITY, March 6—This city is to have one of the big motor car speedways of the country. The track and grandstand and other buildings will be constructed on land on which an option has been obtained, several miles east of the city. The Kansas City Speedway Association, which is promoting the undertaking, is headed by John A. Butler, with E. E. Peake, former secretary of the Kansas City Motor Car Dealers Association, as secretary and manager.

Ash Demand Growing Southern Mills Show

Orders Received from Automotive Industry Fill Books for Some Weeks Ahead

ATLANTA, March 9—Evidence of the steady improvement being noted in automobile manufacturing throughout the country is shown in the increased demand for ash at the southeastern lumber mills, orders from this source having now reached a point where a majority of the mills cutting ash have ample business booked for some weeks ahead. This demand has been unusually active for the past month and has been increasing steadily every week, with present indications portending still further improvement during March.

Ash prices have remained comparatively firm since the first of the year, but millmen generally are expecting increases within the next few weeks if orders continue to be booked in the present volume from the automobile trade. Due to the tendency on the part of some of the smaller mills to accept orders at below the market that they might obtain a quick turnover of their stock, prices are rather inclined to be bullish. However, this is not seriously affecting the situation.

Present prices for ash, tough white cane, band sawn stock, f.o.b. at the mills, only the principal items being included, are quoted as follows by the larger dealers: 4-4 ones and twos, $80; 4-4 No. 1 common and selects, $36; 4-4 No. 2 common, $18; 4-4 No. 3 common, $10; 8-4 ones and twos, $85; 8-4 No. 1 common and selects, $42; 8-4 No. 2 common, $20.

Tokio Buys Truck Fleet for Disposal of Sewage

TOKIO, Feb. 10 (*by mail*)—The City of Tokio has purchased a fleet of 47 trucks to be used for the disposal of sewage. Of these, 35 are one-ton Fords, pneumatic-tired, which will be fitted with covered rack bodies of Japanese construction. The remaining 12 are Packards, Model EC, complete with electric starting and lighting equipment and solid tires. Eight of the Packards will have Japanese-made vertical hoists and steel dump bodies, and the remainder will be fitted with ordinary platform and stake bodies.

These trucks will be used to convey the night-soil from the residential districts to the outskirts of the city, where it is sold to the farmers. Tokio, like all Oriental cities, has no regular sewer system, and the use of motor transportation for the disposal of sewage has long been advocated by local motor dealers. If other Japanese cities follow Tokio's lead in this matter, a new and large market for motor trucks will be opened. The night-soil has been previously transported by hand cars pulled by coolies.

FINANCIAL NOTES

Fisk Rubber Co. for the year ended Dec. 31, 1921 shows net profit after depreciation and rebates but before interest charges, of $3,336,467. After interest charges there remained a surplus of $2,011,379. A charge of $8,390,455 was made against profit and loss account. Surplus after payment of preferred dividends was $1,494,464. After inventory adjustments and reserve for commitments there was a surplus of $1,873,417, compared with $7,789,085 on Dec. 31, 1920. The balance sheet as of Dec. 31 last showed cash, $2,079,124; accounts receivable, $8,718,714; notes receivable, $824,871; deferred charges, $1,419,425 and inventories, $13,160,207. Accounts payable totaled $1,274,588; notes payable, $4,845,000 and depreciation reserve, $4,103,570.

Replacement Parts Co., Kansas City, adjudicated bankrupt in Federal court in that city Feb. 11, has filed its schedules, showing $64,714 secured claims and $58,099 unsecured. The secured claims consist of two notes for $25,000 and interest of $1,833 due Myrtle B. Stillwell and Ada Bambach given for cash, and note secured by deed of trust for $32,500 due Marien E. Pixley with interest of $2,464. The petition against the company was filed July 16, 1921, and delay in adjudication was due to the controversy springing out of circuit court litigation.

H. H. Franklin Manufacturing Co. for the first time is making a public offering of common stock independent of the preferred stock as part of its plans for financing its new four-cylinder model. An investor has the privilege of purchasing either preferred or common shares or both. Ninety per cent of the 285,000 shares of Franklin common stock at present outstanding is owned by officers, directors and heads of departments in the Franklin industry. The common stock, which is without par value, is offered at $50 a share.

Wire Wheel Corp. shows net loss deducted from surplus for last year's activities of $433,620. Included in this amount is operating loss of $90,588, adjustment of the inventories to present market values and writing off the usual patent depreciation. The balance sheet as of Dec. 31, last, shows cash amounting to $183,759; notes receivable $115,337; accounts receivable, $73,872; inventories, $915,557; accounts payable, $26,909; accrued taxes, etc., $23,379, and surplus, $1,130,065.

Lee Rubber & Tire Corp. for 1921 reports net profits of $9,328 after all charges and inventory adjustments, equivalent to 6 cents a share earned on its 150,000 shares of no par common stock. This is contrasted with net profits of $326,638 after charges and Federal taxes, or $2.11 a share, earned in 1920. The company's net sales aggregated $7,358,436, against $6,705,930 in 1920. Its deficit after dividends was $290,762 for 1921, as compared with a surplus of $101,638 a year before.

Firestone Tire & Rubber Co. has declared a regular quarterly dividend of 1½ per cent on the 6 per cent preferred stock and 1¾ per cent on the 7 per cent preferred. A dividend on the 6 per cent preferred is payable April 15 to stock of record April 1, and on 7 per cent preferred May 15 to stock of record May 1.

Chandler Motor Car Co. has declared the regular quarterly dividend of $1.50 a share on the capital stock, payable April 1 to stock of record March 20. The dividend is being paid out of current earnings. During the last two quarters the dividend was paid out of surplus, because of the depression in the industry.

Atlas Drop Forge Co., Lansing, paid a 50 per cent stock dividend and a 25 per cent cash dividend in February, the dividend being in reality the distribution of a surplus which has been accumulating over a period of eight to ten years.

International Motor Truck Co. has declared regular quarterly dividends of $1.75 a share on both first and second preferred stocks, payable April 1 to stock of record March 21.

Kelly-Springfield Tire Co. has declared a regular quarterly dividend of $1.50 a share on the 6 per cent preferred stock, payable April 1 to stock of record March 20.

Packard Motor Car Co. has declared a regular quarterly dividend of 1¾ per cent on the preferred stock, payable March 15 to stock of record March 1.

Sends Out Questionnaire on Trade Body Activities

WASHINGTON, March 4—Correspondence between Secretary of Commerce Hoover and Attorney-General Daugherty regarding the legal status of trade associations has brought so pointedly to the front the necessity of a complete understanding of the functions, methods and accomplishments of national trade organizations that this subject is to be made an important feature of the convention of the National Association of Manufacturers to be held in New York City, May 8, 9 and 10.

The association has sent out a questionnaire to its members in order to develop an elaborate study of the work of trade associations. The questionnaire, among other things, asks as to the type and percentage of industries represented, the character of the membership of associations, whether composed of individuals, firms or corporations, etc., and purposes, scope and authority of the departments of the organizations. This data will afford an opportunity for the compilation of a volume of authentic information regarding the work of trade bodies.

TRANSPORT RE-ELECTS OFFICERS

MT. PLEASANT, MICH., March 6—Officers of the Transport Truck Co. were re-elected at the annual meeting of the corporation. M. A. Holmes continues as president and general manager, with H. E. Chatterton as vice-president and assistant general manager. A. E. Gorham is secretary and treasurer.

MUST USE AFFIX TO HUDSON

NEW YORK, March 6—The statement that Judge Learned Hand had granted the Hudson Tire Co., Inc., of Newark, N. J., a permanent injunction restraining the Hudson Tire & Rubber Corp. of Yonkers from using the word "Hudson" on its tires, was somewhat misleading. The court order permanently enjoins the Yonkers company from the use of the word "Hudson" without "some distinguishing affix thereto." In all other respects the temporary injunction against the Hudson Tire & Rubber Corp. was vacated.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During the past week call loans ranged from 4 per cent to 5½ per cent, as compared with 4 per cent to 6 per cent in the previous week. For fixed date funds also, the undertone was easier and offerings were more plentiful. Quotations ranged from 4¾ per cent to 5 per cent for all maturities from sixty days to six months. The prime commercial rate remained unchanged at 4¾ per cent to 5 per cent.

The Federal Reserve statement as of March 1, 1922, showed a decrease of $48,000, the net result of an increase of $4,599,000 in gold reserves and a decrease of $4,647,000 in other legal reserves. Total bills on hand declined $570,000, while total earning assets showed an increase of $57,371,000. Total deposits increased $46,261,000. Federal Reserve notes in circulation declined $1,070,000, and the reserve ratio declined from 78.1 per cent to 76.7 per cent.

The total reserves of the New York institution decreased last week $22,247,000. Total bills on hand declined $1,622,000. Total earning assets increased $35,684,000 and total deposits $24,439,000. Federal Reserve notes in circulation increased $129,000, while the ratio of total reserves to deposit and Federal Reserve note liabilities combined decreased from 87.1 per cent to 84.1 per cent.

On March 3 an issue of 7 per cent 5-Year Gold Notes of the Argentine Republic to the amount of $27,000,000 was brought out in this market.

Last week Bradstreet's Food Index number, based on wholesale prices per pound of thirty-one articles used for food, showed a gain of 1.9 per cent over the previous week, but a loss of three-tenths of 1 per cent from the corresponding week of the previous year.

The Swiss National Bank reduced its discount rate last week to 3½ per cent from the 4 per cent rate that has been in effect since August 11 last.

FORD MAY CLOSE CORK PLANT

DETROIT, March 6—Henry Ford is considering the advisability of closing his plant in Cork, Ireland, because of an attempt by the municipal authorities to coerce him into employing 2000 men instead of 1000. The Cork Corp. has decreed that the Ford company must comply at once with an alleged condition of the factory lease by employing a minimum of 2000 workmen for five years.

EXPORT TRUCK SALES GAIN

NEW YORK, March 7—Truck sales in the export field are increasing because of the strength of foreign exchage, according to M. L. Pulcher, general manager of the Federal Motor Truck Co. As typical of the way in which foreign orders are coming in, he cited one from India for thirty trucks.

INDUSTRIAL NOTES

Wharton Motors Co., Pittsburgh, states that it expects to start production at its new plant in Dallas some time this year. The company has an option for a factory site in Johnstown, Pa., where it will build a three or four-story building for the manufacture of passenger cars and trucks. Robert H. Campbell, who was former president of the Campbell Engineering Co., Chicago, and who has been associated with a number of manufacturers in the industry, has become associated as vice-president and chief engineer of the Wharton company. Thomas P. Wharton is president; E. W. Fluke, second vice-president, and L. D. Heckman, secretary and treasurer.

Grand Rapids Tire & Rubber Corp. re-elected L. A. Brown, C. G. Dyer, C. S. Dickey, H. H. Swan and M. J. Goldner directors at the third annual meeting, which was attended by three hundred stockholders. The officers remain as in the past. President Brown reported the progress made in distribution and outlined plans for expansion. Treasurer Dickey stated the company was in excellent condition financially with nothing owing but current bills and with a comfortable surplus in the treasury.

Auto Body Co., Lansing, has elected John W. Haarer, cashier of the City National Bank, secretary, to succeed Fred C. Ruch. J. Edward Roe continues as president. Harris E. Thomas is vice-president and W. V. C. Jackson vice-president and general manager. Ruch continues as a director. Other directors in addition to the officers are E. S. Porter, A. C. Stebbins, C. E. Bement and Richard Price.

Hendee Manufacturing Co. has made effective a wage reduction averaging 15 per cent. This applies to the entire factory force of 600, but varies according to the kind of work done. There has been no pay cut for the office force. A survey of wage conditions in other establishments preceded the readjustment. The plant continues to operate full time.

A. & D. R. Black, consulting aeronautical engineers of New York and Washington, D. C., have closed their office in the former city, due to the slow development of civil aviation, upon which their work was partly dependent. They are carrying on consulting work at Garden City, N. Y.

Greenfield Tap & Die Corp., Greenfield, Mass., has compiled a comprehensive telegraph and cable code intended for overseas and domestic customers. It is a five letter code and so arranged that it can be combined with the majority of standard commercial codes.

Fedders Manufacturing Co. of Buffalo has purchased the former Lautz marble works plant in Bridgeburg, Ont., with the purpose of refitting it and manufacturing radiators there. Seventy-five men will be employed at the start, the force to be increased to 200 later.

Northern Wheel Co., Alma, Mich., directors have elected Frank W. Ruggles president. A. C. Chapman has been named vice-president and general manager; J. W. Blakley, vice-president; Orville Allen, secretary, and Charles O. Ward, treasurer.

Watkins Manufacturing Co., Ltd., of Canada will establish a central factory and distributing office in Syracuse. The company, which does rebabbitting with special machinery, will employ at least twenty-five men in the Syracuse plant.

Franklin Tractor Co. plant at Greenville, W. Va., has been disposed of at bankrupt sale to H. E. Bulock of Chicago, who paid $27,500 for the land and building and $7,000 for the chattels and other machinery.

Timken Roller Bearing Co. has begun operations in its new factory branch at Walkerville, Ont., choosing this point as a distributing point for all Canada.

Universal Tool Co., Inc., assets will be sold by the receiver March 21 at the plant at Garwood, N. J.

Spanish Rates Lowered on Automotive Imports

WASHINGTON, March 7—Confirmation of the reported decrease in the customs duties on automotive products in Spain has been received by the Bureau of Foreign and Domestic Commerce. The new rates, which decrease these duties materially and which again should open that market for American automobiles, are based on the c.i.f. value of the shipment at the Spanish port of entry.

The new duties, according to a statement transmitted from Hugh Chalmers, head of the tariff division of the Bureau, to Gordon Lee, director of the automotive division, show that American products are given a preference of from 5 to 30 per cent. The rates are as follows, the second category applying to shipments from the United States:

Automobiles	First tariff Ad Valorem	Second tariff Ad Valorem
Chassis with engine and automobiles complete value up to 20,000 pesetas	30 per cent	25 per cent
Motor trucks, motor buses	30 per cent	20 per cent
Framework (armaduras) without motors, longitudinal bearers, suspensions, transmissions, gearings, and separate parts not specified, for automobiles	40 per cent	25 per cent
Vehicle bodies, all kinds	60 per cent	30 per cent

INSURANCE COMPENSATION BILL

ALBANY, March 4—A bill which would create the New York Automobile Owners' Mutual Compensation Association, in which all owners of motor cars would have to be insured at cost, has been introduced in both houses of the legislature. The bill would provide compensation for persons injured or the families of those killed in automobile accidents.

It is contended that not more than 25 per cent of the money which automobile owners now have to pay because of accidents ever reaches the injured persons or their families because of litigation, expenses and insurance company profits.

SHALER PLANT BURNS

MILWAUKEE, March 6—The plant of the C. A. Shaler Co., manufacturing tire repair apparatus and headlight lenses at Waupun, Wis., has been destroyed by fire with an estimated loss of $300,000, which is partly covered by insurance.

METAL MARKETS

TO-MORROW'S unfilled tonnage statement of the United States Steel Corp will, in the present condition of the steel market, partake somewhat more than it would ordinarily of the character of a compass to the industry's future course. For the last two or three weeks producers generally have had their ears to the ground in an effort to determine whether the rumblings indicated a steady growth in the demand which would eventually justify an upward movement of prices or a relapse that would again defer hopes of increased spring demand.

The corporation's rate of operations underwent considerable expansion last month, and undoubtedly a large number of orders booked in February were filled in that month, thus exerting no influence at all on the unfilled tonnage at the end of the month. Whether to-morrow's report on the backlog of the corporation's orders shows a slight increase or a slight decrease its bearing on the state of the industry's needs is relative. For all that, however, its sentimental effect on the market's undertone will be in evidence. There has been no lack of effort to pave the road toward an upward price movement in the event that developments should be in the least favorable. "The head of one large steel company," a Wall Street publication said the other day, "declares the industry has definitely turned for the better and any one who buys steel at contract prices will consider himself fortunate before the close of spring."

While there is more diversification to the character of steel buying than there was a few weeks ago, the automotive industries are still the market's chief prop. The bulk of the steel bar business being placed at this time is for automotive rim section material. Improvement in the strip steel industry is solely traceable to broadened automotive demand. The relatively steady demand and market for sheets would be non-existent were it not for automotive buying.

Pig Iron.—Automotive foundries are melting more iron and there is a larger number of orders being placed. Buyers of more than hand-to-mouth tonnages seek concessions, however, and in most instances have been able to secure them so far. "For the moment, manufacturers are interested chiefly in volume," significantly remarks one of the large pig iron interests in its latest market letter, "looking to the future for prices which will allow a profit."

Steel.—Passenger motor car manufacturers have been specifying freely against the remainder of their first quarter 1922 sheet contracts and considerable business for second quarter has been placed in the last few days. Previous quotations continue to hold. Non-integrated sheet mills are showing more interest in sheet bars, which reflects the continuing demand for automotive sheets. A decidedly better demand for strip steel is noted. Alloy steel makers continue to broaden operations. Several fair-sized orders for bolts and nuts are reported to have been placed by automotive interests in the Middle West. Prices generally are fairly steady, the market, however, exhibiting an uncertain undertone.

Aluminum.—Automotive demand is reported to be on the up-trend. Following the sale of some sacrifice lots of 98 to 99 per cent virgin ingots at 16½c. the market is now on a minimum basis of 17c., with first hands asking from 18c. upward. One dealer points out that aluminum is again being used for automobile hoods in fairly large quantities.

Copper.—The outlook is for a slight recovery following the market's recent setback.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

CONVENTIONS

May 8-10—New York, National Association of Manufacturers.

May 10-12—**Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.**

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24 — White Suplur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

5,000 Trucks Needed by British Railways

Order Depends Upon Sanction Being Given to Legislation Now Pending

LONDON, Feb. 10 (*by mail*)—The group of British railways which is seeking legislative sanction to start an automobile road service has offered two modifications to allay the increasing organized opposition to the proposals. The companies agree not to concern themselves with passenger service and not to undertake to build motor trucks for their use. The former waiver interests bus lines particularly and the latter truck manufacturers. If the legislation is sanctioned, it will probably mean an order for 5000 motor trucks, chiefly from 1 to 3½-ton capacity.

As service will be an essential feature it would seem that truck makers would be able both to build and undertake maintenance of the trucks on a contract basis.

Ford Prices Lowered

British Fordson has been reduced in price to £120. Within a recent period it has fallen from £250 to £225, to £205 and to £190. For £250 the British farmer can buy a Fordson special power farming plant, comprising tractor, plough, cultivator, roller and mower, the price being about a third lower than was ruling less than a year ago.

MOTOR HORN FILM SHOWN

DETROIT, March 3—Harry G. Sparks, sales manager of the automotive equipment division of the Sparks-Withington Co., Jackson, spoke to 800 students of the Michigan State Auto School on "Motor Horns—How to Sell and Service Them." The Sparks-Withington film "Tooting Your Own Horn," which is a supplement to the Automotive Equipment Association "Ask 'Em to Buy" film, was run.

A motor horn assembly cut-out and a similar cut-out of a Sparton radiator, mounted for classroom work in the school, were presented to the students. Sparks, in furthering the "Ask 'Em to Buy" movement, has addressed and shown the film to more than 200 assemblies of dealers' and jobbers' salesmen.

CANADA OPPOSES MORE TAXES

MONTREAL, March 6—Concerted action in protest against heavy increases in motor vehicle fees was planned at emergency meetings of the Automobile Club of Canada and the Montreal Automobile Trade Association. The taxes on passenger cars would be increased from 70 cents per horsepower to 90 cents, and on motor trucks to $50 per ton capacity. It was pointed out at the meeting that the tax on a Ford car, for example, would be $26.70 under the new rate as compared with $8.75 in New York state. The tax on a McLaughlin would be $33.90, on a big six Studebaker $46.50, on a Cadillac $42 and on a Pierce-Arrow $66.30.

TIDEWATER CREDITORS AGREE

WASHINGTON, March 7—Creditors of the Tidewater Lines, Inc., owners and operators of a highway motor service in the District of Columbia and Maryland, have signed an agreement under which 20 per cent of the outstanding indebtedness will be paid up immediately and extending the period for the payment of the balance until Jan. 5. Meanwhile the company has several new directors and will pay on a cash basis. It is stated that this firm will purchase new equipment within a few weeks and make an effort to cut down maintenance costs.

STARTS JAPANESE SURVEY

TOKIO, Feb. 10 (*By Mail*)—William L. Irvine, special trade commissioner from the automotive section of the Department of Commerce, has already commenced an intensive survey of the local market. Irvine expects to remain in Japan for several months and will make a thorough investigation of the possibilities of Japan as a market for American automotive products. He has already met several of the leading dealers and will be offered every facility for his investigation.

Franklin Net Profit In 1921, $452,489

Annual Report for Year Shows Sales Were 81 Per Cent of 1920

SYRACUSE, N. Y., March 8—The annual report of the H. H. Franklin Manufacturing Co. shows a net profit for 1921 of $452,489, after taxes, depreciation and all reserves including a special reserve of $550,000 to reduce inventory to current market value. Sales for the year equalled 81 per cent of 1920.

The comparative income account shows net sales in 1921 of $22,543,484, against $28,585,399 in 1920; cost of sales, $22,090,995, compared to $27,888,884.

Current Assets, $9,369,420

The balance sheet shows total current assets of $9,369,420, against $10,940,752 in 1920. In the former figure the cash on hand equals $1,192,529; accounts and notes receivable, $543,795, and inventory, $7,484,630. The 1920 total includes cash, $1,748,295; accounts and notes receivable, $591,203, and inventory, $7,614,696.

The current liabilities for 1921 were $4,084,630 and for 1920, $7,368,180. The accounts and notes payable in 1921 stood $4,004,630, against $7,233,180 in 1920, and the Federal taxes, $80,000, compared to $135,000 in 1920.

EXHIBITING AT TOKIO

TOKIO, Feb. 5 (*By Mail*)—Several of the leading local dealers are preparing exhibits for the Peace Exhibition, which will open here March 10 and run until the end of July. Only a small part of the exhibition will be devoted to automotive products. Takata & Co. will exhibit an Isotta-Franchini chassis with eight-cylinder in line engine and models of the English Bean; Midzushima will show Renault enclosed cars, and Sale & Frazar, agents for Ford, Hupmobile, Franklin and White will have a large display. Other dealers have not yet announced their programs.

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Gasoline Bus or Trolley Bus —Which?

The author, who has had a broad experience both in this country and abroad, discusses the relative usefulness of each type of vehicle and carefully weighs the value of each in municipal transportation.

By Walter Jackson*

FEW facts will support the assertion that there is no place for either the track or trackless trolley in city transportation services. There are, however, just as few facts to support the assertion that there is no place for the gasoline motor bus in such services. Each has its definite place, and this article is written, not in an attempt to show the disadvantages of the trackless trolley, but rather to show the advantages of the gasoline bus. In a great many cities, both in this country and abroad, this form of transportation has proved its value both to the operator and to the public. It has certain definite advantages which could never be gained with the trackless trolley. However, the old adage of Sir Roger de Coverly, "There is much to be said on both sides," still holds true.

Counsel on this subject has been darkened by the nature of many estimates of cost published by manufacturers' representatives on both sides. They usually assume some general condition, such as intervals between vehicles and number of people to be carried a given distance. Cost of power, upkeep and depreciation are made as favorable to that particular writer's side as possible. The other fellow's estimates are magnified and his hopes belittled. Quite naturally we are led into a triumphant "Q. E. D.," proving that only in a few exceptional cases may the other fellow have a look-in.

In real life, however, we find that this or that vital figure in the commercial estimate is decidedly different in the individual or specific case before us. Aside, also, from the question of cost, we find that other elements enter at times, such as flexibility of route, need for a mobile corps, fixed or intermittent traffic needs, legal technicalities, such as New York's and London's esthetic viewpoint of the public, and so on. For these reasons the writer will try to show in the following discussion how different conditions lead to different conclusions.

Since the cost of power is one of the three or four largest items in running either kind of bus, it is well to understand where this element is dominant in making a choice. The Tees-Side (England) case furnishes a good example, inasmuch as the writer studied this property in detail on the ground in the summer of 1921.

The territory served consists of a number of small steel mill towns, totaling 45,000 people. These towns are connected by but one main road which would be the only one available for any form of transportation. It followed, therefore, that no mistake could be made in using a fixed structure. The project of giving service to this district, covering a route length of some 5

*Consulting engineer.

miles, came up during 1918 when gasoline was not only extremely high priced (about 60 cents per imperial gallon), but also restricted in supply. On the other hand, one of the steel mills was prepared to supply electricity for 10 years at the very low price of 1.5 cents per kilowatt-hour. The difference in favor of electric power was about 8 cents per mile. During the earlier period of operation, when gasoline went still higher, the difference in favor of electricity, naturally, was increased.

It will be clear that the Tees-Side Railless Traction Board was fully justified in adopting the trackless trolley. The difference between gasoline and electricity was so great that it might well be expected to wipe out any possible advantages due to the greater earning power of a fully flexible bus. Besides, it has been pointed out that only one highway was available in any event. On the other hand, had gasoline prices been closer to those in this country, a different decision might have been in order, because a difference of but 3 or 4 cents might have been offset by the possibility of running the buses a few miles farther to the seashore. British summer days are long, and Britishers are so fond of the open air that in non-working hours the gasoline buses would be earning top-notch fares, whereas most of the trackless trolley buses are then idle. And this is a sixteen-bus installation, too.

Installation in Yorkshire

Within the same province, Yorkshire, is another trackless trolley installation. This is in the charming old city of York. There are but four buses run on a route 1¼ miles long through narrow streets that would not allow track operation in any event. In this instance we have a good example of how changes in the cost of power can affect the question of what trackless vehicle to use. At York the choice had to be made during 1920. The difference between gasoline and electricity costs was not so great as at Tees-Side, since power at York would be billed by the lighting department of the municipality at 2.5 cents instead of 1.5 cents per kw.-hour. But one year has produced a different picture, owing to a considerable fall in price of gasoline. We learn that the City Council is prepared to reopen the question before it decides upon the character of operation for running to the suburb of Clifton.

Generally speaking, the sane advocate of trackless trolleys for England bases his chief argument on the saving in power. Thus, an article in the Nov. 17, 1921, issue of the *Railway & Tramway World* notes a case where the difference is 8 cents (12 cents—4 cents) in favor of electricity. In other words, the trackless trolley is preferred because electric power is but one-third the cost of gasoline power. Does this ratio apply in the United States? Let us see.

Operating Costs

In examining the estimates of electrical manufacturers' engineers here, we find that a gasoline bus weighing 10,000 lb. is credited with but 4 to 4.5 m.p.g., whereas the gasoline bus makers aver that 7 m.p.g. is nearer the possibilities. If we compromise on 5.5 m.p.g. with gasoline at 27 cents per gallon, the cost per bus-mile would be approximately 5 cents.

On the other hand, the electrical man figures only 2.5 cents per kw.-hour, which at an overall energy consumption of but 1 kw.-hour per bus-mile would make the cost of electricity one-half instead of one-third the cost of gasoline. Actually, the condition would not be so favorable. Only the larger power plants could deliver kilowatt hours at the rate named. On one property with which the writer was concerned the cost of power was really more than 3.5 cents per kw.-hour. Nor was it likely that the energy consumption per 10,000-lb. trolley bus would be as low as 1 kw.-hour per mile after lighting, heating and transmission losses were taken into account. Based upon foreign studies, the writer concluded that the trolley bus would take at least 1.25 kw.-hours per mile. This consumption at 3.5 cents per kw.-hour meant a power cost of 4.4 cents, or but 0.6 cent less than gasoline.

From the foregoing it will be plain that the cost of power as we find it in any given situation must control, and not some generalized cost. The Tees-Side property, with its 3:1 ratio, was justified in adopting the trackless trolley, but a property with only a 1½:1 ratio in favor of electricity ought to do considerable thinking.

While platform labor is a heavy item in operating expense, it is common to both kinds of buses. Hence we need not discuss it here. In some estimates a factitious advantage is shown for one or the other by assuming a difference in schedule speed per hour, and so crediting the faster bus with a lower wage charge. In practice this is not likely to obtain in city extension, crosstown or suburban service because either type will meet the conditions. We can, therefore, proceed to the next disputable item—namely, the likely upkeep cost of each kind of trackless vehicle.

If experience with trackless buses actually in use in Great Britain for some years were to be our sole guide we would find a surprisingly small difference between the repair cost of trackless and gasoline buses. Bradford and Leeds show costs in excess of 10 and 12 cents per mile, with the more modern Tees-Side much the same. During like periods the larger British bus undertakings, such as Sheffield, showed 9 cents and upward. In the latter cases we are dealing with vehicles approaching the end of their careers. The repair costs of the Aberdeen and Edinburgh buses are approximately one-half as much because the buses are newer and more efficient. Much the same figure (4.6 cents) is given in the case of the York trolley bus, but this does not include body reinforcement charges which were assessed against the bus builder.

Maintenance Comparison

If this is the story of the past and present of gas and electric buses in England, what of the future? In this respect the writer was assured by J. B. Parker, the general manager of the Tees-Side system that his new 36-seat bus was not expected to exceed 5 to 6 cents per mile maintenance cost. Now, in the *Tramway & Railway World* article, previously mentioned, the writer thereof, although advocating the trackless trolley, states that the "additional maintenance of petrol engine over electric motor" is ½d. or 1 cent per mile. Compare this with the American assertions that the trackless bus will tend to cost but 4 cents to 5 cents per bus-mile against 8.5 cents to 10.6 cents for the gasoline bus. The British writer based his figures on a decade of experience with both kinds of vehicles, whereas the American engineers have been obliged to base their figures on trolley car experience and the operation of motor buses under jitney and other small-scale conditions. Let us hold fast to the fact that the Britisher's outstanding reason for using trackless is not because of its lower maintenance, but because of its lower power cost in so many parts of his country.

On a trackless trolley system, of course, it is also necessary to maintain the overhead line at, say, ½ cent to 1 cent per mile run. If the trackless system were self-contained it would also have a substation to look after. These are additional upkeep costs that tend to

cut down the difference in upkeep costs between the vehicles themselves.

The cost of a trackless trolley bus of, say, 25-seat capacity is now some $1,000 greater ($8,000 against $7,000) than a gas bus of like capacity. On top of this the trackless bus also has the special investment for overhead line (four wires) and feeder wire from substations which would result in almost doubling the investment charges in those thin traffic cases where the number of buses will be fairly equal to the number of miles of route. Even if the investment required was not double, the charges would tend to be higher because money for the trackless trolley equipment could hardly be raised at the favorable rates open to any reliable purchaser of gasoline buses. The obvious reason is that so much of the trackless trolley investment is special, whereas the gasoline buses could be removed at once if their user did not make good.

As an offset to this, the depreciation or amortization charges on the trackless trolley bus should be lower—possibly by 25 per cent or better. But this lies in the realm of conjecture and hope because control, drive and current collection are still in the "x" stage of the equation. The first few months of American experimentation have already brought half a dozen types into the picture.

As shop costs, roadway maintenance, wages, traffic management, etc., would be the same cost in either form of operation, it is needless to detail them here.

An ironical characteristic of communities in the past has been an insistent demand for electric railway service provided the new tracks were laid and the new poles and wires erected anywhere except on the streets occupied by the petitioners. In the end, of course, the line had to be built somewhere amid much gnashing of teeth at the tearing up of streets and the destruction or defacement of trees, etc. What would a residential district be likely to prefer to-day if it wanted mass transport? Would it accept tamely the idea of the old-style overhead with four wires in the air instead of two, or would it naturally desire a neat vehicle using precisely the same motive power as the hundreds of private automobiles and trucks running regularly over the highway? There is not much doubt as to the answer the public would give.

Good will is so essential to a mass transport organization that it can hardly afford to incur avoidable antagonism. Where the factors of cost favored the trackless trolley it might be good policy to let the public express its preference with the understanding that whatever system was adopted must receive compensatory fares, whether on a flat or distance basis. In the case of extension through factory districts, on the other hand, this esthetic point would not arise and the trackless would have much in its favor.

As a practical operating matter it is well to point out here that it is often an open question whether the extension should be a shuttle service from the old trolley terminus or whether it should be a combination of non-stop running between city center and trolley terminus, plus local service thereafter. The adoption of gasoline buses permits trial of both plans. The adoption of trackless trolley buses permits application only of the shuttle plan, for it is not practicable yet to run trackless buses and electric cars under the same overhead structure for any considerable distance.

We now come to the preponderant factor from the money-making standpoint, that of relative earning power. Here the foot-loose gas bus is without a competitor. It is simply a question of determining whether its potentially greater earning power is exploitable enough to the point where it wipes out any greater overall expense. A few examples will suffice to illustrate this point.

One day as the writer sat in the office of the Sheffield Tramways he observed a poster on the wall advertising motor-bus runs to the Rivelin Valley to be given Sundays and holidays only. On inquiry he learned that the buses used for this service are part of the fleet which on business days is engaged in the company's trolley line extension services. For this holiday service the municipality receives a substantially higher rate of fare than for regular running. A cross-country example is the Birmingham & Midland Motor Omnibus Company, which runs scores and scores of overland routes every day in the week. But it is always possible to use a portion of the fleet to carry parties of friends from anything like a football game to a festival play at Stratford-on-Avon, the routing and stop-overs being arranged according to the convenience of the customer.

So, too, in pre-war days the buses of Berlin were largely diverted on holidays from city to woodland travel.

These are merely examples of the shifting of the bus from business to pleasure travel. The opportunities for moving them from one line to another in metropolitan service is simply infinite, as will be discovered by anyone who studies the operations of a concern like the 3000-bus London General Omnibus Company. To run, also, two, three or four times as many buses in one direction as in the other is no novelty at all.

The ability to get around obstacles, as in the case of parades, fires and other temporary obstructions, obviously is possessed only by the bus that is not tied to rails or wires. The value of flexibility in a given case where the best route was being felt out was brought home recently to the writer in connection with the abandonment of two low-traffic trolley routes. Instead of slavishly following the old routes with buses, the company has been trying out certain detours that will bring its vehicles into contact with more riders. In fact, during some hours it will make changes to attract people who would otherwise want to use their cars for the comparatively short run to the golf links. With the best will in the world, no one could have set down a trackless trolley route that would have been right and stayed right from the standpoint of maximum revenue from, and therefore maximum service to, the public.

The foregoing incident came up in a town of less than 25,000 population, where one would not expect many opportunities for diversity of use. Yet hardly had the buses been in use two or three weeks than a local fraternal club was greatly pleased to learn that it could engage one for the later hours when only part of the equipment was needed in the regular runs. The value of the bus fleet in keeping off competition is no mean

WHILE Mr. Jackson has not attempted to set forth all the factors that enter into the problem of the trackless trolley or bus, enough has been presented to make clear the point that there is no general answer to the question, that the assertions of the enthusiasts on both sides should be sifted item by item and that the less tangible but weighty factors of public good will, flexibility to meet emergencies and potential earning power must be studied as carefully as the comparative investment and running costs themselves.

factor, either. The trolley run to a nearby town is no longer the shortest or quickest way. It would be possible for a jitney operator to do much harm by running a competitive bus. He is not doing so, because the company can play the game of "freeze-out" a lot better than he.

Buses for Seasonal Work

No one will question that the gasoline bus is the only thing to use where the traffic to be carried is of seasonal or intermittent character, as to fair grounds, parks, etc. There are many situations, however, on the border line. Service to a college is a case in point. Analysis will show how many days in the year and how many hours in the day the college is in session and, therefore, in need of transportation. Then is the time to see whether the permanent or the removable service is better, all things considered.

Then, too, is the possibility of using the gasoline motor bus as a rush-hour relief, for the reason that it can give non-stop runs over a large number of streets, whereas it would be absurd to think of erecting half a dozen trackless trolleys for that class of running. Such auxiliary service might not pay in itself, but would help to speed up the main traffic arteries and keep off the cost of street widening or of building elevated trackways or subways.

Finally, as regards overland running, there seems little chance for the trackless trolley at its present stage, owing to the fact that it could not meet the high speeds possible with small-capacity, high-powered buses. This field will probably build up to thousands of installations, small in themselves but imposing in the aggregate.

The foregoing discussion has not attempted to set forth all the factors that enter into the problem of trackless trolley or bus. It is hoped, however, that enough has been presented to make clear the point that there is no general answer to the question, that the assertions of the enthusiasts on both sides should be sifted item by item and that the less tangible but weighty factors of public good will, flexibility to meet emergencies and potential earning power must be studied as carefully as the comparative investment and running costs themselves. The apparent fact that there seems to be more opportunities for gas than electricity should not interfere with the acceptance of trackless or even track trolley where the cost of electric power and the permanence of good travel are unusually good.

A New Refractory Insulating Material

ISOLANTITE is a new ceramic product developed in France during the war for which superior qualities as a spark plug insulator are claimed. It is made by a new process which is said to improve upon the good qualities of porcelain and to obviate its defects. No glazing is required to prevent the penetration of water and oil, and the material can be milled, planed, threaded and drilled, the same as metal, and with the same degree of accuracy.

Tests of the physical strength of Isolantite were made at the French Government Laboratory in Paris. These tests were made on two series of cylinders about 0.8 in. in diameter and of the same length. One of the series was fired in an oxidizing atmosphere and in consequence was yellow in color, while the second series was fired in a reducing atmosphere and was white in color. The resistance to crushing was determined at different temperatures up to 1500 deg. Cent. by special methods available at the laboratory. Of each grade of material three samples were tested, and the results averaged, and converted into English measures, are given in the following table:

Temperature, Deg. Fahr.	Breaking Strength, Lb. per Sq. In. Yellow Samples	White Samples
59	37,683	32,521
2012	9,456	7,437
2192	4,233	2,915
2372	2,702	2,076
2552	384	213
2732	0	0

The crushing at ordinary temperatures was effected in the hydraulic press. Between the ordinary temperature and 2012 deg. Fahr. it was not possible to break the cylinders, the pressure required being beyond the capacity of the press used. At 2732 deg. Fahr. the material is completely melted.

Tests for dielectric strength were made at the Central Electrical Laboratory of Paris. In this case cylinders about 3 in. long and 1¼ in. in diameter were used. There was an axial hole about ⅜ in. in diameter at one end of the cylinder, of varying depth, so as to leave a bottom of different thicknesses, according to the type of the sample. Some of the samples were glazed on the cylindrical surface and head.

Tests were made to determine the dielectric strength for different thicknesses of insulating material, both when dry and after immersion for 24 hours in water at atmospheric temperature. In making the tests, each cylinder, submerged entirely in oil, rested with its base on a metal plate which was connected with one terminal of a transformer, the other terminal of which was put in mercury at the bottom of the hole in the cylinder. Electric pressure was applied to an initial voltage of 20,000 and was then gradually raised in steps of 1000 volts.

With cylinders of 4 mm. thickness at the bottom, unglazed cylinders not submerged in water punctured at 60,000 volts, and two glazed cylinders punctured at 50,000 and 60,000 volts respectively. Cylinders having been submerged in water for 24 hours punctured at exactly the same pressures as the dry ones. On the strength of the above figures it is claimed by the manufacturers that the dielectric strength of Isolantite is 75 per cent greater than that of wet process electrical porcelain.

Income Tax Procedure

INCOME Tax procedure is a mystery to almost all persons who are not connected in some way with the legal profession, and for that reason it is advantageous to know of a reliable source from which accurate information may be obtained. Such a source is the 1922 edition of "Income Tax Procedure" by Robert H. Montgomery, C.P.A., published by the Ronald Press Co.

While dealing with the new Income Tax Law in detail this book includes Matter on the Federal Capital Stock Tax, Federal Estate Tax and a supplement to excess profits tax procedure of 1921. Two valuable features of this book which should be mentioned, are: The policy of quoting exactly from law and regulations all material of importance in the preparation of returns, and, the including in footnotes facts concerning former law and procedure, this latter serving to help in the solution of problems arising over old returns.

New Durant Product Makes Good Impression

Star car compares favorably in design with cars selling in next higher price class. Parallels Ford in prices of all body models. Has 102 in. wheelbase, pump circulation, long, semi-elliptic springs, conventional gearset, storage battery and several other features usually found in higher priced cars.

By Herbert Chase

WASHINGTON, March 9, 1922.

DURANT and his engineers, collaborating with a number of parts makers, appear to have done the thing which many have thought possible but few have seriously attempted, the production of a car of conventional type and free from certain types of construction peculiar to the Ford product, but intended to sell at a price the same as that of the Ford in all body models. This car, to be known as the Star, was shown here publicly for the first time, to-day, and proved to be the center of intense interest on the part of the public as well as many men prominent in the automotive industry.

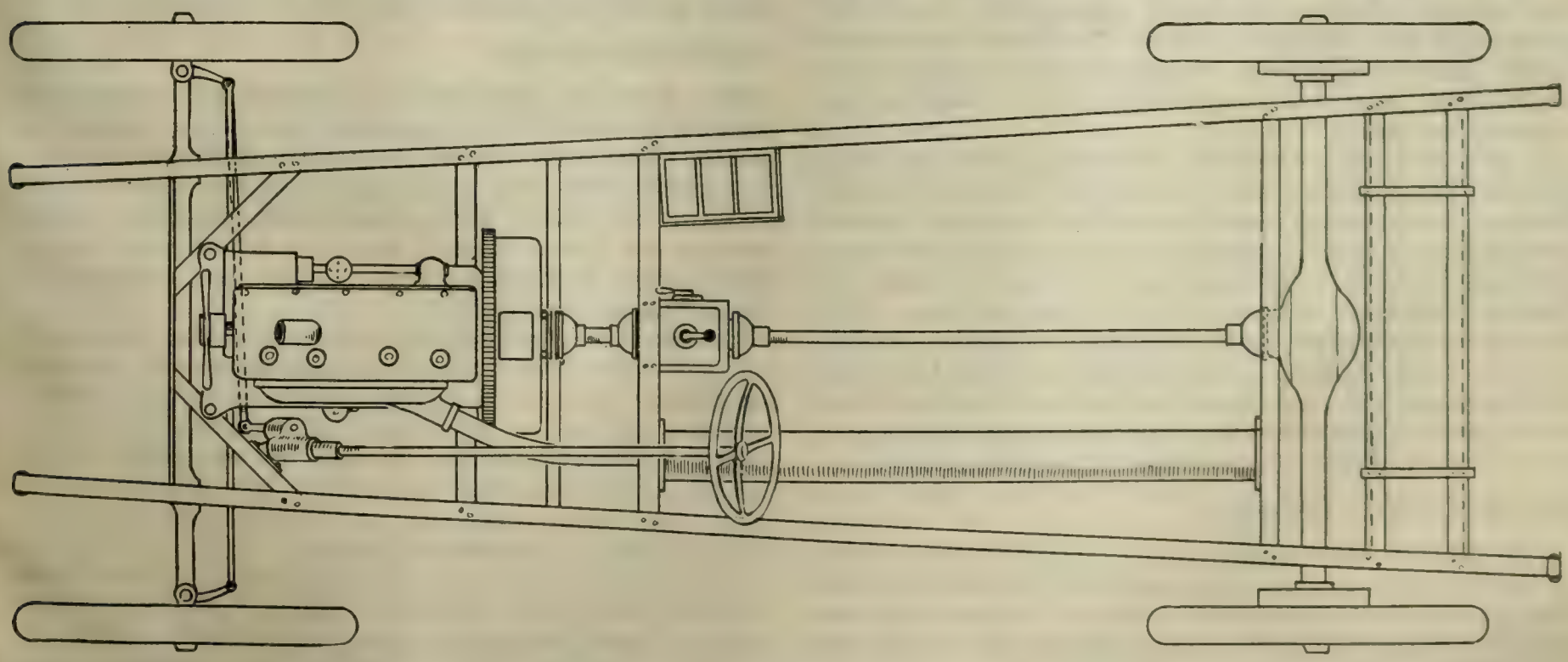
Expected to Heighten Competition

The new product compares favorably in design with that of concerns which have heretofore come close to Ford in the price of their cars but sells, when equipped with demountable rims and starters, for about $100 less than the least expensive of well-established makes, other than Ford, now on the market. Just what this will mean, especially to Ford and his nearest competitors in the price scale, remains to be seen, but if the move proves to be all that it appears to be on the surface and is carried through in respect to sales and service in a manner similar to that which has proved so successful with Ford, there seems to be little reason to doubt that it will heighten competition and prove to be a large factor in the automotive trade of the country.

The Star Company for whom Durant will make the car on contract has not yet been incorporated. Those in a position to know are emphatic in their statement that the various parts makers will not be stockholders, a statement which is borne out by representatives of parts manufacturers who came here to see the new car and learn more regarding plans for its manufacture, and sale. Sales plans are not yet worked out, but it was learned on good authority that the intention is to follow closely Ford's marketing policy. There will not, in any case, be exclusive territorial allotments, and there will, as with Ford, be as many agencies in each town as the trade warrants.

Most Units New in Design

The car is not, as some assumed, wholly an assembly of existing parts. Most of the units are quite new in design, but a few are now used in existing cars. The design is not the product of any one engineering organization. It has been worked out by Durant engineers in co-operation with the engineers of the various parts companies interested in supplying the various units. On this account the components of each unit are already standardized and in use to a certain extent, but other parts have been specially designed to meet the particular con-



Diagrammatic sketch showing approximate layout of the chassis of the new Star car. Side rails and all cross members save that under rear end of engine are straight

dition so that the units as assembled are not in most cases duplicates of units used in other cars, though they are mostly of conventional design and are so laid out as to facilitate ready production with existing tool equipment wherever possible.

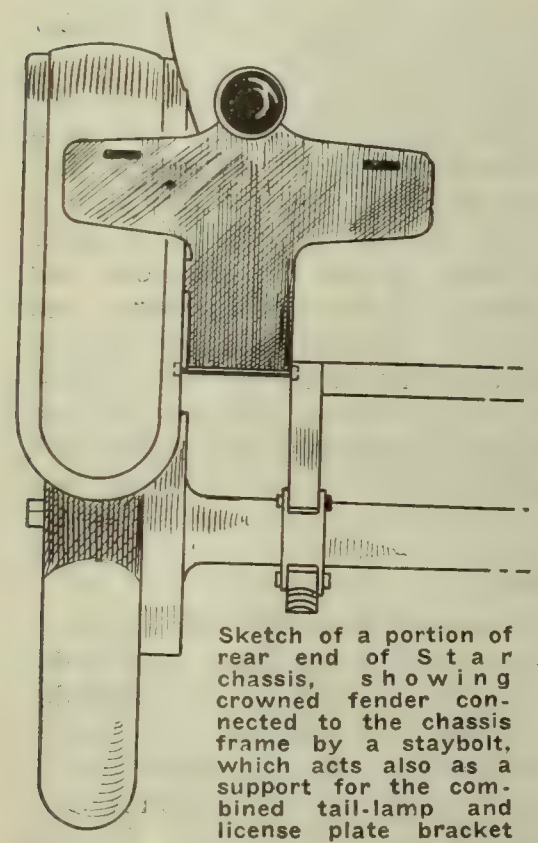
In general the design is quite similar to that of the Durant Four, being characterized by the use of a tubular frame member, which serves as a muffler, but is primarily intended to prevent twisting of the frame with consequent body weaving, and the employment of a separately mounted gearset located amidship, instead of the unit power plant used by Ford and nearly all other American car manufacturers. This construction adds certain parts, but has material advantage in the way of added accessibility, especially in respect to the clutch.

The longer wheelbase and wider frame enable the use of a body which is not unduly cramped and is reasonably comfortable, while the body lines are modern and as pleasing as those of most cars in the low-price class.

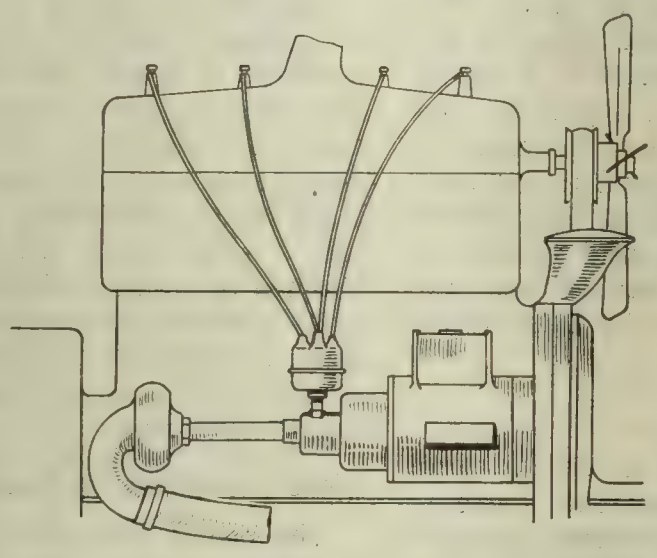
understand that each parts maker was given a certain limit in respect to price and the space available and told to offer the best he could within these limits. The result is highly commendable and one which could probably not be duplicated in any other country and perhaps not in any other industry, save the close-knit and progressive automotive industry.

Durant plans to begin production of the new car about June 1 at the rate of about 50 cars per day, this rate to be increased to 500 per day as rapidly as possible. It is expected to reach 1000 or more per day in 1923. Parts makers are tentatively working upon plans which call for units for 500 cars per day by Sept. 1, 1922. First deliveries are expected June 15.

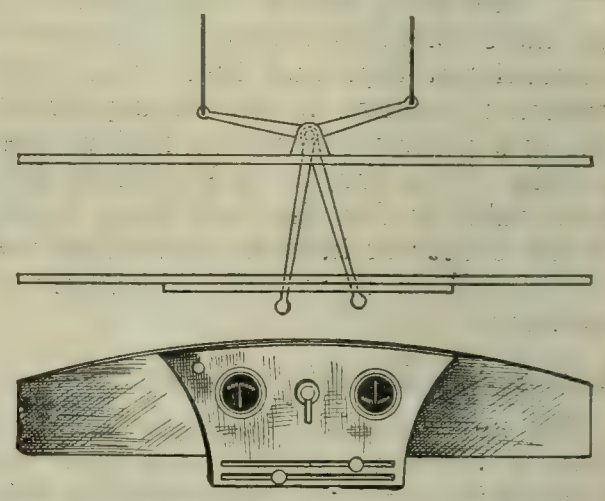
It has not yet been announced at which, if at any of the existing Durant plants the new car will be assembled, but it is probable that a portion of the Long Island City plant will be used at least temporarily for cars to be delivered in that vicinity. The prices quoted are, however,



Sketch of a portion of rear end of Star chassis, showing crowned fender connected to the chassis frame by a staybolt, which acts also as a support for the combined tail-lamp and license plate bracket



Sketch showing general arrangement of the chain-driven Auto Lite generator and ignition unit, and the water pump, which is at rear end of cylinder block



Sketch showing approximate layout of instrument board. The spark and throttle levers are bell-cranks which project through the dash and are connected by rods to timer and carbureter

The long semi-elliptic springs should also make it easier riding. The lamp equipment and arrangement appears to be as good as that on many higher priced cars, and the battery, which is furnished even when the starter is not sold also, provides current for lights whether or not the engine is running. Modern ignition and lubricating systems are also supplied and other features are quite up to date.

It will thus be seen that the design has not been skimped by confining it to the use of bare necessities. Cheaper construction could have been used in several instances, had this been considered desirable, but probably not without sacrificing some desirable quality or feature considered well worth the added expense. This does not mean that certain changes and refinements, or perhaps some simplification will not in time be made, but it does mean, if present promises are fulfilled, that the public will be offered a thoroughly modern car at a price as low as that of the cheapest car of to-day.

How Design Was Developed

The product here discussed is especially remarkable in that it was, we are told, designed and built in less than one month's time. This has, of course, been due partly to extraordinary co-operation among the various parts makers and in part to an unusual conception and execution of a plan worked out by Durant engineers. We

"plus freight from Detroit" as in the case of Ford sales.

The new car, it is understood, will not in any way interfere with the manufacture of other Durant products, which are to be continued according to schedule.

Engineering Features

The Star car presents an interesting engineering study, although it follows conventional lines in most respects. The construction is entirely different in many particulars from that employed by Ford. In a number of ways the chassis layout and many details resemble those of the four-cylinder Durant car, which might be expected since both cars were in large part designed by the same engineers.

It should be understood that, while the component parts of the car are made by various makers of standard parts, they have in nearly all instances been specially designed for use in the Star. The engine is, for example, a design laid out jointly by engineers of the Durant and Continental companies, but necessarily retains many parts similar to, or identical with those employed in other Continental engines.

The engine is of conventional L-head construction, with cylinders and crankcase cast in a single piece to which is bolted a separate head and a lower crankcase pressed from sheet metal. The engine is described as a high speed type and is said to develop a maximum of 35

hp. at 2500 r.p.m. It is of 3⅛ bore by 4¼-in. stroke, giving a piston displacement of 130.4 cu. in. as compared to the Ford with 3¾ by 4-in., with a piston displacement of 176.7 cu. in. The engine is said to weigh about 10 lb. less than that used in the Ford, but, because of its higher speed, to have considerably more power. It differs from the Ford engine in a number of other particulars, the most important of these being the use of a chain instead of gears for driving the camshaft and the combined lighting generator and ignition units, and in the use of a pump instead of thermo-syphon circulation. The pump as now arranged is located near the rear end of the engine and is driven off an extension of the generator shaft. The chain is arranged in a triangular layout and is enclosed by a cover of sheet metal.

Carbureting and Electrical Equipment

Besides the spark plug holes there are, in the head over each cylinder, holes tapped with ⅛-in. pipe thread in which priming cocks can be inserted, but the engine shown was not supplied with the cocks. The inlet and exhaust manifolds are cast with one common wall which serves as a hot spot to heat the incoming charge. The carbureter is of Tillotson make and is fed from a Stewart-Warner vacuum tank which draws fuel from the main tank located at the rear of the frame. A hot air stove with short pipe connecting with the carbureter inlet is also used.

The Auto-Lite lighting generator and ignition unit are located at the right side of the engine just back of the chain case. The cutout is placed on the side of the generator and the coil on the top of this unit, while the distributor, which comes about opposite the center of the engine, is on a short, vertical shaft. With this location, short high tension wires to the plugs can be used. A combined oil filler and breather pipe is mounted on the chain case, just above the lighting generator.

The car shown had no starting motor, but the flywheel is toothed to mesh with the conventional pinion with Bendix drive when the electric starter is furnished as an extra.

The oiling system employed is a combination pressure and splash type, the oil being fed under pressure through the hollow camshaft from which it flows, still under pressure, to the main bearings. The connecting rod bearings and pistons are arranged for splash lubrication.

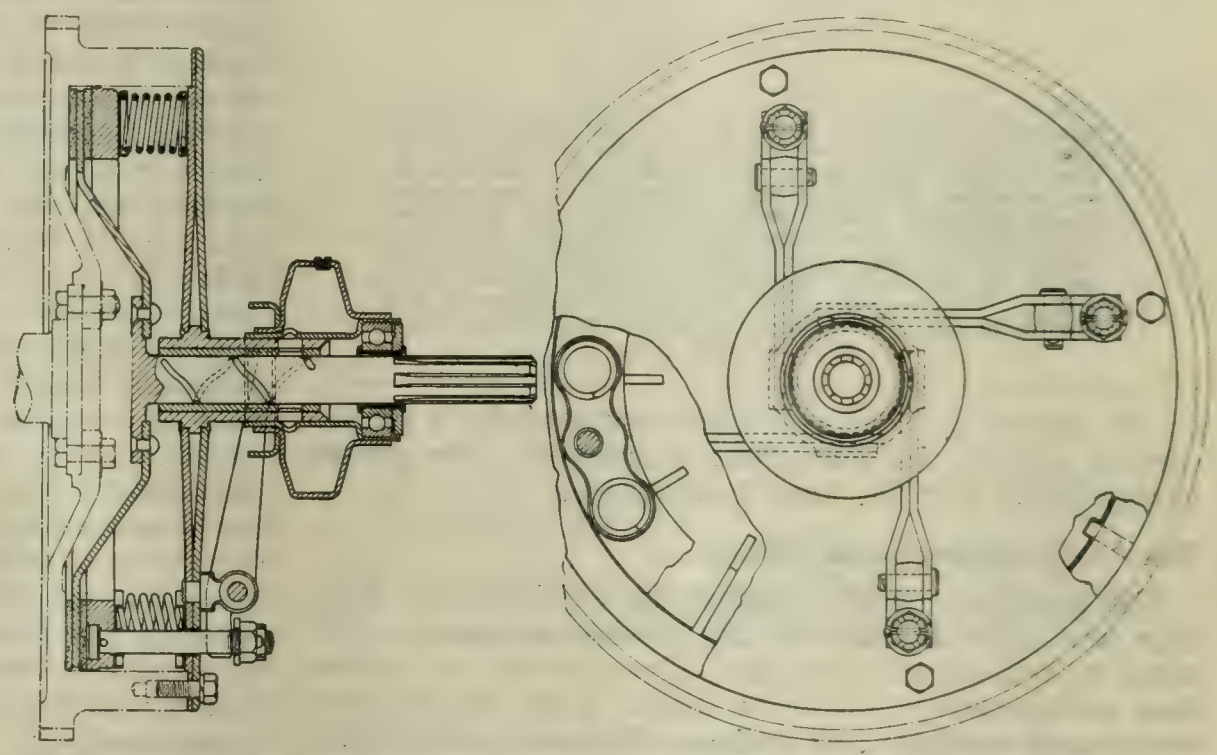
The fan is mounted on a fitting attached to the front end of the cylinder casting and is driven direct by belt from a pulley on the crankshaft. The fan is adjustable vertically to provide for taking up a slack belt.

The combined inlet and exhaust manifolds are located on the left side of the engine. The latter has a four-point suspension, the rear end resting on a channel-section cross member, which is bent downward at the center to pass under the crankcase, and the forward end on the diagonal channels which run from the main side member of the frame to the front cross member.

Clutch and Gearset

The clutch is of the single plate type and is practically identical in general design to that used in the Durant four-cylinder car. The spindle of the light driven member is carried in a sleeve supported from a flange bolted to the rim of the flywheel. This flange, together with the flywheel, completely encloses the clutch, and to the flange are pivoted the disengaging levers which move the pressure ring against the action of the springs which bear directly upon it. Two molded rings of asbestos composition form the clutch facings which float on each side of the driven member. The facings are thus pressed between the face of the flywheel and the thrust ring. The driven plate is thin and is slotted radially at a number of points to prevent heat distortion.

The annular type throwout bearing is enclosed in a pressed metal case filled with oil. This oil serves to lubricate the clutch spindle as well as the throwout bearing.

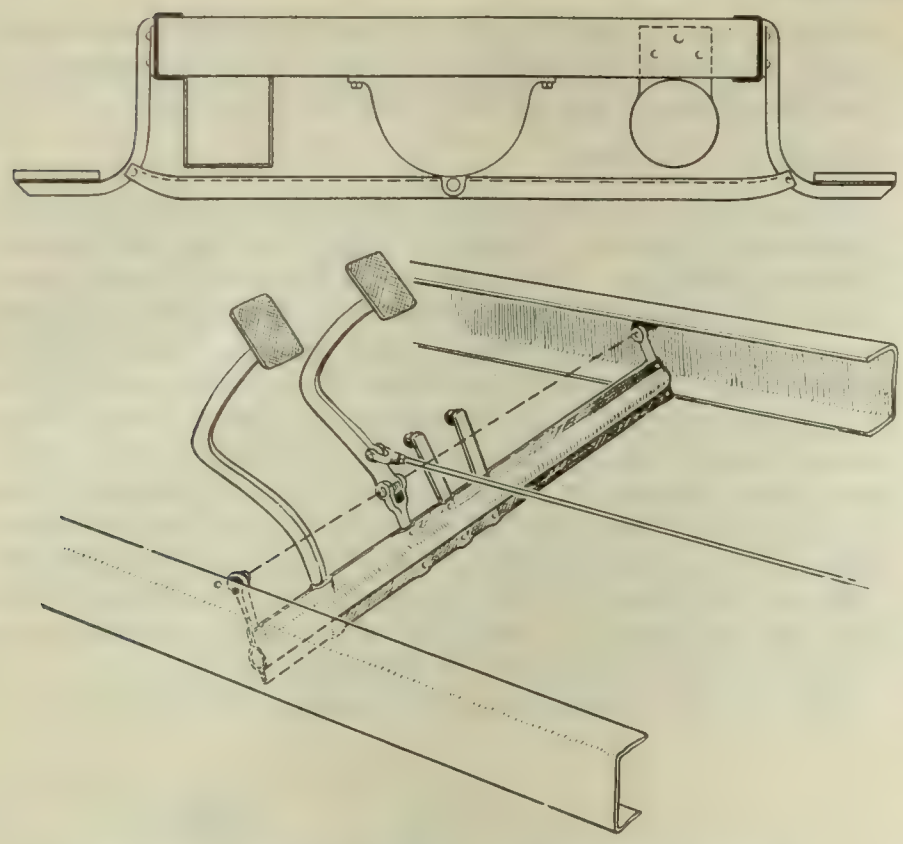


Clutch used on the Durant Four. The clutch employed on the Star is substantially a duplicate except as to a possible variation in number of springs employed

The clutch is operated by a pedal attached to a tubular member which, as shown in one of the accompanying cuts,* runs across the frame under the clutch spindle. This tubular member is carried at each end in trunnions which enable it to swing through a short arc, as the clutch pedal is depressed. A yoke at the center of the tubular member engages the throwout flange of the clutch. The tubular member also serves to carry the pivot for the brake pedal, the axis of this pivot being in line with the axes of the trunnions, which carry the tubular member. For this reason the action of the foot brake is entirely independent of the clutch, although both pedals are supported by the same member.

It has not yet been announced who will manufacture the gearset and the clutch, but the former is to be of conventional type with three forward speeds and reverse. The shaft and gears employed will be similar to those used in other light cars, such as the Chevrolet "490," but the case will be made to conform to the separate mounting on cross members, as shown in the accompanying sketch. The case is bolted to the lower flange of a straight channel cross member, and rests below on an angle iron attached to the running board supports, which are in turn attached to the outside of the main

*We are told that no complete drawings of the Star car have yet been made, and that because of the speed at which the car has been assembled, certain details will be changed, for which reason detailed photographs cannot yet be furnished. On this account and because of the crowd around the car the time it was placed on exhibition the drawing here reproduced had to be worked up from rough sketches made on the spot. The drawings are in part diagrammatic and not intended to show details of construction so much as to give a better picture of the type of construction employed than would otherwise be possible.



Sketches showing, above, an approximate sectional view of the chassis just forward of the separate amidship gearset which is bolted to a channel above and an angle below, the latter being attached to the running board hangers. Location of the battery and combined muffler and frame member is also indicated. The lower view shows diagrammatically the tubular member which is carried in trunnions attached to the main frame. This member is made from two stampings and serves to carry the brake pedal and the clutch pedal and throwout yoke

frame channels. The gearset is operated by a central control arm in the conventional manner. The gearset cover carries also the hand brake lever.

Rear Axle, Springs and Frame

The rear axle is of conventional semi-floating banjo type and is to be built by the Timken company. It is fitted with a spiral bevel gear, giving a 4⅞ to 1 reduction and carries 10-in. brake drums with internal hand brakes and external foot brakes. The wheels and differential are carried on Timken bearings. A rear cover plate permits ready access to the differential, which can be removed through the rear opening.

The rear springs are of semi-elliptic type and are of unusual length for a light inexpensive car. They have six leaves, 1¾ in. wide and measure 48 in. in length. They are underslung from the axle to which they are held by U-shaped spring bolts. The springs are located directly under the frame and are pivotted at their front ends on pins carried between triangular plates riveted to the frame. The rear ends of the springs are carried by long shackles pivoted on the rear horns of the frame. These shackles are stamped from heavy sheet metal formed into an H-section, the central portion acting to hold the side link members parallel. This shackle is similar to that used on Durant cars, except that it is somewhat longer.

The front axle is a Timken product of the usual I-beam construction and has Timken bearings for the wheels. It supports semi-elliptic springs, which measure 1¾ by 34 in. The tie rod is in back of the axle and is just below the drag link, which is connected transversely from the right steering knuckle to the steering arm on the left side of the car.

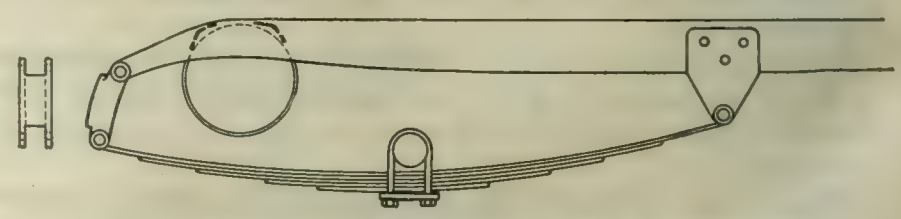
Wheels are of wood and carry 30 x 3½-in. tires all around.

In general construction the frame is very similar to that employed in the other Durant cars. It is characterized by the use of a long tubular member, which is rigidly connected to the cross member in front of the gearset and to the main rear cross-member, which is almost over the axle. This gives the frame unusual rigidity against twisting strains for the tube is of a large diameter and is formed of steel about 3/32 in. thick. It serves also as a muffler. The side members of the frame are made of channel 4 in. deep by 1½-in. flange and are straight, except for the horns formed at the front and rear ends. No kick-up is provided at the rear. All other members of the frame are also straight with the exception of that which supports the rear end of the engine. The fuel tank, which is cylindrical, is carried between the two rearmost cross members. The latter are angle stampings formed approximately to fit the contour of the fuel tank, which is hung from straps which pass over these members.

Narrow diagonal channels are rivetted to the front and side members at the front end of the frame. They not only support the front end of the engine, but that at the left supports also the housing of the steering gear. The latter is of the worm and wheel type with the shaft of the wheel inclined with its lower ends slightly further forward than the upper end. To the lower end of the wheel shaft is attached an arm, which in turn carries the left end of the transverse drag link. The steering wheel is similar to that in general use, but carries only the horn button at its center. The spark and throttle control levers are bell-cranks pivotted on a bracket in front of the dash. The long arms of these cranks project through the dash and terminate in knobs which slide in slots formed at the under edge of the instrument board. The latter is of sheet metal and carries in a central panel an oil gage, ignition and lighting switch and an ammeter, as well as the handle for the carbureter choke. The throttle is inter-connected with an accelerator.

The fenders have a slight crown and are well supported at the front by a tie-rod, which carries the headlamps. The latter are adjustable for tilting. The rear fenders are attached to the frame by short stay bolts, one of which carries a combination license plate and tail lamp bracket.

The rims regularly furnished are not detachable, but five detachable rims and starter are provided at an extra charge, which includes also a carrier for the extra rim, the latter being attached to the rear of the chassis.



Diagrammatic view of rear end of chassis frame showing long underslung semi-elliptic spring arranged for Hotchkiss drive, H-shaped shackle, and cylindrical gasoline tank mounted between two angle members from which it is supported by straps

The wheelbase of the chassis is 102 in. The chassis is arranged to carry the various types of passenger or a light commercial body. It is not expected that an extended chassis, with heavier rear axle for commercial use, will be furnished, as is the practice with Ford.

The equipment of the car includes a U. S. L. battery which, of course, is arranged to provide lights when the engine is not in operation. The battery furnished, when no starting motor is supplied, may be somewhat smaller than that furnished for use in cars equipped with a starter, although this point is not yet definitely decided.

It is claimed that the car is capable of traveling 30 to 35 miles per gal. of fuel. It is said to weigh 1800 lb.

Sperry Compound Diesel Engine

Uses two stage compression of the air and solid injection of the fuel. The transfer valve between the high and low pressure cylinders and the air inlet valve to the high pressure cylinder are mounted concentrically to insure cooling of the former. An increase in fuel economy is claimed.

SOME information regarding the development work on Diesel engines done by Elmer A. Sperry has been given in former issues of AUTOMOTIVE INDUSTRIES, as Mr. Sperry has been pursuing this line of work for the past twelve years and has on several occasions spoken of it in discussions before the S. A. E. The engine has now reached a production stage, and further particulars have been furnished in recent papers before the American Society of Mechanical Engineers and the S.A.E. Motor Boat meeting, on which papers the following article is based.

Diesel himself worked out a compound type of engine working on his cycle, but it proved a failure. Two or three isolated attempts to compound the Diesel engine were made later on by others in both Germany and England, but these too petered out. Sperry took out a patent on a compound engine as long ago as Dec. 10, 1892. Of late the development work has been carried on energetically, one experimental model having followed another, until the essential problems are believed to have been fully solved.

Sperry's contention is that the simple engine of the Diesel type must necessarily be excessively heavy, because the cylinders, pistons and connecting rods have to be built sufficiently strong to withstand the enormous initial pressures of the power stroke, but because these pressures are maintained only for a very small fraction of the stroke, the parts of great weight and strength are poorly utilized. By allowing the expansion to occur in two successive stages, the high pressure cylinder, which must be very strong, can be made quite small, so that its weight will not be very great, and the low pressure cylinder and its accompanying parts, which must be large, can be made relatively light.

Indicator Cards

Consider the Diesel indicator card Fig. 1. Draw the vertical line *XY*, and it is easy to see that the expansion pressures to the left are high, whereas those to the right, especially following the dotted extension line of expansion, are low, and could advantageously do their work in a low pressure cylinder. The vertical line *XY* also divides the compression into two stages, low and high, the latter taking place in the combustion cylinder proper as a second stage. No air compressor for pressures of 500 lb. per sq. in. accomplishes its work in a single stage; there are at least two stages. The old single stage compressor has been discarded and replaced by the modern two stage compressor.

Supercharging or compressing in two stages also has the advantage that the temperature range of each compression chamber is greatly reduced. In the simple Diesel, as the compression ratio is in the neighborhood of 15:1, the compression space approximates a very flat cylinder which has a very large surface area in proportion to its volume. By referring to the sectional view of the engine and taking account of the fact that the upper end of the piston stroke substantially coincides with the plane of the joint between the cylinder block and the head casting, it will be seen that the compression space in the Sperry engine is hemispherical in the main, but also includes a passage to the inlet and transfer valve at one side. From the standpoint of ratio of surface area to volume this compression space is certainly a good deal better than that of the standard Diesel engine.

No Air Compressor for Fuel Injection

One of the difficulties with the standard Diesel, which is especially bothersome when it is attempted to build engines of this type in small units, is the need for an air compressor for compressing the air used for injecting the fuel. Pressures of nearly 1000 lb. per sq. in. are used, and the compression is usually effected in three or four stages. This compressor not only adds greatly to the weight and complication of the engine, but also materially reduces its mechanical efficiency. Vickers in England has dispensed with compressed air injection and uses instead what is known as solid injection, the fuel being forced into the compression space in a solid stream by piston pressure. It is claimed by the champions of air injection that much cleaner combustion is obtained where that method is used, but the fact that Vickers engines are installed in many motor ships shows that the solid injection principle is practical at least.

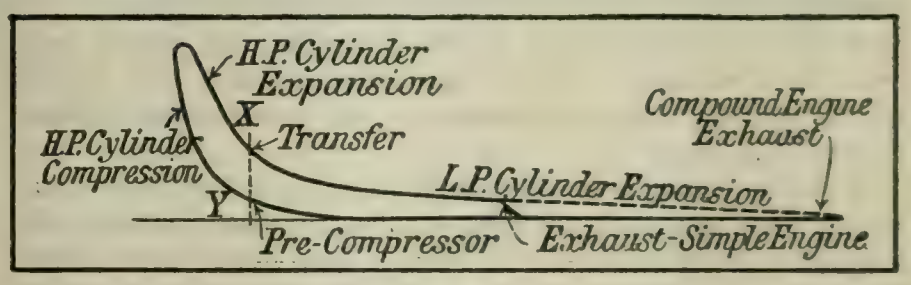
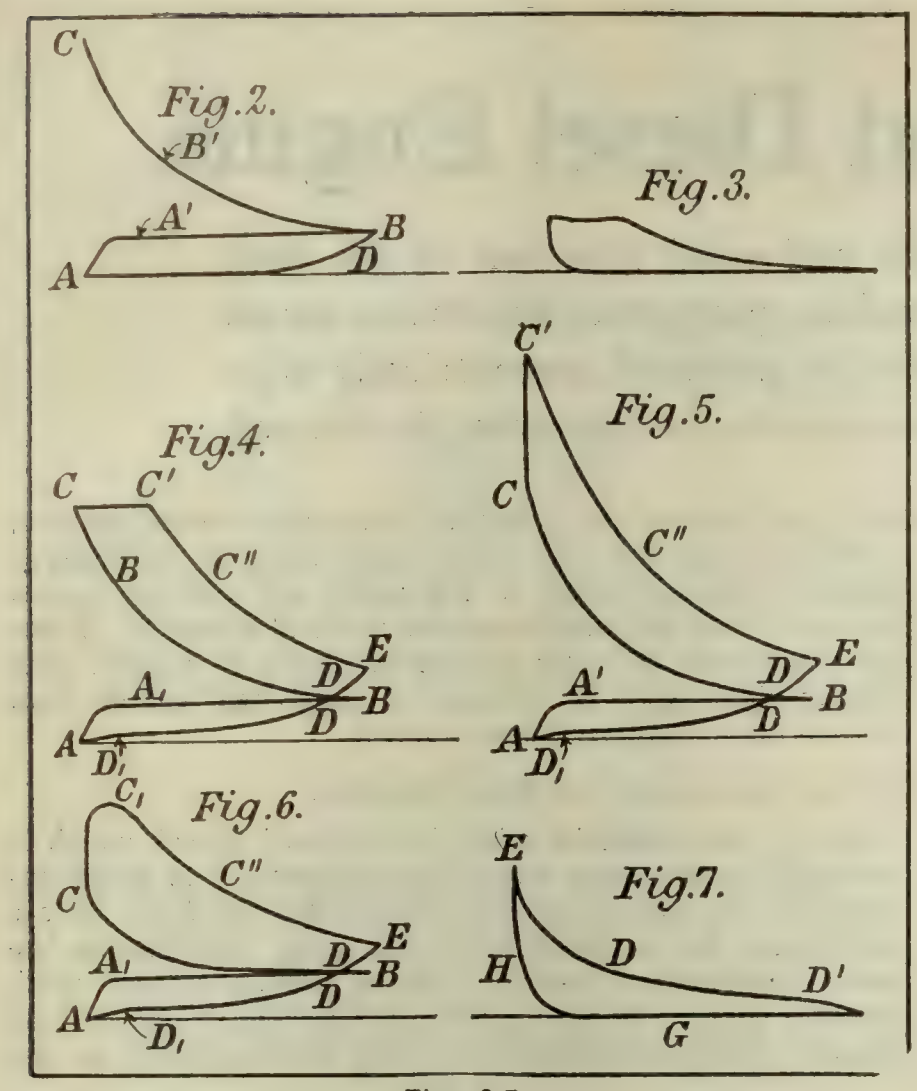


Fig. 1

Sperry uses the solid injection principle, and claims that, since the compression space is not shallow as in the simple Diesel engine, the injected fuel has to pass through a bulky mass of highly heated air before it can strike a wall, so that the difficulty resulting from the fuel stream coming in contact with relatively cool walls, which has been experienced with simple Diesel engines using solid injection, is eliminated in his engine.

Six-to-One Ratio of Piston Areas

In his A. S. M. E. paper Sperry says that instead of expansion ratios of 3 or 4 to 1, as in the automobile engine, and about 12 to 1 in the Diesel, the expansion ratio in his engine can be made as high as 120 to 1. In an automobile engine the pressure in the working cylinder at the moment the exhaust valve opens, if the engine is operating under full load, is between 50 and 70 lb. per sq. in., and in a simple Diesel engine it is about the same. A gain in power and efficiency evidently would be reached if the charge were further expanded to such a pressure



Figs. 2-7

that the excess pressure of the gases on the piston head over the pressure of the atmosphere against the bottom of the piston were just equal to the mechanical friction of the engine.

A weak point in all compound engines is the dead space in the low pressure cylinder or the passage between the high and low pressure cylinders. This dead space allows the gases coming from the high pressure cylinder to expand before they do any work on the low pressure piston, and, therefore, constitutes a source of loss. Sperry shapes the compression space of his high pressure cylinder so that it extends partly over the low pressure cylinder and is cut off from the low pressure cylinder by the transfer valve, which makes for a small dead space. He has, moreover, hit upon another means of practically eliminating clearance losses.

The Compound Cycle

Fig. 2 shows the cycle card without fuel, taken from a high pressure cylinder of a 10 to 1 compound engine, that is, an engine with a low pressure piston having 10 times the area of the high pressure piston head. The air, after having been pre-compressed, enters the cylinder at *A* on the outstroke of the piston, at a pressure of about 113 lb. per sq. in., giving a pressure line *A'*. At point *B* the inlet valve closes, and during the instroke the compression proper starts and rises along *B'* to Diesel values at point *C*. There being no fuel injection, the receding stroke brings the pressure down on practically the same line *B'* to point *B*. Here the transfer valve opens, and the gases pass during the instroke to the low pressure cylinder as shown by line *D*. This is the outstroke of the low pressure piston, the pressure dropping to a trifle below atmosphere before the exhaust valve opens. The valve remains open during the whole of the next stroke of the low pressure piston. This cannot be shown on the high pressure card, but is brought out on the low pressure card Fig. 7.

Fig. 3 is the air pump card, representing the first stage of the compression, which delivers the air to a small receiver, from which it passes during the inlet stroke along line *A'* of Fig. 2. This is virtually a power stroke, and thus some of the power lost in the first stage compression is recovered here.

Fig. 4 is the same as Fig. 2, except that fuel has been injected, and shows the slow combustion of the regular Diesel cycle, common to all early cards of these compound engines, where from point *C* a perfectly level line is often drawn to point *C'*, which marks the point of cut-off. The gases then expand on line *C''* to point *E*, where the transfer valve opens and the gases continue their work of expansion on the low pressure piston, as indicated by line *D*. When the exhaust valve opens, at point *D*, the pressure within the low pressure cylinder is only slightly above atmosphere. An objection to the simple Diesel engine is that heat is added to the charge after the piston has moved away from the top dead center position and is approaching the point of exhaust opening.

Operates as Constant Volume Engine

Mr. Sperry states that a research extending over a year and a half led to the discovery of a method by which detonation can be invariably secured. He does not say what this method consists in, but it is obvious that if the fuel were injected during the compression stroke before the temperature of the air became sufficiently high to ignite it immediately upon its entry, then detonation would result as soon as the air temperature reached the ignition value. In an English report on researches on Diesel engines carried out during the war, the statement is made that detonation was encountered which at times was rather distressing, and that it was very desirable to eliminate this detonation, but that it could not be done without at the same time lowering the fuel efficiency. Sperry, however, claims to have found that the thermodynamic efficiency is higher in the case of high detonation diagrams than in most of ordinary ones, and he has therefore sought to "harness and utilize" to the full the detonation phenomena which are such a bugbear to the automotive engineer.

Fig. 5 is a typical card taken under the same conditions and from the same engine as Figs. 2 and 4, exhibiting "detonation." When operating in this way the engine also gives a very much truer Carnot-cycle card. All recent running of the compound engines has been in accordance with this card. One of the achievements of high-intensity

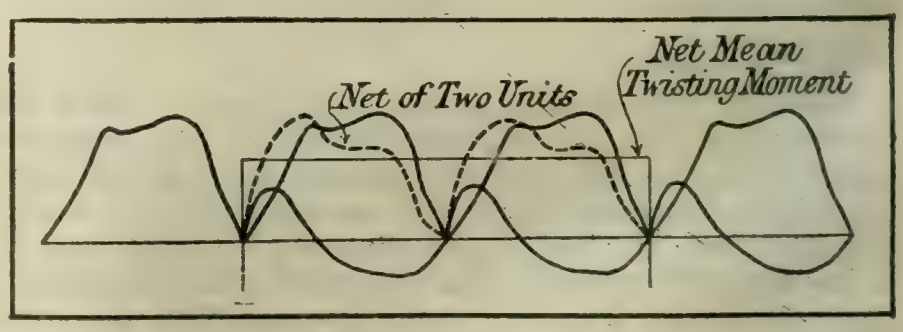
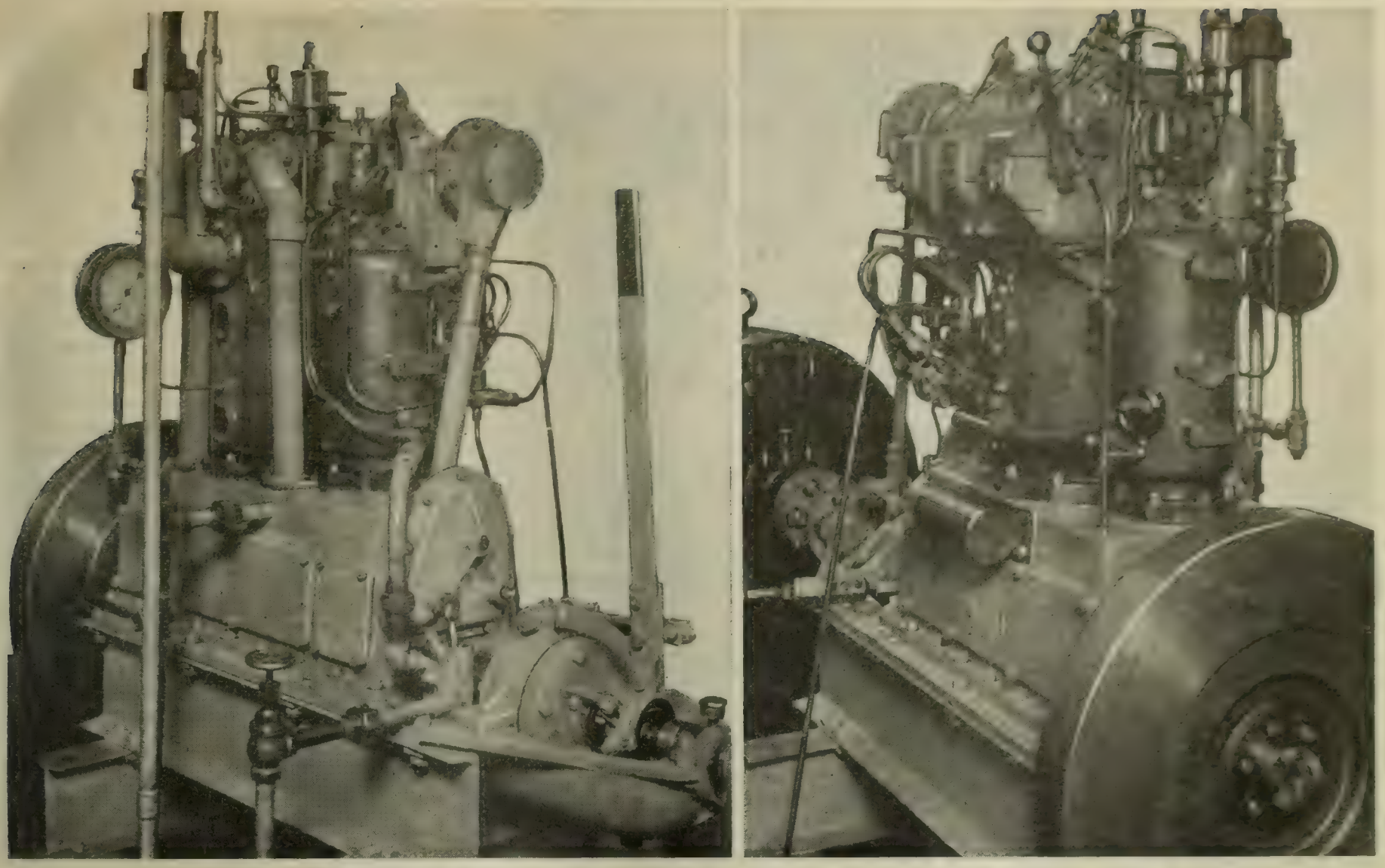


Fig. 8

combustion is better thermal efficiency and a still further reduction in the exhaust temperatures. The engine with this type of card is changed from a constant pressure to a constant volume cycle engine, which change is claimed to free it from all speed limitations. The detonation characteristics, *e.g.*, the vertical rise on the diagram, persist even at very high speeds. This card also insures operation at lower fractional powers without indication of carbon deposits. Fig. 6 is given as showing the range of control of the peak and shape of the card at will under the same operating conditions and with the same spray nozzle. Referring to Figs. 5 and 6, the peak pressures given by these cards may seem high, but they are said to



Two views of Sperry compound Diesel engine for marine use

be not as high as the pressure often encountered in the cylinders of gasoline engines, and the factors of safety provided easily take care of the stresses caused by these pressures.

Avoiding Transfer Losses

A complete solution of the problem of avoiding losses due to the low pressure cylinder clearance is said to have been found in a modification of the process of cushioning —closing the exhaust valve at a pre-determined point before the outstroke end, trapping a little of the hot gases and cushioning them up to the transfer pressure so the transfer valve opens under conditions of equal pressure on each side. There is, therefore, no flow of gases except that due to the slow starting of the strokes of the two pistons. There are practically no losses sustained in cushioning; the power of compression is returned very completely on expansion. Cushioning is credited with the additional advantages of preventing all erosion due to high velocities of the hot gases over the transfer valve seats. These seats are jacketed and are said to remain smooth, bright and perfectly sealed over long periods.

Compounding is said to completely suppress all pre-ignition, because the first part of the compression occurs outside the combustion chamber and the work of the Bureau of Standards has shown that the pre-ignition must occur early in the compression stroke in order to cause really dangerous pressures. No safety valves or pressure relief valves are therefore required or fitted.

The Transfer Valve

The transfer valve, considered as an exhaust valve, is here called upon to handle much hotter gases than ever before. A difficult situation is therefore presented. Are special materials necessary and how can the valve successfully perform this duty? It is known that the exhaust valves of the Liberty motor run red hot, and the stems white hot, and yet they are handling gases of lower temperature than are here present. Mercury cooled valves were originally provided and have now stood on the shelf unused for some years, as neither of these expedients is found necessary, nor are any but ordinary materials required. It must be remembered that compression in the compound engine is by the two-stage method. Air is admitted to the combustion chamber under comparatively high pressure, and although it is warm, yet with each doubling in pressure its cooling powers are doubled. Air at 100 lb. per sq. in. thus has seven times the cooling power of atmospheric air, as seven times the number of molecules come in contact with the valve for cooling in a given time. The part through which the air enters the high pressure cylinder is in line with the transfer port, and the induction valve itself rides on the back of the transfer valve in the form of a hollow sleeve *I* (Fig. 9) seated directly on the top of the transfer valve *T*. The back of the transfer valve is provided with greatly enlarged radiating and cooling surfaces presented to this cooling air, and powerful convection currents are constantly acting when sealed.

Now in following out the cycle it will be noticed that this is the very step that follows directly on the heels of the transfer of the hot gases (*D*, Fig. 2) and continues throughout the next quarter cycle (see *A'*, Fig. 2), and through the entire descent of the high compression piston. The transfer valve is intensely heated on its under side during the transfer stroke, but it is also intensely cooled on its upper side, which has a surface area five times as great, and the result is said to be that the mean temperature of the valve is only about half as high as that of the Liberty engine exhaust valve, not nearly approaching red heat. The seats of these valves are said to give no trouble, because they are backed by ample water jackets. They need to be ground in only very rarely.

As to the proper ratio for compounds, engines of 10:1

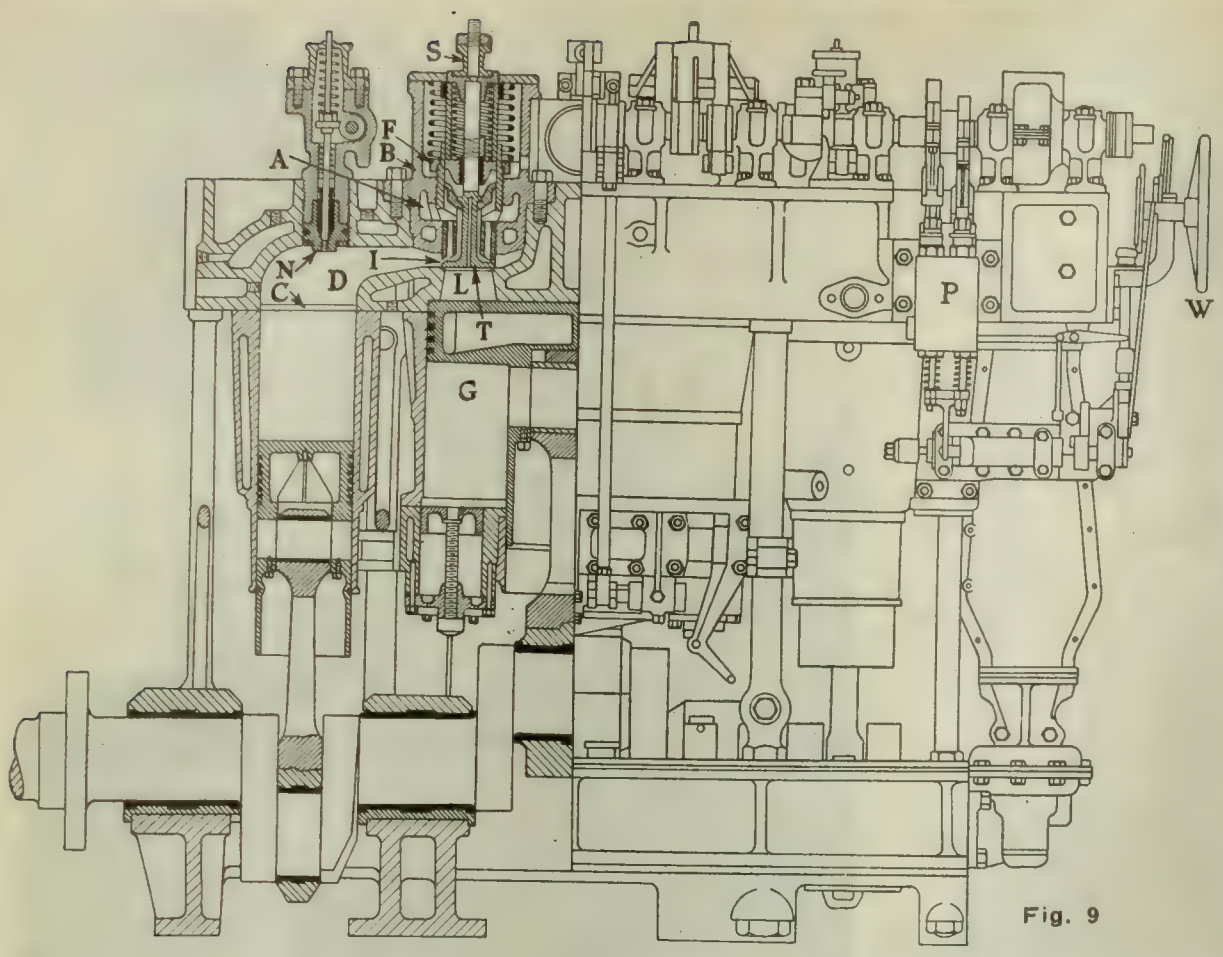


Fig. 9

ratio of low-pressure to high-pressure cylinder areas, also 8:1 and 6:1 have been made, operated and studied, the smaller ratios being at present considered more desirable. The weight factor does not change materially with changes in ratio in this region. The low-pressure piston operates two-cycle. The power distribution and the weight of the reciprocating parts both equalize best at about 6:1. This makes a perfectly balanced unit, the end masses equalling and also moving oppositely to the central. The two full power impulses following each fuel injection are also about equal. Thus full four-cylinder performance is secured with only three cranks, and two extra power impulses are delivered on the induction stroke (see line *A'*, Fig. 2) making six power impulses for each cycle.

Now as to the construction of the compound, Fig. 9 shows an elevation (to the right of the center) and longitudinal section (to the left) of the engine as built. The two high-pressure or combustion pistons on their out-stroke are at the ends, and in the center is the low-pressure at its extreme in-stroke. The sturdy construction is indicated by the size of the crankshaft, approaching the bore of the combustion cylinders themselves. The fuel pumps *P* and the control and manipulating wheel *W* are shown in elevation to the right. To the left the large clearance dome *D*, forming the combustion chamber of the compound, stands out in marked contrast to standard Diesel practice, which is shown by the little space *C* between the solid horizontal line just above. The dome is large and forms an upward extension of the combustion cylinder, extending also to the right in a large sweep surrounding the transfer valve *T* which seals the transfer port *L*. The sleeve-like induction valve *I* is shown seated on top of the transfer valve and is controlled by the cam-operated fork *F*. The transfer valve and sleeve are lifted by a fork not shown, located in thimble *S* near the top of the stem. The first stage annular compression pump *G* surrounding the trunk piston below the low-pressure piston proper delivers its air to a small receiver, which in turn discharges to the cored port *A* surrounding the induction sleeve *I*, the cooling action of which has been described. The little balancing cylinder *B* sustains a permanent connection with the low-pressure cylinder. The solid-fuel injection valve and nozzle *N* are placed approximately over the center of gravity of the large masses of air in the clearance dome *D*.

It is understood that the two high-pressure cylinders are operating four-cycle, one 360 deg. back of the other, discharging alternately into the low-pressure, which therefore works two-cycle and delivers power on each down stroke.

The Soldier Bonus

THE following statement has been issued by Joseph H. Defrees, president of the Chamber of Commerce of the United States, with reference to the proposed certificate plan for paying the soldier bonus:

"A general bonus paid through certificates is just as objectionable, from the point of view of the Chamber of Commerce of the United States, as such a bonus paid in cash. The organizations participating in the national chamber's referendum, which closed on Feb. 21, were as unmistakable in their opposition to a certificate plan as to a cash plan. They cast 1221 votes against a general bonus in either form and only 467 votes in favor.

"The chamber's opposition is to a general bonus, however paid. The chamber has not opposed a bonus merely on account of the amount of money that is involved. Attention has been called to the money requirements because of their importance and the financial problems and consequences they entail.

"Some features of the certificate plan now under consideration by the House Committee on Ways and Means are even more objectionable than the original bonus bill. It is proposed that certificates should be used as collateral for loans at banks and such loans should be rediscounted at the Federal Reserve Banks. Such a purpose means return to war conditions under which the reserve banks held large amounts of loans secured by Government war obligations. One of the problems of readjustment has been to get this paper out of the reserve banks and other paper of similar kind out of other banks. Great progress has been made, but this progress will be undone by the new proposal.

"Loans of this character have no place in the commercial banking system. They found their entry only in a war emergency. No loans should go into the Federal reserve system except such as are speedily and surely self-liquidating. Violation of this principle means inevitable inflation and other evils which are sure to follow violation of sound banking principles.

"It may be expected that evil results of such a plan as has been proposed will be increased as details are announced—such details as the terms of the loans and the rate of rediscount."

A New Friction Clutch of Radical Design Developed in France

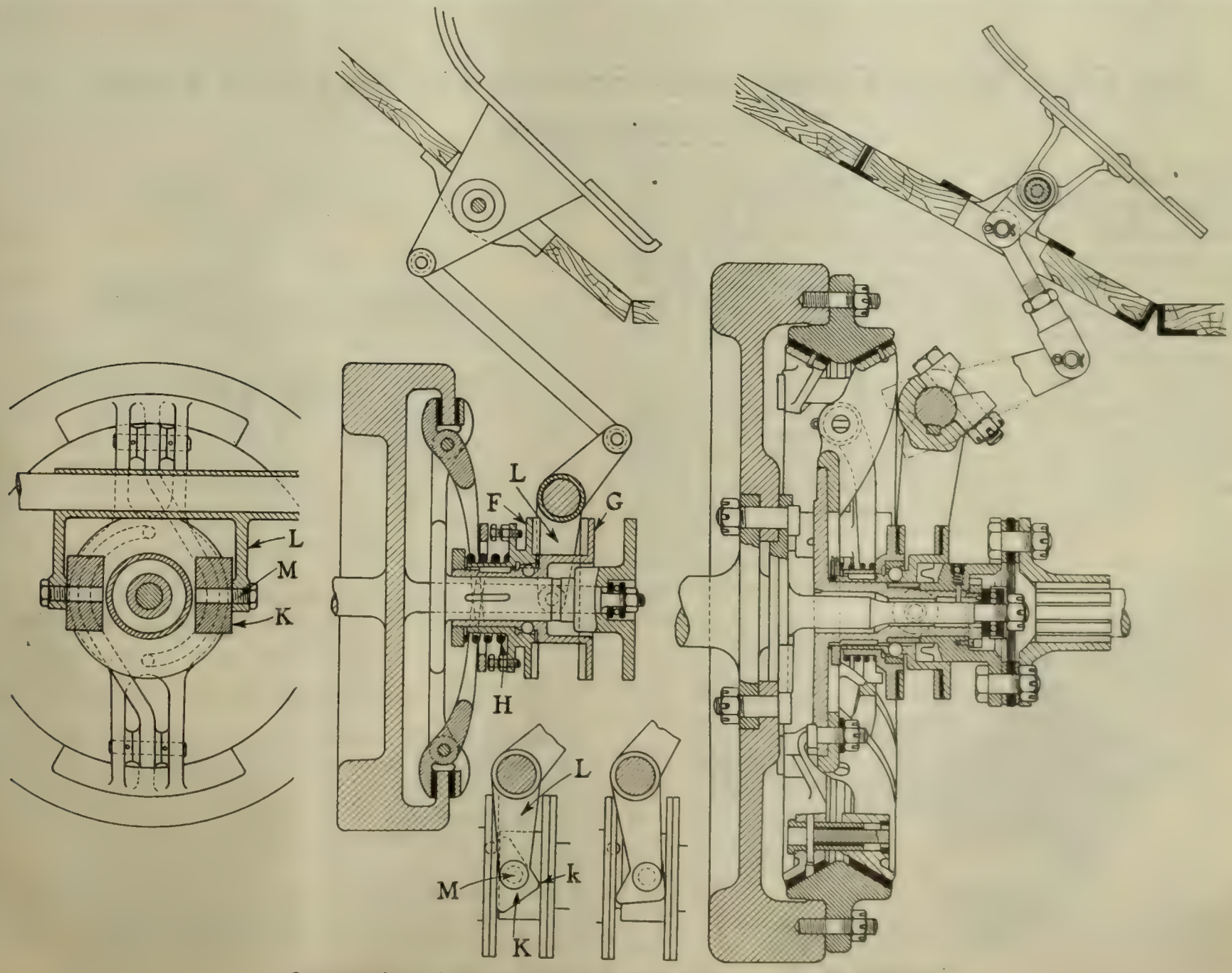
Contrary in action to the ordinary type in that the clutch is engaged by increasing foot pressure. The advantages claimed for it are: smoothness of action, absence of any drag, and ease of adjustment and gear shifting.

A NEW friction clutch for which remarkable softness of action is claimed has been brought from France by the Framerican Industrial Development Corp. It is known as the Baudoux clutch and the exclusive manufacturing rights have been acquired by Schneider & Cie., the well known munitions makers, who also manufacture gasoline omnibuses, mine locomotives, canal boat tractors, etc.

In the ordinary friction clutch as now used on automobiles and motor trucks, the clutch is forced into engagement by a spring. When the clutch is out, the driver compresses this spring by pressing on the clutch pedal, and when he wants the clutch to take hold he reduces his pressure on the pedal. It is much more difficult to gradually reduce the pressure of the foot acting against a strong spring, than it would be to gradually increase the pedal pressure, and it is little wonder that, especially in the case of unskilled drivers, the clutch often takes hold by jerks or has what is called a fierce action. Soft clutches are particularly desirable in such vehicles as motor omnibuses, which start and stop continually and which, on account of their great weight, are naturally hard to accelerate.

In the Baudoux clutch, the force that engages the clutch is not that of a spring, but the direct pressure of the driver's foot on the clutch pedal. The operating action is very much like that of a brake, the degree of application of which can always be plainly felt. The clutch is being made in two forms, one a sector clutch suitable for very light vehicles, and the other a double cone clutch, which can be made in very large sizes if desired.

Referring to the illustrations of the sector type herewith, the flywheel rim is made with an inward flange which serves as one of the friction members. On the clutch pilot shaft



Cross sections of Baudoux clutch as built for light and heavy vehicles

is carried the hub of the driven member. This driven member is in the form of pincers gripping the driving flange on the flywheel. One arm of the pincers is stationary, while the other arm is pivoted on the stationary arm. The outer ends of the pincer arms form the clutch sectors which engage the flange on the flywheel rim.

The pressure of the operator's foot is transmitted to the free arms of the pincers by means of the clutch collar. It is the motion of the clutch collar toward the engine that produces engagement of the clutch. The clutch collar is positively locked in its successive positions by a locking mechanism.

The automatic locking mechanism comprises essentially two flanged sliding collars, F and G, sliding one upon the other in such manner that the distance between the two flanges is increased or decreased. The collar G, which slides directly upon the hub of the driven clutch member, is provided with a series of recesses on its circumference, in which are located steel balls. The other collar, F, has a conical counter bore bearing on the balls, by reason of the pressure exerted by the light spring H. This spring is lodged between flanges on both of the collars. Owing to the wedging action of the conical surface on the steel balls, pressing them against the hub of the clutch driven member, the sliding collars cannot recede to the right. The two sliding collars and the hub of the driven member are provided with splines, and may therefore slide longitudinally one upon the other without angular motion.

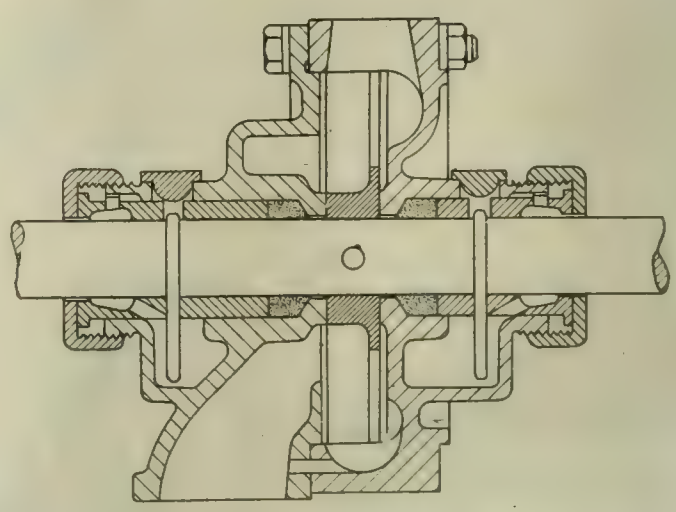
When the clutch is to be disengaged it is, of course, necessary to relieve the wedging acting on the steel balls. The release is effected by pressing simultaneously to the left on the left flange F and to the right on the right flange G. The recession of the two sliding collars releases the balls and consequently allows the assembly of collars to slide on the hub of the driven member. This result is obtained automatically by the effect of the spacer K which operates as follows: The forked lever L, which bears on the flange F for the engagement of the clutch, applies its effort through the intermediary of two triangular cams K on trunnions M. The contour of these cams is shaped to give the following result: For the clutch engaging action (right to left) the long side of the cam is forced against the left-hand flange and the opposite point is out of contact with the right hand flange. For declutching, the pressure toward the right on the trunnion M brings the point K of the cam in contact with the flange G and in consequence of the adherence of the steel balls, effects a rocking motion of the spacer K. This action on the clutch yoke therefore forces the two sliding collars apart, and since the force on the yoke is toward the right, the sliding collar assembly is withdrawn toward the right and the clutch thereby disengaged. The two flanges F and G are provided with hardened facings, and the pressure of the point of the cams is distributed over a large area. Adjustment of the clutch can be made by means of the adjusting screws plainly shown.

Among the advantages claimed for this design of clutch are great smoothness of action, due to causes already explained; absence of drag, due to the small number of parts and the precision with which adjustment can be effected, and, finally, ease of gear shifting, by reason of the small inertia of the driven member. The clutch is in use on motor omnibuses and other heavy vehicles in France.

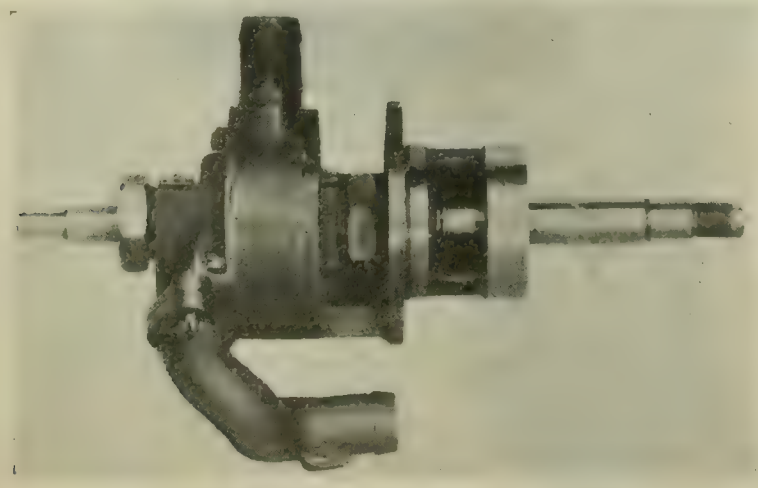
Aro Circulating Pump with Special Packing and Means of Lubrication

THE Arrow Pump Co. has incorporated its ring oiled packing gland feature in a standardized design of circulating pump for automobiles, trucks and tractors. As may be seen from the accompanying views, the pump proper is a standard unit, and special fittings for the inlet, outlet and mounting bracket are provided to suit different installations. The pump is shown herewith ready for installation on the Paige motor.

The cross sectional view shows in detail the Arrow construction of the packing gland, with its ring oiling method of lubrication. This construction is claimed to entirely prevent leaky glands, scored and pitted shafts and worn bearings. With this method of lubrication it becomes practical to place the packing between the hot water and the bearing. The new construction is intended to prevent entrance of hot water or foreign substances into the bearing, thereby protecting bearings and shaft from destructive effect. It prevents the lubricant from being washed out, and confines it to the bearings, shaft and packing.



Cross section of Aro circulating pump



Complete pump with special fittings

An Improved Drill Chuck

A DRILL chuck with a safety feature to prevent the breaking of drills has been developed by the SaveAll Tool Co. A positive pin drives the collet and shears before drills, reamers, etc., can break or burn. Tools can be quickly changed while the machine is running or stopped. The compensating positive collet lock automatically takes up wear, eliminating end play of the collet and reducing the chances of the tool hogging into the work. One advantage claimed for this chuck is that dull tools cannot be used.

Aircraft Engine Experience as a Basis for Automobile Engine Development

Super-compression and over-dimensioning of engines as an aid to fuel economy. Its possible application to "gearless" cars. An improvement of the starting torque would make the internal combustion engine flexible. Mr. Dechamps gives the results of actual tests as well as his calculations.

By H. Dechamps

THE enormous development of aircraft during the war in all the participating countries has borne fruit in the further improvement of internal combustion engines, in that the weight and fuel consumption have been reduced and the specific output increased in entirely unexpected proportions. Although the service conditions of automobile and aircraft engines are materially different, there is so much in common between the two that it is good policy for automobile engine designers to heed the lessons of aircraft engine experience.

It is not the intention in this article to discuss details of construction, particularly in view of the fact that many of the improvements which were found absolutely necessary in aircraft engines have since been applied to automobile engines. Reference is here made to such features as the location of valves in the cylinder head, the hemispherical formation of the compression space, the complete machining of the compression space, the use of steel and aluminum in place of cast iron for cylinders, improved means for heat disposal by the use of aluminum pistons, the increase in the number of cylinders and the better balance of the moving parts.

Increasing Compression

These various improvements, the advantages of most of which can be checked by means of comparatively simple theoretical calculations, have made it possible to use a higher compression without incurring danger that the engine will knock. The favorable effect of an increase in the compression ratio on the output and fuel economy is well known. It is probably less well known that the gain is actually greater than theoretical considerations would lead one to expect. Very accurate tests on a Benz engine, whose compression ratio was increased from 5 to 5.8 by the installation of longer pistons, gave the results compiled in the following table, those for a compression ratio of 5 being placed equal to unity:

Compression ratio.....	1:5	1:5.5	1:5.65	1:5.8
Theoretical output.....	1	1.045	1.055	1.065
Actual output.....	1	1.065	1.100	1.125

This extra gain in output, beyond what would be expected from the increased pressure and temperature drop, is due to an improvement in the efficiency of combustion with increased compression, effected more rapidly, as is further attested by the fact that the gain increases rapidly at higher speeds.

Unfortunately, the permissible compression is rather closely limited by the tendency of the engine to knock and the demands as regards smooth running are much more severe in the case of automobile than that of aircraft engines. This is not the place to go into all the different causes of knocking, but it may be pointed out that this factor is a test of the ability of the designer. Whereas some engines begin to operate roughly with a compression ratio of only 4.5, the more capable designer succeeds to force the compression up to 5.8 without the engine inclining to knock. Aside from the timing of the valves, which is of considerable influence, the cooling arrangements are determining. A chain proverbially is no stronger than its weakest link, no matter how strong the others may be. In connection with cooling the weak link is the particular point whose overheating causes preignition, and whose determination and elimination is a problem for the engineer. If the rules which in the foregoing were referred to as well known are given due consideration, the weak link which causes knocking is usually the spark plug. In determining the location of the latter it is impossible to be too careful that the spark plug boss is effectively cooled by water all around, and that the walls of the boss are thin enough so as not to permit of too great heat accumulations. The selection of the spark plug also is of great importance. There is as yet no universal plug, because the plugs manufactured for engines with super compression, which have excellent heat radiation facilities, become easily sooted when the engine is idling, as under that condition the temperature of the plug insulator is too low to burn any oil that collects upon it. In connection with these very sensitive engines, more exacting demands must also be made on the workmanship, as a single passage on any cylinder boss which is clogged with core sand or iron suffices to cause steam pockets to be formed and overheating to result, and thus lessen the value of the whole engine.

Fuel Economy

In the case of commercial vehicles, where economy is imperative, it is possible to effect a considerable economy in fuel consumption by an increase in compression ratio, in combination with the use of a suitable reduction ratio between the engine and rear wheels. A departure in this direction was made by the Bayerische Motorenwerke, who are furnishing a 45-hp. truck engine with a guaranteed fuel consumption of 220 grams (0.484 lb.) per horsepower-hour, which as compared with consumptions of 300 to 350 grams (0.66 to 0.77 lb.) represents a saving of approximately 30 per cent. This result has been accomplished by forcing the compression to a particularly high point, which was rendered possible only by throttling the engine so as to keep the maximum explosion pressures and temperatures within the limit found in conventional engines.

Special interest attaches to the theoretical proof of the economy which it is possible to secure—which was first developed by Prof. Weisshaar—for the reason that it is not easy by other than mathematical reasoning to arrive at the conclusion that such advantages can be achieved by super compression and throttling.

Let us denote by

G the weight of a cylinder charge consisting of
G_f fresh mixture and
G_r spent gases from a previous explosion,
V_h the piston displacement,
V_c the compression space,

$r = \frac{V_h - V_c}{V_c}$ the compression ratio,

p_h the maximum explosion pressure,
p_r the pressure at the end of the power stroke,
T_h the absolute maximum temperature of the explosion,
T_r the absolute temperature of the spent gases,
R the gas constant;

we then have, $$G = \frac{p_h V_c}{R T_h}$$

$$G_r = \frac{p_r V_c}{R T_r}$$

By subtraction,

$$G_f = G - G_r = V_c \left(\frac{p_h}{R T_h} - \frac{p_r}{R T_r} \right)$$

From the definition $$r = \frac{V_h - V_c}{V_c}$$

it follows that $$V_c = \frac{V_h}{r - 1}$$

and by substituting this value we obtain

$$G_f = \frac{V_h}{r - 1} \left(\frac{p_h}{R T_h} - \frac{p_r}{R T_r} \right)$$

If we apply to an engine with increased compression the same designations and add an index figure a, we obtain for this type of engine—

$$G_{fa} = \frac{V_{ha}}{V_h} \left(\frac{p_h}{R T_h} - \frac{p_r}{R T_r} \right)$$

The ratio of the charges of the two engines is then

$$\frac{G_{fa}}{G_f} = \frac{V_{ha}}{V_h} \frac{r - 1}{r_a - 1}$$

If we assume that the mechanical efficiency as well as the efficiency of combustion of both engines are the same, we obtain for the ratio of the outputs,

$$\frac{N_a}{N} = \frac{G_{fa}}{G_f} \frac{\eta_{ta}}{\eta_t}$$

where η_t represents the thermal efficiency. By introducing the values for the degree of filling with fresh gases we obtain

$$\frac{N_a}{N} = \frac{V_{ha}}{V_h} \frac{r - 1}{r_a - 1} \frac{\eta_t}{\eta_{ta}}$$

If both outputs are equal we have $N_a/N = 1$ and

$$\frac{V_{ha}}{V_h} = \frac{r_a - 1}{r - 1} \frac{\eta_t}{\eta_{ta}}$$

from which it follows that

$$V_{ha} = V_h \frac{r_a - 1}{r - 1} \frac{\eta_t}{\eta_{ta}};$$

that is to say, the high compression engine must have a greater piston displacement than the one with normal compression. But in order that its output may remain the same the mean effective pressure p_{ca} must be reduced by throttling.

For equal outputs we have

$$p_c V_h = p_{ca} V_{ha},$$

and the mean effective pressure for the high compression engine, therefore, is

$$p_{ca} = \frac{p_c V_h}{V_{ha}} = p_c \frac{r - 1}{r_a - 1} \frac{\eta_{ta}}{\eta_t}$$

An example will more clearly bring out the relations. Let us take a four-cylinder truck engine of 4½ in. bore and 6 in. stroke, which at 1000 r.p.m. and a compression ratio of 4.5 to 1 develops 40 hp. and consumes 0.585 lb. fuel of 17,000 B.t.u. heat value per horsepower-hour.

The piston displacement is 382 cu. in;

The compression ratio 4.5;

The thermal efficiency $\eta_t = 1 - r^{1-\gamma} = 0.41$ (assuming γ to be 1.35).

If now an engine with a compression ratio of 6 is to give the same output, since its thermal efficiency will be

$$\eta_{ta} = 1 - 6^{1-\gamma} = 0.466,$$

this must be made with a piston displacement

$$V_{ha} = V_h \frac{r_a - 1}{r - 1} \frac{\eta_t}{\eta_{ta}} = 382 \frac{6 - 1}{4.5 - 1} \frac{0.41}{0.466} = 480 \text{ cu. in.}$$

or about 25 per cent more.

In the same proportion the mean effective pressure must be reduced by throttling. For the conventional engine this pressure amounts to

$$p_c = \frac{40 \times 792{,}000}{382 \times 1{,}000} = 82.9 \text{ lb. per sq. in.}$$

In the high compression engine the mean effective pressure must be reduced by throttling to

$$p_{ca} = p_c \frac{V_h}{V_{ha}} = 82.9 \frac{382}{480} = 66 \text{ lb. per sq. in.}$$

Theoretically the fuel consumption varies in direct proportion to the thermal efficiency, and it therefore becomes

$$b_a = b \frac{\eta_t}{\eta_{ta}} = 0.585 \frac{0.41}{0.466} = 0.515 \text{ lb. per sq. in.}$$

which represents a saving of

$$\frac{0.585 - 0.515}{0.585} = \text{approximately 12 per cent.}$$

In reality the saving will be greater, as the assumption that the efficiency of combustion will be the same in the two cases does not hold, this factor being higher in the case of the super-compression engine, so that a fuel consumption of not over 0.485 lb. per horsepower-hour can be relied upon.

This calculation gives a valuable indication as to the direction in which there is a chance for the improvement of truck engines. The objection that the weight and manufacturing costs will be increased, owing to the greater piston displacement, is of little moment, as in the case of motor trucks the engine weight is not a very important factor, and any slight increase in manufacturing costs are compensated for by the saving in operating cost during a very short period. The life of such an engine, too, need not be shortened, as the specific bearing pressures can be kept low, and as the throttling in part neutralizes the influence of the super-compression on the pressure diagram. A more important feature is the increased difficulty of cranking, which, however, does not need to be considered where an electric starter is fitted. Possibly the fuel economy may be further increased by providing the carbureter with several spray nozzles and venturis, so that the engine may be fed a rich mixture when under full load, whereas when the engine is throttled to carry its normal load a second carbureter comes into play which delivers a very lean mixture.

Such a super-dimensioned and throttled engine possesses a considerable reserve of power, if the drive is sufficiently robust, as it is possible to operate it temporarily on a fully open throttle. The thought suggests itself that this may be taken advantage of by dispensing with the change speed gear. It may here be remarked, parenthetically, that this often discussed problem has lost greatly in importance through improvement in transmission design. It is true that we are still using clash gears, which according to ideas current in general mechanical practice are an exceedingly crude device, but through a long succession of improvements in design and construction material, in the clutch as well as the transmission, the formerly heavy, bulky and more or less unreliable transmission has shrunk to an unobtrusive excrescence to the engine housing, so that its elimination would not have nearly the same advantage which it would have had only a decade ago. As often happens in the history of mechanical development, time brings solutions of problems which previously staggered the most capable, when these solutions no longer are of any particular value.

A "Gearless" Car

With large cars, such as the eight-cylinder Cadillac, with its excellent clutch, one can start without difficulty on the direct drive and needs the transmission only on exceedingly steep grades and in backing. This idea of the gearless car was taken up by Maybach, who exhibited such car at this year's Berlin automobile show, with a six-cylinder engine delivering 70 hp. at 2000 r.p.m. The engine is fitted with a specially powerful electric starter, which is put in operation by pressing on a pedal, and as the clutch is not withdrawn, this starts the car as well as the engine. The starting pedal also connects to the throttle valve, opening the throttle as it is depressed, and as the ignition is then closed the engine picks up its cycle at once. A further depression of the pedal cuts out the starter. As the engine develops a very high torque, this pedal serves as the only control member for use on level roads and moderate grades. For exceptionally steep hills a "hill pedal" is provided which connects a planetary gear built into the flywheel housing into the transmission line without shock. In the intermediate position of the "hill pedal" the clutch is disengaged, so that it is possible to let the engine idle in special cases. Backing is effected entirely electrically, by reversing the starter. Even though certain objections may be raised against this solution of the problem, the boldness of the new idea must be acknowledged, which greatly facilitates the operation of the car by unskilled persons, since gear shifting is eliminated and instead use is made only of a single pedal, if we disregard the "hill pedal," which is used only in exceptional cases.

Weakness of Explosion Engines

This solution, consisting in the use of an exceptionally powerful starter, masks the inherent weakness of all explosion engines residing in the fact that they give a substantially constant torque, instead of increased torque at low speeds, like a steam engine. It is natural that the ideal solution of an explosion engine with variable torque must be matured first in the form of a stationary engine, which is subject to fewer restrictions with respect to weight, tending, bulk, etc. If we disregard the interesting, but so far unsuccessful, experiments with mechanical changeable transmissions, as, for instance, by a change of the stroke, the most direct method of increasing the output is the use of blowers.

Aircraft engines have been very successfully fitted with blowers, for the purpose of maintaining the output at great altitudes in spite of the decreased density of the air, but the problem in connection with motor cars is an entirely different one. On the contrary, very remarkable results of tests on Junkers stationary two-stroke engines are to hand, where by the use of sufficiently large blowers and throttling of the exhaust ports the output was temporarily increased by from 30 to 50 per cent, which results should be taken notice of in the further development of automobile engines. The chief objection raised to this construction is that it gives a machine which normally can be used only as a throttled motor and is therefore not fully utilized. This argument is not entirely valid, as the parts are so proportioned that the engine would not stand operating continuously under full load, as regards both mechanical stresses and heat disposal. Still more interesting in this respect is the Diesel engine of the Sulzer experimental locomotive, which on starting off is caused to produce a very high torque by overfilling with air under pressure. Owing to the high consumption of compressed air and the cooling requirements, this method of operation can be continued for only a short period, until from one-quarter to one-half the normal speed has been attained. From that point on both fuel and compressed air are blown into the cylinders, and as ignition of the charge is effected, a very "full" indicator diagram is obtained, corresponding to an overload. This is continued until the train has reached its full speed, whereupon the engine output is reduced to its normal value.

Extended laboratory tests make this method of operation appear satisfactory, but in practice so many detail difficulties must be overcome that years will be required to ripen a project of this sort.

Future of Research

In the case of the automobile engine this plan seems to have greater possibilities. The slight extra weight of the blower is compensated for by the elimination of the transmission; the stresses in the rear axle are not increased, and considerations of weight do not prevent a strengthening of the engine cylinders and drive mechanism. The flexibility of the engine and the form of the diagram in case of super-charging, as well as the influence on the inflammability with mixtures of different proportions are questions that still remain to be settled. An investigation of these problems would be a worthy task for American mechanical laboratories equipped with optical indicators and other suitable instruments, particularly since research work in German institutions has almost completely stopped, on account of lack of means due to the economic situation. An exchange of ideas which would make available to American engineers the results of many not yet fully exploited German researches as a guide for further research work, and by which German engineers might be acquainted with recent experimental results obtained in America, could only be of advantage to the engineers of the two countries.

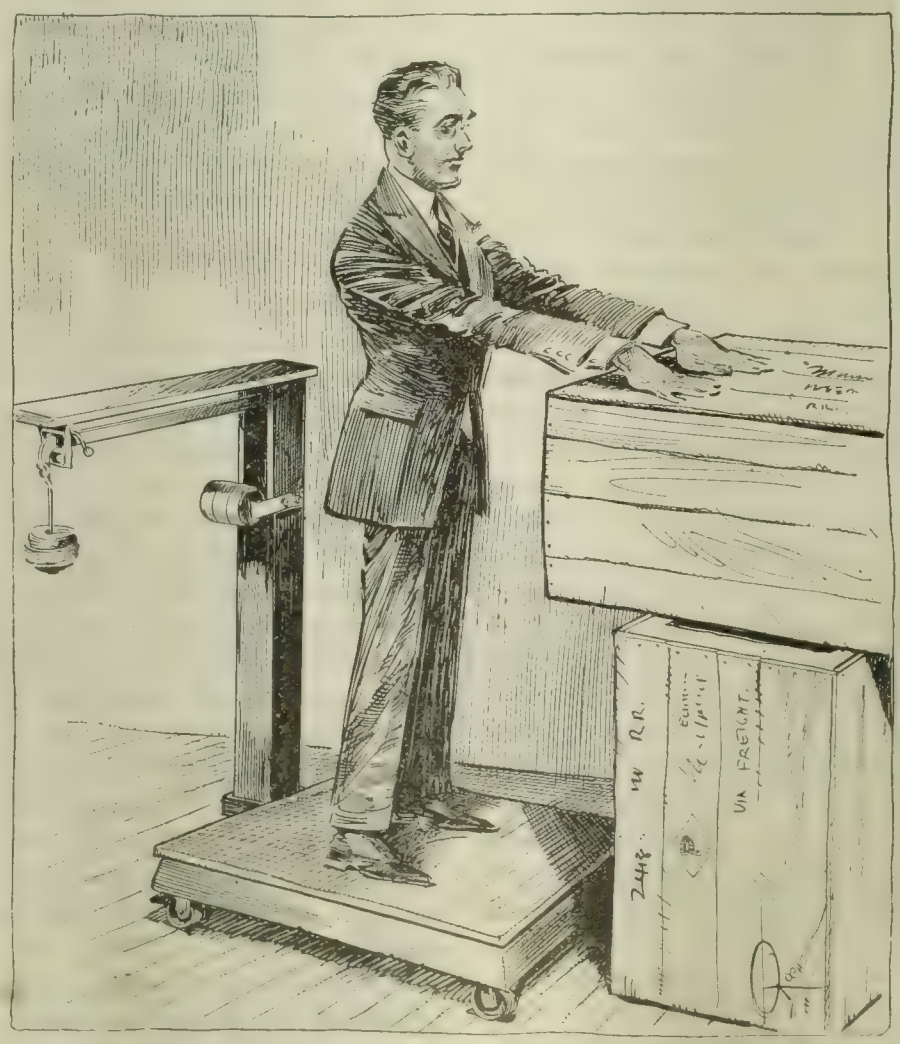
THE Stevenson Gear Co. has recently brought out a down-stroke model of its multiple shaper or gear cutter, complementary to the up-stroke model described in AUTOMOTIVE INDUSTRIES of Aug. 25, 1921. This machine is known as the Model 6-A and resembles the vertical shaper or slotting machine in general appearance and principle of operation. The principal unit of the mechanism is a special tool head which consists essentially of a series of radially disposed tools spaced about the circumference of the blank to be cut. The machine operates in the same manner as an ordinary vertical shaper except that the tools are held stationary and the gear blanks are reciprocated past the tools.

Stability of Two-Wheeled Tractors

Usually in these tractors the torque removes weight from the drive wheels and transfers it to the implement on which rests an extension frame. The drawbar pull has the contrary effect if the drawbar is below the wheel axis. Mr. Heldt discusses other phases of this problem in this article.

By P. M. Heldt

THERE has been a good deal of discussion on the subject of the transfer of weight from the front to the rear wheels when a rear wheel-driven, four-wheel tractor has power applied to its wheels, and the fact is now thoroughly established that when the front end leaves the ground as a result of this effect, it is around the rear axle center line that the motion takes place. On the other hand, comparatively little has been said on the corresponding effect in a two-wheeled tractor. The reasons probably are that so far there have been only a few models of two-wheeled tractors on the market, and that in no case is there any danger of serious accidents when a machine of this type is pulling heavily.



Simple illustration showing how ground pressure can be reduced by torque reaction

Since action and reaction are always equal and opposite, it is quite obvious that the tractor, when power is applied to the wheels for forward motion, tends to turn backward with exactly the same torque or turning effort as that with which the wheels turn forward. To hold the tractor frame from rotating it is provided with a rearward extension, which generally rests upon the implement, but in some cases upon a two-wheeled truck furnished with the tractor. The product of the downward pressure upon the implement or truck, into the perpendicular distance from the axis of the tractor axle to the center line of this pressure, is equal to the torque on the driving wheels, and is known as the torque reaction. Of course, if the center of gravity of the tractor is located ahead of the driving wheel axis, a part of the weight of the tractor will also press down on the implement.

It is a general principle of mechanics that when a system is in equilibrium all outside forces on it vanish. The "system" here considered is the tractor, and the outside forces take effect at the center of gravity, at the points of support of the tractor and at the drawbar hitch.

When the tractor is at rest, with no power on its drivers, there are three forces active which must be in equilibrium. The force of gravity W acts at the center of the gravity of the whole tractor, and is balanced by the ground reaction P against the wheel and the reaction p of the implement against the frame extension, as in Fig. 1. The moments around any axis vanish. For instance,

$$Wl = pL \text{ and } Pl = p(L - l)$$

Referring to this Fig. 1, it will be seen that the sum of the two reactions is equal to the total weight of the tractor, and the reactions are inversely proportional to the distances of the points at which they occur, to a vertical line through the center of gravity of the tractor. As in this case the center of gravity is very near the wheel axis, the pressure of the wheel on the ground is far greater than the pressure of the frame extension on the implement.

If now power is applied to the tractor and a load is hitched to it, the previously existing outside forces are considerably changed in magnitude, and there is one more outside force acting on the tractor, namely, the reaction to the drawbar pull at the drawbar hitch. If we designate the drawbar pull reaction by R and the rolling resistance encountered by the tractor by A, then the tangential force at the wheel rim gives rise to a horizontal reaction of the ground against the wheel (the force which prevents the wheel from slipping) which is represented by $A + R$. In order to obtain rational proportions we have assumed in the diagrams that the maximum drawbar pull is equal to three-fourths the weight of the tractor, and the rolling resistance equal to five-eighths this weight.

The tangential force at the wheel rim, represented by $A + R$, acting at the length of an arm r equal to the wheel radius, is balanced by a similar moment created by a reaction B at the point of contact between the frame extension and the implement, acting on a lever arm L, constituted by the perpendicular distance between the center line of this reaction and the wheel axis. We have then (Fig. 2)

$$(A + R)\, r = B\, L$$

hence

$$B = \frac{(A + R)\, r}{L}$$

This reaction is in the same direction as that due to the component of the force of gravity at this point (p); in other words, the pressure of the frame extension on the implement is increased by the torque reaction.

It has been intimated that the drawbar pull R is balanced by a fraction of the horizontal reaction of the ground on the drive wheels. But since these two forces are not in line they cannot completely balance each other. In fact, we took a moment of the reaction to the tangential force on the wheel $(A + R)$ around the wheel axis, and we must also take a moment of the reaction to the drawbar pull around this axis. In the drawings we have assumed that the perpendicular distance a of the drawbar center line from the wheel axis is equal to one-third the wheel radius r. This moment tends to raise the frame extension and is contrary to the moments due to weight and torque reaction. The reaction to this moment at the point of contact between frame extension and implement, which is denoted by C, is therefore downward. This reaction

$$C = \frac{R \times a}{L}$$

The actual pressure of the frame extension on the implement in regular operation therefore is

$$p' = p + B - C$$

where

p is the reaction at this point when there is no power applied to the tractor wheels.

B is the reaction due to the driving torque.

C is the reaction due to the drawbar pull.

The first item, p, can be decreased by moving the center of gravity of the tractor closer to the wheel axis, and vice versa. The reaction due to the propelling torque can be decreased by lengthening the frame extension, and vice versa. The reaction due to the drawbar pull can be *increased* (which has the same effect as decreasing either of the two items) by placing the drawbar hitch lower. In general, smallness of pressure on the implement is desirable.

It is obvious that the pressure of the driving wheels on the ground when the tractor is under load depends also upon three items—

$$P' = P - B + C$$

That is, the pressure of the driving wheels on the ground when the tractor is under load depends upon the tractor weight component upon the wheels, an item depending upon the torque and an item depending upon the drawbar pull and the height of same.

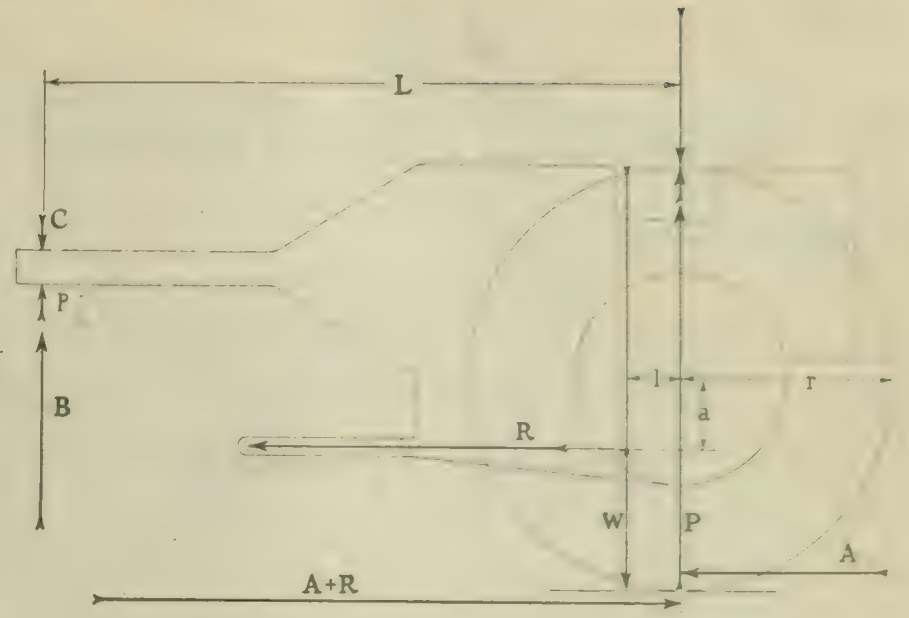


Fig. 2

That the drawbar pull adds to the load on the drive wheels if the drawbar is below the wheel axis is easily shown. In Fig. 3 are sketched the wheels and tractor frame in a diagrammatic manner, and the reaction of the implement on the drawbar, $C\ B$, and the downward pull, A, B, which must be exerted on the end of the frame extension to keep the frame in equilibrium, are drawn in. The resultant of these two forces, $O\ B$, takes the form of axle pressure on the wheel bearings and must be balanced by an equal and opposite reaction $O\ D$ of the ground of the wheels. This reaction is inclined and has both a horizontal and a vertical component. The horizontal component $O\ E$ is part of the resistance to slippage of the wheel on the ground, while the vertical component $E\ D$ constitutes an increase in the vertical reaction of the ground on the wheel, and hence in the pressure of the wheel on the ground.

We want the greatest possible pressure of the wheels upon the ground, because upon this pressure depends the maximum drawbar pull of which the tractor is capable. This means that B (Fig. 2) ought to be made small, by using a long frame extension or small wheels, and C large, by placing the drawbar low or making the frame extension long. Of course, the greatest pressure of the drivers on the ground that can possibly be obtained is equal to the total weight of the tractor. The sum of the reactions at the point of ground contact and point of contact with the implement is always equal to the weight of the tractor—

$$(p + B - C) + (P - B + C) = (p + P) = W$$

If it were possible to make B and C equal then the pressure of the drivers on the ground could be made inde-

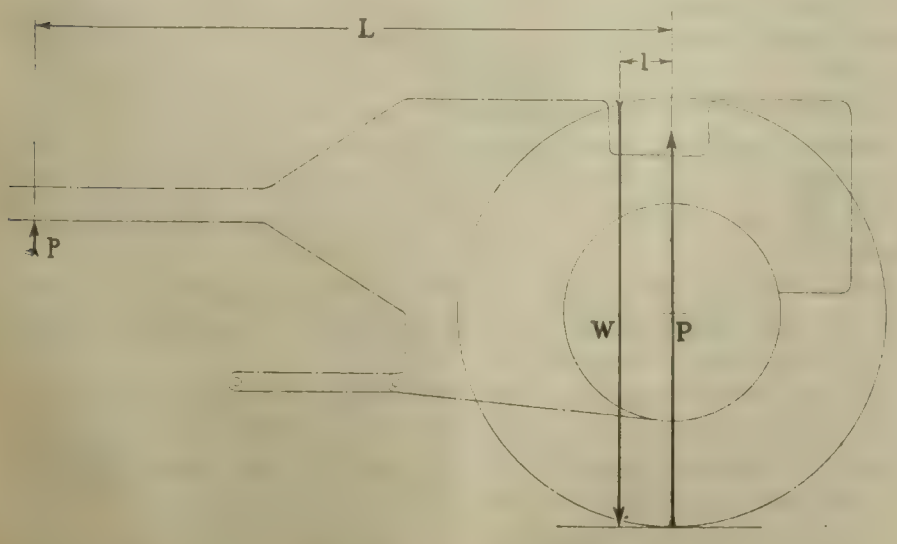


Fig. 1

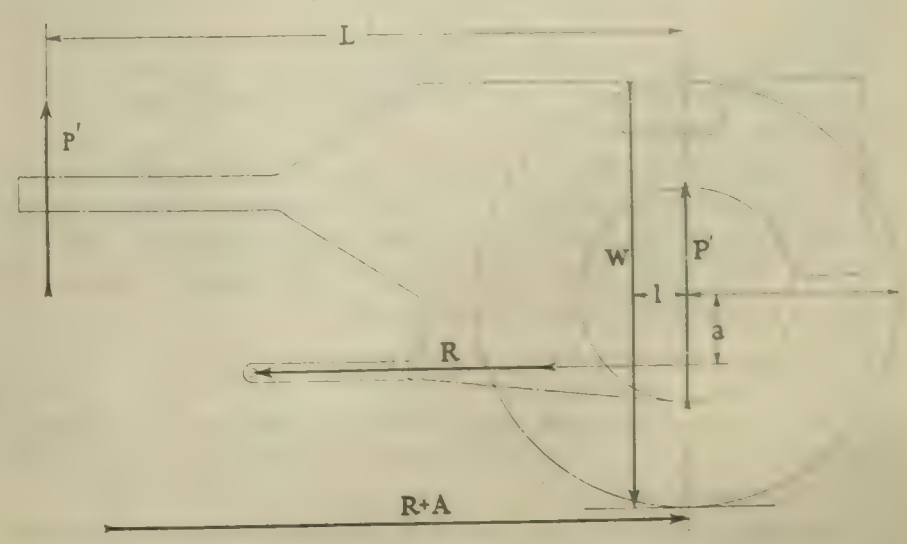


Fig. 4

pendent of the load on the tractor. But since

$$B = \frac{(A + R)\, r}{L}$$

and

$$C = \frac{R \times a.}{L}$$

it would be necessary that

$$\frac{(A + R)\, r}{L} = \frac{R\, a}{L}$$

or

$$(A + R)\, r = R\, a$$

or

$$a = r\left(\frac{A + R}{R}\right) = r\left(1 + \frac{A}{R}\right)$$

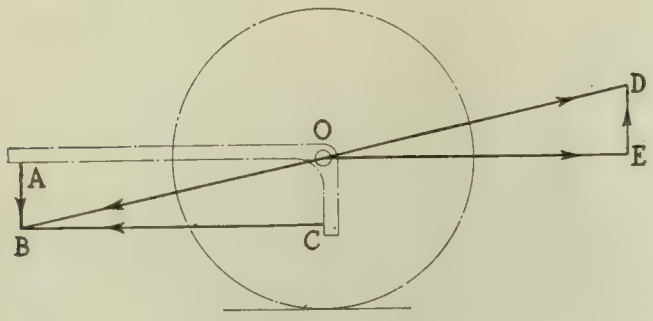


Fig. 3

That is, since in practice A is nearly equal to R, the drawbar hitch ought to be below the wheel axis a distance equal to twice the wheel radius, which is impossible. In practice, if the drawbar is located at one-third wheel radius below the wheel axis, it neutralizes about one-sixth the effect of the torque reaction in transferring weight from the driving wheels to the implement.

In Fig. 4 are indicated the resultant forces at each point where outside forces act upon the tractor. By comparing this with Fig. 1 it will be seen that the vertical pressure of the drive wheels on the ground, represented by P and P' in the two cases respectively, is reduced by 41 per cent. This figure, of course, applies only to the proportions assumed in drawing the diagrams and which have been stated in the foregoing. It would seem from this that from the standpoint of limiting draft the two wheel construction is not as advantageous as generally believed.

It may not be directly obvious to those not familiar with the method of solving problems in mechanics, how the ground pressure of the drivers can be reduced by the torque reaction. A homely illustration will make this clear. however. If a man stands on a weighing scale and then extends his arms horizontally and presses down upon some support of suitable height, the weight indicated by the scale will be reduced. If the support upon which he presses were upon another scale, then the sum of the weights indicated by the two scales would at all times be equal to the sum of the weights of the man and the support. The man's muscles then would act as a motor, tending to cause his arms to swing around their sockets, and the pressure of the hands upon the support multiplied by the length of the arms would measure the torque.

Body Standardization Work in Progress

At a recent meeting of the Passenger Car Body Division of the Society of Automotive Engineers Standard Committee it was reported that investigation showed that a center-to-center distance of 1½ in. between escutcheon plate screws was very common. As the standardization of door handle square bearing diameters was suggested, it was decided to continue the investigation. The subject was assigned for further consideration to G. E. Goddard, who will make an investigation covering escutcheon plates, door handle square bearings and the bevel on door lock bars and escutcheon plate screw sizes.

Discussion of door hinges indicated that it may be possible to standardize some features of exposed hinges, the following dimensions being submitted as desirable practice.

Type	Plate Width, in.	Thickness, in.	Screws No.	Size
Malleable	1¾	3/16	4	No. 10
or				
Forged	2	1/4	4	No. 12
Pressed	2	1/8	4	No. 12

Clearance between plates shall be 1/16 in. at the exposed end, tapering to ⅛ in. at the concealed end when hinges are closed.

As it was advocated that hinge pin diameters, hinge offsets and possibly hinge projections be standardized, it was decided to give this subject further consideration. E. G. Simpson was appointed to secure the necessary data and prepare a tentative recommendation.

Top Irons and Windshield Side Arms

O. H. Clark, who was appointed to formulate a recommendation on top irons in February, 1921, recently submitted a tentative report.

This report is based on a survey of present-day top iron practice, which showed a great variety of types and sizes. A careful analysis of the data, however, indicated that the great majority of top irons are made with 7/16-in.-14 United States form threads. This thread has therefore been specified and should meet with general approval. The top iron types recommended cover all general requirements. The through-the-rail type of front top iron can be used through the rail by body builders who do not wish to provide for the removal of the top iron in case the permanent or California type of top is used. This type of top iron is superior to the separate through-the-rail type of front and rear top irons inasmuch as it is not necessary to counterbore such large holes through the rail for the top iron sockets, avoiding the weakening of the top rail.

This report was discussed at the last Passenger Car Body Division meeting, but no definite action was taken. It was felt that probably only the threaded shank on the top iron can be standardized, as there are so many varying conditions that control the other dimensions and shapes, and as no one top iron can be used interchangeably on different bodies or cars.

It was suggested at the last meeting of the Passenger Car Body Division that a standard should be formulated for the shanks on windshield side arms, so that body builders can provide standard holes in the body frames. It was thought that the shank diameters should be in odd-number sizes and the holes in even-number sizes, and that there should be a definite series of lengths and threaded ends.

The Society is to circularize the windshield manufacturers for suggestions and data in this connection before further action is taken.

It has been requested that the Truck Division standardize the mounting dimensions for motor truck cabs so as to permit interchangeability. This matter has been referred to the members of the Truck Division. If it should be the general opinion of the Division that this subject should be taken up, a Subdivision will be appointed to formulate a tentative recommendation.

Improvements in Gearbox Design

Part III.

In this article Mr. Orcutt deals with factors in the production of gearboxes. He shows how weaknesses are revealed by an examination of the costs of production and offers suggestions for improvements in gearbox design.

By H. F. L. Orcutt*

IN no way are the anomalies and weaknesses of the gearbox so clearly revealed as through an investigation of costs of production. Such an investigation is specially recommended as a stimulus to reform in design and in methods of production. It will reveal that when the best running qualities are desired in proportion to its size, number of parts, and machine operations, the gearbox is a costly unit. It will reveal that a box with almost any elaboration of design necessary to secure good running qualities will be cheaper to produce than the conventional type with all its uncertainties of costs, both direct and indirect.

With regard to costs, motor car boxes may be broadly divided into two classes: Those in which the costs are known, and those in which they are unknown. The "known" class includes those boxes which are produced under well-organized conditions, where labor-saving machines are properly equipped with up-to-date tools. Wide clearances are allowed, limits are not very fine, no fitting is called for; costs of assembling are low and it is done by unskilled labor. The teeth of gears are cut with plenty of backlash, with no stoning, or "running in," and no scrap. Noisy running is tolerated, boxes are never pulled down after road tests. The costs of these boxes are low, and in many cases they give good service, but are nearly all very noisy. There is nothing in the problem of production of this class of box that is not well within the capacity of most makers of components. All the machine operations are of the ordinary class, the costs of which are common knowledge. The foregoing applies principally to the so-called three-speed box. As long as the public is satisfied with their running qualities, so long will the maker continue to supply this class of work.

Niceties in Gearbox Manufacture

The "unknown" class of gearbox might well be called the "unlimited" class as far as costs are concerned, for many makers never stop work on them until they run to the satisfaction of their road testers. They may pull them down once or a dozen times; work is put into them regardless of expense and time—the whole output of cars is often held up through faulty gearboxes. A forecast of their cost is impossible, and an estimate of what they really do cost is so involved and mixed with other costs that no exact figure can be given. Hundreds of pairs of gears have been seen in more than one motor car works which are thrown aside as scrap. In many works all costs on gearboxes after the first machining and bench work are charged either to erecting and testing, or considered a part of "on-cost." Much depends on the degree of silence that is expected. Some well-known makers are content with silent running for the constant-mesh gears only, others add the third speed. Quiet running on second and first speeds is given up altogether, and reverse gears are rarely bothered with, no matter how badly they may run. Very few indeed make any attempt to secure equally quiet running on all speeds.

Good Workmanship Reduces Assembling Cost

In boxes where the best running qualities are desired, costs are usually enhanced by inaccurate machine work. It should not be forgotten that the central idea should be so to design and make the gearbox that it will support accurate tooth contact. Limits of workmanship have been given without which the best results will not be secured in any design. These limits are adhered to by but very few makers of either good, bad or indifferent boxes. Inaccurately seated ball bearings are a fruitful source of unnecessary costs. They have a narrow face compared with the diameter. For this reason they can be easily tilted in the casing. The outer ring should fit in the housing to a nicety which closely approaches gage work. They can be easily pushed home in such a manner as to permanently upset the soft metal casing, resulting in more noise perhaps from bearings than from the gear teeth. Dismantling and re-assembling gearboxes alone often cures this defective alignment, certain noises disappear but costs are increased. Hole-grinding in gears is not always kept within the limits necessary for good mounting. Bad broaching is common, and combined with inaccurate shaft work runs up fitting costs and often neutralizes good work on gear teeth. An examination of a large number of splined shafts reveals the fact that in many the finish-ground cylindrical surfaces are not concentric. This is largely due to bad centering. Results—bearings do not line with each other and gears run out. Bad workmanship in splined shafts and gear teeth is the rule, not the exception. The limits which should be observed on these details have been given above. The added costs due to the defects mentioned are naturally uncertain, irregular and difficult to assess. They include "running in" and hand-stoning gear teeth, fitting which is wholly unnecessary, dismantling and reassembling, and road testing wholly for gearbox rectification. With many makers road testing for gearbox troubles alone is a formidable item of costs which is wholly chargeable to gearbox production. These costs include wear of tires, fuel, testers' time and general mileage costs, all not infrequently repeated a number of times. Scrap parts are often a large item in costs, and are wholly unnecessary.

Regardless of design, the best running results can only be expected where correct and uniform workman-

*Paper read before the Institution of Automobile Engineers, December 15, 1921.

ship is the rule. With correct workmanship, gearbox assembling should be an unskilled operation, even when the best results are expected. There should be no fitting work whatever. Gears need no stoning or "running in," boxes should not be dismantled and reassembled, special road tests should not be required. Scrap is unnecessary. The designer should be the first to insist on good workmanship, for without it he cannot trace inherent defects, nor try out improvements with any certainty. The engine designer would never have made the progress which he has if he had not been backed by the superior workmanship which is commonly found in the motor car engine. Very few makers would consider for a moment assembling an engine with its principal components made with the indifferent workmanship we usually find in the gearbox. It is doubtful if there is any other working surface in the motor car except the gear tooth which is hardened after it is carefully machined. As with the engine or the axle, the cheapest box is the one which is accurately machined, that is, if the best results are desired. The difference between the costs of irregular and regular machine operations is small, inspection costs may be slightly increased; assembling and fitting costs are the lowest when good machine work can be relied upon.

As to costs of scrap on gears when they are finish-ground, many records show that 1 per cent is ample allowance. The same figure can be taken for splined shafts when they are correctly machined.

Finishing Gear Teeth

The greatest interest naturally centers on the cost of gear-teeth finishing, as this is the most costly of any machine operation in the gearbox. The producer has the choice of various methods. There is not much difference in the costs of ordinary gear-cutting when the best machines are employed in either the generating, hobbing, or plain milling processes. Good, bad and indifferent qualities of work are produced by all methods, much depending on experience and on the methods and supervision employed.

When results are desired which call for gear-tooth treatment after hardening, there is a choice of three methods:

1. "Running in" and stoning.
2. Finishing with a cutter.
3. Grinding with the abrasive wheel.

Grinding with the abrasive wheel gives a quality of tooth form that cannot be produced by any other method; this quality includes theoretical accuracy as well as uniformity, and when the highest quality is required it is the cheapest. When design is suited to production and quantities are possible, gear-tooth grinding adds little, if any, to the cost of the gearbox Quality for quality, it is the cheapest method that can be employed when total costs are considered. Stoning and "running in" are makeshift processes, irregular in cost and quality. Finishing with a cutter after heat-treatment gives better results than hand-finishing. The greatest additional cost is in maintenance of cutters, which wear rapidly. Strict supervision is necessary to maintain uniformity —only certain grades of hardness can be tolerated. Accuracy of tooth form necessary to very quiet running is impossible.

As a means of reducing costs and assisting to regular output, accurate machining of the splined shaft is second in importance to gear-tooth finishing. There are three forms of shafts for driving gears: the square shaft, the cylindrical shaft, with an inserted key, and the so-called splined shaft. The splined shaft is used in two ways, with the gears mounted on the tops of the keys, and with gears mounted on surfaces between the keys. There is only one method of driving which is recommended as possessing the combined virtues of high quality and low costs. This is found in the splined shaft on which gears are mounted on the circular surfaces between the keys. Mounting gears on the tops of splines or on a square shaft may be considered as a practically impossible method of securing uniform results and one which is consequently costly. The difficulty in both cases is in finishing the inner surfaces of the gear which take the bearing on the shaft. When these surfaces are hardened, costly hand work is necessary to finish them to anything approaching a degree of accuracy. When the gears are mounted on the circular surfaces of the shafts which is between the keys, the hole in the gear can be cheaply ground within fine limits. The splined shaft can also be ground so accurate that no fitting between the two parts is called for, and the gear will run so truly that with good teeth the best possible running qualities are secured. If a box so finished is noisy in running, better workmanship will not cure the evil—design must be studied until inherent defects are corrected and costs due to these defects are eliminated.

Inaccuracies in Gear Teeth

There is one peculiar feature of gearbox costs which is worth special examination, and which is not a regular item of production expenses. It is caused by gearbox troubles which are experienced by many makers. These troubles follow intervals of steady output with those who turn out cars of good quality with fairly quiet running gears Suddenly car after car is turned down by the road inspector and the whole output is held up by gearbox defects. It is a costly business. It is so sudden and disastrous that it might well be termed an epidemic. Investigation often reveals the origin in defective gears, defective in the teeth or mounting. It has been stated that the allowable variation from accuracy in gear teeth is smaller than is usual in the finest grinding work if the best results are desired. The facilities and the experience for keeping gear work within these fine limits exist in but very few workshops. Often large quantities of gears are hardened and completely finished with inaccuracies that can only be detected by a running test. These errors are large enough to cause bad running, but are so small and of such a nature that they are not to be found by ordinary methods of gear inspection. They may be due to the displacement of tooth-form caused by wear in tooth-cutting machines, or in wrongly shaped or wrongly set cutters, or an alteration in the heat-treatment.

It is usually a costly business to face a trouble of this nature. Gears which are hardened after they are finished and are found to be faulty are not easily recovered. Some times the teeth can be ground to correct form so that they run well even with a backlash of 0.025 in. or 0.030 in. If this operation will not save them, they must be added to the scrap heap or badly running boxes must be accepted. If detailed work on gearbox parts is carried out as suggested, spasmodic troubles of the nature described should not occur. Exact costs of gearboxes in which the best running qualities are expected should be capable of being forecasted just as well as in those boxes in which noise is considered of no importance. To avoid unnecessary costs care should always be taken to make certain of the origin of the gearbox troubles. Many times it has nothing to do with the box itself; it sometimes can be traced to defective work in the engine, in couplings or in shafts. When corrections in these parts are made noises in the gearbox disappear.

It may be disappointing that more definite figures as to gearbox costs are not given. They are so difficult to ascertain that exact records are not often kept. As before stated, costs of the original mechanical operations on parts are common knowledge and do not vary to any extent. One thing is certain, the gearbox is more directly responsible for hold-up in output than any other part of the car. This is very costly, and through improved design and workmanship should be eliminated. When it is, exact estimates of costs can be made and relied on. Accurate workmanship is recommended as the indispensable precedent to alteration in design. A complete return of costs should be an indication as to whether the best methods of production are employed or not. Startling revelations await more than one manager who may insist on having a complete return of costs of car production for which the gearbox is directly responsible.

Without doubt, some of the gearbox eccentricities which add to the cost of production are due to heat

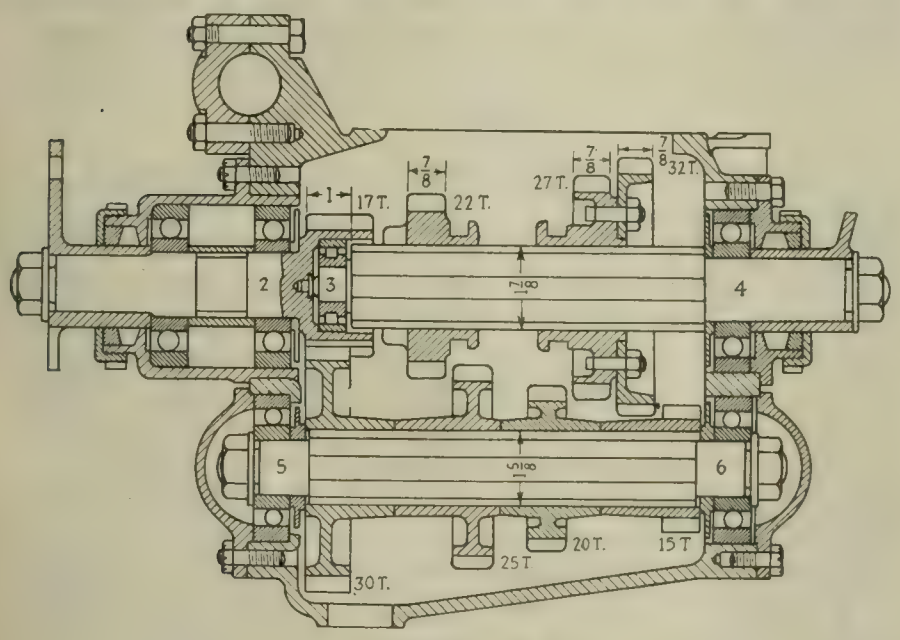


Fig. 5

generated by oil-churning. Thin aluminum casings are easily distorted by heat. Otherwise, the conditions of service which the gearbox has to fulfill are purely mechanical. It should have features of design and specifications of workmanship so that costs could be exactly calculated. Mechanical and assembling operations, clearances, limits, inspections and tests, should be planned as they are for thousands of other mechanisms. In so far as all these details are not definitely dealt with in the course of production, costs will be uncertain. It will, perhaps, be well to repeat the most common workshop irregularities which add to costs:

Most Common Faults

Ball bearings badly mounted in casings.

Spigot ball bearings badly mounted in the constant mesh position.

Inaccurate workmanship on splined shafts.

Gears badly mounted, especially when the gears seat on the tops of keys or on square shafts.

Holes in gears ground with too much clearance and too wide limits.

Holes too roughly finished.

Irregular-shaped gear teeth.

Added to these details is the common lack of correct specifications, of clearances and limits, of good methods of inspection. As to design, costs are increased by corrections which must be made in boxes easily deflected by internal strains and chassis distortions, and by badly designed details. Costs of this nature can only be reduced by the designer himself. There is another detail of design which is often the source of trouble and expense. In both lay shaft and main shaft in many boxes it is possible to lock up the ball bearings so that they are subjected to permanent end strains. It should not be forgotten that in good ball bearings the clearances are only a few ten-thousandths of an inch, and consequently they can be easily unduly strained. If they are so mounted that they must take a load or resist a strain which they are not made to carry, they will give trouble which is costly to locate and to correct. Correcting the errors of workmanship above mentioned and insisting on an inspection by which limits are kept to specification should do more than reduce costs of production. Running qualities would be much improved in all boxes, and a definite line would be drawn between troubles due to workmanship and those to design. These troubles are so often intermingled that they cannot be clearly observed and correct remedies cannot be applied.

When costs of assembling and erecting are low, it may be assumed that fundamentals of design and methods of production are not bad. Some examples of assembling costs will be given for a few boxes, in all of which the quality of workmanship is the best and the running qualities are satisfactory, although the design is more or less conventional.

Time Required for Assembling

Example 1.—A 6-ton truck gearbox with four speeds and reverse. Time of assembling, 6 hr. Time includes all labor for fitting work and assembling of all parts, bearings, shafts, gears, selector and brake parts. This box is never dismantled, but is put into the chassis and never removed. No parts are scrapped. There is no "running in," nor gear-teeth stoning. The running qualities are the best.

Example 2.—A three-speed and reverse gearbox for 15-hp. car. Time of assembling complete, 5 hr. The time includes all labor for assembling and fitting shafts, bearings, gears, change-speed levers, all brake parts, speedometer-drive, cover and housing for universal joint. The box has the best of workmanship throughout and the best running qualities.

Example 3.—A 3-ton truck gearbox with four speeds and reverse. Time of assembling complete, 4 hr. Labor includes assembling all parts of the box except the brake. These boxes were the subject of special inspection for quiet running. In several thousand boxes there was practically no scrap.

The above times given for assembling include the complete cost of the gearbox from the time the machined parts are received from stock until the car is ready to deliver to the customer. They are representative of what should be accomplished on any car of the best quality.

There are records of numbers of cases where changes in limits and new specifications of accuracy were adopted, with the result that dismantling, scrapping and repeated road tests were reduced from a large percentage to practically nothing. Better running qualities were secured and costs reduced.

Suggestions on Design

In Figs. 5 and 6 are shown different designs of gearboxes, Fig. 5 illustrating the weaknesses of a common design of box, Fig. 6 suggesting lines on which an improved box may be evolved.

The power transmitted in both boxes is 35 b.h.p. at 1500 r.p.m. The gear ratios are nearly the same, and the gears selected are 6 D. P., 20 deg. angle of pressure.

The contrasting features of design are principally in

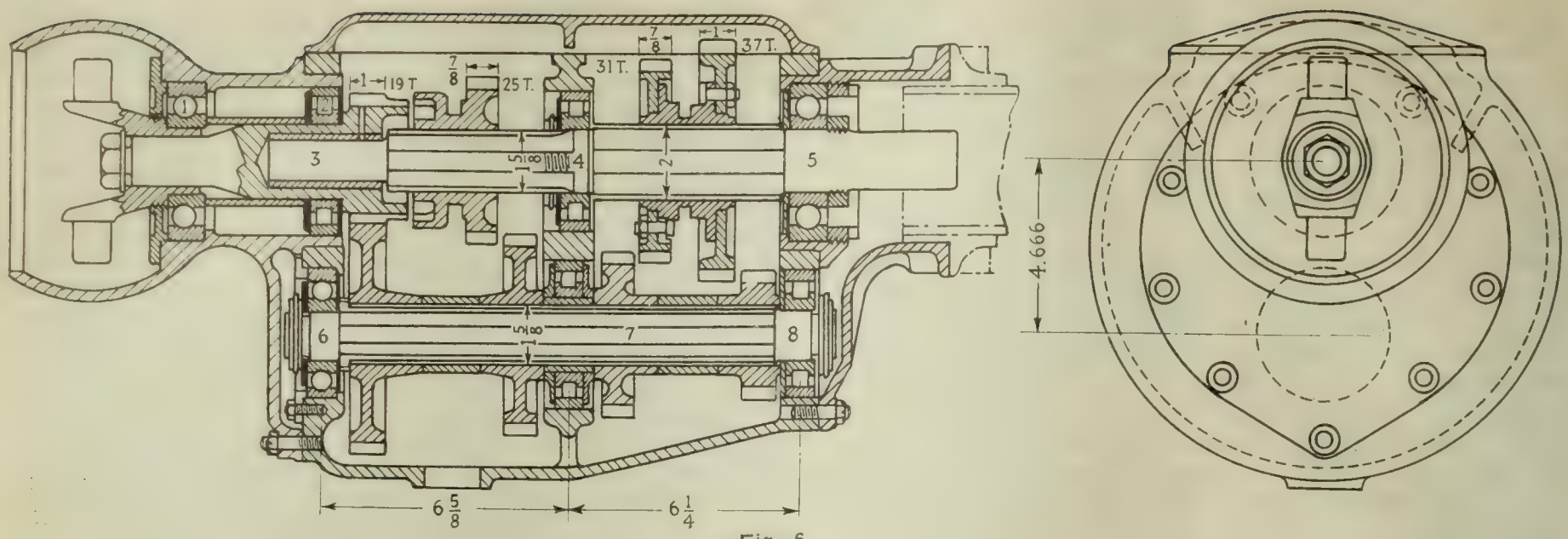


Fig. 6

the method of mounting, the shape and material of the casing, the center distances between the shafts and the distance between the bearings. A special feature of Fig. 6 is the central bearing. It is believed that the circular form of the casing in Fig. 6 will resist stresses better than the box form as in Fig. 5. Two methods of mounting the improved design are shown, the object in both cases being to avoid transmitting chassis distortion to the box itself. In Fig. 6 the ball end to the casing could be set in a socket secured to a cross-member of the frame, the rear end of the casing being secured to the torque tube. The front and rear ends would be malleable castings and the central portion would be of aluminum. With this construction the casing would be well reinforced and further strengthened by a vertical wall in which the central bearings would be housed. In Fig. 6a the box is bolted directly to the engine casing, a practice which is to be noticed in many new designs. It seems to predominate in American and French cars. A few models are now made with the ball joint and torque tube mounting.

The outside dimensions of Fig. 6 are greater than those of Fig. 5. The distances from bearing to bearing in Fig. 6 are 6⅝ in. and 6¼ in. as compared with 10¼ in. in Fig. 5. The center distances are 4.666 in. in Fig. 6 and 3.9166 in Fig. 5, a difference of ¾ in. This increase in center distance is fully as important as the decrease in the lengths of the shafts between the bearings. Larger gears can be used, and there is ample space for housing ball bearings, which are well above their load. Contrasting velocities, loads and stresses are shown in Table I. The velocities of the gears in Fig. 6 are very

Table I

	Gear Velocity, Load and Stress					
	Pitch Line Velocity		Tangential Load		Stress, Lb. Per Sq. In.	
Gear	Fig. 6	Fig. 5	Fig. 6	Fig. 5	Fig. 6	Fig. 5
C. M. pinion.....	1,244	1,114	928	1,038	17,750	20,600
Third slider.....	1,040	928	1,105	1,240	22,400	25,800
Second driver.....	840	742	1,370	1,555	27,750	33,300
First driver.....	638	556	1,805	2,070	34,500	49,250

little higher than in Fig. 5; the loads and stresses are very much less. Good construction is difficult when the center-distance between the shafts is small. Sometimes it is so restricted that ball bearings cannot be used with a proper load-capacity, as indicated in Table II. In this table the maximum bearing loads, the revolutions per minute, and the bearings with safe loads as given by the makers, are shown. In the design shown in Fig. 6 it is possible to use ball bearings with safe loads in all cases. In the design in Fig. 5, on account of the close center-distance, it is impossible to use the makers' "safe-load" ball bearings in bearings 2, 4 and 6. Roller bearings with "safe" loads could be used in 2, 4 and 6. In this case, however, an end thrust bearing should be added in bearing 4. Table III has been compiled to show the maximum and safe loads on bearings which are directly comparable in Figs. 6 and 5. The pilot bearing in Fig. 5 design is shown with rollers. It is often a ball bearing too small to carry the load. Results which are of special interest seem to be brought about by the introduction of a central bearing, as in Fig. 6. Table IV has been compiled to show the effect of this bearing in the distribution and minimizing of loads. The maximum bearing load in Fig. 6 is 1575 lb.; in Fig. 5, 1925 lb. The minimum load in Fig. 6 is 0; in Fig. 5, 275 lb. It is instructive to contrast loads on individual bearings.

Table II

Maximum Actual Loads and Safe Loads

	Fig. 6			Fig. 5		
Bearing Number	Max. Load, Lb.	R.P.M. of Bearing	Safe Load, Lb.	Max. Load, Lb.	R.P.M. of Bearing	Safe Load, Lb.
1	297	1,500	1,540	420	1,500	1,180
2	1,287	1,500	1,500	1,327	1,500	1,180
Spigot						
3	262	....	....	862	532	*1,220
4	1,202	620	1,880	1,925	400	1,870
5	1,505	396	2,500	810	850	1,320
6	803	770	1,490	1,870	850	1,320
7	1,030	770	1,890			
8	1,575	770	2,930			

*If a ball bearing is fitted here, as is often the case, it would have a safe load of 620 lb.

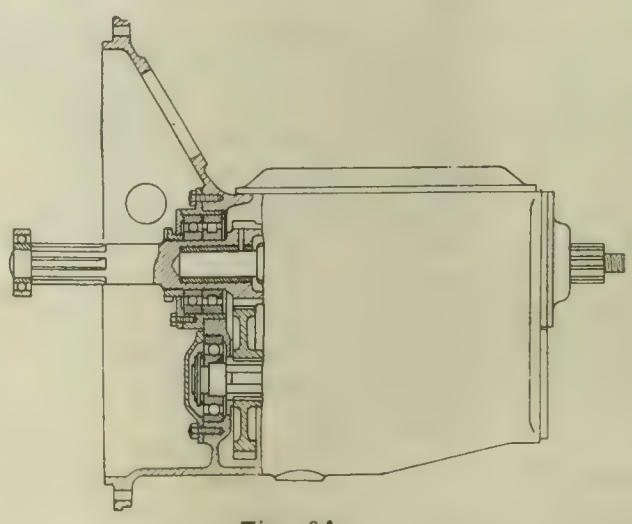


Fig. 6A

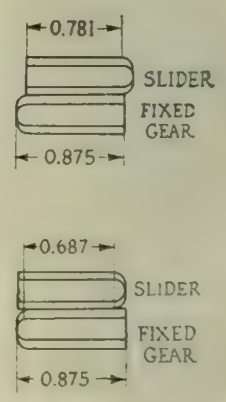


Fig. 7

Table III

Maximum Actual and Safe Loads on Like Bearings in Lbs.

Fig. 6			Fig. 5		
Bearing Number	Max. Load	Safe Load	Bearing Number	Max. Load	Safe Load
1	297	1,540	1	420	1,180
2	1,287	1,500	2	1,327	1,180
3	262	....	3	862	1,220
5	1,505	2,500	4	1,925	1,870
6	803	1,490	5	810	1,320
8	1,575	2,930	6	1,870	1,320

The pilot bearing is an inherent weakness of the standard gearbox. With the central bearing this weakness is partly neutralized. The overhung ball race in Fig. 5 supporting the pilot end of the main shaft should be contrasted with the plain pilot bearing in Fig. 6, which is seated well inside the constant-mesh pinion. In Fig. 6 this bearing on the first speed and second speed takes no load; in the third speed it takes 262 lb. contrasted with first, second and third speeds in Fig. 5 of 275 lb., 758 lb. and 862 lb. respectively. Bearing No. 6, in Fig. 5, is a bearing which in nearly all four-speed boxes takes the heaviest load when the first-speed gears are engaged. In the box of one well-known car two ball bearings are used in this position. The contrast is, in Fig. 6 (bearing 8), 1575 lb., in Fig. 5 (bearing 6), 1870 lb.; in Fig.

TABLE IV

Bearing No.	Loads in Lb. First Speed Fig. 6	First Speed Fig. 5	Second Speed Fig. 6	Second Speed Fig. 5	Third Speed Fig. 6	Third Speed Fig. 5
1	297	420	297	335	297	340
2	1,287	1,327	1,287	1,045	1,100	1,045
Pilot						
3	0	275	0	758	262	862
4	415	1,925	1,202	897	918	458
5	1,505	810	258	635	0	630
6	803	1,870	803	900	650	480
7	230		1,030		820	
8	1,575		292		0	

5 (bearing 4), on first speed the load is 1925 lb., compared with Fig. 6 (bearing 5) on first speed, 1505 lb. There are several instances where the loads on bearings in Fig. 6 are heavier than on the same bearing in Fig. 5. As pointed out, the increased center-distance in Fig. 6 allows the use of bearings with plenty of surplus capacity. In Table V tooth pressures are contrasted. The difference in favor of gears in Fig. 6 is due to the widths of the gears and to sliding the gears so that the full possible working tooth contact is made use of. This is often overlooked in the standard type of gearbox. Fig. 7 shows the method of overlapping suggested, which increases the length of the box by ⅜ in.

The gears in Fig. 6 are reduced in variety as far as possible. The gear teeth numbers are duplicated; there are two 19-teeth, two 25-teeth, two 31-teeth and two 37-teeth gears. The variety of teeth in the gears in Fig. 5 is quite common, and is an unnecessary addition to costs and trouble in gear-tooth finishing. The gears in Fig. 6 are in all cases designed to facilitate the cheapest production on the most costly operation, that is, tooth-finishing. Some of the gear teeth can be finish-ground, four at one setting. The sliding gears in Fig. 6 have a much better seating on the main shaft than the sliding gears in Fig. 5; the space between the fixed gears is, however, greater in Fig. 6 than in Fig. 5, but shaft deflection is prevented by the central bearing. That portion of the main shaft on which the second and first-speed gears slide, is made larger in Fig. 6, principally to facilitate assembling. The particular design of the first, second and third-speed sliders is suggested in Fig. 6, so that these gears, when under load, will be close to the supporting bearings. As the gears taking the heaviest loads, the first speeds in Fig. 6 are made with a wider face than the third and second-speed gears.

Recommended methods of locking up bearings are shown in Fig. 6. They are so locked that the end thrusts are taken on the ball bearings Nos. 1, 5 and 6. The other bearings are rollers and have a free end movement. With this construction it is impossible to throw loads on to the ball bearings which they are not made to carry. It hardly needs to be mentioned that with the central bearings all gears are well supported when under load, much better, indeed, than they would be with abnormally large splined shafts with no central bearing. Production costs of a box made on the lines suggested in Fig. 6 should be but little in excess of those of a box as in Fig. 5. The number of parts is increased by two central bearings, and the end pieces to the casing are more expensive. Weight will be somewhat increased, but this is essential to substantial mounting for highly stressed gearing. For many years the endeavor has been made to get good results from the conventional design—it has failed. The motor car maker must decide whether he will carry on with the old type or not. No box is known in which are embodied all the principles shown in Fig. 6, though each separate detail is to be found in different boxes. To get the best results they should be combined. To do this and not increase weight over that of the usual design is impossible. As previously stated, stability and rigidity must be the guiding principles of gearbox design. These principles cannot be adhered to if flimsy construction is permitted. With correct methods of manufacturing, total costs of production of an improved design need not exceed those now paid when the endeavor is made to supply a good running box of inferior design.

TABLE V

Gear	Tooth Pressure per Inch of Contact — Total Face. In. Fig. 6 In.	Total Face. In. Fig. 5 In.	Actual Contact, In. Fig. 6 In.	Actual Contact, In. Fig. 5 In.	Lb. per In. of Contact Fig. 6	Lb. per In. of Contact Fig. 5
C. Mesh	1.0	1.0	1.0	1.0	990	1.100
Third Speed	0.875	0.875	0.781	0.687	1.510	1.920
Second Speed	0.875	0.875	0.781	0.687	1.870	2.410
First Speed	1.0	0.875	0.8125	0.687	2.360	3.200

Fig. 6 is intended to illustrate as far as possible the principles which must be followed in gearbox design if quiet running is desired. No claim can be made that a box exactly as shown will be the ideal box. As before stated, such a box cannot be produced without individual experimental and development work. Design will vary, of course, to meet the service called for by the car in which it is mounted.

Simplified Theory of the Magneto

THE Bureau of Standards has recently made some experiments on ignition for the National Advisory Committee for Aeronautics. Part of the results of these investigations have been published in a paper known as Report No. 123.

This paper describes a type of circuit which has been found useful for representing the action of the high-tension magneto. While this equivalent circuit is relatively simple, and consequently can be used as a basis for deriving definite mathematical formulas for induced voltages and similar quantities, it has been found experimentally to correspond quite closely in its performance with the highly complicated electrical circuits of an actual magneto. In the paper, formulas are given for the voltage induced in the secondary under various conditions of operation, and a number of numerical examples are worked out, showing the application of the equations to a variety of practical problems.

A copy of Report No. 123 may be obtained from National Advisory Committee for Aeronautics, Washington.

The "All-Purpose" Tractor on the Modern Farm

Farmers must have machines designed to perform a multiple of tasks, not those for one or two uses. This writer is of the opinion that unless a change to this effect is brought about the industry will go backward.

By J. S. Clapper*

I KNOW I am subjecting myself to criticism by some of the tractor men in going on record by saying that unless some changes are made by the manufacturers, and that very quickly, the tractor business has reached its peak and it will be a long time before the farmer can be persuaded to accept the present type of machine and to do his part in motorizing his farm.

There is too big a gap between what the manufacturer receives for his product and what the farmer has to pay. The manufacturer does not get enough money to later meet all the demands made by the selling organization and the user. I am of the opinion that the tractor industry has reached the most critical period in its history and, whether it goes forward or goes backward, depends entirely upon the manufacturer and the sales organization through which all products must find an outlet.

That the tractor business is sick, we must all admit, but, how many of the manufacturers have made the proper remedy, I do not know. But I do know that some of the large manufacturers of accessories, necessary to the production of tractors, as well as the managers of some of the most prominent advertising mediums are fully awake to the situation and are trying to place some of the actual facts before the manufacturer. We all know that it takes more courage to correct a mistake than to suffer with it for years.

From my observation I am thoroughly convinced that the farmers have been quicker to appreciate the possibilities of applying mechanical power to their farm operations than the manufacturer and I base this statement on the fact that the manufacturers as a whole have held to a "one-purpose" machine, expecting the farmer to arrange his work to fit the machines instead of analyzing the farmer's conditions and supplying him with a machine that will fit the work to be done on his farm. I think this comes more from following the old custom of designing and perfecting a machine or implement to do one certain class of work.

In the development of the tractor in the early days there were only two operations considered by the manufacturer: first, the breaking out of the large acreage of prairie sod and, second, the pulling of separators for threshing or belt power. I often wonder if the manufacturer of farm implements has ever given the farmer the credit he is entitled to for the part he has played in developing and perfecting every farm implement that has been put on the market. It was the farmer who first discovered he could pull disk-harrows and a battery of seeders and hook up the binders for cutting grain with his tractor.

No one who has any knowledge of farming with horses, in the strictly grain section, and has seen them replaced by a well designed tractor can question its adaptability and the wonderful saving over horses, and it was in this field that the present type of tractors have been developed and found such a ready market but this field is small as compared to the entire acreage cultivated; besides, I'm wondering if the demand has not already been supplied.

A tractor designed to meet all the conditions and requirements in the diversified farming sections will find five prospective purchasers where there is one for the "one-purpose" machine. It is only necessary to consult the government figures, that show the annual acreage devoted to row crops every year in the different states which must be cultivated from three to five times each season, to convince anyone of the possible demand for the all-purpose power plant on the farm.

I believe the government report further shows that there is a total annual loss of $232,644,000 because of weeds in corn, cotton, potatoes, beans, sugar beets, sweet potatoes and soy beans from the lack of proper cultivation, and it has been my firm conviction for several years that with the experience we have all gone through, it was entirely practical and feasible for the engineers and manufacturers to correctly analyze the farmer's requirements and hold their design and actual accomplishments to fit the work to be done.

The most difficult operation in farming is the first and second cultivation of the tender plants and, unless the operator has an entirely unobstructed view of the rows and the machine has the necessary flexibility so that the cultivating teeth or the shovels will respond promptly to every move of the operator, good clean cultivation is not possible without injury to the plants. Unless we can give the farmer a machine capable of doing equally as good cultivating, easier and more economical to operate and which will perform the work faster with less effort on his part than can be done with horses, we have little argument to persuade him that he should motorize his farm.

What argument can a salesman put up to the farmer today to persuade him to invest twelve to twenty-five hundred dollars in a machine with the present price of horses and feed when the records show tractors have replaced only 20 per cent to 22 per cent of the horses. What would be the result if another salesman could show this same farmer a machine so adaptable to his work that it would actually replace 75 to 80 per cent of his horses and 40 to 60 per cent of his surplus labor and the price was within his reach.

The machines must be readily adapted to the different classes of work and at a price within the farmer's purchasing power, which has now reached the lowest point in our history.

The "all-purpose" machine or a machine so designed

*President of the Toro Motor Company, Minneapolis. Condensed from a paper read before the Minneapolis Section of the S. A. E.

that it can be easily adapted to more different kinds of work on the farm is entirely practical and will be readily accepted by the farmer who is looking for more improved and economical methods. I do not want to be classed as a pessimist as there is no one engaged in the tractor business more optimistic over the possibilities of power farming or the success of motorizing the farm than I. We must motorize our ideas and our own products before we can expect the farmer to motorize his farm.

On January 1, 1920, the Agricultural Department at Washington reported a total of 246,000 tractors on the farms in the United States or about one farm out of every 28. The states showing the highest percentage of all farms, reporting tractors in 1920 were as follows:

South Dakota	16%
North Dakota	15%
Montana	12%
California	10%
Kansas	10%
Illinois	9%
Iowa	9%

The complete report released by the department covering the year 1920 gives the total valuation of all farm equipment manufactured in the year 1920 at $537,000,000. The report further shows there were manufactured in 1920, 203,000 tractors, the value $193,000,000 or more than one-third of the total of farm equipment. It is estimated there were about 160,000 of these tractors marketed during the year.

Now, let us take the acreage of the four principal crops for ten years. The report shows as follows: In 1910 there were 69,000,000 acres of corn; in 1919 63,000,000 of corn or 3,000,000 less than in the year of 1910.

In 1910 there were 32,000,000 acres of wheat; in 1919 53,000,000 or an increase of 11,000,000 acres.

In 1910 there were 27,000,000 acres of oats; in 1919 31,000,000, an increase of 6,000,000.

In 1919 there were 14,000,000 acres of cotton; in 1919 15,000,000 acres, or an increase of 1,000,000 acres.

These figures would indicate there has not been a very great increase in the acreage of the four principal crops during this period but the figures show that the value of farm implement equipment during that period has increased 185 per cent.

It has been the custom of the Agricultural Department to tabulate each season the totals of 22 of the principal crops, one-half of which are row crops requiring cultivation. The following figures are given by states, indicating the difference in valuation of these 22 crops produced in 1919 and 1920:

New York.—Of the 22 crops, there was a drop of $23,000,000; of the total crop, a drop of $32,000,000;

Pennsylvania.—Of the 22 crops, there was a drop of $50,000,000; of the total crop, a drop of $77,000,000;

Maryland.—Of the 22 crops, there was a drop of $18,000,000; of the total crop a drop of $23,000,000;

New Jersey.—Of the 22 crops there was a drop of $3,000,000; of the total crop, a drop of $6,000,000;

Ohio.—Of the 22 crops there was a drop of $173,000,000; of the total crop, a drop of $199,000,000;

Illinois.—Of the 22 crops there was a drop of $344,000,000; of the total crop, a drop of nearly $400,000,000;

Iowa.—Of the 22 crops there was a drop of $263,000,000; of the total crop, a drop of $450,000,000; and

Minnesota.—Of the 22 crops, there was a drop of $197,000,000; of the total crop, a drop of $212,000,000.

It will be noted that the loss in the middle and western states is considerably greater than in the New England states. This is an indication of the shrinkage in the valuation the farmer has taken in the last 12 months.

As regards the machines produced the following figures show the number of manufacturers and sizes of machines made in 1920.

Horsepower	No. of Manufacturers	No. of Machines
8 hp. and less	6	7,678
9-15	8	3,366
16-18	17	107,782
19-22	17	39,964
23-26	24	18,073
27-32	33	12,861
33-39	10	1,410
40-59	15	3,684
60 and over	13	1,389
Total		203,207

Value: Of this total number manufactured, only about 29,000 were estimated sold for export, leaving 175,000 for domestic trade. The total of all farm equipment manufactured during 1920, amounting to $537,000,000, only $66,000,000 was estimated sold for foreign trade, leaving $471,000,000 for our domestic trade.

THE farmers have been quicker to appreciate the possibility of applying mechanical power to their farm operations than the manufacturer. This statement is based on the fact that the manufacturers as a whole have held to the "one purpose" machine, expecting the farmer to arrange his work to fit the machine instead of analyzing the farmer's conditions and supplying a machine that will fit the work to be done on his farm.

It must be remembered our export on all lines of farm equipment declined during the war while production was normal except in 1918 and our surplus, formerly going to Europe, was accumulating here. Then with our enormous increase in production during 1919 and 1920, caused by the urgent appeal of the Government officials, is it not only reasonable to assume we would have felt the effects of over-production in the farm equipment line even though the farmer's product had held up in prices. If you will consult the records as far back as you please, you will find this one thing: Whenever our imports go up and our exports come down so that the imports exceed in value our exports, we feel the effect in all lines of business and not until our surplus begins to move to foreign countries, does business improve to any marked degree.

A great deal has been said and written about selling the country banker on farm tractors. Few really consider the matter from the banker's standpoint. The banks are not in position to extend further accommodations to the farmer until he has liquidated some of his present debts.

A majority of the farmers, who want to buy a gas tractor on time, want the banker to go back of the deal and take the gas tractor as security. We all know that after the machine has been used for one or two years, and put up for sale under foreclosure at the end of the season, it brings a very small part of the purchase price. Besides the banker must judge at the outset whether in his opinion the tractor is going to be a profitable investment for the farmer, especially if he is furnishing the money. If he does not think it will prove a profitable investment, and the farmer has no other resources behind him to take care of the obligations when they come due he naturally refuses to lend the money.

I believe the country banker has been criticized too severely for not financing the farmer in tractor sales.

Fifth Semi-Annual Gasoline Survey

Bureau of Mines reports results of investigation into price and physical characteristics of fuel sold in various localities throughout the country. There has been but little change in quality during the past year, but the price, normally lower in winter, is higher than last summer.

IN order to obtain information concerning changes in the character of motor gasoline, the Bureau of Mines two years ago began a series of semi-annual surveys. The fifth of these, covering gasolines marketed in January, 1922, has just been completed.

The July, 1921, survey showed that the average motor fuel sold at that time had a surprisingly high volatility. This was contrary to expectations, because for a number of years past "summer quality" gasoline has been much less volatile than "winter quality." Gasoline stocks were largely drawn upon during the summer and the country entered the winter period with little more gasoline in storage than is normal.

The present survey shows that the quality of the gasoline being sold during the present winter is, on the whole, similar to that sold a year ago. This indicates that the condition of high volatility reported last summer was only temporary and that there has been no radical change in the refining or marketing methods employed.

Present tank wagon prices are practically the same as last summer. The following table gives some comparative tank wagon prices (in cents per gal.) in the cities indicated:

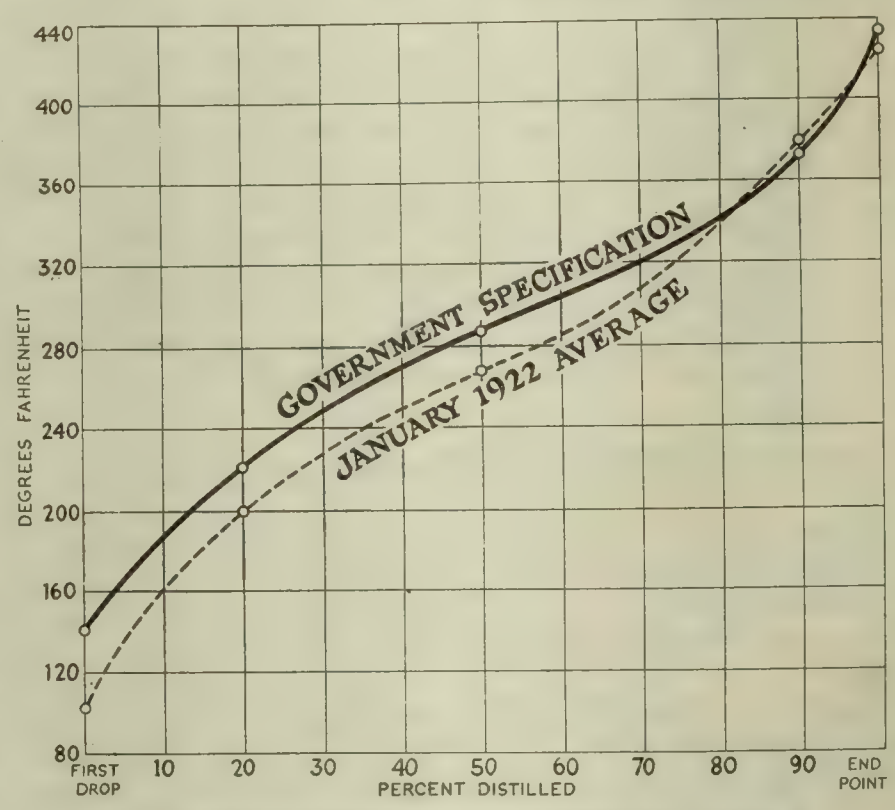


Chart showing how the average distillation curve of gasoline sold throughout the country compares with Government specifications for this fuel

	July 1921	Jan. 1922	
New York City	24.0	25.0	+1
Washington	22.0	22.0	Same
Pittsburgh, Pa.	22.0	23.0	+1
Chicago, Ill.	18.0	19.5	+1.5
New Orleans, La.	17.5	21.5	+4
St. Louis, Mo.	17.4	18.9	+1.5
Denver, Col.	22.0	21.0	—1
Salt Lake City, Utah	25.0	25.5	+0.5
San Francisco, Cal	23.0	21.0	—2
Average	21.2	21.9	+0.7

The bureau's first gasoline survey was made in 1915, a second in 1917 and a third in April, 1919. Two limited surveys were made in 1920. All of these showed a continuous decrease in the volatility of gasoline, probably due to an increase in demand. By January, 1921, however, the volatility had increased to some extent and since that time there has been little change in the gasoline marketed.

Although the general average for the entire country shows very little change from last year, differences are noted when individual cities are compared. A decided improvement is observed in the gasoline sold in Salt Lake City, the initial boiling point decreasing 13 deg. F., the end point decreasing 27 deg. F. and the average boiling point decreasing 24 deg. F. Gasoline sold in Washington, D. C., also showing an improvement, initial boiling point being lowered 20 deg. F.

In this survey 119 samples of gasoline were collected from nine cities, the samples being taken as in previous surveys. The analyses were made in accordance with the methods given in Technical Paper 214 of the Bureau of Mines, entitled "Motor Gasoline," by E. W. Dean. The actual specific gravity at 60 deg. F., corresponding Baumé gravity, initial boiling point or "first drop," 20, 50 and 90 per cent points, end point and average boiling point, and the percentage recovered in the receiver were determined for each sample and tabulated. The average figures for each city, as obtained from this tabulation, are collected for purposes of comparison in the table below, which also includes the average for the nine cities, and an average for the eight cities included in the January, 1921, survey.

Average Results of Motor Gasoline Survey, January, 1922

District	Specific Gravity	Baume Deg.	First Drop	20%	50%	90%	End Pt.	Avg. B.P.	Per Cent Recovered
New York City	0.742	58.6	109	205	268	368	421	268	96.1
Washington, D. C.	0.751	56.6	98	195	259	380	428	264	95.8
Pittsburgh, Pa.	0.733	61.3	93	176	256	390	430	260	94.0
Chicago, Ill.	0.751	56.6	104	208	272	386	442	270	96.4
New Orleans, La.	0.744	58.3	114	212	274	371	428	273	97.3
St. Louis, Mo.	0.743	58.5	96	205	279	386	435	274	95.5
Denver, Col.	0.746	57.8	104	201	266	378	432	268	97.0
Salt Lake City, Utah	0.744	58.2	99	197	261	362	412	261	96.6
San Francisco, Cal.	0.762	53.6	112	208	261	359	421	264	97.2
Average for 9 cities	0.745	58.0	102	200	267	377	430	268	96.0
Average for 8 cities included in January, 1921, survey	0.745	58.0	102	199	266	377	430	267	95.9

Tables were also prepared comparing the averages of each city with those of January, 1921, and with July, 1921.

A distillation curve of the average figures for January, 1922, was prepared as well as the curve for Federal Specification gasoline. Distillation curves for the average figures of January and July, 1921, would be practically identical with that of January, 1922, which is given above.

Authorities Show Need for More Efficient Use of Petroleum

One presents in perspective the economic facts relating to petroleum and interprets these facts in their relation to the oil and allied industries. The other authority deals with the utilization of liquid fuels and his book serves to give the engineer a clearer picture of the combustion process.

By Herbert Chase

"WHETHER the output of petroleum in the United States has actually or almost reached its maximum rate is immaterial. Likewise, the exact size of the unmined reserve is of secondary importance. The point to be emphasized is the coming necessity for increasing the overall efficiency of petroleum—a problem that concerns not only the producers and refiners of oil but the manufacturer of appliances that consume its products as well. From now on the tendency will be to use relatively less of the material itself, but to put greater effort into increasing the service value extracted from it." Such is the statement contained in the preface to a book entitled "The Economics of Petroleum," by Joseph E. Pogue (John Wiley & Son), one of the two best books dealing with various aspects of the liquid fuel situation which have come to our notice within the past year. Standing alone, such a statement would call for relatively little notice, but when made as a result of perhaps the most thorough and comprehensive study of the economics of petroleum ever made, it is worthy of careful consideration. This, indeed, may be said of the book as a whole. The data used are of the most authoritative character and are presented with unusual care and in excellent graphical form. Present trends are projected into the immediate future in cases in which the author considers this feasible from the data in hand.

Fuel Consumption

When the people of one representative State, Ohio, spend from $80,000,000 to $100,000,000 annually on fuel for automotive vehicles, the Experiment Station of their State University need offer no apology for compiling a bulletin in which the economical use of this fuel is discussed at some length. Just this has been done by Prof. C. A. Norman on behalf of the Experiment Station of Ohio State University, and the 200-page book, entitled "The Economical Utilization of Liquid Fuel," which has resulted (it is known as Bulletin No. 19 of the Engineering Experiment Station), is a credit both to the university and the author. Professor Norman, in concluding his book, expresses the hope that adherence to the existing type of throttling carbureting engines will not prevent courageous and broad-gage engineering development in the prime-mover field. He sees great prospects for the injection type of engine for automotive use, but does not reach his conclusions without making a thorough analysis of the advantages and disadvantages of the conventional and various other types.

The opening chapter of Doctor Pogue's book outlines the economic organization of the petroleum industry, and the second deals with the resource situation. Maps and charts showing the distribution of the important oil pools of this country and the world and their relative importance are given. Successive chapters deal with the trend of oil-field development and oil production, the transportation of crude, refinery practice, capacity and outlook. Chapters IX and X, which deal with gasoline and kerosene, should be of special interest to the automotive industry, since its products are by far the largest users of gasoline and also consume large quantities of kerosene. The characteristics and source of straight-run, natural-gas gasoline and cracked gasoline are briefly discussed, and interesting charts, which show how the endpoint has increased and to what extent the total supply has been affected by this increase and by other factors, such as cracking and the use of casing-head, are given. Other charts and the accompanying text cover the various factors affecting demand and show how the demand is divided between various classes of automotive equipment.

Status of Kerosene

The present status of kerosene and the various factors of supply and demand are discussed in similar fashion. It is pointed out that the future requirements for motor fuel loom so large that it is questionable whether it will not ultimately cease to be marketed in any large quantity. The chapter on fuel oil is of less direct interest to the automotive industry, but shows that the future demand for this fuel will probably come largely from automotive sources, as a result of the probable conversion of fuel oil into automotive fuel, on the one hand, and from shipping on the other.

"Lubricating Oils" is the title of Chapter XII, which deals with a subject of prime importance to the automotive industry. Various classes of lubricating oils are discussed and the demand and supply analyzed. It is shown that the demand for automotive lubricants accounts for about a quarter of the nation's output, and that this demand has placed a high premium upon the heavy-bodied cylinder stocks which have consequently risen rapidly in price and are more and more difficult to secure in adequate quantities. This situation has been further aggravated by the tendency toward fuel dilution of lubricants which has accompanied the use of fuels with higher endpoint.

Succeeding chapters deal with petroleum by-products, natural gas and gasoline derived from it, marketing, export and price of petroleum products, relation between price and production of crude, the bearing of automotive transportation upon the oil industry, and the economic

significance of cracking. Chapters XXI and XXII, dealing with composite motor fuels and the motor-fuel problem, contain but little that is new to readers of AUTOMOTIVE INDUSTRIES, but include concise statements on these subjects which can be read with profit even by those who know the fuel situation in its broader aspects, and should prove illuminating to both automotive engineers and executives whose close consideration of immediate problems in their own routine work often find them without a broader knowledge of the fuel situation, which is, after all, of paramount importance.

The concluding chapters of Pogue's book deal with the city-gas problem, international aspects of petroleum, Mexico as a source of petroleum, the relation of the coal industry to the oil industry, oil shale, full utilization of petroleum and the function of statistics in the petroleum industry—subjects which have a more important bearing upon the automotive industry than a mere reading of the chapter titles can possibly indicate. Treatment of these subjects rounds out the author's consideration of the economics of petroleum in most satisfactory fashion, and leave one with a feeling that time spent in reading this book is well spent, as it is for all who appreciate or desire a thorough understanding of the important part which petroleum plays in our modern civilization.

The Economical Utilization of Liquid Fuel

A grasp of the general economic situation in respect to petroleum is a valuable asset, but it is quite as, or perhaps more, important for engineers to understand how fuel energy can be used to best advantage in the development of power, and it is with this in mind, among other objects, that Professor Norman has written the bulletin referred to above. This bulletin is divided into three parts, the first dealing with the oil fuel situation, the second with fuel utilization in combustion engines, and the third with a scientific discussion of combustion engine processes. Articles 1 and 2 of Part I treat briefly of the resources and consumption of petroleum and the forms of oil and their uses, and Article 3 with petroleum substitutes. Much of this information is similar to that under corresponding heads in Pogue's book, but is necessarily much more condensed, and in some instances not quite so nearly up to date as that presented by Pogue, though considerable material useful to the engineer and not given by Pogue is included. Particulars regarding certain physical and chemical characteristics of various grades of gasoline, benzol and alcohol, including the distillation curves of these fuels in their commercial form, are given.

The author quite properly draws attention to the poor average efficiency of automobile engines, especially under prevailing part load conditions, and sees much promise in the development of the injection type of engine, which is more efficient, especially under light loads, than the conventional type.

In Part II the nature of fuel, of combustion and of the heat value of fuel is explained, and the heat values and air requirements for a number of fuels are given. The function of expansion in converting combustion heat into power is then considered, and the necessity for early completion of the combustion and of maximum possible expansion for good fuel utilization is stressed. It is emphasized that compression is of importance to fuel economy only by enabling expansion, and it is pointed out that the fuel economy of Diesel engines is better at reduced load than at full load because the expansion at reduced load is greater than at full load. The variation in mixture requirements of present-day carbureting engines for best economy is discussed.

The evil effects of the burnt residue on the fuel economy of throttling carbureting engines at reduced load is pointed out and various means proposed for overcoming these effects are referred to. The progress of combustion is considered; likewise the nature of knock and the methods of overcoming knock. The difficulties resulting from poor evaporation and distribution of the fuel are taken up and various methods of fuel conversion and charge heating are scrutinized. The influence of friction losses on economy at reduced loads forms the subject of one article; the influence of vehicle speed and gear ratio, that of another.

Comparison of Prime Movers

Steam engines and injection engines can run on fuels heavier than those which a carbureting engine can utilize. Both these classes of engines show better maintenance of economy at reduced load than does the present-day carbureting engine. The possibilities of these two types of prime movers for automotive purposes are discussed and the strong points of each are pointed out.

While Part II contains considerable material that will not be new to those who are familiar with elementary thermodynamics and other related information upon which engine design is based and, while much material already published in papers read before the Society of Automotive Engineers and elsewhere is quoted, the chapter is well worth study and can be read with profit even by those well acquainted with these subjects. It contains, furthermore, some tabular and other data useful for reference purposes.

Part III, as its title indicates, is largely a scientific and somewhat theoretical though none the less useful consideration of the combustion engine process. The treatment of the subject is primarily of interest to students of thermodynamics, but is so presented as to be readily used by most engineers who are apt to have the inclination to apply it, as they may well do in their analysis of problems to which it refers. The author has made an effort to present the material as clearly as possible and in very usable fashion. The data on dissociation and on specified heat of combustion gases at various temperatures is of great value, as is also the entropy chart which the author and his associates have worked out with no little labor and, the author believes, for the first time in American units. It is of great value in the study and understanding of combustion phenomena, and is a credit to those concerned in its preparation. By its use it is possible to closely predict the probable efficiency of various types of internal combustion engines, including gas turbines.

Germany to Resume Aircraft Manufacture

NO aircraft has been manufactured in Germany since the acceptance of the Treaty of Versailles. Production of aircraft in that country was prohibited for a certain period by the peace treaty, and this period was later extended as a penalty for the destruction by the Germans of a number of Zeppelins which, according to the peace terms, were to be delivered to the Allies. This prohibition period expires on May 5 next, at which time the Allied Air Control Commission, under the direction of the British Air General Masterman, will discontinue its activities.

While the aircraft industry in Germany has been dormant for the past four years, it was kept alive by the Government, which recognized in it a great national asset. Now that the Germans can resume the manufacture of commercial airplanes without restrictions, it is expected that the business will develop rapidly.

Economics of Highway Transport

This outline shows the scope of the highway transport field and the study necessary for development. Economic phases of highway transportation are discussed and illustrated by means of a Topical Outline Chart.

A TOPICAL outline of data to be developed concerning the economics of highway transport has recently been issued by the Highway and Highway Transport Education Committee. This outline, while tentative in nature, indicates clearly the scope of the highway transport field and the studies necessary in its ultimate development. While issued primarily for the aid of teachers and students, this outline is of definite interest to manufacturers, since the automotive industry is basically interested in the development of the educational work involved.

This preliminary topical outline of the economics of highway transport was prepared by Lewis W. McIntyre, assistant professor of civil engineering, University of Pittsburgh. It is designed to stimulate interest in the economic phases of highway transportation and to aid the experiments being carried on by experts in various parts of the country, to whom officers and taxpayers alike may turn for the fundamental data without which developments of this character cannot be intelligently planned.

The report presenting the outline states that "the outline makes no pretense of being either complete or adequate." It has been limited in various ways. The newness of the subject and the consequent lack of authoritative research make definite conclusions and principles impossible.

Some of the topics are capable of considerable expansion; their use will be determined by the local situation. Others may be used almost as outlined. It is confidently expected that use of the outline will develop innumerable suggestions for its revision. Such suggestions and constructive criticisms will, we are informed, be greatly appreciated.

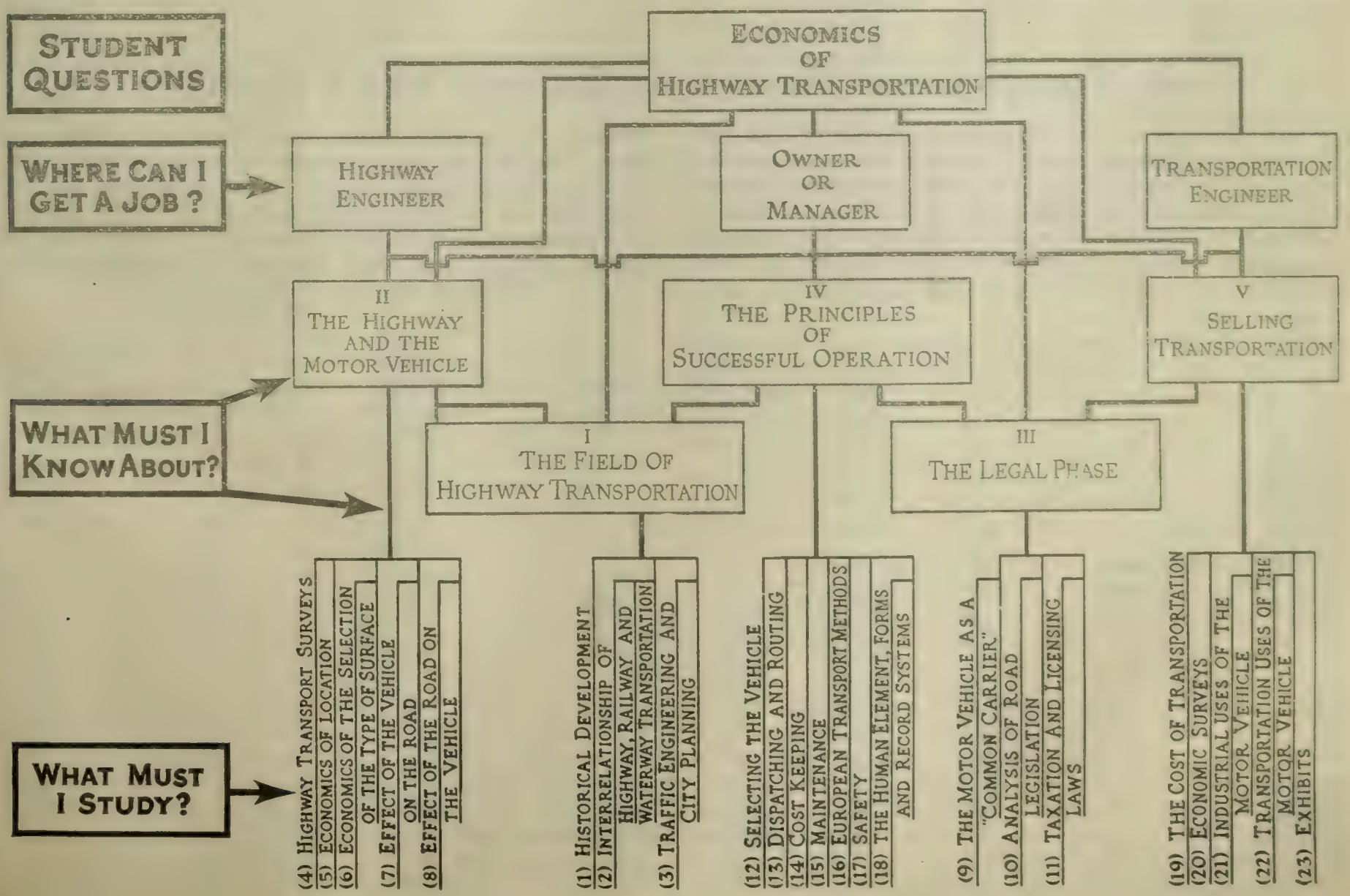
The outline is as follows:

I—The Field of Highway Transport

(1) Historical Development.—Steps in the development; relation of transportation to civilization; problems awaiting solution; magnitude of the problems; the highway program; the field for trained men; salaries available; probable future development.

(2) Interrelationship of Highway, Railway and Waterway Transportation.—Correlation of all forms of service; the electric railway and highway transport; the steam railway and highway transport; the waterway and highway transport.

(3) Traffic Engineering and City Planning.—Relation of



transportation problems to city planning; historical development of city transportation; street traffic problems; street railway problems; traffic regulation.

II—The Highway and the Motor Vehicle

(4) Highway Transportation Surveys.—The traffic census, its purpose, use and limitations; economic survey of transportation; needs of local industries; use of vehicle registration data; intangibles; capacity; peak loads, etc.

(5) Economics of Location.—General considerations; minor details of alignment, distance, curvature, rise and fall and their effect on the cost of transportation; ruling gradient and curvature; typical calculations of effect of these items on operating expenses; justifiable expenditure for their reduction; virtual profile.

(6) Economics of the Selection of Type of Surface.—Adaptation of motor vehicle and highway to one another; limiting factors; economical traffic unit; typical calculation of economical traffic unit; other factors affecting type of construction; economical life.

(7) Effect of the Vehicle on the Road.—Type of vehicle; horse-drawn, high-speed, rubber-tired motor truck stresses induced; types of failure; effect of weight; effect of speed; impact; experimental investigations; types of roads, rigid and non-rigid; traffic intensity; unsprung weight; pneumatic tires.

(8) The Effect of the Road on the Vehicle.—Stresses in motor vehicle; stresses due to load; twisting strains caused by road irregularities, shocks caused by rough roads; driving shocks and loads; braking shocks and loads.

III—The Legal Phase

(9) The Motor Vehicle as a Common Carrier.—The Trend of existing legislation; operation on regular routes; hauling for selected patrons; passenger service; freight service; effect of regulation; result of non-regulation; arguments pro and con; constitution of the regulating body.

(10) Analysis of Road Legislation.—Development of the theory of road laws; analysis of existing laws; effect on transportation; possible changes.

(11) Taxation and Licensing Laws.—Methods of taxation, gasoline tax, tonnage tax, tax according to use, etc.; weaknesses of present systems; outlook for the future.

IV—The Principles of Successful Operation

(12) Selecting the Vehicle.—General requirements; types available; factors affecting selection; body design; trailers; demountable bodies; special bodies; tires.

(13) Dispatching and Routing.—Fundamental principles; scheduling; co-ordination of loads and vehicles; zone system; analyzing routes by time studies; minimizing delays at ferries, terminals, etc.; selecting of routes; loading and unloading devices.

(14) Cost Keeping.—Importance; desirability of uniform system; results desired; data necessary; National Standard Cost System; Commercial Vehicle System; other systems.

(15) Maintenance.—Serious effect of improper maintenance; lubrication, inspection; effect of over-loading; effect of over-speeding; typical systems of maintenance; garage problems.

(16) European Transport Methods.—European transport problems and their solution; application to American conditions.

(17) Safety.—Grade crossings; guard rails; footpaths, etc.

(18) The Human Element, Forms and Record Systems, Etc.—Importance of esprit de corps and how to maintain it; typical bonus systems; mechanical checking devices; bills of lading, etc.

V—Selling Transportation

(19) The Cost of Transportation.—Factors entering into complete cost of transportation; crating; terminal charges, etc.; effect of road conditions on cost of highway transport.

(20) Economic Surveys.—Purpose; surveys of business operations; public haulage surveys; community transportation surveys.

(21) Industrial Uses of the Motor Vehicle.—Farming; lumbering; mining; factory; construction.

(22) Transportation Uses of the Motor Vehicle.—As feeder to railways and waterways; flanged wheel equipment; intercity trucking companies; rural motor express; motor buses; local uses.

(23) Exhibits.—Highway, rubber and automotive exhibits.

A Comparative Report on Rubber Tire Exports

SOME thirty sizes of metric tires, twenty of inch-size fabrics and twenty-two of inch-size cord tires are included on the export list. This was shown in a recent statement made by the Rubber Division of the Bureau of Foreign and Domestic Commerce, listing the exports during two representative months of last year. The figures were compiled from reports to the Rubber Association of America, Inc., representing more than sixty individual firms. The two-month record shows the variation in percentage. Its chief interest is in the sizes and in the comparison of clincher and straight-side. Three-fourths or more of the fabric tires, inch size, are shown to be of clincher construction, while more than four-fifths of the cord tires were straight-side. The figures follow:

Metric Sizes	Per cent total for July	Per cent total for November
700 x 80	.5	8.8
700 x 85	.2	.3
750 x 85	...	...
710 x 90	2.6	1.8
760 x 90	4.7	1.4
810 x 90	3.3	1.3
910 x 90	...	...
760 x 100	...	.8
810 x 100	*	*
870 x 100	...	*
765 x 105	2.0	3.1
810 x 105	...	...
815 x 105	9.9	22.8
875 x 105	2.4	5.1
915 x 105	...	*
815 x 120	.9	2.3
820 x 120	24.7	9.1
875 x 120	.4	.8
880 x 120	32.9	13.1
920 x 120	4.7	4.0
1020 x 120	...	...
815 x 125	.7	...
875 x 125	...	...
820 x 135	1.0	4.8
880 x 135	2.6	6.7
895 x 135	1.3	4.5
920 x 135	.1	...
935 x 135	4.4	3.6
895 x 150	.5	5.7
935 x 150	.2	*
Misc.	*	...

*Negligible quantities.

Inch Fabrics Sizes	Per cent total for July		Per cent for November	
	Clincher	Straight-side	Clincher	Straight-side
30 x 3½	*	...	...	...
28 x 3	19.7	...	.3	...
30 x 3	42.6	...	21.5	...
31 x 3½	...	...	...	...
31 x 3½	...	...	54.7	...
31 x 4	7.3	...	6.9	x
32 x 4	*	1.0	x	3.1
33 x 4	*	4.5	.1	3.7
34 x 4	...	.9	...	.8
36 x 4	...	...	...	...
32 x 4½	...	14.3	...	2.4
33 x 4½	*	.3	...	.6
34 x 4½	...	1.2	x	.5
35 x 4½	...	.5	...	.3
36 x 4½	...	.2	...	x
33 x 5	...	*	...	.3
34 x 5	...	...	...	...
35 x 5	...	.1	...	.5
36 x 5	...	...	...	...
37 x 5	...	*	...	x
Misc.	5.0	...	1.9	x
Total	74.6	25.3	85.4	14.5

*Sizes marked thus amount together to a total of 1/10 of 1%.
x Sizes marked thus amount together to a total of 1/10 of 1%.

Cord Tires Sizes	Per cent total for July		Per cent total for November	
	Clincher	Straight-side	Clincher	Straight-side
30 x 3	...	...	...	...
30 x 3½	16.5	...	11.1	...
32 x 3½	...	2.2	...	2.5
31 x 4	.2	...	...	3.5
32 x 4	...	7.3	...	5.5
33 x 4	...	10.4	...	9.5
34 x 4	...	2.8	...	2.1
32 x 4½	...	27.0	...	28.6
33 x 4½	...	7.2	...	4.8
34 x 4½	...	8.2	...	7.6
35 x 4½	...	2.96	...	2.6
36 x 4½	...	.7	...	.9
33 x 5	...	2.6	...	6.0
34 x 5	...	.2	...	.5
35 x 5	...	5.6	...	8.2
37 x 5	.04	.9	...	1.5
36 x 6	...	3.2	...	2.7
38 x 7	...	1.3	...	1.5
40 x 8	...	.7	...	.4
42 x 9	...	...	...	...
44 x 10	...	...	...	...
48 x 12	...	...	...	...
Misc.	...	...	...	.5
Total	16.74	83.26	11.1	88.9

Labor Courts Do Not Solve Problem

Ten States are planning to pass bills modeled after the Kansas Industrial Court law. Despite immediate advantages such courts do not go to the heart of the problem. Labor and rewards should not be standardized.

By Harry Tipper

THERE are pending in ten states bills modeled along the lines of the Kansas law for the establishment of industrial courts with the expectation of eliminating strikes. The effect of the Kansas law has been considered satisfactory by many people interested in the subject, and there is a definite agitation for further laws of this type. The American Federation of Labor is very active in combating these laws and a large part of the time in the hearing before Committee of the New York Legislature was devoted to the speeches of Gompers and others from the Federation ranks against the introduction of such a bill. The industrial court, as it has been established, has not eliminated the strike, although it has undoubtedly prevented a good many strikes from maturing and has lessened the losses incident to many of the local strikes which occur frequently from trivial causes and without any sound reason.

This method of dealing with industrial disputes does not prevent the dispute at all, or do anything to take away the original reasons for disputation. It simply attempts to limit the dispute and to impose a settlement before the production is stopped by the impossibility of agreement. It has many advantages, but it is not a cure-all for industrial troubles as so many sponsors seem to feel. It must take into consideration only general conditions involved in the strike and these conditions invariably resolve themselves into wages or hours of labor, etc.

One of the important difficulties in modern business is the standard of wage and the tendency to classify all workers of a group by the same standard compensation. Laws of this kind tend to legalize this classification and to further standardize compensation. This is not desirable.

The whole weight of modern study of the labor problem should be put upon the development of the industrial unit as an organization and, therefore, the elimination of separate classifications of workers and management. Otherwise the differences that are continually disturbing the industrial fabric will continue, in spite of industrial courts, national conferences or other means of adjustment.

The factory is not an organization as it stands at present, and it cannot be an organization until the spirit and machinery of organization is such as to provide a common viewpoint and object through the entire working force. None of the legal methods so far proposed are of any value in this particular, and no systems could be suggested of a general character which would be of any value.

While the introduction of these bills before the legislatures of ten states is indicative of the activities of many people who are looking for a short cut to the millenium of industrial peace, the progress of experiments in individual industrial organizations is a very much more important indication of the real tendency of affairs. Since the earlier profit sharing and employee representation experiments were developed, there have been established in the United States over 1300 such systems in individual factories or other establishments. From the progress of these experiments and from their influence upon surrounding conditions, we shall be able to study the possibilities in increasing human efficiency and organization unity much more closely. The wide diversity in the character of these experiments, the common object of organization building which inspires them, and the common desire for increased efficiency which maintains them, offers a hope of progress not exhibited in any of the general systems and legal suggestions so far put forward.

On the surface, the problem of securing labor efficiency and a reasonable degree of stability and contentment is not so acute as it was in the after-war period to the middle of 1920. Statistics show, however, that almost as many strikes have occurred of late as occurred in the previous period, and the general record of the movement of labor does not suggest that the problem is different from what it has been.

The introduction of these bills before various State Legislatures indicates a revival of the tendency to introduce legal restrictions upon the industrial settlement of these matters, a tendency which we have referred to many times in AUTOMOTIVE INDUSTRIES. The hearings which have occurred indicate a lack of interest on the part of business in the progress of political action upon labor matters. There are a number of individuals and groups actively engaged in promulgating the idea of industrial courts for adjustment of disputes, and of other legal machinery for the settlement of industrial disturbances. It will be necessary for business men to analyze these suggested methods and determine, with a full knowledge of the situation, if they are likely to prove of value. Otherwise, the corporations in various states may find themselves limited in their organization development, and in their discussions and conferences with bodies representing labor, by the legal machinery provided by the state. Because of the fact that these methods are being proposed in so many states, an analysis of the original Kansas law would be interesting and important to manufacturers. We shall undertake this in an article in the near future.

Despite the advantages from an immediate standpoint, the establishment of industrial courts does not present a solution of the matter and in some particulars is to be questioned.

One point should be understood very thoroughly in connection with all general means suggested for legislative action regarding industrial disputes. All industrial courts, national adjustment conferences, or other legal bodies, will tend to encourage the formation of labor and employee associations, unions or other bodies, because the necessities of the work of adjustment will require the affected parties to associate themselves more closely, in order to use their combined strength in disputes.

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Systems

INCREASING competition and the difficulties in finding a market for a large automotive production are lending impetus to the study of markets. To do this many different systems of definite values will be instituted and others which will prove invaluable after a tryout, but in any event the action decided upon must be carried through to a conclusion.

Information on marketing subjects is only valuable in so far as it is accurate. The system employed to obtain market information is only valuable in so far as it is rigidly adhered to by those persons who are responsible for carrying it on. Following the action through entails a careful and constant checking up on the system, and this should be done by authorized representatives who realize the necessity for accuracy.

Much can be done to make employees realize the importance of perpetually keeping up a system by giving them an insight as to its object and instill respect for it by a businesslike checking up.

A system which is allowed to "run to seed" does nothing but breed contempt for itself and expense for the company. If such laxity is continued it becomes increasingly difficult to gain co-operation for any system whether its value is apparent or not.

Fundamental Research

THERE are so many industrial problems requiring fundamental research that the automotive manufacturer can scarcely be blamed if he fails to find time in the course of a busy life to follow in detail the various developments. In another sense, however, there is no business more important to the permanent progress of industry than the proper conducting of just this fundamental research and the proper interpretation of its results.

Fuel research, for example, is vital to automotive development. Although some of the work going on may seem a bit super-scientific to the average executive, he can well devote time and effort to fostering and encouraging such efforts by responsible agencies, for upon the successful solution of the problems involved depends in a great measure the future of the automotive industry.

Standardization work, although involving chiefly engineering problems, has a definite bearing upon commercial development. The elimination of waste in manufacturing and selling is being investigated and constitutes another problem for fundamental research of vital character.

Labor and unemployment research is about to be carried on under Herbert Hoover's supervision in a manner never before attempted in this country. The research is now being outlined and when completed will be of extreme value to industry, provided industrial managers furnish the essential co-operation in gathering the necessary data. This survey will first take account of what is shown by the present inadequate statistics concerning unemployment. Data will then be compiled showing types of unemployed, unemployment problems that require further data, under-employment, an index of employment, relation of unemployment to business cycles, and present social cost of cyclical employment. On the basis of this data conclusions will be drawn, the various proposed remedies will be analyzed in the light of the facts developed, and plans for future improvement will be laid out.

While all these researches are slightly removed from the very immediate daily problems of the executive, they are concerned with vital questions pressing for solution in the very near future. The data which they are designed to develop are essential to the efficient and progressive functioning of the automotive industry.

Advertising Appeal

"THE appeal to snobbishness in automobile advertising is a dead letter. Prospective buyers want to know what transportation service they get for their money." Such was the statement made recently by an advertising man handling high-class accounts. It is a fact that many manufacturers of cars in the upper price group use the appeal of exclu-

siveness as their strongest selling talk. This brings forward the question whether the advertising man's statement was wrong or whether he was just one jump ahead of the crowd. It remains to be seen.

It is evident that prospective buyers of cars in the lower price group are weighing values as never before. The question arises whether the same searching tests for value are being applied by the prospective purchasers of high-priced cars.

Luxury and refinement of appearance have always been more or less stressed in high-priced car advertisements, while the idea of sustained fine performance has been used in a minor key. Is this the best way to sell the cars? Is it not possible that many people would buy high-priced cars if they realized that they were buying more than luxury of appointment and appearance? Are there not many people that appreciate high quality to whom exclusiveness carries little weight?

The increasing refinement in the medium-priced car makes it imperative to give a close examination to the selling argument of refinement. A careful analysis of the reasons for the sale of each high-priced car would undoubtedly furnish much information of value in determining just what advertising appeal will bring in the greatest return.

What Do Dealers Want?

THE last year and a half has seen a survival of the fittest among dealers. Dealer turnover has been high in many car organizations. Competition for good dealers is on the increase. The need for efficient and sound dealers has become a necessity. These facts make it interesting to analyze what factors in a manufacturing organization are likely to be attractive to the best type of dealer.

Dealers are just human beings, so it may be laid down as a general rule that the best type of dealer will react favorably to the same sort of appeal as will the best type of man in general. Considering this in conjunction with the necessity for more efficient marketing, it would appear that practical co-operation in the solution of marketing problems will be one potent appeal. The appeal made by one car manufacturer, for instance, in seeking new dealers illustrates well the sort of constructive, sane help that is likely not only to help build a good dealer organization, but also to go far toward reducing marketing costs. This manufacturer in attempting to sell his franchise to dealers, advertises in part as follows:

"How profitable is a Blank franchise? What can I make? How many prospects in my territory? Are sales increasing? These and many other questions will be gladly answered by our Opportunities Department. This department devotes itself to surveys of territories now having Blank representation and those where openings exist.

"It does not generalize, but gives facts. It can show, in actual figures, what results have been obtained in different territories. But it will be glad to study your own community very thoroughly and show you what can be expected."

The company which knows most about its market is in the best position to allot territory and to take on dealers to the mutual profit of all concerned. Knowledge and facts are coming to play a larger part each year all along the line of automotive marketing.

The $348 Car

FOR years Ford has stood supreme in the low-priced passenger car field, and through the establishment of a wonderful production plant and organization, an unusual marketing system, so far as the sale of cars is concerned, and a liberal service policy, has come to occupy a position which has been thought unassailable by many who are presumed to know the trade. Emphasis has, however, always been placed upon the production of a completely standardized product, the design of which has remained practically unchanged for a decade, while many competitors have incorporated refinements which the public has learned the advantage of having. This has proved a highly profitable commercial policy for Ford, who has been able to sell all the cars he could build during most of this period, but has in a way played into the hands of his nearest competitors in the price scale, who have had good arguments to advance in respect to features not incorporated in the Ford chassis and body. A large proportion of the car users in this country have appreciated and been willing to pay for refinements, many of which were prohibited under the policy which Ford has followed.

Now comes Durant, with wide experience in the industry, and, with the aid of parts makers whose combined facilities are perhaps as great as Ford's and rather more flexible, announces a plan for the production at Ford's present prices, of a car which incorporates many of the refinements and other features which have come to be associated with cars in the next higher price scale than the present Ford.

This, of course, has created intense interest upon the part of the whole passenger-car industry and resulted in much speculation as to what move Ford will make when and if the new competitive factor is developed to the extent anticipated. It also furnishes food for thought as to the probable effect upon the market for cars in the next higher price class than that directly involved.

The parts makers have long been a large factor in the automotive industry, and may be on the road to becoming a still larger element. On the other hand, Ford has apparently found it more desirable to make than to buy most of the components in his cars, and now follows this practice to a large extent. Whether experience will ultimately prove that a similar course is expedient in the case of the new product shortly to be placed in production remains to be seen. The results of the new venture will in any case be watched with great interest, and will, it seems certain, serve to heighten competition in the low-priced car field. However, Ford has a long start and a reputation for rendering real service to the users of his product—a policy which those who seek to compete with him cannot afford to overlook, and may well emulate.

1,000 Daily Output Planned for "Star"

Predicted Production Facilities Alone Will Limit Sales—Orders for June Delivery

NEW YORK, March 13—The new Star which was unveiled at Washington last week and which will be shown at Boston this week in the show rooms of the Collins Motor Car Co. already has created a considerable sensation in the automotive industry. Keen observers have no hesitation in saying that its sale will be circumscribed only by production facilities.

It is the ultimate purpose of Durant Motors Inc. to turn out 1000 a day and the Star will provide the first real competition Henry Ford ever has had.

Standard Parts Used

The question of service has not been neglected. The car will be built entirely of standard parts which will be available within a few hours in any section of the country. These parts will be carried in stock in the chains of parts service stations and sub-stations which are being established by the leading unit parts makers either individually or in groups. This service, with that which will be supplied by the dealers, will be entirely adequate, it is felt.

Parts makers, their plants and personnel have played an important part in the development of the Star. It is understood that it was the original idea that they should have some share in the making or distribution of the line, but it now is stated that they are to have no financial interest in the enterprise except as an outlet for their products.

It can be said, however, that the manufacturers of all the units which will be used are co-operating to the fullest possible extent. The first step in this direction was in setting prices which would permit the assembling of such a car at such a price. The second step was in arranging for uninterrupted and adequate production facilities. It now is believed there will be a steady flow of materials to the factory.

Financing Production

Fundamentally, although not actually, the parts makers may be said to be financing the enterprise. In other words, no large expenditure of capital by Durant Motors apparently will be necessary. For example, suppose enough parts to turn out 1000 complete cars are shipped this week by the various purveyors. Within another week these supplies will be at the factory. They will be assembled into complete vehicles and shipped with bills of lading attached within another week. The bills of lading will be deposited in the bank, and Durant Motors will be able to discount its bills.

This condition prevails, however, with any company turning out a car in which only specialized parts are used. The parts makers really finance all these manufacturers. It means that these car builders are not required to expend large sums in building and equipping factories. No overhead expense of this character is necessary. With parts bought in huge quantities at the prices Durant is getting, the ultimate cost probably will be less than it would be if he made all of them himself.

In connection with this car, which will compete only with Ford and which is expected to sell in very large quantities, the parts makers can well afford to make a low initial price because of the parts replacement business which will come to them eventually through service stations.

Parts makers insist that their relations with Durant in this respect will be no different than with the builders of other specialized vehicles. They deny emphatically that they have entered into any formal combination. Those in the group which have arranged for the establishment of a chain of service stations point out that these stations also will be available to persons using any vehicle in which these parts are used. They insist that they regard Durant only as another customer.

(*Continued on page* 639)

129,500 CARS AND TRUCKS MADE IN FEBRUARY: IS 44 PER CENT INCREASE OVER JANUARY

NEW YORK, March 14—Production of passenger cars and trucks by all makers for February is estimated at approximately 129,500. This was an increase of approximately 39,000 or about 44 per cent over January. The monthly production figures since June, when they first became available, follow: July 176,336, August 180,781, September 158,314, October 147,544, November 116,349, December 78,995, January 90,486 and February 129,500.

February shipments of passenger cars and trucks, including driveaways converted into carload equivalents, were 215 per cent of February 1921. Factory shipping figures for the first two months of 1920, 1921 and 1922 follow:

	Carloads			Driveaways			Boat		
	1920	1921	1922	1920	1921	1922	1920	1921	1922
January	20,057	6,485	15,241	29,283	3,185	7,397	....	93	154
February	25,505	9,986	19,600	43,719	7,507	9,950	....	99	169

Bethlehem Stockholders to Investigate Failure

ALLENTOWN, PA., March 13—An organized effort to save something from the wreck of the Bethlehem Motors Corp. was decided upon at a meeting here of New York and Allentown stockholders. Although the session was secret, it was announced that Alexander A. Bibighaus had been elected charman and given power of attorney to prosecute if it was found anyone was criminally responsible for the $2,000,000 failure.

The company was founded by Martin E. Kern, who later purchased the German interests in the Bosch Magneto Corp. and who now is in Europe. Clinton E. Woods, a former New York photographer, who was appointed receiver, said in his latest report that the liabilities were about $2,400,000 and that there was small prospect of a dividend exceeding 20 per cent.

Executives Consider Site for Frontenac

Detroit Makes Overtures—No President Selected, But Directorate Is Increased

INDIANAPOLIS, March 10—Allan A. Ryan, chairman of the board of directors of the Frontenac Motor Car Co., and W. N. Thompson, also a director of the new company, as well as the president of the Stutz Motor Car Co. of America, spent yesterday in viewing and inspecting proposed plants for the manufacture of the Frontenac.

Two extensive industrial plants are said to be under consideration for the home of the car, but it is said that no definite selection has been made. Thompson's interests in the new company are expected to be the determining factor in locating the company here, despite overtures from Detroit.

To Continue Temporary Offices

During the formative period the temporary quarters in this city will be continued. This is a plant with which Louis Chevrolet, designer of the car and vice-president of the company, has been identified. No president has yet been selected, but additional directors have been announced. One of these is Kenneth Howard, New York capitalist, who is listed as secretary-treasurer. William Rand, Jr., also of New York, has been named to the directorate. It is said that several men of prominence in local automotive circles will likewise be identified with the organization.

What is said to be the first experimental car went through trials on the Speedway yesterday, Louis Chevrolet driving.

It is reported that all the major units that will go into production, which is hoped to be on a large basis, will be built here. It is emphatically stated that the job will not be an assembled one. Although no figures as to the list price of the car are being quoted at this time, spokesmen for the company say that the organization will give the city a passenger car built in a popular price class that will necessitate quantity production.

Sharp Upward Turn Is Noted in Sales

Dealers Are Encouraged and Factories Feel Effects of Their Optimism

By JAMES DALTON

NEW YORK, March 14.—Production of passenger cars and trucks for February showed a material increase over January. The gain probably was as large as that of January over December, which was about 40 per cent, exclusive of Ford. Output was very much larger than in February, 1921.

Highly optimistic reports in regard to the volume of orders received continue to come from Detroit. They are accompanied by announcements of increased production. Several companies, including Dodge with 600 a day, Maxwell with 200 a day, Studebaker 400, Cadillac 100, and Hupmobile are approaching maximum production. Ford is speeding up his output both at the Ford and Lincoln plants. Chevrolet has fixed a schedule which calls for an output of 50,000 by July. The Rickenbacker is going into quantity production and the output of Durant fours is being speeded up as rapidly as possible. Other companies which are increasing their schedules are Reo, Paige, Dort, Columbia, Liberty and Wills.

Employment Improves

Employment in Detroit has shown a steady increase week by week since the close of the inventory period after Jan. 1. Employment in automotive plants is slowly but steadily increasing in all parts of the country.

There has been a sharp upward turn in sales at retail, both cars and trucks, in all sections. As a consequence dealers have been greatly encouraged and their optimism has been passed along to the factories. March always marks the real opening of the spring selling season, however, and April was one of the best months last year.

Predictions made in some quarters that the four months ending June 1 may establish a record for production undoubtedly are exaggerated although the volume of business will be large. The industry is establishing itself on a solid foundation for a long period of moderate prosperity. Notwithstanding a belated reduction here and there, it is evident prices have been fairly well stabilized. They are not likely to move sharply in either direction for several months.

While it has been expected that cultivation of the agricultural districts for sales in the fall would be profitable, this market for automotive products is producing business on a moderate scale months earlier than had been anticipated. Demand is becoming apparent for cars in the lower price classes and for light delivery trucks.

Business of parts makers naturally is reflecting the better tone apparent in the vehicle building field and the scope of operations is being steadily expanded. The same is true in tire plants where production costs have been lowered by greatly increased labor efficiency.

Financial Position Stronger

In spite of very heavy losses taken on inventories, the financial position of the industry at this time is stronger than was believed possible a few months ago. No important companies are in serious difficulties.

Every effort has been made to reduce liabilities and an enormous sum has been paid in the aggregate on bank loans and merchandise accounts. While the loss of $38,000,000 by General Motors on the year's operations seems exceedingly heavy, that corporation is in reality in a much stronger position today than it was a year ago and a very satisfactory profit for this year is assured.

Kentucky Wagon Plans for Merger Are Maturing

LOUISVILLE, KY., March 13—Details in the transfer of the Kentucky Wagon Manufacturing Co.'s properties of the Associated Motor Industries, Incorporated, are expected to be completed and operations begun at the Louisville plant under the new arrangement within thirty days, James R. Duffin, attorney for the company, said last night.

Twelve or fourteen large automobile companies will be in the new corporation. Those united in the merger which have not yet made their conveyances are preparing to do so, according to Duffin.

The stock division in the new corporation will be $40,000,000 shares of preferred and $40,000,000 shares of common.

The Wagon company's executive committee in charge of reorganization plans yesterday sent out notices to creditors to obtain formal consent to go into the consolidation, and their approval of the arrangement.

INSURANCE FIRMS DISSOLVED

NEW YORK, March 13—A Supreme Court order has been signed directing the State Superintendent of Insurance to take possession of the Motor Car Mutual Fire Insurance Co. and the Motor Car Mutual Casualty Co. It is alleged that the companies are insolvent and that the management has been guilty of misconducting the business. The court order dissolves both companies.

Schuette Transfers German Air Patents

Acquired by New American Corporation—Plans Developed for Commercial Lines

WASHINGTON, March 13—Announcement is made by Dr. Johann Schuette, president of the Schuette-Lanz Airship Co. of Germany, that he has signed contracts giving the General Air Service Co. the manufacturers' rights and patent interests of the Schuette Lanz airships for the entire world. This contract is expected to result in the virtual transfer from Germany to the United States of the large rigid airship building industry.

The General Air Service, which recently was incorporated for $50,000,000 under the laws of Maryland, plans to start service with two large passenger and express carrying airships between New York and Chicago. The service ultimately will be extended to the Pacific coast and possibly to South America and Europe.

Two new Schuette-Lanz airships are to be designed for the General Air Service Co. Tubing and some other materials will be fabricated in Germany, but the ships will be assembled in this country where other materials will be made. Promoters of the company assert that these dirigibles will use helium instead of hydrogen gas and oil instead of gasoline to drive the engines. In discussing helium, Dr. Schuette said:

Schuette Discusses Helium

It will be unnecessary to change the construction of rigid airships to permit the use of helium. Helium has 92½ per cent of the buoyancy of hydrogen. The guarantee of absolute safety from explosion and conflagration leaves out of consideration the small loss in lifting capacity.

It is perfectly feasible to valve helium, when necessary, by compressing it into retainers, and letting it escape back into the bags as the operating requirements dictate. In that manner the helium will not be lost.

It is one of nature's great favors that the United States seems to be the one country supplied with helium in sufficient quantities to make its extraction economical. This is as it should be, because the extent of the United States within its own continental limits is so enormous that rigid airships are a prime factor in its air navigation. They are essentially long-distance craft, and not economical for routes less than 500 to 700 miles in length.

STABILIZING CONFERENCE

WASHINGTON, March 14.—Exhaustive inquiry into methods of stabilizing industry is to be made by representatives of trade associations who will meet in Washington next Tuesday with members of the United States Chamber of Commerce, the Department of Commerce, and the Committee of the President's Conference on Unemployment. The purpose of the investigation is to find a solution as far as possible of business depressions and practical means to prevent them.

Studebaker Reports 1921 Largest Year

Net Sales Aggregated $96,690,644 with Profits Available of $10,409,601

NEW YORK, March 11—The profits earned by the Studebaker Corp. in 1921 were the largest in the history of the company, according to the annual report submitted to the stockholders. Sales showed an increase despite the depression of the year.

Net sales for 1921 totaled $96,690,644, as compared with $90,652,362 in the year previous. Net profits available for the common and preferred stock aggregated $10,409,601. The balance available for the common shares was $9,723,091, or the equivalent of $16.20 a share on the $60,000,000 common stock outstanding. In 1920 the corporation earned $15.20 a share on the common stock.

Record Year for Sales

The company established a record in its history in the number of sales made, the total reaching 66,643 cars, which was a gain of 29.5 per cent over 1920, when 51,474 sales were made.

After the payment of all dividends, $5,523,691 was added to profit and loss surplus, increasing that item to $18,279,744. The surplus at the close of 1920 was $13,467,048. Total current assets were $38,974,732, and net current liabilities $10,248,395.

The detailed income account for 1921 and 1920 is as follows:

	1921	1920
Net sales	$96,690,644	$90,652,362
Cost of mfg., etc.	84,158,347	78,521,555
Net earnings	$12,532,297	$12,130,807
Interest received	138,149	120,014
Net profit	$12,670,446	$12,250,821
Excess profits taxes	2,260,755	2,428,767
Bal. for dividends	$10,409,691	$9,822,054
Preferred divs. 7%	686,000	710,150
Bal. for common	$9,723,691	$9,111,904
Common dividends 7%	4,200,000	3,937,500
Surplus	$5,523,691	$5,174,404
Previous surplus	9,882,048	20,925,583
Total surplus	$15,345,739	$26,099,987
Transfer to special surplus account	405,000	405,000
Net losses 1921 anticipated, etc	719,995	872,940
Stock dividends	.....	15,000,000
Total deductions	$1,115,995	$16,277,940
Final surplus	$14,229,744	$9,822,048
Spec. surp. account	4,050,000	3,645,000
Total surplus and special surplus	$18,279,744	$13,467,048

Looks for Better 1922

A. R. Erskine, president of the company, in his remarks to stockholders said: "The management believes that business this year will show a substantial increase over that of last year." Production schedules, it was said, called for shipment of 25,000 cars for the first quarter of this year, compared with 11,620 in the first quarter of 1921.

Erskine further said:

The inventories of the automobile division at the beginning of the year amounted to $26,853,948, including 2,932 finished cars. At the end of the year these inventories had been reduced to $21,872,885, including 4,507 finished cars.

On Dec. 31, 1921, there were 1,301 preferred and 5,959 common stockholders, as compared with 1,254, and 6,591 respectively on the same date of the previous year.

Last year the average number of employees on the corporation's payroll was 13,065 as against 13,583 in the previous year.

CLARK EQUIPMENT CO. OFFERS POETS $1,000

BUCHANAN, MICH., March 13—The Clark Equipment Co. which dedicated to the automotive industry last year 12 paintings by eminent artists, depicting "The Spirit of Transportation," now has offered a prize of $1,000 for the best poem or ode on the same theme.

The company proposes to publish full color reproductions of the series of paintings, accompanied by a suitable poem or ode. The board of judges which will award the new prize will be composed of Glenn Frank, editor, Century Magazine; William Stanley Braithwaite, editor, "Anthology of Magazine Verse"; Merle Thorpe, editor "The Nation's Business"; Frank W. Roche, publisher, "Automobile Topics"; Samuel O. Dunn, editor, "Railway Age"; Harold L. Brown, editor, "Bus Transportation."

Full details of the competition and a registration blank may be obtained by addressing the Clark Equipment Co., Buchanan, Mich.

Detroit Exchange Hears Good Report on Columbia

DETROIT, March 9—Columbia Motors Co. has orders on hand for 4000 new light six cars for delivery before July 1, members of the Detroit Stock Exchange were told yesterday at a special meeting staged by advertising counsel of the company. This action was taken to establish the position of Columbia stock on the local exchange, which has shown steady gains in the past two weeks.

The brokers were told that the new manufacturing plans of the company have been approved by financial interests and that production plans were complete. Distribution contracts were declared to have been placed already in 20 important centers.

Columbia, it is understood, will specialize on the manufacture of the new light six model and will discontinue its other lines as rapidly as its manufacturing and merchandising policies warrant.

White Takes Losses; Position Is Strong

Reduction in Inventories Entails Charge of $2,048,023—President Sees Good Year

CLEVELAND, March 11—The White Co. reports a loss of $2,346,824 in its operations during 1921, but nothwithstanding this it entered the new year in a strong position in respect to cash, inventories and back debts. The purpose of writing off losses on inventories entailed a charge of $2,048,023, which, with manufacturing loss and interest, made the full loss of the year $4,837,319.

The company paid $2,000,000 dividends, taking the money from surplus. The full charge against surplus was $6,837,319, bringing that item in the balance sheet down to $2,661,663. Chiefly through a decline of inventories, working capital was reduced in the year from $20,692,277 to $14,431,931. The bank loans were cut in two, as shown in the following table of income and balance sheet items, the loans being carried as notes payable:

	1921	1920
Sales	$30,320,948	$51,998,122
Loss	2,346,824	*3,486,704
ASSETS		
Inventories	$13,351,452	$22,989,073
Cash	1,346,441	1,472,329
Accounts receivable	2,838,393	4,859,038
Notes receivable	2,571,731	2,026,976
LIABILITIES		
Notes payable	$3,600,000	$7,200,000
Reserved for cont.	1,000,000	2,000,000
Surplus	2,661,663	8,472,312

*Profit from operations.

The usual quarterly dividend of $1 a share was declared yesterday, payable March 31 to stockholders of record March 21. Walter C. White, president, said after the directors' meeting that the business outlook was favorable, orders having shown a marked increased since October.

FEDERAL SALES $3,268,468

DETROIT, March 11—Federal Motor Truck Co. for the year ended Dec. 31, 1921, reports total sales of $3,268,468, compared with $10,628,742 in the previous year, giving net profits of $176,800 against $745,879 in 1920, the latter figure being subject to an estimated Federal tax of $200,000. The comparative balance sheet shows cash in 1921 of $165,301 against $163,293 in 1920; receivables, $256,209 compared with $228,811 and inventories of $1,521,050 against $2,497,398. The liabilities include accounts payable of $104,440 in 1921 as against $352,734 and dealer deposits of $23,985, compared with $31,844 in 1920.

NEW GOODRICH TIRE

AKRON, March 11—The B. F. Goodrich Rubber Co. has a new model "55" clincher tire made in 30 x 3 and 30 x 3½ sizes only. The larger of the two sizes will retail at $10.90.

British Overland Sustains 1921 Loss

Inventories, However, Were Reduced Substantially—Cash on Hand Greatly Increased

LONDON, March 4 (*By Mail*) — Crossley Motors, Ltd., of Gorton, Manchester, builder of Crossley "25" and "10.6" cars and, for a short time, a British Bugatti model, reports a trading loss for the year ended Oct. 31 of £234,-965 gross and £224,296 net against a profit of £35,643 in 1920. The bulk of the common stock is held by Crossley Brothers, Ltd., which accentuates that company's loss on its year's business.

Willys-Overland-Crossley Co., representing the Anglo-American fusion since 1919, lost £96,486 gross and £84,275 net in 1921 against a profit of £112,210 in 1920. The stock price at date of issue was 21s. 6d. per share; it has dropped to 6s. 6d., or more than 62 2/3 per cent. Nevertheless the prospects of this company appear better than those of Crossley Motors, Ltd., because while on Dec. 31, 1920, inventories stood on the books at £708,697, they had been reduced last December to £348,602, and cash on hand was increased from £295 to £206,251.

Crossley Brothers, Ltd., is an old-established maker of oil and gas engines. In 1920 it made a profit of £59,112 plus £42,681 brought in from the previous year, and carried forward £51,161. The latest year's report shows a loss of £94,-916 gross and of £42,855.

Truck Firm's Loss

LONDON, March 4 (*by mail*)—Halley's Industrial Motors report a loss on last year's trading. This is attributed to the dumping of many thousands of surplus Government trucks, often sold at prices barely more than the cost of freight for new vehicles. The company, anticipating a revival in trade, has increased its range of vehicles to various carrying capacities between 2 and 6 tons.

Hupp Motors Places New Order for 10,000 Bodies

RACINE, WIS., March 13—Industrial conditions in this city, which is one of the principal automotive production centers in the West, are reported to be improving markedly, considering the stagnation of recent months. Racine produces passenger cars, trucks, tractors, engines, parts, farm operating equipment and similar commodities with world-wide reputations, so that this present betterment of conditions is regarded as significant.

The H. & N. Body Corp., which started work Jan. 1 on an order for 10,000 bodies for the Hupp Motor Car Co., has received a supplementary order for another 10,000 bodies, delivery on the 20,000 to extend over 1922. In addition the concern has substantial orders from the Mitchell Motors Co., Racine. The H. & M. company is owned by the Hupp and Mitchell corporations, from which it derives its name. It is employing 650 people and part of the plant is on an overtime schedule. Skilled workers are being employed in the metal finishing department as rapidly as they present themselves.

The Harvey Spring & Forging Co. has taken contracts for furnishing all springs for the Nash Six and Four, the Mitchell and the Case for the current season, and is gradually increasing its force of 175.

MILWAUKEE DECLINES TO BUY ARMY SURPLUS

MILWAUKEE, March 13—Opportunities and offers to purchase army motor truck equipment from salvage or other sources have been declined by the city of Milwaukee in consideration of the question of providing twelve additional trucks of various types for municipal departments.

A special committee of the common council reported that the experience of other cities with army trucks was not satisfactory. Of the 173 motor vehicles of all kinds now in service in Milwaukee municipal departments, not a single army truck appears.

International Truck 1921 Profits, $126,931

NEW YORK, March 14—The International Motor Truck Corp., for the year 1921, reports net earnings of $126,931 after all taxes, interest and inventory adjustment. This is equal to $1.16 a share on its first preferred stock, against $2,644,013, or $3.98 a share on the common, in the previous year. The sales for 1921 reached a total of $24,849,268, as compared with $34,071,365 in the previous year.

The balance sheet as of Dec. 31 last shows profit and loss surplus of $9,258,-700, against $10,323,422 at the close of 1920. Accounts receivable were $5,639.-901 against $3,472,348. Inventory was valued at $9,675,583 against $15,588,848.

President A. J. Brosseau, in his remarks to stockholders, stated: "Orders on hand and prospects for business justify the belief that the sale of Mack trucks during the coming year will be at a greater rate than in 1921."

PARISH & BINGHAM CORP.

BOSTON, March 13—The Parish & Bingham Corp. reports for the year ended Dec. 31, last, a total operating deficit of $356,000 against $262,296 in 1920.

The net sales in 1921 reached a total of $4,201,124 compared with $9,128,443 in 1920. The cost of sales was $4,037,468 in 1921 and $9,089,813 in 1920, leaving an operating profit of $163,656 in 1921 and $38,630 in the previous year.

The deficit after dividends was $356,-080 in 1921 and $712,296 in 1920.

Chandler Profits for Year Decline

Inventory Was Reduced Materially, Annual Report Shows—Ample Surplus Helped

CLEVELAND, March 11—Chandler Motor Car Co. for the year ended Dec. 31 last reports gross profits on sales after deducting cost of material and manufacturing expenses, etc., of $1,890,-319 as compared with $9,440,326 in the previous year, net income of $41,017, equal to 14 cents on the 280,000 common stock of no par value, against $4,213,-111, or $15.04 in 1920, and a deficit after dividends of $1,918,983, as compared with a surplus of $5,588,111 in the previous year.

The balance sheet as of Dec. 31 last shows cash $538,448 against $949,791 on Dec. 31, 1920; accounts receivable, $131,-845, compared with $492,474; inventory, $2,773,742, contrasted with $5,788,504, and total assets and liabilities of $13,-255,570 against $16,611,509.

Many Economies Effected

In his remarks to the stockholders, President F. C. Chandler says:

> The year 1921 was the only year since starting business that found the company with an excessive inventory and a large stock of cars in hands of dealers.
>
> We were fortunate that prior to this depression we had built up a surplus fully ample to carry business through a period of this kind and maintain a strong financial position. We effected many economies and were able to make extensive reductions in overhead expenses to permit us even with limited operations to carry on business with a fair operating profit.
>
> All our financing has been done without aid of any large amount of borrowed money, and recent improvements in business, especially since Jan. 1, have been such that all current obligations at Dec. 31, 1921, have been paid, that portion of taxes which became due also was paid, and bank loans reduced by $500,000 to date of this report.

Second Offering Ordered for Obenberger Property

MILWAUKEE, March 13—A second offering has been ordered made on March 20 of the property of the bankrupt John Obenberger Forge Co. at West Allis, Milwaukee County. But one bid was made at the first public auction conducted by J. F. Gerdis, trustee, this being by Adolph H. Weidner, attorney, on behalf of secured creditors, in the sum of $233,000, which the bankruptcy court ruled as inadequate to cover assets appraised at $955,242.

The Weidner offer was to pay $48,000 in cash and assume liens aggregating $185,000. The explanation was that under present industrial conditions the assets have a market value far below the real worth. The liabilities of the Obenberger company are estimated at approximately $800,000.

Higher Tire Prices Predicted at Akron

Manufacturers Say Upward Revision Will Do Much to Stabilize Market

AKRON, MARCH 13.—Predictions that tire prices will be increased within the next 30 or 60 days are being made by Akron manufacturers. They contend that a study of balance sheets of tire companies will disclose plainly why higher prices are necessary and will afford justification for them.

Manufacturers contend that an upward revision would do much to stabilize the market and disabuse dealers generally of the erroneous impression that another reduction is in prospect.

The downward trend of tire prices, started last May by the B. F. Goodrich Co. and quickly followed by practically all large and small competitors, brought reductions which made tire prices at the end of the year 1921, approximately 40 per cent lower than at the beginning of the year. The new prices were also lower than before the war, and lower than in 1910, with the 1921 tire producing twice the mileage of the 1914 tire and three times the mileage of the 1910 tire, thus giving the motorist more tire miles per dollar than ever before.

Operating Costs Lowered

Scarcely had the last of these price reductions taken effect, than the price of raw materials used in tire manufacture began steadily to climb. The tire companies were forced to make drastic cuts in operating and overhead expenses. Office forces were pared to the bone. Sales forces were greatly reduced, territories were expanded and salesmen were compelled to "double-up." Finished goods inventories were also reduced to the lowest point for many years. In many factories the finished goods inventoried in the latter part of 1921 were smaller in tire units than the number of tires these same companies the year before had kept in transit.

Manufacturers claim the steady climb upwards of raw material prices, coupled with the absolute fundamental necessity for increased revenue so as to avert deficits in 1922 and so as to permit resumption of dividend payments, make the contemplated price increases justifiable. Forces can be reduced no further. Factory forces are down to rock bottom. All poor workmanship has been weeded out and only the most proficient tire builders have been kept. This has increased efficiency to a large degree but has not been sufficient of a saving to the companies in wages, to offset the 40 per cent reduction in gross sales revenues as occasioned by price cuts last year.

SUES PORTAGE STOCKHOLDERS

AKRON, March 14—Thirty-nine stockholders of the bankrupt Portage Rubber Co., now the property of the Seiberling Rubber Co., have been sued by W. E. Young as attorney for George D. Bates of Akron, trustee in bankruptcy, for a total of $46,000, said to represent the unpaid portions of their subscriptions for Portage stock prior to the company going into receivership. The amounts being sued for range from $400 to $4,800.

Miller Rubber 1921 Sales Gain But Profits Decline

AKRON, March 14.—Although sales of the Miller Rubber Co. for 1921 showed a 5 per cent increase in volume over sales of 1920, the Company reports a net loss for 1921 of $91,986 and a total deficit on Dec. 31, 1921, of $1,290,604 according to the annual statement and balance sheet given to stockholders at their annual meeting here.

While sales in volume exceeded those of 1920, in gross revenue, due to the series of tire price cuts enforced last year, 1921 tire sales were only $18,983,677 as compared to $26,182,391 in 1920.

The company, according to the annual balance sheet, reduced its inventories from $9,321,803 to $3,981,922. After writing down its inventories and deducting an amount considered adequate to cover doubtful accounts, discounts and contingencies, the current assets of the company amount to $7,983,224 less current liabilities of $2,060,437 (all bank indebtedness being paid), which gives the company approximately $5,922,237 net working capital or 31 cents on each dollar of the net volume of business the company did last year, according to President Jacob Pfeiffer.

Brighton Mills Sued for Seiberling Stock

AKRON, March 13—Suit to gain possession of $45,000 worth of stock in the new Seiberling Rubber Co. has been filed in the Summit County common pleas courts in Akron against the Brighton Mills Co., a New Jersey corporation, by the By-Products Realization Co. of Chicago.

The By-Products company alleges that the Brighton Mills Co. was a creditor of the Portage Rubber Co. of Barberton which has been acquired by the Seiberling Rubber Co. and that the defendant company owed the plaintiff $45,000 for services rendered last year. It also sets forth the claim that the Brighton Mills Co. agreed to pay the plaintiff in Seiberling stock, which it received in settlement of its claims against the Portage Rubber Co., and that payment has been refused.

BRADE LEAVES AUSTIN

LONDON, March 1 (*By Mail*)—Sir Reginald Brade, former secretary of the War Office, has resigned from the board of the Austin Motor Co., Northfield, Birmingham.

Gordon McGregor, Ford Executive, Dies

Head of Canadian Company — Succeeded Father as Walkerville Wagon President

DETROIT, March 13—The plants of the Ford Motor Co. both in Detroit and Windsor will be closed to-morrow when the funeral of Gordon M. McGregor, president of the Ford Co. of Canada, will be held. McGregor died Saturday. He was 40 years old and had served for almost 20 years as president of the company which he organized in 1903.

McGregor succeeded his father as president of the Walkerville Wagon Works in 1903. The company was in financial straits and McGregor interested Henry Ford in forming a Canadian branch of the Ford Company to take over the Walkerville Wagon plant. A company was capitalized at $125,000 with rights to sell in all parts of the British Empire, except the British Isles. Ford for his patents and sales rights received 51 per cent of the stock. This has since been reduced to about 20 per cent.

The plant began operations in 1904. In the second year only 110 cars were manufactured and of these 76 were exported. Then business boomed. In 1911 the capitalization was increased to $1,000,000 and in 1916 to $10,000,000. Employees now number 14,000.

No time has yet been set for the directors to act upon the death of McGregor. Wallace R. Campbell, secretary, assistant treasurer and assistant general manager, is looked upon as the most likely successor.

R. & V. Motors Opens Branch at Its Factory

EAST MOLINE, ILL., March 13—In line with the success of its retail branches in Chicago, Boston, Baltimore and other automobile trade centers, the R. & V. Motor Co. has opened a factory retail sales and service department, adjoining its main factory building. B. N. Ward and D. S. Smith are in charge.

Reports from branches and distributors, officials say, indicate a 1922 business eclipsing that of 1921, when the R. & V. plant was one of four manufacturers whose sales exceeded 1920 and second only to one other in higher percentage of increase.

The factory is now working full time with practically a normal force, and production is at a rate greater than last year.

LOWER PRICED WASHINGTON

EATON, OHIO, March 11—The Washington Motor Co. has stopped production on the light six model priced at $1,635 and is at present working on a design for a lower priced car to sell for about $1,275. The heavier model is being continued.

Milwaukee Reports Better Conditions

Car Manufacturers Increase Delivery Specifications on Standing Parts Orders

MILWAUKEE, March 13—A slight but gratifying increase in delivery specifications on standing orders held by Milwaukee automotive parts manufacturers from the various passenger car factories has been a feature of the past week's business. Some new orders placed likewise have brought about a better feeling.

During January and February parts makers were just about able to hold their own in the matter of production, but it appears that since the national and local winter shows have portrayed the possibilities of demand, and the effect of the local shows has been to increase retail sales, which has been reflected into distributors' orders, car builders are proceeding on a broader basis.

There is nothing particularly striking or sensational about the present improvement in the local parts industry, save that it means a recovery from a sort of trough into which it found itself during the between-season period from the holidays until the beginning of March. A survey of the general situation of Milwaukee industries, wholesale and retail business, indicates that lost ground is steadily being regained. Unemployment is again being relieved, especially in the general iron, steel and machinery trade.

Local Trade Better

Although here and there comes a fresh jolt in the form of a new price reduction announcement by passenger car manufacturers, the demand here is making progress and dealers believe that a point has been reached where the position of prices may again be called stable, or nearly so.

Those handling the makes within a range from $950 to $1,500 are now doing a better business than at any time since last July or August, judging by sales so far in March. The higher priced lines, who were relatively more active than others in the last four or five months, are holding their own. Ford dealers report gains, with prospects more inclined to close pending deals.

Prospective buyers still have something to learn about the obvious pursuit of used car values in relation to new car prices at the reductions which have been made, but the lower level of used car allowances is gradually becoming better understood.

IMPLEMENT EXPORTS GAIN

WASHINGTON, March 10—Exports of agricultural implements and tractors for the first month of 1922 show an increase of $314,208 over the month of December, 1921, according to a special report by the Agricultural Implement Division of the Department of Commerce. There is reason for encouragement in the fact that the statistics for January indicate an upward trend of exports. The chief decrease in January, 1922, as compared with January, 1921, when the total exports were $7,320,277, was in plows and cultivators, and mowers and reapers.

FORD WILL PRODUCE 400 TRACTORS DAILY.

DETROIT, March 13—The Ford Motor Co. will increase its tractor production to 400 daily in April, thereby doubling the present output. All parts of the country are represented in the increased business, the distribution being through the regular channels. Production of cars and trucks is 34,000 ahead of production last year at this date. January assembly at the plants approximated 40,000, against 30,000 last January. February production was 52,649, compared with 30,305 last year.

Trade Reviving in West, Cadillac President Wires

DETROIT, March 13—H. H. Rice, president and general manager of the Cadillac Motor Car Co., who is on a trip to the far West, wired the factory from Spokane, Wash., that even to the "ultra conservative" element indications of a business and trade revival are clearly discernible in the West.

"The more optimistic are outspoken in predicting very much improved business for about all the West," Rice reports, after analyzing the situation as he has seen it in Nebraska, Colorado, Montana, Utah, Oregon and Washington. His message continues:

> Cattle, hog and sheep feeders are making good showings. The copper mines have opened after a long shutdown. Prices for all live stock and for wheat are much better. Shipments of lumber are greater than for months. Money is easier, and, best of all, people begin to feel that a distinct change for the better has really taken place.
>
> The automobile business generally can expect a much better condition than in 1921, and Cadillac particularly will show a very substantial increase.

Durant Canadian Program Calls for 12,000 Output

TORONTO, March 11—The first car produced in the plant of the Durant Motors of Canada, Ltd., Leaside, was delivered to E. A. Wallberg, Toronto representative. The Leaside plant is now equipped and ready for quantity production and all cars to be absorbed by the Canadian market will be manufactured there. The present year's schedule calls for between 12,000 and 15,000 automobiles.

Within the next few days a considerable number of Durant cars, now in process of construction, will be shipped from the Leaside plant and distributed throughout the Dominion.

Credit Men Discuss Retail Time Sales

More Careful Selection of Dealers Suggested to Bring About Better Paper

NEW YORK, March 10—The cost of financing retail time sales cannot be materially reduced, except through the improvement of the character of paper sold to the finance corporations. This opinion was expressed by F. G. Rawson, vice-president of the Commercial Credit Co. of Baltimore, before a meeting of the Automobile Financing Credit Men's Association, which is allied with the National Association of Automotive Bankers.

Better paper will result through the education of the dealer as to the best way to sell on time and get paid for it, it was suggested, and through the more careful selection of dealers by the manufacturers. Under present conditions collection costs and the losses of revenue on delinquent payments are so high that it is impossible to reduce the rates.

Rawson favored the financing of the dealer's stock of cars by his own bank. However, he did not think that the dealer should use his line of bank credit for financing retail time sales. A further disadvantage is that the bank has no machinery for collection, and, in case of a delinquent payment, the note comes back to the dealer for collection. This is the thing the dealer wants to avoid and can avoid through the use of a finance corporation.

The types of instruments required for retail time selling in the various states due to the variations in legal practice were discussed by P. W. Haberman, vice-president of the Commercial Investment Trust Co. The conditional sale contract is used in all states except Ohio, Missouri, Colorado, Michigan, Louisiana and Pennsylvania. The chattel mortgage is used in all of these states except Pennsylvania, which requires the bailment form.

10 Carloads of Tractors to Be Shipped by Eagle

APPLETON, WIS., March 13—The Eagle Manufacturing Co., manufacturer of the Eagle tractor, has booked orders in the last two weeks for about ten carloads of tractors, four being for Canadian shipment and the others for Pennsylvania, Ohio, Indiana and Michigan.

According to Charles J. Hagen, general manager, indications are that present tractor prices will never be lower, and a material advance may be expected after June 1, by which time it is expected that the supply now on hand, which was carried over by manufacturers, will be exhausted and new production will be on a basis of present material, labor and manufacturing costs, as compared with present "pressure" prices. Hagen regards the outlook for the remainder of the year as good.

Offices of Chrysler Bear Maxwell Name

Former Willys Executive Has Mapped Out No Definite Program for Future

NEW YORK, March 14—Walter P. Chrysler has returned from a brief vacation at Palm Beach and opened offices in the Equitable Trust Co. building on Madison Avenue. The name on the door will be the Maxwell Motor Corp., of which he is chairman of the board.

Chrysler said to-day he had not mapped out a program for the future. He will devote a considerable share of his time to the affairs of the Maxwell and Chalmers companies, but also will give considerable attention to his own affairs, which have been neglected in the past two years.

While Chrysler does not propose to cast aside altogether business responsibilities, he does propose to rest a great deal more than he has for a long time. In addition to his duties as executive vice-president for the Willys enterprises, he had much of the responsibility for working out the reorganization of the Maxwell and Chalmers properties.

In connection with reports that Cleveland interests are negotiating for the purchase of the "Chrysler Six," which was to have been made by the Willys Corp., it was stated by Chrysler that he had withdrawn the right to use his name in connection with this enterprise and that while the receivers of the Willys Corp. can sell the engineering rights in this car, the name does not go with them.

New Zeder Motor Co. Advancing Car Plans

CLEVELAND, March 13—Royal T. Hodgkins, manager of the Cleveland Tractor Co. and one of several Cleveland business men who are interested in the new Zeder Motor Co., said to-day that definite plans are under way for the manufacture of a new car, which will be known as the Zeder, in the plant of the tractor company in this city.

Hodgkins denied that the new company, which has been incorporated under the laws of Ohio with a nominal capital of $500, has under consideration the purchase from the Willys Corp. of the rights to the car which it was to have manufactured in its Elizabeth, N. J., plant.

It had been reported that preliminary steps to this end were being taken by Rollin H. White, president of the tractor company; Clement Studebaker, Jr., who severed his connection with the Studebaker Corp. ten months ago, and Fred Zeder, former chief engineer of the Studebaker organization and designer of what was to have been the Chrysler Six. It is stated, however, that Studebaker is associated with White in the new venture.

The car will be powered with an engine developed by Zeder.

WANTS NAME TO BRAND "JAY WALKER" DRIVER

WASHINGTON, March 14—The American Automobile Association wants a name that will brand reckless motorists just as "jay walker" brands careless pedestrians.

"A jay walker," it is explained, ""is a person not sufficiently civilized to cross the street at the proper crossings. He or she endangers public safety as well as obstructing traffic. The jay walker deserves prosecution, but even more effective is the ridicule carried by the term."

A similar name is wanted for rowdy and careless drivers to show them that they do not "belong," and it must be as comprehensive and have the elements that will make it as popular in its use as its pedestrian brother.

The association offers a $25 prize. The contest will close May 15 and the award will be made May 29. The Contest Editor is located at 1108 Sixteenth Street, this city.

Columbus Has New Firm to Make Truck Parts

COLUMBUS, March 11—The Bingham Manufacturing Co. has been incorporated with a capital of $100,000 to manufacture special parts for trucks and to assemble trucks. The company has taken over the East Livingston Avenue plant of the Immel Co., body makers, which went into the hands of receivers some time ago.

New machinery is being installed. Many of the parts are patented and are designed for special jobs. H. N. Bingham is president and general manager; F. E. Kocher, vice-president, and G. P. Hinkle, secreteary. Other incorporators are J. A. Shearer and James R. Spellman.

Agents Sign for Space at Show in Mexico City

MEXICO CITY, MEXICO, March 3 (*By Mail*)—Indications point to the success of the annual automobile show that will be held here, commencing April 16, under the auspices of the automotive division of the American Chamber of Commerce. W. F. Saunders, Jr., secretary of the chamber and likewise secretary of the show, stated to-day that fifteen agents already had signed up for space.

ALL METAL VALVE CO. FORMED

DETROIT, March 11—Articles of association of the All Metal Valve Co. were filed in this city yesterday, Frank L. Klingensmith, C. Malinz, Kansas City, and Frank F. Beall being shown as principal stockholders. The company is to manufacture a tire valve with a patented locking device. Capital stock is $200,000, with 2000 shares at $100 a share.

Bureau of Standards Revising Headlamps

Values for Lights on Road Increased Under Agreement with Society

WASHINGTON, March 13—Revision of specifications for headlights on automobiles has been undertaken by the Bureau of Standards, in co-operation with the committee on Motor Vehicle Lighting of the American Illuminating Engineering Society. An agreement was reached whereby the values specified for lights on the road were considerably increased, while the limiting values, which are intended to control glaring lights, were left unchanged. Other changes were also made.

As many devices approved under the present regulations would not satisfactorily meet the requirements of the revised ones, it is probable that these specifications will only be recommended for adoption at some definite period in the future, presumably two or three years.

Reports received by the Bureau of Standards show that the establishment of headlight adjusting stations in garages has been a very desirable step toward uniformity of automobile lighting. Automobile manufacturers are very much interested in regulations governing headlights used on motor vehicles and are assisting the Bureau of Standards and legal authorities in the United States which have framed laws governing the use of headlights. The Bureau is particularly desirous that there should be uniform treatment in all states.

Uniform Laws Needed

In order to secure a satisfactory degree of uniformity in all parts of the country, it will be necessary to have (1) uniform laws, (2) uniform procedure in the enforcement of the laws, and (3) an extensive campaign of education both for enforcement officers and garage men and drivers of automobiles.

With the idea of securing uniformity in the adoption of such regulations, an informal organization of state authorities representing the whole of New England, New York, New Jersey, Pennsylvania and Maryland has been formed. Another meeting of this organization will be held at Harrisburg in April, and it is understood that an attempt will be made to establish a board of officers who will be charged with the approval of devices in all the states represented.

KNOX TIRE PLANT SOLD

MT. VERNON, OHIO, March 10—The plant, equipment and other property of the Knox Tire & Rubber Co. has been sold at public auction by Trustee Paul M. Ashbaugh to F. G. Litsch of Middletown, Ohio, representing a group of stockholders of the company. The property had been appraised at $213,186 and was sold for $175,000.

1,000 Daily Output Planned for Star

Predicted Production Facilities Alone Will Limit Sales—Orders for June Delivery

(*Continued from page* 632)

The situation in a nutshell is that the leading parts manufacturers are seeking the expansion of their markets by fostering the sale and development of specialized vehicles. They are eager to do anything within their power to balance so far as possible the output of assembled cars as compared with that of the builders who make most of their own units.

It is not to be denied that some of the parts makers have given consideration to the question of extending a certain amount of financial backing to certain assemblers whose product possessed large sales possibilities. There even has been talk of accepting a share of the profits of these companies, but this plan has been abandoned. There will be no formal combination, it is said, for the present at least.

While orders are being taken for June 15 delivery of the Star, detailed plans for its distribution have not been worked out, but it can be stated that the policy will follow closely that of the Ford company and that no exclusive territorial sales rights will be given.

Plant Location Not Determined

While all cars are being sold at Ford prices, f.o.b. Detroit, the location of the factory has not been definitely determined. The freight rate from the entire Michigan manufacturing district is the same as from Detroit. It is probable the first cars will be made at the Long Island City plant.

Although no definite plans have been made for the manufacture of the Star, it can be stated that Durant engineers have inspected the Elizabeth, N. J., factory of the Willys Corp. Durant has been favorably impressed by this modern plant, but for assembly purposes it would be worth only a fraction of what it cost, and there is nothing as yet to indicate that he will decide to buy the property.

As already announced, the distribution, sale and servicing of the car will be in the hands of a company to be known as the Star Motor Car Co. This will be a subsidiary of Consolidated Motors, a Maine corporation which will serve as a holding company. Consolidated Motors was incorporated three or four years ago, but has been dormant ever since that time and recently was reincorporated. It has 2,000,000 shares of common stock at $10 par value. None of this stock will be issued to the public. It is assumed various other companies will be formed later as subsidiaries of Consolidated Motors. No information is available as to the stockholders either in the parent company or its subsidiaries.

N. A. C. C. RECOMMENDS CAUTIONS IN DRIVING

NEW YORK, March 14—The National Automobile Chamber of Commerce has suggested to manufacturers that they attach in some way to each car or truck sold the following cautions regarding the need for care in using motor vehicles:

1—Always remember you are an engineer, fully responsible.

2—Inspect your brakes at least once a month.

3—Never pass to the left of a street car.

4—Never pass a street car when it is stopping for passengers.

5—Always signal with hand when slowing down, turning or stopping.

6—Sound horn three times when backing.

7—Observe the traffic rules carefully; they are made for your safety.

26,840 Visitors at Washington

WASHINGTON, March 10—Actual count showed that 26,840 visitors inspected the new Star when it made its debut here. Durant expressed himself as highly pleased with the number and the interest shown. Salesmen declared that several hundred people had expressed their intention to purchase the car as soon as it has been put on the market.

R. H. Harper has been named distributor for this territory.

35,000 at Boston

BOSTON, March 14—Approximately 35,000 persons have viewed the new Star, Durant product, when it was shown in this city. It was stated that orders were taken at the rate of one a minute. The car will be taken from here to New York the last of this week for a brief showing.

Shaler to Build Larger Plant to Replace Old

WAUPUN, WIS., March 13—Arrangements to build a new plant on a scale exceeding that of the one totally destroyed by fire March 3 are being made by the C. A. Shaler Co., manufacturing vulcanizers, tire and rubber repair equipment, headlight lenses and other automotive specialties. Although the loss was a heavy one, only a part of the damage of $300,000 to $350,000 being covered by insurance, the company will engage immediately in the rehabilitation of its productive facilities.

C. A. Shaler, founder and president of the company, was in California at the time of the fire and wired instructions to R. B. Dunlap, secretary and sales manager, to proceed with reconstruction as early as possible.

French Compound New "National Fuel"

900 Parts of Gasoline Contained in Mixture to Be Given Competitors in Test

PARIS, March 1 (*By Mail*)—A mixture composed of 900 parts high-grade gasoline, 100 parts 95 degrees alcohol, 17.5 parts cyclo-hexanol, and 37.5 parts phenol, will be given to the competitors in the "national fuel" competition to be held near Beziers on April 2.

These trials, which form part of a big movement to secure home-produced fuel for France, consist of a 250-mile road test for all types of cars, which are given a determined amount of the above fuel according to their piston displacement and weight. The winner will be the one traveling the greatest distance on this allowance, while maintaining the minimum average speed required in his particular class.

The mixture adopted for the Beziers competition, and designated "national fuel," differs entirely from the "national fuel" recently put on the market by the Government. This latter is composed of equal parts of alcohol and benzol.

Benzol Stocks Depleted

One of the results of the Government action in marketing an alcohol-benzol fuel has been to remove all benzol supplies from the French market. This has caused dissatisfaction among motorists, and particularly among the big taxicab proprietors. The Department of Commerce has issued an official statement to the effect that the French production of benzol is only 800 tons per month, and practically the whole of this is used by the producers. Owing to adverse exchange rates, supplies cannot be obtained from England and America.

Under the terms of the Peace Treaty, Germany is obliged to deliver 2500 tons of benzol to France every month. The whole of this is monopolized by the Government for making its "national fuel," composed of 50 per cent alcohol, 50 per cent benzol. The Government is anxious to get this fuel on the market in order to exhaust its big stocks of alcohol, but is not meeting with much success. The Paris Omnibus Co. is using the Government fuel, but the taxicab companies and private owners refuse to have anything to do with it.

Cadillac, Detroit Founder, to Be Honored Annually

DETROIT, March 14—The celebration of the anniversary of Antoine De La Mothe Cadillac, founder of the city of Detroit, by the Cadillac Motor Car Co., proved to be so successful that it will lead to the institution of an annual Cadillac day by the company. Distributors throughout the country joined in the celebration.

Strike Will Retard South African Trade

Demand for Buses and Tires Forecast, However—Country Reports Good

JOHANNESBURG, UNION OF SOUTH AFRICA, Feb. 6 (*By Mail*)—The motor industry has not suffered as much from the coal and gold mining strike as was expected at the outset. In fact, the street cars in this city have been unable to operate for many days because of the lack of coal. Motor transport, therefore, has carried citizens from and to their homes. All types of motor vehicles have been in use, from heavy trucks to taxicabs and automobiles. This has resulted in reducing the stocks of tires on hand.

Johannesburg has never had many motor buses because the street cars, being operated by the municipality, have a monopoly. It is anticipated that after the present experience the municipality will order a number of buses in the event of any future tie-up in street car transportation.

Air Will Be Cleared

Following the present trouble, things are bound to be bad for some months and very few new cars may be sold. But it is thought that the strike will clear the air once and for all and put an end to the Rand's industrial strife.

Reports from the country districts are very encouraging and show that the farmers have more money to spend. For instance, Hupp Garages, Ltd., and the General Garage, Dodge Brothers agent, sold nearly as many cars in January as in the previous month despite the industrial situation. Most of these sales were in the country districts, although Johannesburg, Pretoria and Cape Town were responsible for a number of sales.

The 1922 Maxwell has arrived in South Africa and has been very favorably received. The Buick Four is still on the water and its arrival is awaited with interest. It is understood that a shipment of Nash Fours is also on its way. The Oldsmobile Four has met with a favorable reception and there have been a number of sales made in the coast towns. The latest model of the Hudson has arrived and there is no difficulty in disposing of the sporting models, which are great favorites in this country. Speedy cars are liked here despite bad road conditions.

More British Light Cars

A few more British light cars have been received and it is understood that others are on their way. These light cars, however, have a very limited market owing to poor roads.

American-made motorcycles find a market, although British machines are steadily gaining as the prices become lower. The Indian and Harley Davidson are the most popular of American makes and probably top the list of all motorcycles sold as regards quantity. The Excelsior is growing in popularity. The British A. J. S., Triumph, Matchless, Enfield, B.S.A., Coulson, Zenith, Douglas, and Norton are gaining in sales.

Car prices have been reduced considerably during the past month or two. Buick, Chevrolet, Ford, Hupmobile, Studebaker, Cadillac and Maxwell have all made downward revisions. Dodge Brothers have announced that a reduction retroactive to Jan. 1 will be forthcoming soon. While the Nash Six is still being quoted as during the war period, the price has always been far below that of its competitors.

M. EDWARD.

Marlin-Rockwell Corp. Organizes Subsidiary

NEW YORK, March 14—The Marlin-Rockwell Corp. has organized a subsidiary known as the Marlin Wire Wheel Corp. to take over the manufacture of the Rudge-Whitworth Wire Wheel, which has been manufactured under a license giving exclusive right to the use of that name in this country. The wheel has been manufactured heretofore by a division of the parent corporation, and it is believed formation of the new corporation will give impetus to sales efforts.

The Marlin Wire Wheel Corp. has as its president Guy Vaughn, who is president of the Standard Steel & Bearings Corp., another Marlin-Rockwell subsidiary, and general manager of the Philadelphia plant. H. C. Pryer is the secretary and treasurer.

New Soft Top Increases Demand for Closed Cars

DETROIT, March 14—The advent of the new soft top type enclosed car with its price differential of only a few hundred dollars from the open models, has brought the enclosed models into active demand, even with spring at hand.

Factories making the inexpensive enclosed models report a demand for these cars parallel with open model sales and in some cases exceeding them. The Essex, which was the leader in this field, is now paced by Hudson, Dodge and Hupp.

This demand has been so noteworthy that President J. D. Dort of Dort Motor Car Co. has made the statement that in his belief open cars will in the near future be almost entirely superseded by enclosed cars except in the cases of persons who keep more than one car.

JEWETT SEDAN AT $1,395

DETROIT, March 11—A second Jewett model just announced by the Paige-Detroit Motor Car Co. is a four-door, five-passenger sedan and sells at $1,395. All body panels are of steel. The joints are welded together over a framework of hardwood to form a seamless shell. This type of construction is said to permit the application of a standard finish to the whole exterior of the car.

All Models But One of Earl Are Reduced

Price Cuts Range from $90 to $200—Roadster Unchanged at $1485

NEW YORK, March 10—Reductions of from $90 to $200 on the Earl cars and delivery wagons were announced here today by factory representatives. The new and old prices are:

	Old Price	New Price
Phaeton	$1,185	$995
Sedan and brougham	1,895	1,695
Express delivery wagon	1,085	995
Panel delivery wagon	1,160	1,060

The custom-built roadster remains unchanged at $1,485, being the only model on the new Earl line that was not reduced. Extra charges of $15 for radiator thermometer, windshield wiper and bumper are announced on the phaeton and $30 extra for this equipment and heater and running board mats on the closed cars.

CHALMERS TO INCREASE $100

NEW YORK, March 13—The Chalmers Motor Corp. will increase the price of its various models by $100 on April 3. This increase will not apply, however, to the Maxwell models.

MERIT PRICES REDUCED

CLEVELAND, March 14—The Merit Motor Car Co. of this city announces today a price reduction from $1,985 to $1,895 for its five passenger phaeton and two passenger roadster.

DANIELS, $1,000 LOWER

READING, Pa., March 14 — The Daniels Motor Car Co. has made a straight reduction of $1,000 on all models of its line.

LOWER R. & V. PRICES

EAST MOLINE, ILL, March 15—The R. & V. Motor Co. announces a reduction of 10 per cent on the prices of the R. & V. Knight four and six cylinder models.

Irish Business of Ford Gains Under New State

DETROIT, March 15—Business of the Ford Motor Co. in Ireland has increased encouragingly since the establishment of the Free State. The company reports that Irish dealers forecast a much larger volume of sales throughout the year for Ford products. The plant at Cork is now furnishing cylinder blocks and other parts to the Manchester, England, plant, and it is stated that the Manchester product soon will be entirely British made.

Activities out of Manchester are expanding steadily, but sales in England have been confined largely to trucks and delivery vans, which are said, this year, to dominate the automotive field.

Exchange Retarding Trade with Hungary

Country Stands in Need of Motor Trucks—Market Also for Passenger Cars

WASHINGTON, March 11—The exchange rate in Hungary is practically the only drawback to the sale of American motor trucks in that country. A study of the situation by Vice-Consul D. A. Willson at Budapest shows that Hungary needs great quantities of motor trucks at this time to reduce transportation costs of essential commodities. He believes that medium priced trucks and passenger cars will find a ready sale as the exchange rate becomes more favorable.

Willson has produced figures showing that the supply of horses in Hungary has dwindled to about 37 per cent of the horses existing in 1918. Analysis of transportation costs showed that the cost of transport of one ton of merchandise by a 5-ton truck, with trailer attached, would amount to about 12 crowns per kilometer, as estimated by transportation men in Budapest.

Higher Rail Rates

The rate for transporting the same weight of merchandise by rail, without allowances for cartage and transfer, is 19 crowns per kilometer by fast freight, according to the Transport Tariff of the Hungarian State Railways, in force since August 1920—and a 100 per cent increase in rail rates is expected to be put in effect some time early in 1922.

The automobile manufacturing industry of Hungary has never prospered. It reached its highest point of productivity during the war when the government requisitioned plants for the manufacture of trucks for the army.

During the years from 1910 through 1920, the total number of motor vehicles manufactured in Austria was 2504, of which 409 were passenger cars and 2095 were trucks. These were the output of six factories, all of which manufactured trucks, but only four of which made passenger cars. One firm has not manufactured any motor vehicle since 1912; from 1915 through 1918 only one factory was making passenger cars and four or five were producing trucks; in 1920 four factories were operating, two manufacturing passenger cars and two trucks.

Scarcity of Raw Materials

It is believed that were it not for the difficulty of importing raw materials the Hungarian motor industry would be more successful, in view of the fact that the low rate of the crown and the corresponding low rate of wages would permit the exportation of cars to nearby countries with favorable results. However, at the present time the factories are working on a reduced scale because of the further fact that the transportation situation is most unsatisfactory, and there appears to be a general slump in the motor car market of Hungary.

The greater part of the motor vehicles used in Hungary are imported from other countries, and the business is carried on through the agents of foreign manufacturers. The first real influx of foreign motor vehicles began in 1905, due to the interest aroused by the Second International Motor Show held in Budapest during that year. Since that time the total importation of motor cars has been nearly four times as great as the entire domestic production.

About 85 per cent of the motor vehicles imported into Hungary, however, are never put into use in that country, but are re-exported to nearby countries. During the period from 1910 through 1920 the total number of foreign motor vehicles brought into Hungary and used in that country amounted to 784, of which 547 were passenger cars, 59 motor trucks and 178 motorcycles.

Report of Stewart-Warner Shows $767,411 Net Income

CHICAGO, March 14—After writing down inventories about $500,000 and making surplus adjustments, the net income of the Stewart-Warner Speedometer Corp. was $767,411, according to the company's annual report. After payment of $1,172,105 in dividends, there was a deficit of $404,694, which resulted in the surplus being reduced to $7,637,234 compared with $8,041,397 at the close of 1920.

The report states that business thus far this year was about 100 per cent above the corresponding period last year, that a normal production basis was being rapidly approached and that a satisfactory profit was expected this year.

N. A. C. C. Considering Joint Fuel Research

NEW YORK, March 15—Members of the National Automobile Chamber of Commerce have been informed that the directors are considering a joint fuel research plan by the N. A. C. C., the American Petroleum Institute, the Society of Automotive Engineers and the United States Government.

Based on the report that it is possible to produce a great deal more gasoline under certain processes than is now being done, the directors have authorized the appointment of a committee to examine what is known as the "Greenstreet Process" as it is in operation in some of the refining plants.

OHIO BODY REPORTS LOSS

BOSTON, March 15—The Ohio Body & Blower Co. reports a net loss for 1921 after charges and inventory adjustment of $558,660, as compared with a net loss of $397,338 in the previous year.

Net sales in 1921 were $1,531,468, as against $2,737,260 in 1920. The cost of sales, inventory adjustment, etc., reached a total of $1,601,397 in 1921, as compared with $2,479,540 in the year previous. The total operating loss was $391,568 in 1921 and $229,903 in the year before.

Scandinavia Calls for Parts Stations

American Exporters Must Establish Them to Offset Domestic Competition

WASHINGTON, Mar. 13—Study of the Scandinavian motor car industry by Commercial Attache N. L. Anderson indicates that American exporters must place a complete line of spare parts at a central distribution point in Scandinavia in order to offset domestic competition. He has reported to the Department of Commerce that there is a good field for automobile sales, provided the difficulties incident to obtaining spare parts are overcome. It is suggested that main service stations be located at Copenhagen, as it is a principal commercial center station of Scandinavian and Baltic countries.

Replacement, Great Problem

Anderson states that it is of utmost importance to the success of American business that some plan be devised to eliminate the replacement problems from which dealers are suffering, due to the distance from American factories.

The motor market in Scandinavia is still unstable. Financial conditions put the "Scania Vabis," the largest motor car manufacturers, out of business for several months. A reorganization is now being effected in Sweden under the name of Aktiebolaget "Vardsholmen." The factory in Denmark continues under the old name and has kept up the manufacture of gears.

Accordingly, it may be said that "Scania Vabis" is to-day out of business as an automobile manufacturing concern, but the high quality and former success of the "Scania Vabis" cars will probably bring about a further reorganization of the company for the renewed manufacture of automobiles when times are more normal.

Other Car Makers

De Forenede Automobilfabrikker (United Automobile Factories), with headquarters at Odense, Denmark, and a branch factory at Copenhagen, was started about five years ago by uniting three existing Danish automobile factories—the Thomas B. Thrige at Odense and the Anglo Dane and Jan in Copenhagen. This concern has a capital of 2,000,000 Kroners, employs about 200 workmen, and produces 200 cars annually under the trade name "Triangle." This output is almost entirely trucks, which are very substantial and economical in upkeep. Motor locomotives are also manufactured by this concern. The financial rating of the company is very good, in spite of the general bad condition of the local automobile market.

In addition, Kramper and Jörgensen (the "Gideon" motor cars) of Horsens, Denmark, and A/B Tidarholms Fabrikker of Sweden, have until recently been manufacturing automobiles in Scandinavia. Both these firms, however, are now out of motor car manufacturing.

Owner's Confidence Is Big Trade Item

E. K. McGinnis, Formerly With Packard, Says Service Is Important Factor

AUSTIN, TEX., March 11—"The automobile distributor must look at his business in the light of confidential relationship with his customers, as the doctor or lawyer with his clients; if he abuses the confidence he will lose future business."

This was the expressed opinion of Edward Karl McGinnis, formerly connected with the sales department of the Packard Motor Car Co. of Kansas City and now Professor of Business Administration in the University of Texas. McGinnis believes that there are three chief faults in the sales policies of automobile distributors.

He said:

"The greatest mistake, I believe, is in the service situation. When the demand for automobiles fell off in 1920 very decidedly, those companies that had been 'gouging' in their service policy were the first to find business leaving them. Many were forced to liquidation or bankruptcy on account of enemies made by their service policy."

McGinnis then explained the service policy by an example. In St. Louis a truck company, which later went bankrupt, left a monkey wrench in the rear axle of a truck. The wrench tore out about $1,000 worth of repairing for the purchaser. He brought the truck back to the manufacturer for reparing, and they charged him for the work, even though the break-down was due to their own carelessness.

As an exception to this questionable policy, McGinnis cited the case of the Ford factory. Ford, he explained, has a school at the factory for service men; the most experienced workmen in each distributing house would send in candidates for the school. Ford paid them regular wages while in the school, and gave them stiff examinations regularly on all work. Then they were sent back to their jobs. A uniform charge for all repair operations has been set.

Another mistake made, McGinnis said, is the trade-in policy. He then stated:

A third mistake is in the sale of cars on credit. They are sold on a basis of 15 to 20 per cent interest on deferred payments. But the interest charge is so mixed with the cost of insurance, and is a flat rate on the whole price of the car, that customers are deceived in many cases in the amount they thought they were paying.

NEW YORK PASSES FEE BILL

ALBANY, March 16—Increased registration fees for motor vehicles are authorized under two bills passed by the Assembly and sent to the Governor. One provides that the fee for passenger cars shall be 50 cents for each 100 pounds of the cars, fully equipped, weigh 3500 pounds or less, and 75 cents for each 100 pounds if they weigh more than 3500 pounds. The fee for all other cars would by $8. Motor trucks of two tons or less would be assessed $16, and the registration fees of all other trucks would be $8 for each additional ton.

MILWAUKEE MAY HAVE "TRACKLESS TROLLEY"

MILWAUKEE, March 13.—As the result of the success experienced by the Milwaukee Electric Railway & Light Co. in the operation of a number of motor buses as connecting lines to regular street car traffic arteries and similar uses the utility has now applied to the Milwaukee common council for permission by ordinance to place in operation a "trackless trolley" on Lincoln Avenue, which would be the first motor bus line using overhead trolleys for power in operation in Milwaukee.

Industry in Canada Shows Big Expansion

OTTAWA, ONT., March 14—The rapid expansion of the automobile industry in Canada is shown in a report issued by the Dominion bureau of statistics. The total value of production in 1920 was $137,420,351, an increase over the total figures for the previous year of $36,223,645. The value of the automobile output in 1920 was over $101,000,000; of motor supplies and accessories, over $19,000,000, and automobile repairs, over $16,000,000.

The capital invested in the automobile manufacturing industry in the Dominion in 1920 was nearly $54,000,000, an increase of about $19,000,000 over the capital invested in the previous year. Registration of motor vehicles in use in Canada increased from 69,598 in 1914 to 469,310 in 1921.

GORDON LEE IN CHICAGO

CHICAGO, March 15—Gordon Lee stopped here to-day on his western trip to talk to the Automotive Equipment Association on export possibilities. Lee's story of the new work being done by the Department of Commerce was largely new to these manufacturers. Especially were they surprised at the movement to describe the channels of trade in foreign countries and for aiding manufacturers to produce the kind of goods that could be marketed in these countries. There was also present at the meeting Paul L. Palmerton, chief of the Rubber Division.

TRAINLOAD OF WHITES

SAN FRANCISCO, March 15—More than 100 White motor trucks have arrived here on a fast freight train consisting of 45 cars consigned to mercantile firms, utilities or municipalities in various parts of the coast territory. In the trainload were trucks of four capacities, ¾, 2, 3½ and 5 tons.

Japan Is Preparing to Start Road Work

Leaders Confer with Samuel Hill —Country Convinced of Highway Needs

LOS ANGELES, March 13—It is expected that Japan this year will enter upon the comprehensive national road and highway building campaign which has been planned for several years. Samuel Hill, president of the Columbia River Highway Association and the leading spirit of the Pacific Highway Association, is now in Japan conferring with the Japanese leaders in the movement to establish a network of highways throughout the empire.

The carrying out of the program outlined holds great possibilities for the American manufacturers of automobiles, for just as soon as Japan, China and the other coutries of the Far East are "sold" on the value of good roads as the United States has been "sold," the Orient will become a market of tremendous fertility for motor vehicles. Hill says:

Japan has now reached the place where she is convinced of the need of good roads and rapid transportation. All nations preparatory to launching upon an extensive road building program must go through a period of education. Japan has gone through that, the same as America went through it and as many other nations have done.

In Japan all that remains to be done now is to organize the forces for carrying out such a program, to lay out a thoroughly scientific and proven method of construction, including the correlation of all the roads of the Empire, and then begin the actual work of construction. I am convinced this work will be undertaken later this year.

Use of Rail Declines in Transporting Stock

KANSAS CITY, March 13—The Monthly Review of the Federal Reserve Bank of Kansas City takes official cognizance of the radical increase in the use of motor trucks during the past few months for transporting livestock to the six principal markets in this District.

It is well known that the open winter has been propitious for the highway transportation of commodities, but no comment had previously been made on the actual extent of this practice, especially in its reference to railroad traffic. The Federal Reserve Bank, however, collating data on movements of stock, notes the decline in the number of railroad cars carrying stock to market.

The editor, however, did not rest content with that particular piece of information, but sought other data to round out livestock figures. The marked increase in numbers of animals received at yards "through the gates," that did not come by railroad, gave the cue—the "drive-ins," including both stock actually driven in on foot and that transported in vehicles, showing a marked increase.

MEN OF THE INDUSTRY

N. H. Van Sicklen, at one time publisher of Motor Age and latterly manufacturer of the Van Sicklen speedometer, has been appointed assistant general manager of Apperson Bros. Automobile Co. Van Sicklen is a pioneer in the industry, having been long identified with several of its branches. He is also well known nationally as a sportsman. T. E. Jarrard will continue as vice-president and sales manager.

Wilbur F. Opdyke, for a number of years connected with the Crescent Tool Co., Jamestown, N. Y. and later connected with the Walden Worcester Co. of Worcester, Mass., has been appointed district sales manager for the Ohio and Michigan territory for C. N. & F. W. Jonas, direct manufacturers' representatives to the jobbing automotive trade of a number of well known accessory lines.

F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, will address the engineering students of the Massachusetts Institute of Technology on March 24. He will speak before the Bay State Automobile Association on March 22, and will discuss the use of motor buses by traction lines before the New England Railway Club on March 23.

W. T. Helfer who has been ill for more than a year has fully recovered his health and is contemplating moving from Detroit where he is now living to Southern California, probably Los Angeles, to return to active work in the industry. Helfer is one of the veteran tire men of the country, being the first branch manager of the Diamond Rubber Co. in Boston.

Francis W. Davis, one of the best known men in the automotive engineering field, has resigned as consulting engineer of the truck department of the Pierce-Arrow Motor Car Co. with which he has been associated for several years. Other than leaving on an extended trip to Europe he has announced no definite plans for the future.

Frank J. Pardee, for many years identified with the automobile industry in Chicago and for a long period sales manager of the Diamond-T Motor Truck Co., has been named general sales manager of the Leach Motor Car Co. of Los Angeles, succeeding Roy D. Heartz who has retired from business.

C. W. Henry has joined the field force of the Elgin Motor Car Corp. as district manager in charge of the Minneapolis zone. He was formerly associated with Dodge Brothers and with the Maxwell-Chalmers organization in the capacity of district representative.

George C. Kloss, formerly eastern district sales manager of the Gillette Rubber Co., has been appointed special representative of the Delion Tire & Rubber Co. of Baltimore. Kloss has served with various tire companies since he first joined the industry in 1900.

W. H. Sackman who recently resigned as chief engineer of the Light Manufacturing & Foundry Co. of Pottstown, Pa., has been chosen a director and chief engineer of the Pennsylvania Gasoline Drill Co. of Philadelphia.

Earle T. Sutton, formerly advertising manager of the Denby Motor Truck Co. and having wide sales experience both wholesale and retail, has been appointed to the factory staff of the Signal Truck Corp., Detroit.

H. K. Wheelock has returned as managing head of the Western Vulcanizer Manufacturing Co., Chicago. Wheelock relinquished management a year ago on account of ill health and his duties were taken over temporarily by W. J. Jarratt.

E. Z. Jones, formerly director of sales of the Winther Motor Corp. and handling sales in 1921 for the Jackson Motors Corp., has been appointed New York branch manager for the Anderson Motor Co.

P. L. Palmerton, chief of the rubber division of the Bureau of Foreign and Domestic Commerce, will leave soon for Europe to make the first governmental survey of markets abroad for tires and other rubber products.

William C. Hunt, formerly advertising manager of the Columbia Motors Co., has become automobile editor of the Detroit Journal.

Guy Core, former sales manager of the Jackson Motor Shaft Co., has become assistant sales manager of the Reynolds Spring Co., Jackson, Mich.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, will leave Monday for a two weeks' trip to the factories of members of the organization.

J. Henry Smith has been appointed manager of sales of the automobile body department of the Pullman Co. with headquarters at Chicago.

F. B. Willis has been named sales manager of the H. C. S. Co., Indianapolis.

Wright Rubber Products Formed; Will Make Mats

RACINE, WIS., March 13 — The Wright Rubber Products Co., a new Racine, Wis., corporation with $300,000 capital, will start work immediately on the erection and equipment of a factory. It will make a wide variety of mechanical rubber goods, including mats for motor cars and running boards.

It will not, at least for the present, engage in tire and tube manufacturing. Clarence Wright, for many years connected with Racine tire and rubber companies, is president.

Senate Committee Favors Further Federal Road Aid

WASHINGTON, March 13—Continuance of Federal aid to states in highway construction is advocated in the report of the Senate Committee on Postoffices and Post Roads in the postoffice appropriation bill reported to the Senate. The committee recommends an appropriation of $50,000,000 for Federal aid during the fiscal year of 1923, and suggests the authorization of $65,000,000 in 1924 and $75,000,000 in 1925.

The committee declares that refusal to appropriate for 1923 means the abandonment of Federal aid. It also advocates an appropriation of $2,200,000 for air mail service from New York to San Francisco. The current appropriation amounts to $4,125,000.

FORD TITLE TO LINCOLN CLEAR

DETROIT, March 15—Federal Judge Tuttle has decided that Henry Ford has a clear title to the properties of the Lincoln Motor Co. and that any claims filed by the government must be settled by the Detroit Trust Co. as receiver for the old Lincoln company.

Boston Holds Last Big Sectional Show

Exhibit Clinches Impression From Other Parts of Country of Public Interest

BOSTON, March 15—Boston's twentieth annual show, the last of the industry's great sectional exhibitions this year, is clinching more firmly the impressions made by the ten weeks of shows preceding it that popular interest in motor cars is strong and that, aside from conditions peculiar to certain parts of the country, a sales volume in excess of 1921 may be expected during the remainder of the spring selling season.

Attendance has been satisfactory and has been increasing daily, the interest indicating a good proportion of potential buyers. New England dealers up to Wednesday night had registered close to 50 per cent of their numbers at the show, and most of the sales meetings conducted by the manufacturers and distributors have been well attended.

Sales Resistance Diminishing

Motor car dealers from the outlying communities brought encouraging reports of diminishing sales resistance due to price uncertainty and a more hopeful public attitude concerning general business conditions.

The trade in Boston proper and the adjacent territory is spotty. Dealers who have close, efficiently operating organizations are moving cars in fairly good volume right now. Some of them are piling up large spring delivery sales. The rest are showing some improvement over the sales of a year ago.

There is a note of increasing optimism in the truck section, due to the better general business tone of the territory, and all of the exhibitors expect the spring months to show a marked improvement in sales. In fact, selling already has reached good proportions in lighter trucks and business cars.

Few Motor Vehicles Made in Germany Reach America

WASHINGTON, March 15—Only 2.2 per cent of the 968 motor vehicles exported from Germany were received in this country during January, according to an analysis of foreign trade by the Automotive Division of the Department of Commerce. Holland was the principal country of destination, as 21.5 per cent of the German exports were taken across the frontier.

Exports from Germany showed a slight decrease as compared with December. Belgium accepted 17 per cent of the passenger cars, trucks and chassis (for both); Sweden, 9 per cent; Spain, 9 per cent; Denmark, 8 per cent; South East Asia, 6.6 per cent; South America, 2.7 per cent; Switzerland, 1.6 per cent; Austria, 1.5 per cent, and all other countries less than one per cent each.

FINANCIAL NOTES

Gray & Davis, Inc., for the calendar year of 1921, which was the first full year operated under American Bosch Magneto management, reports an operating loss of $179,594, compared with a deficit in 1920 of $468,108 and with a net profit in 1919 of $465,680. The Cambridge plant, with sales of $1,061,642, showed an operating profit of $6,980, and the Amesbury plant, with sales of $791,193, reported an operating loss of $186,574. In 1920 the net loss for the first seven months under the old management was $436,109, and in the final five months under the new management it was but $4,998, of which the Amesbury plant showed a loss of $53,215, and the Cambridge plant a profit of $48,216.

Maxwell Motor Corp. executive committee has voted to anticipate the maturity of the issue of approximately $3,850,000 series A gold notes due June 1, 1922, by retiring them under the call of privilege of April 1. The strength of the company's cash position is indicated by this action in retiring the notes sixty days before maturity. Maxwell carries no bank loans at the present time.

Reynolds Spring Co. of Jackson has declared a dividend of 1¾ per cent on the preferred A stock, payable March 31, 1922 to stockholders of record at the close of business on March 22.

Hupp Motor Car Corp. has declared its regular quarterly dividend of 1¾ per cent on preferred stock, payable April 1 to stock of record March 20.

Fisher Body Corp. of Ohio has declared its regular quarterly dividend of $2 on the preferred stock, payable April 1 to stock of record March 25.

Kelsey Wheel Co. has declared the regular quarterly dividend of $1.50 on the common stock, payable April 1 to stock of record March 20.

Meixell States Gasoline Tax Is Discriminatory

NEW YORK, March 15—Motor vehicle taxes upon gross tonnage and horsepower instead of upon gasoline purchases were advocated by Harry Meixell, secretary of the Motor Vehicle Conference Committee, in an address before the Oil Trades Association of New York. He said:

The main objections to the gasoline tax are that it discriminates against the internal combustion vehicle in favor of those driven by electricity or steam; that it fails to discriminate between the use of automobiles for pleasure and for business; that it is costly in administration and brings with it other and higher taxes upon the users of motor vehicles.

Without question, Meixell said, owners of motor cars should pay a share of the expense of maintaining highways, but only on the basis of gross weight and horsepower. He estimated that one-tenth of the motor vehicles in use in the United States are commercial trucks.

BOWSER TIME LENGTHENS

FORT WAYNE, IND., March 14—Scheduled hours for employees in the shop of S. F. Bowser & Co., Inc., of this city, pump and tank manufacturer, are now fifty a week, due to increased business. The day men will work nine hours a day for the first five days of the week and five hours on Saturday. The night men will work ten hours a night for five days a week, starting at 7:30 o'clock. Overtime will not start until the scheduled hours for the day have been worked. This is the longest work schedule in force at the Bowser plant for some time.

60,000, G. M. Output in First Three Months

NEW YORK, March 15—Production by the various General Motors divisions, including all types of motor vehicles, will approximate 60,000 for the first three months of this year, as compared with about 25,500 for the same period in 1921. The total output of all divisions for January were approximately 15,400, compared with 6000 in January, 1921.

February production increased to 21,000 as compared with 8900 for February last year. Buick continues to lead all other divisions. Business of the General Motors Truck Co. has not increased to the same extent and sales by the Samson tractor division have been small thus far this year.

Kelsey Wheel Co. Reports $16.06 Earned on Common

DETROIT, March 16—Although the gross sales of the Kelsey Wheel Co., Inc., showed a substantial decline during 1921, at $17,487,597, compared with $25,200,913, during 1920, the net profits are shown in the annual report, after charges and Federal taxes amounted to $1,792,862 equivalent, after providing for preferred dividends, to $16.06 a share earned on the $10,000,000 common stock.

Net profits during 1920 totaled $1,916,008, or at the rate of $17.24 a share. After payment of deferred dividends, there was a surplus of $1,606,109, as compared with $1,724,107 at the end of 1920.

MULLINS BODY CORP.

SALEM, OHIO, March 16—The Mullins Body Corp. for the year ended Dec. 31, 1921, reports net operating loss of $87,617 after expenses. Net sales during the year amounted to $1,431,243. Gross profits from sales after deducting cost amounted to $130,061. After deducting miscellaneous charges of $23,327 and expenses $217,678, there was a deficit of $110,392.

AVERY REPORTS DEFICIT

PEORIA, ILL., March 15—Avery Co.'s annual report shows a net deficit of $714,969 on operations and a total deficit of $2,657,827, after inventory adjustment and other expenses, compared to an operating profit of $17,355 in 1920.

The comparative balance sheet as of Nov. 30, 1921, shows accounts receivable, etc., of $1,243,713, against $817,625 in 1920; and inventory of $4,209,696 in 1921, compared to $7,010,994 in the previous year.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

The trend of the call money market was generally downward throughout last week. The week's range was 3½ per cent to 5 per cent, as compared with 4 per cent to 5½ per cent in the previous week. For fixed date funds offerings were in better supply, although the range remained unchanged at 4¾ per cent to 5 per cent for all maturities from sixty days to six months. The prime commercial rate continued to be quoted at 4¾ per cent to 5 per cent. The plentiful supply of funds during the greater part of last week was principally due to the accumulation of money here for the March 15 turnover, which will include the payment of the first installment of the 1921 Federal Income Tax.

Further gains of $14,5000,000 of gold and of $13,200,000 of total cash reserves were shown in the Federal Reserve statement as of March 8, 1922. Total bills on hand decreased $70,309,000 and total earning assets $39,506,000. Total deposits decreased $38,391,000. Federal Reserve notes in circulation, on the other hand, increased $451,000.

The gold reserves of the New York institution increased last week $3,137,000. There was a shrinkage of $9,873,000 in total deposits. Federal Reserve notes in circulation showed an increase of $1,607,000, and the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 84.1 per cent to 84.9 per cent.

Bradstreet's Index Number of commodity prices as of March 1 showed a further slight gain, the eighth gain shown in nine months in the general price level since early last June. The index numbers as of March 1 indicates a gain of 1.5 per cent over that of February 1 and of 8.5 per cent over that of June 1, 1921, but it is 2.2 per cent below the level of March 1, last year.

Proponents of Metric System Are Organizing

WASHINGTON, March 14—That proponents of the metric system are going to stimulate efforts looking to the establishment of this plan of measurement has become evident. An organization of the local section of workers for the installation of the metric system and the passage of the Britten-Ladd bill was effected last Friday night at George Washington University Law School.

It is also proposed to name an "educational" committee in order to acquaint the people of the country with the alleged benefits that would arise from the metric system. Senator C. F. Ladd, of North Carolina, spoke of an amendment to his bill which would provide that in 1926 all Government specifications and engineering works be done with the use of the metric system.

INDUSTRIAL NOTES

Deman-Myers Cord Tire Co. reported a bright outlook for the year at its annual meeting. The overhead expense has been reduced to the minimum, it was stated, and the company is now operating on the lowest cost possible and still maintain the efficiency of the organization. Full capacity production is planned, although conservatism will mark the company's program. F. F. Dugan, formerly with the Goodyear Tire & Rubber Co., has been elected vice-president and director of sales. C. L. Mason, sales manager, will be in charge of distributors and branches. Additions to the field force include J. H. Appleby who will cover Illinois and J. P. Egan whose territory takes in Ohio. The Board of directors elected the following officers: President, Walter E. Myers; vice-president, F. F. Dugan; secretary and general manager, Walter R. Denman; treasurer, John E. Morris; and assistant secretary and treasurer, L. M. Harper. The offices of the company have been moved from Cleveland to Warren, Ohio.

Ewing Bolt & Screw Co., Detroit, has acquired the plant of the **Detroit Machine Co.**, new capital being provided for the development of both concerns. Plans contemplate the sale of the Machine company's property and the construction of a new plant in the River Rouge near the Ford steel plant on a site owned by the Ewing Corp. Myles E. Ewing, president and J. A. Hale, secretary and treasurer of the Ewing company, assume the same offices with the Machine company. David W. Pell, manager of the Machine company becomes production manager of the Ewing concern. The directors are Hal H. Smith, Frank W. Blair, Arthur T. Waterfall, David W. Pell, A. N. Marion, Myles E. Ewing, J. A. Hale, all of Detroit; and H. J. Douglas and David L. Rockwell both of Cleveland, the latter being vice-president.

Perfection Heater & Manufacturing Co., Cleveland, at its annual meeting elected C. S. Pelton president and general manager, W. A. C. Smith vice-president and F. D. Kellogg secretary and treasurer. E. L. Jones was appointed sales manager and G. W. Rouvel, assistant treasurer. All directors were re-elected. The company reports business to be in a very satisfactory condition with bright prospects for 1922. A number of important changes are being made in its production equipment.

Kendell Engineering Corp., Fort Wayne, Ind., formerly the Kendell Engineering Co., has completed its plans for expansion under which it will begin operations immediately on a new plant. There has been no changes in personnel, C. A. Kendell continuing to act as president and engineer; Robert L. Kendell as vice-president and sales director and M. W. Cartwright as secretary and treasurer.

Carpenter Tire & Rubber Co., Hempstead, Long Island, is confining its business exclusively to the manufacture of solid motor truck tires. Production is now fully underway at its new plant. The company was formed several years ago as distributors, with Harry B. Carpenter as president and general manager. Associated with him is Harry Davenport as general superintendent.

Torbensen Axle Co. is establishing a chain of parts service stations, each station to be centrally located and to carry a complete line of the company's parts. It is planned to arrange these locations so that there will not be more than twenty-four hours delay in service. It is expected that the entire distributing organization will be completed within the next sixty days.

Lakeside Forge Co., Erie, Pa., has opened offices in the Penobscot building, Detroit, and at 334 North Capitol Avenue, Indianapolis, in addition to its present district sales offices in New York and Cleveland. These are industrial sales offices and are not in any way connected with the jobbing or dealer end of the business.

Tuscora Rubber Co., a $1,500,000 company making special rubber articles at Dover, Ohio, has been placed in the hands of C. C. Adams and Henry Krantz as receivers. The corporation was organized in 1919 and started operations in 1921. There are approximately 1,600 stockholders throughout Ohio and West Virginia.

Chicago Automobile Supply House announces a change in its personnel. William M. Weber is president and treasurer; Robert S. Mitten, vice-president and general sales manager and Otto H. Weber, secretary. The former secretary and treasurer, J. E. Brennan, has retired.

Kelly-Springfield Tire Co. at its annual meeting increased the number of directors from eight to twelve, the new members being C. A. Brown, T. C. Marshall, J. V. Mowe and M. Switzer. The old directors were re-elected.

New England Velie Co., Boston, is developing plans under which it will finance both wholesale and retail car sales.

E. Edelmann & Co. plant in Chicago has been sold to the Bassick Manufacturing Co. for $260,000.

Cleveland Fisher Body Plant Operating Full Time

CLEVELAND, March 14.—In line with the general improvement in automotive conditions here the Fisher Body Corp. plant is now operating on a full time basis and is turning out 200 bodies a day. Practically capacity production is the schedule, with 2,800 men employed. About six months ago the plant was practically closed down, after having been in production with about 3,000 men the latter part of 1920. Last October production was resumed on a small scale and it has been increased steadily.

At the plant it was reported that inquiries for bodies of the closed type have greatly increased.

The Baker R & L Co. has announced that business has reached 50 or 60 per cent of normal. The Ohio Body Blower Co. and the Rubay plants also report that inquiries have increased and that production gained during March.

The industry is responsible largely for the expansion of the Otis Steel Co. and the Empire Rolling Mill Co., both of which are going into the production of steel sheets.

REO ACTIVITIES INCREASE

DETROIT, March 13—Reo Motor Co. has placed its engine department on approximately full time production, and will increase its operations in other departments as the supply of engines is increased. Steady growth in orders is reported from all parts of the country. The new Reo special taxicab will be ready for the market within thirty days.

METAL MARKETS

Significant in the present condition of the steel market is the reaction which the announcement that certain producers of bars, shapes, and plates had revised upward their asking prices for these products had upon the mind of the industry as a whole. Not a few sales managers were frankly uneasy that the ado which was made about these advances might be misconstrued and tend to scare out of the market buyers of steel products prices on which never descended to the low levels of bars, shapes, and plates. At 1.35¢, the level recently prevailing in the bar market, this product was $1 a ton below its ten-year pre-war average.

Plates and shapes were $3 a ton below that average, whereas black sheets at 3¢, the price in vogue throughout this year, are selling at $14 a ton above their ten-year pre-war average. While there was ample statistical ground for the advance in bars, shapes, and plates, the independent that led in the upward revision announced the higher quotation only after his books were comfortably filled with orders at the old price. Noteworthy it is also that at about the same time this interest raised its price on structural shapes $3 a ton, another independent booked a large structural contract, erected, on a basis of 1¢ a pound for structural shapes or $10 a ton below the new quotation of the former and $7 a ton below the market that had prevailed previously.

That the independent who led in the advance on bars, shapes and plates had followers, means very little. In the first place, compared with other steel products, those affected sold at too low a price. Moreover, any fairly prominent steel producer who announces an advance will always have a certain number of followers. The latter will try it out for a time. If they can not book orders at the new price, the responsibility for the advance rests with its originator, and they can very easily back water after a certain length of time. As concerns distinctly automotive steel products, especially sheets, producers generally are in a "let well alone" frame of mind.

Pig Iron.—Several sizeable tonnages for second quarter delivery have been contracted for by automotive castings makers in the Middle West, malleable seemingly leading foundry in point of consuming interest. The market's tone is fairly steady.

Steel.—Quite a few transactions in steel bars have been consummated of late for account of automotive consumers at prices below those announced by some of the independents. The automotive industry has the market for cold-finished steel bars virtually to itself. Similar conditions prevail in the hot-rolled and cold-rolled strip steel industry which is now operating at the highest rate of the year, about 50 per cent of capacity. The sheet bar situation is unchanged, $29 being generally quoted, Pittsburgh or Youngstown. Demand for all sorts of sheets continues steady, as do prices. No unusually large commitments are noted but automotive consumers are buying consistently and nearly always for early shipment. Improvement is also noted in the demand for bolts and nuts. Orders for several thousand tons of frame stock and full finished sheets are overhanging the market.

Aluminum.—If there are any bargain lots of sheets around, they are visible to buyers. Ingots, of course, continue in abundant supply, but holders are somewhat more reserved when it come to prices.

Copper.—The market is gradually recovering.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March, 1922 — Santiago, Chili, Annual Automobile Show.

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24 — White Suplur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Sacramento Market Is Becoming Active

Reflects Opinion of Farmers and Business Men That Good Year Is Here

SACRAMENTO, CAL., March 9—After passing through one of the worst winter seasons ever known here in the automobile industry, indications are there are much better times ahead. Conditions here have been as elsewhere. Financial readjustments and depression, price uncertainties and a general drop in the price of farm products, with no corresponding decrease in freight rates or production costs, have made the farming districts poor fields for the motor car salesman.

Of course, the winter season always is light and spring always shows a decided improvement. But the winter just ended was worse than usual, far worse. There were almost no sales. But the spring is brighter than ever, and sales already are coming along in good shape. With the conviction that prices have been settled for the time being, buyers seem willing to open up the purse strings and the first few bright, warm days of the season saw hundreds of new jobs on the highways of northern California.

The automobile market may be taken as a fair index of conditions generally. Automobiles are bought when there is money available or in sight. Hence the fact that the market is showing activity reflects the belief of the farmers and business men that this is going to be a good year. This winter has been ideal for fruit; there should be big crops which means many automobiles.

S. A. E. APPROVES CHANGES

NEW YORK, March 15—The revisions in the standard body nomenclature, together with other recommendations of the Standards Committee made at the winter meeting of the Society of Automotive Engineers, have been adopted by a mail vote of the society. This excludes, of course, the recommendations pertaining to the stamping of engine numbers which were withdrawn by authority of the council and the revision of the engine testing forms, which was referred back to the Engine division.

Britain May Eliminate Automobile Import Tax

LONDON, Feb. 24 (*by mail*)—The Industries Act passed by the Coalition Government has proved so irksome and expensive to certain British export industries of national importance that it is almost certain to lapse. The dropping of this legislation no doubt is responsible for the rumor that Britain will revert wholly to her free imports policy.

The attempt to keep out automobiles by a 33 per cent duty was frustrated early in its history by the expedient of assembling in Canada and shipping here under the preferential rate, which generally means a drop from 33 per cent to 9 or 10 per cent duty, at which rate the tariff is economically useless and wasteful to collect. Moreover the setting up of assembling works in Britain by American interests and possibly in the near future by at least one French firm will leave the British automobile makers bereft of any bolstering up anticipated from the tariff.

7200 WILLS ORDERED

DETROIT, March 14 — The Wills Sainte Claire Co. has issued a statement that it has contracts with distributors for 7200 cars for 1922 delivery. February production of 15 daily has been increased to 20 daily for March. Six hundred men are now employed at the Marysville plant.

New Orleans Orders Eight Kelly Trucks

Plant Force Grows—International Harvester and Westcott Motors See Brighter Outlook

SPRINGFIELD, OHIO, March 14—Good sized orders are being booked by The Kelly-Springfield Motor Truck Co. During the past week it received an order for eight motor trucks from the city of New Orleans, to be delivered within the next two weeks. There are 75 per cent more men employed in the plant to-day than there were last October. A number of men were added to the force during the past week.

While in the city conferring with Superintendent Charles H. Smart, of the Springfield Works of the International Harvester Co., A. A. Jones, assistant to Cyrus McCormick, works manager, with headquarters at Chicago, said that the outlook is brightening considerably. Smart stated that a shipment of high speed trucks was made during the past week to Australia. The foreign demand for trucks is increasing, he said. The Springfield works is turning out 50 trucks daily. These are being shipped about as fast as they are produced.

Orders have been steadily increasing at the plant of The Westcott Motor Car Co. It was stated by one of the officers of the company that more orders have been received during the past week than for any one week during the past two years. On March 15 the company will increase its production to meet the demands of the trade.

Material has been received preparatory to speeding up production. Indications are that the plant will be busy for the next three months at least. The company is receiving orders from the New England states, north of Virginia, and as far west as Chicago.

AUTOMOTIVE INDUSTRIES
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Keen Sales Competition in Middle Priced Car Field

46 per cent of all car manufacturers are competing for the 18 per cent of total car business comprised in the middle priced market. This article analyzes the $1000-$2000 car market, and presents statistics and methods of value to passenger car manufacturers.

By Norman G. Shidle

Charts and Statistics by Raymond B. Prescott

THE market for cars selling between $1,000 and $2,000 calls for special analysis, since it presents the field of keenest competition in the automotive industry. Manufacturers building cars in this middle-price group need, perhaps more than any others, detailed data upon which to plan production and sales effort.

In 1921 there were 85 N. A. C. C. members producing passenger cars, and of this total 33 were making cars in the middle-price group; 1921 passenger car production totaled 1,457,000. Of this total 291,432 consisted of middle-price class production. In other words, 39 per cent of the car manufacturers were competing for 20 per cent of the business.

The 1922 production figures, as predicted by AUTOMOTIVE INDUSTRIES, indicate that about 306,000 cars, or 18 per cent of the total 1922 production, will consist of cars in the $1,000-$2,000 class. But a survey of the N. A. C. C. membership lists shows that 46 per cent of the total car manufacturers in the field this year are competing for this 18 per cent of the probable total business.

The chart in Fig. 1 shows the relation of production in the middle-price group to total car production for the years 1912 to 1921 inclusive, the figures for 1922 being predicted. A study of these curves indicates that the proportion of cars in this group as related to total car production has not varied widely from year to year, although the "high spending" years of 1919 and 1920 reacted to the benefit of the middle-price group at the expense of the "under $1,000 group." These years were clearly abnormal, however, both for the automotive industry as a whole and for the middle-price group.

The manufacturer in this price group is interested in two sets of data:

1. The status and probable development of the price group as a whole.
2. The relation of his individual company to the group development.

Viewing the figures for this group over the period indicated, a tendency toward a relative decrease appears. That is, the percentage of cars in this group, as compared with the total car production, shows no indication of growing any larger, the tendency being rather in the opposite direction. This relation, of

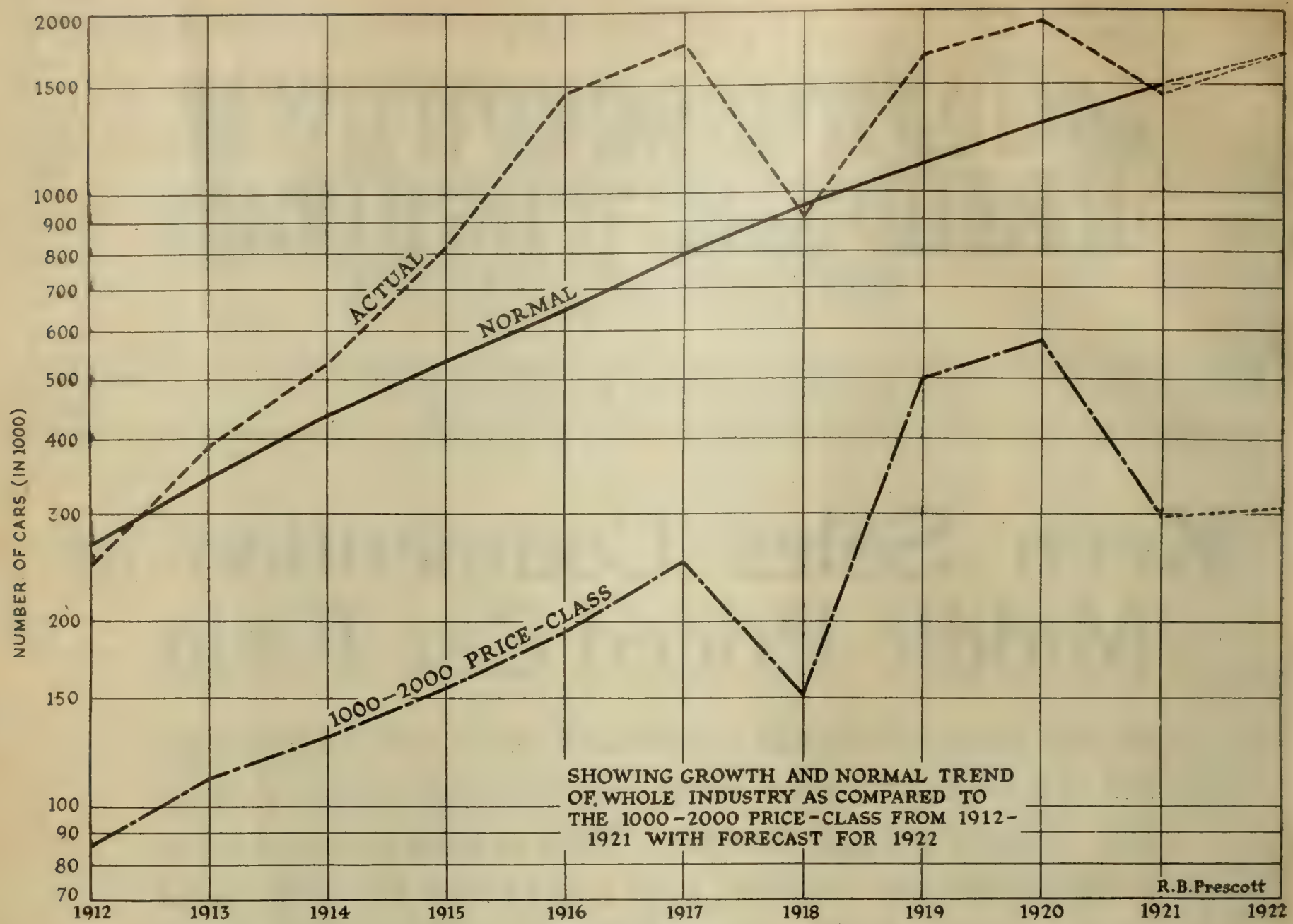


Fig. 1

course, is relative and not absolute; it has no bearing on the actual car production in this group.

A summary of the period 1912-1921 shows that 11,162,000 cars were produced, of which number 2,463,000, or about 22 per cent, were in the $1,000-$2,000 price class.

The tendency of middle-price production to decrease slightly in proportion to total production is particularly interesting, in view of the relative increase in the number of manufacturers making cars in this class. The curve in Fig. 2 shows this relation clearly.

It might be expected that, as the percentage of the total production comprised by this group dropped, the number of manufacturers in the group would drop also. As a matter of fact, just the opposite has occurred.

As the middle-price class percentage of total production dropped, the number of manufacturers entering the group increased. This was true during the period 1912 to 1916, during which the percentage steadily dropped. And the figures available for 1922 indicate a similar tendency at the present time.

This trend indicates a distinct increase in the competitive conditions of the middle-price class market at times when the potential market possibilities of the class are on the decline as compared with the total market. It indicates, as well, that those manufacturers who remained in the price group during the period when the percentage of business was increasing benefited in getting a stronger hold on the particular market.

This latter trend is illustrated by an analysis of the 1921 figures for this price group. These figures show that, in 1921, 33 manufacturers in the middle-price group produced 291,432 cars, but that of this total, 80 per cent of the cars were produced by ten companies. A further examination shows that of these ten companies producing 80 per cent of the middle-price cars, nine of them have been constantly in this price group for five years.

The increase and decrease in middle-price percentage of total car production has been given to or taken from the "under $1,000" group chiefly. In other words, the percentage decrease in the middle-price group from 1912 to 1917 was compensated chiefly by a percentage increase in the "under $1,000" group, while the middle-price group percentage increase in 1918 to 1920 was accompanied by a loss in production percentage in the "under $1,000" group.

The drop in the number of firms in the middle-price group in 1918-1920, on the other hand, occurred chiefly because of the jumping of many firms in the middle-price group to the high-price classes. The following table shows the movement of cars in and out of the middle-price class from 1912-1922:

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
Total in group	20	20	30	39	38	43	40	35	33	34	44
New cars	..	4	12	2	3	8	3	1	3	5	2
From lower price group	..	0	1	1	0	2	5	4	3	0	0
From higher price group	..	1	1	9	4	0	0	0	0	1	12
Out of business	..	4	1	2	1	2	3	2	2	1	1
To lower price group	..	0	2	1	5	3	0	1	0	1	3
To higher price group	..	1	1	0	2	0	8	7	6	3	0

Studying the actual production figures of this group for a moment, it will be noted that the highest production for the group was in 1920, when 590,780 cars were pro-

duced. Not all of the companies in this price class in 1920 are still there in 1922, of course. But, figuring the 1920 production of the individual companies as their production capacity, the capacity of the 44 firms in the middle-price group in 1922 totals about 550,000. The calculated production in this group for 1922 is 306,000. Thus it appears that in 1922 the middle-price group will be operating at about 55 per cent of capacity.

This average, of course, is for the group as a whole and does not apply to particular firms, some of which will undoubtedly run much nearer to capacity, while some will have to operate at less than half capacity.

This completes the picture of the middle-price class group as a whole. The picture shows a field of intense competition, into which more cars have come during periods in which the field offered decreasing possibilities. It shows about 25 per cent of the companies in the field producing about 80 per cent of the cars, the remaining 75 per cent of the companies competing for 20 per cent of the potential middle-price class market.

Individual Problems

But the individual manufacturer is concerned with the relation of his particular company to the market, as well as to the price class market in general. His possibilities of obtaining more business rest in two points:

1. He must take away some of the business held by other manufacturers.
2. Or some companies must leave the field, thus increasing the possible sales for the remaining companies.

In considering the market possibilities for his particular car, the individual manufacturer must utilize, not only the statistical data presented, but also the principles upon which that data is built up. Experience shows, for instance, that a given company can scarcely expect to make radical changes in its trend of sales curve within a single year. Human nature is such that habit and inertia play a large part in buying and also in organization methods and ideas. Much progress can be expected within a single year or two, but radical changes cannot. A manufacturer can well base his plans for the coming years upon the trend of his sales curve in past years as related to the sales curve of his price group. It is this fact that makes the accompanying statistical data of value; that makes it possible to draw a sound, normal curve for the industry, and to predict with considerable accuracy the production and registration figures of the industry for two to five years in advance.

It is worth while to emphasize here again the necessity for those using these figures in planning to be familiar with the data that has gone before and the basis upon which that data was built up. The two previous articles appeared in AUTOMOTIVE INDUSTRIES of Nov. 17 and Dec. 22, 1921, respectively.

STEADY profits are related to many factors other than quantity production. It is perfectly possible for a company to continue in a prosperous condition, although its production growth does not keep pace with that of its price class. The trend of individual production curves, however, as related to price class production curves constitute an important part of the market picture necessary in planning production and sales schedules.

Enthusiasm and optimism are essential parts of sales effort, but in buying equipment and materials, sound facts yield greater profits. The production schedule should be based upon what the individual manufacturer can reasonably expect as his proportion of his price class market. This article gives the statistics and methods necessary to a determination of that proportion.

Some Specific Examples

Fig. 3 shows the relation of six typical middle-price class cars to the progress of their price group. The cars chosen for this illustrative analysis have all remained in the middle-price class group throughout the period charted. Two of them are so-called assembled cars, while the other four are built up almost entirely within the manufacturer's own factory. An analysis of the chart brings out some interesting points.

Car A, for example, has had the largest production and has followed very closely the production trend of the entire price class. So striking is the similarity between A's curve and the price-class curve that A may be said to be a signpost to the probable trend of the entire group. The curve indicates that Company A has consistently maintained its relative position in respect to the price group of which it is a part, and that its production for the coming year will probably be about the same in relation to its past production as will be the total group production in relation to the past group total. In other words, a company with a production curve similar to that of Company A can plan its production schedule with reasonable certainty on the assumption that it will at least maintain its relative position in its price group. The proportion might be stated in this way:

Company A 1922 production: Company A production capacity = middle-price group 1922 production: middle-price group capacity.

In most cases, however, the analysis is not quite so simple. Factors enter into consideration that cannot be accounted for purely on the basis of price-class market. The new car entering the field must take time to establish itself; change in policy and management may occur, necessitating temporary slowing up in production or readjustment in sales policy; internal financial battles may be waged with a consequent effect upon public opinion and sales. All such factors must be considered by the individual manufacturer in making his analysis.

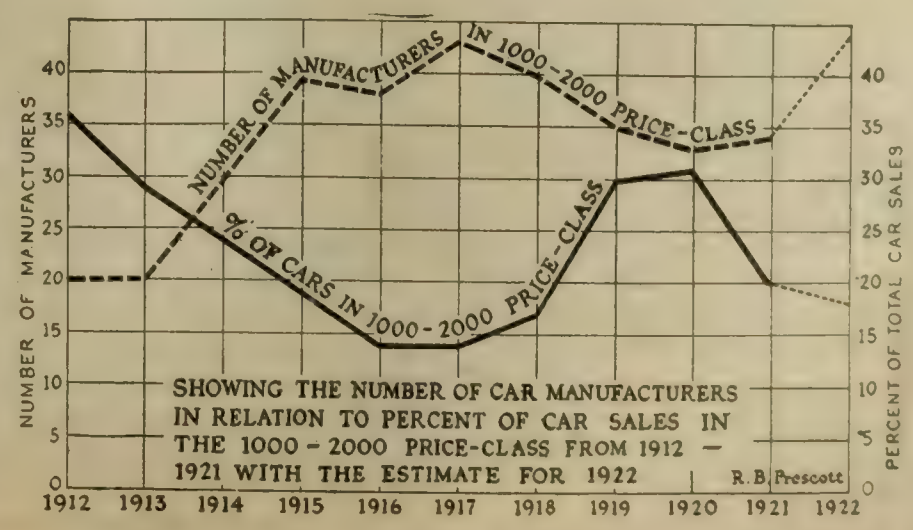


Fig. 2

The production of Company B shows a somewhat different picture. This company made more rapid progress than its price group from 1912 to 1916, but since that time has not kept pace. It is worth while to note here, however, that a company may continue to be prosperous without keeping pace with the

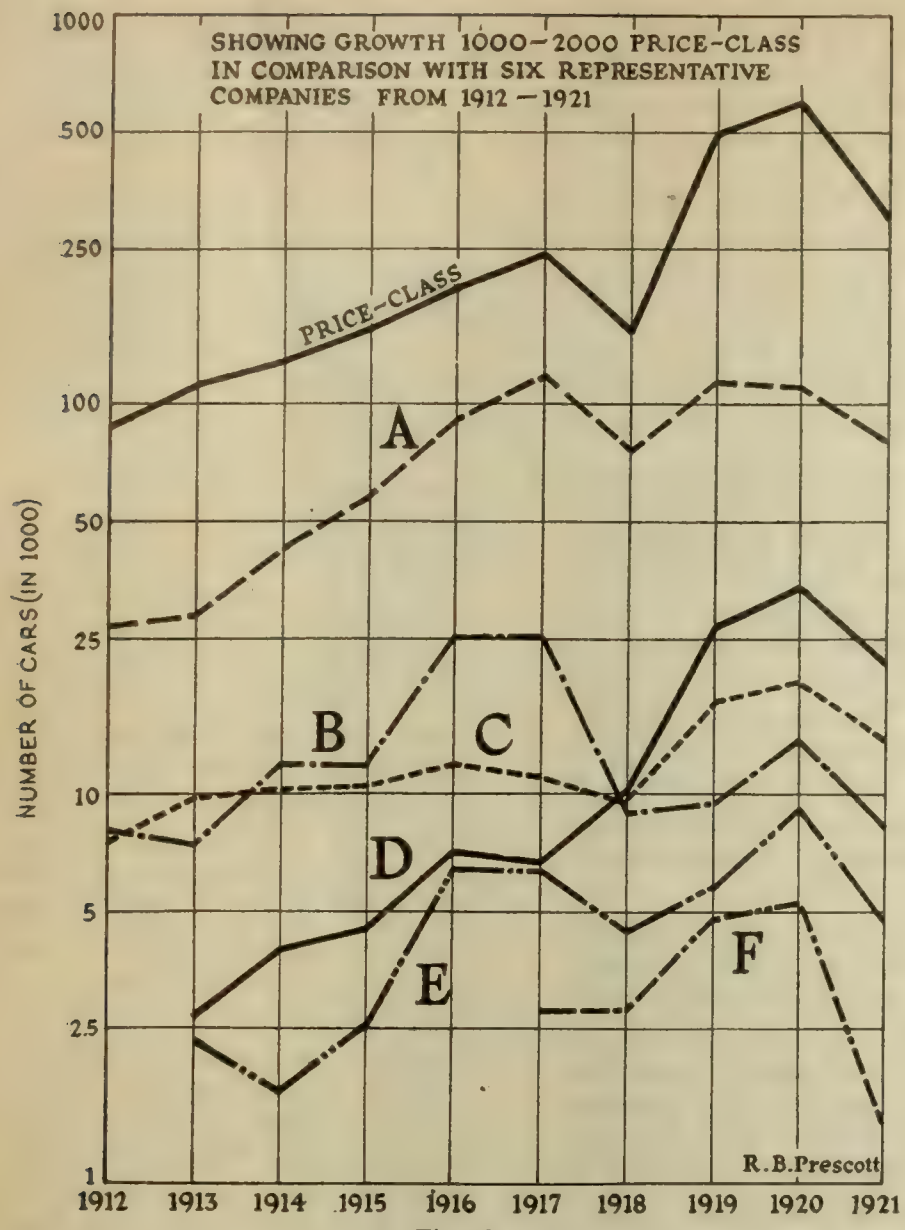


Fig. 3

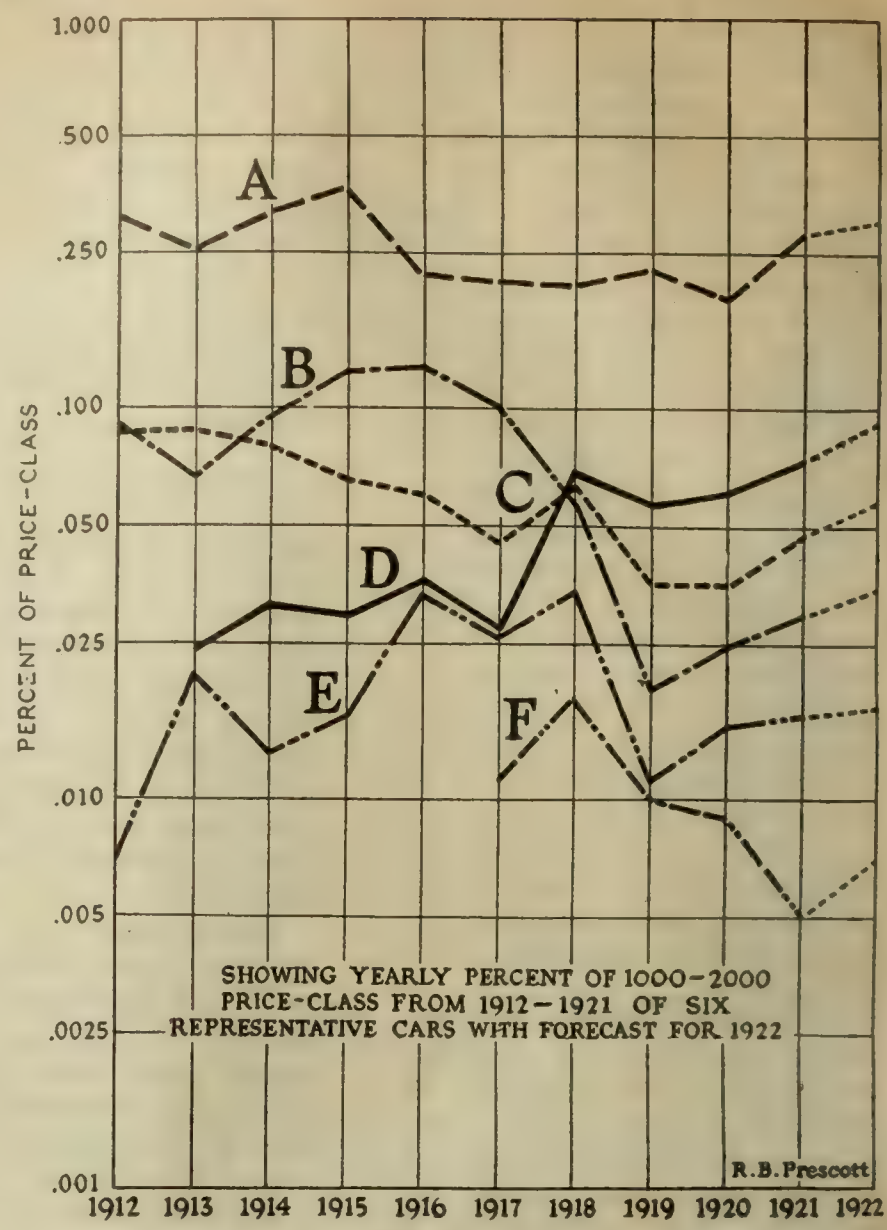


Fig. 4

growth of its price group. Steady profits are related to many factors other than quantity production.

In the case of Company B, however, there would appear to be a production capacity in 1922 of some 16,800 in excess of actual production, thus indicating the necessity of either reducing the production capacity or obtaining a greater share of the price-class market that production may be increased. The trend of Company B's curve during the last five years does not indicate that there is a likelihood that Company B will be able to obtain that larger proportion of the market during the next year or two.

The curve for Company C shows a different condition again. Clearly, through the period charted, this company has failed to increase its production in proportion to the general increase of the price class. On the other hand, taking 1920 as its production capacity, there is not a large discrepancy, comparatively speaking, between its actual 1921 production and its production capacity.

Company D, according to the chart, is shown to have gained consistently at a more rapid rate than the middle-price group as a whole, while its 1921 figures show no abnormal drop from the 1920 capacity peak. On the basis of these records it would appear that Company D is the only one plotted which can logically expect to obtain a larger proportion of the business of the middle-price group during 1922 than it had during either 1921 or 1920.

Company E is shown to have gone forward with considerable rapidity during the early stages of its career—more rapidly than its price group as a whole. In later years, however, it has just about kept pace.

Company F came into the field later than the other companies charted. As might be expected, during its period of growth it did not progress as rapidly as the group as a whole. It felt the effects of the business depression more heavily than did the companies more firmly established in the minds of the public, as is shown by the relatively sharp drop in 1921 production.

Fig. 4 shows the percentage of the total business of the price class obtained each year by these six typical companies. It gives in actual figures the general trend outlined.

Production and sales plans must be made upon the basis of real analysis and accurate data if permanent progress is to be made. In fact, such analysis is necessary if a company is to stay in business under present competitive conditions. Enthusiasm and optimism are essential parts of sales effort, but in buying equipment and materials sound facts yield greater profits.

It is human nature for every individual maker to feel that by more intensive sales methods he may be able to obtain this year a considerably larger share of his price-class market than ever before, and thus produce enough cars to cut down his overhead expense.

All the data and experience available, however, indicate that this is not probable in the case of any individual manufacturer—or in the case of any price class, for that matter. The data given by AUTOMOTIVE INDUSTRIES has been gathered over the entire period covered by the automobile industry, and can be said to picture with considerable accuracy the lessons and experience of the past and to form a basis upon which intelligent predictions for the near future can be made.

The production schedule should be based upon what the manufacturer can reasonably expect as his proportion of the price-class market, this proportion to be determined on the basis of the best available statistical data and financial situation of the individual company.

International Brings Out Advanced Design of Tractor

Employs one-piece frame, but maintains unusual degree of accessibility. Engine has two-bearing crankshaft, removable cylinder liners and overhead valves, all wearing parts being easily replaceable. Double reduction by bevel and spur gears to live rear axle. All gears run in bath of oil.

By Herbert Chase

ONE of the most interesting and advanced designs of farm tractor which has recently come to our notice is that developed by the International Harvester Co., which is to be known as the 15-30 gear drive model. This machine embodies many of the features of the most progressive designs which have appeared of late, and goes a step further than these in some directions.

The new product is of the one-piece cast frame type, and has a live rear axle and an automobile type front axle with single support at its center. One of the objects which the designers have sought to attain is an unusual degree of accessibility. The chief disadvantages of some machines with a one-piece frame is the fact that it has been rather difficult to dismantle them or reach various parts when repairs are required. In this new product, however, most of the units, such as the gearset, the clutch, the axle gears and the belt pulley drive, can be readily taken out without disturbing, except in a minor way, adjacent units. Furthermore, the design is such that the various parts can be removed and dismantled with minimum expenditure of time.

The new tractor has a wheelbase of 85 in., rear wheel tread of 50 in., front wheel tread of 46 in. and a turning radius of 15 ft. It weighs 5575 lb. filled, 3325 lb. being on the rear wheels and 2250 lb. on the front wheels.

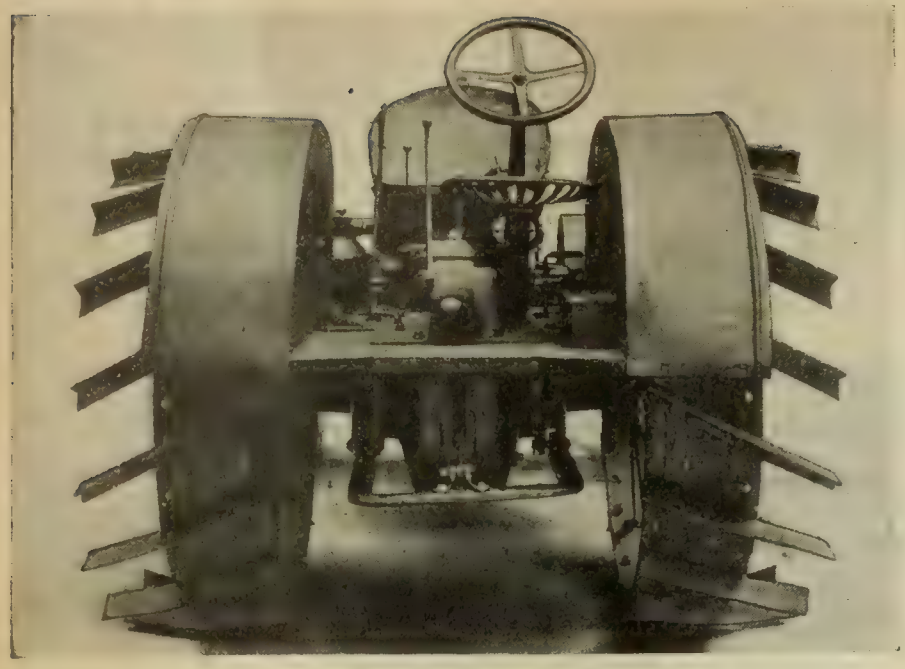
Among the unusual features of this tractor is the use of a two-bearing crankshaft and a main casting which carries the removable cylinder sleeves and includes both upper and lower halves of the crankcase. The crankshaft is supported in two large annular ball bearings. The connecting rods can be inspected by removing hand hole covers at the side of the case and are easily adjusted after removing the crankcase pan. The cylinder head is detachable, and is used to hold the separate cylinder liners in place. Against the latter bear rubber gaskets, which make a water-tight jacket joint. Aside from the features mentioned, the engine is more or less conventional in general design. It has a 4½-in. bore and 6-in. stroke and is governed to run normally at 1000 r.p.m. Overhead valves are employed. They are operated by rocker arms and pushrods from the camshaft in the crankcase. Oil troughs above the rocker arms provide lubrication through wicking. The removable sleeves are machined inside and out, and can be easily replaced when worn or scored, as can all other wearing parts of the engine.

The connecting rod bearings are bronze-backed, babbitt-lined and measure 2⅞ in. diameter by 3 in. long. The crankshaft is heavily constructed to give adequate stiffness. The connecting rods have a conventional H-section and carry a solid bronze piston pin bushing. The pins are 1½ in. in diameter and are locked securely into the pistons. The latter are 5⅞ in. long and equipped with four rings, all located above the piston pin.

Lubrication is by splash, the oil being raised from the sump to the oil pan by a gear pump driven by a vertical



Front and side views of 15-30 gear drive International tractor, showing one-piece frame, pivoted on front axle, wishbone and location of belt pulley and air cleaner



Rear view of new International tractor, showing power take-off on upper axle housing and adjustable drawbar

shaft off the camshaft. An oil gage, located on the dash, enables the operator to determine whether or not the oil is circulating properly.

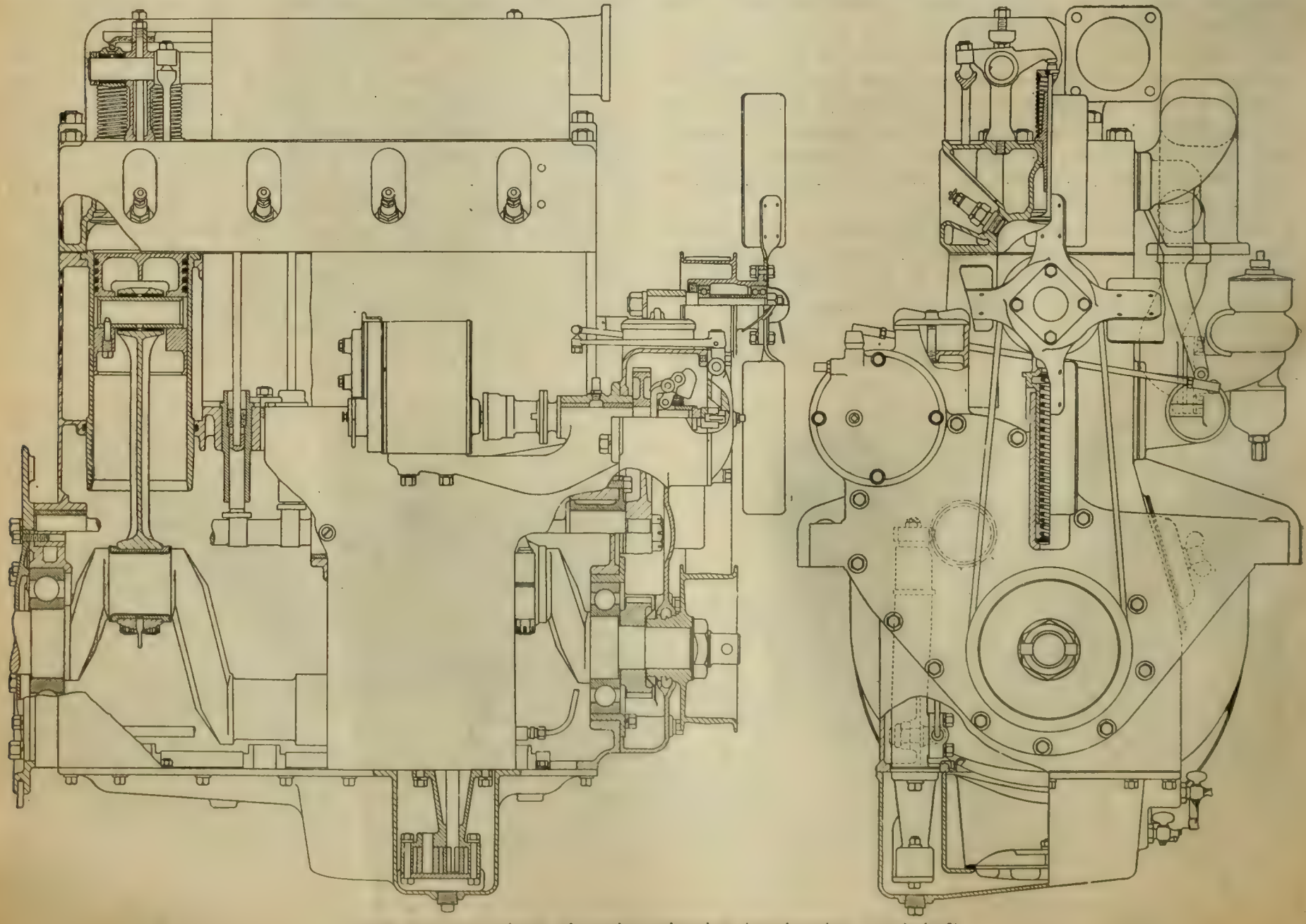
All working parts of the engine are completely inclosed, so that the exterior has a clean appearance. The exhaust manifold at the left side of the engine is bent downward and terminates in a short pipe projecting through the lower edge of the hood. The air cleaner is mounted at the left side of the frame outside and just back of hood. It is connected to an Ensign carbureter which delivers the mixture through a short riser to the exhaust-heated inlet manifold, which is cast in one piece with the exhaust header. This fuel system is designed to handle either gasoline or kerosene, tanks for both being provided. A centrifugal throttling type governor, driven off the magneto shaft, is employed. A high-tension magneto with impulse starter is fitted.

The Clutch and Gearset

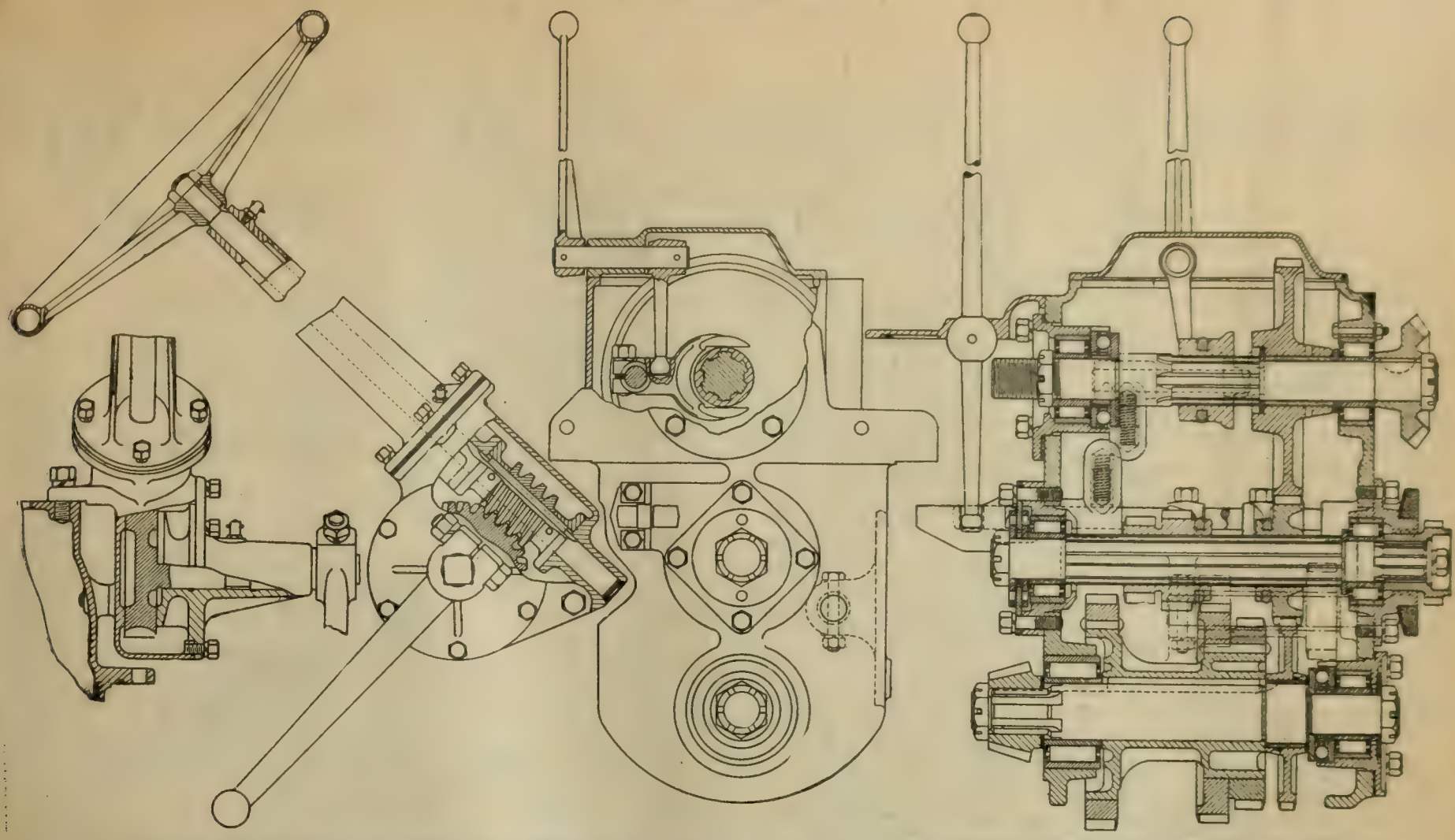
The clutch is of the multiple dry disk type, driven by pins bolted to the flywheel flange. The driven member is piloted on a short extension of the crankshaft which carries an annular ball bearing. From this point the drive is taken through a short splined shaft, which is integral with the external half of a semi-flexible joint of the internal-external gear type. An annular throwout bearing is carried in a housing with a friction surface which acts as a clutch brake. There are six driving and five driven disks. The design of the clutch is so worked out as to permit of its removal without disturbing either the engine or the gearset.

Directly back of the clutch and driven through the semi-flexible joint referred to is the gearset, mounted in a removable carrier which seats in the main frame casting. This gearset is similar in general construction to that used in automobile practice, the speed changes being accomplished by sliding gears on a splined countershaft. The shafts are mounted on hardened roller bearings, which, in common with similar roller bearings used in other locations, are the product of the International Harvester Corp. Where bevel gears are employed, ball thrust bearings are used.

The belt pulley assembly is a separate unit, mounted in a separate and easily disconnected housing on top of the main frame casting and driven by bevel gears



Part sectional views of engine, showing two-bearing crankshaft



At right, the gearset used in the new International tractor. The central shaft is driven by the engine. It drives in turn either the lower shaft, which is geared to the bull pinion shaft, or the upper shaft, which drives the belt pulley. At left the worm and wheel steering gear

from the upper shaft of the gearset. The shaft carrying the belt pulley is mounted in roller bearings, with its axis at right angles to that of the crankshaft. The belt pulley drive gear is provided with a solid jaw clutch which permits of disengaging the pulley shaft. When this clutch is engaged, the belt pulley is operated through the main multiple disk clutch. The belt pulley is so located at the side of the tractor as to give ample clearance for the belt, both at the side and above the front axle. The pulley is 16¼ in. in diameter and runs normally at 595 r.p.m., giving a belt speed of 2530 ft. per minute.

Final Reduction Gears

Just aft of the change speed gear, mounted in the main frame casting and driven by a bevel pinion and ring rear from the lower shaft of the gearset, is the bull pinion shaft. This is short and heavy and is mounted in roller bearings. It can be removed through the side wall of the main frame without disturbing other units. Mounted on the bull pinion shaft, outside the frame, is a brake drum to which is fitted a substantial band brake operated by a hand lever.

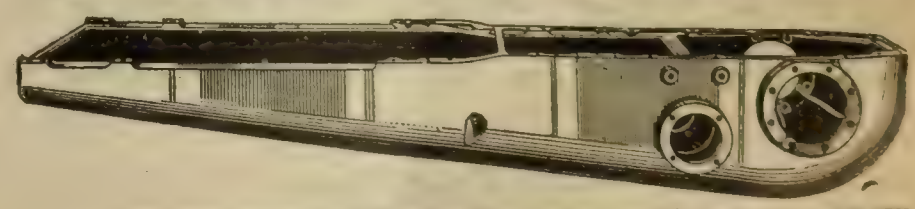
The bull gear and differential are mounted in the main frame casting and tubular extension attached to it. The differential housing and rear axle are carried on roller bearings. The wheels are keyed and clamped to the live rear axle shafts, which latter are provided with hardened steel flanges arranged to take end thrust. These flanges are carried between the main casing and the removable bearing caps or flanges. The wheel and axle can be easily removed by taking out eight flange bolts. The bull gear and differential can then be taken off the frame case, the cover of which is readily removed.

All of the gears in the entire transmission are of steel, carbonized and hardened. The main gears are made from steel rings, which are fastened separately to the carriers so that replacement can be made at minimum expense. All of the transmission bearings, except those on the reverse idler, and the ball thrust bearings, are of the roller type. The entire transmission (gearset, bull gears, bevel gears and differential) runs in a bath of oil which is continuously circulated by the action of the gears.

Special Power Take-off

The tractor is designed to receive a special power take-off, driven from the engine through the transmission. This take-off terminates in a shaft carried in the upper half of the differential casing, and is made accessible by removing a small end cover. This is a special feature which can be readily attached and is expected to find many uses for driving parts of trailing machines of the same general character as those which are now frequently drawn by tractors, but which are now, in general, operated through power taken from driving wheels in contact with the ground. Other accessories, such as power winches, can also be driven from this take-off. An adjustable drawbar is attached to the main frame and axle housing.

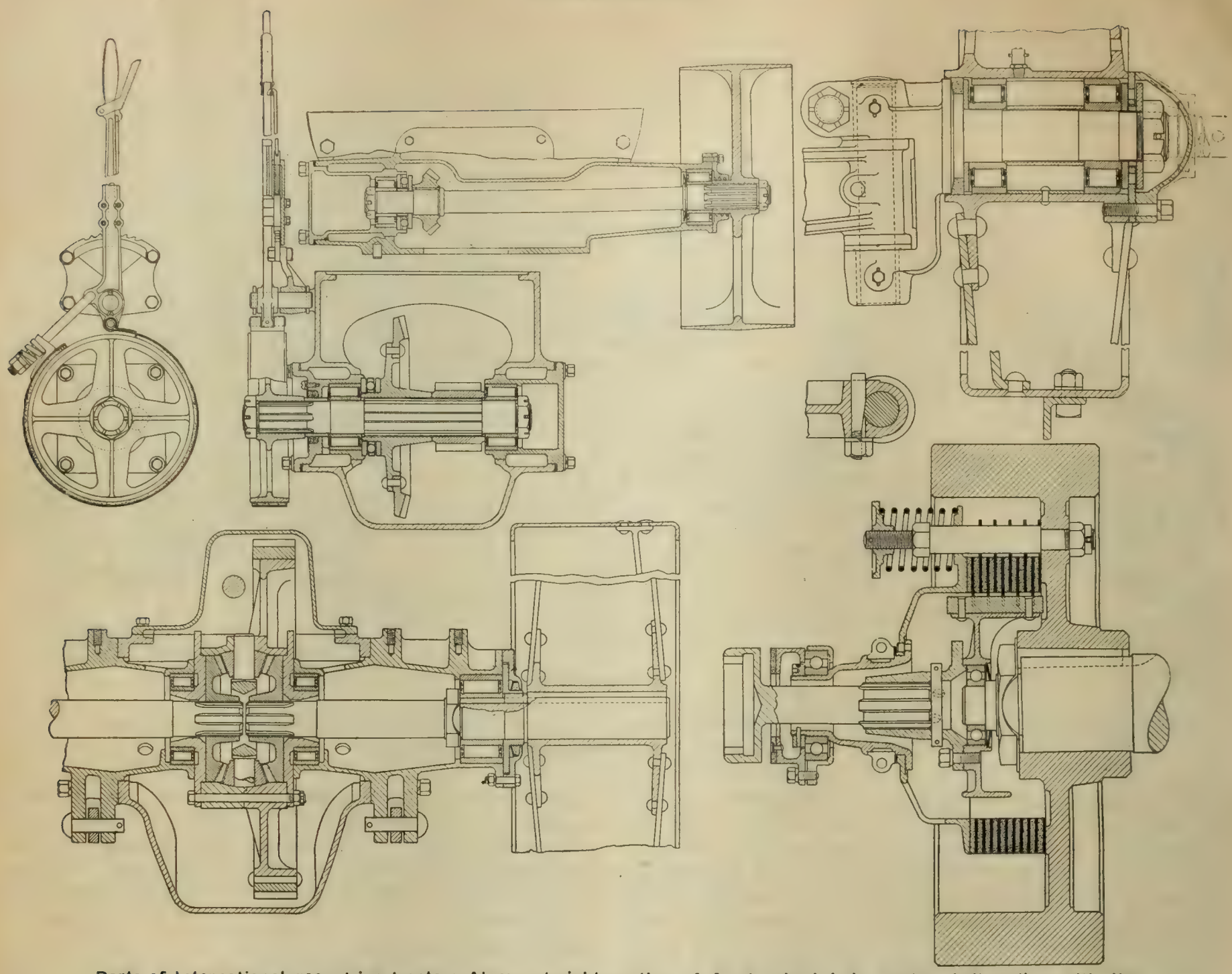
The rear tractor wheels are 50-in. diameter by 12-in. face, and the gear reductions on the three forward



Cast one-piece frame, showing large openings which render all parts easily accessible

speeds are such as to give the machine a speed of 2, 3 and 4 miles per hour respectively. Gear shifting is accomplished in the same manner as in passenger car and truck practice.

The steering gear is of the worm and wheel type, both worm and wheel being of hardened steel. Suitable thrust



Parts of International gear drive tractor: Above, at right, section of front wheel hub; center, belt pulley with its bevel gear drive; at left, bull pinion shaft and hand brake, which acts upon it. Below, at right, the multiple disk clutch; at left, section of rear axle, showing bull gear, differential, thrust flanges, live axle and wheel.

bearings and an 18-in. cast iron steering wheel are provided. The worm wheel is on a horizontal shaft, and the steering arm normally occupies a vertical position. It is connected to the right steering knuckle by a long drag link and thence to the left steering knuckle by a cross link in back of the axle.

The drop-forged front axle is of I-beam section, tapered from center toward the end. The front end of the frame is pivoted at the center of the axle, which is thus capable of considerable angular motions in reference to the frame, without distortion of the latter.

The axle is held rigidly against fore and aft motion by a heavy fork or "wishbone" bolted rigidly to the axle, but pivoted in a ball and socket joint attached to the under side of the main frame.

The front wheels run on roller bearings carried on spindles integral with the steering knuckles, similar to automobile practice, except that a hardened steel flange is used to take thrust, in the manner shown in the accompanying cut. The pivot pins are bronzed bushed. The front wheels are 34-in. diameter by 6-in. face and are fitted with removable skid rings. The spindle of the right front wheel is extended through the hub to carry the self-steering device when this accessory is used.

The controls of the machine, which are quite similar in most respects to those used in automobile practice, are placed within easy reach of the driver. Substantial shields are provided over the rear wheels. Extension flanges and an assortment of lugs to suit various soil conditions are supplied when desired.

The few parts outside the main frame which require lubrication are fitted with Alemite connections.

Cast Iron Cutting by Oxy-Acetylene Flame

CAST IRON cutting by the oxy-acetylene flame is an interesting development of the last two years. The cast iron must be preheated to redness over a considerable space. A large and powerful oxygen jet is then directed on the red hot cast iron, with the preheating continued. The kerf made in the iron casting is quite similar to that made in cutting of steel, except that its width is generally double that in a similar sized steel casting and it is not quite so clean looking. It is plain that more gases are used than in similar steel cutting, and it has been noted in tests that the time for cutting is about double that in the case of steel; therefore, cast iron cutting is three or four times as costly as steel cutting and in normal work it can hardly be said to compete with saws.

White Chassis Designed Especially for Bus Service

New product is provided with special, long, low hung frame with out-riggers to support body, long flat springs, 50 h.p. engine and double band propeller shaft brake. Steel wheels with solid tires, or disk wheels with pneumatics can be supplied without variation in height of chassis frame.

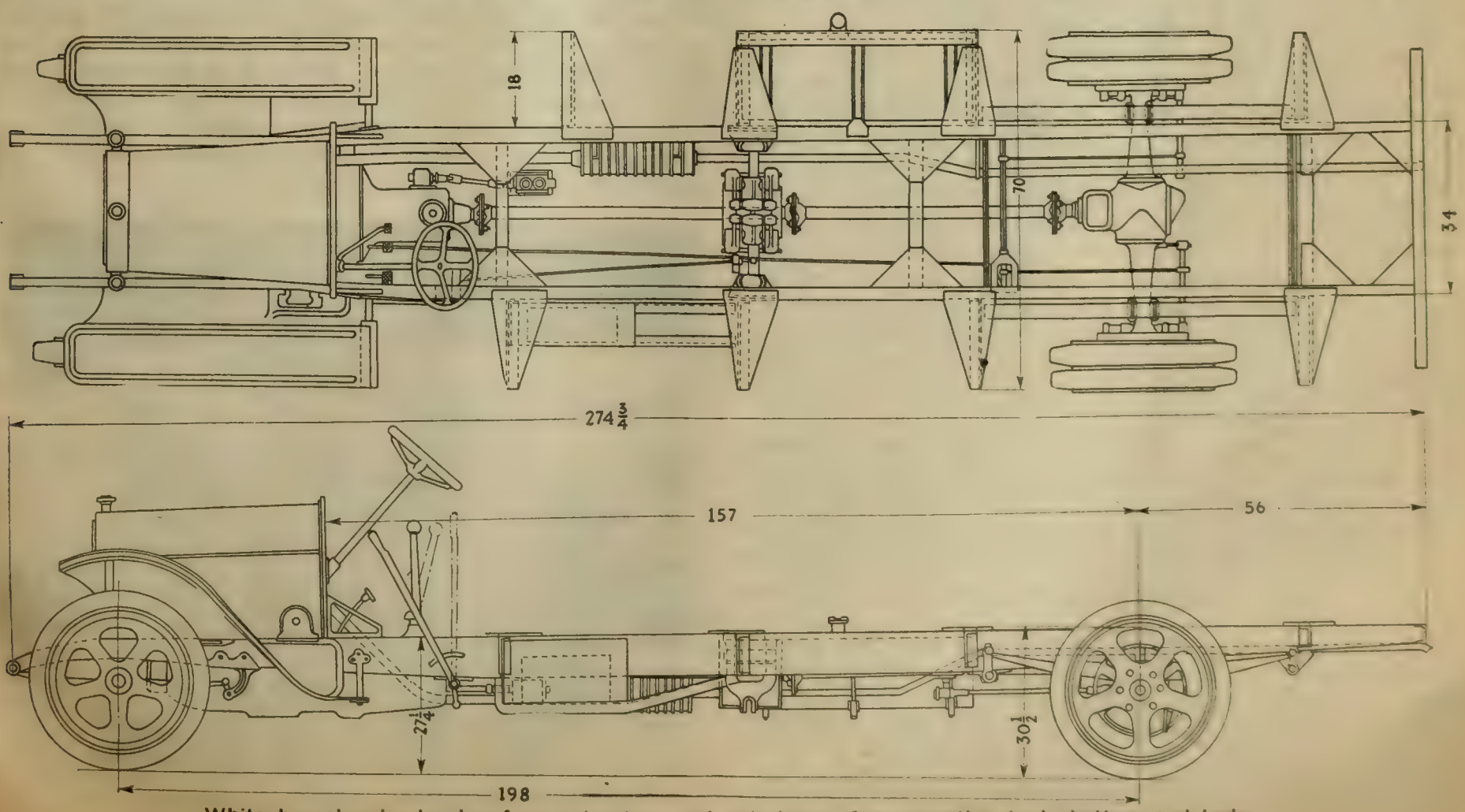
By J. Edward Schipper

A CHASSIS which has been designed specifically for bus service, either in urban or interurban work, has been brought out by the White Co., and has already been put in use in different parts of the country. The chassis is known as Model 50, and it is particularly interesting in view of the fact that it is not a modification of any particular model of White truck chassis, but is designed especially for bus service. A number of features which are important in passenger carrying and are not generally found in the conventional type of truck chassis have been incorporated. As compared with the usual truck chassis, this particular bus chassis has a longer frame, a lower platform height, increased riding comfort and a wider range of speed and acceleration. The chassis frame is designed with sufficient length to mount a body seating 25 passengers without undue overhang. The wheelbase is 198 in., while the overall length of the chassis is 276 in., and the overhang at the rear end is only 56 in. measured from the center line of the rear axle.

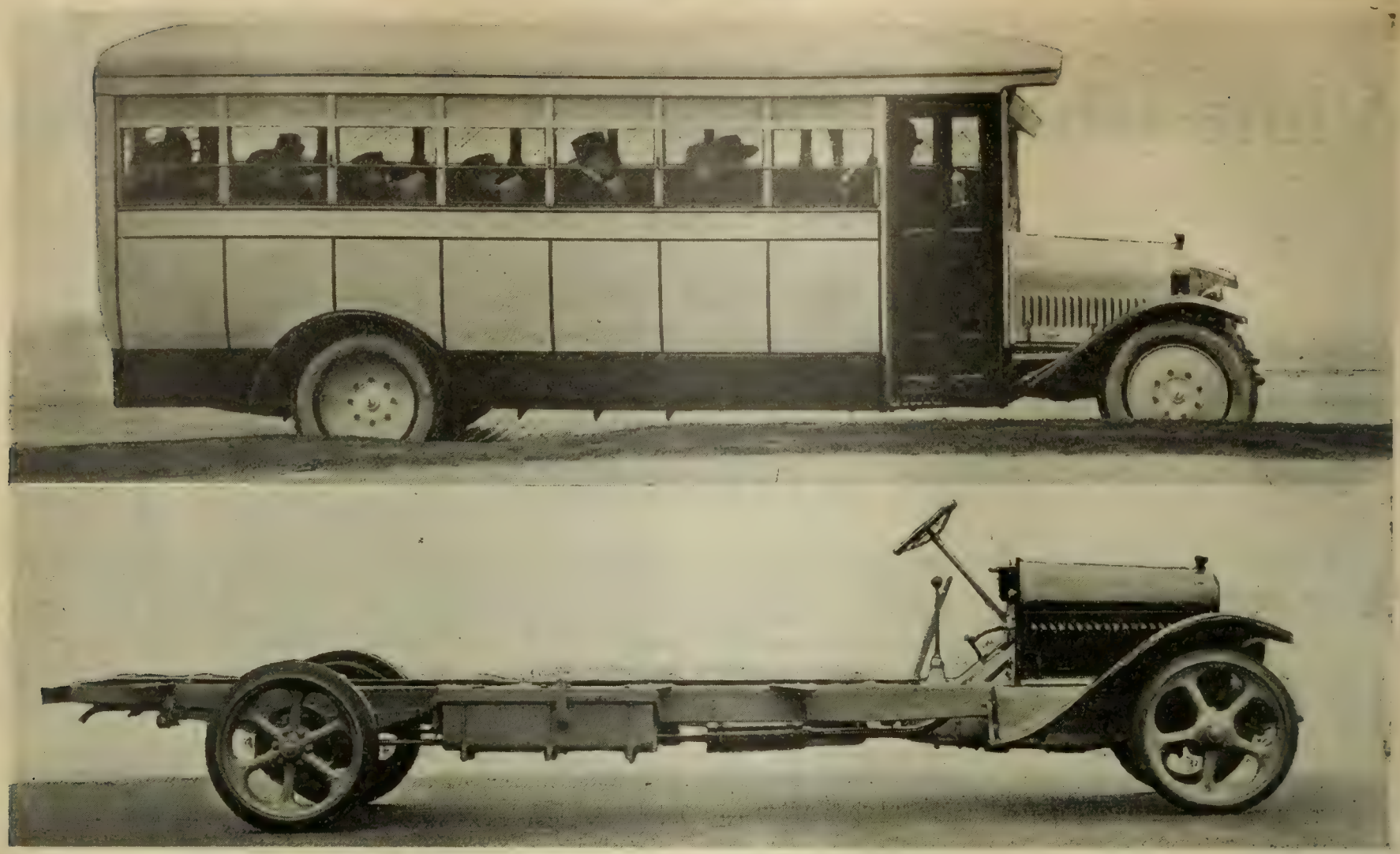
Keeping the loading height of the frame down permits passengers to enter and leave more rapidly and is claimed to have a material effect on the length of stops and, consequently, to provide for a faster schedule without increasing the speed when the vehicle is in motion.

The long wheelbase, low frame, giving a low center of gravity, and long flexible springs, combine to give easy riding qualities. The front springs are 41½ in. in length by 2½ in. wide and have seven leaves. The rear springs are 60 in. long by 3 in. wide and have sixteen leaves. Both the front and rear springs are exceptionally flat for a vehicle of this character.

To provide for a wide range of speed and acceleration, optional gear ratios and transmission ratio combinations are provided to meet the requirements of the particular service. The chassis layout is such that either of two types of wheel and tire equipment can be provided. Steel wheels and solid tires are standard equipment and are especially adapted to operation on paved city streets. For interurban work, pneumatic tires mounted on Budd-Michelin dual disk wheels are available. The use of pneumatic tires does not increase the frame height nor raise the center of gravity on this installation because of the dual arrangement which permits of moderate tire diameter.



White bus chassis showing frame structure and out-riggers for supporting tank, battery and body



(Above)—Brown twenty-five passenger bus body mounted on White model 50 bus chassis. (Below)—Side view of White model 50 chassis designed exclusively for bus service

The chassis weight averages about 5400 lb., but varies with the equipment. The pressed steel frame has a maximum depth of 8 in. at the center. The frame width is 34 in. and the height from the ground 28¼ in. without load at the door position. The standard gear ratio provided is 6.8 to 1, with an option of 7.5 to 1. The tire equipment, standard, is 36 by 4 in. single front with rear 36 by 4 in. dual, or 36 by 7 in. single. The dual disk steel wheels used with pneumatic tires take 36 by 6 in. dual in rear and 36 by 6 in. single front.

The engine employed is rated at 50 hp. and has a bore and stroke of 4¼ x 5¾ in. The engine, clutch and transmission are embodied in a unit powerplant. The clutch is a single plate type operating in oil and the gearset is of selective type with four speeds forward and one reverse. In some cases, especially where both city and rural service is provided, the gearset is arranged for direct drive on third, and has an overgeared fourth speed.

Ignition is by magneto. Lubrication by pressure feed and cooling by centrifugal pump through a cellular radiator. Fuel is fed by a vacuum system from a 35-gal. tank mounted on the right side of the chassis frame. The engine speed is limited to 1550 r.p.m. by use of the Standard White governor.

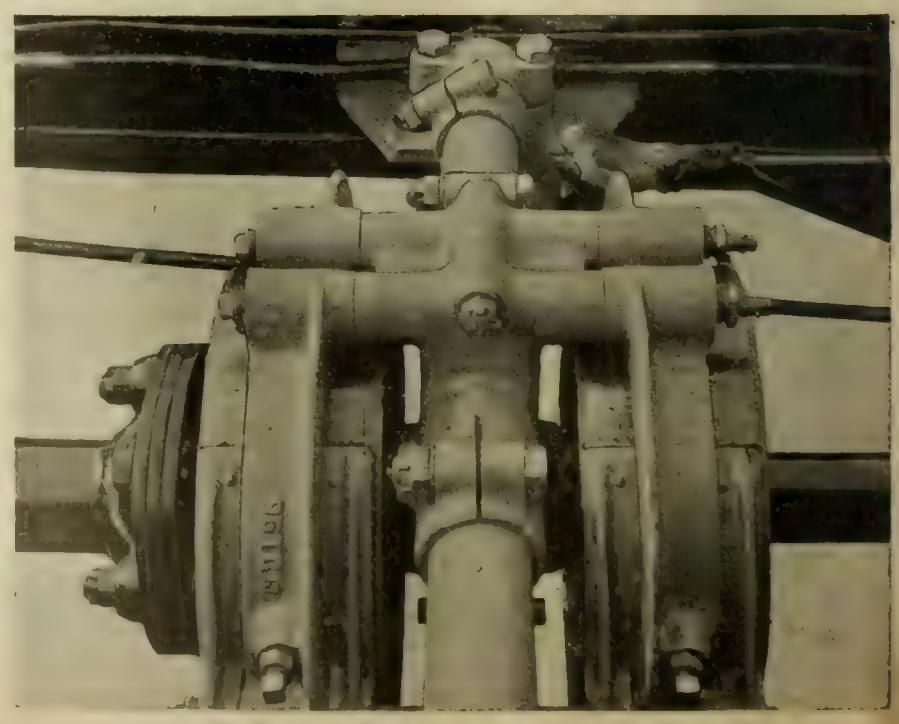
The truck is driven by a divided propeller shaft having one telescopic joint and two universals. The foot-operated service brake acts upon drums on the driveshaft being supported by a cross-member of the frame, as shown in one of the accompanying cuts. The internal expanding emergency brake, operated by a hand lever, acts upon rear wheel drums.

An interesting point in connection with the flexible spring suspension is that in order to keep the weights in balance on the bus, the battery is hung on left hand outriggers, while the gasoline tank is supported from outriggers on the right side of the chassis frame.

The rear axle employed is similar to that used on the Model 20 two-ton White truck, but only one set of brakes, the internal expanding set, is employed. This axle is of the double reduction type. The road clearance is 10½ in. and the gage 60½ in. The front axle is also similar in design to that used in the two-ton truck, but is given a slightly greater drop to facilitate lowering of the frame.

Standard equipment includes a 12-volt Leece-Neville lighting generator driven direct from the timing gears of the engine, and in tandem with the magneto, which is driven off the generator shaft. A 13-plate, 120 ampere hr. battery is also furnished. A Leece-Neville starting motor, with Bendix drive to flywheel, is mounted on the clutch housing when furnished as extra equipment.

The radiator is described as a touring car type, and is formed to accommodate a sloping hood, which adds to the appearance of the completed vehicle.



Service brakes on White bus chassis mounted on the propeller shaft at the point of its division

Experience in Development of Cylinders for Air-Cooled Engines

An accumulation of data collected as a result of experimental and design work relating especially to cylinders of high output. The advantages and disadvantages of various types of fins, valves and valve seats, cylinder heads and cylinder material are discussed by a student of this subject.

By S. D. Heron*

IT is proposed to review some of the salient points arising in the design and development of the modern air-cooled cylinder of high output. Investigation has shown that for every brake horsepower developed an average of approximately 0.6 hp., or 25 B.t.u. per min., has to be dissipated directly to the cooling air by the external cooling surface of the cylinder. In addition, 0.4 to 0.5 hp. has to be dissipated by the oil, by conduction to and radiation from the crankcase and similar means. The amount of heat absorbed by the oil will depend largely upon the amount reaching the cylinder and the piston walls and the facilities for cooling the oil. Power output, fuel consumption and cylinder-wall temperatures, such as are quoted herein, are dependent upon liberal splash lubrication and the resultant oil-cooling.

In the light of present-day knowledge a design for a cylinder of high output has to fulfill approximately the following requirements:

1—Develop a volumetric efficiency of 80 to 85 per cent.

2—Produce a brake mean effective pressure of at least 130 lb. per sq. in. at the normal speed on a maximum fuel-consumption of 0.56 per b. hp. hr.

3—Dissipate 25 B.t.u. per min. per b. hp. from the external cooling surfaces of cylinder, this heat to be dissipated so that the maximum temperature of any portion of the exterior of the cylinder walls does not exceed 550 deg. Fahr., and is preferably lower. In addition, the mean temperature of the exterior of the cylinder walls should not exceed 350 deg. Fahr. To produce a layout that fulfills the stated requirements it is necessary that heat-flow be the primary point in mind during design.

The Supply of Cooling Air

As the amount of heat lost to the walls from the charge differs largely in various parts of the cylinder, it is obvious that to have anything like even temperature distribution, the supply of cooling air to any portion of the cylinder should be proportioned approximately to the amount of heat given to that portion of the cylinder.

Considering a normal design of overhead valve cylinder with circumferential cooling fins, it is evident that the side of the cylinder head and barrel that carries the exhaust ports will receive the greatest heat supply per unit area, and therefore should receive the major portion and the greatest effect of the cooling air supply. This requirement is suitably met by applying the cooling blast on the exhaust side of the cylinder. In practice, with such blast application, the circumferential temperature difference at the top of the cylindrical portion of the combustion chamber will not exceed 50 deg. Fahr. Toward the base of the cylinder the circumferential temperature differences will probably increase, but this is usually of little moment, since the maximum temperatures attained there are low. Contrary to the opinion commonly held in this country, the back or side of the cylinder that is in the lee of the blast does not give overheating trouble when the cylinder design is sound and the air supply is suitably arranged.

Cylinder Design

The aim in design should be to remove as far as possible the heat from the cylinder at the point where it is given to the head, ports and barrel. Investigation has demonstrated that neither a material of high conductivity nor an excessive cooling air supply will remedy poor design. A simple cast-iron cylinder with only a small cooling air supply but fulfilling some of the fundamental necessities for efficient heat dissipation will give a performance much superior to that of designs that presume to function by high wall or fin conductivity in conjunction with large quantities of air supplied to those portions of the cylinder where little is needed and a total lack of effective air supply where it is required.

The temperature of an air-cooled engine is determined by the cooling air temperature as a datum point. If the air temperature rises 50 deg. Fahr. the actual cylinder temperatures are sensibly increased by that amount. In general, with an efficient cylinder design, the effect of the air temperature is little felt. A considerable rise in the air temperature increases the cylinder temperature, but it simultaneously reduces the charge weight, and thus to some extent the heat to be dissipated by the cylinder is diminished. A variation of 350 deg. Fahr. in maximum cylinder temperature at full throttle is permissible for short periods of time, such as exist during a fast steep climb by an airplane or the ascent of a mountain by an air-cooled car. That cylinder temperature control is necessary for air-cooled aircraft engines has yet to be proved in practice, although urged as a disadvantage of air-cooling by its opponents. The stabilization of the carbureter temperature is much more likely to be found necessary, due to the rapidity with which an air-cooled engine cools during a glide or dive when switched off or idling.

Many designs have been proposed and many built in which the ingoing charge is presumed to cool the various parts of the cylinder, usually the exhaust valves and exhaust ports. In practice such designs do not function, little or no cooling from the ingoing charge is obtained, and the general result is usually a marked reduction in the volumetric efficiency, accompanied by a pronounced overheating. The ratio between the amount of air required

*Condensed from a paper presented before the Dayton Section of the Society of Automotive Engineers. The author is attached to the Engineering Division of Air Service, U. S. Army.

for cooling and that used for combustion serves to show the unsoundness of attempts to use the ingoing charge for cooling. Further, the cylinder is not the correct place to apply heat to the charge, as heat supplied there can have no beneficial effect on the distribution.

In calculating the air required for combustion a brake mean effective pressure of 130 lb. per sq. in. and an 85 per

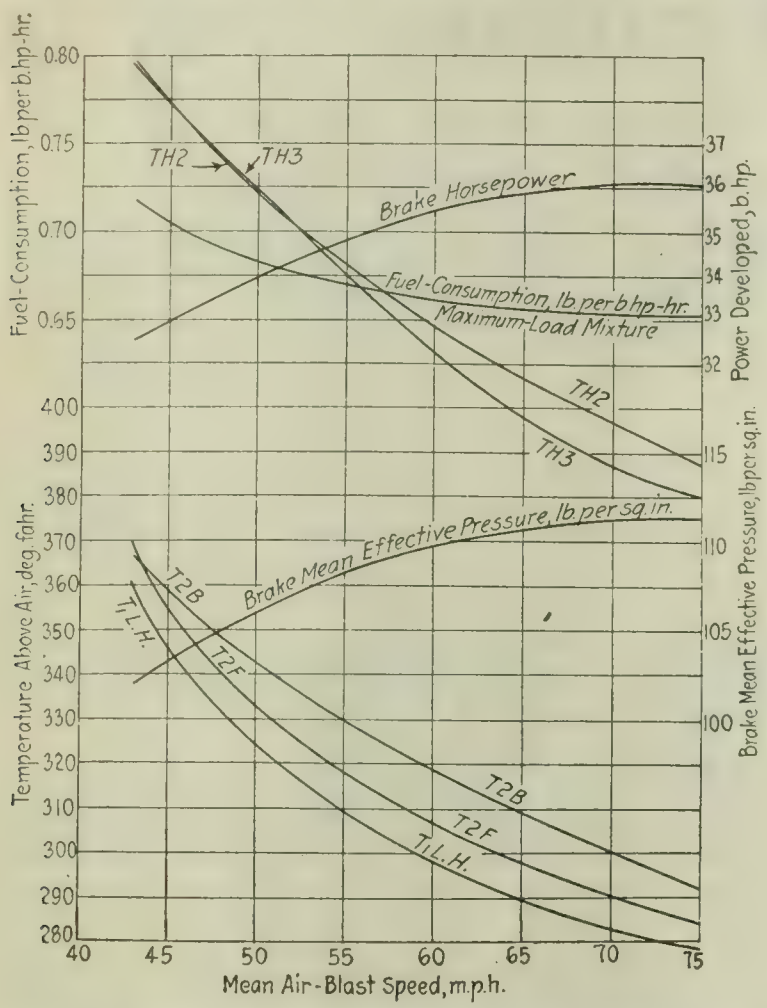


Fig. 1—Effect of the variation of blast velocity upon the temperature and fuel consumption of the Airco cylinder

cent volumetric efficiency in terms of air at the carbureter mouth are assumed. This brake mean effective pressure almost exactly equals 6.1 cu. in. of cylinder capacity per brake horsepower in a four-cycle engine running at 1000 r.p.m. The volume of air per brake horsepower per minute required for combustion is 1.5 cu. ft. and the ratio between the air required for cooling and that needed for combustion is 24.5:1. Although less than 36.7 cu. ft. of cooling air per brake horsepower can be used, and the foregoing calculation takes no account of the cooling effect derived from the latent heat of the unevaporated fuel, nevertheless it gives a measure of the unsoundness of a method of cooling so attractive to many.

An example of what may be accomplished in the way of automobile engine cooling with small air supply is shown by the B. S. A. light car. This car has a 90 deg., two-cylinder V-engine of 66 cu. in. capacity and is cooled entirely by natural draft, no fan being employed. One of the early engines was fitted to a car weighing 1700 lb., including passengers and regular equipment, and road tests of the cylinder temperature under these conditions are of interest. Climbing a hill rising 1200 ft. in 2½ miles, the temperature at the hottest point of the hottest cylinder was 310 deg. Fahr. above the air temperature at the start of the ascent and 495 deg. Fahr. at the finish. This ascent was taken on the run with the engine at normal temperature and was made in a following wind in 11 min. There is little question that the heat-storage capacity of the cylinders is of considerable importance in preventing overheating under such conditions. The heat storage capacity of a water-cooled engine having a large quantity of water in the jackets and the radiator, in this sense a heat accumulator, is known to be of advantage in preventing boiling in mountainous country. This is a parallel tending to show the similar advantage of thick, heavy cylinders for air-cooled engines.

Assuming the average brake horsepower as 10, the mean temperature rise of the cylinder bodies as 100 deg. Fahr. and the weight of the two cylinder bodies as 44 lb.; the heat given to cylinders during the climb is 2750 B.t.u. The heat storage of the cylinders for a given temperature rise equals the product of the weight of the cylinder bodies, the specific heat of the material and the temperature rise, or $44 \times 0.12 \times 100 = 528$ B.t.u. Therefore, 19 per cent of the heat given to the cylinders during the climb was stored therein. This calculation is, of course, only approximate. The assumption as to the brake horsepower and the mean temperature rise of the cylinders are reasonably sound, and even if inaccurate the result serves to show the advantages of heavy cylinders with large heat storage capacity for engines depending almost entirely on radiation for cooling during limited periods of full throttle operation.

Results of Correct Design

A cylinder of sound design, when running at its most suitable compression ratio, will usually develop its maximum power, maximum cylinder wall temperature and maximum tendency to detonation when the air-fuel ratio, by weight, for gasoline and gasoline-benzol mixtures is between 12 and 13 to 1. This mixture strength gives approximately the maximum rate of flame propagation. A mixture strength of 12 or 13 to 1 by weight, when used in a composite aluminum and steel aircraft cylinder, usually results in a fuel consumption of approximately 0.55 lb. per b. hp. hr. with aviation gasoline or aviation gasoline and benzol. This, however, only applies at the most suitable compression ratio. If the ratio be too high, fuel consumptions have to be increased to eliminate detonation. That a fuel consumption of approximately 0.55 lb. per b. hp. hr. usually produces the maximum power and the maximum cylinder temperature is confirmed by Table 1.

The minimum fuel consumption that an air-cooled cylinder will run on is generally a measure of its soundness. In this respect a rather curious difference is noticeable between efficient and unsound design. A poor design will usually work over a wide range of fuel consumption, say from 0.7 to over 1.0 lb. per b. hp. hr. without much variation in the power output, whereas an efficient design will generally show a drop in the power output if the fuel consumption at maximum load of approximately 0.55 lb. be increased by about 15 per cent, the power progressively decreasing with a further increase of the mixture strength.

Table 1—Effect of Mixture Strength on Cylinder Temperatures

Power Developed, B. hp.	Fuel Consumption, b. hp. hr.	Air-Fuel Ratio by Weight	Cylinder Head Temperature Rise Above Air, Deg. Fahr.
32.8	0.70	10.5	319
33.2	0.64	11.4	345
33.3	0.57	12.9	385
32.9	0.54	13.5	371
30.6	0.51	15.4	345

The reduction in the cylinder wall temperature obtained when the mixture strength is enriched beyond 12 or 13 to 1 may be attributed to the increase of internal cooling by the evaporation of liquid fuel particles and to the reduction of both the rate of flame propagation and the flame temperature.

The circumferential fin, on the whole, appears to have the majority of the advantages. It gives a considerable

stiffening effect to the cylinder that is of advantage in resisting distortion under temperature, explosion and bending stresses. Circumferential finning in general simplifies the problem of best applying the air supply to the cylinders. A combination of circumferential fins for the barrel and the cylindrical portion of the head with circumferential and axial fins or axial fins alone for the crown is used at times and is practically essential for four valve roof head types.

Cylinder Head Design

In general the work on which this paper is based shows that the flat head does not compare favorably, as regards either power output or cooling efficiency, with the spherical or roof types. The reasons for this are plain in my opinion. In the first place, the flat head renders it difficult to maintain the required air spaces between the valve ports and the necessary metal sections between the valve seats without reducing the valve sizes excessively. Large air spaces between the inlet and exhaust valve ports are desirable with three or four valve designs employing a pair of exhaust valves, and it is essential to have a minimum air space of ¾ in. between the adjacent exhaust port walls in such types. Further, with aluminum heads, it is necessary to maintain approximately ⅝ in. as a minimum section of aluminum between adjacent exhaust valve seat inserts; otherwise overheating, distortion and cracking will be apt to occur. It is not wise to reduce this section much between pairs of inlet seats or between adjacent exhaust and inlet seat inserts.

The discharge of an inclined valve in a spherical or roof head appears to be much less disturbed and more likely to promote and maintain turbulence than that of a similar valve in a flat head. The flat head is more liable to deflect under explosion pressure and, in practice, breathing of flat heads is by no means unknown. The truly hemispherical head is the ideal form as regards minimum stress due to explosion pressure.

For two-valve designs the spherical head appears to be the most suitable. For four-valve heads the spherical head is undoubtedly the most efficient, but, except for very special cases, its use does not appear to be justified, owing to the manifest difficulties of valve operation and also to the fact that excellent results are obtainable from a suitably designed roof head. When, however, very large cylinders are required, or medium size designs, either of large bore stroke ratio or to run at such high speeds that sufficient valving in conjunction with good cooling cannot be obtained with a roof head, there is little question that the spherical head is the most suitable design.

Experience to date indicates that for aircraft engine cylinders up to about 170 cu. in. capacity and with bore-stroke ratios not exceeding 1.25 to 1, designed for normal speeds of up to 1800 r.p.m., the roof head will produce the best all-around results. The design of an efficient roof head cylinder is, however, a decidedly tricky proceeding, slight faults in detail being liable to result in poor cooling.

Advantage of High Compression

Relatively high compression is of considerable advantage for air-cooling. It is not likely that any further considerable increase of the possible compression ratio with present aircraft fuel can be secured by any improvement in the design. It is probable, however, that the use of fuel dopes will render possible a further considerable increase. This has been investigated on small air-cooled aircraft engine cylinders and medium size water-cooled aircraft engines: the results have shown a considerable increase in the brake mean effective pressure. Should the proportionate increase of performance prove as large with 160 cu. in. air-cooled cylinders as has been found with the 70 cu. in. types, some rather remarkable performances are likely to be produced in the near future.

Investigation has shown that a steel surface gives 5 to 10 per cent greater heat dissipation than either aluminum or copper. The dissipation of aluminum, however, is improved about 10 per cent by coating with a glossy black enamel, the percentage of improvement varying with the nature of the enamel and the blast velocity. The effect of surface dissipation is of considerable importance and further investigation of the subject is to be made by the Bureau of Standards and the Engineering Division of the Air Service.

The principal alloy that has been used by the British for air-cooled cylinder construction is the Air Ministry 2-L-11 alloy, containing 7 per cent of copper, 1 per cent of tin and 92 per cent of aluminum. This was developed after failure had attended efforts to use the aluminum zinc group, employed so largely on the Continent for crankcase and similar parts. This alloy is both weak and

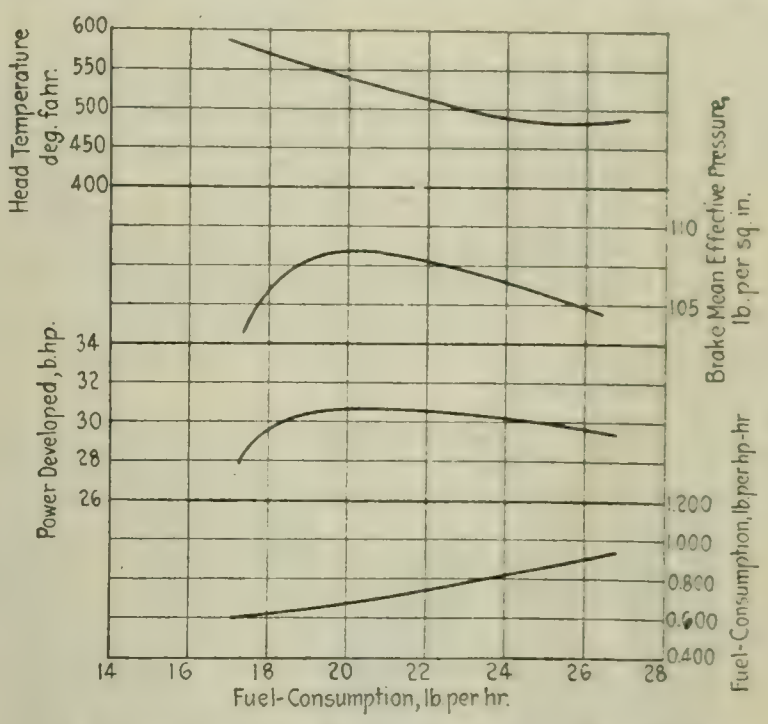


Fig. 2—The effect of fuel consumption upon the output and head temperature of a type D cylinder

soft when hot, but its bad qualities are, nevertheless, fairly well understood as a result of considerable experience. It sand casts relatively well: the tin content, which reduces the strength and hardness, also seems to reduce shrinkage and pin holing.

For cast aluminum cylinders a fin having a length of from 1 to 1⅛ in., a thickness at the roof of ⅛ in., a thickness at the tip of 1/16 in. and a ⅜ in. pitch is fairly readily cast and is reasonably strong for handling. Fins of a somewhat decreased thickness and pitch can be cast, but are likely to lead to foundry difficulties and are easily damaged.

Use of Cast Iron

Cast iron at present is somewhat despised as a cylinder material. Nevertheless, it can be seen from the B. S. A. and R. A. E. 4D cylinders mentioned earlier in the paper that efficient results are obtainable with this material. I believe that for commercial purposes, excepting aircraft engines, the use of any other material than cast iron for cylinder construction is not justified by the increased efficiency obtained. The use of any more expensive material than cast iron also involves more complicated and expensive construction. In the light of present experience that statement appears to hold good up to an output of 12 hp. per cylinder at about 2500 r.p.m.

Copper has been used extensively for air-cooled cylinders and was employed on some of the earliest air-cooled cars.

The high conductivity is of considerable advantage, but there are many practical objections to its use. One of these is that it is exceedingly difficult to fin a cylinder head efficiently with sheet copper fins. To attach the latter to a spherical head such as the type J cylinder is almost out of the question and in any case entails the use of a heavy iron casting for the body of the head. Some copper air-cooled aircraft engine cylinders were produced in Great Britain during the war. These had a closed end steel barrel fitted with sheet copper circumferential fins, head cooling being attempted by a finned cast aluminum cap. The performance compared unfavorably with that of the composite aluminum and steel type with cast on or screwed in heads. The economical use on a weight basis of copper as a fin material requires the use of thin sheet, and such fins are readily bent and damaged. The copper finned cylinders previously referred to presented an extremely ragged appearance after a short period in service, as handling was sufficient to bend the fins.

Valve Design

Neither the L nor the T-head cylinder is worthy of much notice at this date. In my opinion a good side valve cylinder, for either aircraft or automobile use, is decidedly superior to a crude overhead valve design. In spite of years of effort the number of really efficient air-cooled side valve cylinder designs in existence is probably under a dozen. Such efficient designs as exist are the result of protracted experiment: an overhead valve design to give equal or superior results can be produced readily with practically no development.

The side valve cylinder has marked advantages in comparison with the overhead type. Combustion chamber areas are relatively greater, equally efficient finning cannot be obtained, the temperature distribution is perforce much more uneven and distortion is much more likely to occur. Distortion is exceedingly difficult to avoid in side valve cylinders. The inlet and exhaust ports usually distort the barrel, with the result that piston contact is poor and the ring fit uneven. The valve seats rarely remain true when hot, with the result that grinding in the valves with the cylinder hot is resorted to at times.

The side valve design of necessity departs from the symmetry so desirable for an air-cooled cylinder. For equal class of design and development, the mean effective pressure of a side valve cylinder is usually 20 per cent less than that obtainable from an overhead valve type with continuous full throttle operation. A comparison of cylinders of equal size which is contained in the Internal-Combustion Engine Subcommittee of the British Advisory Committee for Aeronautics Report No. 24 gives, in my opinion, an average figure for the relative efficiencies of overhead and side valve types.

The two-cycle air-cooled cylinder is generally considered to be, almost of necessity, prone to overheating and some consideration of the type is therefore justified. It is not surprising that the average two-cycle air-cooled cylinder should overheat, as it is usually a very light, thin and poorly finned cast iron type. However, efficiently cooled cylinders for two-cycle engines are now produced.

The use of aluminum perhaps is justified commercially for two-cycle cylinders for air-cooled motorcycle engines, for the cooling conditions on such engines are usually very arduous. With cast iron combustion chamber the carbon deposit is both more adherent and of greater quantity than with one of aluminum.

Valve Seat Inserts

Valve seat inserts are a frequent source of trouble in aluminum cylinder construction. Conditions require an insert that has a tight fit and good thermal contact with the cylinder head metal when both are hot. The use of cast iron or steel inserts is not good practice, regardless of how they are fitted, as the coefficients of expansion of cast iron and steel are only 30 and 40 per cent respectively of that of aluminum. Cast iron or steel inserts if cast in are very liable to cause blowing of the aluminum surrounding the insert. Aluminum bronze has, on the whole, proved the most successful for cast in seat inserts.

Cast in inserts are a poor production proposition in the foundry. They are exceedingly liable to shift on the core when in the mold and cause the bore of the insert to be eccentric with the outside when finish machined. The cast-in insert of any material is prone to develop defective thermal contact or even to come loose. Due to casting shrinkage the insert initially may be tight in the cylinder head when both the head and the insert are hot. As a result either of annealing in the course of production or of the gradual annealing that occurs in operation the casting shrinkage is ultimately largely removed. The less the difference is in the coefficient of expansion of the material of the head and the insert, the greater will be the chance of a cast-in insert remaining tight. Aluminum bronze cast-in inserts have on this account proved markedly superior to steel or cast iron. Cast-in inserts are an example of evading a design issue at the expense of the foundry.

In general, exhaust valve cooling has two distinct phases, cooling through the seat and cooling via the stem and the guide. If either be at fault, inspection when running on open exhaust will determine which is the offender. For efficient seat cooling as effected by valve design, I prefer a tulip valve with a thick rim, possessing greater circumferential conductivity than the flat head valve, and the use of a wide valve seat. The width of the valve seat undoubtedly has a marked effect upon the heat flow from the valve to the cylinder head, as the intensity of the heat flow will depend on the area of the valve in contact with the cylinder. The heat flow from the valve to the cylinder will be affected to some extent by the load of the valve spring: from this standpoint the greater the load the better.

Efficient stem cooling is assisted by extending the valve guide and guide boss down as close to the head of the valve as possible, and shrouding the guide with a heavy boss that is able to conduct away the heat abstracted from both the valve stem and the exhaust gas. The cooling via the valve stem is partly controlled by the sectional area of the stem and the area of the stem in contact with the guide.

Valve Cooling

Claims that the exhaust valve cooling of air-cooled engines is as good as that of water-cooled engines may appear to be an exaggeration. Nevertheless, such claims are not merely my personal opinion, but can be confirmed readily by the Engineering Division of the Air Service.

For an air-cooled engine the results appear to indicate that:

1—The exhaust and the inlet valves should be of approximately equal diameter and have equal lifts.

2—A mean gas-velocity through the valve annulus of from 140 to 160 ft. per sec. seems to give the maximum performance with valves of between 1⅜ and 1⅝ in. diameter.

The first conclusion has exceptions, as in large two valve cylinders the exhaust valve is often made smaller than the inlet for valve cooling reasons with satisfactory results. Such an arrangement usually requires an excessive exhaust opening period to produce the best results, in spite of running generally at a somewhat lower speed than the four-valve type.

Experience tends to show that with an increase of the valve size the velocity through the annulus can be increased considerably without affecting the brake mean effective pressure. This is probably due to the decrease in friction in the port, owing to the increase of the ratio between the port area and the maximum area in the annulus.

In reply to an invitation to discuss this paper, Thomas Midgley, engineer of the Fuel Section of the General Motors Research Corp., stated that his experience had been more largely with cylinders of smaller diameter than those discussed in Mr. Heron's paper. He expressed the opinion, however, that the general principles, as outlined by Mr. Heron, would no doubt apply. Lester S. Keilholtz, chief engineer of the Delco Light Co., also stated that his experience had been with engines running about 6 hp. per cylinder and consequently he was not in a position to discuss the larger cylinders referred to.

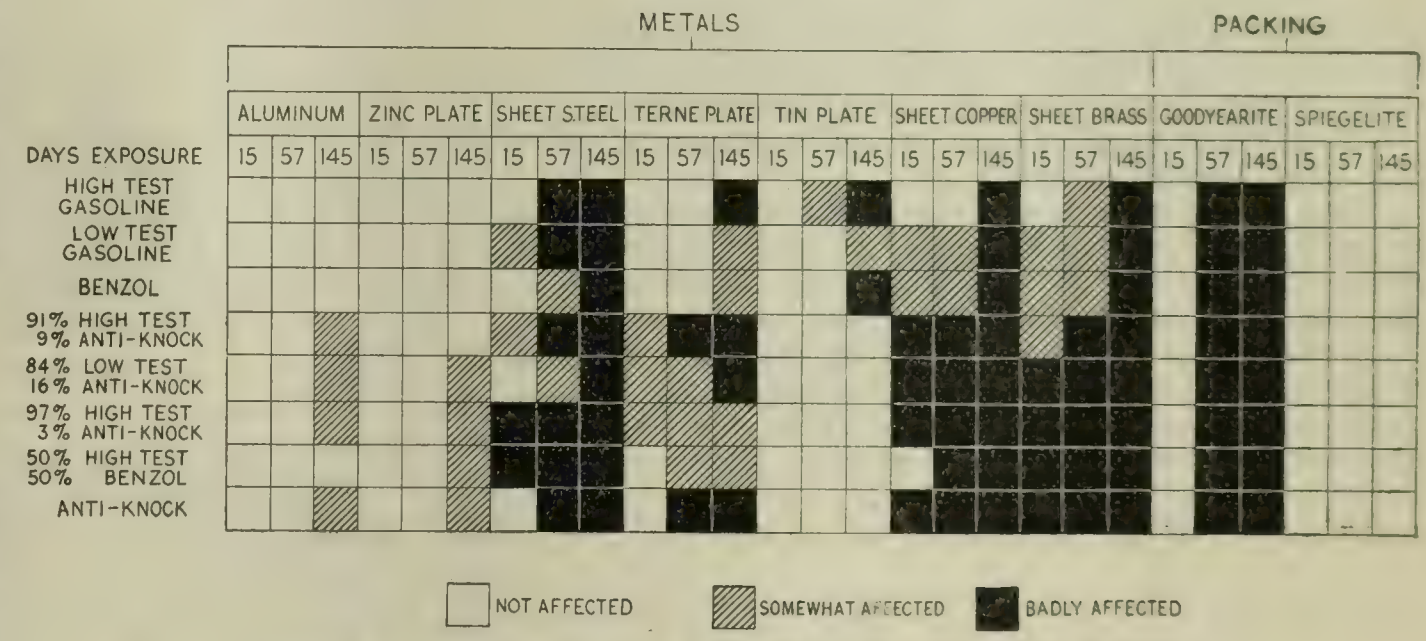
J. H. Hunt, research engineer of the Dayton Engineering Laboratories Co., expressed the opinion that it would have been a good thing if everyone had experimented with air curves showing the cylinder temperature secured with different mixture ratios. This, he says, was true regardless of whether the engine experimented with were water-cooled or air-cooled. He stated that in experimental work, if the radiator temperature after a change of mixture were noted, we would know more about engines than we do by simply trying to keep the temperature constant by connecting with city water sources.

H. M. Crane stated that this paper is a challenge to everyone who is designing water-cooled engines. He stated that the paper is of value to the designer, as it shows where high temperatures occur, and this is equally essential whether water or air cooling is used. He dwelt to some extent on the advantages of water cooling, one of the advantages mentioned being that the air-cooled engine delivers the heat to the atmosphere directly from the cylinder, whereas the water leads it away and dissipates it at a point remote from the cylinder itself. He stated that in aviation cooling in the slip stream is a disadvantage, as it is apt to be a factor in head resistance beside resulting in construction which cuts off the pilot's view.

Considerable discussion developed around the advantages of the air-cooled cylinder in extremely cold countries as well as in desert areas where water is hard to obtain. The consensus of opinion seemed to be that for this type of service, the air-cooled cylinder had already proved itself to be highly satisfactory. The use of air-cooled radial engines by the British in the Mesopotamia countries was cited as an example of this.

Effect of Doped Fuels on the Fuel System

THE use of anti-knock compounds in aircraft operation has become practically a necessity, and for two main reasons, viz., the constantly increasing use of higher compression ratios and the necessity for the use of a cheaper fuel. The Material Section of the Engineering Division, War Department, Air Service, McCook Field, Dayton, Ohio, has made an investigation of the effect of these doped fuels on the fuel system. According to the reports issued it was found that corrosion of the fuel tanks and the subsequent accumulation in tubes and strainers of the corroded matter, due to the use of anti-knock compound, caused obstructions of the gasoline line. Aluminum and zinc are very slightly affected, if at all, by the doped fuels, but copper, brass, terne plate and iron are badly affected. In making the experiments, the following fuels were used:



Effect of doped fuels upon fuel system in the presence of moisture

High-test gasoline, low-test gasoline, anti-knock compound, 91 per cent high-test gasoline containing 9 per cent anti-knock, 97 per cent high-test gasoline containing 3 per cent anti-knock, 50 per cent high-test gasoline containing 50 per cent benzol and 84 per cent low-test gasoline containing 16 per cent anti-knock. The anti-knock compound referred to is anti-knock No. 1, and was obtained from the General Motors Corp. Research Laboratory. This anti-knock compound is said to be composed of 70 per cent aromatic amines and 30 per cent benzol. The amines are probably orthotoluidine, paratoluidine, xylidine, aniline or mixture of these. A diagram of the results of the investigation is given herewith. It may be observed that the metal which stood up better than any other is aluminum. Next comes zinc and third tin, while steel, terne plate and particularly copper and the copper alloy, brass, are very badly affected by fuels containing anti-knock compounds. The presence of moisture materially increases the effect of these compounds on the metal.

Manufacture of Cast Segmental Wheels

THE Van Wheel Corporation, whose sectional wheel was recently described in these columns, states that, while the manufacture and assembly of the segmental sections, of course, requires certain operations of machining and locking the joints not required in one piece wheels, there are, on the other hand, several operations eliminated in this type of construction which are necessary in a one-piece cast metal wheel. These include: grinding the sides of the wheel, chipping the heavy flash which appears in the one piece castings and not in the segmental section castings, and turning off the excess metal required when pouring a one piece casting.

It is claimed also that the need for truing up is less in the segmental wheel. Beyond this the advantages of lower weight and less material are claimed.

Seamless Steel Tubing in Motorcycle Construction

The tapering of a steel tube in diameter or gage often reduces its weight and increases its strength. In this article the author emphasizes the need of using suitable quality steel and shows a very simple method by which the carbon content of steel can be determined to within 0.025 per cent.

By W. W. Hackett*

SEAMLESS steel tubing is a product of modern times, some fifty years having elapsed since it was first produced commercially. Its use has made possible the manufacture of articles which could not otherwise have been made, while it has also been the means of popularizing the use of articles which, before the introduction of steel tubing into their manufacture, found only a small sale.

From past experiments and errors we gain knowledge of what is practicable and learn what to avoid in the use of steel tubing in cycle and motorcycle construction. It will be useful to review some of the difficulties with which we have had to contend, and to discuss the remedies for failures we have experienced, in order that similar faults, which might be repeated from lack of knowledge of cause and effect, may be avoided.

When the Bowden brake was first used on cycles and motorcycles, numerous breakages occurred at the point where the hole was drilled through the handlebar near the lug in order to allow the cable to pass through. This defect was remedied by passing the cables through a properly designed lug, or through a hole in the lug, but many accidents occurred before the cause of the breakage was discovered and the remedy adopted. Under an alternating stress a tube that has been drilled, unless properly reinforced, is very likely to fail. For the purpose of proving the weakening effect of a hole, in a tube, quite a large number of running tests on drilled and undrilled tubes were carried out on the special machine shown in Fig. 1, and in some cases the undrilled tube had from ten to twenty times the life of the drilled one.

Having found that, when the tube was subjected to a fiber stress of 20 tons, the drilling of a hole reduced the number of revolutions while under alternating stress to one-tenth, or even to one-twenty-fourth, it was discovered that if the area of metal removed is replaced by two 1¼ x ⅝ in. oval patches merely sweated on each side of the tube around the hole, from 70 to 80 per cent of the life of the tube is restored. Continuing along these lines, two half-bushes, about 2½ diameters long, were sweated to the sides of the tube, whereupon the life of the tube proved to be practically the same as that of the undrilled tube, and instead of a break occurring at the hole, a fracture took place at the chuck of the testing machine.

*Paper read before the Institution of Automobile Engineers, condensed.

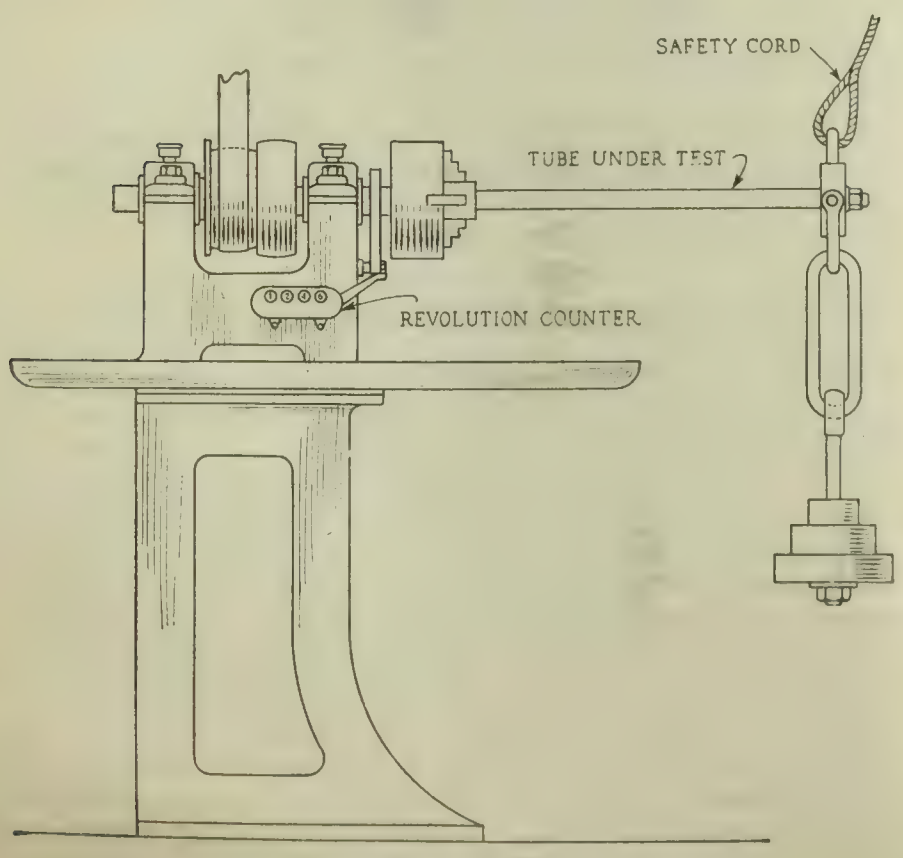


Fig. 1—Alternating stress endurance machine

Tests With Lugs

Another series of failures was caused by unsuitable lugs. Some of those used in the earlier days of motorcycling had very strong outlets, and case after case of tube failure occurred. The tube often broke off so cleanly as to give the appearance of having been cut through. The broken tube could be flattened, thus proving that it was in a ductile, and not brittle, condition, and a series of tests was carried out in order to prove that the fault lay in the excessive strength of the lug outlets. A lug having strong outlets was taken, and one outlet only being tapered off. A piece of tubing of the usual size and quality was brazed into the lug, the lug then being firmly secured to a plate. The ends of the tube were then moved by eccentrics and connecting rods, giving a half-inch movement at a speed of about 400 r.p.m. Each time the experiment was tried the tube broke off cleanly close to the thick outlet, whereas it was always intact at the tapered outlet.

In another test two tubes brazed into lugs, one with a thick and the other with a tapered outlet, were held rigidly by the lugs and similar weights were applied at the ends. The tube brazed into the lug with a tapered outlet bent with an easy curve, but that brazed into the lug with a strong outlet bent abruptly close to the lug.

Alternating stress tests were also carried out on a number of tubes held in grips, half of which had tapered outlets and the others strong outlets. When the taper grip was used the average number of revolutions before breakage occurred was 248,371, but when the strong outlet was used, breakage occurred after only 120,545 revolutions, or

less than half the number experienced in the case of tapered outlets.

Research work carried out also demonstrated the improved condition of the tube after blueing. The alternating stress tests proved that a longer life could be obtained than was possible in the bright-drawn condition, and blueing, which was specified by the Air Board as heating up to a temperature of between 380 and 450 deg. Cent., was insisted on. There is no doubt that when tubes are to be soldered into position they are better for the blueing, but when they are to be brazed the value of the operation is negatived.

It has been proved to the satisfaction of many cycle and

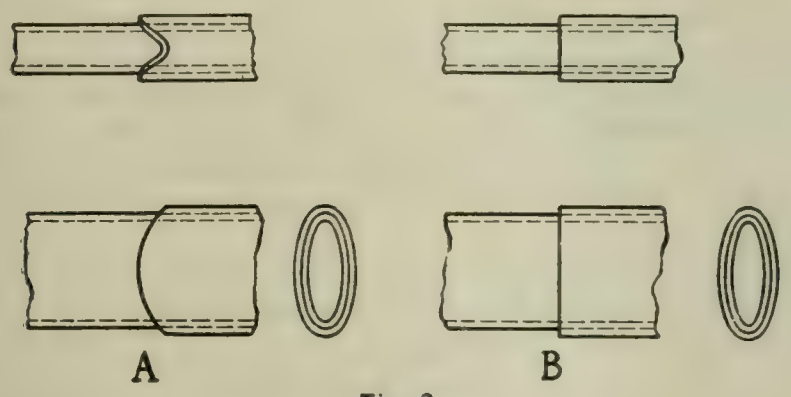


Fig. 2

motorcycle engineers, that to keep on merely increasing the gage of a tube that appears to be too weak for its work is not always good practice. For instance, take the case of the front fork tube as used on the ordinary cycle. This tube has proved of ample strength for use on the highways of this country, but for Continental roads something better was wanted. Some years ago the author's firm supplied a large quantity of front forks produced from 19 gage tubes to Russian cycle manufacturers. We were asked to increase the thickness to 18 gage as a number of breakages had occurred. We did so, but matters were not improved, and we were then requested to further increase the thickness to 17 gage. There was still no improvement; indeed, the number of breakages increased. The forks all broke off where they were brazed into the crown, and we were asked by the Russian manufacturers to help them out of their trouble. One way of doing this would have been by using a suitable liner or sleeve, but we tried another method which proved quite successful. We brought back the gage of the tubes to 18 where brazed into the crowns, and tapered the gage to 22 at the bottom ends. This proved effective, and thus a lighter article by about 40 per cent from the same quality steel stood the strain successfully. The result is accounted for by the fact that the shock was more equally distributed along the tubing, due to the strength being reduced gradually away from the brazed portion, whereas in the plain gage tubing the whole of the movement was concentrated in a very small space near the crowns.

Running Tests on Front Forks

The author has carried out quite a number of running tests on front forks of various tapers, reducing to what may be thought to be ridiculously small diameters at the bottom of the fork, but the life of the fork increased as the size at the bottom diminished. In many cases weight can be saved and increased strength be given by a tapering of the tube in diameter or in the gage.

Alternating tests have been carried out on 1 in. by 20 gage steel tubing, both in parallel lengths and with a taper of ½ in. per foot. A weight of 111.56 lb. was suspended from each tube at a distance of 12¾ in. from the grips, giving 25 tons per sq. in. stress. The average number of revolutions borne by the plain pieces was 25,987, while the tapered pieces, which were 7½ per cent lighter, broke after 30,891 revolutions. In both cases the break in the plain tubes was straighter than in the tapered tubes.

A pair of front-fork tubes, having a D-section at the top portion and tapered to 9/16 in. round section at the bottom, was brazed into the crown. A weight of 130½ lb., giving 15 tons stress per sq. in. at the crown, was suspended from the tubes, which broke at the crown after 1600 revolutions.

Another pair of forks, of a similar section at the top to those used in the previous experiment, but tapered down to 5/16 in. diameter at the bottom, was tested in the same way, and broke at the crown after 3180 revolutions. While it will be recognized that this is not an ideal method of testing front forks, it does demonstrate effectively the mechanical advantage gained by reducing the strength away from the breaking point of a tube. Numerous examples from nature's handiwork can be cited to show that this principle is a naturally sound one. In the bones of human beings, animals, fishes, and birds, or in the trunks, branches, and twigs of trees, it is seen that the slow process of evolution has produced the design best suited to withstand the natural forces with which certain embodiments of life have to contend, and that all the parts mentioned have assumed a tapered form.

Value of Taper-gaging

On motorcycle frames it is possible greatly to decrease the weight of the tubes by a proper distribution of the strength. The motorcycle manufacturer knows at which part of the frame breakage occurs. In many instances the front down-tube has been the vital part, and the break has occurred close to the top lug. It is much better to put in a taper-gage tube to prevent the trouble than merely to increase the gage. If a 12 gage down-tube has previously been used, a tube of the same weight, but tapered from 10 to 14 gage in its entire length, will, no doubt, remedy the defect. The tube is stronger because of its added thickness at the critical point, and also because the tapered gage enables the fatigue to be carried away from the lug. A 12 to 15 gage or a 12 to 14 tapered gage would be stronger than the 12 gage plain tube. Another place where breaks have occurred is at the front of the top tube. This weakness can be removed by butting or taper-gaging the tube.

Front forks are a critical point on a motorcycle, and to a great extent determine the shocks the frame has to take. The proper springing of a front fork takes away a good proportion of the shocks from the frame, the springs themselves absorbing the strains. The more the shocks are absorbed by the springs, the less the tubing is fatigued. It is possible to use springs too strong for their work, and

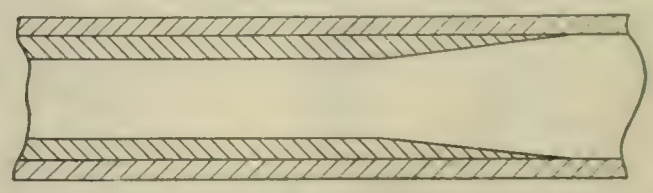


Fig. 3

too great a factor of safety on a spring may mean an increasing strain on the frame. After stronger springs have been put on the forks, the author has seen breakages occur in the steering columns or fork tubes when these parts were previously satisfactory.

The tubes on front forks are always liable to fatigue, and breaks often occur against the lugs. The builders cannot take too much care in the production of these forks, as there is often a thinning of the tube at the point of junction with the lug, caused by filing after brazing. It is much better to leave some trace of brass there than to

take the steel away. The lugs should be kept as light as possible at the outlets, and a lug with a curved shape at the outlet as illustrated in Fig. 2-A is better than one with the square-cut outlet generally used, Fig. 2-B.

Some makers "liner" the fork blade, and this is a very wise procedure, as in the case of fracture of the blade there is a support that may prevent an accident, but the value of a liner in preventing a fracture is very small indeed. In order to lessen the risk of fracture of the tube, the liner may be soldered or brazed to the tube. Should the break occur, however, the liner will probably give way at the same time as the blade. The disadvantage of this practice is that no warning is given, whereas when a loose liner is used the fracture of the outer tube is noticed before a complete break occurs. The blade with a liner



Fig. 4—Re-inforcing tubing

soldered or brazed in has, however, a longer life before a fracture takes place. It is always advisable, if a liner heavier in gage than the tube it is intended to reinforce be used, to taper the gage at the ends of the liner gradually to below that of the outer tube, as in Fig. 3.

The efficacy of a liner depends upon the position of the reinforced tube in the frame of a machine. Take, for example, the reinforced tubing shown in Fig. 4. These sections, where bending or compression strains occur, are most useful, but where the tubes are in tension they are not satisfactory. In the case of the front down-tube of a motorcycle, which has the vibration and weight of the engine to counteract, the strain has to be borne almost entirely by the outer tube. If this fractures, it will draw away from the inner tube, unless the inner and outer tubes have been properly brazed together. Numerous experiments have been carried out which have proved these

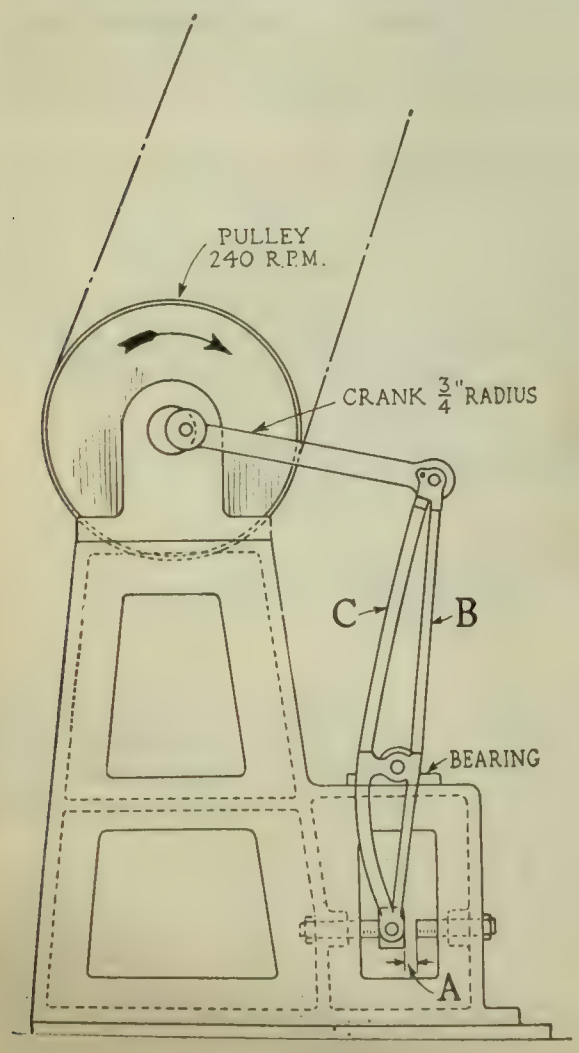


Fig. 5—Testing Machine for motorcycle forks Dimension "A" is so arranged that the fork under test shall move at this point ¼ in. less than the theoretical movement (according to the dimensions of machine parts and fork), this making the fork bend, i.e., tubes "B" and "C" are alternately in tension and compression

points. Alternating stresses were applied to front forks, various lengths and thicknesses of liners being used. The longer the liner, the better the result obtained. The break, however, still occurred at the lug, but the brazing of a piece of steel on to the outside of the blades strengthened them sufficiently to make the steering column break instead of the forks. These tests are illustrated by Fig. 5.

The following tests seem to prove conclusively the added value given by a tight-fitting liner. The only way to ensure a liner being tight is to draw it into position, the liner being expanded against the tube, or the tube being drawn tightly round tne liner.

Alternating-stress tests on tubes with tight- and loose-fitting liners

Size of outside tubes.....1 in. by 20 g.
Thickness of liners .....20 g.

For the tight-fitting liner tests the 1 in. by 20 g. tube was drawn on to the liner and then cut into test lengths. For the loose-fitting liner tests the 1 in. by 20 gage tube was cut into test lengths and the liners were pushed in by hand. The 1 in. by 20 gage outside tube was tested with no liner.

Tests were made on plain tubes held in a loose socket and also on tubes brazed 1 in. into thick lugs. The results of the tests were as follows:

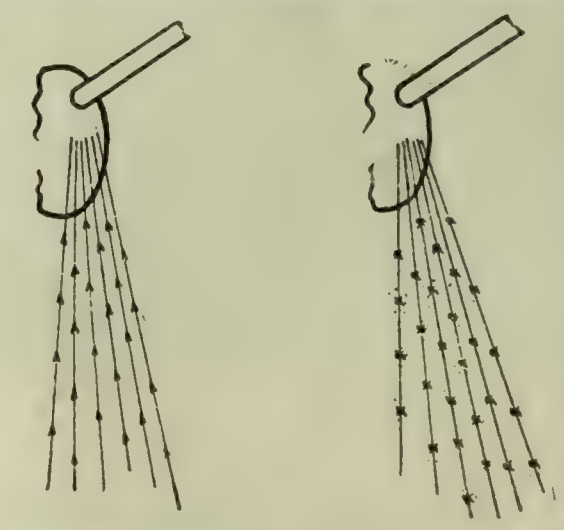
(1) Tight liner. Stress at socket 20 tons.
Plain tube broke at socket at .....95,647 revs.
(2) Loose liner. Stress at socket 20 tons.
Plain tube broke at socket at .....23,579 revs.
(3) Tight liner. Stress at lug 20 tons.
Brazed joint broke at lug at ..... 2,579 revs.
(4) Loose liner. Stress at lug 20 tons.
Brazed joint broke at lug at ..... 503 revs.
(5) Tight liner. Stress at lug 15 tons.
Brazed joint broke at lug at ..... 9,886 revs.
(6) Loose liner. Stress at lug 15 tons.
Brazed joint broke at lug at ..... 2,746 revs.

In the plain-tube tests the outer tubes and the liners broke, but in the brazed-joint tests the outer tubes only broke.

1 in. by 20 gage outside tube only

(7) Plain tube. Stress at socket 20 tons.
Broke at socket at .....12,811 revs.
(8) Brazed joint. Stress at lug 15 tons.
Broke at lug at ..... 2,614 revs.

Besides using means such as tapering, etc., for over-


0·15 per cent carbon. 0·5 per cent carbon.
Fig. 6

coming possible weakness, too much care cannot be taken to put into the different members steel of a suitable quality. From experiments carried out during the war period on airplane tubing, it was found that excellent results could be obtained by using 0.5 per cent carbon steel tubing, giving in the bright or blued state a yield of 40 to 45 tons per sq. in. and an ultimate stress of 45 to 50 tons per sq. in. When annealed, the steel should give

23 tons per sq. in. yield and 35 tons per sq. in. ultimate. The author found, however, that in the motor trade there was no inclination to use these high-carbon steel tubes, and opinions were expressed that the tubing from this steel would of necessity be brittle. While it is recommended that care should be taken with the heat-treatment, the whole of the author's testing has been carried out on joints brazed in his shops in a commercial manner, with no more care taken than in ordinary production. Although hundreds of tests have been carried out, he has not had a contradictory result, the value of carbon steels being proved; 0.3 per cent carbon tubing has always been better than 0.15 per cent, and 0.5 per cent always superior to 0.3 per cent.

Sometimes there is uncertainty as to the grade of steel of tubing carried in stock. The tube maker may get some wrong billets from the steel maker, or mistakes may occur in transit or in the tube works. If any test is to be made to check the carbon contents on commercial lines, that test must be a cheap one. The "Spark test" for carbon is a quick method, and, in the hands of a capable and properly trained man, the percentage of carbon in the steel can be determined to within 0.025 per cent.

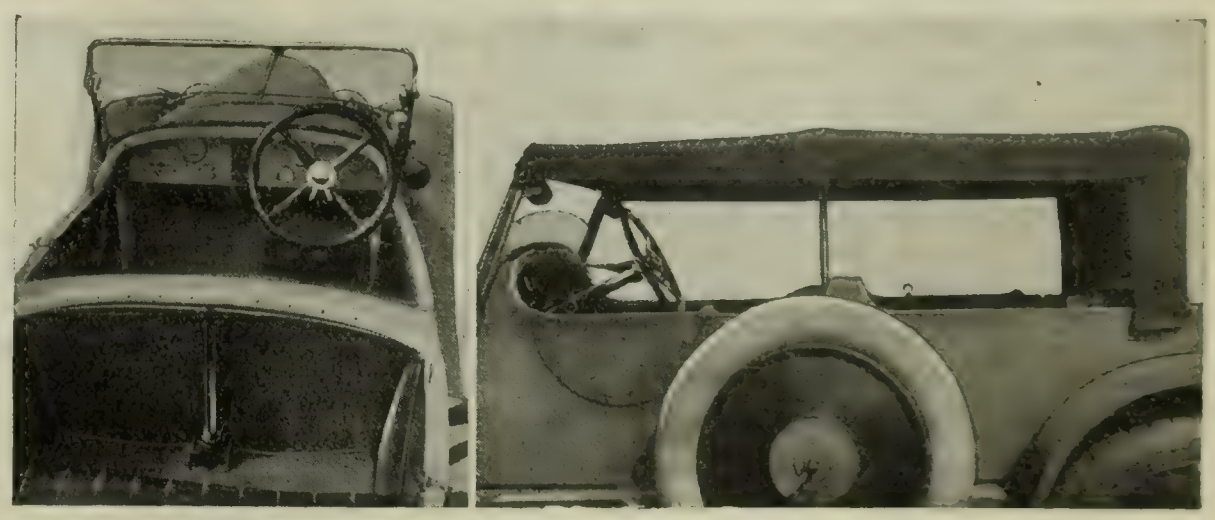
When a piece of steel is pressed against a grinding wheel a shower of sparks is produced, and this shower may be called a "spark-sheaf." The spark-sheaf consists of spark rays or lines of light, produced by the flight of the sparks, and spark pictures, which are small explosions appearing along the spark rays. It is chiefly from the spark pictures that the percentage of carbon is estimated, since the brighter and more numerous the spark pictures, the higher the percentage of carbon. For example, in a 0.15 per cent carbon steel the spark pictures are small and few in number, whereas in a 0.5 per cent carbon steel the spark pictures are clustered together much more thickly and are bigger and brighter, as suggested in Fig. 6. Steel can be tested by this method in any condition, since the character of the spark-sheaf is not affected by the physical condition of the steel. It is possible by this method to test each piece by merely touching the grinding wheel with it in such a manner that the tubing is not rendered unserviceable.

A French Development in Tops

AN unusual type of top is one of the features of the automobiles produced by the Voisin Company. This firm having been a pioneer in the aviation movement, has paid a lot of attention to head resistance in the design of its cars, and has condemned the conventional type of top as responsible for a considerable waste of power. Their design cheapens production, reduces weight and improves the streamlining of the car.

On close-coupled four-seater semi-sporting type bodies the top is carried on a couple of steel tube T-members, the forward one of which is dropped into a socket immediately behind the front seats and the rear one in a similar socket back of the rear seats. At the base of the vertical member of the T is a notch which fits over a pin in the socket, thus preventing any tendency to turn. The canvas is entirely separate from the frame. The top and back are in one piece, and when not in use are folded up and kept in a suitable pocket, or under the rear seat cushion. When required as a protection, the canvas is fastened down at the rear by push buttons, carried over the two T-members and brought over the top of the wind screen frame. Attachment is made at the front by a stiffening bar running through the front edge of the canvas, and having its two ends fitting into eyes on the top of the windshield frame.

When not required, the vertical leg of the forward T-member drops into the corresponding leg of the rear T, and by means of short projecting pins on the lower face of the cross member of the forward T registering with holes on the rear T, the two supports become one unit. They are placed under the "deck" back of the front seats, and by means of a large-diameter knurled nut on the base of the stem are wedged in position between the floor and the underside of the deck. The top can be put up or taken down quickly and with little exertion. Construction is cheap, for the frame consists only of steel tubing with plated finish, with one end threaded to take a nut. Weight is certainly 50 per cent less than with an ordinary type top.



Details of the new Voisin top

French Aviation Appropriations

CIVILIAN aviation in France will receive during 1922 a total of 154,878,000 francs from the French Government, according to the budget estimate for the year which was recently made public. The largest item in the estimate is 84,405,000 francs for works, aerodromes, technical laboratories and meteorological services. Subsidies totaling 37,022,000 francs have been set aside for French companies, enabling them to share in transcontinental transportation. In 1921 the sum for this purpose was 27,885,000 francs.

Six new international air lines are to be established in France during this year. While it has not been definitely established as to where these lines will run, indications are that Bordeaux will become a port for the head of lines to Switzerland, Morocco, Spain, Italy and the Mediterranean routes, as well as a stop on the Paris-Lisbon (Portugal) route.

There is available in the Automotive Division of the Bureau of Foreign and Domestic Commerce a comprehensive report on "What the French Government is Doing for Commercial Aviation." It may be obtained by applying to the division for exhibit No. 49,220.

The Relation of Carburetion to Fuel Economy

Part I

The solution to the problem of fuel economy centers about that of proper carburetion. Mr. Golten states that existing carbureters and hotspot devices are inefficient and urges study of problem from a new angle.

By J. N. Golten

THE chief problems of the automotive engineering fraternity to-day are those relating to fuel economy. These problems are many, and they vary from the purely mechanical to the highly theoretical. Such considerations as increasing mechanical efficiency, decreasing gear ratio, etc., offer minor means of increasing car mileage, but the greatest latent possibilities center about the solutions of carburetion problems.

The statement has often been made that the fuel consumptions of our present day engines can and must be reduced, and numerous minor changes in engine design have been made with this end in view, most of them centering about the carbureting system. However, nothing really drastic has been undertaken, probably because there has not been sufficient co-ordinated knowledge of the essentials of proper carburetion.

The exposition that follows is intended to be a summing up of the conditions necessary to proper carburetion, in a modern engine, with modern fuels, and statements on the shortcomings of the carbureting means now ordinarily employed. It is the purpose of this article to present for the first time these various facts in their true relation to each other and the carburetion problem as a whole.

Functions of a Carbureting System

The ultimate aim of the carbureting system is to introduce into all the cylinders of an engine equal amounts of the most economically burning mixture. With this object in mind the three primary essentials of a correct carbureting system may be stated thus:

1—The metering of the most economical air-fuel mixture at all loads and speeds.

2—The uniform distribution of this mixture to all the cylinders.

3—The complete vaporization of all the fuel at the instant the spark passes in the cylinders.

These three essentials will be taken up in the order stated.

From time to time excellent articles have been published, tabulating the results of exhaustive tests made to determine the most economical mixture ratio for various speeds and loads,[1] but in spite of this fact the general knowledge of proper mixture proportioning for maximum economy is exceedingly hazy.

There is a widespread impression that a constant air-fuel mixture ratio of 15 or 16 is the most economical at all speeds and loads, but this idea is erroneous. Actually, at any given speed the mixture ratio for maximum economy varies from about 12 at no-load to about 17 at full-load. (These figures are for gasoline.)

Following are a few curves taken from P. S. Tice's article on "Carburetion Requirements of a Typical Gas Engine"' which may serve to make these points somewhat clearer.

These curves represent the variation of the brake specific consumption in pounds of fuel per brake horsepower hour, with variation in the air-fuel mixture proportion, (R), for several manifold pressures. A line drawn through the lowest points in each curve will give the variation in the mixture ratio of maximum economy with change in manifold pressure. This relation is represented by curve AB, Fig. 2, where R is plotted against absolute pressure in the manifold (H_s). The relationship shown by this curve is practically independent of speed. It is solely a function of the absolute pressure existing in the intake manifold.

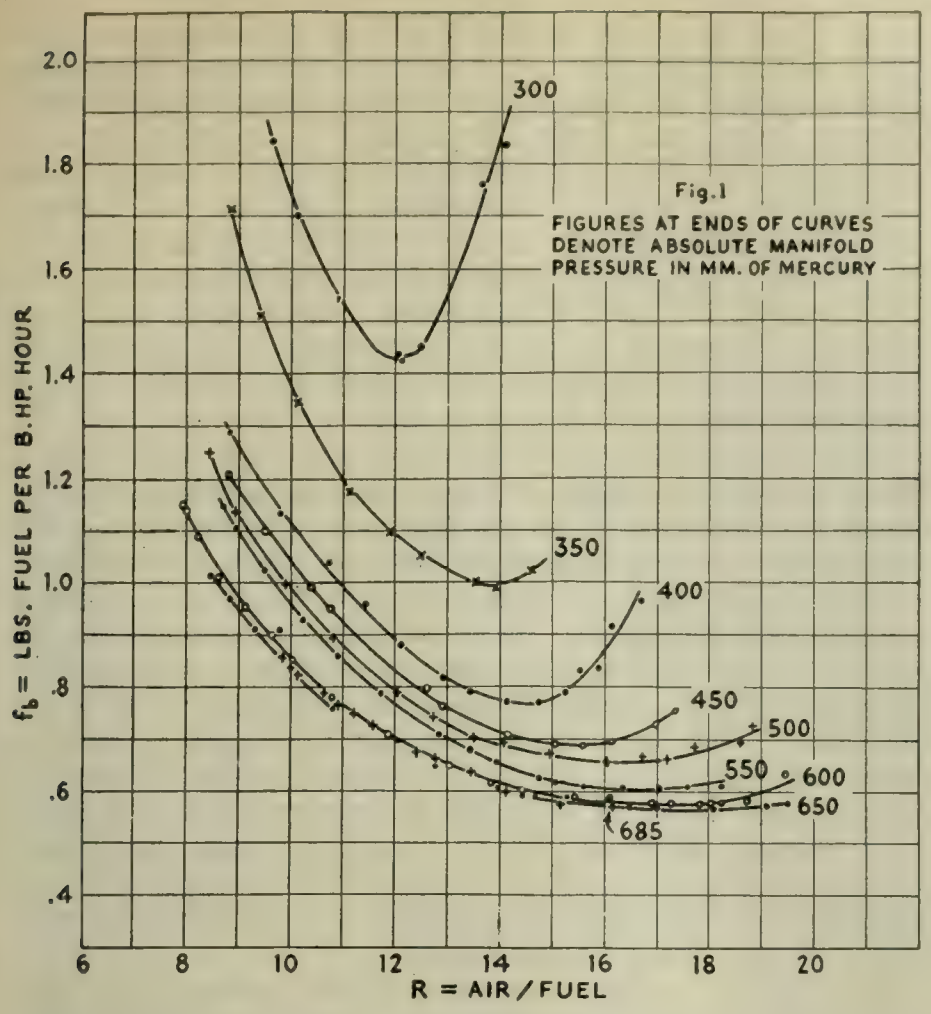
It will be noticed that at an absolute manifold pressure of 300 mm. of mercury, which corresponds to a car speed of from 15 to 18 m.p.h., a very small change on either side of the air-fuel ratio (R) corresponding to maximum economy results in a very large increase in the fuel consumption. As the manifold pressure increases a given variation in R accounts for a much smaller variation in fuel consumption. It is rather unfortunate that at manifold pressures which correspond to the normal running speeds of a car, comparatively small deviations from the most economical mixture ratio account for such large increases in the specific fuel consumption.

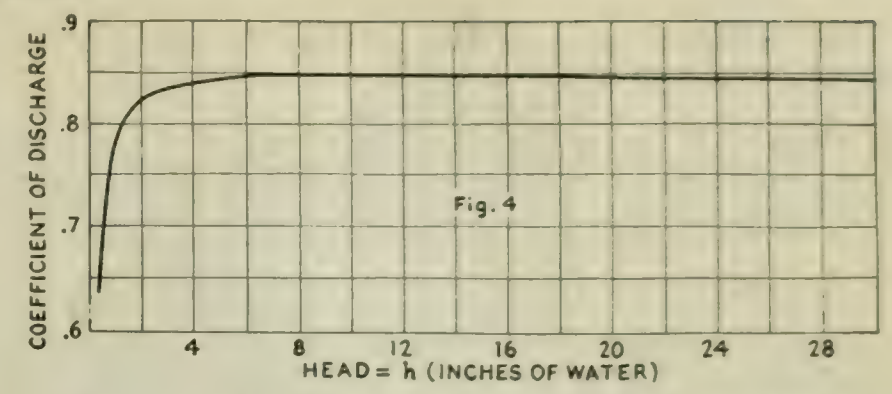
Metering Characteristics of an Ideal Carbureter

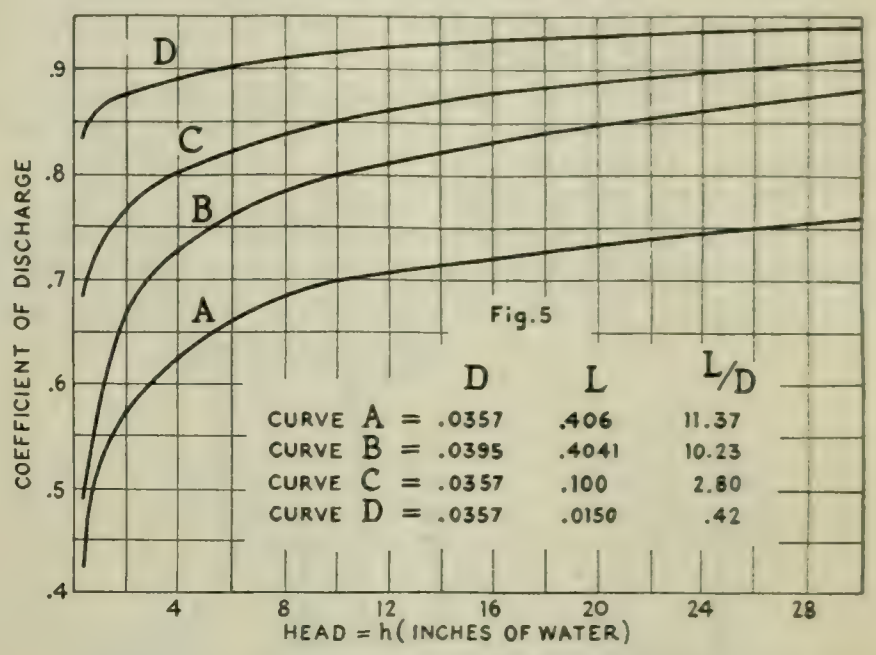
The ideal metering characteristics for a carbureter would be one in which R would vary with the manifold pressure according to the relationship shown in Fig. 2, curve AB, until nearly maximum manifold pressure was reached, and then R would change to the mixture ratio giving maximum power. As long as an increment of manifold pressure, meaning an increment of throttle opening, accounts for an increase in power, it is highly desirable to have the carbureter set so as to give maximum economy, but full throttle opening is only occasioned by a demand for maximum power, and this demand can only be satisfied by a reduction in R so as to get maximum engine output. Such a metering characteristic is shown in curve AC, Fig. 2.

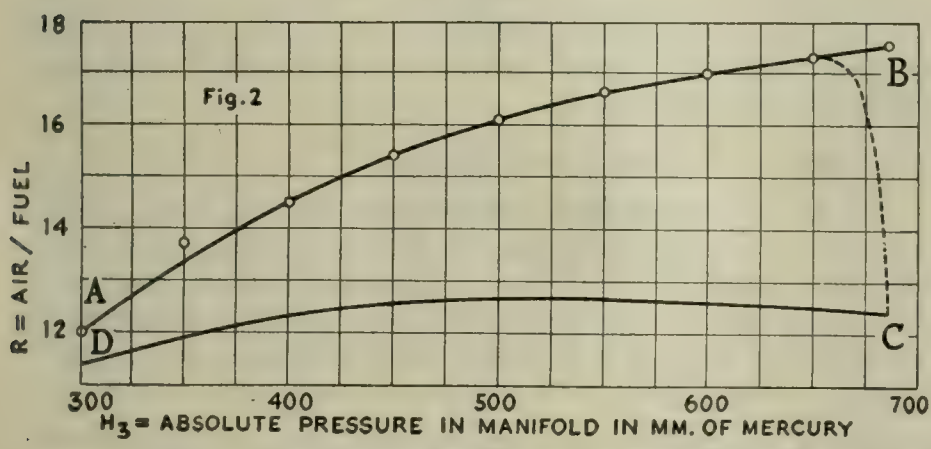
Repeated tests with gasoline as fuel have shown that a mixture-ratio of 12 to 13 will give maximum power independent of speed or load. Curve DC, Fig. 2, which is a

[1] See P. S. Tice's article, "Carburetion Requirements of a Typical Gas Engine" in *Automotive Industries* of June 24, 1920. and "The Carburetion of Gasoline," Purdue Engineering Experiment Station Bulletin No. 5, by O. C. Berry and C. S. Kegerreis.









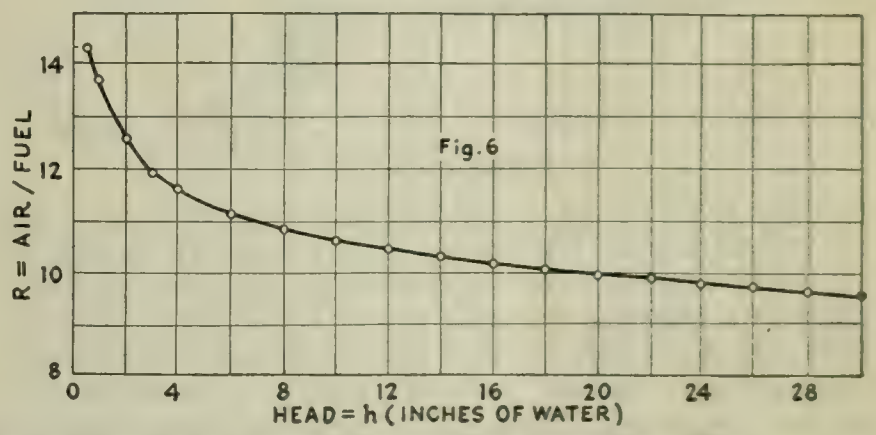


Fig. 1—Variation in specific fuel consumption with change in the mixture ratio, for various manifold pressures. Fig. 2—AB, curve of most economical mixture ratio with relation to engine load as represented by manifold pressure. AC, metering characteristic of an ideal carbureter. DC, mixture ratio of maximum power relative to engine load. Fig. 4—Variation in the coefficient of discharge of a typical carbureter venturi throat, with change in metering head. Fig. 5—Coefficients of discharge of carbureter metering orifices relative to pressure drop across these orifices. A comparison of curves A and B shows the effect of a change in orifice diameter upon the valve of the coefficient of discharge. A comparison of curves A, C and D shows the effect of a change in orifice length upon the value of the coefficient of discharge, and its rate of variation with change in head. Fig. 6—Metering characteristic of a simple carbureter incorporating a throat having a characteristic similar to the one shown in Fig. 4, and a metering orifice with a characteristic similar to curve B, Fig. 5

typical curve, illustrates this. It is plotted from the same data as other curves of Figs. 1 and 2.

It is often stated that present-day carbureters are almost perfect as metering devices, but actually the reverse is true. This statement may sound radical, but by analyzing the performance of a simple carbureter and then proceeding by steps to the present-day carbureter we may show in what respects the latter are faulty. Fig. 3 is a representation of such a structure. X is a constant level source of fuel supply for the nozzle Y which operates in the venturi throat Z. W is an adjusting needle used to vary the effective nozzle opening.

The force or metering head which causes fuel to be discharged at Y is expressed by the formula $K h = \frac{V^2}{2g}$ in which K is equal to the ratio of the density of the air passing through the throat to the density of the fuel $\left(\frac{d_a}{d_f}\right)$; h is included so that the metering head, or force which causes the fuel to flow can be expressed in inches of fuel; V = the velocity of the air through the tnroat; and g = acceleration of gravity = 32.2. The weight of fuel, f, discharged from the nozzle, Y, in unit time is expressed by the formula

$$f = ca\sqrt{2gh}\,d_f$$

However,

$$h = \frac{V^2}{2\,g\,K}$$

Substituting for h

$$f = \frac{ca\,d_f\,V}{\sqrt{K}}$$

in which c is the coefficient of discharge[2] of the nozzle jet; a is the area of the nozzle jet; and d_f = density of fuel; the other symbols having the same significance as in the previous expression.

For a given amount of air flowing through the throat in unit time f may be varied either by changing the size of the throat, and thus changing the velocity and metering head, or by changing a, the area of the nozzle. The latter means of adjustment is the ordinary one.

[2] The coefficient of discharge is the ratio of the effective area of an orifice to the actual area. Due to contraction of the stream flowing through an orifice, the effective area is always less than the actual area.

The weight of air, A, flowing through the throat in unit time is expressed by the formula

$$A = Ca_1 Vd_a$$

in which C is the coefficient of discharge of the throat; a_1 = throat area; V = velocity of the air and d_a its density.

The mixture-ratio R of such a nozzle and throat = A/f

$$R = \frac{A}{f} = \frac{Ca_1 Vd_a}{ca\, d_f} \frac{\sqrt{K}}{V} = \frac{Ca_1}{ca}\left(\frac{d_a}{d_f}\right)^{1.5}$$

From this expression it will be seen that if the areas a_1 and a, and the densities, d_a and d_f, are constant, the mixture-ratio R will be a direct function of the ratio of the coefficients of discharge C/c.

With the shapes of venturis ordinarily employed, the coefficient of discharge, C, varies only between very narrow limits. (See Fig. 4.)

However, the same cannot be said of the coefficient of discharge of the fuel orifice, c, which may vary between very wide limits, its value depending upon h, the pressure drop across it. The rate of variation of c with h depends

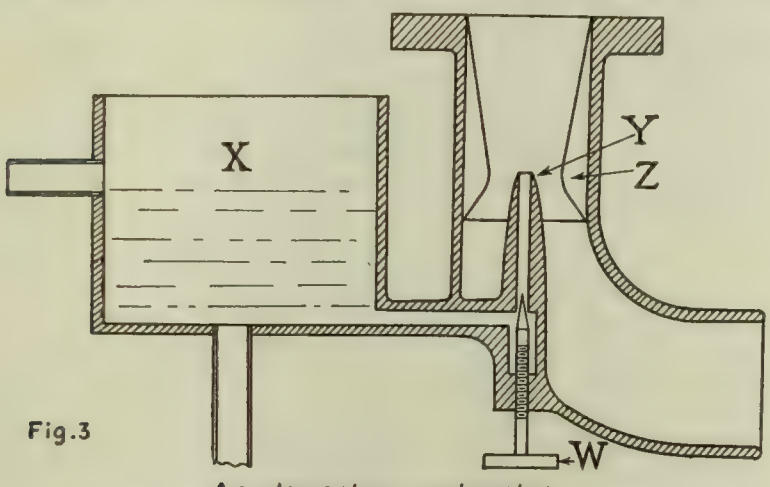


Fig.3 An elementary carbureter

upon the ratio of the orifice length to its diameter. Several typical curves illustrating this are shown in Fig. 5.

It will be noted that the coefficient of discharge for an orifice in a thin plate is very nearly constant. (Curve D.) With such a metering orifice in a carbureter, R would remain almost constant. However, in all carbureter work the fuel metering orifices employed are relatively long compared to their diameters, and this results in a metering characteristic in which R becomes smaller and smaller as A increases, when exactly the opposite effect is needed. Fig. 6 is a curve showing the variation in R with change in h, for a venturi with a constant C, and a fuel orifice with a coefficient varying according to curve B, Fig. 5.

There are other contributing factors which cause the mixture to become richer with an increase in A or h. In order to prevent dripping from the fuel nozzle when the carbureter is not in use, the fuel level in the float chamber must be maintained below the top of the nozzle. Thus a portion of the actual metering head, h, is employed in merely lifting the fuel and does not cause any flow. As A, and consequently h, is increased, the ratio of effective metering head to actual metering head is increased, resulting in the mixture becoming slightly richer.

Pulsating Air Flow

A very much more important factor and one of which very little is generally known is the increase of effective metering head due to pulsating air flow through the venturi throat. No matter what the direction of the air flow through the venturi, the throat pressure is always less than the pressure at either the upstream or downstream end, and consequently there will always be an effective metering head, causing fuel to flow independent of the direction of air flow through the throat.

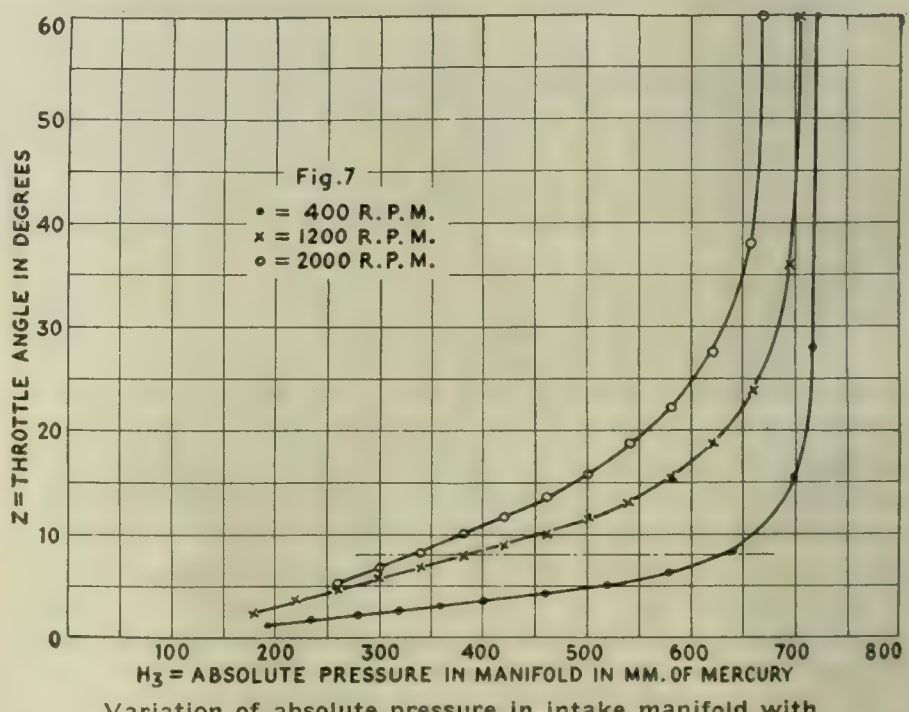
In order to visualize the effect of pulsating air flow upon the air-fuel mixture-ratio let us assume an extreme case in which the same fixed volume of air is alternately forced back and forth through a carbureter throat. With this happening there will be fuel discharged from the nozzle, in amount depending upon the rapidity of the pulsations, but there will be no actual air pumped. For such a condition R would be infinitely small. In actual practice this exaggerated effect does not take place, but there is an appreciable pulsating flow through the carbureter throat which contributes to the normal metering head.

Anyone who has held his hand in front of the carbureter inlet of a four-cylinder engine operating at wide-open throttle will vouch for the fact that there is quite an appreciable "blow-back." In some cases a fine plume of fuel spray can be seen issuing several inches from the carbureter mouth. This blow-back varies with the speed, its variation depending on the number of cylinders, the engine valve timing and the amount of throttle opening. The effect of the blow-back is inappreciable at small throttle openings, but at open throttle it may increase the metering head by as much as 65 per cent.[3] It is largely because of this variation in pulsating flow that a carbureter which works satisfactorily on one engine may be found to be entirely unsuitable for another of the same displacement.

In addition to these effects, bosses placed near the carbureter throat and the shape of the passages leading to the throat, produce effects on the effective metering head due to the throat, which are changeable and very difficult of explanation.

Carbureter Problems and Design

From the preceding paragraphs it may be deduced that the carbureter engineers have some hard problems on their hands in order to compensate the carbureter so as to give usable mixture ratios throughout the throttling range, and the methods they have employed in attempting to solve these problems have been both numerous,



Variation of absolute pressure in intake manifold with change in throttle position for several speeds.

and from the standpoint of maximum economy, ineffective.

Some small idea of the amount of work that has been done in order to develop a successful carbureter may be gathered from the comprehensive report on carbureters and carbureter patents written by Lucke,[4] in which he lists and classifies over 3400 different carbureters patented in the United States.

The means employed by these designers to secure

[3] This figure has been obtained by experiment on a 4.0 x 5.25-in. 4-cylinder truck engine.
[4] Second annual report of the N. A. C. A., 1916.

what they considered proper metering characteristics are both numerous and ingenious, but practically all of them have striven after the wrong goal. True, a few have met with some measure of commercial success, as witnessed by the carbureters on the market to-day, but they have all fallen far short of the ideal.

The auxiliary means employed to vary the mixture proportions on the better known carbureters of to-day consist of multiple nozzles, auxiliary air passages, cam operated needle valves, weighted valves, "air bleeds," etc., or combinations of these, but without exception the carbureters are so designed that the variations in mixture proportions depend upon the throttle position, or the quantity of air pumped by the engine, or both, whereas, as we have seen before, **variation in R should be solely dependent on the absolute pressure existing in the manifold.**

Figs. 7, 8 and 9 are curves showing the relationships existing between throttle angle, Z, air pumped by the engine, A, and the manifold pressure, H_3. An examination of these curves in connection with Fig. 2, in which is shown the variation in the mixture ratio of maximum economy with manifold pressure, will serve to explain the shortcomings just referred to.

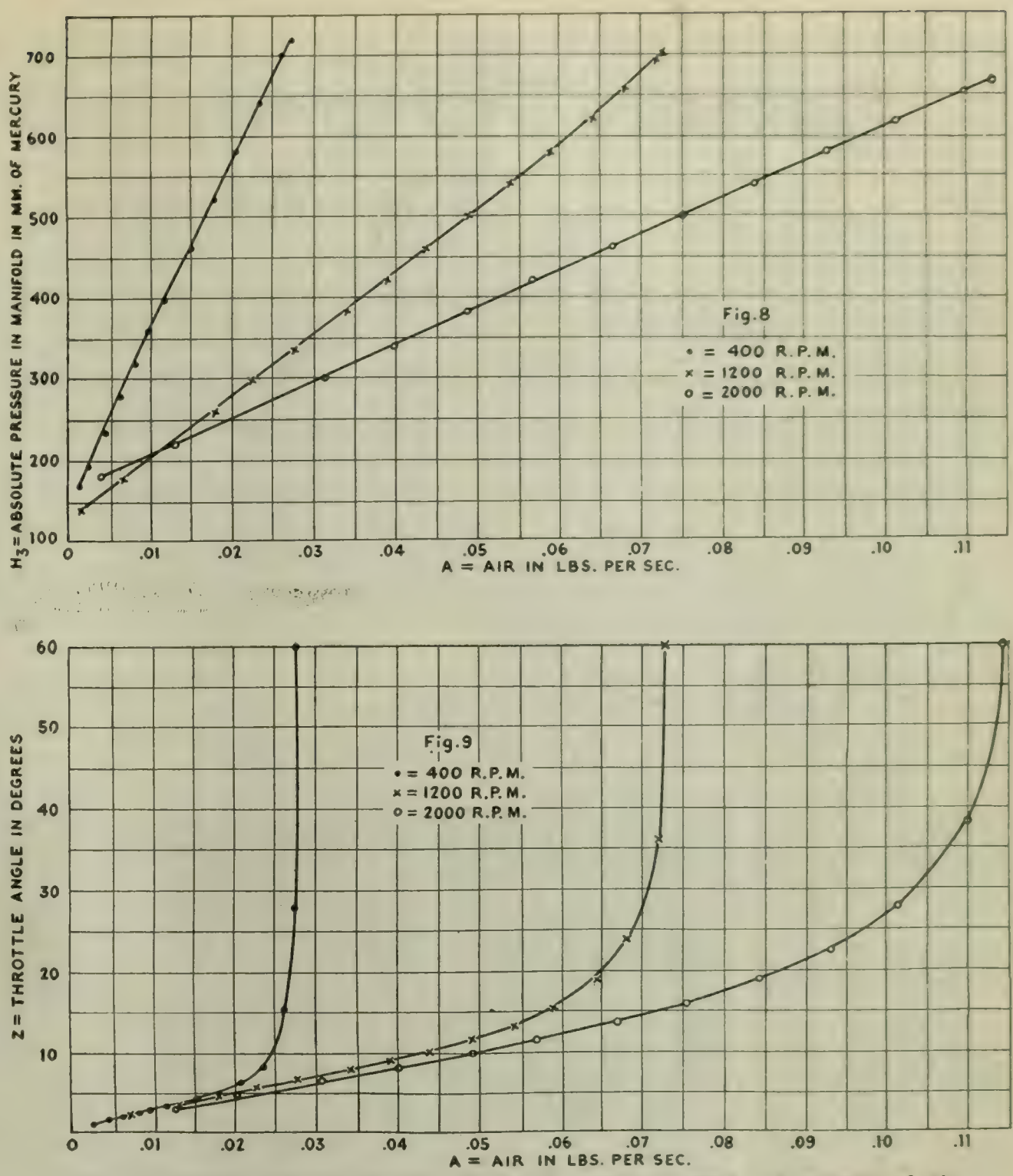


Fig. 8—Relation between absolute pressure in intake manifold and quantity of air pumped for several speeds

Fig. 9—Relation between throttle angle and amount of air pumped at several speeds

Following is an example of the errors in metering relationship introduced in a carbureter giving a constant R, or one in which compensation is attempted by any of the just named means. Let us assume a fixed throttle opening of 8 deg. Referring to Fig. 7, we find that at the several speeds shown H_3 is equal to 332, 385 and 630. Taking these values and referring to Fig. 2, we find that these several manifold pressures correspond to mixture ratios of 12.83, 14.19 and 17.20.

Thus, for these several speeds we find that for the best results we need widely different air-fuel ratios, whereas the conventional carbureter is designed to give but one. Therefore, at only one of an infinite number of speeds will the mixture from this carbureter be correctly proportioned at that particular throttle opening. The same reasoning holds true for all other throttle positions.

For those carbureters that depend upon the amount of air flowing for any extra variation in the metering head or fuel nozzle opening, there is a similar error. If we assume a fixed quantity of air and determine the corresponding manifold pressures and mixture ratios for the several speeds, there results a similar large range of mixture ratios, which indicates a corresponding error. Thus it may be positively stated that any and all carbureters that depend upon a change in air or throttle opening for a change in mixture proportions, can never be made to realize the mixture proportions of maximum economy at all loads and speeds, or even closely approximate these ratios.

Proper mixture proportioning is of absolutely no avail unless we have at the same time perfect distribution. The mixture ratios giving maximum economy are fairly close to the lean limits of combustibility; consequently, should one of the cylinders receive less than its share of the fuel the mixture in that cylinder will be so lean that it will either fail to ignite or burn so slowly as to provide very little power. In either case the result will be a ragged running engine. In order to avoid this condition of uneven running, the operator enriches the mixture so as to get the lean cylinder to fire regularly, and in so doing he provides an excess of fuel to the remaining cylinders with a resulting loss in economy. This catering to a lean cylinder or cylinders is experienced in almost all engines.

All that has been said in the foregoing paragraphs on metering has implied the condition of perfect distribution, but, sad to relate, with our present carbureting systems and modern fuels, this condition is never obtained because of the presence of liquid fuel in the inlet manifold.

(To be continued.)

Quantity Production of Passenger Car Axles

A description of methods followed in the manufacture of axle housings at a plant built especially for this purpose by the General Motors Co. Output is nearly three times as great as that formerly possible with the same number of men and same floor space, due to special tool equipment.

By J. Edward Schipper

A NUMBER of the axles for General Motors cars, including Oldsmobile, Oakland and others, are being made in the new axle plant which adjoins the Oldsmobile factory at Lansing, Mich. This building was designed and built especially for this purpose. It measures 140 x 750 ft., giving a total floor area of 105,000 sq. ft. The entire building has been designed to put through the axles rapidly in a progressive manner so that the flow of material is constantly in one direction from the point at which it enters as raw stock to that at which it leaves as completed axles. Both front and rear axles are made in this building.

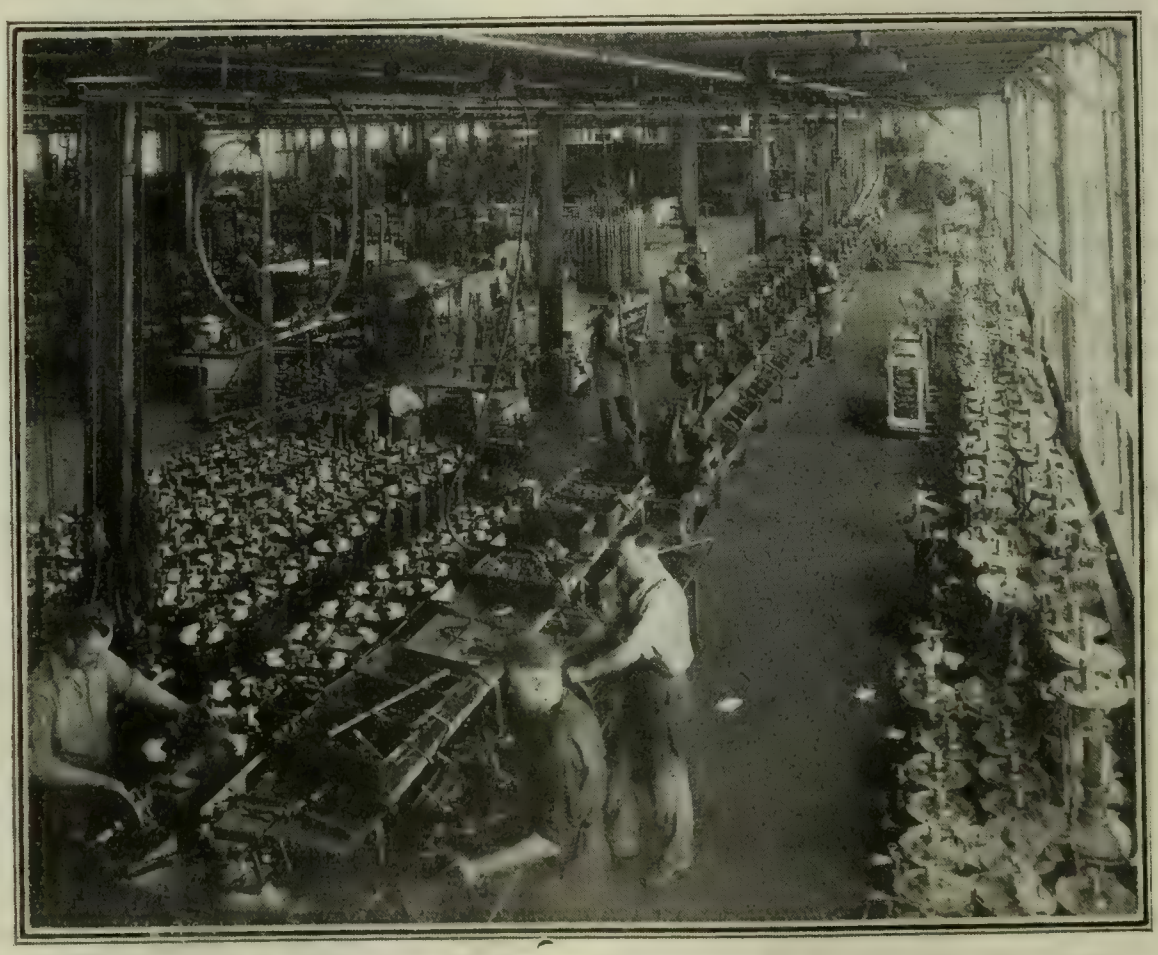


Fig. 1—Portion of Oldsmobile axle shop, showing part of the assembly line in the foreground

Arrangements have been provided in the way of traveling cranes with electric magnets for unloading the incoming stock and loading the outgoing axles. The equipment at the present time consists of sufficient machinery to manufacture 400 front and 400 rear axles per day. The building is so designed that it allows latitude for expansion. Additional machinery can be installed to double present capacity. In the manufacture of the rear axles, the majority of the machining work is, of course, required on the housing. The axle tube, axle shaft and other units are relatively simple and can readily be handled by stock machines. However, a great deal of special machine equipment which is very interesting from the standpoint of economy of space, as well as rapidity in manufacture, is used in the production of the axle housing. An idea of the plant layout is given in Fig. 1.

The machine operations not only on the housing, but also on the axle shaft and tubes, takes place at one end of the building and partially along the rear axle assembly line, so that the finished parts are brought to the assembly department at a point where they can be applied to the assembly without requiring intermediate stocking in finish or semi-finish stock rooms. Malleable castings for the housings come in from outside and are in three parts; left and right differential housings and the pinion shaft housing. It will be remembered that the Oldsmobile has a torque tube arrangement on the rear axle, the pinion housing taking the differential housing at the rear end and the torque tube, which incloses the propeller shaft, at the front end.

Malleable housings for the differential and drive gearcase require different machine operations on the left and right sides owing to slightly different shapes, and the fact that one of them has to be drilled for oil filler and drain holes. These two housings are bell-shaped, the large ends being joined in assembly and the smaller ends being bored to take the tubes which surround the axle shaft.

The left differential housing is almost entirely machined in a remarkable special machine, Figs. 2 and 3, which is the design of the Defiance Machine Works. It is a two-way automatic, which performs a complete series of operations. The work is located on a floating sleeve with three floating pins which butt against the work in the center, and another floating pin which passes between the bosses for the brake camshaft holes. The work is fixed in position by a floating center clamp and is driven by two set-screws. The machine is capable of 45 pieces per hr., but owing to the fact that hard castings have been encountered recently, the speed has been cut down to 33 per hr.

There are ten operations altogether on this machine,

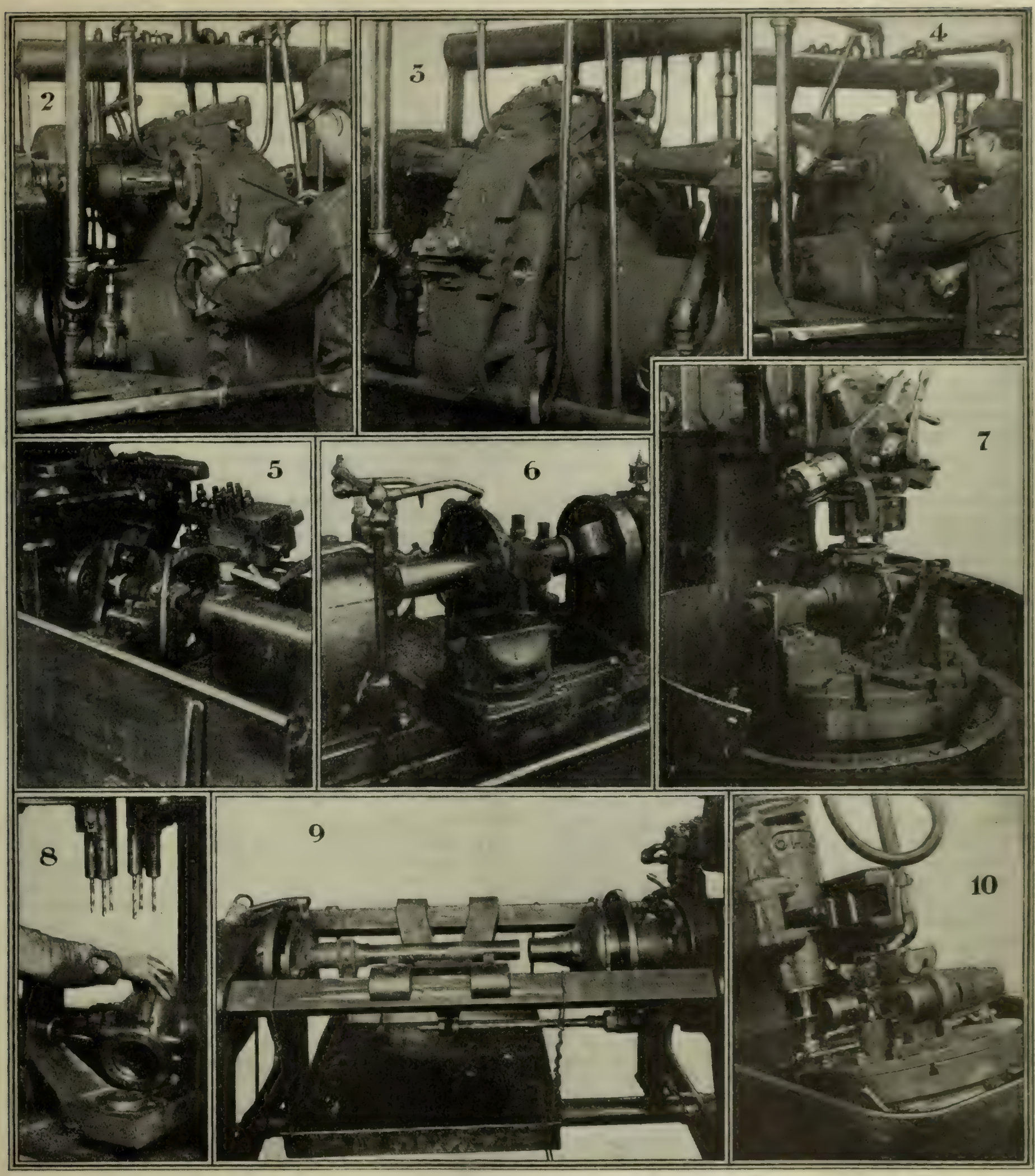


Fig. 2—Operations on the malleable differential and drive gear housing on the Defiance special, two-way automatic. This illustration gives an idea of the chucking and location of the work, as well as the way in which the three internal diameters are handled simultaneously on the left side of the machine. Fig. 3—Operations on the rear axle center housing on the right side of the Defiance two-way special automatic. The operations on the right and left sides of the machine are carried on simultaneously. Fig. 4—Defiance two-way special automatic used for the pinion shaft housing. This is a similar machine to that used for the central housing. Fig. 5—Roughing flange joints at the center of the rear axle housing on Fay automatic. Fig. 6—The finish work on the flange joint is done on LeBlond heavy duty lathes, of which there are two. Fig. 7—Finishing the outside of the housing on a semi-automatic Gisholt boring mill. These machines perform six operations at a speed of 1000 pieces per 9 hr. day. Fig. 8—Interesting jig method for locating the work on the Gardam multiple spindle drill for the six 3/8 in. stud holes in the flange of pinion shaft housing. Fig. 9—Pressing in the axle tubes on an Eastern air press. Fig. 10—Sawing the bearing clamp slots in the pinion housing on an Ohio tilted rotary miller.

some of which are compound, so that the number really runs up to considerable more than this. The operations are indexed automatically. The first is a rough boring operation both on the left and right side, the small rougher going into the small end of the housing, Fig. 3, and the large rougher into the bell opening. This opera-

tion also spot-faces the different depths on the interior of the housing, Fig. 2.

The second operation consists of boring a cluster of seven 25/64 in. holes on the open side and semi-roughing, spot-facing and chamfering operations on the small opening also. The machine then revolves to the third operation, which produces a semi-finish on all three bores on the open side and includes a finishing operation on the depths on the open end. At the same time centers are made for the two holes for the brake camshaft and the bosses on the small side.

In the next index position a finish reaming of the open end for all three bores is accomplished. This is done with a sectional reamer which reams three surfaces simultaneously. On the other side, the 5/16 in. holes and the bosses which were centered on the previous operation are drilled.

The next and final operation on this machine is the tapping on the open end of the 3⅜ in. bore for a sixteen thread, 1¼ in. deep. This is the thread for the adjusting nut which governs the position of the ring gear. On the other side of the machine, simultaneously with this, the tapping of the two ⅜ in. holes in the bosses is taking place.

Operations on Right Housing

The operations on the right housing are very similar to those which have been described on the left housing. The machine used is also similar, being one of the Defiance two-way automatic lathes which was designed specially for the General Motors Co. and with their co-operation for this work. The location is from a floating sleeve and the work is held in place by a floating chuck clamp as in the other case. The drive is through two set screws which hold the work firmly in both directions.

Following the work on the Defiance automatic, the housings are put through a Fay automatic, Fig. 5, which roughs the flange joints at the center of the rear axle housing where the two bell openings of the left and right side go together. This work is located from the shoulder at the base of the thread for the ring gear adjusting screw. The finish work on the flange joint is done on a LeBlond, heavy-duty lathe, Fig. 6. It requires two of these machines to keep up with the Defiance two-way automatic.

The oil plug holes and oil drain holes in the right half of the housing are drilled on a Fosdick drill press. Both halves are put on a LeBlond machine to face off the end of the housing to an exact distance from the shoulder at the base of the thread. This is solely a locating operation for the next cut which is taken on a Gisholl boring mill, Fig. 7. This is a semi-automatic machine which performs a series of interesting operations, substantially finishing the housing. In these operations, the two halves of the housing are bolted together and the operations are mainly for the purpose of forming the openings which take the pinion housing and finishing the exterior of the housing. Location is from the shoulder and against the face, which was finished exactly in the previous operation. These Gisholl machines perform five to six operations at a speed of 1000 pieces every 9 hr. per machine. It is claimed that to duplicate the amount of work on individual drills would require the installation of at least a dozen ordinary type machines and the employment of eight additional workmen. Furthermore, it would be difficult to hold the same precision of which this heavy machine is capable.

The first operation is to rough face the housing; second, to rough bore the inside and outside diameters. The third operation semi-finishes the inside and finishes the outside. The fourth operation finish faces and chamfers the inside of the housing, and the final operation reams the finish hole for the housing. McClusky reamers are used for this purpose.

An interesting jig method, Fig. 8, is used to locate for the Gardam multiple-spindle drill, which drills the six holes for the ⅜ in. studs used in connecting the housing to the flange of the pinion shaft casing. Locating plugs enter each side and pilot in the bores in the sides of the housing, and, in addition, the housing is piloted on a dowel in the pinion shaft bore with the drilling operation performed around this dowel.

Before assembly, the threads for the ring gear adjusting screw are re-tapped by hand to insure their accuracy. This is done on both the right and left hand housing. The axle tubes are pressed in position on an Eastern air press, Fig. 9, this being a very close press fit. After being pressed in, the tubes are riveted in place. The tubes are all machined on automatics and are ground on the wheel bearing end prior to assembly.

The operations on the pinion shaft housing are performed in very much the same way as those on the right and left halves of the central housing. A Defiance automatic two-way lathe is used for this work also, Fig. 4. Location on the floating sleeve is on three points and there are also three jaws which act as a universal chuck. In locating the work, the chuck brings the inside flange of the work back against the chuck, the inside of the flange being in contact with the outside of the chuck. The outside of the pinion housing is ribbed and one of the ribs is taken between two jaws in the floating collar which acts as a driver.

The two-way operations on the Defiance machine are as follows: First, on the left side a large rougher enters the bore, and on the right, a small rougher machines another bore. On the left side, the tool roughs out three diameters on the interior of the housing, and on the right side, one diameter. On the right side there is also a spot-facing operation on the end of the housing and a 45 deg. chamfer. The machine then indexes for the next operation. On the left side are drilled six 15/32 in. flange holes. On the right side a tool semi-roughs the small bore and finish faces and finish chamfers it.

Details of Third Operation

The third operation, on one side only, is one in which a semi-finisher goes straight through all four bores, giving true alignment, and also finishes the outside face and chamfers the left side. In timing this machine over a long period, it was found to average 31½ pieces per hr. The limits on the four bores after the final reaming operations on this machine are as follows: 0.0008 in. on the bearing surface; 0.002 in. on the thread surface; 0.001 in. on the adjusting sleeve and 0.002 in. on the tube end. A Warner & Swasey finishes the exterior, particularly the face which goes against the gear housing, and an Ohio tilted rotary miller, Fig. 10, saws the bearing clamp slot. In the latter operation, the work is piloted on its bore over an arbor for location. The pinion housings are spot-faced and drilled and then passed along the assembly line. A progressive system assembly is used.

This is a rather brief outline of the operations which take place in the manufacture of the rear axles. Nothing has been said in this regarding the heat treating department, which is an important unit in this manufacture. Heat treating is used for such parts as the axle shafts and pinion shafts, and heat treating operations are given after the bulk of the machining work is done so that the duty on the cutting tool is as light as possible. The outstanding feature of the axle department is the fact that 800 sets of axles can be manufactured in a day, while with older methods, with the same space and number of men, the plant would hardly have produced a third of that amount.

The Relation of Vehicle Speed to Highway Damage

There is a definite relation between the speed of a motor vehicle and the wearing effect upon the highway. This articles gives the results of some interesting tests that have recently been made to determine this relation. Increased speed of solid tired vehicles increases the impact in far greater proportion than it does in the case of pneumatic tired vehicles.

By W. G. Robertson*

SPEED, for the purpose of this discussion, will be taken in the sense—rate of travel or velocity rather than in the sense—to make haste, perhaps unnecessarily.

It is well known that speed is a very important factor in the amount of destruction which results from the unrestricted use of the roads by vehicles. The impact increases very rapidly with increase of speed. It increases much more rapidly in the case of a truck equipped with solid tires than one equipped with pneumatic tires, because of the greater resilient qualities of pneumatic tires.

A report issued by the United States Bureau of Public Roads on the "Effect of Impact on Pavements" gives some interesting information on this subject, and shows that the impact resistance increases with the velocity, with the total weight of the vehicle, and with increasing road-surface roughness. In these tests, the impact resistance of good asphalt or bitulithic or other smooth pavement, was practically negligible, and reached its highest values on granite-block roads with sand-filled joints, and on badly worn macadam pavements. The rate of increase of impact resistance with speed was most marked on the roughest roads.

The following urban pavements are enumerated in the order of their desirability for vehicle operation from the point of view of tractive resistance at 20 km. (12.4 miles) per hour, as found in this investigation. (1) asphalt, (2) wood block, (3) hard, smooth macadam, (4) brick block, (5) granite block with cement-filled joints, (6) cinder, (7) gravel, (8) granite block with sand-filled joints.

The equivalent grade at 20 km. (12.4 miles) per hour of a badly worn city macadam road was found to be nearly three times as great as that of the best asphalt road tested. This means, at this speed, a consumption of energy at wheel treads of nearly three times as much on level macadam roads as on good level asphalt roads.

Increasing the gross weight of the vehicle by 12 per cent. through load was found to have no effect on tractive resistance within the observed speed limits for smooth roads in good condition; but on rough roads, a distinct increase in tractive resistance with this extra weight was observed.

Tests have been made which show that increased speed of a vehicle equipped with hard rubber tires tremendously increases the impact which its wheels make on the roadway where there is any unevenness. On the other hand, where pneumatic tires are used, increased speed adds comparatively little to the impact. It has been suggested that these tests will be of great value not only in settling questions of design, but may also lead to a rational basis for determining license fees for motor vehicles.

Trucks have been used in these tests varying in size from a 1-ton up to a 7½-ton truck, carrying an excess load. Each truck was run over a special recording device imbedded in the roadway and the impact which resulted, when one of the wheels made a two-inch drop from a ledge built in the surface, was recorded.

Recent tests were made with a 3-ton truck loaded so that the weight on each rear wheel was 7000 lb., the unsprung portion being 1700 and the sprung portion 5300 lb. The truck was equipped first with an old solid tire that was worn down to a thickness of one inch. Then, with exactly the same load on the truck, a wheel was fitted with a new solid tire 2½ inches in thickness. And finally the truck was equipped with pneumatic tires, 42 x 9 in., blown up to a pressure of 142 lb. per square inch. The following table shows very clearly the bad effect an old tire is likely to have on a road surface and the greatly lessened impact which is produced by trucks equipped with pneumatic tires. The tests show that as the vehicle's speed was increased, the impact from the old hard rubber tire increased greatly. The impact from the new tire was somewhat less.

Speed	Old Tire	New Tire	Pneumatic Tire
5.7 miles	11,600 lb.	9,400 lb.	7,100 lb.
10.2 miles	18,500 lb.	14,100 lb.	7,900 lb.
14.6 miles	26,500 lb.	18,700 lb.	8,330 lb.

In fixing speed limits for motor vehicles, legislators hitherto have given consideration mainly to the question of safety. Diversity of opinion as to what constitutes a safe maximum speed is reflected in the variety of legislation on this subject in different provinces and states. The State of Kansas sets 40 miles per hour as the upper limit of speed in the open country. California and a number of other states draw the line at 35 miles per hour, while 30 miles per hour is about the average for all the states.

Thirty miles per hour is the maximum speed limit in British Columbia, while the other western provinces fix no limit other than requiring speed at all times to be reasonable, having regard to traffic. In Ontario, Quebec

*An address delivered at the annual convention of the Ontario Good Roads Association. Mr. Robertson is secretary-treasurer of the Ontario Motor League.

and Nova Scotia the upper limit has been fixed at 25 miles per hour. New Brunswick sets no definite speed limit other than what is reasonable, having regard to traffic, while Prince Edward Island, but recently opened up to the automobile, puts the ban on a speed in excess of 15 miles per hour.

In this Province the Load of Vehicles Act (Section 5) stipulates that no vehicle carrying a weight in excess of four tons, including the vehicle, shall be operated on any highway at a speed greater than 10 miles an hour; and no vehicle carrying a weight in excess of six tons, including the vehicle, shall be operated upon any highway at a speed greater than 8 miles an hour.

The speed limits for trucks provided in the Ontario act are extremely restrictive. If modified in conformity with recent experience, all commercial vehicles equipped all around with pneumatic tires would be restricted to 25 miles per hour on open country highways, while commercial vehicles equipped partially or all around with solid tires would be required to conform to the following speed schedules:

Gross Weight	Open Country Highways
Under 2 tons	25 miles per hr.
2 to 6 tons	20 miles per hr.
6 to 10 tons	15 miles per hr.
10 to 14 tons	12 miles per hr.

To fix the speed limit of commercial vehicles at an extremely low figure means also interference with the free movement of general traffic on the highways. On a road of average width, when there is a steady stream of traffic in opposite directions, it is at once both difficult and dangerous to pass a succession of slow-moving vehicles in the face of oncoming traffic.

The great increase in motor truck traffic, indeed, points to an early necessity of providing such width on main highways as will enable trucks and slow-moving vehicles to travel the outside of the road and leave a lane of sufficient width for two lines of the more swiftly moving passenger cars. Under present conditions it is just a question whether it might not be conducive to safety to require all motor vehicles to travel at not less than a minimum rate of, say, 12 miles per hour under normal traffic conditions.

Width of highways, degrees of grades and curves, nature of road intersections, ditches, and railway crossings, and volume and kind of traffic are all factors which must be considered in determining speed from the standpoint of safety. So complex are these factors that it is impossible to state what might be considered a reasonable speed on any but a straightaway stretch of country road without taking into account local conditions. Vigilance and sound judgment are essential to safe driving everywhere, and no arbitrary speed limits can be devised which will relieve the drivers of motor vehicles from the ever-present obligation of giving due regard to constantly changing traffic and road conditions.

Peru Offers Possibilities for Truck Sales

PRODUCTS of most of the leading truck manufacturers in the United States are found in Peru, as well as many European trucks. No one make of truck, however, with the exception of a well-known light truck, is found in any great number, though four or five makes of heavier trucks have each a respectable following.

The large number of different makes of trucks is probably due to the fact that consumers or users imported direct from manufacturers, rather than buying from local agents. The amount thus saved in the purchase price was probably offset by extra investment in spare parts, or by having the truck laid up for lack of them. Perhaps both.

There are three prominent fields for the motor truck in Peru. The first is in transporting merchandise from the coast to the commercial centers located a short distance from the seaboard. The leading trade centers of the coastal region of Peru are not situated right on the ocean, but a few miles inland. Lima is some nine miles (12 kilometers) distant from her port Callao. To the north of Lima, Piura is found a few miles from the port of Paita; Chiclayo offers a double opportunity to truck manufacturers, being a few miles from two ports, Eten and Pimentel; Trujillo follows suit, being a short distance from the port of Salaverry. To the south of Peru it is the same story. Cañete is a short distance from the port of Cerro Azul; Chincha Alta from Tamo de Mora; Ica from Pisco; and Moquequa from Ilo. Despite the fact that railways connect all the coastal commercial centers with their ports, there is a field for the motor truck. This is shown by the fact that trucks are now doing service between Lima and Callao against three forms of competition: mule-drawn carts, steam and electric railway. Further advantages to the truck will soon be evident for the highway for freight traffic between Lima and Callao is to be improved.

A more ambitious project than the linking of the coastal commercial centers with their ports would be a belt line of trucks joining up the different commercial centers one with another. This doubtless will come in time, for now automobiles are coming to Lima from outlying cities, such as Pisco, and there is a light truck service, perhaps irregular, between the capital and Cañete.

The second field for the motor truck is found on the haciendas or ranches of Peru, which are immense centers of agricultural activity like our western ranches or Southern plantations. From the haciendas the trucks can bring the cotton, sugar and rice to the commercial or trade centers, to be transported to the seaboard.

The third field is in the mines. Although the mining companies now have trucks, American manufacturers should see that they have more and better trucks. This should be easily accomplished, for most of the mining companies have home offices in the United States, and the manufacturer has neither a trip abroad nor foreign credit to consider. Here is export trade on his own doorstep.

At the present time the American motor truck is far in the lead in Peru, and in the field of the light truck bids fair to maintain it. In the heavier truck the European seems to be making more headway for the moment, due, perhaps, to the more favorable continental rate of exchange.

As to the type of truck suitable for Peru, without going into detail, it may be said that it should be a good truck, of the best material and well built; for only such a truck will stand the hard conditions of service in Peru. And any truck sent should be amply supplied with spare parts.

Just why the commercial centers of the coastal region were stuck a few miles back from the sea is not clear. It was probably for protection against the enemy. Be that as it may, it has resulted in putting all of them within truck shot of the coast. Let the American manufacturer plant his trucks on these sites, ready not to destroy but deliver any merchandise that may approach.



The Automobile in Brazil

Editor, AUTOMOTIVE INDUSTRIES:

Twelve years ago the poor pavement of Brazilian streets and the impassable roads of country districts made traveling by automobile in this country an almost impossible task. At the present time, from Amazonas to Sertão in Matto Grosso, from Minas Geraes to Rio Grande do Sul our country is covered with beautiful roads of the modern type. In the State of Sao Paulo the "Better Road Movement" has taken unusual progress since the present governor, Hon. Washington Luiz Pereira de Souza, was appointed to office. The Hon. Pereira de Souza is personally a great motorist, and one of the first steps he took after being elected was to use his influence in having the municipal governments of the leading cities within the state to appropriate sufficient funds for the construction of new roads and the upkeep and improvement of the old ones. During the first two years of his administration great headway has been made in road construction and improvement. In addition to numerous smaller roads, his administration should be credited with the remarkable Sao Paulo-Campinas road, 105 kilometers long. The State of Paraná has likewise an enterprising governor who has successfully promoted road construction within his state. Notable examples of newly built roads in Paraná are the 800-kilometer road from Ponta Grossa to Iguassu and others of shorter distances.

As a matter of fact, in all Brazilian states there is to-day an evident desire for better roads. This desire varies in intensity, it being dependent upon local wealth and natural resources. Nearly 150 kilometers of the interstate road from Rio de Janeiro to Sao Paulo have already been completed. Funds for this interstate road are provided by the Federal Government and the state government of Sao Paulo.

Roads, of course, have made it possible to introduce the modern automobile in our country. And among the cars used the American is found in larger numbers than those of European makes. We can state with emphatic assurance that public officials, as well as our leading plantation owners and farmers, merchants, etc., throughout our country, are beginning to realize the fact that automobiles, motor trucks and tractors are indispensable means of transportation and agricultural and industrial progress. Cars are to-day used for practically the same purposes that horse carriages and animal-drawn vehicles were employed years ago. Notwithstanding this remarkable progress in automotive vehicles, Brazil is in its infancy as yet when we consider the fact that three, four or more times the number of present cars could be used throughout the country.

In spite of the commercial depressions, past and present, the automobile trade is one of the most solidly built activities of our local trade. In no city has the popularity and use of the automobile decreased. Taxi companies are prosperous. The people have come to look upon the taxi with the same regard as street cars. It has even taken the place of the horse and the omnibus; taking the place of railroads, has solved the long-distance transportation.

The future of the automobile in this country is in the hands of those manufacturers who will strive for producing better cars and giving Brazilian importers and dealers better service and facilities. At the present time the American car is supreme in our markets; but this supremacy is likely to be lost to American manufacturers if they fail to make special efforts now to retain it. It will not take a great effort on the part of German manufacturers to compete with the Americans. Our exchange on the German mark is far more favorable than on the American dollar. There is always the possibility of German manufacturers coming to this country, looking up local requirements and going back home to build cars in just the manner that our buyers like to have them built and delivered. Germany just now is working hard to introduce her latest models. German manufacturers are looking for big business, and we believe that, with the advantage of the mark exchange in our favor, they will have no difficulty in introducing again their products. Of course, we must always bear in mind that American manufacturers are more advantageously equipped for the business, when we consider this advantage from the viewpoint of repair parts and mechanical equipments for car servicing and repairing. The handsome body styles and mechanical improvements are also to their advantage.

Our state of Sao Paulo should be considered as being the "leader" in our country in connection with automotive activities. Our state has to its credit a larger road mileage, and 15 large concerns devoted exclusively to the importation, sale and service of automotive products. These concerns handle American cars almost exclusively, in addition to tires, accessories, etc., of American makes. They handle about 50 per cent of the total automotive trade of Brazil. In view of these facts, American manufacturers should turn their attention to our state.

Among the most important things that American manufacturers should look into are the following:

(A)—Protection to representation granted to Brazilian firms or individuals. Agencies should be established on permanent and sure basis, so that agents or representatives will handle it properly through personal interest in the business. Manufacturers should not change representatives as frequently as they have done in the near past.

(B)—To comply with all requirements or specifications indicated in our orders, in connection with finish, color, type of rim or wheel, magneto ignition and others of similar tenor. Most manufacturers disregard these instructions.

In spite of the existing depression weighing upon our markets and which reflects against American-made goods, since the exchange on the dollar is exceedingly high, and curtails importations from the United States, the automobile business has not suffered as much as other lines of activities. It is true that sales have fallen off when compared with normal market, but, however

reduced, there has been a steady stream of orders, and we can say that, all things considered, this has been a fairly good business.

The prospects are brighter for the 1922 season. Brazil will commemorate this year her independence centenary. Those of optimistic mind are hopeful that this occasion will mark the rehabilitation of the exchange with the United States. At any rate, we all hope the coming year will witness an era of rehabilitation and readjustment of our economical life which will mean higher local production and more money in circulation.

Let me now make some brief remarks as to what I consider wise for American manufacturers to do during the present period in order to retain and improve their business and relationship with Brazilian automotive importers and dealers:

(1)—To establish commercial relationship with reliable native firms or individuals. To send traveling representatives to become thoroughly familiar with Brazilian markets, selecting for this purpose men of good manners and of wide experience in international trade able to speak our language and acquainted with our mode of living. Preference should be given to those having technical knowledge of methods and equipments for servicing and repairing automotive products.

(2)—Manufacturers should endeavor, as far as feasible, to give their representatives or important clients long credits. This policy will be found very advantageous in connection with tires, repair parts and accessories, as local buyers usually buy these goods on terms.

(3)—To give more attention to the matter of service to owners, through reducing the price of spare parts. During the past months these have been sold at fantastic prices. Also special attention should be given through manuals or other forms of printed matter, to repair and maintenance methods.

Should American manufacturers follow these leads as closely as possible it will not be surprising to see, say in the course of ten years, that all cars in Brazil are American-made cars. Let me also state the fact that American manufacturers will never find a better market for their cars than our country. Automotive development is here in its infancy. The automobile is just beginning to make headway under the right character of a vehicle of practical utility rather than a conveyance for the wealthy and exclusive.

I write authoritatively on these matters because I have had many years' experience in this line in my native land.

FLORIANO P. SANTOS,
Sao Paulo, Brazil.

Air Cleaners

Editor, AUTOMOTIVE INDUSTRIES:

Referring to your editorial in the Jan. 26 issue on the subject of air cleaners for road vehicle engines, it is unquestionably desirable to employ an air cleaner and particularly on truck engines.

Reference is made to the objection to the use on high speed engines of air cleaners of the type which offers high resistance of the passage of air. An air cleaner of the so-called filter type, while being the most satisfactory from the standpoint of efficiency, fails to function consistently where an excessive amount of dust is handled for the reason that while they can be made self-cleaning, they will not work under severe conditions and quickly become clogged. In this respect, has sufficient attention been paid to the location of the air intake so that the amount of dust the cleaner has to handle is minimized?

In almost every instance, the location of the air inlet is inside the hood, subject to all the dust that is drawn in by the fan through the radiator. It is evident that this location is most unfavorable, and tests have indicated that if the air were taken from the driver's compartment, for instance, the amount of dust taken through the cleaner would be reduced by 60 per cent. Under these conditions, a filter type of cleaner of the simplest type can be effectually used.

NORTHWAY MOTOR & MFG. CO.,
Div'n General Motors Corp.,
A. A. Bull, Chief Engineer.

The Vaporization of Motor Fuel

Editor, AUTOMOTIVE INDUSTRIES:

I noted with some surprise your article in the AUTOMOTIVE INDUSTRIES, page 509, of March 2, 1922, headed "A System for Complete Fuel Gasification." I refer particularly to your statement that it is necessary to raise the mixture for the average American gasoline to a temperature of about 425 deg. Fahr.

Your article would lead one to believe that in order to completely vaporize gasoline, the temperatures that must be maintained are fixed only by the end points of the fuels used.

There has been so long a misunderstanding in the automotive industry on the subject of the scientific use of motor fuel, I feel inclined to call your attention to this erroneous statement. It seems to be a recent discovery to automotive engineers that a fundamental scientific fact respecting materials existing in combination is that their characteristics are affected by their environment. Physical chemistry has so long dealt with partial pressures, and the laws of mass action, now fundamental to all chemistry, are so entirely based upon partial pressure, it seems a reflection on the intelligence of technical men to have to refer to the subject.

About a year and a half ago, one of the technical associates of the Deppe Company wrote Dr. Cottrell, then Director of the Bureau of Mines, and called his attention to the fact that the specifications for motor fuel were to be based entirely upon the distillation points under atmospheric pressure, which was wholly misleading, as the fuel was never utilized in that manner. Partial pressures of the fuel, when dealt with in the presence of other matter, have been quite generally overlooked in the automotive industry and yet are fundamental principles of chemistry and physics. It is unfortunate that terms having a definite meaning in science frequently have another meaning in industry. To such an extent has this become prevalent that it is necessary to define the meaning to prevent misinterpretation. Thus, evaporation in chemistry and physics is known as slow vaporization. Evaporation to dryness, for instance, has a very definite meaning in the chemical laboratory. In engineering practice, evaporation, instead of being applied to a slow rate of vaporization is applied to the most rapid rate of ebullition which is practiced in the arts. The performance of a steam boiler is always specified in evaporation per pound of coal or the rate of evaporation per hour and the standard definition of horsepower is technically so specified. Another term having a definite physical and chemical meaning, "vapor tension," has long been used by the Government and the Interstate Commerce Commission to define the allowable pressure permitted on gasoline tank cars. In other words, "vapor tension" has been used under Government sanction for total pressure. It is only recently that a joint committee has pointed out that from the scientific point of view this is not vapor tension. *The term, however, has not been changed.* In selecting a term to be applied in the arts, therefore, its use in such arts must be taken into consideration and not its use alone in the physical or chemical laboratory. Thus it is with "boiling point." There is really no fixed boiling point, the

boiling point being dependent entirely upon the conditions to which the liquid is subjected, each pressure having a different boiling point. By agreement, the standard boiling point of water is taken under standard atmospheric barometric pressure, namely, 100 deg. Cent., at 760 mm. pressure. This standard, therefore, defines these conditions only and does not in any manner attempt to define or limit the fact that there are other boiling points. These boiling points are commonly taken for materials in the liquid mass and not in an atomized or spherical condition. A globule of water dancing on a red hot plate is an illustration of the phenomenon known as "false equilibrium." In this case, the surface tension of the globule has now disturbed the boiling point and the globule no longer boils at normal temperature. Therefore in selecting a term to define under what conditions a liquid may be converted into a gaseous state, consideration must be given to conditions other than temperature and pressure. One is at once confronted with the fact that mechanical sub-division may alter the boiling point independently of the temperature or pressure of its environment and that where liquids are used in mechanical sub-division such as an atomized condition, certain laws relating to the boiling point in the mass no longer hold. In other words, colloidal chemistry is an accepted principle of physical chemistry and has laws that are immutable. It is possible to boil water at 32 deg. Fahr. by reducing the pressure low enough. It is possible to run this temperature up to the decomposition point of water without boiling it if the pressure on the liquid is high enough. Temperature alone means nothing in specifying the boiling points of liquids.

We have read with great interest Mr. Howard's very able paper in which he endeavored to determine the pressures and temperatures at which vaporization takes place, but any application tending to interpret that subsequent condensation cannot take place under changing temperature or pressure is not in accordance with physical laws. Likewise of interest were the very able and ingenious methods proposed by Professor Wilson for determining what he calls an "equilibrium solution," but we have watched in vain for some technologist to ask why the end point of his equilibrium solution became 482 deg. Fahr. whereas his original gasoline had an end point of 410 deg. Fahr. This brings one into a complicated field of physical chemistry but it is so pertinent to the hot spot applications that I cannot refrain from commenting on it. In other words, in applying heat to cracked gasolines, it will be found they are tremendously susceptible to polymerization, and singularly enough while the automotive industry as a whole criticizes the heavier fractions of the fuel, as these have already polymerized, they do not in general have the same tendency to polymerize as some of the lighter fractions which have been temporarily hydrogenated. The subject of hydrogenation has attracted much attention in the past three or four years and is the next debutante to the automotive society. In cracking heavy fuels to produce light motor fuels, if it is desired to produce a high content of saturated hydrocarbons, probably hydrogenation must be resorted to, the question of whether the hydrocarbons are saturated or unsaturated being determined by well known chemical tests and not by any method of determining whether the molecules have a tendency to remain stable or to become unstable when quickly subjected to heat.

One of the important features in the Deppe process which you fail to comment on (and, by the way, I was not consulted or notified that you expected to publish this article or I should have been glad to have made these suggestions) is the fact that the Deppe method avoids subjecting the mixture to an abrupt cracking or polymerization producing unstable and heavier molecules as shown in Professor Wilson's tests. You will note particularly the emphasis we place on progressive heating and in this respect Mr. Howard's laboratory work followed more closely the Deppe methods by removing the lighter products before the heavier products were acted upon by increasing temperature.

H. P. DEPPÉ.

We note that Mr. Deppe was surprised to read that it was necessary to raise the gasoline to a temperature of 425 deg. Fahr., from which we infer that this is not the temperature he uses, but we fail to find in his communication any information as to what is the maximum temperature used in his system.

If we consider the gaseous mixture as an absolutely homogeneous mass, it is a comparatively simple matter to calculate what temperature is necessary in order that a mixture of any particular proportion and under any particular pressure may remain in the gaseous state after the fuel has been once completely vaporized. But it is a rather different problem to determine the temperature to which the media which carry heat to the fuel must be raised. For instance, if it were found that the fuel in a certain mixture under a certain pressure would not separate out at a minimum temperature of 150 deg., the medium through which heat was imparted to the fuel must evidently be raised to a materially higher temperature than 150 deg., for if it was not, the gasoline could not possibly reach 150 deg. within a definite time. How much higher its temperature must be would depend upon the time available for the volatilization of the fuel for one thing and the fineness of spraying for another. As to the time factor, if the gas passes through the manifold at the rate of 150 ft. per second and the heating surface is 6 in. long, the length of time that any particular portion of the charge is near the heating element and under its influence is one three-hundredth part of a second.

We do not believe that the vacuum in the intake manifold is a very important factor in this connection, for although the temperature of vaporization is directly proportional to the absolute pressure, and this is comparatively low when the engine is throttled, there are certain conditions of engine operation when the manifold pressure is very close to atmospheric, and the heat supply, of course, must be adequate to meet these most unfavorable conditions.—EDITOR.

Automobiles in Madagascar

FRENCH automobiles are in the lead in the Island of Madagascar, about 116 of the 159 cars there being made by French manufacturers. Thirty-eight cars are of American make, and all but three of these are privately owned. The majority of the French cars are owned by the Government. Two Italian and three British cars are on the island. About three tractors are used for agriculture and about 79 motor cycles are in use. But seven of these latter vehicles are American.

On the neighboring island of Mauritius, which has a smaller population than Madagascar, there are 1600 cars. On the Island of Reunion there are 30 or 35 cars.

This information has been furnished by the American Consul at Tananarive, Madagascar. American consular officers at any foreign city will furnish such information directly to any American asking for it.

The Study of Car Markets Demands Careful Analysis

The possible future market for any one manufacturer can be determined by an analysis of the past history of his market in its relation to that of all his competitors. The author explains how this may be done.

By Harry Tipper

So far, in the discussion of this subject, it has been impossible to go any further than the basic economic conditions, the channels of distribution, and the economic requirements of those channels. To be at all effective, these considerations must be applied by the manufacturer of the automobile to the requirements of his own organization, considering the product which he is dealing with, the production and the character of the organization as it stands. In order to do this, the manufacturer must have some very definite way of arriving at

First—The future market for his particular product in comparison with the present production.

Second—The plans necessary to secure that market.

Third—The least operating cost at which those plans can be effectuated.

In order to determine the market, it is necessary to know the fundamental facts concerning

First—Tendency of future registration.

Second—Life of the car.

Third—Variation in the territorial developments in each of the territories.

Fourth—Character and tendency of the competition.

Fifth—Relation in the market in the different price groups as intimately as possible.

Sixth—Tendency as to styles, types and models.

While these elements are also part of the production necessities, they are much more intimately a part of the marketing considerations.

THE accuracy with which the past growth of registration, in relation to population and wealth, is considered, will almost govern the efficiency of the marketing calculations as to plans based upon these considerations. The total market for new cars is based upon the probable increase in registration. The increase in production capacity in comparison with this increase in registration offers an indication of the probable tendency of competition.

The more efficient concerns tend to grow somewhat more rapidly than the general growth of the business in which they are engaged so that it is possible for the market to be enlarged by an increase of efficiency in the same price group and under the same general conditions of competition. What it means is that the efficient concerns, in addition to absorbing the natural increase of the market, succeed in taking away the potential business from the less efficient concerns so that they grow faster than the increase in the total market by that process. Having in mind these considerations, the general market should be known as to the following items:

(a) The tendency of production and registration with relation to tendencies in population and wealth established. (Some of this information has been given to subscribers of AUTOMOTIVE INDUSTRIES in earlier articles.)

The method of calculating such tendencies is of great importance. The ordinary percentage curve is of no value in such a connection because it is not possible to calculate a normal growth from that so that the future may be safely predicted. It is necessary that these calculations should be based upon the modern statistical practice in this respect such as is used by the actuaries and of which the application of Gomperz Law to economic factors is the most important example.

(b) These tendencies should be determined also in relation to the growth of the different automobiles, divided by groups such as price groups, so that the manufacturer will be able to determine the limits of his section of the market as well as the enlargement of the market to be secured from any change in his price policy.

(c) To carry this consideration of the market to the point where a thorough application can be made, the same calculations should be arranged for the different states or on some territorial basis, which would enable the manufacturer to calculate his market for each distributing point and the territory adjacent thereto.

The accuracy with which the past growth of registration, in relation to population and wealth, is considered will almost govern the efficiency of the marketing calculations as to plans based upon these considerations. The total market for new cars is based upon the probable increase in registration. The increase in production capacity in comparison with this increase in registration offers an indication of the probable tendency of competition. The consideration of production by price groups and the tendency of that production indicates the probable action of the market in relation to automobiles involving the expenditure of different amounts of money. Properly worked out, this curve will show the true relation regardless of inflation and deflation which may affect prices for a short period.

If the production capacity is growing more rapidly than the registration, especially in certain groups, the tendency of competition will be toward readjustments in values, more intensive marketing efforts, and a more definite pressure on the distribution channels. An examination of these factors in connection with the different states will indicate the variation in the marketing possibilities in those areas and therefore the proportion of business to be expected from those areas and the amount of sales pressure which can be economically put upon each area in order to effectuate the probable sale. It is advisable where possible that the manufacturer should also plot out his own relation to his competitors within the same price group, not from the amount of production so much as from the tendency in

their production efforts.

In order to make this case a little clearer, we will take the case of two manufacturers, A and B, in the $2,000 to $3,000 price group.

The total production predicted for 1923 is 1,800,000 passenger cars.

The total registration predicted is a little over 11,000,000 passenger cars.

In both of these cases trucks have been eliminated.

For the last four years the price group mentioned has run 4 to 4½ per cent.

For 1923 the expected percentage is 4 per cent, which would give for this group a possible market of 72,000 cars for that year.

Car Manufacturer "A"

1916.....Started
1917.....Reached capacity
1918.....Dropped 15%
1919.....Same production as 1918
1920.....Increased production over 1917, 15%
1921.....Dropped 5% below 1917 production

Car Manufacturer "B"

1917.....Started
1918.....Production 60% of Car "A"
1919.....120% of Car "A" production
1920.....120% of Car "A" production
1921.....140% of Car "A" production

Car "A"—1921 Production 1200—2%
Car "B"—1921 Production 1680—2.8%
Car "A"—1923 Market probabilities 2.0%—72,000 cars—1440
Car "B"—1923 Market probabilities 2.8% of 72,000 cars—2016

The tendency of Car "A" 's activity has been decreasing so that the market for Car "A" in 1923 would be 2% — 5% of 2% = 1368 cars.

The tendency of Car "B" has been to increase the effective activity very rapidly, an average of 35 per cent increase in each of 3 years.

With increased competition, this may be harder to maintain, but the market is

2.8% + 35% of 2.8% of 72,000 cars.
Total market probability 2690 cars.

Car "B", continuing its steady growth, should be able to increase its production in 1923 to 2600 cars which is about 3 per cent of the market for that price group. In other words, Car "B" 's prospective business is increasing more rapidly than the group, whereas Car "A" 's prospective business is not increasing with the same rapidity as the group production and registration. This is simply carrying the expected general market, the expected group market, and the particular manufacturer's production forward over the next year in order that consideration may be given to the marketing plans necessary to develop the matter.

The same calculations should be made for each state or each territory into which the country has been divided by the manufacturer for purposes of his own distribution. Comparisons should be made in each of these territories so that the manufacturer may know the relation between his own growth in business, the growth of registration in the territory in his price group, the expected market and his own probable expectation of business.

As a hypothetical case, take State A as follows for Car Manufacturers A and B.

STATE A

Registration 100,000 1919
125,000 1920
147,000 1921

In price groups:
1919— 54,000 under $1,000
37,000 between $1,000 and $2,000
4,600 between $2,000 and $3,000
5,400 over $3,000
1920— 90,000 under $1,000
25,000 between $1,000 and $2,000
5,000 between $2,000 and $3,000
5.000 over $3,000
1921—103,000 under $1,000
30,000 between $1,000 and $2,000
6,000 between $2,000 and $3,000
8,000 over $3,000

State registration three years in the $2,000 to $3,000 group:

1919	1920	1921
4,600	5,000	6,000
	Increase 8.7%	20%

Car Manufacturer A's sales in State A:

1919	1920	1921
138	140	141
	Increase 1.4%	7%

Car Manufacturer B's sales in State A:

1919	1920	1921
90	120	165
	Increase 30%	37%

The relative position of the two manufacturers indicates the necessity for close analysis of respective methods and the reasons for the changes in effective activity.

This development will be continued in analysis in a later article.

The Thirteen Points

SINCE the President's Conference on Unemployment made its recommendations and adjourned last October, when it was estimated that 3,500,000 persons were jobless, concrete results are already apparent, and Secretary of Commerce Hoover, chairman of the conference, names 13 points, which are:

1. Public opinion, for the first time in American history, has been focused on unemployment.
2. Municipal committees are organized for the first time on a nation-wide scale to relieve it.
3. A national clearing house is ready to assist the municipalities, with district representatives in the field.
4. Industry is assuming a share of its responsibility to the unemployed.
5. Municipal bond sales for public works have broken all previous records.
6. Congress has inaugurated important public works.
7. A large appropriation for the United States Employment Service is before Congress.
8. A variety of other measures have been introduced in Congress to carry out the recommendations of the conference, such as Senator Kenyon's bill for long-range planning of public works.
9. Impetus is being given public education as to the nature of the problem of unemployment.
10. A scientific basis for future research is now being laid.
11. The construction industries are being organized nationally and locally under public direction, as, for example, in St. Louis.
12. In other notoriously seasonal and intermittent industries, such as the soft coal industry, stabilization studies are being planned.
13. A thorough investigation of methods for controlling the business cycle is in progress.

The conference is now in touch with all cities of the United States of more than 20,000 population and 19 regional directors cover practically the entire Union. They report regularly to Col. Arthur Woods, chairman of the Emergency Committee in Washington.

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W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
David Beecroft, Directing Editor
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
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EDITORIAL
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816 Fifteenth St., N. W.

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Leadership

THE position of being a leader entails a responsibility for leadership. Factory officials sometimes fail to realize the weight that is attached to their words or they would, when talking to organization gatherings, pay more attention to preparation of the subject matter.

Selling organizations are especially subject to hearing "wind contests" which may momentarily enthuse them but later, when given sober thought, cause unfavorable reaction toward the subject matter and the speaker. Such contests tend also to lessen the faith which the salesmen may have in the leaders and no dealer organization can succeed without faith and plenty of it.

As competition becomes keener, men need something solid to chew on. Real fighters gain their objective better by knowing the obstacles. The selling organization must be composed of fighters these days in order to win, hence it is up to the leaders to tell these fighters how to overcome the obstacles, not to paint them out with fine words.

Facts, if properly presented, can give a strong stimulus to any organization and who is so well equipped to tell these facts in the right way as the leaders.

Loss of Power at High Altitudes

DURING the period of intense aircraft development we heard a good deal about the loss of engine power at high altitudes and means for eliminating this loss, or at least reducing it. Considerable trouble from this same cause is experienced with automobiles and other types of automotive vehicles in Mexico and South American countries of a mountainous character. For instance, vehicles that are a little shy on power for use in lowlands are quite impractical at altitudes such as found in Mexico.

It is generally held that the power of an engine decreases directly with the density of the atmosphere in which it is operating, but this is not strictly correct as regards the ordinary engine adjusted for use in low countries. In the case of such engines the loss in power is materially greater. There are really three distinct causes of power loss when the engine works in a rare atmosphere. In the first place, the amount of air taken into the cylinder during each inlet stroke is less in direct proportion to the lowering of the atmospheric pressure, and if this air were utilized with equal efficiency as the air taken in when the engine works at sea level, the power would decrease in the same proportion as the air pressure. Unfortunately the air is not used to the same advantage. This is due partly to the fact that the compression is lower, and the thermal efficiency decreases with the compression. On the other hand, the carbureter will be adjusted for operation at low altitudes and will give too rich a mixture at high altitudes. Of course, a mixture slightly richer than that containing just enough gasoline so that all of it can be burned by the air present, will give more power than the theoretically correct mixture, but the carbureter is apt to be set to give this maximum power mixture in the first place and in that case the mixture which it delivers at high altitudes will be over-rich and will give poor economy as well as reduced power.

Of these various causes for the falling off in power of engines at high altitudes some can be readily eliminated. For instance, the change in the mixture proportion can be easily corrected by adjusting the carbureter needle valve or by the replacement of the carbureter nozzle by a slightly smaller one. The reduction in the compression is less easily compensated for. The only real remedy consists in reducing the compression space, which in the case of detachable head engines can be done by planing or milling off the cylinder block top face or the cylinder head, in whichever the compression space happens to be, but this involves the complete disassembling and reassembling of the engine, in addition to the machine work on the block or head and consequently entails rather heavy expense.

The most radical and effective method would consist in providing the engine with a super-charger, as has been done for some time in connection with air-

craft engines for high altitude flying. This overcomes all three causes for the loss of power at the same time. The engine then can be given a full charge, its compression will be the same as at sea level without super compression, and the carbureter will be adjusted to give the proper mixture proportion under the conditions under which charge is forced into the cylinders. Unfortunately, such superchargers cannot readily be attached to the engines of standard cars, and the trouble from loss of power is probably not sufficiently severe and the market in high altitude districts not sufficiently large to warrant the building of special cars embodying supercharging equipment.

Realizing the Problem

THE question often arises as to what can we do now to succeed or make our business progress. This question is apt to be the result of looking the field over with the idea of finding more worlds to conquer; of seeking an outlet for energy as if the mere application of energy was in itself commendable. "What is the problem to be solved?" should, in many cases, be substituted for "what can we do?" It is not a matter of the phrasing of these two questions, but of the attitude of mind as expressed by them.

Careful and accurate analysis of conditions will lay bare the problem and aid in determining the method to be employed in its solution. The realization that there is a problem to be solved tends to coordinate effort to be expended and direct it in the proper channels.

Accessibility and Service Costs

NO one who has any knowledge of the service business questions the desirability of construction which is readily accessible, but designers too often neglect this factor, and are so often dominated by considerations of easy production that the problem of the service station is entirely overlooked. A part or an assembly is frequently ideal from the production or assembling standpoint, but when placed in the vehicle is so difficult to dismantle that the time required for the service operation is two or three times as long as it would be if due consideration were given in the first place to making it easily reached and as easily taken apart or removed as it was easy to assemble and install. It is, for example, a simple matter to place a clutch in the flywheel of an engine when the latter is detached from the gearset, as in a normal assembling line, but in some cars it is necessary to not only remove the gearset before the clutch can be taken out, but before this can be done the rear end of the frame must be blocked up, the springs disconnected and the axle moved back!

A reputation for moderate cost for repair work, when this is necessary, is coming to be regarded as more and more important by purchasers who are now car owners and who have, as a rule, had some unpleasant experiences in this line, which, if the truth were known, were in many instances quite largely due to inaccessibility. In any case, service costs must be decreased, and one important means to this end is the use of accessible construction. Executives should see that this fact is given due consideration by their engineering departments, and should for this reason encourage closer contact between that department and the service stations, to whom they must look for the care of their product.

This situation does not apply to passenger cars alone. It is perhaps more important in the case of trucks and tractors. One of the latest designs of tractor is laid out in such a way that every important unit can be easily detached, in most cases without disturbing adjacent units. To do this has materially increased the cost of the machine, but the manufacturer, who is one of the largest producers in this field, is convinced that the greater accessibility secured will soon offset the higher first cost, and thus prove a better investment for the farmers who buy and must maintain their machines. Can anyone doubt that this is a sane and far-sighted policy?

"God Helps Those—"

EFFECTIVE handling of industrial relations depends chiefly upon the provision of opportunity for the development of the individuals making up the working force. Discontent usually arises, if the trouble is traced to its source, from the fact that too many jobs fail to provide sufficient interest in themselves to allow for continuous personal growth on the part of the worker. In many cases a given job provides neither interest within itself nor training for promotion to more attractive work. One of these factors is necessary.

One excellent way to provide workers with an opportunity for personal development is through the maintenance of an up-to-date and useful factory library. Such a library has been established in a number of automotive plants and serves a useful purpose, especially in those cases where it is kept supplied with current business books and where some effort is made to "sell" the library to the men.

To keep its factory library in condition for maximum use, for example, one of the large truck companies has written to various well-known publishers of business books asking for their latest catalogs. This particular firm has for a long time maintained an excellent general library for its employees, comprising works on economic and social subjects, as well as literature of various kinds. It is now about to establish a technical library. And the interesting part about this factory library is that it is in constant use and has played its part in making successful the broad and intelligent industrial relations policy of the organization.

The catalogs of the better business book publishers might make interesting reading and might furnish some worth-while ideas for those in charge of factory personnel work. To provide workers with books specially adapted to their particular work is to give to these employees an excellent opportunity for self-development—and that old maxim that "God helps those who help themselves" has an important place in any discussion of industrial relations.

Quarter Will Meet Early Predictions

Production of January and February More Than Comes Up to Expectations

By JAMES DALTON

NEW YORK, March 22—Predictions that production of passenger cars and trucks the first quarter of 1922 would show a material increase over the same period in 1921 have been more than justified by the first two months. The February total was approximately 129,500 against 90,486 in January, 78,995 in December and 116,349 in November.

Carload shipments for January and February this year, including the Ford Detroit plant, totalled 34,841 as compared with 16,471 for the same months last year and 45,552 for the same period in 1920, the biggest year the industry ever had. In making comparisons with 1920, however, it is only fair to state that the number of vehicles driven away from the factories in January and February was 73,002 while this year it was 17,347. In 1921 it was 10,692.

March Gain Just as Favorable

But no matter on what basis comparisons are made, the showing thus far this year is very creditable. It is probable the gain this month over March 1921 will be fully as favorable, but it is likely that the other months of the year, except for the last quarter, will show considerably smaller increases as compared with the corresponding months in 1921. There may even be a decline in passenger car production in the third quarter.

Nothing will be gained by exaggerated expectations for the year as a whole. The fact remains, nevertheless, that the industry has made a remarkable recovery since the close of 1921 and that the aggregate of business for the 12 months will be very gratifying.

While passenger car makers, as a whole, had a good year in 1921, the truck manufacturers, with a very few exceptions, did practically nothing and the volume of sales by parts makers was not as large as the production of vehicles would indicate. The proportionate gains in the truck field this year have been fully as large as in the motor car branch of the industry and parts producers have had a substantial increase in sales because the inventories of vehicle builders have been greatly reduced.

Reports from the parts and acces-

(*Continued on page* 690)

Business in Brief

NEW YORK, March 22—Trading in stocks is on a broad scale and the market is buoyant.

Railroad freight traffic is increasing and the number of idle freight cars is decreasing. This is true particularly in the West.

There is slightly increased activity in the iron and steel industry with plants operating around 50 per cent of capacity.

Improved crop prospects are reported in the Southwest because of good weather conditions. Corn and cotton planting is under way east of the Mississippi, but has been delayed by rain in parts of Texas.

Grain movement from the farms has been restricted somewhat by lower prices, bad roads and increased field activity. Stocks on hand are comparatively small.

Trade in primary textile markets is dull except in seasonal lines. Woolens for spring are fairly active.

Bank clearings for the week ending March 16 were $6,636,104,000, a gain of 4.8 per cent over the preceding week, but a loss of 4.7 per cent as compared with the same week last year.

There has been recently a considerable decline in exports of wheat, flour and corn.

Factory employment in New York State increased 3 per cent in February.

Activity in building construction continues. Total for 27 Northwestern States in February was $177,365,000, an increase of 73 per cent over February, 1921.

Little public interest is apparent in the coal strike which seems certain on April 1.

Stevens-Duryea Asks for 6 Months' Extension

SPRINGFIELD, MASS., March 21—Stevens-Duryea has mailed letters to its creditors asking for an extension of six months to meet its obligations. The annual meeting, which was set originally for March 13 but postponed, has again been postponed until March 27, and it is considered unlikely that it will take place at that time, as more time probably will be required to present an intelligent and satisfactory report to the stockholders.

George M. Berry, treasurer of the company, says the general outlook has improved, but that it is difficult to borrow money for working capital at this time. He is hopeful that the extension will be granted and believes that if it is, the difficulties of the company can be worked out satisfactorily.

The plant, which has been running three days a week some time past, has been placed on a five day a week basis, curtailment in certain departments.

New Overland Plan Has Willys' Favor

Replaces Bank Proposal—Stockholders Will Be Asked for Their Approval

NEW YORK, March 20—Preferred stock holders of the Willys-Overland Co., who hold the veto power, have been asked to approve a plan under which the bank creditors of the company agree to accept $16,500,000 in 7 per cent bonds, maturing Dec. 1, 1923, to retire the present unsecured bank loans. These bonds would be secured by fixed assets of the company in such a way that the current assets would be available as working capital.

The preferred stock of the Willys-Overland company stipulate that no encumbrance can be placed upon the fixed assets without the consent of holders of 75 per cent of the preferred stock. It is understood that the Stephens interests, which own considerably more than one-third of the preferred, are agreeable to this plan which has been accepted by the reorganized board of directors.

Willys Approves Plan

The new plan, which also has been approved by John N. Willys and the officers of the company, as well as by the directors, is a very material modification of the reorganization proposition originally worked out by the bank creditors. The first proposal was that the company should be permanently refinanced by issuing $25,000,000 in first mortgage bonds. The bank proposed to pay $18,000,000 of this amount to pay the $16,500,000 bank loans and commissions incidental to them. The other $7,000,000 would have been held for emergencies as working capital.

The proposition for a mortgage bond issue met with the unalterable opposition of Willys and the Stephens interests. When the bankers found that it would be impossible to have it accepted either by the directors or by 75 per cent of the preferred stockholders, it was revamped into the program which has been accepted by the directors.

The new Toledo directors of the company were in New York for two days last week, conferring with the bankers, and it is understood that a complete agreement was reached. John N. Willys will remain as president of the company, and the bankers expressed gratification because C. B. Wilson, the vice-president, has been made general manager.

The following statement, in reference to the refinancing plan has been issued by Ralph Van Vechten, vice-president of the Continental and Commercial National Bank of Chicago, and chairman of the Bank Creditors' Committee:

The Willys-Overland company has per-

(*Continued on page* 690)

Samson Plans Made for Financing Sales

Provide for Payments for Tractors According to Income Farmer Receives

DETROIT, March 20—General Motors Acceptance Corp. has worked out a series of plans for the financing of sales of Samson tractors and farm implements to the farmers, whereby the payments are arranged according to the income of the buyer from his products. Examples of the way the plans operate are as follows:

Ability to Pay Considered

Plan No. 1 is recommended for sales to dairy farmers or those having a regular monthly income. This provides for a down payment of 30 per cent in cash and equal monthly payments over a period of twelve months or less, according to the ability to pay.

Plan No. 2 is recommended for sales to farmers raising cotton or other yearly crops. This provides a down payment of 40 per cent in cash and the balance in one payment in twelve months or less.

Plan No. 3 is recommended for sales to farmers raising an annual crop and live stock. This provides for two payments, the first in six months or less, the second in twelve months or less, with a one-third cash down payment.

Plan No. 4 provides for two deferred payments of eight and eighteen months with a down payment of 40 per cent. This permits the final payment to be spread over two crops and allows the use of the tractor and implements in preparing the soil for each crop.

Plans also have been worked out for the disposal of used cars or trucks taken in by dealers in the rural districts in part payment for tractors and implements. One of these provides for a 40 per cent down payment with equal monthly payments for twelve months or less. The other is for 50 per cent down with one deferred payment in seven months or less.

Provision for Rebate

On the monthly payment plan a rebate of one-half of one per cent a month will be made where the entire indebtedness is met before due. A rebate of one per cent a month is allowed for each month of anticipation under plan No. 2. Under plans No. 3 and No. 4 the rebate is one per cent a month on each payment prepaid for each full month of anticipation.

The wholesale plan is a method of financing factory shipments of Samson tractors, trucks and power implements to be stored either in a warehouse or on the dealer's showroom floor. Under this plan, Samson products may be shipped by freight direct to the dealer or by the manufacturer to a sub-dealer for the account of the direct dealer.

Only enough products are financed to enable the dealer to have a representative stock and to enable prompt delivery to customers. No stock will be financed which the dealer cannot sell at retail before the maturity of the note. All papers in connection with the transaction are handled through the local bank of the dealer. The dealer must pay 15 per cent of the invoice price of the products. The differential charged by the company is three-quarters of one per cent on the 85 per cent financed. Products remain the property of the finance corporation until fully paid for. If paid before maturity of the note, refunds of one-fortieth of one per cent are provided for each day the money is not used after the first month.

No notes covering invoices will be drawn for more than six months, because no more should be bought than can be sold in six months. Wholesale indebtedness should be cleaned up at least once a year, the company holds, at a time when collections are best in the territory. This clean-up date will be determined by the acceptance branch under which the dealer is operating and which will notify him.

Under the wholesale finance plan all products will be financed. Under the retail plan, Samson power-drawn implements will not be financed except when sold in conjunction with a tractor. Bank fees are paid by the corporation for handling the wholesale transactions. Insurance on products up to the time the dealer note is paid is covered by the differential rate.

TANKS FOR THE JUNGLE

LONDON, March 8 (by mail)—Sir Frederick Lugard, thirty years administrator in British Tropical Africa, says in a book just published that mechanical transport has a big future in Africa.

He considered it unnecessary to build railroads and metalled roads through the jungle, and suggests that tanks similar to those used in the war should be adopted instead. "Roller-track" vehicles, he claims, would create rather than destroy roads, and would be very economical in running.

These tractors should be of 100 H.P., and capable of drawing 20 ton trailers.

Ford Extends Working Week and Increases Employees

DETROIT, March 21—In connection with its extension of manufacturing to a five-day week schedule, starting this week, the Ford Motor Co. is increasing the number of employees to round out the forces in all departments.

A considerable number will be added over a period of weeks bringing the total close to the 48,000 mark. In a letter to American Legion officers in this city, Edsel Ford, president of the company, said ex-service men would be favored as far as possible in making assignments to the new work.

New Company Likely for Old Times Square

Provision Made in Reorganization of Consolidated Distributors to Pay Creditors

NEW YORK, March 21—The Consolidated Distributors, Inc., formerly the Times Square Auto Supply Co., which went into receivership, is to be reorganized through the formation of a new corporation, if a plan being considered by the reorganization committee is adopted. The new company, it is planned, would acquire such assets of the old company not disposed of by the receiver or in connection with the reorganization plan.

Under that plan the new company would issue four year notes and first and second preferred and common stock. Banking creditors consenting to the reorganization would receive 100 per cent of their claims in the notes, carrying a 6 per cent interest rate, or in participation certificates of one of the banks as trustee for all the banks.

To Pay 65 Per Cent of Claims

The general creditors, exclusive of loan creditors whose claims are subordinate to bank loans and of holders of scrip dividends, would receive 65 per cent of their claims in first preferred stock of $10 par value and cumulative as to 7 per cent dividends. The present stockholders would be given a share of new second preferred stock for 10 shares of old common stock. What use would be made of 300,000 shares of common stock which would be issued has not been announced.

Shuler Axle Acquires Assets of Old Company

LOUISVILLE, KY., March 18—The Shuler Axle Co., Inc., has acquired the entire assets of the Shuler Axle Manufacturing Co. and is already in operation on the production of front axles for motor trucks, trailers, tractors, etc.

W. F. Robertson of Cincinnati, president of the Robertson Steel & Iron Co., is president of the company, and W. H. May of Louisville is secretary and treasurer.

The company is beginning operations with a paid-up capital stock of $150,000, which assures ample cash resources for immediate and continuous development of the business. The line of front axles which was made by the Shuler Axle Manufacturing Co. will be continued and plans have been completed for additions to the line.

Frank A. Shuler will continue to act as general manager of the new company and will have personal charge over the increased manufacturing program. Harry W. Helms has been retained as sales manager. Other department heads who have been with the Shuler organization since its inception will continue with their previous activities.

Elgin Stockholders to Help Boost Sales

Asked to Secure Names of Prospects for Reference to Local Dealers

CHICAGO, March 18—A sales boosting meeting attended by about 2000 stockholders was held at Orchestra Hall here by the Elgin Motor Car Corp. in preparation for the marketing of the new model Elgin, which was exhibited at recent shows. A chassis of the model was displayed and its various improvements from an engineering standpoint were explained. The stockholders were requested to gather names of prospective purchasers and send them to the general offices of the company at Argo, from where they will be referred to dealers in the localities from which they came.

This plan of aiding sales was explained by C. S. Rieman, president and general manager of the company, who said that the word of mouth advertising resulting from such stockholders' meetings was of great value. He pointed out that in addition to the 2000 attending the meeting, 17,000 other stockholders who are scattered throughout the country would receive a full report of the proceedings and would be asked to assist in the sales plan.

Production of the new model has not yet started, and the prices at which the various styles will be retailed have not been announced. The car will be made in phaeton, roadster, coupe, sedan and sport bodies. It will have a 118-in. wheel base.

The meeting of stockholders was addressed by Mayor William Hale Thompson, A. Vere Martin, vice-president of the Lake State Bank, and President Rieman.

Governors of Aeronautical Chamber Choose Officers

NEW YORK, March 17—At a meeting of the executive offices here, the board of governors of the Aeronautical Chamber of Commerce of America, Inc., elected the following officers:

President, Grover C. Loening, president of the Loening Aeronautical Engineering Co.; first vice-president, Charles F. Redden, president, Aeromarine Airways, Inc.; second vice-president, C. C. Witmer, president, Airship Manufacturing Co. of America; treasurer, B. E. Bushnell, director of sales, Stewart Hartshorn Co.; secretary and general manager, S. S. Bradley, Manufacturers Aircraft Association, Inc.; assistant secretary and assistant treasurer, Luther K. Bell.

U. & J. SALES PLANT BURNS

CHICAGO, March 20—The U. & J. Sales Co., manufacturer of carbureters and other automobile accessories, whose factory at 507 West Jackson Boulevard was destroyed by fire March 14, announces that it will lease or buy another building and resume production at once. The company's loss, including machinery and stock, was about $200,000. About 100 employees were affected. C. A. Kemper, sales manager, said that the company's patterns were at the foundry and were not destroyed.

Worker Succeeds Tolles as President of Phoenix

EAU CLAIRE, WIS., March 20.—C. L. Tolles, for many years president and directing head of the Phoenix Manufacturing Co., manufacturing heavy duty tractors, log haulers and logging and sawmill equipment, has resigned, although remaining a stockholder and director. Robert D. Briggs, secretary and treasurer also has resigned these offices.

Tolles is succeeded by J. G. Worker, vice-president and general manager. H. J. Thompson takes the place of Briggs as secretary and treasurer. A movement is under way to consolidate the Phoenix company and the McDonough Manufacturing Co., of Eau Claire, the latter manufacturing metal and wood working machinery, machine tools, saw and planing mill equipment, etc. Both concerns operate foundries and machine shops.

Coats Steam Car Removes Sales Offices to Chicago

CHICAGO. March 20 — The Coats Steam Car Co. has moved its general sales offices from Indianpolis to Chicago and established them at 2337 Michigan Avenue where G. A. Coats, president of the company, will make his headquarters. Miss I. Siefker is office manager.

The company has acquired the factory of the Stewart Motor Car Co. at Bowling Green, Ohio, and announces that it expects to start production in the near future. The program of the company calls for a minimum output of 10,000 cars the first year, and on this basis officials state that the first year's production is already oversold. A phaeton and a roadster will be made, each to retail for $1,085, and it is planned to produce a sedan later at $1,495.

The output of the Bowling Green factory will be marketed under the name of the Stewart-Coats Steam Car.

New Rolls-Royce Price Proves Big Sales Factor

SPRINGFIELD. MASS., March 18—Rolls-Royce of America, Inc., reports that the new price established two weeks ago has greatly stimulated interest, as expressed in sales as well as inquiries from all parts of the country from persons who are inclined to invest either in the phaeton or some special custom body design.

More cars are being turned out from the plant than at any time since production was resumed in the fall, and the prospects are that the plant force will be further increased April 1.

Franklin to Build Four at Syracuse

Good Labor Conditions Figure in Decision—Sixteen Cities Bid for Site

SYRACUSE, March 20—H. H. Franklin, president of the H. H. Franklin Manufacturing Co., has set aside all rumors that the Franklin Four, which will be on the market in April, 1923, will be built outside Syracuse. Following a conference of officials, he announced that Syracuse had been selected for the new plant which, it is estimated, will cost between $2,000,000 and $3,000,000. Sixteen cities made bids for the plant's location.

Definite plans for the production of the new car have not been developed, although a general working organization has been formed. It will take a year at least to have the new plant ready for operation, but it is understood that the big Messina Springs tract of 1000 acres just beyond the city limits will soon be the scene of construction not only of the Franklin factory but of an immense housing project.

Production in Present Plant

The first Franklin Fours will be made in the plant here. This is made possible by construction work completed a few months ago. Production of the Franklin six cylinder will not be reduced because of the new model. It is planned to manufacture 40 cars a day, with production steadily increasing.

Labor conditions are said to have been a big factor in the decision to stay here. Not since the Franklin company started manufacture has there been a strike in the plant. Relations between the company and its employees have been singularly happy and harmonious.

The development of the sales force is proceeding. A. G. Maney, vice-president, states that Franklin representation throughout the country will be greatly augmented this year to handle the new Four when it is put on the market.

"We are setting our mark at 250 new dealerships to begin with," Maney says. "But this number will be gradually added to in order to care for the distribution of the Franklin Four. We now have over 500 dealers and expect in time to have several thousand so that Franklin service may be made practically universal."

Boston Bankers Provide Wills $6,900,000 Credit

DETROIT, March 21—Arrangements have been made with Boston bankers by C. H. Wills & Co., maker of the Wills Sainte Claire car, under which they will be provided with a revolving credit of $6,900,000, which will run until July, 1923. This will provide a working capital entirely adequate to meet all needs and will relieve the company of all financial worries for more than a year, at least.

Campbell Is Named McGregor Successor

Latter's Widow Is Given Place on Directorate of Ford's Canadian Company

DETROIT, March 18—Wallace R. Campbell was named first vice-president and treasurer of the Ford Motor Co. of Canada, Ltd., to succeed the late Gordon M. McGregor, at a meeting of directors this week. Campbell was formerly secretary, assistant treasurer and assistant general manager of the company. Henry Ford is president.

When the Ford Motor Co. in Detroit was undergoing reorganization of its personnel a year ago, an effort was made by Ford to induce Campbell to join the Ford forces on this side of the border, first as general manager and then as treasurer. Campbell spent several weeks at the Highland Park plant at Ford's request and then decided to continue his allegiance to the Canadian company.

Mrs. McGregor will succeed her husband as director during the unexpired term of his directorate. This appointment was conferred as a tribute to the results achieved by McGregor in the development of the company from a $125,000 corporation to its present $10,000,000 capitalization.

P. W. Granjean, assistant secretary, becomes secretary and assistant treasurer. Other appointments to positions made vacant through the promotions are deferred temporarily.

Ford Ideas on Efficiency Carried to Lincoln Plant

DETROIT, March 17—Reorganization of factory facilities at the Lincoln plant to meet Ford ideas on efficiency are being carried through rapidly so as to whip the plant into shape for increased production. This work is progressing under the direction of Charles E. Sorensen, director of all Ford manufacturing operations, and P. E. Martin, Ford factory superintendent.

There is a liklihood of all the executive offices of the Ford company being housed in the Lincoln office building because of its position midway between the Highland Park and River Rouge plants.

Fire, Theft Underwriters Aiming at Uniform Policy

PHILADELPHIA, March 18—Automobile fire and theft underwriters are studying conditions closely to come to a uniform policy in proposed new forms of contracts. The losses incurred last year caused a general movement by underwriters toward a drastic change in the valuation of coverage. Falling prices of cars created a bad moral risk under established contracts.

At present some companies are issuing policies at a smaller cost, but covering only 75 per cent of the market value of the car at the time of loss. Others are keeping in force old forms, which cover the loss in full at increased rates. However, the tendency is to adopt the newer form. Some companies are contemplating issuing a graduating policy, the premium being graduated in accordance with the moral risk.

Kentucky Tables Bill to Put Dates on Tires

LOUISVILLE, KY., March 18—The bill of Representative E. A. Gullion of Henry County to require tire manufacturers to stamp the date of manufacture on tires sold in Kentucky was tabled in the House of Representatives.

F. J. Humbert, representative of Louisville, led a fight on the bill, asserting that its passage would work an unjustified hardship on tire manufacturers and dealers.

All Production Meeting Will Be Held by S. A. E.

DETROIT, March 20—The Detroit section of the Society of Automotive Engineers will hold a production meeting on March 24 at the Board of Commerce. The program represents an innovation, as it will be the first time the society has had a 100 per cent production meeting, according to the officers of the section.

The subject will be largely concerned with the manufacture of automobile gears, and the program is designed to include the men who produce the tools, those who furnish the machines, and those who use both the tools and machines actually to produce gears.

Papers will be presented as follows: S. O. Bjornberg, Illinois Tool Co., "How to Use Hobs"; R. S. Drummond, Gear Grinding Co., "Gear Grinding Machines"; John Edgar, Barber Coleman Co., "Hobbing Machines," and F. Lamborn, Dodge Brothers, "Hobbing Experiences."

Durant Motors Will Add to Its Plant in Canada

TORONTO, March 21—Several important announcements in reference to Durant Motors of Canada, Ltd., were made at a luncheon given by E. A. Wallberg, manager of the Toronto branch.

He said that new buildings would be added to the plant in the near future. The first will be a three-story fireproof structure, 600 ft. by 80 ft., one of the largest factory buildings in the Dominion. The Electric Auto-Lite Co. of Toledo is ready to install machinery in this building.

In addition to the Durant four and six, the Canadian plant at Leaside will turn out the Star and the Mason high-speed 1-ton truck.

Durant Motors of Canada will build at Leaside this year a school for the children of employees, and when building prices come down, will construct model houses for workmen.

Continues Petition to Sell Auto Stores

Creditors Seek Plans to Effect Greater Return Than at Public Sale

PHILADELPHIA, March 20—After counsel for the creditors had objected on the ground that their clients had no opportunity to express their desires, Judge Thompson, in United States District Court, continued a petition by receivers of the United Auto Stores, Inc., for permission to sell its assets.

The court ordered the receivers to issue notice to stockholders and creditors that the assets would be sold. Joseph L. Kun, assistant district attorney and counsel for the receivers, declared that the expenses of maintenance of the office here and the fifty-eight branch stores were greater than the income. As the result, stockholders and creditors of Edward B. P. Carrier, the 28-year-old promoter, he said, were incurring greater loss.

Jacob I. Weinstein and James J. O'Brien, representing the creditors, suggested a plan might be devised for the sale of the accessories at prices that would be better than for articles offered at public sale.

A tentative proposal, according to Abraham M. Ross, one of Carrier's lawyers, has been made by a group of accessory dealers in New York.

Former Jefferson Rubber President Is Arrested

JEFFERSON, WIS., March 20—Officials of the Jefferson Rubber Co. caused the arrest at New Castle, Ind., of Robert W. Lyons, promoter and former president of the company, on charges involving alleged shortages of about $3,000, said to have been discovered upon examination of accounts for income tax return purposes. A warrant also has been issued for C. R. Girton, associate of Mr. Lyons in promoting the company.

The Jefferson Rubber Co. was organized two and a half years ago, with $300,000 capital, and erected a plant, equipping it for the manufacture of tires, tubes and mechanical rubber goods. In the fall of 1921 a reorganization was effected, Jefferson stockholders taking entire charge. Lyons and Girton left Jefferson shortly thereafter.

TEMPLAR DECISION DELAYED

COLUMBUS, March 17—Judge Warner in the Franklin County Court has taken under advisement definite action in the receivership proceedings brought against the Templar Motors Co. by N. Clyburn of Washington, D. C., as a stockholder. The defendant company and officials have filed a long brief, and this is being considered. Decision will not be rendered until the evidence has been gone over.

Milwaukee Business Is on Old Bookings

While Parts Makers Report Better Situation New Trade Develops Slowly

MILWAUKEE, March 20—Indicative of the increased passenger car production growing out of a slowly but steadily improving early season demand is the fact that manufacturers of automotive parts in this market are daily receiving more shipping directions on contracts.

New business, however, is developing very slowly, the output being confined largely to the needs of regular customers whose bookings were made some time ago, with flexible delivery specifications framed because of the impossibility of anticipating current needs until the retail selling season opened and the demands upon car builders could be judged more accurately than in advance.

Manufacturers of patented automotive equipment are able to operate at a better schedule than other parts industries. This is due to the improved call from distributors and jobbers of such equipment catering to owners. The demand for standard accessories used as stock equipment by passenger car builders has increased proportionately to the call for engines, frames, transmissions and other major as well as minor parts.

Weather Helps Local Trade

A week to ten days of balmy spring weather, following a period of similar length when typical extreme winter conditions existed, has had a markedly beneficial effect upon retail sales of passenger cars here. During most of the past week temperatures were abnormally high for this season, with plenty of sunshine, and as a result there was a touch of "spring fever" which was reflected by a quickened call for cars.

The best business is reported by dealers featuring cars in the price class of $900 to $1500 for open types, and up to $2000 in closed types. However, Ford sales are showing a seasonable increase, and dealers in the higher range of values say that prospects are more amenable to reason, with sales gradualy increasing. Prospects for sales in April are regarded as much more favorable than they were a year ago at this time. This is not a mere guess on the part of dealers, but a prediction based on analysis of the market.

Packard Not to Abandon Twin Six Manufacture

DETROIT, March 21—Alvan Macauley, president of the Packard Motor Car Co., has issued a statement to distributors and dealers pointing out that there are more than 30,000 owners of Packard twin six cars in the United States and that the company, despite persistent rumors, has no intention of abandoning the twin six manufacture.

"The twin six must of necessity command a relatively high price," he said, "and we decided four years ago that we would not cater exclusively to the high price field but would make a Packard car to sell at a lower price. That is the reason for the company's presentation of the single six."

RACINE REPORTS SHOW IMPROVED CONDITIONS

RACINE, WIS., March 20—The industrial situation in this city, the second largest in Wisconsin and a center of the automotive and power farm equipment industries, has improved materially in the last two to three weeks. Some of the high lights are:

Mitchell Motors Co.—In a better position than for four to six months past. Orders picking up in all sections.

J. I. Case T. M. Co.—Gratifying reception accorded new Model X, five-passenger car. Production on both models increasing. More than 500 Case tractors sold in 60 days. Inquiries more numerous.

J. I. Case Plow Works Co.—Business improvement advances date of resumption of active production with 350 to 400 operatives, on Wallis tractor.

Harvey Spring & Forging Co.—Booked all spring needs for passenger cars of Nash, Mitchell and Case. Setting up remaining equipment. Plant on full capacity schedule; some departments working overtime.

H. & M. Body Corp. Force being increased. Original order from Hupp for 1922 bodies, numbering 10,000, increased to 20,000. Orders from Mitchell and other factories booked. Reinstatements made generally. Seeking more skilled workers.

Walker Manufacturing Co.—Motor equipment orders increasing, especially on jacks. Prospects best in six months or longer.

University Is Preparing Automotive Steel Experts

MADISON, WIS., March 20—To meet the increasing demand of motor car and parts manufacturers and other makers of machinery for highly trained men to make metallographic analyses of alloys and alloy steels, the department of mechanical engineering at the University of Wisconsin, Madison, has organized a new course in metallography with an enrollment of sixty-five students, under Prof. E. D. Fahlberg.

Mechanical engineering students are required to take the course so they may make the kind of study of alloys and alloy steels needed in shop work.

Truck Makers Buy on Greater Scale

Car Builders Also Help in Encouraging Parts Manufacturers in Detroit

DETROIT, March 21—Parts makers in the Detroit district have been greatly encouraged by the volume of business which has come to them since the turn of the year. A considerable number of plants are approaching an output of 50 per cent of capacity.

While the major part of the business has come and continues to come from a comparatively few companies, releases and new orders for supplies are coming in smaller volume from most of the companies in the industry. This would indicate that all manufacturers are sharing in the increased sales of motor cars. Truck builders also are buying on a scale which demonstrates a better market for commercial vehicles.

Some Report March Best Month

At a recent meeting of credit men representing some twenty-five companies in the Detroit and Cleveland districts, reports of better business were almost unanimous. In most cases February sales were at least double those of January, and in a few instances much more than that. March business in many instances will double those of February, and April will be better than March. Two or three reported that March will be the best month they ever had.

Collections on current business are excellent.

The chief element of doubt in the minds of the parts makers is what is going to happen after April, for they have few specifications beyond May 1.

Bearings Service Co. Makes Additions to Field Force

DETROIT, March 20—J. L. Whalen, former central district manager of the Bearings Service Co. of Detroit, has been named assistant sales manager and assigned to the central district with headquarters in Detroit. W. H. Anderson, former New York branch manager, has been named assistant sales manager and assigned to the eastern district, with headquarters also at Detroit. W. C. L. Hodgson will remain in Detroit as one of the assistant sales managers and has been assigned to the southern and western districts.

A. H. Pratt is now the company's New York branch manager. C. R. Norris, formerly branch manager at Newark, will be assistant manager. P. W. Daniels, assistant at the Philadelphia branch, has been made Newark branch manager. G. M. Flyum, former manager of the Brooklyn branch, has been succeeded by N. B. Keller, who resigned as manager of the Minneapolis branch.

Standard Mould Co. Resumes Dividends

Suspended Payments During Slump, in Company with Other Akron Manufacturers

AKRON, March 18—The Akron Standard Mould Co., manufacturer of rubber making and tire building machinery, is the first of the many Akron companies which were forced to suspend dividend payments during the slump in the automotive industry, to resume such dividend payments.

Announcement that the company will resume common stock dividends April 1 is considered one of the most important and optimistic developments in the rubber metropolis since the restriction of credit and diminished sales first forced all Akron companies to retrench and lay off thousands of men over a year ago.

Directors of the company have declared a 1 per cent dividend payable April 1 to stock of record March 15. It is understood the company expects to maintain the 1 per cent dividend payable monthly in the future, having paid all of its bank indebtedness.

Reflects General Improvement

Although the Akron Standard Mould Co. is not essentially a rubber factory, by reason of the fact that it specializes in tire building machinery, including tire moulds and cores, its existence and growth naturally depend solely upon the prosperity of the tire industry, and the fact that it is able to resume dividends is accepted as a definite reflection of material improvement in the tire industry in general. The company reports sales of $500,000 last year and announces that business is steadily increasing.

With very few exceptions all Akron manufacturers suspended dividends during the low ebb of the slump period.

Others are expected to follow the lead taken by Standard Mould, indicating a marked degree of improvement and a substantial stride toward normal.

New Selling Organization Incorporated in Porto Rico

SAN JUAN, PORTO RICO, March 15 (*by mail*)—Certificate of incorporation has been issued to the Porto Rico Tire & Rubber Co., Inc., with offices here and with an authorized capital of $50,000. The corporation, it is stated, will dedicate itself principally to the purchase and sales of automobiles and automotive equipment. The incorporators are A. Panzardi, L. Garcia Mendez, Ignacio Guasp and J. Gutierrez Guasp, all of San Juan.

Attention is directed to the possible confusion of the name of A. Panzardi, one of the incorporators, with that of Santiago A. Panzardi of the company of Santiago A. Panzardi, Inc., an old established firm that has represented several American cars for ten years or more and has branches throughout the Island. Santiago A. Panzardi, general sales and service manager of this corporation, is not connected with the new Porto Rico Tire & Rubber Co.

BUSINESS IN MARCH EXCEEDS ALL FOR 1921

MILWAUKEE, March 20—The Lavine Gear Co. of this city announces that its shipments of gears this month will be greater than its shipments for the entire year of 1921.

Stearns Declares Dividend; Iowa Resumes Ordering Cars

CLEVELAND, March 20—A quarterly dividend of 50 cents a share has been declared by the directors of the F. B. Stearns Co., maker of the Stearns car. This is one-half the rate that has prevailed since the stock was changed from a par value of $25 to no par.

President George W. Booker stated that business in March is better than it was the preceding month and that inquiries indicated the records would be better during the months of April, May and June. It also was stated that the first order received from Iowa for some time came into the factory last week.

Heavy Rains Prevent British Tractor Test

LONDON, March 3 (*by mail*)—The tractor demonstrations organized for March 1 and 2 near Exeter, England, have been cancelled owing to the effect of heavy rains on the soil. These were the first of a series of three demonstrations which were planned for early spring, summer and autumn this year, to be held in various parts of the country, instead of a national trial in the autumn.

Fifteen tractors, three self-contained rotary tillers and one garden cultivator had been entered for the event, which, incidentally, was the first tractor trial or demonstration organized in England canceled or even postponed.

The heavy rains during the latter end of February, however, had rendered plowing out of the question for at least a week after the arranged dates, even if continuous fine weather could have been relied upon for the first part of March.

FEES SHOW ONTARIO GAIN

OTTAWA, ONT., March 18—The Ontario government expects to get the sum of $3,500.000 from the licenses of motor vehicles in the province. This will mean an increase of about $500,000 over the figures for the past fiscal year. An order-in-council has been passed by the Ontario government making a nominal fee of $1 per annum payable on all motor vehicles owned by municipalities.

Fisher Body Extends Factory Facilities

Leases Plant in Cleveland—Standard Parts Business in 1921, $7,233,033

CLEVELAND, March 18—Two of Cleveland's largest industries, both of which are allied with the automotive industry, are riding along on business waves that are breaking more smoothly than they have for the past two years.

The Fisher Ohio Body Co. has found that the $6,000,000 new plant, in which it commenced production last September, is not large enough to accommodate its business and has taken a lease on the building of the Briggs Manufacturing Co., which is adjacent to its main plant. This acquisition will give an additional 175,000 square feet of space, which will be used to house the finishing business. E. E. Fisher, president of the Cleveland company, states that the entire production is now going to the Chandler, Cleveland and Chevrolet companies.

When the new Fisher plant was opened in this city, it was thought that the 850,000 square feet of manufacturing space was far in excess of the requirements, but seven months after it is running at capacity production and is turning out from 250 to 275 bodies daily.

Standard Parts Report

The annual statement of the Standard Parts Co., which has been in the hands of a receiver for nearly two years, shows that the company's net business in 1921 was $7,233,033, which is one-third below the record for the previous year.

On this business the company produced a profit of $316,380 before a heavy depreciation and inventory adjustments were made. During the year the company found it advisable to enter a depreciation of $398,341 and inventory adjustments of $204,348, leaving a net loss of $286,409.

Nothwithstanding the difficulties that were encountered, Receiver Frank Scott bettered the cash position of the company. This account rose from $428,661 on Dec. 31, 1921, to $613,881 on March 1 of the present year. The sum of $4,931,920 was disbursed to Dec. 31, 1921, and of this amount there were two dividends to creditors totaling $1,943,018.

In line with a general policy of retrenchment and the unification of the manufacturing end of the business, the plant of the Canton Forge Co. was sold for $293,500. Remaining equipment and inventory not available for the American Axle plant was sold for $59,000.

The receiver states that in the sixteen months of his administration he has finally reached the point where inventories reflect the true market value, while all obsolete material in the plants that are being operated has either been sold or marked down to scrap value. After adjustments the company's assets total $15,134,467, exclusive of patents.

Akron Likes Trade Acceptance System

Tire Makers Will Continue and Expand It Despite Outside Adverse Criticism

AKRON, March 18—The trade acceptance system employed by Akron tire manufacturers in negotiating with banks for their credit has vindicated itself and will be continued and expanded, despite the outside criticism aimed at the system, according to William O'Neil, vice-president and general manager of the General Tire & Rubber Co., and president of the Ohio State Savings & Trust Co. of Akron.

Speaking of the situation, O'Neil says:—

The plan adopted by Akron bankers and manufacturers of extending credit on orders booked for manufactured merchandise—in other words the trade acceptance plan—has been widely criticised and condemned both in and outside of Akron and by both manufacturers and bankers. But the trade acceptance system has been so effectively employed here for years that it is largely responsible for what and where Akron is to-day as one of the manufacturing centers of the world.

Bankers Approve

Akron bankers and manufacturers unite in recommending the system to other cities and other industries. The trade acceptance system has many advantages. It has helped to bridge the tire manufacturers over the seasonal dull periods. It has averted periodical lay-offs of men. It has kept production on an even keel for the manufacturers in times when business was dull have had the banks back of them ready to pay the wages of their employees, to pay their shipping bills and their raw material bills, accepting as security therefore the orders booked by those companies from their dealers. It is a tremendous advantage for an Akron manufacturer who receives a bona fide order for, say, $500,000 worth of tires and rubber goods, to take that paper to the bank and negotiate credit upon it sufficient to manufacture the goods ordered.

The success of this system has been reflected in mercantile lines and other business channels. It has benefited the merchant and it has likewise benefited the entire motoring public, for it has helped to reduce the cost of tire manufacture. In short, it has made possible the national, or rather the world-wide, business which Akron now is engaged in, for it has helped to stabilize local conditions.

Speaking both as a rubber manufacturer and as a banker, I firmly believe the trade acceptance system, if adopted in other cities, will help to similarly stabilize businesses and will work to the benefit of everyone. It is a system that is going to be continued in Akron, for we know what it has meant to us in the past and what it will mean to us in the future.

INDIA TARIFF INCREASED

WASHINGTON, March 18—Advices have been received by the Division of Foreign Tariffs of the Department of Commerce that a new schedule of import duties for British India became effective March 1. The new rates include an increase of from 20 to 30 per cent on motor vehicles which, under the Indian tariff laws, are classed as luxuries.

The general import duty was raised from 11 per cent to 15 per cent ad valorem. Railway material and machinery, etc., which heretofore had been dutiable at the low rate of 2½ per cent, in order to encourage the industrial development of British India, was advanced to 10 per cent ad valorem.

The import duty on lubricating oil was not changed. An excise duty of one anna per imperial gallon is levied upon all kerosene produced in India and Burma, while the custom on imported gasoline and motor spirits has advanced from 1½ to 2½ annas per imperial gallon.

Personnel of Zeder Begins Taking Shape

CLEVELAND, March 17—Although plans for the manufacture of the Zeder automobile by the Zeder Motor Co., in the plant of the Cleveland Tractor Co., in this city are largely in outline at present, it is believed the making of the car will start in the near future.

Tractors will continue to be made in the plant here in increased number as the demand this year is good.

The personnel of the organization is beginning to take shape. E. B. Wilson, former sales manager of the Willys Corp., is said to have been engaged to take charge of the merchandising end. R. T. Hodgkins, a vice-president of the Cleveland Tractor Co., is already planning the sales campaign, it is reported. J. O. Hahn former branch manager of the Studebaker in this city, is also to be a member of the organization.

One of the moves contemplated in financing the project is the doubling of the $6,000,000 capital of the tractor company. This corporation owns 110 acres of land with a frontage of 1200 feet on Euclid avenue, also frontages on both sides of the Nickel Plate railroad, St. Clair avenue and a frontage on the New York Central railroad.

Arrangements Completed for Frontenac Location

INDIANAPOLIS, March 20—With the departure for the East of Allan A. Ryan, New York capitalist and chairman of the board of directors of the Frontenac Motor Car Co. of this city, reports were confirmed that arrangements were practically completed for the purchase of an extended factory site for the new car.

Ryan was accompanied by William N. Thompson, president and general manager of the Stutz Motor Car Co. of America, Inc., another member of the directorate of the Frontenac company, who, with Ryan, has been active in its organization.

BENZ STATIONARY ENGINES

NEW YORK, March 21—A dispatch from Frankfort-on-the-Main says that a section of the Benz automobile works in Mannheim are being transformed for the construction of stationary motors by a special company with 40,000,000 marks stock capital.

Weight Forms Basis for New York Fees

Supplants Horse Power — New Car Owners Had Been Paying Less Than Old

ALBANY, March 21—New legislation of chief importance to motorists in New York state is confined chiefly to the two bills increasing registration fees of both passenger cars and trucks. In licensing passenger cars the legislature, at the recommendation of the tax commission, abandoned the old-time method of horsepower as a taxation basis. For the first time in this state weight will determine the amount of the registration fees, the cost being rated at 50 cents per 100 pounds for cars weighing, fully equipped, 3,500 pounds or less and 75 cents per 100 pounds for cars over 3,500 pounds.

With the recent price changes the motor experts of the state discovered, somewhat to their surprise, that owners of new cars registered for the first time this year were paying a lower fee than owners of similar cars purchased a year or two ago. The new system increased the registry fee by 10 to 15 per cent over existing rates. The minimum fee, hereafter will be $8. At present the minimum fee is $5 for a four-cylinder vehicle. The new registry plan will not go into effect until Jan. 1, 1923.

Commercial Vehicle Rates Higher

Rates on motor commercial vehicles have also been increased, but, through the representations made to Senator Lowman and others by motor truck interests, the legislators admitted that the fees first proposed were excessive, and substantial reductions were made. Notwithstanding this, the new motor truck fee for all vehicles will be 60 per cent higher than at present, a very material increase.

The new system imposes a fee of $8 per gross ton, making $16 the minimum for two tons or less. The fee for such commercial vehicles is now $10. The average 5-ton truck, which, when fully loaded, has a gross capacity of about 11-tons, will pay a fee of $88 instead of $55, as at present. These new motor truck fees will also go into effect on the first of next year.

No effort has been made to introduce a gasoline tax, which was hardly necessary in view of the fact that higher fees have been imposed all along the line on cars owned in this state.

CANADIAN OFFICE IN NEW YORK

OTTAWA, ONT., March 18—The office to be opened in New York by the Canadian Trade Commissioner there will be in operation on April 1. It is said that inquiries have been received with regard to prices of automobiles, trucks and accessories, and it is believed that a market can be secured for Canadian products.

Men of the Industry and What They Are Doing

Unwin Goes With National

Harry Unwin has been appointed sales manager of the National Motor Car & Vehicle Corp. at Indianapolis, succeeding James Clark who has become identified with a dealership organization. Unwin has been connected with the industry since 1901. He participated in laying out the route for the New York-to-Pittsburgh automobile endurance contest in 1903. During the war, when he held a commission as major in the Army, he superintended the construction of artillery tractors for war purposes at the Reo and Maxwell plants. He was the first secretary of the National Association of Automobile Manufacturers, later merged into the National Automobile Chamber of Commerce. Unwin has been connected with the Chicago branch of the Reo Motor Car Co. and before that was associated with agencies in New York for the Chalmers, Pierce-Arrow and the White.

Elgin Appoints K. T. Leech

K. T. Leech of Dallas, for a number of years engaged in the automobile business, both in wholesale and retail work, has been appointed a district sales supervisor for Earl Motors, Inc., his territory covering Oklahoma, Louisiana and Texas. About six months ago Leech retired from the business with which he had been associated for ten years and went to Germany to enter a new field of endeavor.

Sanders Will Retire

Frank H. Sanders, for eight years dealer in Franklin cars in the Chicago district, will sell out the business he has operated under the name of the Franklin Motor Car Co. and retire from the retail automobile field. When Sanders went to Chicago from Cincinnati the yearly business at the former dealership totaled 61 cars. In 1921 Chicago led the entire list of Franklin dealerships.

Davies Directs Service Work

R. G. Davies has been appointed field service director for the Ruggles Motor Truck Co., Ottawa, Ont., his territory including Ontario and Quebec. His duties will bring him into touch constantly with Ruggles truck owners, and by keeping the owners satisfied with the service rendered, it is expected that he will prove of material aid to the selling end of the business.

Morgana Joins Maxwell

Charles Morgana has tendered his resignation as vice-president and director of C. H. Wills & Co. to become superintendent of the Maxwell Motor Corp's Detroit plants. Morgana was with Wills and J. R. Lee in the Ford organization, and resigned with them to enter the Wills enterprise at Marysville.

ACTIVITIES OF EXECUTIVES

I. B. Derbyshire will succeed Harry Barrett as assistant treasurer of the Detroit Pressed Steel Co. in the near future, Barrett having tendered his resignation to enter the radiophone manufacturing field with a company which he is now organizing.

Captain William Sparks, president of the Sparks-Withington Co., is analyzing conditions in the Southern market for a few weeks, during which time he will make his headquarters at Daytona, Fla.

A. C. Andrews, vice-president of the Chase National Bank, has been elected a member of the executive committee of the American La France Fire Engine Co.

W. J. Rennick has been appointed secretary and treasurer of the McKone Tire & Rubber Co. at Millersburg, Ohio.

He was a specialist with Ford in the machine tool and engineering department, entering that company when it annexed the John R. Keim mills, Buffalo, in 1910.

Leahy, Durant Sales Manager

M. B. Leahy has been appointed general sales manager of passenger cars for all the Durant companies. He will be in charge of sales for the Long Island City, Lansing and Toronto plants. Leahy's first important position in the automotive industry was as New York branch manager for the Chevrolet Motor Co. He was promoted steadily until he became assistant general sales manager of Chevrolet under W. C. Sills. In this capacity he was in charge of sixty retail stores. When the Durant Motor Car Co. of New York was formed by W. C. Durant, he engaged Leahy as sales manager of that company and his promotion to general sales manager has followed in little more than a year.

Pfeffer in Engineering Company

Clarence A. Pfeffer, who was formerly president of the Saxon Motor Car Co., has formed a consulting engineering company under the corporate name of C. A. Pfeffer & Associates, which will specialize in financial problems within the industry. New York and Chicago men will be affiliated with Pfeffer in the new company, which will have offices in the Penobscot building, Detroit, and branch offices in New York and Chicago.

Mosher Leaves Covert

F. E. Mosher has resigned as vice-president and treasurer of the Covert Gear Co. of Lockport to become associated with the Dauch Chemical Co. of Louisville. Mosher is widely known in the industry, having been with the Covert Gear Co. for several years. His resignation is effective April 1.

Charles S. Turner Joins Hupp

Charles S. Turner, formerly of the Robertson-Cole Co., New York, has joined the Hupp Motor Car Co., as Far Eastern representative and is now preparing for a trip through this territory, which will take about 18 months' time. While with Robertson-Cole, Turner handled the Cole export interests in this field and is familiar with the business possibilities. There is much constructive work to be done by American manufacturers throughout the Far East before business can be restored to its former strength, Turner says. With the exception of India, he states, most of the countries are approaching a prosperous era and should present a good automobile market.

Vail Leaves Waltham Watch

E. L. Vail has resigned as sales manager of the automobile equipment division of the Waltham Watch Co., effective April 18. He has been connected in the automotive equipment field, where he is widely known, for many years. Prior to his activities in developing the market for Waltham clocks and speedometers, he was New England representative for the Splitdorf Electrical Co. and later served as sales manager for the Hoffecker speedometer.

Hardy and Peasley on Tour

A. B. C. Hardy, president of Olds Motor Works, and Guy H. Peasley, sales manager, have been making a tour of the middle and far west, visiting distributors in those sections. They report that both dealers and distributors are unusually optimistic and that prospects for immediate and spring business are beyond their expectations. The distributor at Los Angeles, they report, has sent in an order for 250 cars and says he will need 400 more for March.

Allen Made Branch Manager

W. C. Allen, former manager of the Black & Decker Philadelphia branch and subsequently special representative, has been made branch manager of the company's Chicago territory. Allen has been a jobber's salesman, was connected with the Manley Manufacturing Co. as assistant sales manager and has been associated with the Black & Decker Manufacturing Co. for about three years.

New Overland Plan Has Willys' Favor

Replaces Bank Proposal—Stockholders Will Be Asked for Their Approval

(*Continued from page* 682)

fected arrangements with its own banks whereby the latter are to take $16,500,000 in 7 per cent bonds maturing Dec. 1, 1923. These bonds are secured by fixed assets of the company in such a way that the current assets will be available for the normal operation of its expanding business.

All bank loans will be returned by these bonds, and inasmuch as the current liabilities of the company outside of bank loans are quite small in proportion to current assets the company will be left in a position to take care of operations at full capacity when conditions in the automobile industry will get back to normal.

While this financing provides for the company's needs and will have the effect of stabilizing the business for two seasons' operations, the bonds will be so drawn that they can be retired before they are due in order to make it possible for the company to refinance itself permanently at any time if it is deemed advisable to do so.

A considerable portion of fixed assets and properties can be disposed of during the life of these bonds, so that before maturity the issue should be considerably reduced in amount, thus facilitating the problem of permanent financing when conditions in the industry are propitious.

In view of the fact that the company owns a large amount in securities and properties which are not essential to the business as now conducted, and it is believed their properties can be converted into cash during the life of these bonds, it was felt by the directors of the company that this plan offered special advantages over any plan for long term financing at this time.

Loans Recently Extended

The banks recently extended for three months the $16,500,000 loans which matured Dec. 1, but were extended to March 1.

Officers of the company are assembling data on assets unessential to the business which can be converted into cash. In this category will be several parcels of real estate in various parts of the country, some buildings and other tangible property which can be placed on the market now.

The Willys-Overland interest in the Moline Plow Co., it was asserted by officers, will not be offered for sale at the present time. These holdings amount to 82 per cent of the Moline common stock.

Has $8,000,000 Cash

Willys-Overland has $8,000,000 in cash and it is believed no difficulty will be experienced in taking up a considerable portion of the bond issue before it matures. Retail sales which have been very good for several months, are reported to have been even better since the latest price reduction.

Leroy Peed, assistant sales manager, states that the Toledo branch will break its monthly record this month with the sale of more than 500 cars. Sales are excellent throughout the Central and Eastern States.

COMMERCE ADDING RADIOPHONE TO LINE

DETROIT, March 21—The Commerce Radiophone Co. has been formed as a subsidiary of the Commerce Motor Car Co. by Walter E. Parker, president, and other officers of the company. Production and deliveries have been started already.

The development of the radiophone as an auxiliary to automotive manufacture is regarded as one which may be taken up by other companies as a means of utilizing some of the present unoccupied factory space. The General Motors Corp. anticipates that some of the factory buildings it is offering for sale will be taken over by radiophone companies.

Quarter Will Meet Early Predictions

(*Continued from page* 682)

sory end of the industry are exceedingly gratifying. Releases and new orders have been received in such large volume that many plants are approaching capacity production. Business booked ahead indicates that this condition will prevail for another two months at least.

Truck sales promise to expand steadily as the year progresses. This will be true particularly of light delivery wagons as the result of the unexpectedly early improvement of conditions in the agricultural districts.

Tire production also is increasing and there are reports from Akron of a prospective price increase in the near future. Even if there is no upward revision it is assured that there will be no further tire price reductions. Increasing cost of materials has counterbalanced the greater efficiency of labor and reduced operating expenses.

From a financial viewpoint, the annual reports of large companies in the industry demonstrate that all of them have taken their losses and are going ahead this year on a profit making basis in spite of keen competition.

AMERICAN-EGYPTIAN TRADE

LONDON, March 8 (*by mail*)—Official statistics show that Egypt imported 926 motor vehicles in 1921, valued at £471,563. More than 30 per cent of these came from the United States. Italy and France sent 25 and 20 per cent, respectively. During the same period gasoline to the value of £1,389,181 was imported, chiefly from the United States, Rumania and Persia.

Court's Views Sought In Association Case

Hardwood Counsel to Make Petition—Hoover Calls Conference for April 12

WASHINGTON, March 22—A motion for a rehearing or modification of the United States Supreme Court's decree in the American Hardwood case will be made by L. C. Boyle, general counsel, this week. He will petition the court to state more definitely whether its judgment in the so-called open-competition case means absolute prohibition or inhibition on gathering industrial statistics and the distribution of these data to memberships of various trade organizations.

The court will also be requested to determine whether such activity is prohibitive only when used in connection with other factors of the trade association work which reflect agreement or understanding to fixed prices or curtailed production. The outcome of the Supreme Court action in this matter will be of utmost importance to all lines of industry.

The trade associations are manifestly uncertain as to methods of procedure in view of the Hardwood decision. Secretary of Commerce Hoover is cognizant of the situation, and as a consequence has called a meeting of various trade bodies in this city on April 12 for the purpose of discussing trade association work and devising lines of operation in accordance with the views of the Department of Justice and the Department of Commerce.

Boyle is of the opinion that the Court acted on an important statement of facts by the Government, and if a rehearing is granted he will endeavor to show that industry needs a more definite statement as to the line of cleavage in association work.

Motor Transportation Gains in Syria; Market Is Dull

WASHINGTON, March 22—Motor truck transportation has developed considerably of late in Syria, but at the present time the market is overstocked and business is depressed, according to reports received by the Automotive Division of the Department of Commerce.

Consul Knabenshire, at Beirut, reports that motor trucks, especially those with a capacity of 2 and 3-tons, have proved effective competitors to wheel carts and railways for transportation of both passengers and merchandise. With 250 trucks in operation in the Damascus district, business is improving.

The railway company there has met motor truck competition by the establishment of an automobile transportation service between Beirut and Damascus, a route of 69 miles; Beirut and Didon, 29 miles, and Beirut and Tripoli, 56 miles. The motor vehicles have been ordered from France.

Maxwell-Chalmers Report Is Presented

Balance Sheet Shows $19,731,000 Current Assets—Current Liabilities $6,278,000

DETROIT, March 21—The consolidated balance sheet of Maxwell Motor Corp. and Chalmers Motor Corp. and their subsidiaries as of Dec. 31, 1921, shows a total of $62,794,256 assets and liabilities. Total current assets are placed at $19,731,658 and current liabilities at $6,278,943.

Current assets show cash of $2,895,284; bank acceptances, marketable securities, etc., $4,121,385; car shipments against B/L drafts, $871,678; notes receivable, $528,892; customers and dealers accounts, $606,069; claims against the United States government, $144,453; and inventories, at lowest cost, $10,563,895.

Current liabilities are notes payable due June 1, 1922, amounting to $3,849,795; accounts payable, $1,841,309; accrued interest, taxes, etc., $334,141; dealers' and distributors' deposits, $253,697.

Permanent assets, shown as land, buildings, machinery and equipment, less depreciation, aggregate $16,677,590. Other assets are listed at $982,977. This latter item includes $518,603, due from Maxwell Motors, Ltd., London. Good will is carried at $25,030,296.

Gold notes of Maxwell Motor Corp. due June 1, 1923 and 1924, total $8,172,171. Gold notes of Chalmers due Oct. 1, 1922, aggregate $3,150,000; reserves for exchange, discounts, contingencies and for sales refunds, $613,144. Capital stock totals $44,579,996. This represents $21,463 minority stockholders' interest in Chalmers; $15,186,800, class A Maxwell and $29,371,733, class B Maxwell.

Chalmers' Balance Sheet

The consolidated balance sheet of Chalmers Motor Corp. and subsidiaries shows total assets and liabilities of $8,655,764. Current assets total $3,420,529 and current liabilities, $409,033. The assets include cash on hand, $741,517; car shipments, $36,997; bank acceptances, $11,508; notes receivable, $87,097; customer and dealer accounts, $165,927, and inventories at lowest cost or market value, $2,377,482.

Current liabilities are accounts payable, $257,836; mortgages and land contracts, $15,424; accrued interest and taxes, $61,528; dealers' and distributors' deposits, $74,244.

Permanent assets total $4,950,811. Other assets, $55,421; deferred assets, $229,001. A claim against Maxwell Motor Co., Inc., is listed at $1, pending determination of validity and amount.

Other liabilities are listed as: acquired by purchase of assets of Maxwell Motor Co., Inc., June 1, 1921, $4,163,694; credits subsequent to June 1, 1921, $196,739. First mortgage gold notes as shown in Maxwell consolidated statement, are $3,150,000. Reserves total $315,962. The amount of capital stock outstanding is 43,986 shares of preferred and 399,348 shares of common. A foot note declares the company "obligations for materials undelivered on Dec. 31, approximated $1,000,000."

The attention of stockholders is directed by President William Robert Wilson to the substantial balances of cash and cash securities and the ratio of current assets to liabilities. He notes a further reduction of approximately $6,000,000 in inventory since the last report.

"The corporation's new product, after a phenomenal reception, is finding an increasing acceptance and a more extensive dealer distribution," Wilson asserts. "Its quality and appearance have apparently marked it out among automobile buyers as an outstanding value, and your management has confidence that your corporations will enjoy during the coming year their share in the increased volume of business anticipated.

Receivers Are Appointed for Ward La France Truck

ELMIRA, N. Y., March 22—Oscar N. Reynolds and Alexander S. Diven of this city have been named receivers for the Ward LaFrance Truck Co. by Federal Judge John R. Hazel of Buffalo. Application for receivership was made by Leslie L. Zeet of Pittsburgh. The action will keep intact assets of the company, it is said, until bills can be paid.

The company claims assets of $280,000 and liabilities of $180,000. The business is being continued, and the receivers say that prospects for paying off all indebtedness are favorable.

Before the receivers were named, A. Ward LaFrance, president and general manager of the company, notified creditors that financial affairs of the company had reached a crisis and that some of the note holders had asked for the appointment of a receiver. He expressed the hope that someone would be able to come forward with a satisfactory reorganization plan.

NEW WACHUSETT TRUCK

FITCHBURG, MASS., March 18—The Wachusett 2½-ton truck, assembled from standard units for the New England market is a newcomer in the commercial field. The parts used include such names as Continental, Timken and Brown-Lipe. Officers of the Wachusett Motors, Inc., the assembler, are F. S. Suthergreen, president; W. C. Dresser, vice-president; F. H. Brown, treasurer, and R. H. Bingham, secretary.

ALLEN SALE DATES FIXED

COLUMBUS, March 17—Judge Sater in the Federal court has set April 18 for the sale at public auction of the assets of the Allen Motor Co. The property consists of plants at Columbus and Bucyrus and much material as well as some finished automobiles. The minimum upset price is fixed at $500,000.

Negotiating to Buy Torbensen Axle Co.

Cleveland Interests are Seeking Controlling Interest in Stock Republic Holds

CLEVELAND, March 22—R. C. Enos, vice-president and general manager of the Torbensen Axle Co. stated to-day that Cleveland interests are negotiating for the company, and it is expected that purchase of the plant will be closed late this week.

The Republic Motor Truck Co. has owned all the $750,000 common stock of the company since 1917, and the Cleveland interests propose to buy a controlling interest in this stock. It is understood that if the reorganization is effected there will be some new financing that will greatly strengthen the position of the axle company.

Enos denied a report that J. O. Eaton, formerly president of the Standard Parts Co. and later one of the receivers for that company, had been selected as president of the Torbensen company.

The $2,500,000 funded debt of the Republic Truck Co. is secured by a first mortgage on all the fixed assets of the company and by pledge of the entire common stock of the Torbensen Axle Co. This fact has complicated somewhat the negotiations for purchase.

The Torbensen company was incorporated in Ohio in 1916 as a successor to the Torbensen Gear & Axle Co. It also controls the Powrlok Co., which manufactures differentials in Cleveland. The Torbensen plant here has an annual capacity of from 40,000 to 50,000 sets of axles.

Autocar Business Gains 25 Per Cent This Year

ARDMORE, PA., March 21—The Autocar Co.'s main factory here, has increased its working time three hours, to fifty hours a week, because of increased business. This brings additional returns to 1250 employees. One thousand other employees in branches also are working on the same basis.

David Ludlum, president of the company, states that business so far this year has increased 25 per cent. Activity in highway construction and building are reflected in orders for trucks.

MONOGRAPH ON CHINA READY

WASHINGTON, March 22 — Announcement was made at the Automotive Division, Bureau of Foreign and Domestic Commerce, that a monograph entitled "China; Automotive Conditions and the Good Roads Movement," by J. Morgan Clements, American Trade Commissioner, has been prepared and is ready for distribution to the trade upon application. It is pointed out that the increase in road-building in China is not sufficient to warrant heavy sales of motor cars and trucks in that country.

Illinois Will Test Experimental Road

Results in California Show Roads Laid by Commission There Are Failures

WASHINGTON, March 22—Final tests on an experimental road that has been built at Bates, Ill., by the Illinois Division of Highways with the co-operation of the Bureau of Public Roads, will be started on March 27. The road is two miles long and includes 63 different sections, representing as many different methods and kind of construction with various thicknesses of concrete, cement grout and asphalt filled brick, as well as asphaltic concretes and concrete filled with rolled stone bases.

Since the completion of the construction of the road in April of last year, a corps of engineers has been kept engaged making observations for the effect of temperature changes, static and repeated loads and subgrade conditions, thus collecting data which, when analyzed, will supplement the information necessary for the rational design of roads.

In the final tests a fleet of ten motor trucks, surplus material from the war department, will be driven over the pavement, loaded lightly at first, but increasing in weight as the tests progress until a maximum of 12,000 pound rear wheel load is reached. The results will show definitely the types of pavement which can be expected to support heavy traffic, as well as those which will not satisfy the heavy traffic requirements that may be expected in the next ten or twenty years.

Results in California

SAN FRANCISCO, March 18—The concrete highway test conducted at Pittsburg, Cal., has developed the following results, according to the California State Automobile Association:

The five-inch reinforced concrete slabs now being laid by the California Highway Commission were the first to disintegrate and fail during the test.

The steel reinforcement method does not appear to be of sufficient value to pay for the additional cost required. It appears clearly that on equal foundations thickness of slab is the only insurance of permanency.

Section "J", the Arizona section, showed but little evidence of failure. This section is the six-inch plain concrete section and most nearly approximates the recommendations made by the association in its recent investigation of the state highway system as the minimum thickness and type of pavement that should now be laid on main trunk lines by the state highway commission.

Between Nov. 9 of last year and the close of January of this year, marking the beginning and end of the test, the amount of traffic driven over the highway reached a total of 3,668,100, figured as equivalent to traffic for ten years on the ordinary state roads. Each of the thirteen different types of concrete roadway was subjected to the same test and, except for the design of the pavement itself, under identical conditions. Of these thirteen sections, but three, two of the California Highway Commission which proved failures and the one known as the "Arizona standard" are in general use in the western part of the United States.

Four Models of Stoughton Truck Reduced in Price

STOUGHTON, WIS., March 20—The Stoughton Wagon Co. has made reductions ranging from $205 to $450 in the price of the chassis of the Stoughton truck. The new schedule follows:

	Old Price	New Price
Model F, 1-ton	$1,995	$1,790
Model B, 1½-ton	2,350	2,150
Model D, 2-ton	2,800	2,490
Model E, 3-ton	3,600	3,150

The price of the C Model ¾-ton remains unchanged at $1,240. No list has been issued on bodies which the Stoughton company manufactures to order in any type and size desired by customers, according to specifications.

WICHITA TRUCKS LOWER

WICHITA FALLS, TEXAS, March 17—The Wichita Motors Co. has made a downward revision in the prices of its trucks as follows:

	Old Price	New Price
Model K—1-ton	$2,000	$1,875
Model M—2-ton	2,500	2,400
Model RX 3-ton	3,500	3,200
Model O—4-ton	3,900	3,500

Ogren Price Reductions Range from $500 to $700

MILWAUKEE, March 22—The Ogren Motor Car Co. announces price reductions ranging from $500 to $700. The list follows:

	Old Price	New Price
7-pass. Phaeton	$4,350	$3,850
4-pass. Roadster	4,250	3,750
5-pass. Sport Phaeton	4,250	3,750
4-pass. Sport Roadster	4,250	3,750
7-pass. Sport Phaeton	4,350	3,850
4-pass. Coupe	5,200	4,500
7-pass. Sedan	5,500	4,800

YUBA TRACTOR REDUCED

SAN FRANCISCO, March 20—The Yuba Products Co. has announced reductions in the prices of its various models of tractors. The old and new prices are:

	Old Price	New Price
Model 12-20	$2,600	$2,400
Model 15-25	3,100	2,750
Model 25-40	4,650	4,250
Rodebilder, Yuba engine	5,000	4,750
Rodebilder, Wisconsin engine	5,000	4,600
Model 20-35 oversize	4,185	3,900

FEDERAL CORP. ASSETS SOLD

BOSTON, March 22—The Liberty Spark Plug Corp. has purchased the assets of the Federal Corporation of Westfield, Mass., and also the patent rights and trade mark to manufacture and sell Liberty spark plugs.

Majority Creditors Accept Premier Plan

Refinancing Will Bring in $500,000 New Money—Has Backing of Bank

INDIANAPOLIS, March 23—Plans for the reorganization of the Premier Motor Corp. have been practically completed, but a detailed statement is withheld pending final decision regarding the management and additional directors. The plan has been accepted by 90 per cent of all creditors, including 75 per cent of the merchandising creditors.

The refinancing, it is understood, will bring in about $500,000 in new money. It is reported that the plan has the backing of the Fletcher-American National Bank and the administrator of the estate of the late L. S. Skelton.

The reorganization plan is conditioned upon the transfer of all assets of the Premier Motor Corp. of Delaware to the Premier Motor Corp., which would be organized under the laws of Indiana with a capital of $1,000,000 divided equally into preferred and common shares. The new capital which would be brought in would be sufficient to complete the present production schedule, thereby liquidating enough of the inventory to provide for the ultimate payment of merchandise obligations.

Automotive Equipment Makers Discuss Exports

CHICAGO, March 22—Following a luncheon given by the Association of Automotive Equipment Manufacturers to hear Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce, it was announced that the association would take up the appointment of an export committee at its regular meeting on March 24 to cooperate with the Department of Commerce.

It developed during the luncheon and the discussion that attended Lee's remarks on the work of the bureau that several members of the association have had some rather troublesome experiences with export orders. These members did not know before the meeting how to obtain the information that the department is now ordering for them.

Previous to coming here, Lee visited St. Louis, addressing the Advertising Club there and conferring with executives of the automotive industry in that city.

FORM NEW TRUCK COMPANY

KENOSHA, WIS., March 23—William Martinson, formerly first vice-president of the Winther Motor Truck Co., and Charles T. Abbott, who formerly was secretary of the same company, have formed a new corporation to be known as Martinson Motors, Inc., to manufacture motor trucks. The capital of the new company is $2,250,000.

Arkansas Bankers Discourage Buying

Regardless of Their Attitude, However, Sales Have Shown Steady Increase

LITTLE ROCK, March 18.—Arkansas bankers continue their strangle hold on the automobile business of the state and apparently it will take something stronger than a change of heart to loosen the purse strings of the strong boxes. There is plenty of money in the banks for almost any kind of a loan, with the one exception of motor cars and every possible discouragement is being placed in the path of the prospective purchaser of an automobile.

Automobile dealers are loaded down with prospective buyers—people who really want motor cars and while sales have increased since the first of the year, there is plenty of room for improvement before the industry gets back to anything like normal. Without the aid of banks, however, it is noted that sales have been showing a steady increase for several months.

Another element, also, has entered into the sale of new automobiles and that is the man with a car to trade in. He usually wants twice what the car will bring in the market and when shown what cars similar to his are bringing he invariably insists that those are old cars, while his is in good condition.

Little Rock dealers have tightened up on trading to a point where it is practically impossible for a buyer to get a high price for his old car. The dealers know what cars are selling for and govern their trades accordingly.

Ministry Decides to Sell British Airship Fleet

LONDON, March 7—(By Mail)—The British Air Ministry has decided to hand over at once its fleet of airships to the Disposals Board, despite the announcement made last month at the air conference that a period extending up to June next would be allowed for an imperial air service to be organized with these airships as the nucleus of a fleet.

The plan for the formation of such a service has failed, for although the governments of India, Australia, South Africa and New Zealand were invited to co-operate, only Australia assented. On this account and for reasons of economy, the reprieve of the airships has been cancelled.

The airships in question are: R80, R33, R36, R37 (incomplete) and the ex-German Zeppelin L71; R36 is the only one fitted with a passenger car. In addition to the vessels themselves, there are stations, engines, fabric, gas bags, station equipment, spare parts and stores to be disposed of.

The Disposal Board will be free to decide how and when they shall handle the airships; they may hold them for awhile in the hope that even now a corporation may be formed to fly them, or they may scrap the entire fleet and sell the material piecemeal. Alternatively they may sell them to a foreign power, and in this connection it is reported that an emissary is on his way from the United States with the object of securing R33 or R36 for that country.

Business in Britain Is Feebly Fluctuating

LONDON, March 10 (*by mail*)—"Slow" and "Stop" are the prevailing speeds in the British motor industry. Demand for small cars and motorcycles is dead steady, while that for the large car is dead. Small orders have been obtained from Australia, Brazil and South Africa. Owing to stagnation, manufacturers find it difficult to retain skilled workers, and in some cases the latter are being paid for doing nothing in order to prevent them obtaining employment elsewhere.

It is thought that potential buyers are waiting for the present quarter to elapse in order to evade taxation. Company reconstruction is in the air, but is being deferred because conditions do not appear to justify fresh issues. Sir William Letts of Crossleys and other motor concerns, who has just returned from America, thinks it will be eighteen months before trade revives.

DORT PRODUCTION GAINING

DETROIT, March 20—Dort production in 1922 is showing steady gains as the season progresses, according to an analysis of sales by President J. Dallas Dort. January tripled the output of the same month in 1921, and February more than doubled January. Orders for March delivery will exceed February by more than 200 per cent, he says.

1400 "INDIANS" BY APRIL 1

BOSTON, March 22—According to a director of the Hendee Manufacturing Co. orders have been issued to speed up operations at the plant so that a production of 1400 motorcycles can be reached in April. The company soon will announce a new selling policy whereby machines may be paid for on installments.

MACK MAKERS CHANGE NAME

NEW YORK, March 22—Stockholders of the International Motor Truck Co. at their annual meeting here to-day decided to change the name of the company to Mack Trucks, Inc. All the directors of the company were re-elected. No other business was transacted.

W. E. MC CREA DEAD

ROCK ISLAND, ILL.—W. E. McCrea, for 20 years general manager of the Moline Wagon Works and vice-president and sales manager of the plant after it was taken over by Deere & Co., died at his home in South Pasadena. He had resided the last nine years with a sister there. He was 63 years old.

Banks Favor Trucks But Deprecate Cars

Speaker at Credit Meeting Says Financing "Pleasure" Vehicles Is Poor Business

CHICAGO, March 17—The Central Automobile Credit Association at its meeting here listened to an address by Charles W. Folds of Hathaway, Smith, Folds & Co.

Folds spoke on the necessity of presenting to the bankers a more convincing argument for financing automobile sales. He said that there was a wide spread conviction on the part of the bankers that the financing of automobile purchases was a more or less hazardous business and that furthermore the operation of the financing companies had a tendency to encourage extravagance and was contrary to the thrift ideas which the bankers were so anxious to establish in the minds of the public.

Cites New York Banker

The speaker said that he recently addressed the Robert Morris Association at Indianapolis, and one of the speakers on that occasion was an official of the National City Bank of New York. This banker was asked if the business of financing automobiles was a good business and he replied that the financing of trucks might be considered good but the financing of "pleasure" cars could not be considered good banking.

This remark created some amusement on the part of the diners, but a guest, a banker of Argo, Ill., asked permission to be heard and he expressed very frankly the opinion of the New York banker. He said that it was the purpose of bankers to inculcate ideas of thrift to be manifested in savings bank deposits. He asserted that the financing companies were encouraging extravagance by financing purchases of cars for men who could not afford either to buy or to maintain them after they were bought. He admitted the validity of utility sales but said exactly the same thing which the speaker referred to at Indianapolis emphasized, namely, that his bank would encourage the purchase of a motor truck or a tractor while at the same time deprecating the purchase of an automobile.

Speaker Not Convinced

Much of the rest of the meeting was devoted to members of the association trying to convince this banker that the purchase of an automobile was really promoting habits of thrift on the part of the car purchaser, and that the use of the automobile for recreation and business was well worth the money that was invested in it. However, they made very little progress and those present regarded Franklin's opinion as indicative of the tendeney of a good many bankers.

Folds called attention to the fact that because of an arbitrary ruling at Washington the paper of the automobile financing companies is not regarded as discountable at Federal reserve banks.

FINANCIAL NOTES

Eisemann Magneto Corp. reports net sales for the year ended Dec. 31, 1921, of $646,775 and a gross manufacturing profit of $84,758. The total income was $87,516, the net loss $201,635 and deficit after dividends $175,380. Unfilled orders as of Jan. 1, 1922, eliminating doubtful accounts, were 42,968 magnetos for 68 customers, approximating $1,500,000 in value. A new line of production is in process of development. The comparative balance sheet shows cash on hand Dec. 31, 1921, of $39,086, as against $298,530 at the commencement of operations on June 30, 1919; accounts receivable, $190,316, compared with $391,212 on the latter date and inventory of $1,879,698 Dec. 31, 1921, contrasted with $1,140,730 in 1919. The notes payable aggregated $300,000 at the conclusion of last year's trading, compared with nothing on the 1919 date, and accounts payable in 1921 of $65,960, as against $22,024 June 30, 1919.

J. I. Case Threshing Machine Co. ended the year 1921 in a strong position despite the adversities with which it had to contend in its line of industry. The net result of operations was a loss of $583,431 but this was due in large part to an inventory adjustment which caused a loss of $2,788,458. The company had a comfortable working capital at the close of the year although cash on hand had shrunk considerably. Total current assets amounted to $21,411,013, against which stood current liabilities of $6,456,221, leaving a working capital of $14,954,786. Current assets amounted to about three and a third times current liabilities. The total surplus was reduced by the year's loss of $583,431, $910,000 preferred dividends and a special contingent reserve of $700,000, leaving as of Dec. 31, 1921, a surplus of $1,622,491.

Packard Motor Car Co. reports that there are 3844 holders of preferred stock of the company and 1698 holders of the common stock. The outstanding shares of preferred stock total 147,818 and those of common stock 1,888,314. The widening of distribution of ownership is indicated by the fact that nearly 56 per cent of the preferred stock is in the hands of small holders, those owning less than 100 shares. These investors number 3658 or about 95 per cent of the total number of preferred stockholders. Only 13 per cent of the outstanding shares of this class is held by owners, or more than 1000 shares each. The highest amount in the hands of any individual is 3215 shares, or about 2 per cent. Out of the 1698 holders of common stock 1333, or about 78 per cent, own less than 100 shares each.

Chandler Motor Car Co. since Jan. 1, 1922, paid off all current trade obligations as of Dec. 31, $420,000 dividends payable Jan. 1 and had reduced bank loans $500,000, or 40 per cent. Based on this, 57 per cent of current liabilities at the beginning of the year had been met in the last two and one-half months. January and February shipments are reported to be 1600 cars, compared with 692 in 1921. The company expects to approach 2000 car shipments in March and to maintain this rate throughout the second quarter.

Martin-Parry Corp. reports for 1921 net income, after charges, inventory, adjustments and Federal taxes, of $820, against a net income of $311,345, or $3.11 a share earned on the 100,000 shares of its no par capital stock in 1920. After payment of dividends there was a deficit of $200,820 against a surplus of $111,354 in 1920. The company's cash, according to the balance sheet, was $98,732, in contrast to $98,422 in 1920, and its accounts receivable were $174,454, against $133,509, while the notes receivable were $48,455 in contrast to $38,992. Accounts payable increased from $74,962 to $114,099. The company borrowed $150,000 on notes.

Wright Aeronautical Corp. for the year ended Dec. 31, 1921, reports net income, after charges and Federal taxes, of $597,555, equivalent to $2.66 a share earned on the 224,390 shares of no par value common stock. This compares with net profits of $411,349, or $1.83 a share, in the previous year. The net sales in 1921 were $2,426,187 compared with $1,486,124 in 1920. The operating income was $458,488 in the year first mentioned and $140,116 in the last named year. The surplus at the close of the year's business in 1921 was $485,360 against $411,349 in 1920.

Carlisle Tire Corp. announces that it is offering $200,000 in notes exclusively to stockholders. They are payable one year from April 1 next with 8 per cent interest, payable semi-annually. The proceeds of the notes will be devoted to increased operations and material investments. The company contends that it is the part of wisdom to buy materials at this time, when the market prices are low.

General Motors Corp. directors will meet next week to take action on dividends. Payments will be ordered on the preferred and debenture stock, but the common will again be passed.

Lansing Plant Surveyed for "Star" Possibilities

DETROIT, March 22—Complete details of the equipment at the Durant Lansing plant have been forwarded to Durant engineers in New York by Carroll Downs, vice-president of the Durant Michigan Co., with a view to ascertaining the possibilities of the plant for the manufacture of the new Star car in large quantities.

According to statements accredited to Downs in Lansing, the plant probably will supply the territory between the Alleghanies and the Rockies with the Star and will get into limited production by June 1. By the end of the year it is expected to reach a 200 a day schedule.

Downs was in Lansing accompanied by Edward Ver Linden, general manager of the plant, and M. B. Leahy, general sales manager for the Durant organization.

Contracts for the supply of units for the new car are practically signed, according to one of the leading unit makers, and will be official within a short time. Preparations for the manufacture of the parts are in most cases complete, and as soon as the Durant factories are ready to receive them, deliveries will begin.

Dealers from All Sections Wish to Handle New "Star"

NEW YORK, March 22—Several hundred applications from dealers in every section of the country to handle the new Star car have been received at the headquarters here of Durant Motors, Inc.

Detailed plans for the distribution of the Star have not been worked out, however, and no appointments will be made until that has been done. While no announcement has been made, it is understood that some new sales plan is likely to be adopted for the sale of the car which is designed to compete with Ford.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Call loan rates displayed an easier tendency last week and quotations ranged from 3 per cent to 4 per cent as compared with 3½ per cent to 5 per cent in the previous week. This is the lowest range since early in January, and it is doubtless due, in the main, to the accumulation of funds resulting from comparative inactivity in several lines of business.

Fixed date funds also showed signs of ease and toward the last of the week 60 and 90 day maturities were quoted at 4½ per cent, and four, five and six months' loans at 4½ per cent to 4¾ per cent as compared with a previous range of 4¾ per cent to 5 per cent for all maturities. The prime commercial paper rate remained unchanged at 4¾ per cent.

The Federal Reserve statement as of March 15, 1922, showed an increase of $10,149,000 in gold reserves and $7,437,000 in total reserves. Total bills on hand declined $53,931,000, while total earning assets increased $100,595,000. Total deposits increased $133,408,000, while Federal Reserve notes in circulation showed a decline of $8,841,000. The Federal Reserve ratio declined from 77.8 per cent to 75.6 per cent.

The statement of the New York institution showed the following decreases: $35,027,000 in total reserves; $9,884,000 in total bills on hand; $100,753,000 in total earning assets. Deposits, on the other hand, increased $74,019,000, while Federal Reserve notes in circulation declined $1,779,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined decreased from 84.9 per cent to 78 per cent.

Last week the Federal Reserve Bank of Atlanta reduced its discount rate on all classes of paper from 5 per cent to 4½ per cent.

The Bureau of Labor Statistics index number for February showed a gain of more than 2 per cent in wholesale commodity prices, as compared with a recession of 7/10 of 1 per cent for January. The February gain marks the sharpest advance for any month since last August. The general price level now stands 51 per cent above the 1913 average, although it is 44.5 per cent below the peak reached in the spring of 1920.

The Treasury Department's recent offering of $250,000,000 1-year 4¼ per cent Certificates of Indebtedness dated March 15 was heavily oversubscribed.

G. M. DEALERS ORGANIZE

DETROIT, March 17—The General Motors Dealers Association has been formed in Milwaukee by dealers handling lines produced by General Motors units as a means of furthering their mutual interests and the interests of the corporation. The plan has met with the approval of company executives, and similar organizations in other cities are expected to follow the Milwaukee initiative.

INDUSTRIAL NOTES

Air Reduction Co. has purchased all assets, including patents and trade marks, of Davis-Bournonville Co., pioneer manufacturer of all lines of oxy-acetylene apparatus. The manufacturing and sales organizations of the latter company will be amalgamated with those of the Air Reduction Sales Co., which is the operating company for the Air Reduction Co. This will further enlarge the company's extensive business in oxygen, acetylene, carbide and all products used in the oxy-acetylene industry. The purchase was accomplished without public financing or bank loans.

General Spark Plug Co., St. Louis, has been incorporated for $120,000, fully paid up, and expects to be in production in thirty days. T. W. Meloan is president of the company, B. C. Howard vice-president, W. H. Grant secretary and treasurer. These officers compose the directorate, together with E. J. Newton of Cleveland and Wells S. Murphy of Kendallville, Ind. J. M. McKernan is production manager.

Martin-Parry Corp. has completed negotiations for a five-year contract with the Edward Hine Lumber Co. of Chicago for lumber for Martin-Parry bodies. The contract also calls for the erection of two plants at Lumberton, Miss., one to be used as a special cutting-up plant of the lumber company and the other to be built by Martin-Parry for the finishing and assembling of its base and top units.

Alemite Lubricator Co. of Syracuse has been purchased by W. H. Smith of that city, who will operate the business on a larger scale than heretofore. The company plans the erection of a large installation rack and will provide fifteen minutes' service. Smith has been connected with the Alemite company in Colorado, New Mexico and Wyoming.

Atlas Asbestos Co., Norristown, Pa., has been organized with J. Carroll Johnston as president to specialize in brake lining and other asbestos textiles and packings. Johnston was associated for many years with the American Asbestos Co.

Braender Rubber & Tire Co. has elected the following directors: J. K. Watson, R. Trimble, C. A. Horton, C. A. Shreffler, H. Cross, R. P. Boyd, T. Gardner, J. T. Johnson, M. Damman, W. P. Braender and F. L. Braender.

Black & Decker Manufacturing Co. has moved its Cleveland office to 2030 East Twenty-second Street. Dan Paul, formerly manager of the Pittsburgh office, is in charge.

New Jersey Die Casting Co. has been formed at Irvington, N. J., with E. H. Kelley president, and has acquired the entire assets of the Die Casting Co. of New Jersey.

Taft-Peirce Manufacturing Co. announces the removal of its Detroit office to 2230 First National Bank Building. William Fairhurst is manager of the office.

Automobile Body Builders Association is now located in the Gotham National Bank Building, New York.

BEARING BUSINESS IMPROVED

PHILADELPHIA, March 21—Roller bearing manufacturers state that for the first time in a year and a half orders are being placed for future delivery. Equipment is being improved and new machinery ordered. Business in some cases has almost doubled in the last few months and covers a wide range of products. Sales indicate that factories are preparing for increased production in the immediate future, and the present points to a good year in this district.

Reserve of Gasoline Near May, 1921, Mark

WASHINGTON, March 20—Stocks of gasoline jumped 119,000,000 gallons during January, giving a reserve of 705,700,000 gallons, according to statistics compiled by the Bureau of Mines. This reserve is 130,000,000 gallons more than for the corresponding date in 1921, and is rapidly approaching the 800,000,000 gallon peak set in May of that year. Present stocks are equivalent to a 50-day supply, based on the total daily average consumption for 1921.

The daily average production in January increased by 371,195 gallons over production for the preceding month. This, however, was about 240,000 gallons under the daily average production in January, 1921. The daily average consumption fell off in December by about 1,000,000 gallons.

Lubricating oil shows a daily average production of 2,397,000 gallons during January, this being 266,000 gallons less than the daily average for December, 1921. Stocks on hand were 245,000,000 gallons, an increase of 28,465,000 gallons over the month previous.

Advice Given Tractor Makers on African Trade

WASHINGTON, March 22—American tractor exporters are advised to obtain co-operation of merchants as a preliminary to developing interest among farmers when seeking a market in Africa. The Department of Commerce has received communications from agents in South Africa, stating that the tractor market is largely in the hands of American exporters, and this is due principally to American enterprise and sales methods.

According to British competitors, successful development of these markets depends upon the tractor deals.

Machine Tool Makers Join in Big Merger

PHILADELPHIA, March 23—Officers of the Hilles & Jones Co. of Wilmington, Del., manufacturer of machine tools, announced to-day that the leading machine tool manufacturing plants of the country had been merged under the name of the American Machine Tool Corp. The capital is to be predicated upon the size and holdings of the plants to be merged, and will run into hundreds of millions of dollars.

The companies going into the consolidation are Hilles & Jones, Betts Machine Co., Rochester, N. Y.; Colburn Machine Tool Co., Cleveland; Newton Machine Tool Works, Philadelphia; Modern Tool Co., Erie, Pa.; Carlton Machine Tool Co., Cincinnati; Lodge & Shipley Machine Tool Co., Cincinnati, and Dale Machinery Co., New York City.

METAL MARKETS

AS a means of quickening orders and specifications at the old prices, the recent advance in steel bar quotations by certain of the independent interests may be said to have been fairly successful. Quite a few consumers enjoyed protection on the 1.35@1.40c. quotation, Pittsburgh base, and when the 1.50c. price was announced by one of the independents (several others later following the former's example), these consumers made haste to safeguard themselves. In some instances contracts covering requirements until June 30 were closed at 1.40c. The market, however, is no more 1.50c. today than it was when Jones & Laughlin Steel Co. announced its unwillingness to book further steel bar orders at below that level.

Some mills are asking 1.50c., but there is no limit to the tonnages that can be placed at 1.40c. and, while there is no question that quotations of 1.25c. and 1.30c., which were freely heard a month ago, have disappeared, there is considerable blank space left in the order books of some of the rolling mills, and they are more than eager to build up a comfortable backlog. So far there has been no advance in cold-finished steel bars as the result of hot-rolled prices. Where tonnages are involved makers of cold-finished bars appear to be glad to name 1.80c.

There are sufficient orders in the market to support prevailing prices for most steel products. The demand, however, is not sufficient to warrant any advance in prices. The best that producers can and do hope for is a steady market, not a rising one. In the sheet market fairly active demand for ordinary sheets continues, but there has been a decided easing off in fresh inquiries for full-finished automobile sheets. Competition has turned even keener than in the past, and there have been rumors of isolated instances of sharp cutting of prices on black sheets.

Steel.—Automotive consumers are consistent buyers of both cold- and hot-rolled strip steel, orders of 500 tons being more plentiful than in a long time. As a result, the rate of operations of strip steel mills is constantly improving. The market for hot-rolled ranges from 1.80c., Pittsburgh, upward, while cold-rolled is quoted at 3.50c. The sheet bar market is more active and the general quotation is $29, Pittsburgh or Youngstown. Bolt and nut interests report good demand from the automotive industries, with much shading of prices in evidence.

Aluminum.—Publication a few days ago of a report that the Committee of Ways and Means was ready to report the revised tariff bill in the near future has caused holders of aluminum to be more reserved. While opposed to any increase in the duty on aluminum, importers and dealers in foreign aluminum naturally will want to conserve their stocks if there is a possibility of a tariff providing much higher duties being rushed through Congress, a contingency which at least must be reckoned with. The market is steady.

Pig Iron.—Automotive foundries continue to buy conservatively, tonnages involved ranging from 50 to 500 tons. Blast furnaces still complain that market levels are below cost of production, but the probabilities are that early readjustment of freight rates on ore and of the price of that raw material itself will permit of a considerable saving in production costs.

Copper.—Some of the producers who have resumed operations are already back on a 50 per cent of normal basis. Automotive demand for copper and brass products is on the increase.

Calendar

SHOWS

April 3-16—New York. Second Annual Electric Automobile Show. Showroom of the New York Edison Co.

FOREIGN SHOWS

March, 1922 — Santiago, Chili. Annual Automobile Show.

March 15-July 15—Tokio, Japan. Peace Exhibition.

April 16-23—Mexico City. Annual Automobile Show. Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia. Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador. Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen. Automobile Show.

May 24-June 5—Barcelona, Spain. Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil. Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, Mar. 24, April 28, May 26.

June 20-24 — White Suplur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Good Organizations Behind Best Sellers

Interest in Chicago Is Centering on Less Than Dozen Lines

CHICAGO, March 21—The demand for cars in Chicago has centered upon less than a dozen lines. Those favored lines include all classes of cars and for them business is good. Sales are far in excess of those of a month ago, and inquiries and live prospects are in such large volume that the promise of satisfactory sales is held out indefinitely.

In these lines that are popular with the public, favor seems to have been established at the Chicago show. It is not accident that coincident with the best selling lines there should be hard working organizations behind them. Personality of the dealer, his reputation and the reputation of the products he represents, aided by price that seem exactly to fit are other features that are helping to move cars here.

There seems to be a stir in the truck market. Interest in buying is expressed but for the most part this interest has not developed many sales excepting in one line which has been selling almost up to record volume for three or four months. The reasons given for activity in this line is that the organization was kept together and always on the job and that the company was powerfully financed and thus enabled to go through months of financial drain when there were no sales.

Business prospects generally are reported much brighter than they were a year ago. That March sales will go far ahead of February there seems no doubt.

TEXAS TRADE HOLDS UP

DALLAS, March 21—There appears to be no general depression in the automobile business in Texas for the first twenty days of March. Dallas dealers declare the business held its own and the good sales conditions brought about by the annual spring show are still being felt. They say the actual sales thus far this month are about as large as those for similar periods of January and February.

FLAT RATE FOR CHEVROLET

DETROIT, March 22—The Chevrolet Motor Co. is working out, through its Detroit retail branch, a flat rate system of service which is expected to be ready for general adoption by all Chevrolet dealers by early summer. Chevrolet branches are now installing the latest features of the new Chevrolet models, such as the hand emergency brake lever, for owners of former models, at a fixed low cost.

C. L. THURSTON DIES

NEW YORK, March 22—Clarence Luther Thurston, for six years export manager of the Earl Motor Car Co., is dead at his home on Riverside Drive. He was born in Omaha in 1880 and was a son of the late Senator John M. Thurston. He was graduated from Harvard in 1900. He was secretary of the American Legation in Buenos Aires for a year. Thurston was taken ill several months ago while traveling in Spain in the interests of his company. He returned to the United States in February.

TORBENSEN PARTS STATIONS

CLEVELAND, March 23—Announcement is made by the Torbensen Axle Co. that it is establishing a chain of parts service stations throughout the country to assure users of its axles of national distribution of service parts. Each main station will carry a complete line of axle parts for all models, so that parts can be sent to any point in its territory within 24 hours.

Employment Exceeds Mark Set in December

February Shows 89,647 on Payroll in 49 Plants Against 85,524 in January

WASHINGTON, March 20—Comparison of employment in 49 identical establishments in the automobile industry for January and February, according to the Bureau of Labor Statistics, shows that the number on the payroll in February increased 4.8 per cent over the preceding month and that the percentage of wages increased 58 per cent. Statistics for February showed that in the 49 reporting establishments 89,647 were on the payroll in February, as compared with 85,524 in January. The amount of the payroll in February was $2,431,860, as against $1,539,613 in January.

Distinct Gain This Year

Comparing February 1921 and February 1922 a distinct gain is shown this year. The number on the payroll in February 1920 increased 58.4 per cent and the amount of the payroll in 48 identical establishments increased 82.5 per cent. In February 1921, 48 establishments reported 58 536 employees and last month these same firms reported 92,746 on their payrolls. The payroll for February 1922 amounted to $2,528,514, as against $1,381,052 for the same period last year.

Statistics on changes in wage rates and per capita earnings, compiled by the Department of Labor for the automobile industry are reported as follows:

A wage rate decrease of 5 per cent was reported by one establishment, affecting 12 per cent of the force. More time was worked and the per capita earnings showed an increase of 50.7 per cent when January and February figures were compared, bringing the industry back to a little above the level of December after the slack work of January.

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More Definite Planning Needed In Market Study

Passenger car manufacturers are interested in market analysis, but plans frequently lack definite objective. Recent survey shows what is being done, and gives basis for evaluation of methods. Maximum use not obtained from much of data collected.

By Norman G. Shidle

AUTOMOBILE manufacturers are thoroughly awake to the necessity for market analysis. A study of sales possibilities is being carried on by manufacturers of cars in every price class. The work has been going on for so short a time, however, in a majority of cases that methods of procedure are in a primary state. Speaking generally, such work was not undertaken until an absolute necessity arose for it.

While there are varying opinions as regards the usefulness of certain types of market analysis data, very great interest in the general problem is being evinced in every plant. High executives are looking for data of any kind that bears upon the subject, and are scanning carefully whatever material they can obtain.

In a few cases a study of marketing problems was begun a little before such study became absolutely necessary. Some companies began it, as soon as the necessity first began to appear in concrete form a year and a half or two years ago. In most cases, however, serious work has been going on for only a few months, while in the case of one company it is just starting at the present time. These are the outstanding features of a personal survey just completed among representative passenger car companies.

There is no better time than the present at which to take stock of methods and purposes; to evaluate the tendencies in the work which has been done and to determine the proper bases for such work, together with the best methods of procedure viewed from a practical standpoint.

It is unnecessary to point out the need for a study of markets and marketing costs. The necessities along this line have been emphasized frequently. Under present conditions the automobile business cannot hope to go forward successfully without a more accurate knowledge of individual market possibilities, a more accurate basis for the adjustment of quotas, a better possibility of predetermining the number of sales which may reasonably be expected and balancing more closely sales and production plans.

These facts are pretty well recognized by executives throughout the industry.

There is a strong indication, however, that much of the market analysis work in progress is being conducted without a sufficiently definite purpose. There has not been enough planning before the collection of data was begun. Frequently, the appearance of some data bearing upon marketing problems has aroused interest and led to the collection of more data along the same lines. A company has sometimes been sold a subscription to a statistical service without knowing beforehand just what use is going to be made of it.

The offering of the service suggests possible sales plans, rather than sales plans demanding the service.

Then, having subscribed to the service, an attempt has been made to find out just how it might be used to the best advantage. This seems to have occurred in a number of cases, the statistical service being of considerable value *per se,* but not being utilized to the fullest extent in correlation with other data bearing on the same problem. This is the natural result of a failure to lay out a broad and definite objective in the beginning. It amounts to trying to build the superstructure of a building before the foundation has been laid.

Sometimes this difficulty has even gone so far as the establishment of elaborate research and statistical departments, authorized to collect data of various kinds. In one instance such a department was operated for over a year and collected a vast amount of statistical data. Then the department was discontinued because none of the executives found practical use for most of the data gathered. A somewhat similar experience has occurred in one or two other instances. In each case the fault was not with the type of data gathered, but with the failure to determine beforehand what the function of the data was to be.

To solve the practical problems of the individual company, market study must be approached from two viewpoints:

1. A fundamental plan, including:
   - A. The definite purpose of the analysis.
     - a. A determination of the market for the given car which may reasonably be expected by territories for the next few years.
     - b. A correlation of these results with production, financing and administrative planning.
   - B. A list of all the factors bearing on this market.
   - C. The relative importance or relation between these factors as regards the market of reasonable expectancy for the given car.
   - D. A survey of sources of accurate and comprehensive data concerning each of the factors listed.
2. The immediate plan:
   - A. The practical problems that demand immediate solution; quotas of some kind must be set at once on some basis, etc.
   - B. Take immediate action on the basis of whatever data are already available, basing judgment as to the best present action, however, on the ultimate necessities of the fundamental plan.

Immediate action of some kind is necessary in most cases. The laying out of the basis of the fundamental plan, however, need consume only a few days of concentrated thinking on the part of a capable executive. This having been done, whatever immediate action is taken can be so built up that it will ultimately fit into the more comprehensive plan.

Having laid down the outlines of the broad plan, the sales executive can probably turn over to his research or statistical man the task of seeking out the available sources of information and of procuring the data necessary to fill in with concrete figures and facts the fundamental picture already drawn. If this is done, there is no waste effort. Data are sought for and collected with a definite aim in view. When it has been gathered, its function has been predetermined and it is automatically put to the use for which it was collected.

The answer to the problem under discussion will never be reduced to a mathematical exactness. That is obvious. Data concerning certain economic and psychological factors affecting the problem can never be said to be mathematically exact. It is possible, however, by analyzing statistically the sources and information available to come much closer to accuracy than has been done in the past.

Moreover, the picture under discussion is a constantly changing one. Whatever formulæ are developed, whatever methods of procedure are determined upon must take into account the fact that the data to be used will be in a constant state of flux. It is not enough to get a picture of the situation at any given moment. The development of the automotive industry is a dynamic, not a static, factor.

There is much material concerning sales and marketing questions now being collected by the various passenger car companies. Some of these data concern general matters of territorial analysis, competition, etc. Some of it relates to conditions of individual distributors and dealers in the particular organization. Nearly all of these data is being used to some extent. But it may be seriously doubted as to whether or not maximum use is being made of it. Each bit of information is being put to a good use in itself, but the relation between the various units does not always seem clear. The various units are not welded together to give a comprehensive picture.

A DEFINITE marketing plan should determine what data are to be collected and what use is to be made of that data. In certain instances the practice has been just the reverse. The result is considerable waste effort.

The chief necessity in most companies is for a more definite fundamental plan, a more comprehensive correlation of data, and a more detailed analysis of the factors involved in marketing studies.

This article is the result of a personal survey of representative passenger car plants. Following articles will discuss current practice in detail.

Thus far this discussion has been based on the assumption that every company is seeking to know its market of reasonable expectancy and to produce cars on that basis. This is not always the case. In certain instances there is still a tendency to make production capacity the chief gage of what production shall be. This results very frequently, in times like the present, in a production somewhat larger than the reasonable expectancy, with a consequent forcing of cars.

One company, for example, had its production department set the production schedule for 1922 without consulting the sales department. It is now up to the sales department to get rid of the production set. In such a case, it is obviously necessary to base distributors' quotas fundamentally upon this production schedule, regardless of the results of market analysis.

The chief necessity in most of the companies is for a more definite fundamental plan, a more comprehensive correlation of data, and a more detailed analysis of the factors involved in marketing studies.

The work of laying out in detail the outline plan should fall on the shoulders of the general sales manager or some other important executive. It should never be necessary for a research department to sell its ideas concerning market analysis to the general sales manager or other executives. The problems involved are more vital to the permanent growth of the individual firm than any others presented to-day. Careful study and analytical thought are necessary.

The present article has simply attempted to visualize the situation as it stands and to point out probable trends in development.

In following articles the establishment of quotas will be discussed in more detail. The practice of a number of representative passenger car plants will be cited and a general picture of what the industry is doing will be presented.

A Good Example of Modern Engine Design

New model of Buda engine is designed for light commercial trucks and similar applications, but is of heavy duty type and similar in general design to other engines of the same make. Compression ratio is 4.35 to 1. Special attention is given to securing water circulation around the valves.

By J. Edward Schipper

THE Buda Company has added to its line a new engine, which is typical in general construction of other engines of the same series, except that it is a smaller model. It is a heavy-duty, high speed type designed for light commercial or other use where a four-cylinder, 3⅝ by 5⅛ in. engine is applicable.

The four L-head cylinders are cast in block, with the cylinder head and the upper and lower halves of the crankcase cast separately. The two crankcase castings are iron and are divided horizontally. The engines are designed for three-point suspension with the rear supporting arm cast integrally with the upper half of the crankcase and arranged for main frame support. The forward end of the engine is supported at the crank center by a trunnion bracket arranged to rest upon a drop cross-member of the frame.

An idea of the general characteristics of this engine may be gained from the fact that it is a rather high compression type for a heavy duty engine having a compression pressure of 94.7 lb. per sq. in. absolute, or 80 lb. gage. The compression ratio is 4.35 to 1. There has been no attempt, however, to make an extremely high speed engine of this model, but to give it the moderately high speed characteristics which are necessary in light commercial work. The weight of the piston and connecting rod assembly is 7 lb. 3½ oz., the weight of the piston alone being 2 lb. 14 oz. The design has been worked out to be clean and dust-proof as well as accessible.

Cylinder Block

The cylinder block is provided with large water jacket space which is baffled so that the water is discharged directly beneath the valves and is designed to secure circulation around each valve. The spark plugs are located in the cylinder head, the threaded part of the spark plug in contact with the head being entirely surrounded by water. The water outlet on the cylinder head is fitted with a removable elbow which can be placed in four different positions. In fact, the entire engine has been laid out to be as universal as possible in its installation. One factor which may be mentioned from an accessibility standpoint is that the cylinder head is provided with a ledge projecting beyond the block which makes it possible to remove the head without damaging the gasket, and, at the same time, with a saving of considerable time. Lugs on each end of the cylinder and head are provided for breaking the joint in removing.

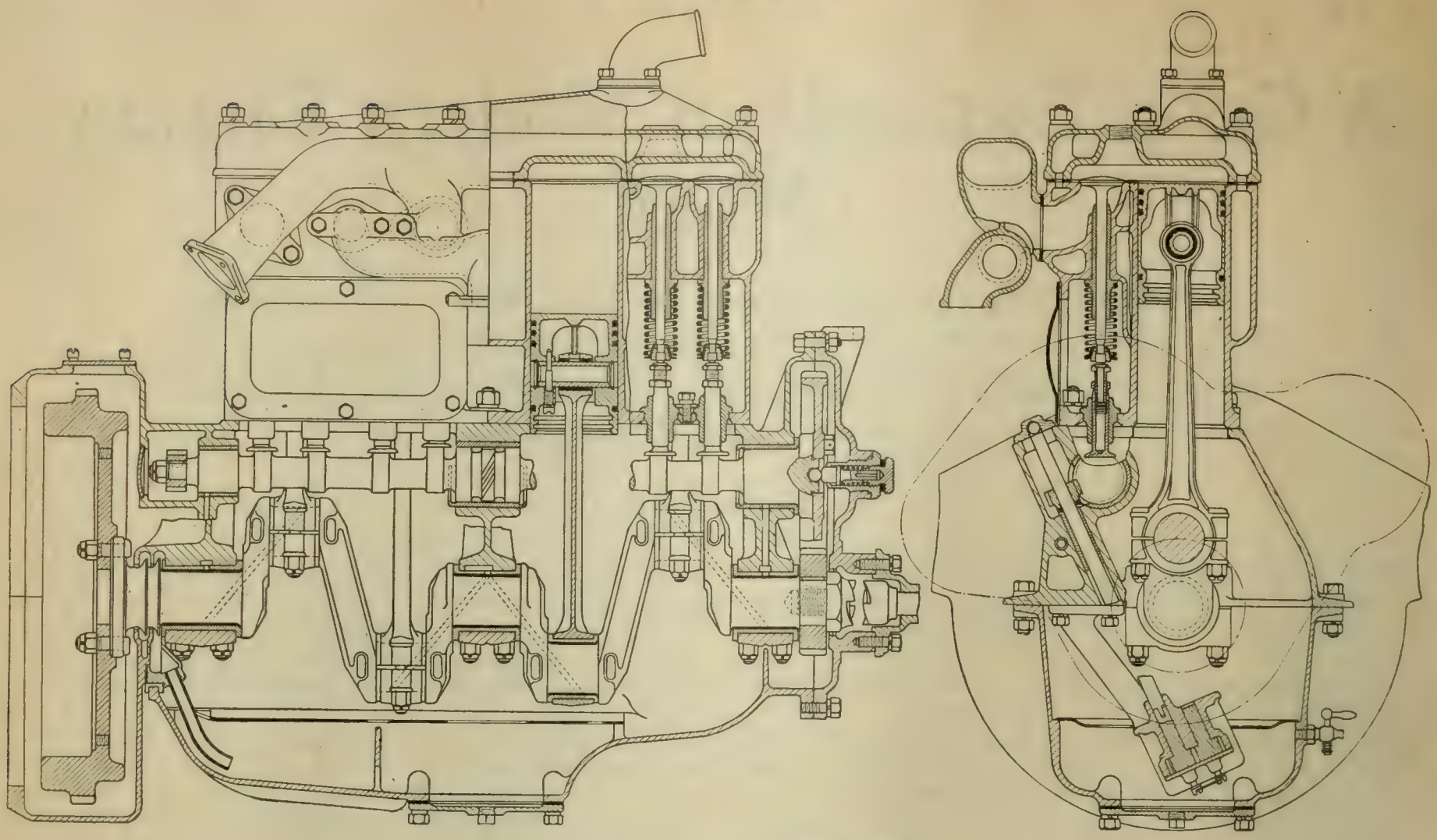
The grey iron pistons are fitted with concentric rings above the wrist pin and one wiper ring in the lower part of the skirt. The piston heads have cooling ribs to dissipate the heat and in manufacture the pistons are so located in the reaming operation as to insure that the piston pin hole is square with the wall of the piston. A balancing pad is provided on each piston to permit the piston to be machined to a given weight and balance. The piston pins are 1 1/16 in. in diameter and have a bearing length of 1⅞ in. The pistons are 4½ in. long. To prevent the piston pin from working through against the cylinder barrel there are two locks on the piston pin, one being an alloy steel lock screw with two diameters and extending through both sides of the pin to give double shear and prevent improper fitting of the pin at any time. The second is a spring retainer ring which expands in grooves turned in each end of the piston bosses.

Crankshaft Construction

Drop-forged, I-beam connecting rods are used without offset. The upper ends are fitted with phosphor bronze bushings and the lower ends with bronze-shell bearings lined with babbitt. Two connecting rod bolts of alloy steel secure each bearing cap. The crankshaft is drop-forged from open hearth steel and is given a machine balance. Due to the heat treatment employed, the tensile strength of the crankshaft is upwards of 120,000 lb. per sq. in., and the elastic limit 85,000 lb. per sq. in. The rear end of the shaft is fitted with two oil throwers to prevent leakage at that point. The bearing dimensions, front to rear, are 1¾ by 2½, 2 by 2½ and 2⅛ by 3 in. diameter and length. The connecting rod bearings are 1⅞ by 2 in. diameter and length. The connecting rod length is 11¼ in. center to center.

Helical gears of wide face are used to drive the camshaft and auxiliary units. Special equipment has been installed in the Buda factory for the machining of these timing gears which are cut on automatic hobbing machines. Particular attention is paid to the gear centers in order to secure quietness. The timing gearsets include the crankshaft, camshaft, idler and pump shaft gears. Also, the generator shaft gear when the generator is used. This is optional with the purchaser. The gears are accessible upon removal of the timing gearcase cover at the front end of the engine.

The camshaft is a one-piece drop-forging of open hearth steel, machined and case hardened. The working surfaces of the cams and the three camshaft bearings are given a ground finish. The valves are driven through mushroom type pushrods which are fitted with removable guides. The pushrods are made large to permit the use of large diameter adjusting screws, as well as to maintain correct alignment. The heads of the adjusting screws are fitted with oil-hardened steel blocks to facilitate alignment and eliminate warpage caused by case hardening. The large



Part sectional views of new Buda engine

bearing area at this point also permits of low unit pressure at the adjustment and consequently minimizes wear. Single piece, interchangeable chromium steel valves are employed both for inlet and exhaust. The valves have an effective working diameter of 1½ in. They are closed by barrel type, self-centering valve springs designed to eliminate side thrust upon the valve stems. The lower end of the valve spring and valve spring cup is held fast by a split type wedge grip valve spring retainer lock. This lock permits no movement up or down and is claimed to eliminate wear both on the lock and the groove in the end of the valve stem. To facilitate removal and permit adjustment of the valve tappets, the cover is split into two sections.

Cooling System

Pump water circulation is used, the centrifugal pump having a bronze runner and large packing glands. Bronze sleeves are fitted over the pump shaft to prevent rusting and pitting and the pump is made up as one assembly unit so that the water pump and its driveshaft can be removed as a unit or separately. The engine can also be arranged to use thermo-syphon circulation if desired. The fan is not furnished with the engine.

Full pressure feed lubrication provides oil for the crankshaft, camshaft bearings and connecting rod bearings. Oil is forced to the main bearings and camshaft bearings through a seamless steel distributing tube which is cast in the crankcase. From the main bearings the oil reaches the connecting rod bearings through passages drilled in the crankshaft. A pressure regulating valve is provided, the oil being pumped from the oil reservoir, which is located beneath the crankcase, by a geared pump located in the center of the oil reservoir and attached to the upper half of the crankcase to make it independent of the oil pan. The pistons and cylinders are lubricated by oil thrown from the lower ends of the connecting rods, while the timing gears are fed positively from the pressure system. The extra wiper ring on the lower end of the piston is designed to prevent an excess of oil reaching the combustion chamber. There is a settling chamber for sediment in the bottom of the reservoir below the oil pump, from whence it can be drawn off from time to time.

The intake and exhaust manifolds are of grey iron cast integrally. Two types are provided, one giving a combination intake and exhaust manifold for gasoline and a special combination design provided for kerosene. The exhaust outlet is fitted with an expansion joint and the manifolds are placed on the valve side of the engine.

Regarding accessories, provision has been made for attaching starting and lighting equipment and for ignition by a magneto driven from the end of the water pump shaft or battery ignition by timer which can be mounted on the water pump driveshaft housing. A governor pedestal mounted behind the rear cylinder carries a vertical shaft driven by the camshaft. All of the accessories can be readily reached and detached. The engine complete weighs 646 lb. with flywheel.

New Oil-Proof Felt Washer

AN oil-proof washer for use on shafting protruding from machinery casings on automobiles, etc., has been perfected by the American Felt Co. It consists of two layers of felt with a layer of a patented compound between.

It is claimed that this laminated washer, after many months of tests in axle housings and other places, has proved to be an effective dam in stopping oil seepage and leakage, and has been used successfully in two other industries, the laundry and the bakery machine industries. In laundry machinery this washer is said to have proved an effective preventative against oil leaking into the vats, and in bakery machinery it prevents oil from leaking into flour and mixing vats. Oil leakage is very annoying, especially in connection with the rear axles, and it is to be hoped that this washer may prove the remedy for this trouble.

German Car of Novel Design Employs Many Aluminum Parts

Uses a six-cylinder, 2.44 by 5.51 in., aluminum alloy engine with thin steel liners cast in the block. The outstanding features are an automatic gear-shift, and rear axle housing casting and pistons of silumin. Although the chassis has a 137 in. wheel base it is said to weigh only 1870 pounds.

By Benno R. Dierfeld

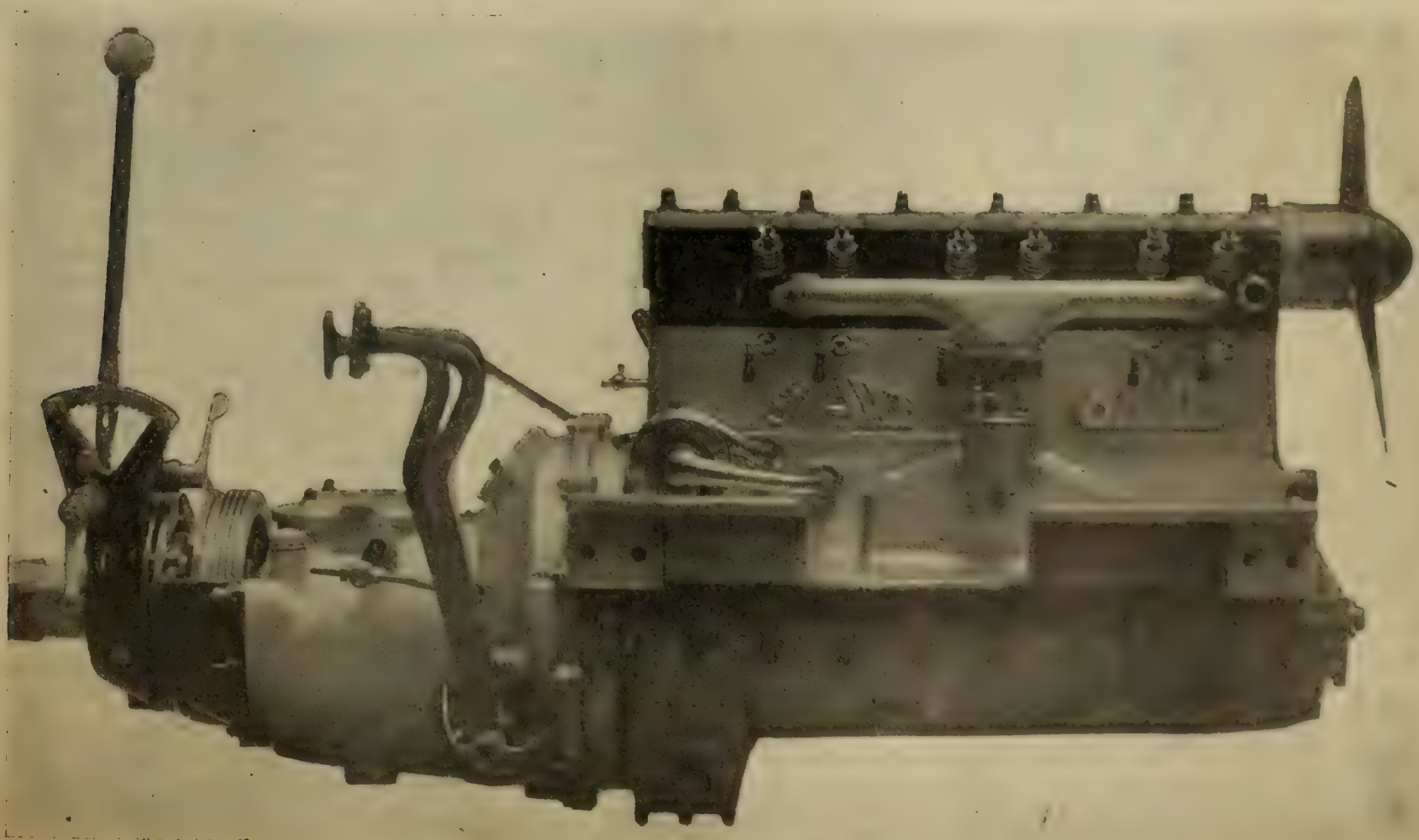
THE Szawe, a high-powered, quality car built principally for export trade, is the product of the firm of Szabo & Wechselmann of Berlin. It was designed by Dr. Bergmann, a consulting engineer, formerly chief designer of the Bayerische Motoren-Werke and the N. A. G. It is claimed to be the first German car into the construction of which light alloys enter to a large extent.

The chassis is laid out to meet fully the requirements of body builders. As will be seen from the views of the chassis, the side members of the frame are straight from end to end, there being no insweep at the front. All of the mechanical parts behind the dash lie beneath the top plane of the frame, so that there is a plane surface, bounded by straight lines, for the body builder to work on. The front springs are semi-elliptic, while the rear springs are of the cantilever type and of great length, which results in an unusual length of frame (110 in.) back of the dash.

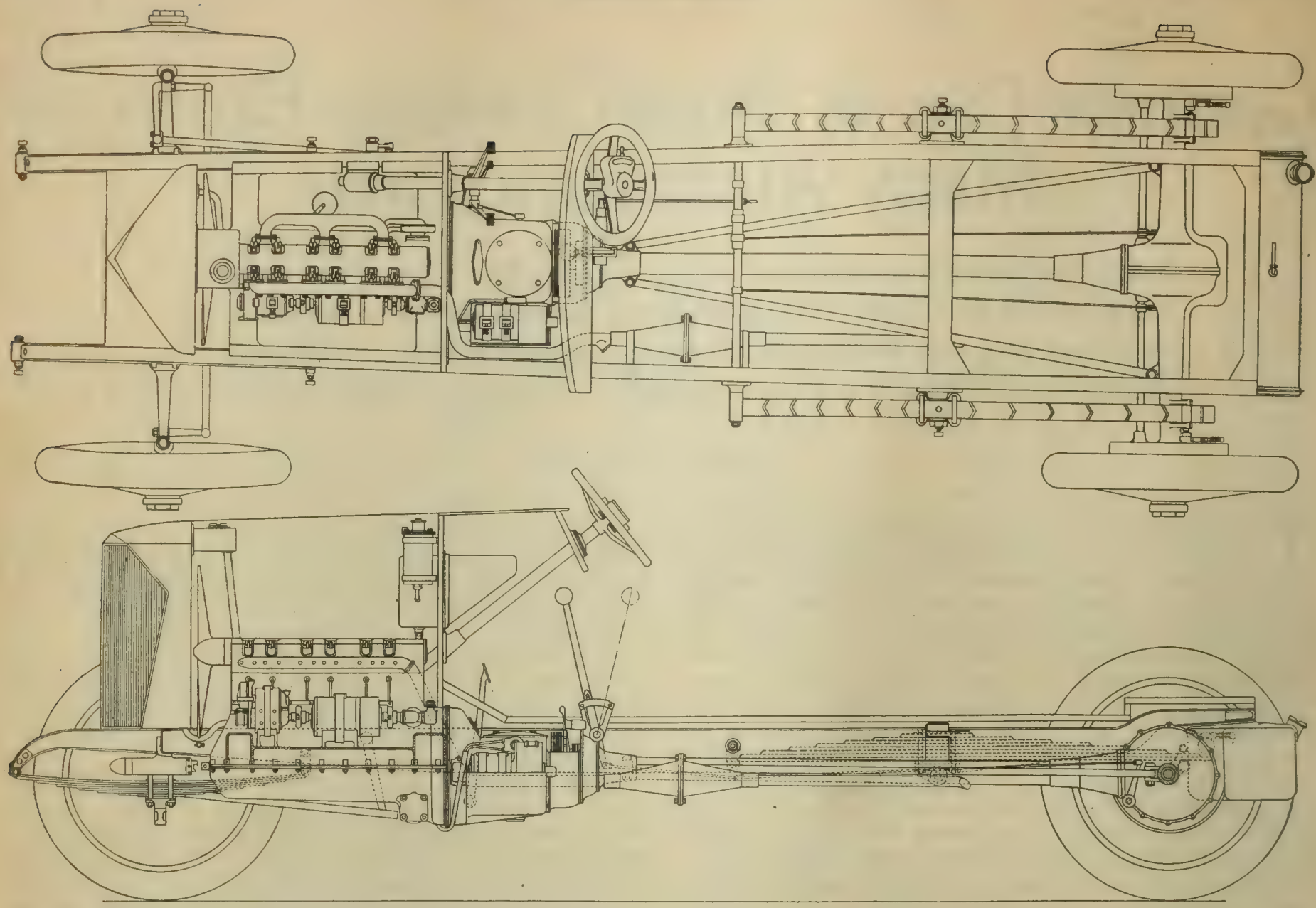
The cylinders and top part of the crank case are cast as a unit in a block of silumin, an alloy of silicon and aluminum, with thin steel liners cast in the block. The bore is 62 mm. and the stroke 140 mm. (2.44 by 5.51 in.), the length of stroke thus being greater than twice the bore. It is claimed that at 2,400 r.p.m. the engine develops 50 hp.

An interesting feature of the engine is the patented piston, which is also of silumin. As may be seen from the sectional view of the engine, the combustion space is not surrounded by water-cooled walls, but is mainly in the hemispherical cavity of the piston head. At the moment of highest temperature, and therefore of maximum heat loss, the combustible gases are not in direct contact with water-cooled walls, and it is claimed that this results in a material increase in fuel economy. Overheating is prevented by the high heat conductivity of the silumin, the heat absorbed by the piston being conducted to the lower, cool part of the cylinder walls.

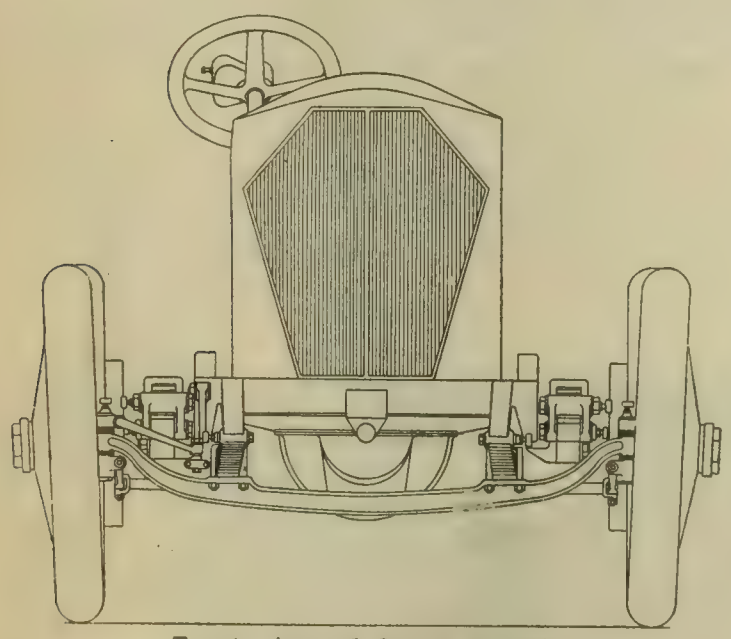
The upper end of the connecting rod is secured to the hollow piston pin, which has bronze bearings in the piston bosses. Lubrication of these bearings is effected



Powerplant used in Szawe car



Plan and side elevation of the new German Szawe chassis



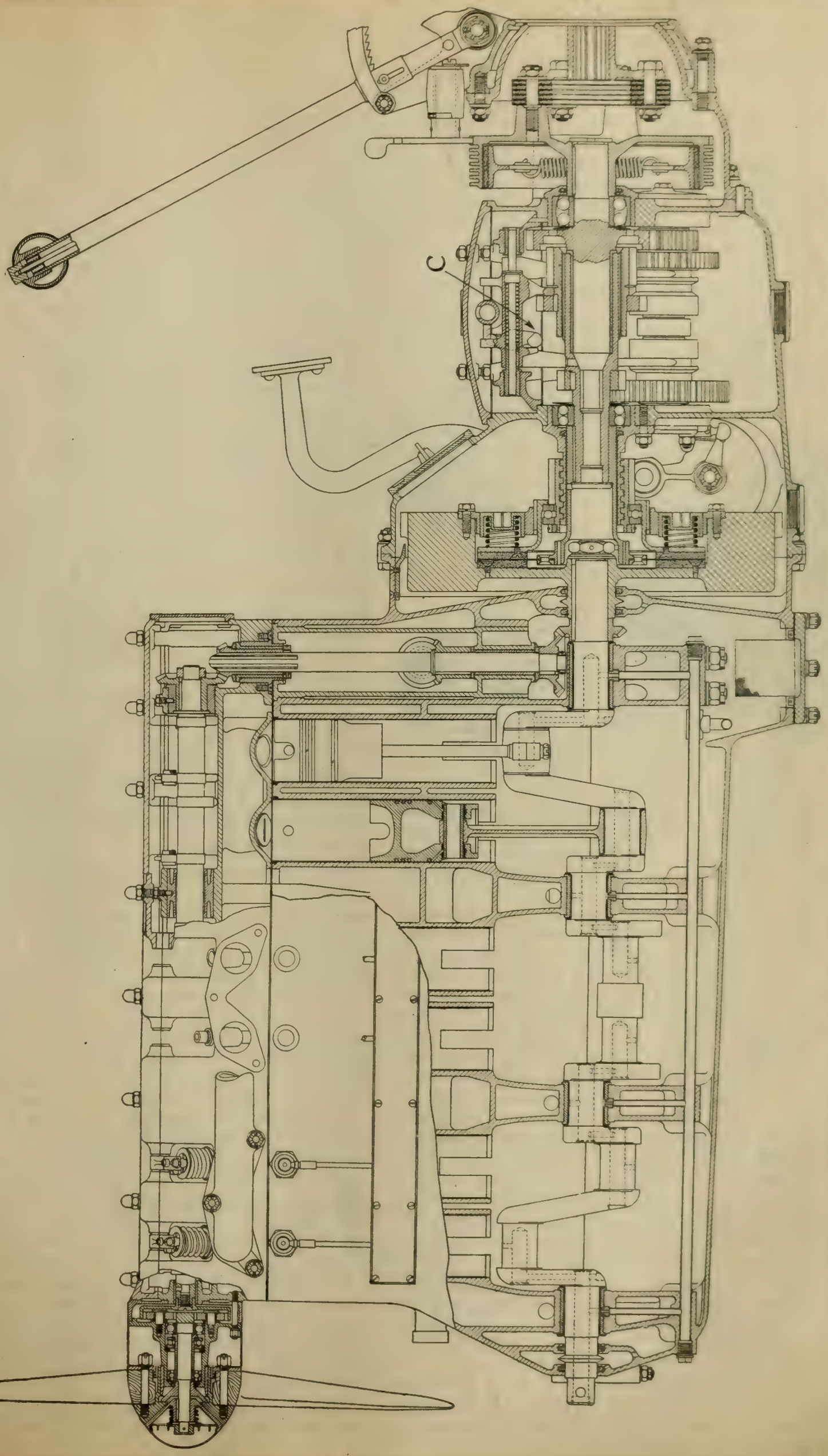
Front view of Szawe chassis

through inclined holes from an oil groove on the piston immediately below the lowest piston ring groove. The crankshaft is supported in four babbit bearings.

The valves are inclined toward each other at an angle of 60 deg. in the detachable cylinder head, and are operated by means of rocker levers from a common camshaft, which is driven from the crankshaft through a vertical shaft and bevel gears at the rear end of the engine. The camshaft drive is completely enclosed and arranged in such a manner that the timing is not disturbed when the cylinder head is taken off. The inclined position of the valves, together with the concave piston head, results in a substantially spherical combustion space, which makes for high thermal efficiency. The relatively long piston stroke tends further to cut down the area of wall surface to which the hot gases are exposed during the early part of the power stroke, and thus to increase the thermal efficiency. Notwithstanding the long stroke, the engine is comparatively low, and no annoying vibration is experienced.

All parts of the lubricating system, including the piping, are arranged in the lower part of the crankcase. Lubrication is by what is known as the dry crankcase system, that is, there is no supply of oil in the crankcase. Similar systems are used on some aircraft engines. A four-part oil pump is fitted, to insure uniform supply of oil to all wearing parts without over lubrication of any one part. The oil pump is located in a depression in the bottom half of the crankcase and is driven through a worm gear. On the pump shaft there are three eccentrics, two of which operate a differential or stepped pistons, while the middle eccentric operates the piston valve for the pump. The main pump piston delivers oil under high pressure to all of the main bearings of the crankshaft. From the rear bearing the oil ascends through a cast-in copper tube to the cylinder head, flows through the hollow camshaft to the camshaft bearings and cams, and on its return to the oil pump inlet passes through the bearings of the vertical driving shaft. The crankpin bearings are lubricated through the hollow crankshaft.

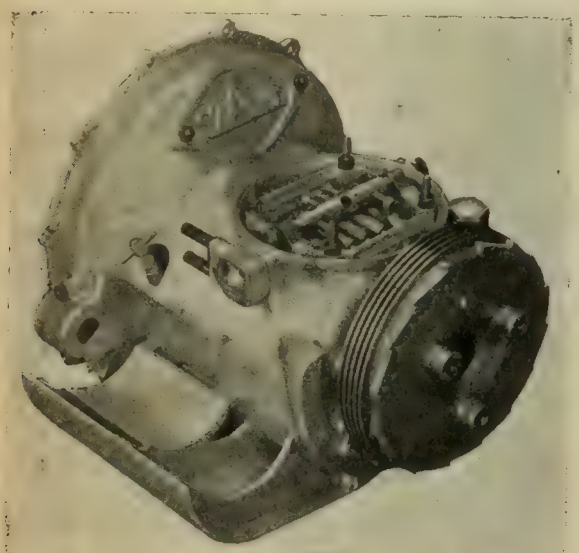
If, while driving downhill for extended periods, a considerable amount of oil collects in the forward part of the crankcase, a second pump piston draws this oil back to the oil well in which the pump is located. A third, smaller pump piston draws oil from an oil tank located above the oil pump and delivers it to the engine system



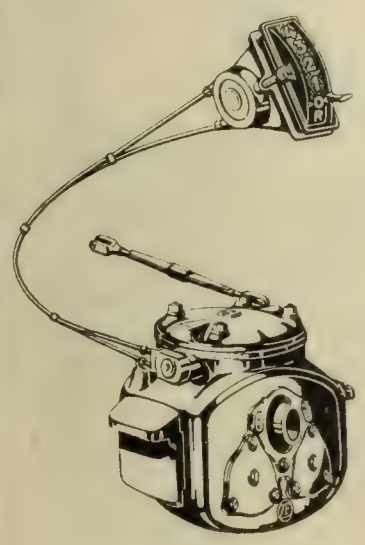
Sectional view of the powerplant used in the new Szawe chassis. Note unusual construction employed to disengage clutch by use of coarse threaded rotating sleeve

to make up for oil consumed. The fourth piston serves to maintain the level in the oil sump where the pump is located, pumping all excess back to the oil tank. By this ingenious arrangement the engine gets only as much oil as is necessary for good service and over-oiling is prevented.

Continuous webs are formed between the crankcase arms, extending from the crankcase to the frame side members, thus rendering a sheet metal underpan unnecessary. The generator and magneto are located on the left side of the engine. These are driven by bevel gears from the vertical shaft. The water pump is located on the right side of the engine and is also driven by bevel gears from the vertical shaft. The fan is driven at twice crankshaft speed from the front end of the camshaft by an enclosed planetary drive. The rotary speed (4800 r.p.m.) and large fan diameter called for a special design. A two-bladed wood propeller of the same shape as an airplane propeller, with a paraboloidal hub to prevent air eddies, is used. The high position of the propeller results in a better utilization of the free space



Semi-automatic Szawe gearset



Bowden wire selector device

above the engine. In consequence of the good fan efficiency, the high pressure centrifugal pump, and the good heat conductivity of the cylinder and piston material, the compression ratio of the engine could be made unusually high.

The carbureter is a vertical type Zenith. Air flows through the crankcase bearing walls around all bearings, and through cast passages to the carbureter. In abstracting heat from the bearings the air is slightly preheated, while at the same time the bearings are cooled.

The dry plate clutch has a driven plate of thin steel sheet of such a small mass that a clutch brake is not necessary. Six small springs produce the necessary pressure. The plates are lined with Ferodo-asbestos, interlaced with copper wire. No clutch release levers are used, their place being taken by a large screw, by which means back lash is avoided and smooth starting insured.

The gearset has four speeds and reverse, and is of entirely new design, the gears being shifted automatically and the gear lever dispensed with. The design is by Count Soden and the gearset is built by the Zahnradfabrik Friedrichshafen. A diagrammatic sketch of this interesting transmission is shown herewith. It has three shafts (main shaft above) and all gears are continually in mesh, change of gear being effected by means of dog clutches. Gears 1, 2, 3 and 4 are loose on their shafts but can be connected with them by dog clutches. All other gears are firmly secured to their shafts. The first speed is obtained through gears 5, 1, 9, 8, by engaging gear 1 with the corresponding dog clutch. In the same manner, the second speed is obtained through gears 6, 3, 9, 8 and the third gear through gears 7, 4, 10, 8. The fourth speed or direct drive is obtained by engaging pins 11 with holes 12. The reverse is through gears 5, 1, 2, 10, 8 and is obtained by an axial movement of gear 2 with the corresponding dog clutch. Gears 1 and 2 of the two secondary shafts mesh with each other, but gear 5 of the main shaft meshes only with gear 1. The number of gears is 10, the same as in the usual 4-speed gearset, but the secondary gears are distributed between two shafts and the transmission therefore is very short.

Every sliding gear can be shifted individually and is connected by a shifter fork with a shifter bar. The shifter bars are pressed by springs in the direction of engagement, but are ordinarily prevented from moving in that direction by a rotatable shifter cylinder resting against pins of the shifter bar. The cylinder has on its circumference axially offset holes into which only one shifter bar pin can enter at one time, according to the position of the cylinder. When the bar is in position the gear belonging to it is locked.

The shifter cylinder has on one end two projecting pins which are connected through a small worm and bevel gear mechanism and Bowden wires to the pointer and lever of the gear selector on the steering wheel, so that if the selector lever is turned, the shifter cylinder is turned also. The shifter cylinder can be turned only when none of the shifter bar pins are in the locking hole and when it is freed from the spring pressure, resting on the shifter bars. This is effected by connecting the clutch pedal with the camshaft C so that by pressing down on the clutch pedal this camshaft is rotated and all shifter bars are withdrawn at once. The rotation of camshaft C begins only when the clutch pedal is completely depressed.

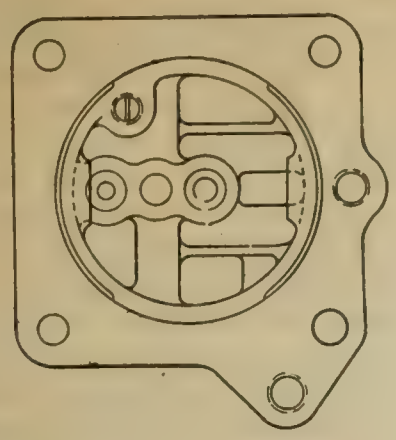
The lever of the gear selector is not rigidly connected with the shifter cylinder, but first operates a spring device, which in turn rotates the shifter cylinder if it is free. Therefore, the effect of the gear selector is preparatory. A pointer on the gear selector informs the driver, which gear is momentarily engaged. Of course, this pointer is rigidly connected with the shifter cylinder.

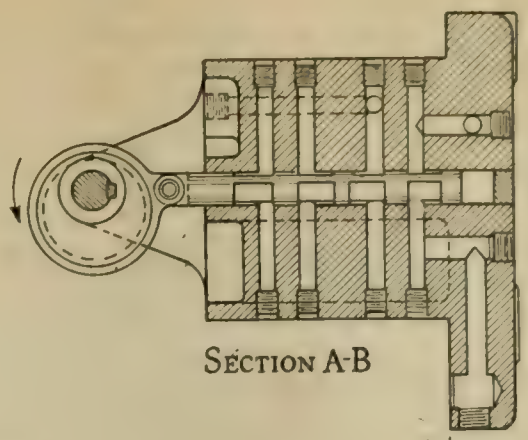
Gearset Operation

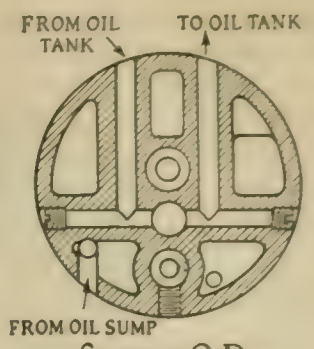
The operation of this gearset is very simple. If, for example, the second gear is engaged, the pointer of the gear selector on the steering wheel stands opposite the 2 on the dial. When the third gear is to be engaged, the lever of the gear selector is turned to 3, the pointer's position being unchanged. The change to the third gear is accomplished by depressing and reengaging the clutch, and can be effected at the most favorable moment, a long time after adjusting the lever of the gear selector, without taking the hands off the steering wheel. The pointer only shows the gear actually engaged. After having set the gear selector for a particular speed it is not necessary, for example, to engage that speed. When driving on second speed with the gear selector set for third speed, it is possible to turn the selector lever directly to the idle running position or to any other gear and then engage the corresponding gear by depressing and reengaging the clutch.

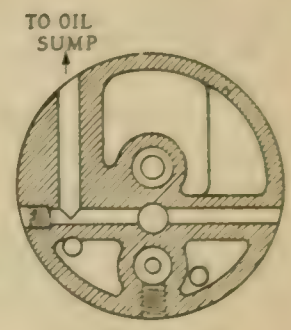
The starting motor is arranged on the left side of the gearset, driving through a spur pinion to the toothed rim of the flywheel. The transmission brake is pedal operated, and has internal shoes lined with asbestos fabric. On the outside of the brake drum there are cooling ribs, and a ratchet type sprag is fitted to the brake drum. Only one universal joint is provided, and that of the leather disk type.

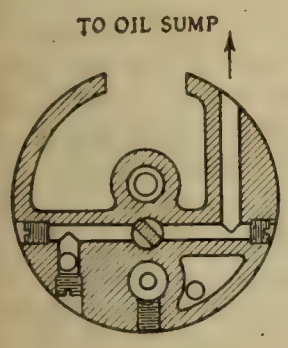
The rear axle housing is of silumin. The rear wheel ball bearings run on steel tubes which are cast in the

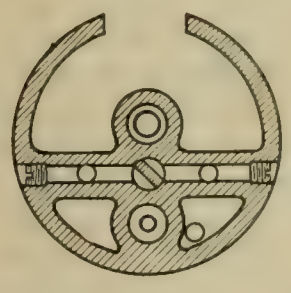


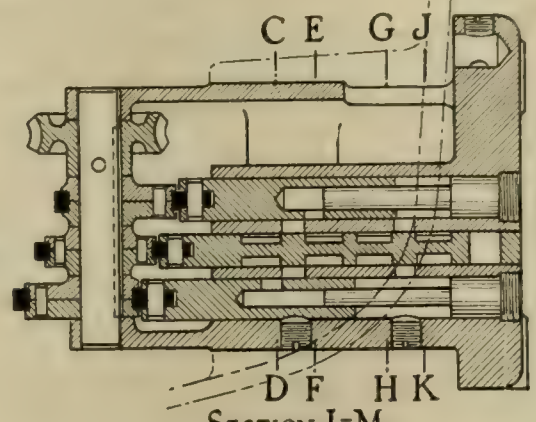


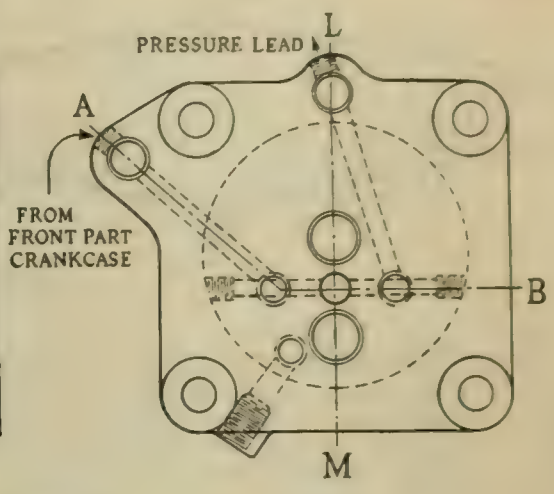




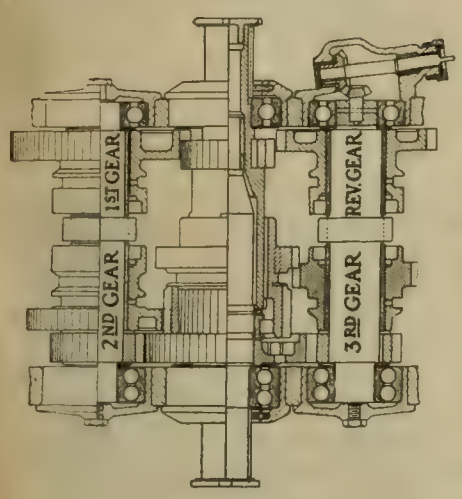


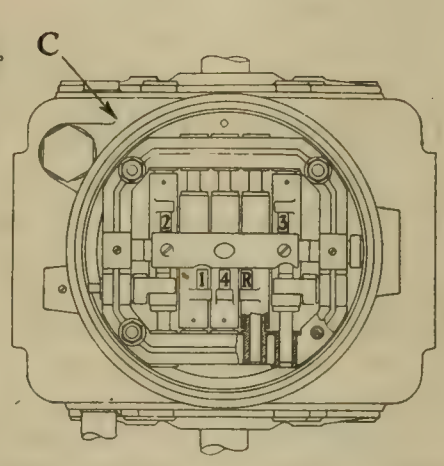


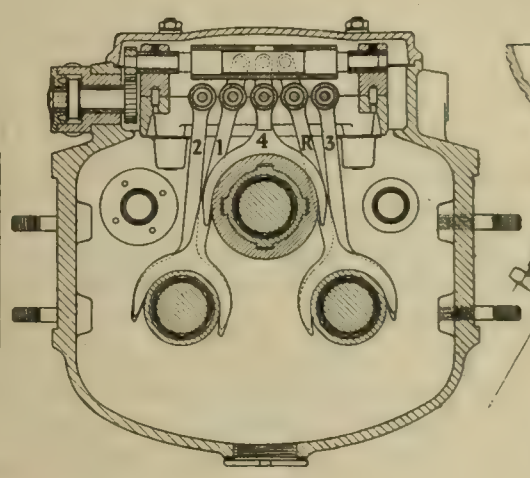


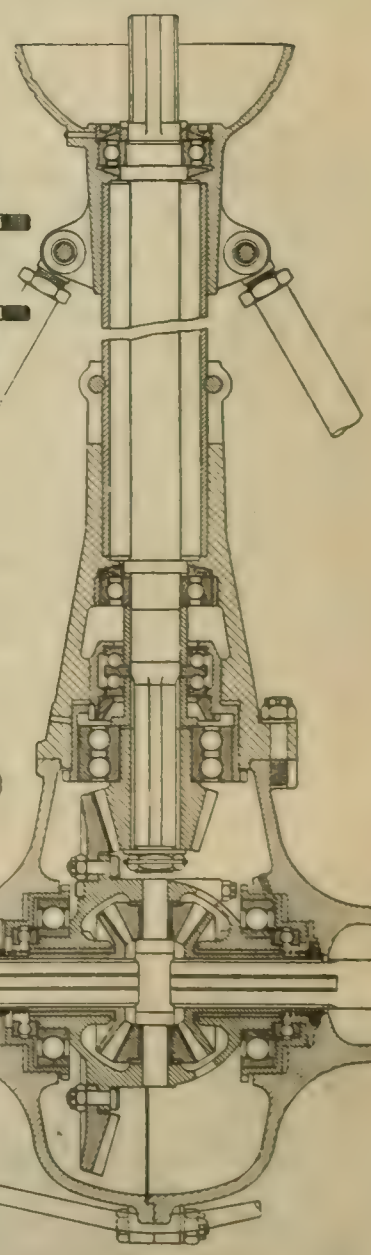


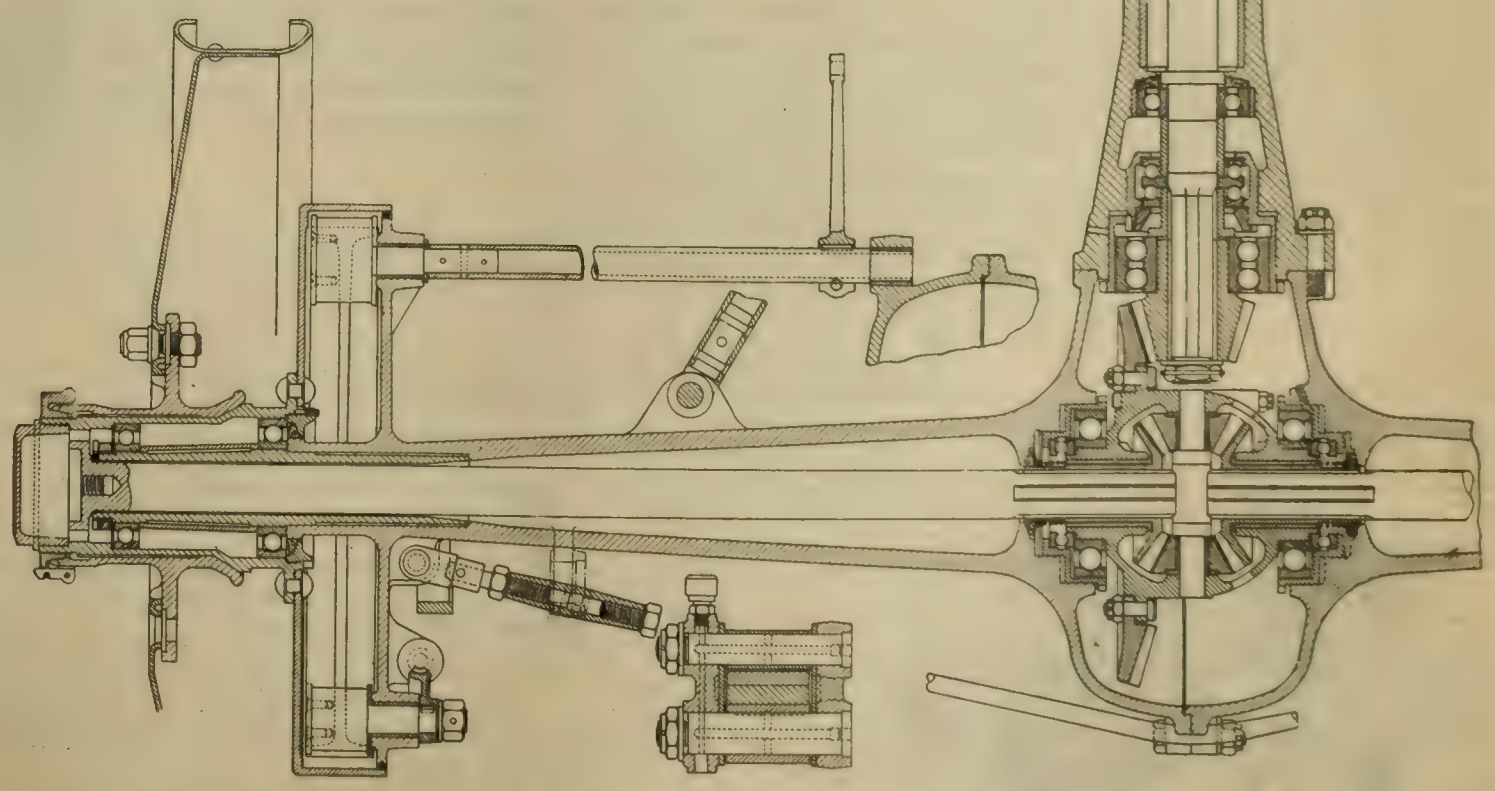
Sectional views of oil pump used on Szawe engine





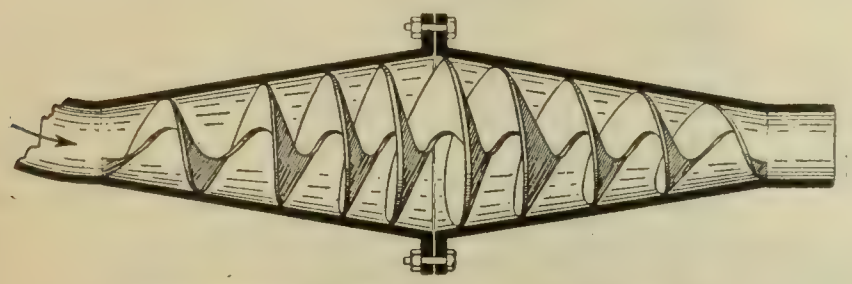






Above, sectional views of gearset and, below, the rear axle with housing of silumin

axle housing and form one piece with it. These tubes extend to a point beneath the rear spring seats, so that the principal bending moment is not imposed on the silumin housing. The rear axle thrust is transmitted by the propeller tube and two radius rods to a ball head at the rear of the gearset. The drive gears are of the spiral bevel type, and the differential is of the bevel gear type. The rear springs are cantilever type, the rear ends of which are carried between lubricated, ground, steel rollers, fastened to the axle case. Ball bearings are used throughout the rear axle. These bearings are not located directly in the silumin case, but in adjustable steel cages,



Novel type of muffler used on Szawe car

so that the thrust bearings do not need to be specially adjusted by inserting steel disks, etc. The axle shafts are subject only to torsional stresses, and can be drawn out from the side. The rear wheel brake is an internal type with toggle mechanism. The steering gear is a screw and nut device of rather conventional design. The front wheels can be turned through the large angle of 40 deg. All joints are lubricated by grease cups, the front wheel hubs run on ball bearings and the steel disk wheels are detachable.

A Pallas fuel feed device is placed on the dashboard. Fuel is delivered from the rear main tank to the carbureter through the front auxiliary tank. The front tank, of about 10 gal. capacity, is always filled, which is of importance in driving in mountainous districts where long upgrades may be encountered. From the auxiliary tank the fuel flows by gravity to the carbureter.

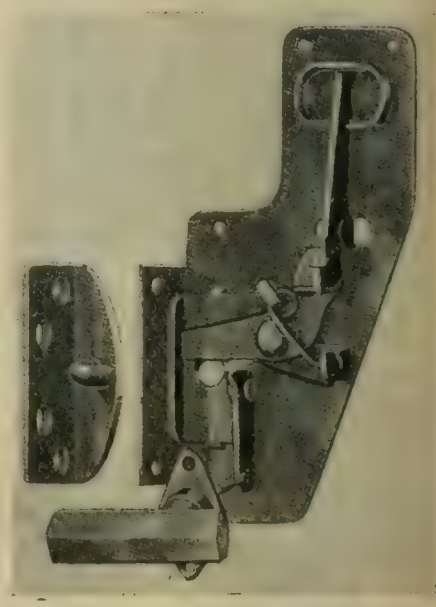
Szawe cars are fitted with the "Johest" muffler, a patented design that is said to be very efficacious. The sectional view of this muffler shows it to consist of a double cone shaped case, containing a sheet metal helix leaving a direct opening at the center. This helix varies in pitch and diameter from the ends toward the middle. The exhaust gases entering at one end flow partly through the central opening and partly through the helical passage. The larger part of the exhaust gases is subject to continuous expansion in the radial and axial directions, on account of the varying diameter and varying pitch of the helix. The result is said to be that the gases leave the muffler at a uniform pressure greatly expanded. This muffler is claimed not to give any detrimental back pressure to damp the noise and cannot be clogged.

Following data relating to the Szawe chassis is of interest:

Wheel base	3,475 millimetres (137 in.)
Tread	1,400 millimetres (55 in.)
Tires (front and rear)	880 x 120 millimetres (37 x 5)
Turning diameter	12 metres (40 ft.)
Seating capacity	6 persons incl. driver
Weight of chassis (without fuel)	850 kilograms (1,870 lbs.)
Speed	100 kilometres 1 hr (62.5 m.p.h.)

An Innovation in Door Locks

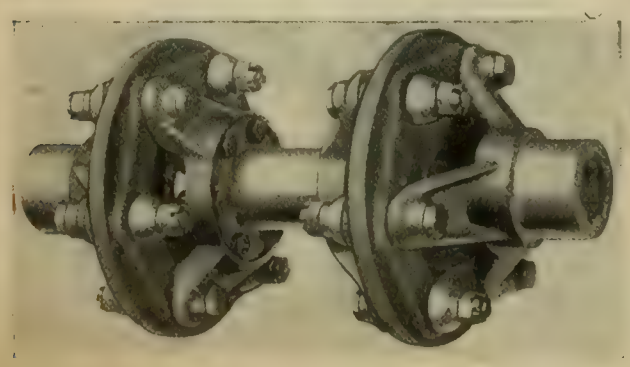
A NOVEL door lock is illustrated herewith, made by the Hooppaw Mfg. Co., who claim for it simplicity, durability and reliability. The lock comprises a keeper having a tapered, notched stud adapted to enter an opening in the lock body-plate. On the latter is a pivotal latch member adapted to engage the notched portion of the keeper stud when the door is closed. The latch member is operated to open the door either by pressing an inside push-botton or by pulling an outside handle, requiring only a slight effort and only one motion in the natural direction of opening the door. The door is positively closed and securely locked without undue force or slamming. Another important advantage is that the keeper stud, entering the opening in the lock body-plate, guides the door into the closed position, and when interlocked with the latch member supports and securely holds the door in every direction. Cutting away or mortising of the door frame is minimized, and the lock body-plate serves as a gusset or reinforcement for the door and at the same time makes it unnecessary to use a supplemental block or frame member for supporting the lock. The locks are made in both right and left-hand models and are furnished with either the inside push-button or outside handle, or both, as may be desired.



Detail of Hooppaw door lock

Cord Disk Universal Joints

A FORM of flexible universal joint which embodies a different type of disk from that which has so far been in common use has been developed by the Climax Motor Devices Co. In the Climax disk raised cord links extend from bolt to bolt, thus adding materially to the strength of the disk, it is claimed. The cords take the stress in direct tension. Only a single disk is used for each joint. Hemispherical bosses are formed at the bolt hole intersections, which are used as driving members. The metal spiders used in conjunction with the disks are formed to fit the disks on one side, and special cup-shaped washers are placed on the other side.



Climax cord disk universal joints

The manufacturer furnishes complete propeller shaft sets as well as double universal joint sets for insertion between the clutch and transmission.

The Pros and Cons of Various Types of Rear Axles for Trucks

A discussion of the advantages and disadvantages of the several types of construction in common use today, followed by an analysis of the stresses in axle shafts and the bearing loads which result under certain limiting conditions of torque and of forward and sidewise skidding of the truck.

By Ethelbert Favary*

THERE are five general types of final drive in use: (*a*) the chain and sprocket; (*b*) the bevel gear drive, with either straight or spiral gears, as mostly used on passenger cars; (*c*) the worm gear drive, which is now the most common type used on trucks; (*d*) the double reduction rear axle, in which two reductions are made between the propeller shaft and the rear axle; and (*e*) the internal gear drive, in which the first reduction is accomplished by bevel gears in the center of the axle, and the second by internal gears in drums or rings attached to the wheels.

Since bevel gears are not, as a rule, practicable for reductions in excess of about 6 to 1, their use on trucks, except on the smaller models, is ordinarily out of the question, for here the final reductions vary from about 6½ to about 14, depending on the capacity of the motor truck and the truck speed.

The chain drive on trucks is used on about 4 per cent of the models manufactured. The chief objection to the use of chains is their exposure to dirt and grit, which in time causes excessive wear and noise. A number of attempts have been made to enclose the chains by covers of some kind, but they gave more or less trouble and were not entirely successful, for provision must be made in the cover for chain adjustment and for the relative lateral as well as the vertical movement of the sprocket centers on account of sidesway and spring flexure. Hence, to-day, most of the chain drives run with the chains exposed and by the employment of hardened chain rollers, pins, bushings and links the wear and the noise are minimized.

Advantages of Chain Drive

Lack of lubrication is by far the most common reason for noisy chains. It is claimed that applying lubricant with a brush to the chains each day, which takes only a few minutes, results in greatly decreased noise and wear, and that with proper care and treatment chains will run from 40,000 to 50,000 miles. This figure is considered far too high by users of chain driven trucks. The following are the principal advantages claimed for the chain drive over the other forms of final drive:

(1) Simplest in construction.
(2) Will stand as much or more abuse than any other type.
(3) Average total efficiency, including the losses in the jackshaft, is as high or higher than that of any other form of drive.
(4) Increased losses due to worn chain and sprockets are very slight.
(5) Easiest form of final drive to repair, as repairs can usually be made on the road with spare links.
(6) Bevel and differential gears are carried on the sprung portion of the vehicle and are thus immune from road shocks.
(7) A substantial load carrying member can be employed, which in the event that it is damaged through accident is not likely to result in damage to the drive shaft and the gears.
(8) The differential gears and the drive shaft can be made lighter than in most of the other types as the maximum torque is produced only at the rear wheels.
(9) The universal joints are arranged to run in line between the transmission and the engine, since both are attached rigidly to the chassis.
(10) Offers the lowest unsprung weight, thus increasing the riding comfort.

*Condensed from a paper presented at the March meeting of the Metropolitan Section, Society of Automotive Engineers.

Chain Drive on Heavy Trucks

Some firms use the chain drive exclusively for their heavier models but give the purchaser the option of a chain drive or a double reduction drive in the smaller sizes. The former offers a greater road clearance than the live-axle type of drive and a much greater range of gear-ratio changes than any other type. In the Mack truck, for instance, gear ratios can be made from 6½ to 1 to 14 to 1, without altering anything but the sprockets and perhaps adding or taking out a link or two of the chain.

In addition to greater wear and noise, chains will require more frequent repairing and renewing than the gears of the worm or bevel drives. When sprockets are worn until they are hooked, or until the true form has been destroyed and the teeth are slightly hooked at the ends of the driving side, they will cling to the chain as it leaves the sprocket and are then pulled away violently. It is claimed that this fault can be remedied by some forms of sprocket design. The chain drive is superior to the worm drive under heavy load and torque and only slightly less efficient than the worm under high speeds and light loads.

In the internal gear driven axle, first a bevel reduction is provided between the propeller-shaft and the rear axle, as in most passenger cars, and to obtain a further reduction at the end of the live axle near the wheel or in the hub small spur gears mesh with internally cut gears attached to the wheel.

One of the advantages claimed for the internal gear driven axle is great strength, since it permits the use of a solid, one-piece load carrying member, usually a drop forging of I-section or a round axle made from bar stock. Sometimes the load carrying member is flattened and shaped in the center to encompass the differential housing, while in some designs the live axle is within the load carrying member. Other advantages are (*a*) this axle can be made lighter than the worm gear type, since the

jackshaft and the differential run at a lower torque than in the worm drive axle, the great speed reduction being made at the wheel, while the reduction at the bevel gears in the center of the axle is usually less than 2 to 1; (*b*) the internal spur gears and pinions are mounted on fixed centers and require no adjustment; and (*c*) the cost is low, while the efficiency is high and fairly constant at all loads.

One of the serious problems with most of the internal gear axles is the proper lubrication of all the parts of the drive, although it is claimed by its sponsors that this drive can run with very little lubrication. The large diameter at the ring gear gives plenty of opportunity for the grease to leak out around the edges of the gears and onto the brake. However, some types run in a constant bath of oil, and the joint is not close to the large diameter of the ring gear, but nearer the center. Another objection against the internal gear is that it is more difficult to provide the double internal brakes on the wheel. Even where the internal brake is used, considerable difficulty is experienced with the rise in temperature due to the application of the brakes, which may cause the lubricant to melt or burn. At present the tendency is to use internal rather than external brakes, as the latter form is exposed to dust and grit. The internal gear, as usually constructed, cannot be made in the semi floating construction, thereby eliminating the use of this design where the bearing pressures can be considerably reduced over those in the full floating type.

Disadvantages of Internal Gear Axle

Opponents of the internal gear axle further claim that it has several fundamental defects. In most of the internal gear types the load carrying member is the dead axle, but in some a central live member is inside the dead member, one or more extra idler gears being inserted between the jackshaft pinions and the internal gear rings in the wheel hub. In all internal gear axles the internal gear is carried by the wheel, or else in the wheel hub between bearings, and all wheels will develop a certain amount of play, since they have to take the road shocks. They will therefore not continue to run perfectly true, and the gears will not maintain their exact relation. If the gears run out of alignment with each other, instead of on a line contact, the contact will take place only on a point, under which condition gears cannot wear well or run silently nor transmit the power efficiently, for the slight play in the wheel will cause them to rock to and fro slightly.

In most internal gear axles the wheels are mounted on some form of dead axle while the jackshsaft, running parallel, is either in front of or behind it and encased in a separate housing, whose only function is to retain the live member. If axis of shaft and dead axle do not retain their parallelism, there is an additional tendency to throw the gears out of alignment. The torque reaction tends to revolve the jackshaft about the dead axle and is restrained from doing so only by the security of the end fastenings and by the rigidity of the dead axle against twisting. If the torque were always equal at both ends of the jackshaft, the twisting moments would be balanced, but since the traction of the two wheels is not absolutely equal, varying greatly at times, the torque stress on the axle is not equal on both ends. It is therefore claimed by opponents that this inequality of torque upsets the absolute parallelism of the two members, which will have a tendency to throw the pinions out of alignment with the internal gears.

In some constructions the load is carried on the dead axle, the jackshaft being perfectly free, not centrally supported; hence it is not deflected when the axle is deflected, and this will have a tendency to pull the gears out of line and cramp the pinion bearings. Sometimes means are provided to take care of the deflection by providing a universal-joint in the jackshaft, as in the rear axle of the De Dion-Bouton Co., and the Rochet-Schneider Co. of France. This, on the other hand, introduces a more complicated mechanism and a larger number of parts.

The type that has a separate dead axle weighs more for a given strength, since the larger outside dimensions of a hollow tube offer more strength with less weight; hence for the same factor of safety a solid axle is heavier than one of tubular construction. However, against the disadvantages enumerated is the fact that over 22 per cent of the models of trucks built in this country employ the internal gear drive and among its adherents are some of the well known companies.

The Worm Drive Axle

The worm and worm gear are usually assembled in a unit and then attached to the axle housing. In this axle the road shocks or stresses, except those coming through the driving axle, do not tend to disturb the alignment of the worm gear. Provisions should be made for preventing the oil in the center of the housing from running out through the hubs. Oil retainers are sometimes used on both the axle shafts and the wheel hubs for this purpose. A vent pipe in the rear axle housing will assist in overcoming oil leaks. Adherents of this axle claim that its average efficiency is very high and that a truck equipped with a high ratio will coast quite freely.

The great advantages claimed for the worm gear axle are the perfect mechanical enclosure of the final drive which is running in a bath of oil, and its practically noiseless operation. Even the wheel bearings are lubricated from the center housing, and when proper provisions are made there is no danger of the lubricant saturating the brakes. When the housing is filled with a suitable oil, the latter will last up to 5000 miles. Due to the perfect enclosure, dirt and grit are positively prevented from reaching the mechanism. Worm gear axles are frequently equipped with double internal brakes, a construction which affords excellent protection against dirt and grit. It is claimed that wheel brakes are more satisfactory than propeller-shaft brakes, for with the latter the stresses in the drive-shafts and the gears are considerably greater than when wheel brakes are employed, the torque arising from the locking of the wheels of loaded trucks being much higher than that of the engine.

Advantages of Worm Gear

Other advantages claimed for the worm gear are (*a*) its great simplicity, it having the fewest number of parts; (*b*) it is possible to obtain any desired reduction with two pieces, the worm and the worm wheel; (*c*) it is possible to obtain an almost straight drive from the engine to the rear axle; and (*d*) its durability is very great. It is better to have the weight in the center of the axle than at the axle ends, for when one wheel rises, or hits an obstruction and is thrust upward, the upward acceleration in the center of the axle will be only one-half of that at the wheel; hence the stresses induced will be smaller, and the action will be more like that of a smaller unsprung weight than if the weight were at the wheels.

Opponents of the worm gear claim that (*a*) it is a highly efficient power transmission gear only under certain conditions, for under a heavy torque a worm gear has a very low efficiency, while at high speed under light load, its efficiency is high; and (*b*) in coasting there is a certain amount of friction in the worm and the gear. Tests made by the International Motor Co. showed that trucks equipped with a worm drive did not coast as well as other types; hence, it is claimed, that even though the worm

may be more efficient than the chain under certain conditions, its average efficiency throughout the range of conditions encountered in service is lower.

The most vulnerable part of the worm drive is the bearing, which takes the enormous thrust exerted by the worm. In some axles ball bearings are provided at this point; others are equipped with taper roller bearings. Since the worm must be carried on the top to obtain sufficient road clearance, the worm bearings can be lubricated only by the oil carried up or thrown up as the worm wheel rotates. When this runs at a low speed, sufficient oil is not always carried to the top. To provide sufficient lubrication special means, like oil troughs, are sometimes fitted inside the worm wheel housing to catch the oil and lead it to the bearings. The worm drive is more expensive than other forms, but it is claimed that the maintenance cost is considerably less. When the pressure on the worm is not too high, the gears properly cut and the lubrication adequate, the film of oil is not squeezed out from between the surfaces, and there is very little friction. However, when the pressure is excessive and the oil is squeezed out, considerable friction exists and damage may result in a short time.

Another reason for rear thrust bearing failures is that the necessary play in the worm takes the form of a blow on the thrust bearing whenever the clutch is thrown in or speed changes are made. While taper roller bearings or ball bearings can withstand high pressure, they cannot withstand impact very well. Trouble with thrust bearings may also be caused by improper clearances, which, under excessive strain or deflection, cause an increase in the temperature with a consequent elongation of the worm. In the worm drive the torque induces pressure on comparatively small surfaces of the teeth, which rub one on the other, while with toothed gears or chains and sprockets there is more of a rolling contact than pure friction.

Some manufacturers claim that torque arms and radius rods impose additional stresses on the worm; hence they advocate the Hotchkiss drive. With this a cushioning effect is imparted to the drive as the springs permit the axle to rock back slightly in starting, thereby reducing the pressure on the worm teeth when the car is first started and the torque is high. It is also claimed that it permits the worm and the wheel to oscillate, thereby working more oil between the surfaces than is possible with a rigid drive. On the other hand, opponents of the Hotchkiss drive in connection with worm gears claim that they must put extra weight into springs when the latter are used to perform the functions of the torque and radius rods, and wherever satisfactory results are obtained with the Hotchkiss drive the springs must have a greater factor of safety. I believe that the Hotchkiss drive when properly designed gives satisfaction, even though the springs are relied upon to perform more severe functions. While many objections are brought forward against the worm drive, 68 per cent of all the truck models manufactured in the United States use this type of final drive.

The Double-Reduction Drive

In the double reduction rear axle two reductions take place between the propeller-shaft and the live axle. The first reduction is by a pair of bevel gears and the second by a pair of spur gears, or vice versa. Instead of straight bevel or spur gear teeth, helical teeth can be employed.

The advantages claimed for this type are (*a*) simplicity of construction, in that only comparatively small bevel and spur gears are employed, which lend themselves easily to quantity production; (*b*) all the gears are perfectly enclosed and protected from dust and grit, and run in a bath of oil; (*c*) its average efficiency is as high as that of any other drive and is substantially constant under all speeds and loads; and (*d*) the gears will always remain in alignment and are silent in running when well fitted.

The disadvantages cited against this drive are (*a*) an increased number of parts over the worm gear drive; (*b*) it is heavier than the internal gear and the chain drive, since the live axle has to carry the entire torque; and (*c*) it is more costly to manufacture.

Semi Floating Axles

By calculating the bearing loads and the shaft stresses of semi-floating and full-floating axles we will be in a position to determine their merits and demerits.

To find the bearing loads and the shaft stresses in semi-floating rear axles three distinct conditions must be considered. These are

(1) The maximum torque plus the normal radial load on the wheel.
(2) The wheel locked and skidding forward when the brakes are applied.
(3) The wheel skidding sidewise while the truck is running.

For example, a certain high grade truck axle has a

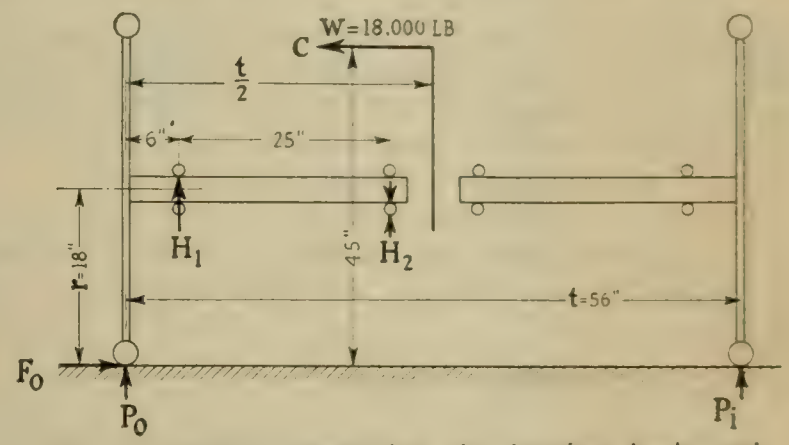


Fig. 1—Diagram illustrating the bearing loads and shaft stresses in a semi-floating axle

maximum total reduction of 49.61; the maximum horsepower is 50 at 1000 r.p.m. and the load on each rear wheel is 9000 lb. The torque in the rear axle shaft with a transmission efficiency of 85 per cent, and running in low gear is 132,850 lb-in. or one-half this amount, 66,425 lb-in., in each half of the rear axle shaft. On the other hand, if a transmission brake is employed or if the engine is speeded up and the clutch thrown in suddenly, causing the rear wheels to slip on the ground, the maximum force at the periphery of the wheel is $0.6 \times 9000 = 5400$ lb., 0.6 being the coefficient of friction between the tire and the road surface, and if the wheel diameter is 36 in., the torque in each half of the shaft is $18 \times 5400 = 97{,}200$ lb-in. However, we will not consider these conditions, for in our example no propeller-shaft brake is employed, and steel can stand a large momentary occasional overload without serious damage.

The shearing or torsional stresses in the shaft can be found from the well-known formula

$$S_s = T/J$$

where

J = the polar section modulus
S_s = the shearing stress in pounds per square inch
T = the torque

The diameter at the weakest point of the axle, which is close to the inner bearing, is 2.4375 in. The polar moment of inertia at this point is 0.1963 times the cube of the diameter. Substituting these values in the formula for the shearing stress, we have

$$S_s = 66{,}425 \div [0.1963 \times (2.4375)^3]$$
$$= 23{,}390 \text{ lb. per sq. in.}$$

At the outer bearing the shaft is 4 in. in diameter and the stress due to torsion at this point calculated from the formula is approximately 5280 lb. per sq. in.

We will now consider the bearing loads and shaft

stresses due to the bending moments. Under ordinary running conditions the radial load on each wheel is 9000 lb.; the distance between the bearing centers is 25 in., and between the outer bearing and the center of the wheel 6 in. approximately as shown in Fig. 1. If H_1 is the reaction or the radial load on the outer bearing, and H_2 that of the inner or the differential bearing, and if the radial load on the wheel is designated by P, then, taking moments about the outer bearing, we have

$6P = 25H_2$, hence $H_2 = (6 \times 9000) \div 25 = 2160$ lb.

Taking moments about the inner bearing,

$$31P = 25H_1, \text{ and } H_1 = (31 \times 9000) \div 25 = 11{,}160 \text{ lb.}$$

The bending moment in the shaft, 1 in. from the inner bearing, is 2160 in.-lb., increasing toward the outer bearing, where it is $2160 \times 25 = 54{,}000$ in.-lb.

The tensile and compressive stress S of a shaft is found from the formula

$$S = B/Z$$

where

B = the bending moment
S = the tensile and compressive stress of a shaft
Z = the section modulus

The section modulus, not the polar section modulus, of a round shaft is 0.098 times the cube of the diameter. Near the outer bearing of the shaft the diameter is 4 in. Substituting in the formula, we have

$$S = 54{,}000 \div [0.098 \times (4)^3] = 8600 \text{ lb. per sq. in.}$$

Near the inner bearing the diameter is 2.4375 in. and by substitution in the formula we find the stress equals 1523 lb. per sq. in.

Torsional and Bending Stresses

To find the stress in a shaft subjected to torsion and bending stresses, we may make use of an equivalent twisting moment T_c, which would create the same stress in the shaft as that due to the combined twisting moment T and the bending moment B and is equal to the square root of the sum of their squares. Near the inner bearing

$$T_c = \sqrt{[(2160)^2 + (66{,}425)^2]} = 66{,}500 \text{ in-lb. appr.}$$

almost the same as that found for the twisting moment only. At the outer bearing

$$T_c = \sqrt{[(54{,}000)^2 + (66{,}425)^2]} = 85{,}000 \text{ in-lb. appr.}$$

The stress in the shaft at the outer bearing is therefore

$$S_s = T_c \div J = 85{,}000 \div 12.56 = 6570 \text{ lb. per sq. in. approximately}$$

While at the inner bearing

$S_s = 66{,}500 \div 2.84 = 23{,}400$ lb. per sq. in. approximately,

showing that the stress in the shaft is much greater near the inner bearing.

The material used for this shaft is S.A.E. Steel No. 2340, which, if heat-treated to a Brinell hardness of 335, or a scleroscope hardness of 51, has a tensile-strength of 175,000 lb. per sq. in. and an elastic-limit of 150,000 lb. per sq. in. The shearing strength of steel is approximately 85 per cent of its tensile-strength or

$$175{,}000 \times 0.85 = 149{,}000 \text{ lb. per sq. in.,}$$

while the transverse elastic-limit or the elastic limit in shear is approximately 35 per cent of its ultimate shearing-strength, and this should be considered when finding the factor of safety. Therefore, the elastic-limit in shear equals

$$149{,}000 \times 0.35 = 52{,}150 \text{ lb. per sq. in. approximately.}$$

Very few data seem to be available as to the elastic-limit in shear of various steels, but at the weakest portion of the shaft the factor of safety is

$$52{,}150 \div 23{,}400 = 2.23 \text{ approximately}$$

under normal conditions, when running in low gear.

Next we will investigate the bearing loads and shaft stresses when the brakes are applied and the wheel is locked and sliding forward. In this case there is a horizontal force at the periphery of the wheel equal to the vertical or normal load of 9000 lb. resting on it multiplied by the coefficient of friction 0.6, as was mentioned before, or 5400 lb. The two forces, the vertical and the horizontal, act at right angles to each other. The resultant radial load R on the wheel due to these two forces is equal to the square root of the sum of their squares or 10,500 lb. If we call the reactions or bearing pressures in the outer and inner bearings H_1 and H_2 respectively, by taking moments about the outer bearing we have

$$6R = 25H_2,$$

from which

$$H_2 = 6R \div 25 = (6 \times 10{,}500) \div 25 = 2520 \text{ lb.}$$

Taking moments about the inner bearing, we have

$$31R = 25H_1;$$

hence

$$H_1 = (31 \times 10{,}500) \div 25 = 13{,}000 \text{ lb.}$$

The bending moment near the inner bearing is 2520 in-lb., and near the outer bearing it is

$$25 \times 2520 \text{ or } 6 \times 10{,}500 = 63{,}000 \text{ in-lb.}$$

Then, since $S = B/Z$, at the inner bearing

$$S = 2520 \div 1.418 = 1770 \text{ lb. per sq. in.}$$

and at the outer bearing

$$S = 63{,}000 \div 6.28 = 10{,}000 \text{ lb. per sq. in.}$$

approximately, the values for Z at the inner enr of the shaft being 1.418 and at the outer end 6.28 as found before. It is seen, therefore, that under these conditions, with the wheels locked and sliding forward, the stresses in the shaft are very low, especially in view of the fact that the shaft is subjected to bending stresses only. The material is in tension and compression, and its elastic-limit is 150,000 lb. per sq. in.

Stresses Due to Side Skids

We will now consider the bearing loads and shaft stresses resulting from skidding sidewise when turning a corner at a certain speed. Under these circumstances the centrifugal force F_c, which causes the rear of the truck to skid, will equal the coefficient of friction, 0.6, multiplied by the total weight, $6W$, carried by the two rear wheels. In this case, therefore, $F = 0.6 \times 18{,}000 = 10{,}800$ lb.

Assuming that the center of gravity of the entire load on the rear wheels is located 45 in. from the ground and calling this distance h; that the total pressure between the two rear tires and the ground is designated by P; that P_o is the pressure on the outer wheel and P_i that on the inner wheel when rounding a curve; that the tread, t, is 56 in. and that the radius of the wheel, r, is 18 in., then, by taking moments about the point where the inner wheel touches the ground, we have

$$P_o \times t = (W \times 1/2t) + (F_c \times h)$$

or

$$P_o = 1/2W + [(F_c \times h) \div t]$$

Substituting the assumed numerical values, we obtain

$$P_o = (18{,}000 \div 2) + [(10{,}800 \times 45) \div 56] = 17{,}700 \text{ lb.}$$

The load on the inner wheel will be 9000 — 8700 or 300 lb.

In addition to the radial load, there is a thrust load L_t on the two wheels arising from the tendency to skid; this thrust load is equal to the centrifugal force F_o and is disvided between the two rear wheels in proportion to their radial load. Hence, the thrust load on the outer rear wheel between the tire and the ground

$$L_o = 0.6 \times P_o = 0.6 \times 17{,}700 = 10{,}600 \text{ lb.}$$

Thus the total radial load on the outer wheel is 17,700 lb., and the side-thrust at the bottom of the wheel 10,600 lb. Taking moments about the inner bearing, we have

$$31P_o = 25H_1 + (r \times L_o)$$

or

$$H_1 = [31P_o - (r \times L_o)] \div 25$$

Substituting the corresponding numerical values for the various letters, we have

$$H_1 = [(31 \times 17{,}700) - (18 \times 10{,}600)] \div 25$$
$$= 14{,}300 \text{ lb.}$$

Taking moments about the outer bearing we have

$$6 P_o = 25 H_2 + (r \times L_o)$$
$$H_2 = [6P_o - (r \times L_o)] \div 25$$
$$= [(6 \times 17{,}700) - (18 \times 10{,}600)] \div 25$$
$$= -3384 \text{ lb.}$$

The result is a minus quantity, as the bearing will carry the load on the top, while under normal running it will carry it at the bottom. It should be remembered that the outer bearing also has to carry a thrust load of 10,600 lb.

Knowing the bearing pressures or the reactions we can easily find the bending moments and the stresses in the shaft, as in the last example. The bending moment B near the inner bearing is 3384 in-lb. and near the outer bearing

$$25 \times 3384 = 84{,}600 \text{ in-lb. approximately.}$$

In addition to the bending moment due to skidding, the twisting moment in the shaft due to the drive must be considered. Evidently the truck will have to be in the high gear to travel at the requisite speed to produce skidding; hence the torque will be much lower, but even if the truck were in the low gear, and the torque be 66,425 lb-in., the maximum stress in the shaft would be barely higher than under *straight forward* travel, when in the low gear. If the low gear torque is added, the equivalent twisting moment near the inner bearing is practically the same as that found before, 66,500 in-lb., and the shearing stress equals 23,400 lb. per sq. in. Near the outer bearing the twisting moment has a value of approximately 107,000 in-lb., and the stress is 8550 lb. per sq. in. When skidding sidewise the torque is considerably lower in practice, for the truck would not skid unless it traveled in one of the higher-speed gears, unless the road surface were muddy or slippery, and in such event the coefficient of friction is considerably lower; hence the bending moment would be lower. The maximum stress in shear is therefore near the inner bearing on straight forward travel in the low gear and amounts to 23,400 lb. per sq. in.

Full-Floating Axles

The stresses in the shaft of a full-floating axle are purely torsional or shearing stresses, and if the engine power and gear reduction are as in the last example, the maximum torque will be as found before, 66,425 lb-in. in each axle shaft. If the shaft dimensions are the same as in the previous example, the maximum unit-stress for torsion in the shaft metal would be as that found before, 23,390 lb. per sq. in. In a full-floating axle the shaft dimensions are, as a rule, uniform, not tapered as in the semi-floating type, since the live axle is relieved of all bending moments by the wheel bearings.

The maximum radial load on the wheels, when the brake is applied and the wheels slide forward, is the resultant radial load due to the combined horizontal and vertical forces and is the same as found before, 10,500 lb. If the distance between the bearings is 7 in., as shown in Fig. 2, the inner bearing H_2 is 2½ in. from the wheel center, and the outer bearing H_1 4½ in., then, by taking moments about the outer bearing, we find

$7H_2 = 4.5 \times 10{,}500$, hence $H_2 = (4.5 \times 10{,}500) \div 7 = 6750$ lbs.

and the load on the outer bearing

$$H_1 = (2.5 \times 10{,}500) \div 7 = 3750 \text{ lb.}$$

When the wheels skid sidewise, the bearing loads on the outer wheel are considerably higher. If the centrifugal force F_o that produces the skidding, and the radial load P_o are, as found before, 17,700 and 10,600 lb. respectively, then by the law of moments we obtain

$$7 H_2 = 4.5 P_o + 18 F_o$$

hence

$$H_2 = [(4.5 \times 17{,}700) + (18 \times 10{,}600)] \div 7$$
$$= 38{,}700 \text{ lb.}$$

and

$$7 H_1 + 18 F_c = 2.5 P_o$$

from which

$$H_1 = [(2.5 \times 17{,}700) - (18 \times 10{,}600)] \div 7$$
$$= -21{,}000 \text{ lb. approximately}$$

showing that on the outer bearing the load is reversed from its normal direction. In addition there is a thrust load of 10,600 lb. The results obtained are given in Table 1.

TABLE 1—COMPARISON OF STRESSES AND BEARING LOADS IN SEMI-FLOATING AND FULL-FLOATING AXLES

Type of Axle	Semi-Floating	Full-Floating
Maximum Stress, lb. per sq. in.		
Near wheel	8,550	23,390
Near differential	23,400	23,390
Maximum Bearing Load, lb.		
Outside of wheel	.....	—21,000
Inside of wheel	14,300	38,800
At the differential	—3,384	.....
Thrust load	10,600	10,600

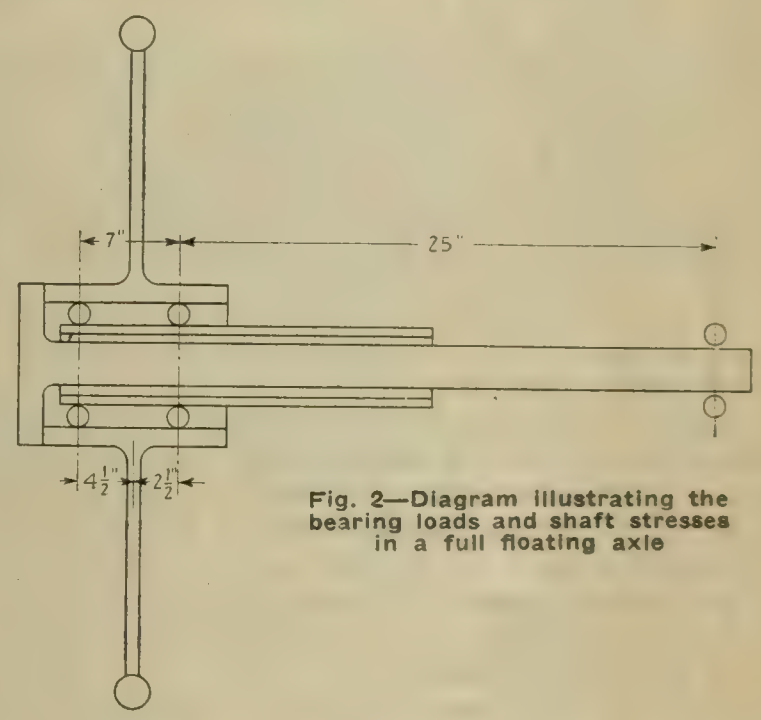


Fig. 2—Diagram illustrating the bearing loads and shaft stresses in a full floating axle

From Table I we can judge that the maximum shaft stresses are practically the same in both designs, but the shaft in the full-floating axle can be made lighter and at less cost since the stress is uniform in the entire shaft and the shaft is relieved of all but torsional stresses. Furthermore, in the semi-floating axle, the bending stresses are continually reversed; therefore a higher factor of safety should be used. The bearing loads in the full-floating axle are considerably higher, which will impose a much greater bending moment on the axle housing. Hence the bearings and the axle housing must be made heavier and thus this axle will be more expensive to manufacture than the semi-floating axle.

Standardization of Axle Parts

Following the presentation of the foregoing paper the chairman stated that the Council of the Society had asked the sections to take a more direct interest in the standards work of the Society, and that for this reason he had requested C. T. Myers of the Truck Division of the Standards Committee to discuss standardization possibilities in reference to rear axles for trucks. Myers thereupon made the following remarks giving his views on this subject:

Myers Suggests Axle Standardization

A casual glance through Favary's paper by an S. A. E. Standards Committeeman will cause him to contemplate with awe the enormous investment in axle spare parts it must entail to service the different makes of motor trucks already in operation. Further contemplation multiplies this by the amount of different manufacturing tool equipment necessary to produce them, and the terrific expense it must entail to keep the many little armies of salesmen each fighting their twenty sided battles over unimportant detail. Eighty million dollars is spent every year to sell trucks—a large part of it going to support fruitless detail arguments. The truck industry now generally recognizes that it must sell transportation and not details, and there seems to be a large opportunity to standardize on axle details. Everyone at interest will benefit by this, for all the well known types of rear axles are firmly established in the trade and give very good results in use. The user is not interested in axles if they carry his goods without disturbing his peace of mind. When accidents happen or wear takes place, however, he wants repairs made quickly and cheaply. This not only saves him money but keeps him in the frame of mind to spend it in buying another truck.

Having in mind that any suggestions I may make will be promptly corrected or amplified, I will put before you certain features of the various axle designs which seem to offer more or less attractive fields in which to pursue the well-defined and enormously profitable policy of standardization, which has been steadfastly fostered by the Society of Automotive Engineers.

The various types perform exactly similar functions in a variety of ways. (a) They support the springs on which rest the weight of body and pay load. (b) They carry brakes. (c) They are supported by the wheel bearings. (d) They carry parts which transmit the engine torque. For equal loads, stresses and similar points of attachment it is natural to think that the same bearings, proportion and size of parts, etc., will serve as well on one axle as another. In this light we can investigate the present subject by comparing the similar aspects of the various axles.

The range of truck sizes to-day may be divided roughly into 7 categories as indicated by their pay load capacities, viz., ¾-ton, 1-ton, 1½-ton, 2½-ton, 3½-ton, 5-ton and 6½-ton.

1—For each category standard spring center-lines and spring widths can be established, giving a reasonable variation for the time being by using spring pads that are wider than necessary. The spring centers will depend upon frame widths, a subject which is now being attacked with every reason to expect success. These established, the spring clips and nuts will readily fall in line. Even the spring pad drilling and spring seat height offer possibilities of being reconciled between chain drive and internal gear axles, and also among single reduction, double reduction and worm drive axles.

2—Standard brake drum diameters, widths and metal thicknesses are now being discussed in the S. A. E. Standards Committee and tentative dimensions have been suggested. Once these are determined the door is open to the crying need for standardizing the dimensions of brake linings, rivets, hinge pins, cams or toggles, diameters of camshafts and bushings, fits for camshaft levers, clearances and movements, release springs and all the unessential details that are so annoying when replacements are needed at an inopportune time or in an out-of-the-way place. There will be double paths to follow here by those who differ as to having more than one brake inside the drum, and possibly by the adherents of an external brake.

3—Once the brake drum width is selected the wheel spoke is located. The wood wheel can readily fall in line here and the steel wheel also. Our tire sizes are standard and also their fits on the wheels. Standard practice with reference to front wheel hubs has already been adopted by the S. A. E. The rear hubs should also yield to the same analysis and attack, although the solution will not be so simple. The hub details depend upon the type, size and location of the bearings used.

4—The wheel bearings cause a considerable diversification. Either ball or roller bearings can be employed in each of the five types of axles most used. But of these five types single reduction, double reduction and worm-drive can be grouped in both the fixed hub or full floating designs; while chain drive and internal gear drive can also be grouped. Thus, for each size truck axle 16 variations in bearing sizes, types, fits and spacing can be reduced to 6. Possibly a thorough study of the situation would still further reduce these as was found possible in the front hub bearing standardization, where over 200 hub variations were boiled down to 10, which are served by only 14 bearings.

5—Hubs, flanges, hub caps and wheel fits can be correspondingly standardized once the bearings are fixed.

6—The fits at the outer ends of spindles and drive shafts can be standardized in accordance with the classification given under 4; and if the wheel tracks are held close the spindles and drive shafts themselves offer possibilities.

7—4, 5 and 6 will react on the spring pads mentioned under 1, and help reconcile some discrepancies which may at first occur there.

8—Differentials can be standardized and the subject is now under consideration. A reasonable number of sizes, which will cover the range of torques to be transmitted, is all that is necessary. It should make little difference in what type of axle they are used. There would be a series for ball bearings and a series for roller bearings.

9—The above accomplished the fits for the inner ends of drive shafts would fall in line.

10—Bevel gearing, spur gearing and worm gearing all offer great opportunities for standardization. This should lead to a similar accomplishment for the bearings and bearing fits on worm spindles and bevel pinion spindles, but these can be standardized whether or not the gearing is standardized.

11—Adjusting devices for differential bearings and spindle bearings also offer a field.

12—The spindle fits for universal joint flanges have already been standardized.

13—Clevises and pins for brake lever connections have already been standardized. Possibly the levers themselves are susceptible to similar standardization.

Discussion of Favary Paper

O. M. Burkhardt of the Pierce-Arrow Motor Car Co. submitted a written discussion in which he explained his reasons for favoring the full floating type of axle for carrying loads up to 12,000 lb. He gave figures to show that the full floating construction is impracticable for greater weights than this.

W. F. Rockwell of the Wisconsin Parts Co. stated that he much favored the semi-floating design which he said weighs less in some instances than the full floating type. He stated that the cam-operated internal brake appears to be the only type which is not rendered inoperative at

times by snow and slush. He stated that he does not favor the propeller shaft brake because of its great sensitiveness, short life due to higher speed and the possibility of serious accident in case of shaft breakage which sometimes occurs before the truck operator realizes that the brake has become inoperative as a means for retarding the speed of the vehicle. He said that the use of bevel gear and double reduction truck axles is increasing and that in England, where the internal gear type was once used, it has been superseded by either double reduction or worm types. The double reduction type of construction involves lower stresses, he said, and less likelihood of costly renewals, due to injury. In common with most engineers, he favors light unsprung weight, but not so light as to interfere with proper alignment of the parts. All axle designs, he said, are compromise designs in which disadvantages are minimized as far as possible.

Effect of Unsprung Weight

A great deal of the discussion centered around the matter of unsprung weight. Favary stated that the greater the weight the greater will be the kinetic energy imparted to an axle where it is raised a given amount in passing over a bump in the road; consequently, the greater will be the shock imparted to the chassis with a given spring suspension. In this connection C. T. Myers stated that there is great uncertainty in regard to the effect of unsprung weight on tire wear It is generally assumed that tire wear increases with increase in unsprung weight, but Myers stated that he had yet to see any conclusive experimental evidence to substantiate this assumption. He mentioned certain tests in which it had been found that tire mileage on some worm-drive Pierce-Arrow trucks was as much as 70 per cent greater than that on similar trucks using chain drive, therefore presumably having much less unsprung weight on the rear axle.

R. E. Fielder of the Fifth Avenue Coach Co. stated that from 1910 to 1913 the tire cost on De Dion buses used by his company was 2½ cents per mile. These buses had extremely heavy rear axles in which the wheels alone weighed over 700 lb. The present cost per mile for tires on buses equipped with a worm-driven axle some 700 lb. lighter than formerly employed is about 0.85 cents. This result is not attributed so much to difference in unsprung weight as to improvements in the tires themselves, and the fact that steel wheels, which are said to hold their shape better than wooden wheels formerly employed, are used. Fielder considers that light, unsprung weight is an advantage, however, not only in respect to tire wear, but in respect to damage to the road surface, which is less with the lower unsprung weight. This fact should not be overlooked as it is certain to ultimately have, directly or indirectly, a considerable bearing upon the cost of bus operation

Advantages of Semi-Floating Axles

In one type of construction employed by the Fifth Avenue Coach Co. Fielder stated that it had been possible to effect a saving of 66 lb. in weight by the use of tubular as against solid axle shafts. He agreed with the author of the paper to the effect that it is better to have unsprung weight at the center than at the ends of the axle. He stated that the semi-floating type of axle possesses considerable advantage from a service standpoint in that it is not necessary to disturb the wheel bearings when the wheels are removed to change tires or repair brakes. With the full floating type of axle dirt is apt to get into the bearings when the wheel is removed and the bearings are not always properly adjusted when the wheel is replaced with the result that rapid wear of the bearings occurs.

Replying to Fielder's criticism of the wood wheel, Myers stated that careful comparative tests of wood and steel wheels had shown an advantage of 12 per cent in tire mileage in favor of the wood construction.

M. C. Horine of Mack Trucks, Inc., drew attention to the disadvantages of using two sets of brakes bearing on the same drum, since overheating caused by the use of one set of shoes adversely affects the efficacy of the second set. For this reason he favors the use of a propeller shaft brake which, he stated, is the only fully equalized type and is therefore least apt to cause skidding. Shaft brakes are serviceable, he said, if rigidly mounted on frame cross members. They are not in any case affected by spring action as are some wheel brakes.

Horine also drew attention to the advantages of a drop forged double reduction axle with banjo set at 45 deg., such as is used in some models of Mack trucks. He stated also that the chain drive has been much improved in recent years as have other types of drive. In answer to a question regarding chain life he stated that the chains used on Mack trucks give an average service of 18,000 to 21,000 miles.

C. W. Spicer of the Spicer Mfg. Co. stated that in his long experience in the manufacture of universal joints and propeller shafts, he had been unable to find that these parts are subject to any higher stresses when the propeller shaft brake is employed than when the brakes are on the rear wheels, but Favary took the view that the use of a transmission brake entails higher torque on the propeller shaft and universal joints and results also in greater axle stresses.

Propeller Shaft Breakage

A. F. Masury, chief engineer of Mack Trucks, Inc., stated that propeller shaft brakes are satisfactory only when they are well supported, and otherwise properly designed He stated further that his experience had shown that propeller shaft breakage is most apt to occur when the driver allows the engine to stop when the truck is coasting and then suddenly re-engages the clutch as a means of cranking the engine. He said also that the use of a full-floating axle with a live axle shaft made of very high grade steel provides a very flexible drive. Axle shafts used in late Mack trucks can, he said, be twisted through three full revolutions before breaking.

Masury stated that careful tests made by his engineering organization on trucks equipped respectively with chain drive, double reduction and worm gear axles had shown superior performance of the first two types, in coasting, climbing grades on second speed, average speed on hills, maximum torque and drawbar pull.

Masury cautioned against the possibility of the ill effects of too comprehensive standardization which, he said, would tend to prevent initiative and progress in improving design. He cited the Master Car Builders' standards as having prevented engineering development in the railway field, and said that the most successful concerns in the passenger car industry had paid least attention to standardization. C. T. Myers took exception to this view, stating that the most completely standardized passenger cars have proved to be the greatest commercial success. He also stated that M. C. B. standards had greatly simplified the problem of repair work wherever this work had to be done.

H. C. McBrair stated that it is possible to make spiral bevel axles with reductions of 9 or 10 to 1 and that with the multiple direct drive type of axle which he advocates it is possible to secure much higher fuel mileage than is usual with single bevel gear construction.

The Relation of Carburetion to Fuel Economy

Part II

Vaporization from a theoretical and practical standpoint is discussed by the author who concludes that proper operation of the entire carbureting system depends on complete and instantaneous combustion of the fuel.

By J. N. Golten

Figs. 10 to 14, taken from P. S. Tice's paper, "Flow in Intake Manifolds and Cylinders,"[5] give a visual indication of the complex flow lines in a simple two-branch manifold, and their variation with change in throttle opening.

Figs. 10 and 11 show the conditions existing in the manifold with the throttle slightly open. Notice that the fuel is not evenly distributed throughout the manifold cross-section, but flows in a comparatively concentrated stream. (Due to the small cross-section of the fuel stream the vaporization rate is greatly reduced. See section on Rate of Vaporization.) Of perhaps even greater interest is the fact that the flow lines in the two horizontal sections of the manifold are entirely different. This would affect the vaporizing action of a centrally located hotspot. A significant fact shown by Figs. 11 and 12 is the collection of fuel in the idle branch of the manifold when the right-hand cylinders are aspirating, and the absence of this collection when the left-hand cylinders are being charged. This phenomenon accounts for some of the inequalities of distribution.

[5] March, 1921, issue of the *Journal of the Society of Automotive Engineers.*

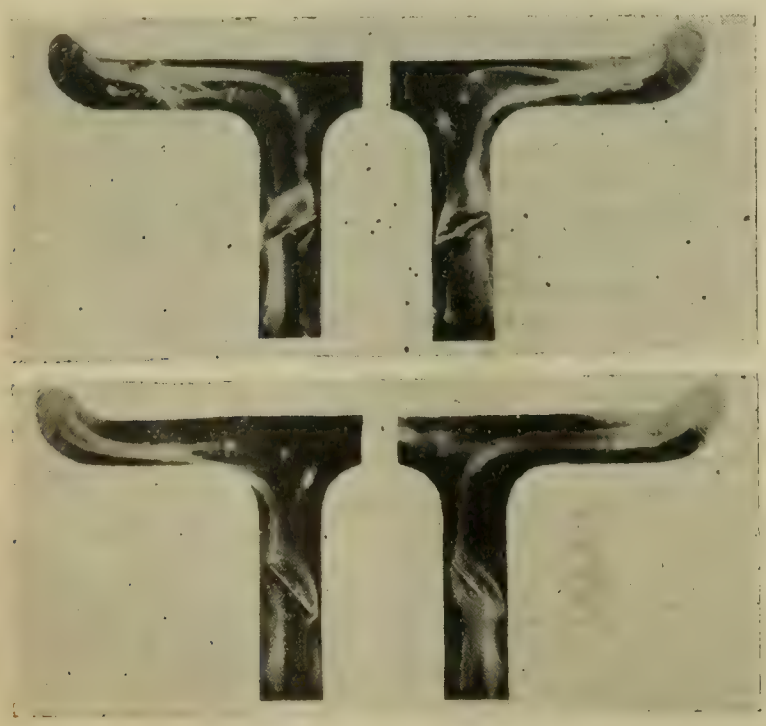


Fig. 10—(Above)—Note the concentrated fuel stream and unsymmetrical distribution in the manifold branches with the throttle slightly open. Fig. 11—(Below)—Opening the throttle still further does not change the nature of the distribution but results in an accumulation of liquid in one idle branch of the manifold

A further cause of unequal distribution among cylinders is the whirling set up in the bends forming the manifold outlets. Examination of the illustrations will show that in the two ends of the pipe the concentrations of liquid occupy somewhat different positions. When the whirling charge reaches the usual siamesed valve pockets it is almost certain that one cylinder of the pair will receive more of the concentrated stream than the other, a fact that is amply demonstrated by experience. In Fig. 13 is shown the open throttle condition which results in the nearest approach to equal distribution.

Charge Deflection by Throttle Valve

Fig. 14 is a section through the riser of the manifold in a plane at right angles to the outlets of the tee. The illustrations show the variation in the throttle deflecting action as the throttle is turned through 180 deg. Note the intense whirling action as the fuel is drawn into the horizontal section of the manifold. At open throttle the flow in the horizontal branch is unstable, whirling first in one direction and then in the other, which results in a symmetrical figure being recorded by the camera.

The illustrations just referred to are indicative of what happens in all manifolds no matter what their shape or size. Of course, it is true that conditions in some manifolds are much worse than in others; each manifold is a case by itself, but changing manifold shape, while it may improve matters, will never secure perfect distribution throughout the throttling range. Redesigning manifolds to secure better distribution is a long and ticklish task, nevertheless, it would well pay many manufacturers to undertake work of this sort.

Vaporization

Assuming that the metering and distributing problems of a carbureting system have been satisfactorily solved, there still remains the third important carburetion essential, vaporization. Unless all of the correctly metered and distributed fuel in the cylinder is available for combustion, the carbureting problem is still unsolved. Liquid fuel cannot burn; it is only when it is in a gaseous or vaporous state that the hydrocarbon fuel molecule can chemically combine with oxygen and liberate heat. Therefore, in order to secure maximum fuel utilization it is highly important that all the fuel be in such a physical state that its potential heat energy can be utilized.

Not only must the fuel be completely vaporized, but the vaporization must be complete at the time the spark passes in the cylinder. Only that portion of the fuel that is vaporized is effective in forming a combustible mix-

ture. Therefore, if a portion of the correctly metered fuel should remain liquid, the mixture would be so lean as to cause a performance loss. In order to supply this deficiency in vapor content, the operator would be forced to supply an excess of fuel, which entirely upsets the metering relations, causing an attendant loss of economy and other detrimental effects.

That portion of the cylinder heat which is available for vaporization is extremely limited; therefore most if not all of the vaporization must be done elsewhere. Before discussing the means of vaporizing fuels it may be well to state some of the fundamental conditions controlling vaporization.



Fig. 12—Throttle approximately half open. The accumulation of liquid in the idle right hand branch is very evident. Fig. 13—Throttle wide open. The fuel flow in the two branches is practically uniform

From the molecular standpoint, vaporization means the flying off of molecules against the forces of molecular attraction, these molecules losing kinetic energy (heat) and gaining potential energy as they leave the liquid. The more rapidly moving molecules will be the first to fly off, hence the average kinetic energy of the molecules remaining behind will be less than the initial average for the liquid, and the liquid will be **cooled** by evaporation. If the vapor is confined over the liquid, some vapor molecules will strike the surface and become liquid again, and as the number of vapor molecules per unit volume (i.e., the density of the vapor) increases, the number of molecules returning to the liquid per second will likewise increase, until finally the average number returning will equal the average number leaving. Under these conditions the vapor is in equilibrium with the liquid and evaporation ceases. The density, and hence the pressure, of the vapor which will be in equilibrium will depend on the temperature, that is, on the average molecular velocity. A vapor in equilibrium with the liquid is said to be **saturated,** and the equilibrium pressure is called the saturated vapor pressure (or vapor tension), which for a given substance depends upon the temperature. If the vapor is not allowed to accumulate over the liquid it will remain unsaturated, equilibrium will not be reached and the liquid will gradually disappear by evaporation. The larger the extent of the liquid surface the greater the rate of evaporization. If no external heat is applied to the liquid during the time this vaporization persists, its temperature will progressively decrease and the process of vaporization will become slower and slower. Similarly, if heat is supplied to the liquid at a rate faster than it is being made "latent" by the change in physical state, the process will be accelerated. The vaporization of a definite quantity of a given liquid requires a definite amount of heat, and the faster the heat is supplied the faster is the rate of vaporization.

Rate of Vaporization

Vaporization may be accelerated in three ways:

1—By an increase in the exposed liquid surface.
2—By the removal of the vapor as fast as it is formed.
3—By the addition of heat.

Of these means the last is by far the most effective.

As stated before, the ideal carbureting system would be one in which the fuel would be delivered to the cylinder in such a condition that its vaporization would be complete at the instant combustion commences. To attain this condition the fuel must be completely or largely vaporized before it enters the cylinder, and the remaining liquid portion, if any, must be in the best possible condition for rapidly absorbing the limited heat supplied by the cylinder, that is, in a fine state of subdivision so as to present the greatest heat absorbing surface.

In the carbureting system the means of accelerating vaporization are two, namely, extension of liquid surface and addition of heat. It is the problems attendant upon the proper application of these two means that has engaged the attention of the carbureter people the past few years.

Need for Heat

With our modern liquid fuels it requires a comparatively large amount of heat to get complete or nearly complete vaporization of the fuel in the short space of time during which it is traveling from the carbureter to the cylinders. Mere extension of the liquid surface by spraying from the carbureter nozzle will accomplish very little as far as vaporization is concerned, this being especially true with the conventional carbureter in which the throttle plate is placed in the carbureter outlet. No matter how fine the fuel spray may be when it leaves the carbureter nozzle, it is almost immediately recombined after it travels the very short distance between the nozzle and throttle plate, due to striking the latter. Whatever effective spraying is accomplished takes place from the edge of the throttle plate (see Fig. 14). This does not apply at open throttle, but when we take into consideration the fact that more than 90 per cent of the time a car is operating the throttle is more than three-quarters closed, it can be realized that those carbureter manufacturers who claim superior operating properties due to more effective spraying are suffering from a delusion.

Application of Heat

Realizing the need of heat to complete the necessary vaporization it now remains to be seen how this heat may be most economically supplied for the most effective application. Inasmuch as the exhaust gases with their large waste heat content can at all conditions of speed and load supply more than enough heat to completely vaporize all the fuel that is used, they obviously represent a very practical and economical source of the necessary heat. The great problem in connection with vaporization is the practical application of this heat.

About the first method that would suggest itself would be preheating the air before it reached the carbureter by passing it over a section of the hot exhaust pipe. This method would result in a loss of power due to the decreased density of the air. If the air were pre-heated sufficiently to vaporize all the fuel this loss in maximum power would become quite large. The magnitude that this loss may assume may be better realized when it is stated that even with intake air temperatures as high as 500 deg. Fahr. some of the fuel in a manifold still remains in the liquid state.[6] At this tempertaure the air

[6] See "Intake-Manifold Temperatures and Fuel Economy," by W. S. James, H. C. Dickinson and S. W. Sparrow, in the August, 1920, issue of the *S. A. E. Journal.*

density would be approximately one-half of that of air at 80 deg. Fahr. Assuming a constant volumetric efficiency, this temperature would result in a decrease of maximum power amounting to 50 per cent.

Some engineers, in an endeavor to vaporize the fuel without heating the air excessively, have exhaust jacketed portions of the intake manifold. This method has the advantage of transmitting some of the necessary heat by direct conduction to the fuel moving along the walls. However, even with this advantage the method results in high charge temperatures without completely vaporizing the fuel.

Hotspot Manifolds

A further modification in design was the introduction of the so-called hotspots. These are nothing more than

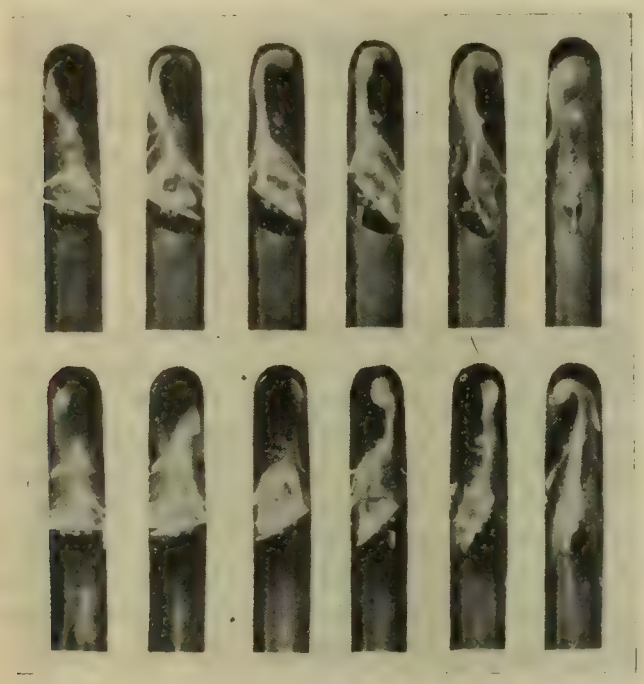


Fig. 14—Change in flow conditions in the manifold as the throttle is rotated through 180 deg. Note the swirling action as the fuel is drawn into the horizontal branch

allegedly highly heated sections in the intake manifold. They are of comparatively small area and are generally placed just above the intake riser on the horizontal portion of the manifold, on the assumption that due to centrifugal force, caused by the rapid change in direction, the fuel would be thrown out onto the hotspot and evaporated. Figs. 10 to 13 show what actually takes place at this point. This method of vaporization does not heat the air excessively and consequently causes no appreciable loss in power. However, neither does it give sufficient heat to vaporize more than a relatively small percentage of the fuel, so further modifications in design have been introduced. These consist of additional hotspots placed near the valve pockets or points where the fuel tends to collect, and small heated pockets used in conjunction with baffles, which deflect the liquid fuel into them.

These additional modifications, while they do improve engine performance and to some extent eliminate oil dilution and other evils attendant upon introducing liquid fuel into the cylinders are, nevertheless, only makeshifts at best, because from the viewpoint of maximum performance and economy they are fundamentally wrong.

Hotspots located at the valve pockets and in the manifold branches, even though they should vaporize all the fuel, which they do not, vaporize it only after it has been unequally distributed and thus fail to eliminate one of the chief sources of excessive fuel consumption. The proper time to vaporize all the fuel is before it is distributed. Then there will be no distribution problem.

Any method of carburetion that allows liquid fuel to wet the manifold walls is essentially wrong from the standpoint of maximum economy, no matter how perfectly the fuel may eventually be vaporized. Unless the entire manifold is dry at all loads and speeds, there will always be a loss in fuel economy, due to the fact that the carbureter will have to be set so that normally it will deliver more fuel than is necessary for good economical running. The reason for this may best be shown by describing the changes that take place inside a manifold due to a fluctuating load.

Let us assume the engine to be lightly loaded, a condition favorable to maximum vaporization, because the amount of fuel to be vaporized in unit time is small and the manifold pressure is low, resulting in a low boiling temperature for the fuel. The result is that relatively little liquid exists in the manifold, and its walls will be as nearly dry as they can ever be.

If the throttle is now opened somewhat, due to a demand for more power, the quantity of fuel to be evaporated in unit time is suddenly increased and the manifold pressure is also increased, resulting in a higher fuel boiling temperature. The amount of heat available for vaporizing the fuel is practically the same, for although the exhaust temperature also increases, its effect on the various heating devices lags so far behind that it is of no immediate assistance. Under these circumstances the equilibrium condition previously existing is disturbed, a lesser proportion of the fuel is evaporated, and liquid fuel quickly collects on the manifold walls. If this load condition continues long enough a new equilibrium condition may be attained at which the rate of fuel vaporization and distribution will be equal to the amount of fuel being metered by the carbureter. However, during the time the walls are being wetted, unless some provision has been made for feeding a large excess of fuel, the mixture will be so lean as to cause a large loss in power, or even total failure to ignite. Since the quantity of fuel necessary to wet the walls is much larger than can be supplied by any accelerating well, the only remedy is to set the carbureter to deliver an excess of fuel, so that normally the mixture will be richer than necessary for steady loading, resulting in an inevitable loss in fuel economy.

If now the load decreases, vaporization conditions improve and the fuel on the walls evaporates, making the effective mixture far richer than necessary.

Although these various vaporizing devices might function very well under a condition of constant load, and the carbureter could be set to operate economically, it must necessarily be set for the normal, more severe conditions, of widely fluctuating load, with the results just stated.

Vaporization, Distribution and Economy

The statement that the fuel must be completely vaporized before combustion commences may be further elaborated by adding that this vaporization must take place before the fuel has an opportunity to wet the manifold walls. Even though there were available a carbureter with this advantageous characteristic, it could not successfully be used with our present-day manifolding and vaporizing arrangements. Wet walls and unequal distribution of the manifold liquid make so many demands upon the metering unit, demands which must necessarily be complied with, that its successful operation depends on a large number of compromises, with a resulting large loss in economy. Therefore, the first and most important step that can be taken for increasing the fuel utilization of our modern engines is the redesign of the entire manifolding system so as to evaporate instantly and completely all of the fuel before it is

distributed into the several manifold branches. Obviously, this result should be accomplished without unduly raising the charge temperature.

The good results attained with such a system would not end with decreased fuel consumption. The total vaporization of the fuel would be a long step in the elimination of what are now thought to be the chief troubles of internal combustion engines. Dilution of oil by the liquid fuel, with consequent cylinder and bearing wear, would be entirely eliminated. With the leaner and dryer mixtures used, carbon formations would be greatly reduced. In addition, the engine performance would be materially improved, both as regards smoothness of running, due to more equal power impulses and accelerating ability. It has been proven that the accelerating abilities of an engine depend not upon the metered air-fuel mixture ratio, but upon the actual fuel available for power production at the instant the charge is ignited,[6] which is another way of saying that the fuel must be in a vaporous state. Taken as a whole, vaporization, properly accomplished, has everything in its favor and nothing to be said against it. It would be well if our engine and car designers would take notice of these facts.

Keeping in mind all that has previously been said, let us see in what particulars our present carbureting systems should be changed, so as to more nearly approximate an ideal carbureting structure.

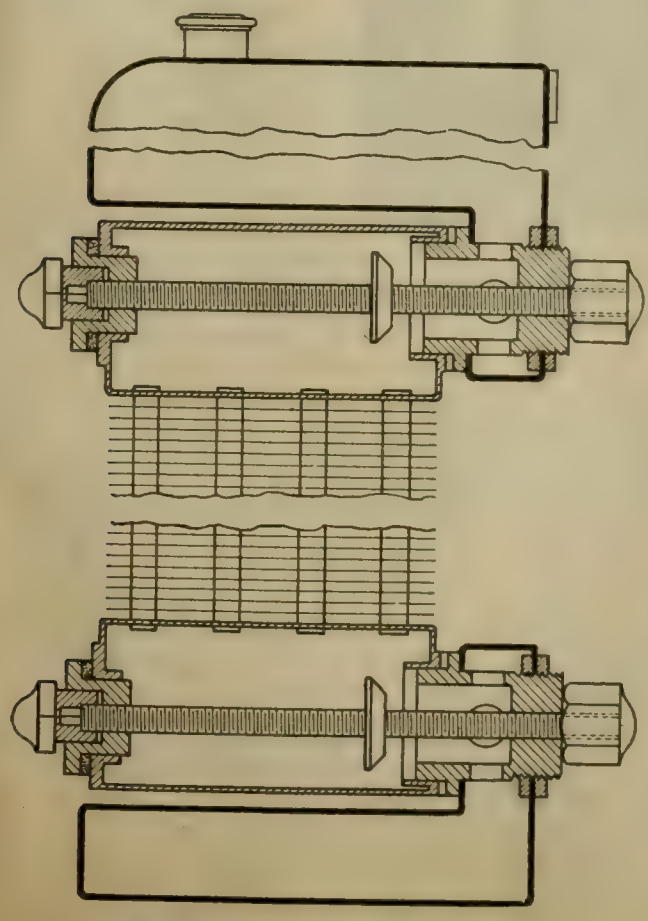
Since the proper operation of the entire carbureting system hinges on the complete and instantaneous vaporization of the fuel, the most important fundamental change will be in the means for vaporizing the fuel. This is the crux of the entire matter. There must never be any liquid fuel on the manifold walls. This point cannot be over-emphasized.

Only with the fuel completely vaporized are there no distribution problems, and then only does it become possible to use a carbureter that will meter the fuel to the greatest advantage. Such a carbureter should be designed so that variations in the mixture ratio will be solely dependent upon the change in manifold pressure, which is a direct function of the load carried by the engine. The mixture ratios should be those that would give the highest economy at all loads until nearly maximum manifold pressure is reached, when the ratio should change to give maximum power. There should be a minimum of adjustments on the carbureter so that once this setting is determined for any given engine it should be beyond the power of the operator or any misguided mechanic to alter it. Whatever adjustment is provided should be very weak and influence the metering relations only at idling.

Correction: An error occurred in the last paragraph of the first column p. 667 (Part I of Mr. Golten's article). The portion which was incorrect should read as follows: K is equal to the ratio of the density of the air passing through the throat to the density of the fuel (d_a/d_f) and is included so that the metering head (h), or force which causes the fuel to flow, can be expressed in terms of height of fuel column.

New Sectional Radiator Design

THE Avios radiator, herewith illustrated, is a new sectional type developed in France by M. L. Chardard, and which has been brought to this country by the Framerican Industrial Development Corp. The new principles involved have to do with the method of joining the sections to the top and bottom tanks and can be applied to radiators of any outside form and of any type of core element.



Cross section of Avios radiator

One advantage of the Avios design is that any section can be quickly put out of action, so that if a part of the radiator core becomes injured it does not incapacitate the entire radiator. A spare section or tube can be substituted for an injured one practically without loss of water, and, incidentally, the rate of flow through the core sections can be throttled and thus the rate of circulation be changed at will.

The vertical core elements are provided at both top and bottom with a header, and these headers are secured to the top and bottom tanks in a suitable manner. A nipple is soldered into the header at one side, and this nipple passes through holes in the opposite walls of a downward extension of the top tank and an upward extension of the bottom tank, both extensions being on the rear side of the tanks and of small depth in the fore and aft direction. On the outer, threaded end of this nipple there are two flat nuts between which the rear wall of the tank extension is clamped.

A threaded rod passing centrally through the header serves to clamp the core element to the tank. Each rod has a valve disk soldered to it. By turning the rod, by means of a nut serving as bolt head, the valve disk can be brought up against the end of the nipple so as to close its outlet. The valve disk has a conical seat, which is brought up against the sharp edge of the nipple, so that even if there should be scale on the valve the outlet of the nipple will be closed up tight, it is claimed. After the injured section has thus been shut off it may be removed and replaced by a spare section, whereupon the valves at top and bottom are opened again, which completes the repair. It is thus not necessary to drain the radiator to substitute the spare section for the injured one. If no spare section is carried the car, of course, can be operated with one radiator section missing until a spare can be procured.

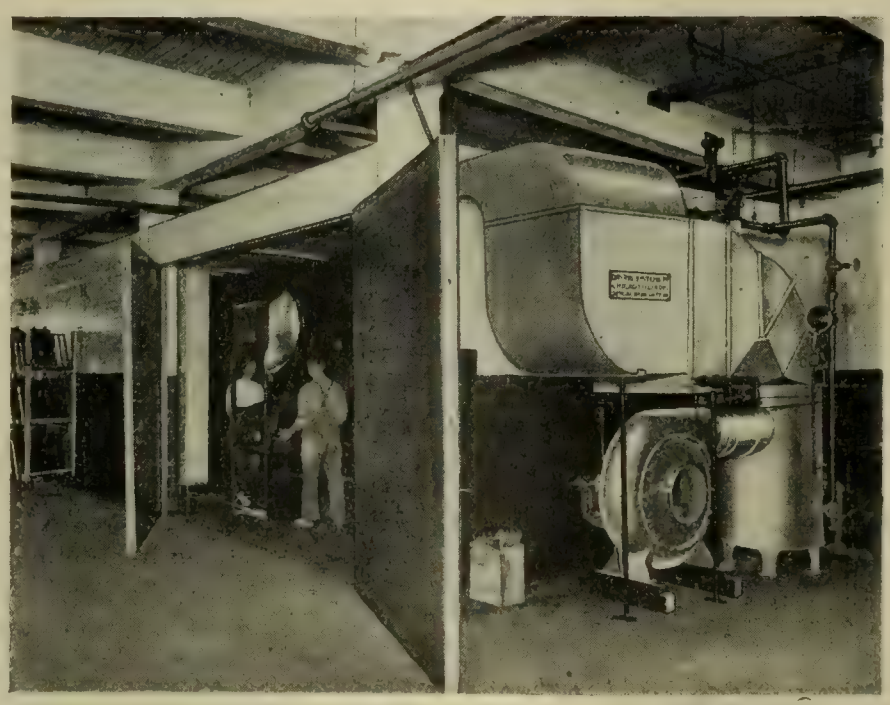
Expediting Body Finish Operations by Use of Drying Equipment

A description of modern facilities for decreasing the time and space required to finish automobile bodies. Use of cleaned, heated and humidified air is said to give more uniform and satisfactory finish than does a greater number of coats with natural drying. Time schedules are given in detail.

By J. Edward Schipper

AUTOMOBILE manufacturers are becoming increasingly interested in methods for reducing the amount of time required for bodies in process. It has been realized for a long time that it is one of the fundamental requirements of quantity production that a piece of work move continuously from the time it starts to be fabricated until it is completed. It has been possible to do this in the chassis, but in the bodies, particularly in painting operations, long pauses between different operations are required because of the necessity for using siccative coats, which require time for the evaporation and oxidation process which must be gone through to achieve what is generally known as drying.

Considerable study has been given by a number of concerns to methods which will shorten the drying period, or in other ways reduce the length of time required for the body to have the painting and trimming operations completed. A very radical change in practice which has made possible to materially shorten this time is the discovery that it is possible to make as good if not a better paint job with a considerably less number of coats than was formerly thought essential. This multi-coat idea is one of the direct descendants of carriage builders' traditions. Ten years ago, thirty-five to forty coats were not exceptional for high-grade work. To-day thirteen well selected and properly applied and riage builders' tradtions. Ten years ago, thirty-five to



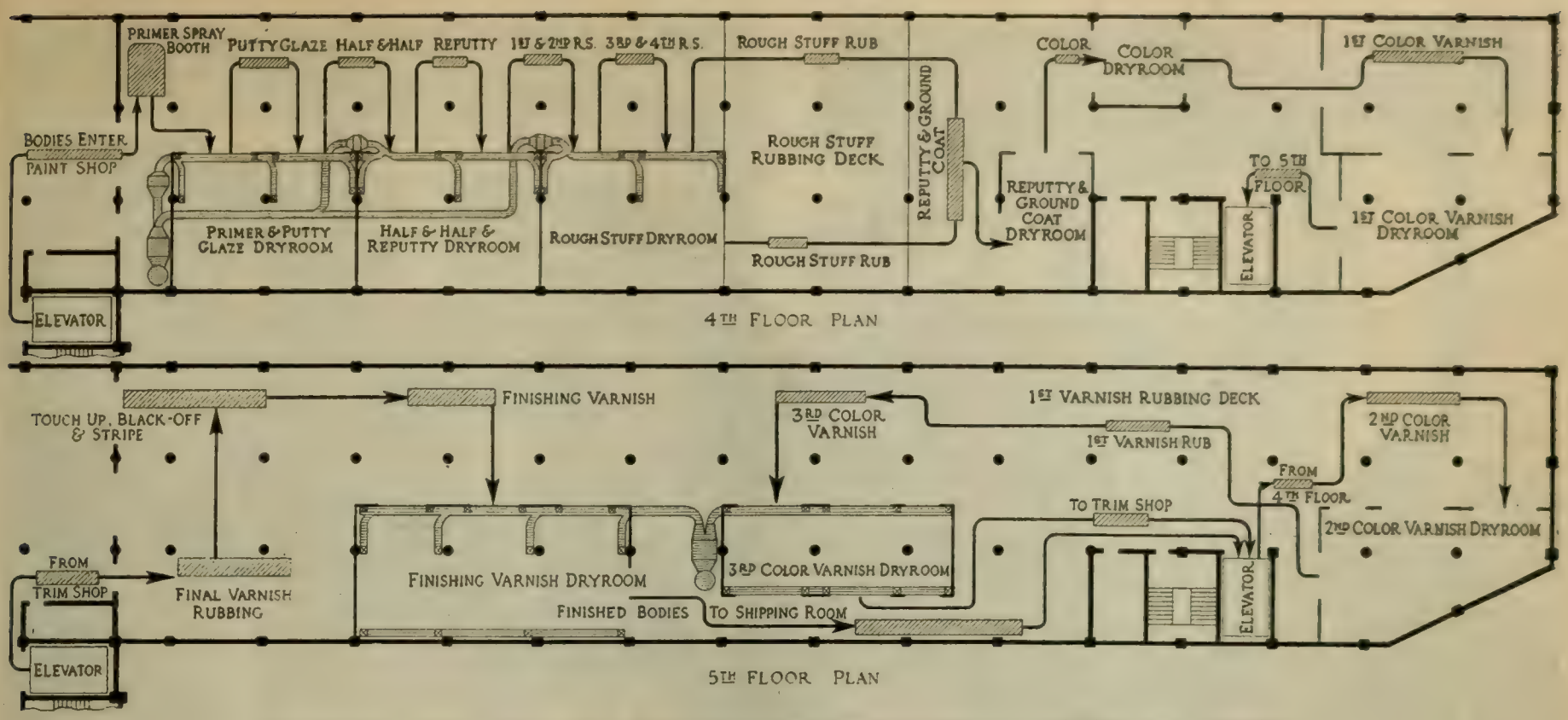
Ovens used at the Franklin plant for paint drying. Apparatus for cleaning, heating, humidifying and circulating the air, supplied by Drying Systems, Inc. is seen at the right

Another way in which the number of bodies and, consequently, the amount of money tied up in bodies in process can be reduced is in the use of methods for more rapidly drying the various coats. The importance of this increased speed in drying may be realized if a concern making 50 bodies to-day may be taken as an example. Assuming the average time for painting without artificial drying is 24 days and the average value of the body during this period is $300, the space necessary for painting and drying would then be that required for 1200 bodies in which would be tied up the sum of $360,000, the interest on which at 6 per cent for 24 days is $1,420. If this time can be cut in half by the introduction of a modern drying system, both the floor space and the interest on investment in bodies would be half in the saving, and interest alone would be nearly 60 cents per body. To this must be added the interest on capital invested in plants, which will, in the latter case, of course, include the drying, and from this must be deducted or added any increase or saving in operating cost.

That there is a considerable net saving is evidenced by the fact that drying systems are being extensively used and are being adopted in an increasing measure both by body and car manufacturers. This is not confined to manufacturers in any price class, but is to be found from the highest to the lowest. The principle, of course, finds its maximum economy in the case of the all-metal bodies where a thin but durable finish can be successfully baked on at high temperatures. Even with the metal body built over a wood frame, however, in which the paint coats cannot be baked at such a high temperature, it has been found possible to completely finish and trim, using a standard twelve coat schedule in 4½ working days.

One of the concerns responsible for a number of successful installations of this character is Drying Systems, Inc. The equipment made by this concern is designed to duplicate ideal drying conditions. It is a well-known fact that drying time varies with atmospheric condition. The spring and fall of the year have been known among carriage builders for decades to be the best time in which to paint a carriage which is to be dried under best atmospheric conditions, and the warm summer months have been generally regarded as the worst period. If it is possible to duplicate ideal drying conditions in the drying ovens or drying room at all times, the element of chance is largely eliminated and a greater uniformity as well as rapidity in results will be obtained.

It is essential to remember that the term, drying of siccative coating, is really a misnomer. Such coatings do not dry, but oxidize. What is called the drying action is



A suggested layout for a paint shop using a progressive system of painting and trimming

really a chemical reaction having two periods. During the first period the volatile solvents are evaporated and during the second there is the chemical reaction of oxidation of the oils. (These oils are transformed chemically into oxides which are solid as compared with the more or less liquid form of the coat when first applied.) It has been found that the presence of moisture in the air is necessary for the oxidation or so-called drying of the coat. Furthermore, there are different ideal atmospheric conditions for each kind of coating and for different colors, while for different colors it may be necessary to have different degrees of temperature and per cent of humidity in the air. Experimentation on these subjects is by no means complete, but a great deal has been learned about them and it is possible to apply the knowledge so gained in commercial work to the extent of being able to greatly accelerate the drying of the various coats.

Moisture Essential

Probably the most difficult point for the average layman and often even the experienced finishing foreman to grasp is that moisture in the air is essential to drying. The theory of the value of the moisture content is that the moisture acts as a catalytic agent and co-operates with the increased heat in performing the chemical reaction of oxidation. The drying equipment is designed to duplicate the ideal conditions of temperature and humidity for various kinds and colors of paints. The advantages claimed for the process outside of the shortening of the drying period and consequently the reduction of the number of cars in process are the consequent reduction in the amount of floor space required to finish a definite number of jobs per unit of time, and the ability to turn out a product with an unvarying color standard.

In the drying of automobile bodies it is essential that the primer, lead and rough stuff coatings receive the same careful treatment accorded to the varnishes, since the strength and durability of the final finish depends entirely on the proper drying of the under coatings. In other words, the job has to be engineered from the ground up. It is just as important that the under coatings be uniform and of proper elasticity as the under coatings, because the failure of a under coating invariably means the breaking down of the exterior finish.

In the best installations of a drying system, the under coat and color varnish operations are generally conducted in the dry rooms of a compartment type located in close proximity to the spray booth. The size and numbers of the dry rooms and ovens, of course, depend on the production requirements. In the case of touring car bodies where it is necessary to rush a large number of bodies through a small space, a material saving can be made in the dry room space by up-ending the bodies in the under coat and color varnish dry rooms. It is claimed that with a properly installed drying system this can be done in perfect safety in the under coat and color varnish dry room. On a production job the schedule for under coat and color varnish drying periods would approximate: Primer, 2 to 5 hr.; lead, 2 to 5 hr.; rough stuff, 2 to 3 hr.; flat color, 1 to 1½ hr.; color rubbing varnish, 3 to 5 hr.

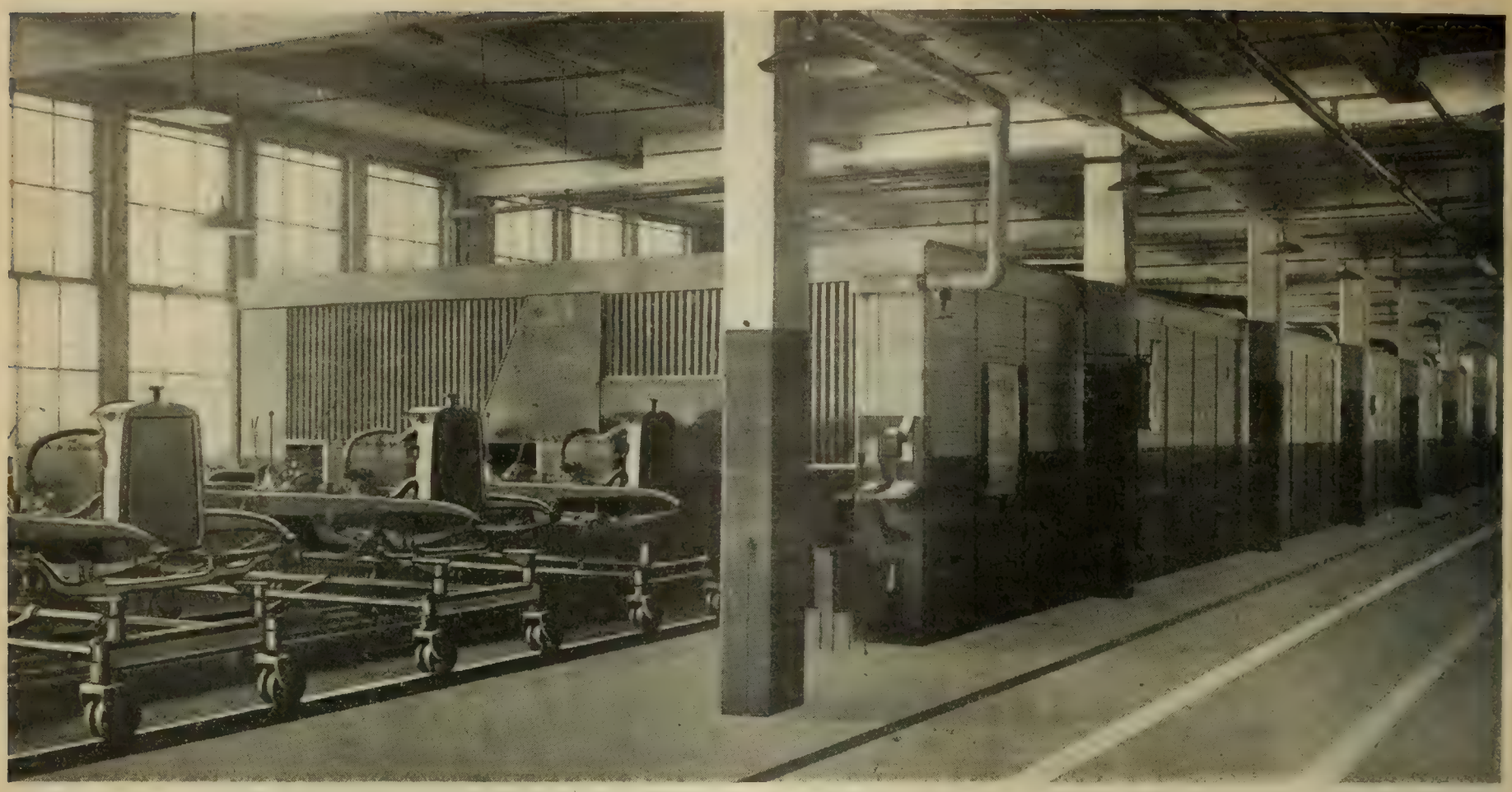
Enclosed Bodies

Enclosed bodies require a relatively longer time because of the great amount of woodwork and it is possible, of course, to use a somewhat higher temperature and consequently to increase the speed of drying on all metal touring car bodies.

The drying equipment furnished by Drying Systems, Inc., consists of a fan, radiator, air washer, humidifier, automatic temperature control, automatic humidity control, steam and water piping. The atmospheric air is brought out and put through the washer, which removes the dirt and humidifies the air. The heat is imparted to the air by cast iron radiators for pressures up to 30 lb. and specially designed pipe coil radiators for higher pressures. Automatic thermostatic temperature control and automatic humidity control is employed and with the installation there is a system of supply and vent ducts to produce the correct circulation of air in the drying room or oven. This is necessary to insure uniform and rapid drying in all parts of the dry room. Closed bodies are usually placed horizontally, while the open bodies are placed verticaly and up-ended so as to give space in each oven for as may bodies as possible.

In chassis work the ovens can be installed along the production line so that the chassis pass through the oven on the regular assembly chain. Such an installation is shown in one of the accompanying cuts.

As regards the best layout for a paint shop, it is impossible to give an ideal condition, as so much depends on



Oven installation at the Chalmers plant for drying paint on the chassis as it progresses along the assembly line

the quantity of the product which is going through. The bodies, of course, would first receive their cleaning up and priming coats, then probably a coat of lead, then a glaze and putty, the various rough stuff coats and, after that, the various color varnish and finish coats. The most efficient way of handling this is to have the bodies progressing on toward the finishing room, as each of these steps take place, so that bodies are coming out of one oven and passing on to the next, then on to the next series of operations in a following oven, and eventually to the finishing room. Whether or not bodies go back into the same oven depends upon the quantity of work going through and the space available. Some diagrams of proposed paint shop layouts are given herewith and they are deserving of study as good examples of what can be done to make the paint and trim work a real progressive job.

With the large number of operations on some of the higher priced jobs, the best possible speed that can be obtained is 11 days, not counting the time for trimming. Before the introduction of drying equipment, it would take from 22 to 30 days to do this same work. Lower priced cars do not have a finishing schedule nearly as long as the high grade varnishes, as, for instance, on large production schedules, it is generally the practice to put on a priming coat, lead coat, putty coat, two coats of rough stuff which are then water rubbed, a ground color coat, two color varnish coats which are water rubbed, and a stripe, black off and finishing coat.

In still lower priced cars where quantity production is of the utmost importance and where high quality in finish is more or less a secondary consideration, it is the practice to merely apply a priming coat, lead coat, two rough stuff coats, a ground color coat, two color varnish coats and a finishing coat. Jobs of this nature can be put through in from 4 to 5 days.

Variations

Practically every color varnish used has a different temperature and humidity at which it dries best. Green jobs, paint men say, will stand relatively high temperatures in the neighborhood of 150 to 200 deg., light blues and whites, which are very delicate, will not stand temperatures in excess of 140 deg. Black enamel jobs, such as those used on Dodge and Willys-Overland cars, are three-coated and baked from 35 min. to 1 hr. at from 425 to 450 deg. These are known as enamel jobs and the finish is relatively inexpensive, but the high temperature baking and the quick drying time resulting therefrom cannot be carried out except with black colors.

The proper laying out of the paint job for efficient operation is of tremendous importance to a manufacturer of any product which has to be painted and delivered to the purchaser with a high grade finish. It is possible to spend a great deal of money in this department of manufacture and then achieve only mediocre results. On the other hand, by a careful analysis of the problem, it is possible to secure highly satisfactory results at a minimum expense and even save a considerable amount of money on the parts tied up in process in this department. When it is possible to cut a schedule from 22 days down to 11 days the money represented by the saving is considerable.

Schedules of Operation

The appended tables show the time required, temperature, humidity, etc., for drying the various coats given under the schedules used by manufacturers of cars in different price classes.

MEDIUM PRICED CARS

For colors such as green, which will stand temperature from 160 deg. to 180 deg.

Prime and lead coat	1 day
Putty, first and second R. S	1 day
Oil, sand, ground color	1 day
First and second color varnish	1 day
Water rub and trim	1 day
Finish	1 day

LOW PRICED CARS
(Fast Schedule)

Prime coat	3 hr.	3 hr.
Lead	2 hr.	2 hr.
First and second R. S.	each 1½ hr.	3 hr.
First and second color varnish	each 1½ hr.	3 hr.
Finish	6 hr.	6 hr.

Total time from prime to finish, including trim, 3½ days.

On all of these fast schedules the drying is accomplished by means of air washing and humidifying equipment in which is employed a very large volume of air, as otherwise if it is attempted to do it with an equipment in which there is only the normal rate of air change, the coating will surface harden.

The relative humidity at temperatures of 160 deg. to 200 deg. runs in the neighborhood of 22 per cent to 30 per cent, whereas from 160 deg. to 120 deg. it runs from 30 per cent to 45 per cent, but the actual amount of moisture in the air for these higher temperatures is very great, otherwise the surface would case harden almost immediately by coming in contact with the large volume of extremely warm air.

DRYING SCHEDULE OF HIGH GRADE CAR

Prime		Sealer coat,	
Lead	1 day	color coat	1 day
Putty glaze,		Egg shell,	
First R. S.....	1 day	First C. V.,	
Second R. S.,		Second C. V.....	2 days
Third R. S.....	1 day	Rub,	
Fourth R. S.,		Third C. V.,	
Fifth R. S.....	1 day	Rub	2 days
Rub out,		Black off,	
Ground coat	1 day	Finish	1 day

This is an 11-day schedule without including time for trimming. The temperature, humidity, and drying time are as follows:

	Temperature, Degrees	Humidity, Per Cent	Drying Time
Prime	120-130	30-35	4-6 hr.
Lead	120-130	30-35	4-6
Putty glaze	120-130	30-35	3-6
First R. S.....	120-130	30-35	3-5 hr.
Second R. S.	120-130	30-35	3-5
Third R. S.	120-130	30-35	3-5
Fourth R. S.	120-130	30-35	3-5
Fifth R. S.	120-130	30-35	3-5
Ground coat	125-130	30-35	2-4
Sealer coat	125-130	30-35	3-5
Color coat	125-130	30 35	2-4
Egg shell	125-130	30-35	3-5
First C. V.	120	37-42	4-6
Second C. V.	120	37-42	4-6
Third C. V.	120	37-42	4-6
Black off and stripe	110	40-45	2-4
Finish varnish	100-104	45-50	10 hr. or overnight

SCHEDULE FOR VERY HIGH GRADE WORK

	Temperature, Degrees	Humidity, Per Cent	Drying Time
Prime	.120-125	30-35	8 hr.
Half and half	.120-125	30-35	8 hr.
Putty coat	.120-125	30-35	4-5
First R. S.	.115-120	35-40	4-5
Second R. S.	.115-120	35-40	4-5
Third R. S.	.115-120	35-40	4-5
Fourth R. S.	.115-120	35-40	4-5
Preparation coat	.115-115	35-40	3-4
Color coat	.110-115	35-40	3-4
First C. V.	.100-105	40-45	8
Second C. V.	.100-105	40-45	8
Third C. V.	.100-105	40-45	8
Finish Varn.	90- 90	45-50	24

There is a rubbing operation between the second and third color varnish coats and also after the third color varnish coat.

New Tube Has No Splice

A NEW tube having a corrugated outer surface moulded in one piece without splice is shortly to be marketed through the Edward A. Cassidy Co., Inc. It will be manufactured under Fairchild patents by the Corrugated Rubber Corp.

The corrugated inner tube is moulded in a ring of oval cross-section, without splices, seams or creases. The valve is vulcanized directly into this ring and thoroughly reinforced. Circumferential corrugations maintain air spaces between the tube and the casing, and are said to prevent overheating and freezing of the tube to the casing. The tube is so made that it floats free from the rim before inflation, preventing pinching. No vulcanizing accelerators are used in its production. Corrugated tubes are said to require only five operations in manufacture. Extra heavy red antimony rubber is used. All tubes are made to conform to Government specifications covering thickness of wall, tensile strength and elastic limit.

In manufacturing the rubber is first broken down, made soft, and compounded with antimony. It is then put through a tubing machine, adjustable as to size and wall thickness. It is then in plastic form, but firm enough to be easily handled and shaped. It is cut to length, bent in a circle and formed. Valve, inner ring and base patch are inserted from inside of tube, the ends are then joined and kneaded together and the outer base patch added. The tube, now completely formed while the rubber is soft, is placed in a vulcanizing mold and as heat is applied to the outside hot vulcanizing gas under high pressure, is automatically applied to the inside of tube. The pressure forces the rubber against the surface of the mold, thus forming the tube to the desired shape. The vulcanization is said to require but twenty minutes as against seventy minutes with old processes. The mold is then opened and the finished tube removed.



Sectional and side views of the corrugated tube molded without splice

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THE Gloucestershire Aircraft Company, Limited, has completed a design for a cargo-carrying machine of high capacity.

"This is a tractor-biplane fitted with a Rolls-Royce 'Eagle' engine. The wings of the upper plane are larger in area and thicker in section than those of the lower plane, and the petrol tanks are fitted inside them. The fuselage of the machine is in three sections. The leading one takes the engine, the middle one the cabin, and the rear one, which carries the tail and skid, is hinged on to the cabin section, so that it can be turned at right angles to the rest of the fuselage. By this means cargo can be taken aboard with great ease. By means of a gangway hinged to the cabin floor loading trolleys can be wheeled right into the aeroplane.

The machine has a goods load of 1600 lb. Its ceiling is 14,000 ft., and its air endurance is four hours and three-quarters at a cruising speed of 92 miles an hour."

State Regulation of State Motor Vehicle Common Carriers

Motor vehicles which are classed as common carriers have been subject to State regulation during recent years. This article gives a detailed survey of the regulations now in force, together with a critical analysis of the character of State control. Facts concern automotive manufacturers.

By Harry Meixell.*

UNTIL a few years ago the legislatures of our forty-eight States in no way differentiated between these various uses of the motor vehicle in the laws which they enacted dealing with operating requirements, registration fees and the many other subjects which are usually found in a State's motor vehicle laws.

In 1914, however, Pennsylvania definitely segregated motor vehicles when used as common carriers and placed them under the regulation of the State's Public Service Commission. To-day the laws of twenty-two States provide for a greater or less degree of such State control.

On following pages is a tabulation setting forth a digest of the more important matters which through the year 1921 had been made the subject of those State laws specifically enacted to bring motor vehicle common carriers under State control and regulation. This tabulation should be carefully considered in connection with the following discussion of the data which it contains.

Without exception State regulation of motor vehicle common carriers has been vested by law in pre-existing State agencies that exercise control over other forms of common carriers such as railroads, trolleys, telephone and telegraph lines, pipe lines, etc. The third column of the tabulation shows that these agencies have consisted of State Public Utilities or Public Service Commissions, Railroad Commissions, the Commerce Commission as in the case of Illinois, the State Tax Commission of Alabama, the Arizona Corporation Commission, or even the State Road Commission as in West Virginia.

In some instances these pre-existing State agencies have assumed control over motor vehicle common carriers by virtue of the broad general powers of the law establishing the Commissions.

In its broadest conception a motor vehicle common carrier is one that passes any and everywhere over the highways, indiscriminately transporting for a consideration all persons who present themselves as passengers or carrying all commodities or classes of commodities offered. Obviously this involves interstate transportation. The Federal Interstate Commerce Act takes no specific cognizance of the matter, however, so the application of control by the various States is in no way guided or modified by Federal laws on the subject.

A few States deal with the subject merely from the standpoint of local control, the incorporated municipalities being given power by the State Legislature to require motor vehicle common carriers to obtain permission and a license for the purpose from the local governing body. This is the case in Massachusetts, where the Board of Selectmen or City Council exercise control over motor vehicle common carriers transporting passengers.

As for State control this expresses itself in two ways: On the one hand there is a State law whose provisions give to some State agency broad general powers of control over motor vehicle common carriers. On the other hand, for the execution of these powers, the agency is permitted to promulgate and enforce such rules and regulations as it may deem necessary, express stipulation being made in some of the State laws on the subject that these rules and regulations shall take precedence over municipal ordinances.

The various laws establishing and defining this State control have in many cases, however, greatly narrowed its application. For instance, while most of the States which have dealt with the subject allow their respective State agencies to regulate both passenger and property transportation by motor vehicle common carriers, Alabama, Connecticut, Maine, New Hampshire and others limit this power to passenger transportation only.

Then, again, while most of the regulating States apply their powers of control to carriers operating within, into, and out from the limits of incorporated municipalities, California, Ohio and Oregon merely exercise authority over such transportation as is not confined solely to the limits of a city, town or other similar form of incorporated municipality.

As another and final illustration most State laws regulating motor vehicle common carriers narrow the scope of such control to vehicles operating "between fixed termini or over a regular route." In the Arizona law this expression is defined to mean the termini between which or the route over which a carrier usually or ordinarily operates his motor vehicle, "even though there may be departures from said termini or route, whether such departures be periodic or irregular." As a rule it is made a question of fact for the State agency exercising control to determine if the carrier is operating "between fixed termini or over a regular route."

With very few exceptions the powers wielded by the Public Service Commissions or similar forms of State agencies over common carrier transportation by motor vehicles are extremely numerous and broad. A consultation of the chart shows that these powers can be listed as follows:

(1) Grant, refuse to grant, amend or revoke Certificates of Public Convenience and Necessity.

(2) Prescribe routes.

(3) Fix schedules.

*Secretary of the Motor Vehicle Conference Committee of the American Automobile Association, Motor and Accessory Manufacturers' Association, National Automobile Chamber of Commerce, National Auto Dealers' Association, Rubber Association of America and Trailer Manufacturers' Association of America.

(4) Determine character of service and promote the comfort and safety of traveling public.

(5) Establish fares and rates.

(6) Require reports and uniform methods of accounting.

(7) Examine accounts and records.

(8) Supervise fiscal affairs such as incorporation, capitalization of stock, etc.

(9) Compel additions to, extensions of or betterments in physical equipment.

It is apparent that these powers are practically unlimited and of such a nature that the State agency has almost absolute control over the life or death of motor transportation within its jurisdiction. Nevertheless all of the rulings of the various commissions are subject to review by the proper courts and aggrieved parties can easily and freely appeal to them for redress of wrongs or supposed wrongs.

Furthermore, in the all-important matter of Certificates of Public Convenience and Necessity, decisions are usually made contingent on public hearings at which applicants for such certificates, other agencies of transportation serving the same territory and the general public are given full opportunity to present facts and opinions on the subject.

Up to this point in the discussion the entire subject has been approached from the standpoint of the State's power. It is now desirable to look at the question from the side of the operator of a motor vehicle common carrier, especially to learn what steps he must take in order, either to stay in business after a State adopts the policy of regulation or enter the business anew.

THE motive of this discussion of State regulation of motor vehicles used for hire is for information only. It is not intended as favoring either one side or the other of the question. The Motor Vehicle Conference Committee will appreciate any comments or arguments pro and con that readers of the article may care to advance. The purpose of the article is to lay before those interested facts and arguments which will facilitate the passage of only such laws as are scientifically correct and fair to all concerned.

In a few States, as New Hampshire, for instance, it is only necessary for the operator to obtain a permit from the State authority. This is the rare exception, however, rather than the rule. In nearly every other State a Certificate of Public Convenience and Necessity is required; while in Colorado, New York and Wisconsin a permit from the governing bodies of the municipalities in which the common carrier seeks to operate must also be secured.

In several States motor vehicle common carriers established at the time the law first went into effect have been expressly exempted from this requirement making it necessary for none but operators beginning business after the passage of the law to obtain Certificates of Public Convenience and Necessity. In Connecticut, however, and in general in every other State, established, as well as new motor vehicle common carriers, have been obliged to demonstrate to the State agency their right to exist after the State control act has been written into the statute books. Obviously, this has very often meant real hardship to those who have invested substantial sums of money in motor vehicles and have built up paying businesses over certain routes only to be obliged to abandon everything under State regulations.

Another usual prerequisite to the operation of motor vehicle common carriers has been the necessity of taking out indemnity bonds for the payment of any claims that may arise from any injury caused to persons or damage done to property by the carrier. In general the conditions of these indemnity bonds and sometimes their amounts are left to the State agency to determine. Frequently, however, the amounts are fixed by law as in Washington, where $5,000 to $10,000 is prescribed for indemnification of claims arising from injury to persons and $1,000 for damage to property.

While in the imposition of annual registration fees and other forms of taxes upon motor vehicles, State legislatures have in only a few cases discriminated between motor vehicle common carriers and private carriers, nevertheless, they have drawn a sharp line between motor vehicles used privately by their owners and those operated for hire.

Any discussion of State regulation of the motor vehicle when used as a common carrier would be incomplete without reference to the arguments for and against such regulation. In so doing, however, the opinion frequently expressed that railroad and trolley companies, as a result of the severe competition of motor transportation, are seeking State regulation as a means of killing off such competition, will be totally disregarded, and only such arguments recorded as are predicated on public welfare, sound economics and strict impartiality.

With these premises, therefore, those who contend for State regulation say that such control is necessary:

(1) Because motor transportation for hire is a public utility, and as such should be regulated along with other public vehicles, so that travelers and shippers by such means can be made sure of safe, prompt, regular, adequate, efficient and economical service.

(2) So that, in all cases where motor vehicle common carriers come, or are likely to come, in ruinous competition with other common carriers, the State can step in and determine whether public convenience and necessity require such competition, and save, if desirable, the pre-existing agencies of transportation.

(3) In order to shoulder upon the motor vehicle common carrier obligations, financial and otherwise, in return for the rights given it to operate for a profit over all or certain highways within a State especially so since the highways are built and maintained by the public. In some cases these rights take the form of valuable franchises which virtually grant monopolistic privileges over certain routes.

(4) For the purpose of eliminating the irresponsible, so-called "fly-by-night" companies and individuals who, while undergoing certain destruction for themselves, pull down with the ruin well managed motor transportation agencies which render a real public service and are entitled to a reasonable return on their investments and a stabilization of their business.

In objection to these arguments for State regulation of the motor vehicle common carrier, opponents of the proposition maintain:

(1) That granted motor transportation for hire is a public utility, public interest can best be served by unrestricted competition and complete freedom from regulation in which none but the fittest can survive. This policy they contend will yield to passengers and shippers the maximum of results with the minimum of cost.

They deny any analogy between motor vehicle common carriers and railroad and trolley transportation agencies, pointing out that the latter by virtue of private owner-

Summary of Salient Features of State Laws Regulating Motor Vehicle Common Carriers

State	Law in Effect	State Agency Exercising Control	Application of Control	Prerequisites of Operation	General Powers of State Agency, Etc.	Special or Extra State Taxes
Alabama	1919	State Tax Commission.	Passenger transportation only. Within, out from and into municipalities.	Filing of written statement showing terminal points of routes to be covered. Obtaining of special license.	x	In lieu of regular registration fees, the following Seating capacity 5 pass. or less $37.50 Seating capacity over 5 pass., less than 10 60.00 Seating capacity over 10 pass 90.00
Arizona	1919	Corporation Comsion.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by Commission.	General control over granting of Certificate of Public Convenience and Necessity; regulating service; fixing rates and fares.	x
Arkansas	x	x	x	x	x	x
California	1917	Railroad Commission.	Passenger and property transportation. Out from and into municipalities only.	Certificate of Public Convenience and Necessity.	Grant, refuse, suspend, revoke or amend Certificates of Public Convenience and Necessity; prescribe service or extensions thereof; fix rates and fares, supervise fiscal affairs; authorize sale or lease of certificates.	x
Colorado	191	Public Utilities Commission.	Passenger and property transportation. Within, out from and into municipalities.	Permission from municipalities to operate. Certificate of Public Convenience and Necessity.	Wide control over issuance of Certificates of Public Convenience and Necessity; prescribe service or extensions thereof; fix rates and fares; promote health, safety and convenience of operation. Municipalities may purchase and operate motor vehicle common carriers.	Special registration fees for passenger carrying motor vehicle: Seating 9 passengers or less, $20; for each additional seat of capacity, $1.
Connecticut	1921	Public Utilities Commission.	Passenger transportation only. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity insurance based on seating capacity; range $5,000 to $10,000 per vehicle.	Grant or withhold Certificate of Public Convenience and Necessity. Street railroad companies may acquire, own and operate motor vehicles for hire.	Extra registration fees as follows: Regular fees plus $15 for vehicle with seating capacity of 5 or less; over 5 but under 21, $2 per seat over 5; 21 but under 41, $5 per seat over 20; 41 or over, $10 per seat over 40.
Delaware	x	x	x	x	x	x
Florida	x	x	x	x	x	Special registration fees: For passenger carrying vehicle: seating capacity 7 or less, $5 per seat; over 7 but less than 17, $7.50 per seat; 17 or over, $10 per seat in addition to 75c per 100 lbs. gross weight of vehicle and load. For property carrying vehicles, $1.50 per 100 lbs. gross weight on pneumatic tires; $2.25 per 100 lbs. on solid tires.
Georgia	1907	Railroad Commission.	x	x	The Commission holds that it has jurisdiction over motor vehicle common carriers, but has not as yet had occasion to exercise this power.	Special registration fees for passenger carrying vehicles with a seating capacity of ten or more, $75.
Idaho	x	x	x	x	x	x
Illinois	1921	Commerce Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Adequate indemnity insurance or sworn statement of ability to meet any possible damage claims.	Grant, refuse, alter, modify Certificates of Public Convenience and Necessity. Regulate rates, fares, service, contracts, practices, etc.	Extra state tax on property carrying vehicles not operated exclusively within a municipality. Gross weight 12,000 lbs. or less, 1c per mile; over 12,000 lbs., 2c per mile. On passenger carrying vehicles gross weight 12,000 lbs. or less, 1/15c; over 12,000 but not more than 15,000 lbs., 1/8c; over 15,000 lbs., 1/6c per mile.
Indiana	x	x	x	x	x	x
Iowa	x	x	x	x	x	x
Kansas	x	x	x	x	x	x
Kentucky	x	x	x	x	x	x
*Louisiana	x	x	x	x	x	x
Maine	1921	Public Utilities Commission.	Passenger transportation only. Within, out from and into municipalities.	Certificate of Permission.	Make rules and regulations governing operation; fix fares, regulate routes and schedules, etc.	Extra State Registration fee amounting to double normal fee.
*Maryland	1916	Public Service Commission.	Passenger and property transportation, Within, out from and into municipalities.	Annual permit.	Grant or refuse permits. Make rules and regulations governing operation. Fix rates, fares, schedules, etc. Provide for safety and convenience of traveling and shipping public.	x
Massachusetts	x	x	x	x	x	x
Michigan	x	x	x	x	x	x
Minnesota	x	x	x	x	x	25% extra registration fee for property carrying motor vehicles and passenger carrying motor vehicles seating more than seven passengers.
Mississippi	x	x	x	x	x	x
Missouri	x	x	x	x	x	x
Montana	x	x	x	x	x	x
Nebraska	1919	State Railway Commission.	Commission has only asserted jurisdiction over property transportation out from and into municipalities.	x	Commission in 1919 issued an order affecting rates and classifications of property carried by motor vehicle common carriers out from and into municipalities. Order rescinded in 1921.	x

State	Law in Effect	State Agency Exercising Control	Application of Control	Prerequisites of Operation	General Powers of State Agency, Etc.	Special or Extra State Taxes
Nevada	1919	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond not less than $500 nor more than $10,000 per vehicle.	Issued or withhold Certificate of Public Convenience and Necessity. Regulate fares, rates, schedules, classifications. Examine books and records; prescribe service; order improvements, additions, etc.	Extra annual tax of $2 per 100 pounds gross weight for operating on first class highways. $1 per 100 pounds on second class; 25c per 100 pounds on other than 1st and 2nd class.
New Hampshire	1919	Public Service Commission.	Passenger transportation only. Within, out from and into municipalities.	Permit to operate. Indemnity bond of $500 per vehicle plus $100 per person of seating capacity.	Grant or refuse permits. Establish reasonable rules and regulations governing operation.	x
New Jersey	1921	Board of Public Utilities.	Passenger transportation only and solely where it parallels street railway lines. Within, out from and into municipalities. Only applicable to lines established after March 15, 1921.	Indemnity bond of $5,000 by municipalities in which lines operate.	General supervision, regulation and jurisdiction in the matter of rates, fares, schedules, service, etc.	Special registration fees as follows: 5 passenger or less; $15; 6 to 8 persons, $17.50; 9 to 12 passengers, $20; 13 to 17 passengers, $25; 18 to 22 passengers, $30; 23 to 26 passengers, $35; 27 to 30 passengers, $40; over 30 passengers, $40; plus $2 per seat in excess of 30.
New Mexico	x	x	x	x	x	x
New York	1915	Public Service Commission.	Passenger transportation only. Within, out from and into municipalities.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	General jurisdiction over rates, fares, schedules, service, etc.	Special registration fees as follows: 5 pass. or less $15.00 — 21-22 pass. $55.00 6- 7 pass. 24.50 — 23-26 pass. 61.50 8-10 pass. 30.50 — 27-30 pass. 67.50 11-16 pass. 43.00 — Over 30 pass. 67.50 17-20 pass. 52.00 — plus $2 per pass. over 30. Schedule not applicable to omnibus operating wholly within municipality under franchise granted by said municipality.
North Carolina	x	x	x	x	x	Extra registration fee of 50% over normal fee.
North Dakota	1919	Board of Railroad Commissioners.	Passenger and property transportation. Within, out from and into municipalities.	x	Fix and adjust rates, fares, classifications, schedules, etc. Establish uniform accounts. Investigate books, records, methods, etc.	Extra registration fee for passenger carrying vehicles, 25c per passenger of seating capacity allowing 16 inches of seating space per passenger.
Ohio	1921	Public Service Commission.	Passenger transportation only. Out from and into municipalities only.	x	Fix fares; exercise general supervision over the operation of the carrier, regulate general relationship between carrier and public.	x
Oklahoma	x	x	x	x	x	x
Oregon	1920	Public Service Commission.	Passenger and property transportation. Out from and into municipalities only.	Certificate setting forth special terms and conditions under which operation is permitted. Indemnity bonds as conditioned by the Commission.	Supervisory and regulatory powers on all matters affecting the relationship of carriers with passengers and shippers. Fix reasonable rates, fares, charges, service, facilities, etc. Supervise and regulate accounts; require reports, data, etc.	For passenger carriers extra registration fee of $4 per passenger allowing 20 inches for seating space per passenger. For property carriers extra registration fee of 50c per inch of total tire width. In addition for both passenger and property carriers an annual fee for administration of motor vehicle common carrier laws of not more than $10 per vehicle.
Pennsylvania	1914	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	x
Rhode Island	x	x	x	x	x	Extra registration fee of 100% over normal fee.
South Carolina	x	x	x	x	x	x
South Dakota	x	x	x	x	x	x
Tennessee	x	x	x	x	x	x
Texas	x	x	x	x	x	x
*Utah	1918	Public Utilities Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	General Supervision and regulation. Fix rates, fares, tolls, rentals, charges and classifications; regulate practices, facilities and methods. Establish uniform accounting; make investigations; require reports, etc.	x
Vermont	x	x	x	x	x	x
Virginia	x	x	x	x	x	Extra annual tax of $5 per vehicle in cities and towns of less than 5000 population; $10 per vehicle where population is 5000 or over.
Washington	1921	Department of Public Works.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond $5,000 to $10,000 per vehicle for injury to persons; not over $1,000 for damage to property.	Grant, refuse, suspend, revoke, alter, amend Certificate of Public Convenience and Necessity; fix proper rates, fares, charges, classifications, regulations. Prescribe equipment service and safety of operation. Regulate accounts; require reports, etc.	Extra annual registration fees: Passenger carriers for vehicles with seating capacity of 8 or less, $10; 50c per passenger over 8. For property carriers, $10 for vehicle of 3 tons or less capacity; $1 per ton of capacity over 3 tons.
West Virginia	1921	State Road Commission.	Passenger and property transportation. Within, out from and into municipalities.	Permit to operate.	Grant permits although no discretionary power is vested in Commission. Classify vehicles and fix their privilege taxes.	For passenger carriers extra registration fee roughly 100% greater than normal annual fees.
Wisconsin	1915	Railroad Commission.	Passenger transportation only. Within, out from and into municipalities.	Consent of Municipality Indemnity bonds as fixed and approved by the Commission.	Determine adequacy and reasonableness of fares, routes and service. District Attorney authorized to enforce rules laid down by Commission.	Special fee for passenger carriers operating wholly within a municipality, $10 per vehicle which is in lieu of regular fee.
Wyoming	x	x	x	x	x	x

*Since these tables were made up the following information under "Special or Extra State Taxes" has come in:

LOUISIANA

Special registration fee for passenger carriers: 68c. per hp., plus $2 per passenger up to 8; $3 per passenger, 8-25; $5 per passenger over 25.

MARYLAND

Special fee, $1.20 per hp.

TEXAS

Carrying persons or property for hire between municipalities, $32 to $160, plus ½c. to 4c. per mile traveled according to net carrying capacity.

ship of franchises, rights of way, road beds, tracks and terminals have an exclusive and monopolistic control over all transportation on their routes. Motor truck operators, on the other hand, even where granted a monopoly of transportation for hire over a certain prescribed highway or portion thereof cannot deny the use of that highway to others who wish for themselves or as private carriers to transport persons or property over those same routes.

Finally, they point out that governmental regulation of rail and trolley common carriers came after these agencies had abused their rights and privileges and through pools, stifling of competition, exorbitant increase of rates, discrimination, stock watering, etc., made it necessary for the public in self-protection to subject them to control. By the very nature of the service these evils are impossible with motor transportation, since the road is free to the use of everyone and motor vehicles the medium for transportation over the roads are quickly, cheaply and in unlimited numbers available for everyone.

(2) Since the obvious outcome of the first argument advanced against State regulation is "cut-throat" competition between various forms of transportation attempting to serve a certain territory and *per se* between the motor transportation companies themselves operating in competition over certain highway routes, the opponents of State regulation cannot escape the query whether they are willing to face the logical consequences of such a struggle. Without hesitation they answer that wherever rail, trolley or any other form of transportation for hire cannot stand up before a newer and better form, public interest demands that it should give way; likewise within that newer and better form of transportation, the rule should be survival of none but the most efficient and economical agencies. They are confident that even though such a policy may mean the destruction at times of more or less invested capital, as it did when rail and inland water transportation first came into acute competition, the final economic benefits to the community as a whole will many times compensate for the loss involved.

(3) As for shouldering upon motor transportation for hire financial and other burdens which it should rightly carry, opponents of State regulation say that legislative bodies have not heretofore found it necessary to establish such control in order to determine the weight limits for motor vehicles used as common carriers; their registration fees and other charges; their liability to the public for injury to persons or damage to property, etc. If this is all that is involved it is not sufficient to warrant almost unlimited regulation in all other respects by a State agency.

(4) Lastly, those against State regulation believe that the natural working out of economic laws will do more to stabilize the motor transportation for hire business than extensive interference on the part of governmental agencies of any sort. They feel that the proposition is paternalistic and will result either in discrimination in favor of one or more types of transportation, and against all the rest, or else that it will promote monopolistic advantages for certain motor transportation companies, and that through it all the traveling and shipping public will pay the cost.

In even-numbered years the activities of State legislatures are relatively light, since no more than eleven or twelve State law-making bodies get together in regular session, while few of the others meet in special session. Notwithstanding this fact 1922 is producing a big crop of bills dealing with motor vehicle common carriers. The Arizona State Legislature now in special session and the current regular sessions of the Maryland, New Jersey and New York State legislatures are considering extensions of the existing powers of their State agencies exercising control over motor vehicle common carriers. On the other hand, in Kentucky, Massachusetts, Mississippi, Rhode Island, South Carolina and Virginia, where the State legislatures are in regular session, and where as yet there is no such regulation, many measures aiming to bring about a greater or less amount of such control are now receiving the careful consideration of the legislators.

In this connection it is interesting to note that in New Jersey the strongest and most active opponents of State regulation and the extension thereof, have introduced and are striving to bring about exclusive power in the premises for the local incorporated municipalities. Apart from any other arguments pro and con for such local control, it must be apparent that the operation of a motor vehicle common carrier beyond the confines of a single municipal jurisdiction of a State becomes extremely complicated and burdensome under such circumstances and is likely to suffer from the varying policies of constantly shifting local governing bodies.

Another interesting movement to note in some States is proposed legislation to require every common carrier motor vehicle engaged in the transportation of passengers to have both a front and rear entrance, while in Maryland a pending measure would require not only a chauffeur but also a conductor on every such vehicle. This would seem to indicate that some State law-makers seek to rewrite in motor-bus transportation the full crew laws which for a long time have been an economic burden for the railroads.

The motive of this discussion of State regulation of motor vehicles used for hire is informative only. It is not intended and in no way must be regarded as favoring either one side or the other of the question. For this reason the conference committee will appreciate greatly any information; arguments pro and con; comments; corrections or criticisms which all those who read this discussion may have to offer, especially if such material includes the practical experiences that have resulted from regulation by the States where it is now in force. How important this is can be seen from the fact that in 1923 the legislators of forty-two States will meet in regular session and doubtless be called upon to make decisions on scores of bills vital to motor vehicle common carriers. The conference committee hopes at that time to be of service in laying before all concerned facts and arguments which will facilitate the passage of only such laws as are scientifically correct and fair to motor vehicle common carriers; competing common carriers and the public.

IT is doubtless known what effect the Townsend law providing Federal road aid in the United States is having to build up our own highways. Brazil has just approved and adopted a similar law, according to a statement from Ambassador Morgen at Rio de Janeiro, stating that an executive decree on Jan. 11, 1922, made effective the law authorizing federal subsidies up to 50 per cent for the improvement and maintainence of roads and highways. The improvement work will be done by the various states of Brazil, and the federal government will reimburse them by 50 per cent of the cost.

This is probably the most significant step yet taken in any country of Latin-America looking to the improvement of roads. The exchange rate in Brazil is temporarily down but it has been pointing upward for some weeks and is now considerably above the low point reached during the latter part of 1921. Brazil already has built many roads, as has been shown in previous bulletins, and with this new federal road aid the possibilities in Brazil appear tremendous.

The FORUM

Standard Valve Stems

Editor, AUTOMOTIVE INDUSTRIES:

1. Referring to the bulletin of the Goodyear Tire & Rubber Co., mentioned in AUTOMOTIVE INDUSTRIES of Feb. 9, 1922, and sent by them to the Tire and Rim Association, regarding a standard valve stem for disk wheels that would enable access to be had to the valve for inflating the same from the front side of the disk wheel, is not the real problem a universal or standard valve stem for all types of wheels accessible from the front of all wheels?

2. As is well known, any disk wheel with the valve stem on the back side of the disk is very impractical. While it may be temporarily so used, unless its position is changed it will kill the disk wheel and prevent its extensive use, and, as pointed out, the continued use of the disk wheel leads to the use of a multiplicity of makeshift devices, all more or less impractical.

3. This is a question of valve stems and not valves, as stated in the bulletin, and these must not be confused. In the bulletin the suggestion is made to "standardize on one type of valve," whereas in reality one type of valve stem is meant; for, as a matter of fact, the valve *per se* is always the same and standard, and the only thing that changes is the length of the valve stem itself, which is naturally modified with all the various sizes and types of wheels used, whether these are of the wood-spoke, demountable-rim type with felloe band, the wire-wheel, or the disk detachable type without felloe band.

4. At present, to meet these various conditions, it requires for the various sizes of tubes six or seven different lengths of valve stems and at least two or three different lengths of valve stems are used in each size of tube, requiring tire makers' dealers to stock two or three different tubes of each wheel size and tube diameter.

5. Added to the above is now the further suggested complication of a valve stem construction that will give accessibility for inflation from the front of the disk wheel, and which, if met in any of the ways suggested, by adopting any device solely applicable to disk wheels, must lead to many more complications, and, as pointed out in the bulletin, may result in each disk wheel maker adopting a special device to suit his individual construction.

6. The construction of the various makes of disk wheels varies to such an extent that any form of valve accessibility that touches the disk itself is impossible unless all disk wheels are of one design, and any suggested standard valve stem must be based upon a predetermined shape and position of the disk relative to the center line of the wheel, and this is impossible without complete and detail standardization of the disk wheel itself.

7. The only completely standardized element of wheel construction, whether the wheel is of the wood-spoke, demountable-rim, wire-wheel, detachable, or disk-wheel detachable type, is the standard rim, and it is necessary to standardize the valve stem relative to the rim only and define and standardize its length and position relative to the standard rim only.

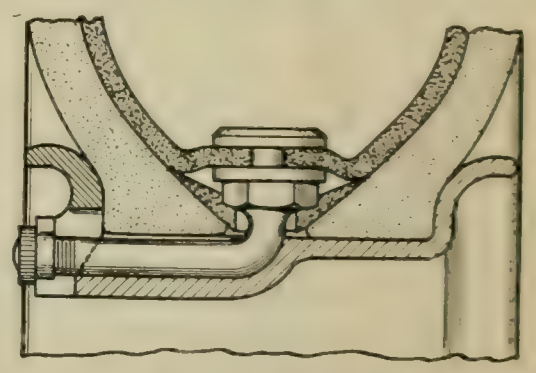
8. In this case the valve stem will be accessible for inflation from the front face of the rim, in a thoroughly protected position, and identically located for all types of wheels, and without the necessity of delving in between wood or wire spokes or behind the disk of the disk wheel. (See accompanying cut.)

9. An absolutely standard valve stem for each size of rim or tire or tube would give the following results:

(a) A single standard valve stem for each size of rim or tire or tube and every 3½-in. tube and valve stem would always be the same, and only one type of 30 x 3½-in. tube would be made by the tire maker and carried in stock by the dealer instead of two or three as at present.

(b) As the valve stem is accessible from the front of the rim, the ease of accessibility is independent of the number of spokes and the depth of the rim, and the 40 x 8-in. valve stem is quite as accessible as 30 x 3½-in. stem, and both are much more easily accessible than the present valve.

(c) The tire with tube and valve stem complete would be much more easily mounted on the rim, as it could be pushed straight upon the rim and not angled over the rim, and is the only form of valve stem that is practical for the larger sizes of tires, and, in the case of demountable rims, would not require a hole through the felloe band, and, in the case of the larger sizes of tires, a cut-away slot in felloe to or beyond the center for the present valve stem to allow the rim to be mounted, causing a great weakening of the felloe band.



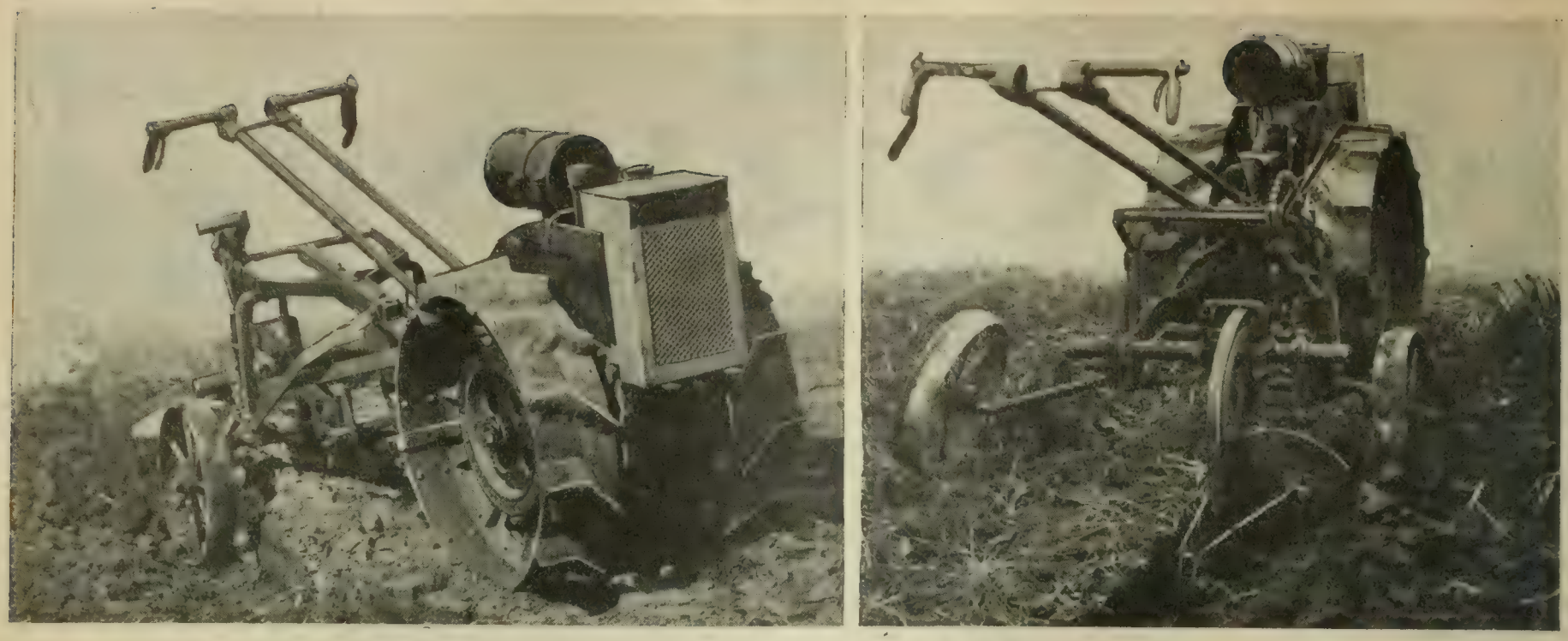
Sectional view of tire stem, showing location of bent valve stem and accessibility

(d) This standard valve stem would be 10 to 20 per cent cheaper than the present valve stem and would be much more convenient in every way, especially as the complete tube, in its packed or collapsed state, would require less space and will be more compactly packed into the box and might use a smaller size box.

(e) This standardization would ultimately result in other great savings and economies and be of great value to all users of pneumatic tires, both the automobile makers and the ultimate consumer.

10. The adoption of the proposed standard could be quickly brought about by the tire makers without any increased expense to themselves or the ultimate consumer, and without any complication or expense in any "interim period," during which both types of valve stems might be required, as either system could be arranged to interchange on all existing types of wheels.

11. The advantages and necessity for such a standardization are apparent, and it is up to the tire manufacturers to bring this about, as this would be to their own individual advantage as well as to the advantage of all tire users.



Two views of Beeman tractor showing anti-side draft offset plow hitch

As Sherman said, "The way to resume is to resume," and equally so, "the way to standardize valve stems is to standardize valve stems," and the greatest financial gainers will probably be the pneumatic tire makers.

W. J. P. MOORE.

Eliminating Side Draft with Garden Tractors

Editor AUTOMOTIVE INDUSTRIES:

In his recent article on Garden Tractors, Mr. Ziesenheim mentioned particularly the trouble encountered with these narrow tractors with the right bull wheel in the furrow. That, as well as many other things he says, indicates that in some way he has gained some real knowledge with reference to garden tractors, and he certainly will appreciate what we have accomplished in developing one anti-side draft offset plow hitch. We enclose herewith two photographs of one of our tractors operating with this hitch.

E. R. BEEMAN, President,
Beeman Tractor Company.

An Analysis of the Coal Situation

AN analysis, the purpose of which is to give business men information regarding possible fuel supplies in the event of a strike of miners on April 1, was issued recently by the Coal Bureau of the Natural Resources Department of the Chamber of Commerce of the United States. The bulletin carries charts covering conditions in particular localities throughout the United States.

A general summary covering the situations with which the booklet is concluded, says:

"Factors which will control supplies in case of a strike that closes the mines in union fields will be stocks on hand and output of non-union fields.

"Anthracite: As the anthracite field is 100 per cent unionized, all supplies in the event of a complete closing of the mines will have to be drawn from stocks on hand. The United States Geological Survey has published figures based on statements from 648 typical retail dealers, showing the day's supply of anthracite usually carried by them on April 1, as follows:

April 1, 1919	31 days
March 1, 1920	21 days
April 1, 1921	36 days

"If these figures should hold good for all dealers, there would be in dealers' hands, normally, on April 1 about a month's supply. The Geological Survey also give the following figures covering approximate stocks of anthracite, domestic sizes, in hands of producers Jan. 1, 1922:

	Tons
At Eastern points	2,000,000
Storage at Great Lake ports	1,000,000
By-product coke for domestic use	1,000,000
Total	4,000,000

"Assuming an equal supply on hand April 1, and assuming further, that this supply could be evenly distributed among all consumers, it would last several months, as it would be available at the beginning of the warm summer months when consumption is lightest.

"The probable disarrangement of the usual system of distribution which would result from a strike, the variation in storage capacities and stocks in storage, with the uncertainties of weather conditions make it impracticable to estimate the length of time the supplies of anthracite on hand would last.

"Bituminous: The following statement of the U. S. Geological Survey will be of interest as indicating the days' supplies of bituminous coal in the hands of various classes of consumers in the United States on Jan. 1, 1922:

	Days
By-product coke plants	42
Steel plants	48
Other industrials	51
Artificial gas plants	89
Electric utilities	51
Coal dealers—bituminous	33
Railroads (estimated from incomplete data)	35

"Subsequent statements are that supplies have increased to some extent up to Feb. 11.

"Average figures covering the entire producing and consuming areas rest on a theory of even division of product and uniform storage capacity and uniform stocks on hand throughout the country. In reality, however, such uniform conditions do not exist in the different communities. Moreover, in case of strike the ordinary lines of distribution are so disarranged that there results great variation in the ability of different communities to secure needed supplies."

Labor Problem Far from Solution

An attempt to weaken the trade unions shows an ignorance of the fundamental causes of labor trouble which previous strikes have not settled. Harmony between the employer and employee depends on the character of the organization regardless of any outside disturbances and influences.

By Harry Tipper

THE trouble with the pressmen in New York, the imminence of the strike of miners, the present strike in the textile field in New England, and reports of other strikes of more or less importance to their industries or localities, indicate how little the problem of labor has been solved by the previous strikes and how far the manufacturers are from being in a position to control the actions of the workers with any degree of efficiency in these various lines of endeavor. There is a good deal of interest in the fact that in all these strikes certain shops have been unaffected. In the pressmen's strike in New York, one of the newspapers was entirely unaffected and is not involved in the trouble as the aftermath of the strike. In the coal strike, some of the mines are not affected; in the textile strike in New England some of the mills are not affected.

These circumstances prove with renewed evidence that the individual establishment is capable of maintaining an agreement with its own employees regardless of the surrounding disagreements, if the proper organization has been built up. The amount of time lost and the money involved in the cost of these strikes is very large, but the loss of efficiency due to the difficulties created by the strikes, the bitterness resulting from the fight and the general antagonism is likely to be greater than the cost of the actual interruption of work. The difficulties of the individual establishments in avoiding strikes are not to be charged merely to the fact that they are in some cases non-union, and in many cases do not pay any attention to the union considerations. If they were notably unfair or unjust to their workers it would be a comparatively simple matter for these workers to organize themselves in order to enforce their demands. In fact, this has been done in scores of cases where there was a real grievance. In these individual establishments there is an opportunity to get together with the employees because the discussion relates to the same immediate organization and the same problems, without the interference of outside groups composed of manufacturers or workers, and officered by men who have added to the desires of members of the group their own demands and their own necessities for action. It is useless to consider the merits or demerits of these strikes. The coal miners claim that the wages have not affected the price of coal, as charged by the operators; that the operations of the mines are notably inefficient as they average only 3 to 4 days per week at work, and that the present wage is not any more than they are entitled to. The actual strike, however, has been caused by the maintenance of a stubborn attitude by both sides to the controversy, which attitude indicates that they are willing to have the matter go to a trial of strength and are not particularly anxious for an agreement. The operators have admitted through their spokesmen that their present intention is to beat the union, a victory which will be of no value either to the coal industry or the rest of the people because it will form merely a basis for future disagreement. They are evidently disinclined to compromise or to arrive at any agreement, hoping to break down the strength of the union at a time when the production of the coal product is not required to such a large extent, and when the surplus supplies are plentiful.

It would seem that the coal operators have not been particularly anxious to avert this strike and, in fact, the actions they have taken would indicate that they have themselves in a sufficiently strong position to be willing to let the matter go to a strike in order to break the strike and thereby weaken the union. It is astonishing that employers groups should learn so little from past experiences. The history of labor union development is one long record of strikes, many of which have been broken, sometimes after months of idleness. In spite of all these defeats the trade unions have grown stronger and have succeeded in securing more from the manufacturer. It is not likely that the success of the coal operators in the strike will weaken the union, and before long that fact will be evidenced in some way or another. The only way in which the unions can be weakened is by the adoption of methods that will provide a greater degree of fair play and justice to the worker than those which the union adopts.

The absence of any serious consideration of the labor question at this time is indicative of the fact that the manufacturer associates labor troubles only with the acute difficulties of strikes and interruptions. Labor is not any more satisfied than it was in 1920, and the labor unions have not receded from their position in any single point. The problem of developing a satisfied and contented organization within the factory is still up to the individual manufacturer.

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Horace M. Swetland, President
W. I. Ralph, Vice-President H. M. Corey, Treasurer
A. B. Swetland, General Manager
David Beecroft, Directing Editor
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
Norman G. Shidle, Managing Editor
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Herbert Chase

DETROIT OFFICE
J. Edward Schipper

WASHINGTON OFFICE
816 Fifteenth St., N. W.

BRANCH OFFICES
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Stresses Due to the Transmission Brake

ONE of the objections often urged against the transmission brake is that it imposes greater stresses upon the propeller shaft, differentials and rear axle shafts than would otherwise occur. The reasoning behind this argument, however, is not always as clear and convincing as might be desired.

If the transmission brake is well designed it is usually an easy matter to stall the driving wheels with it, and the stress on the propeller shaft, rear axle shafts and other members of the transmission line then depends directly upon the adherence of the rubber tires to the ground. The more powerful cars and trucks are so designed that when the engine develops full power on the low gear, and especially on the reverse, there is enough torque on the drive wheels to slip them on ordinary dry road surfaces. In laying down the specifications for the Class B military truck, for instance, this was one of the points insisted upon. But there is one condition of operation under which the torque on the transmission members can be materially increased over that which the engine can produce on a steady pull. If the truck or other vehicle gets stalled on a heavy road it is a very common thing for the driver to put his gear in low, speed up the engine and let the clutch in quickly. Under such conditions, owing to the energy stored by the flywheel and the excess capacity of the clutch beyond the maximum steady torque of the engine, much greater torque can be impressed upon the drive members than in steady driving. The only thing that limits the torque transmitted under such conditions is the adherence of the drivers to the ground, and the limit on the driving torque is therefore exactly the same as the limit on the braking torque. It is true that this driving torque is abnormal, yet it is likely to occur on any truck and must be provided for in the design.

It is therefore not correct to say that the transmission brake imposes heavier stresses on the driving members than any due to the drive itself. On the other hand, the fatigue effects of the braking stresses are additional to the fatigue effects of driving stresses, and since the wheels will undoubtedly be locked by the transmission brake much oftener than they will be slipped on solid, non-slippery surface by a sudden release of the clutch, it is not unlikely that fatigue strains cause an earlier failure of the drive members if a transmission brake is used.

Percentages

THIS editorial is intended not for mathematical sharps but rather for those whose mathematical education has been neglected, if any such there be among the readers of AUTOMOTIVE INDUSTRIES. We fully believe that the great majority of our readers are thoroughly sound in their use of percentages, but, of course, the minority always has a right to consideration.

We often hear the statement that between the extreme values of a variable there may be a difference as great as — per cent. Now, a difference cannot be properly expressed as a percentage, because one can never tell whether the percentage is based on the smaller or the larger of the values. For instance, between 40 and 120 there is a difference of 80, which is 200 per cent of the smaller and 66 2/3 per cent of the larger figure. The statement might be rendered precise by saying that the difference between the extreme values may be as great as — per cent of the lower value, but it is much better to express this relation by saying that the quantity may vary between limits of the ratio of 1 to 3 (using the values of the foregoing example).

Right here it may be in order to point out that a quantity cannot be reduced by more than 100 per cent. This would seem to be obvious, yet statements in which something or other is decreased by more than 100 per cent are met with constantly—naturally less frequently in printed than in hand-written or typewritten matter, because most of the material that appears in print has been gone over by one or more editors and by one or more proofreaders after the author has finished with it. This slip sometimes occurs in unexpected places. For instance, some years ago a rather successful business man with a

college training, who was then president of a leading engineering society, in a public address made the rather surprising statement that by the introduction of improved machinery the production cost of some automobile parts had been reduced 300 and even 400 per cent.

To make percentage figures definite and comparable they must always be based on the same thing. For instance, commercial profits should always be based upon the sales price. If a dealer buys an article at 80 cents and sells it at a dollar, the profit is 20 per cent, not 25.

Some people make a habit of using the percentage method of comparing magnitudes where it is not particularly suitable. For instance, the statement may be made that, in 1920, 10,000 per cent as many automobiles were manufactured as in 1902, which is the same thing as saying that the 1920 production was 100 times as great as that of 1902. The writers who affect this style undoubtedly belong to the impressionist class and are looking for the largest possible figures to use. A small value can be conveniently expressed as a percentage of a larger one, but to express a very large value as a percentage of a small one is not advisable.

The Genesis of Service

MUCH water has gone under the automotive bridge since 1904. Volume of business has increased, design and performance have been improved immeasurably, methods of selling and service have been considerably refined. But many fundamentals are found to be the same in 1922 as in 1904.

Many of the veterans of the industry will find considerable interest in the following editorial which appeared in *Horseless Age* of Nov. 9, 1904. We ran across it the other day and it brought so much food for thought to us that we are passing it along. The editorial was headed, "The Importance of the Agent," and it read like this:

Until about four years ago, the early, successful manufacturers of automobiles declined all offers of would-be agents, as they had no difficulty in selling all the machines they could make, and did not care to pay an agent's commission. In 1901, however, the number of practical machines and the capacities of the individual manufacturers having greatly increased, most of the leading firms found it advisable to establish branches or agencies in all the large cities, and from that time on the agency has continued to grow in importance as a factor in the automobile business. At present many more cars are sold through agents than by manufacturers direct, and the product of a few large concerns is disposed of almost entirely by agents.

In any city where a considerable number of cars are represented, a manufacturer not represented and located at a distance will find it practically impossible to make a sale. The present day purchaser wants to be convinced of the merits of a car by demonstration rides, etc., and will not, as a rule, make a lengthy trip to a factory if he can inspect and test many different makes right in his own city. Then, too, there are many real advantages to the new owner in the fact that an agent for his car is conveniently located in his home town. He will receive more careful instruction in the operation of his machine, and in case of any difficulty during his early experience it will be a great aid to have the agent near to advise and assist.

Agents usually carry a considerable stock of repair parts, and a break or wearout necessitating the renewal of a part causes less delay if the part can be supplied by the agent from stock than if it had to be shipped from the factory.

Finally, in the smaller cities, if a car is bought from a dealer, well and favorably known, it is an assurance to the purchaser that he will be treated fairly in every respect, and that the manufacturer's guarantee will be lived up to. In view of these several facts, the automobile purchasing public prefer to deal with agents, and manufacturers are therefore obliged to appoint agents for all territory in which they expect to do a considerable business.

Since the local markets are thus controlled by agents, and the local business is divided among them largely in proportion to their respective business ability, reputation for integrity, etc., manufacturers are deeply concerned in securing the most capable agents in every locality. As the movement progresses, the difference in the actual value given for the money by different manufacturers will be shaved down finer and finer, and the different models will more closely approach each other in general design. This renders the choice between the different makes of cars constantly more difficult for the purchaser, and sales depend more upon the agents' ability than in the past. The capable agent is, therefore, in great demand at present, and this season, practically for the first time in the history of the industry, his services are being competed for by the leading manufacturers.

Manufacturer's Agents

WE are witnessing the entrance into the field of a new method of automobile distribution, a method which is well known in some automotive products and in other lines, but which has never been used extensively in the selling of motor cars and trucks. It is the use of a manufacturer's agent or jobber. The nearest approach to this has been the controlling of sales of the manufacturer's output by a separate company acting in conjunction, and with an interlocking of interests, with the manufacturer.

Because of the increasing necessity of studying problems relative to the marketing of motor cars and trucks, it may be well to consider the advantages and disadvantages of this method of distribution. Whether the saving accrued will outweigh the loss of personal contact between the manufacturer and the retailer remains to be seen. Many of the minor details of this form of marketing may be advantageous and applicable to the manufacturer marketing his product through his own selling organization. The method is worth analyzing.

Knudsen Takes Charge of Chevrolet

Ex-Ford Production Expert Joins G.M.C.

Election Indicates duPont Has Taken Actual Control of Corporation's Policies

DETROIT, March 27.—The election of W. S. Knudsen as vice-president in charge of operations of the Chevrolet Motor Co. and the assignment of K. W. Zimmerschied, although continuing as president, to advisory duties connected with the office of Pierre S. duPont, president of the General Motors Corp., may be defined in a measure as ushering in duPont as the real active head of the great motors combination.

duPont Has Studied Industry

Since duPont became president of General Motors after the retirement of W. C. Durant, he has confined himself more to a study of the industry, the company's units and possibilities of development than to the active direction of its forces. Practically a stranger to automotive manufacture, he has, for more than a year, been acquainting himself with the men in the industry and the factors that have brought it to its present strength. The realignment of Chevrolet is credited directly to duPont.

Knudsen, former production manager at the Ford Motor Co., was brought into General Motors two weeks ago as assistant to Vice-President C. S. Mott, chairman of the advisory staff of the company. In those two weeks he made a survey of several General Motors units, including the Tarrytown plant of Chevrolet and made certain recommendations. His appointment as operations head of Chevrolet came after these recommendations.

Bigger Production Likely

It has been no secret that Chevrolet has been unable to get into production on a scale that, coupled with present prices, would make the unit a profit producer. With Knudsen's experience in Ford manufacture, and it is said he is one of the few Ford men who ever resigned from that company, General Motors plans to gain the utmost efficiency in the production of its low priced car.

Since the duPont regime in General Motors began, the Chevrolet small car has been steadily built up mechanically to give the utmost value at the price. It is now a question of making the car, with its improved units, at a production rate that will justify prices. The company will concentrate all its efforts on the manufacture of the small line, the F. B.

K. T. Keller will remain as a vice-president of Chevrolet and manager of manufacturing, according to the duPont announcement, and Colin Campbell will continue as vice-president of the several sales companies and general sales manager of Chevrolet.

In connection with the changes, it is recalled at General Motors headquarters that Zimmerschied will be resuming work of a nature similar to that performed by him under Durant. The resignation of Durant from General Motors and Chevrolet resulted in Zimmerschied being elevated to the presidency of Chevrolet.

Business in Brief

NEW YORK, March 28—The Federal Reserve Bank of Atlanta has reduced the rediscount rate from 5 per cent to 4½ per cent because of materially improved conditions.

Crop conditions in the Middle West are decidedly better than a few weeks ago, and strengthening of rural purchasing power has begun to translate itself into orders.

Grain and livestock trade sentiment remains bullish. Ranchmen are planning to replenish their herds.

Freight traffic continues to expand, and there has been a further reduction in the number of idle freight cars.

Steel mill operations, which in some cases are at 65 per cent of capacity, reflect almost unprecedented building operations, which also have served to strengthen the lumber market.

Steel mill and furnace operations generally are expanding.

A feature of the cotton market is its continued strength in the face of bearish operations.

The hide market continues dull, although there has been an increase in footwear production.

Retail distribution of dry goods shows a seasonable quickening.

Bank clearings for the leading cities for the week ending March 23 were $6,817,817,000, a gain of 2.7 per cent over the previous week.

The trend of interest rates is steadily lower.

Investment demand for attractive securities, both new and old, continues strong.

April Will Surpass March in Business

This Month Has Improved Over February, Which Showed Parts Trade Doubled

By James Dalton

NEW YORK, March 28—March will show a decided improvement over February in the manufacture and sale of motor vehicles. Orders already booked by makers of parts and materials assure a better business for April than for this month. Beyond April the outlook is uncertain but there probably are few industries which can look as far ahead as May 1 with assurance of satisfactory sales.

A few parts plants are running at capacity and a substantial number of them are producing at 50 per cent of capacity or more. The total of sales by parts makers in February was approximately double that of January and aggregated the business done in March, 1921, which marked the renaissance of the industry after the slump.

Partly Due to Deflated Inventories

The better business which is being enjoyed by parts manufacturers is due in part to the deflated inventories of motor vehicle builders but not all of it, by any means, can be attributed to this cause. It demonstrates conclusively that both passenger cars and trucks are being sold in much greater volume than at the same time last year. Neither branch of the industry is building up a reserve of completed vehicles and all makers are holding their schedules approximately to actual retail sales.

Spring sales at retail, in substantial volume, have begun nearly two months earlier than they did last year. Speaking comparatively there may be a falling off after May, but a production total of passenger cars equal to 1921 is practically certain and the total of trucks will be substantially larger.

The tone in Detroit is immeasurably better than it was at this time last year and confidence has replaced uncertainty. This confidence is solidly founded and few manufacturers have extravagant hopes. They are studying their markets with the greatest care and making dealer allotments on this

(*Continued on page* 742)

Action Postponed Against National

No Hearing on Petition for Receivership Pending Move Toward Settlement

INDIANAPOLIS, March 27—Hearing on an application for the appointment of a receiver for the National Motor Car & Vehicle Corp., filed by the Columbia Axle Co. of Cleveland, has been postponed until April 1 at the request of attorneys representing the creditors' committee. The postponement was with the consent of lawyers for the axle company and was based on information that a settlement of the suit might be reached out of court.

Lack of Working Capital Claimed

The petition of the plaintiff alleged that the liabilities of the automobile company were in excess of $1,300,000 and that the company's business was suffering from a lack of working capital. The petitioners represent a claim of $12,305.

Company officials and officers of the Fletcher American National Bank, the vice-president of which, Oscar Welbon, is chairman of the creditors' committee which is operating the National factory, insisted at once that the suit had been brought through error. They also said that a representative of the Columbia Axle Co. had been in the city the day before the suit was filed and received a settlement that was satisfactory, and added that the suit would be dropped shortly. Elmer Stout, vice-president of the Fletcher American National Bank, who has been acting as an advisor of the creditors' committee, also affirmed that the suit would be dropped immediately.

Say Suit Was Misunderstanding

To-day George M. Dixson, president of the National company, and M. E. Elstun, secretary-treasurer, gave out the following statement: "The court action was brought through a misunderstanding and will be entirely eliminated by the plan now completed and to be carried out fully at once.

"The financial affairs of the National Motor Car & Vehicle Corp., according to the present agreement with all parties concerned, will be carried out as originally planned."

When the announcement of the refinancing of the concern was made some weeks ago, and the placing of a $750,000 mortgage on the plant was made known, it was stated that but part of the bonds that were to be issued would be floated at that time, and that additional working capital would be supplied in the future.

ERIE OFFICIALS INDICTED

ERIE, PA., March 27—The Federal Grand Jury has returned indictments against officials of the Erie Tire & Rubber Co. charging them with using the mails to defraud and conspiracy.

It is charged the concern had offices here and sold stock on the false claims that it had acquired a 60-acre factory site in this city and had started building a five-story plant. The company was incorporated in Delaware for $10,000,000, divided into 200,000 shares. The Government claims the company purchased no property and had not started a building. The company claimed it had a patent on a double-durability tire.

The officers indicted are: E. H. Blackstone, Robert T. Philip, Albert L. Sleeman, E. W. Snyder, Fred A. Deiberling, Emil Levy, Benjamin Leven and George M. Graham.

The Farmer Will Play a More Important Part in Progress of Industry This Year

By Walter P. Chrysler

Chairman of the Board of the Maxwell Motor Corp.

Detroit, March 23.

FARM buying will have an important part in the progress of the automobile industry in June, July, August and September. There has been considerable buying recently by the farmers, due to an increase in prices for some of their products, notably corn and hogs, and this business will grow as the demand for other of their products brings better prices.

Buying by the farmers after September will lessen, but it will greatly exceed their buying in the winter months of this year and last, when it was practically stopped.

Payment of a soldier bonus should not depress business inordinately if handled by the government on a sound basis. There should be no increase in taxes required. Those soldiers who were injured or are in need should be taken care of at once at all costs. Those who are not in need should be compensated as the business conditions of the country permit.

The more money there is for industry the more work there will be for everyone, and, consequently, more prosperity. Business has made steady gains in spite of resistance, owing to the withdrawal of money from circulation by the government to pay off debts incurred during the war. Prosperity is largely a matter of keeping money in circulation.

Sale of Obenberger Approved by Court

MILWAUKEE, March 27 — The sale of the assets of the defunct John Obenberger Forge Co., appraised at $955,342, for the equivalent of $233,000, to Adolph Weidner, Milwaukee attorney representing the secured creditors, has been approved by the bankruptcy court. The bid was made under the first call on March 10, but was held open by the referee with instructions to J. F. Gerdis, trustee, to seek other bids. Since none were forthcoming, the single original bid was ordered accepted.

The bid of Weidner involves only $48,000 in cash, but the purchasers agree to assume all secured claims, amounting to $185,000. The cash will be used as dividends to unsecured creditors, who will receive about 2 per cent, according to Gerdis. Unsecured claims total $500,880. Administrative expenses will come out of the $48,000, however.

The larger secured creditors in whose behalf the bid was made are the First Wisconsin National Bank of Milwaukee; Klug & Smith, Milwaukee contractors, and the Erie Foundry Co., Erie Pa. According to Weidner, the new owners expect to resume operations in about 30 days.

Form Steel Company with Wills Director

Capitalized at $15,000,000—Will Manufacture for Automobile and Allied Producers

DETROIT, March 27—C. Harold Wills, president of C. H. Wills & Co., is named as one of the board of directors of the new Dominion Alloy Steel Corp., Ltd., which will undertake the production of alloy steel in Canada with a plant at Sarnia, Ont., opposite Port Huron, Mich. The company will have an authorized capitalization of $15,000,000.

Plans thus far made public call for the production of 50,000 tons annually of alloy and high-carboned steels for automobile and allied manufacturers. The work will be financed by the sale of $3,500,000 8 per cent cumulative preferred stock, of which $2,500,000 is said to have been underwritten in Detroit and Cleveland, and $1,000,000 in Canada.

George A. Simpson, formerly sales manager of the Steel Co. of Canada, it is declared, will be vice-president and general manager. Other directors so far named are Harry R. Jones, Canton, president of the United Alloy Steel Corp.; J. J. Mahon, Newark; Sir William MacKenzie, Toronto; Bert H. McCreath, Toronto; Col. William McBain, Toronto; W. Wallace Johns, Toronto, and W. B. Boyd, Toronto.

BUS PLAN FATE IN DOUBT

NEW YORK, March 27.—Trial of a suit instituted by Edward Schafer, a taxpayer, to restrain the Board of Estimate of this city from appropriating $1,000,000 for buses, is expected to begin here to-morrow. If the city wins, it will have the right to spend as much money as it sees necessary, even to the extent of $30,000,000, which its bus plans call for.

Walker Refinanced; Banks to Aid Others

Cleveland Companies Needing It Will Be Provided With Additional Capital

CLEVELAND, March 26—The refinancing of the H. J. Walker Co., maker of automobile engines, which has been announced here, is one of a number of contemplated steps to be taken by banking and financing interests of this city to provide additional capital for half a dozen Cleveland companies that are making automobile parts and accessories, according to well defined rumors.

With inventories worked down and other adjustments made, some of the companies find that the financial surgical operation was rather rough and that it left them lank and lean.

Banks in Better Position

The banks and financing interests here are said to be in a much better position than they were six months or a year ago, and they are now in a position to come to the relief of corporate interests that are intelligently managed and have a worthy product.

The plan for the refinancing of the Walker company, which supplies engines to the Grant Motor Car Corp. and others, was disclosed in letters that were mailed to stockholders.

It is known that a strong group has been formed for the refinancing and that when the names are announced they will give weight and prestige to the company. Until the plans are approved by the stockholders, the names of the syndicate managers and the new operating management will not be disclosed.

The Grant company will be greatly strengthened financially by the operation of the plan proposed, and it will help the corporation to push production and extend its sales campaign.

The notices that were sent to the stockholders propose that the $600,000 bond issue that is due in 1925 and which carries 8 per cent interest, should be exchanged for 10 year 7 per cent bonds that will fall due in 1932. This exchange would save the company 1 per cent in interest, and in the 10 years would amount to approximately $60,000.

$350,000 Floating Indebtedness

There is a floating indebtedness of $350,000, and this will be taken care of by a new issue of $350,000 of 7 per cent cumulative preferred from Jan. 1, 1923. This issue is to be taken at par by the creditors for their claims.

When the creditors do this, a syndicate of bankers and financiers that includes some of the best known men in this city will step in and provide the company working capital by purchasing common stock to the extent of $300,000.

Under such a plan as this, the company will have no obligation of a pressing nature, and its obligations will be limited to the funded debt, and with the capital provided it is felt it will have ample opportunity to develop its business.

It is stated that 50 per cent of creditors already have approved the plan, and that among this number are some of the larger ones. This makes operation of the plan probable.

Application to Appoint Templar Receiver Denied

COLUMBUS, March 27—Upon the grounds that the plaintiff, Nathan T. Clyburn, had not made a sufficient showing to the court to warrant such action, Judge Warner, in Common Pleas Court, refused to appoint a receiver for the Templar Motor Car Co. of Cleveland.

The court based its decision upon two grounds: first, that a creditors' committee is now in charge of the company and is performing the same service as a receiver, and second, that a syndicate committee has offered a plan of reorganization which has been adopted by the stockholders and that from this plan of operation a refinancing of the company seems evident.

Judge Warner also held that the company was not insolvent, as it had $1,387,000 assets as against liabilities of $1,131,000.

Court of Appeals Affirms Decision Against Livezey

NEW ORLEANS, March 27—William S. Livezey must serve a five-year sentence in Leavenworth Federal penitentiary for use of the mails to defraud in connection with raising the $3,000,000 capitalization of the Little Motor Kar Co. of Dallas of which he was president. The United States Circuit Court of Appeals here has affirmed the decision of the Federal Court at Dallas which convicted him.

Livezey was arrested April 13, 1920, after a receiver for the company had been appointed at Dallas on petition of stockholders who alleged that the company's affairs were being mismanaged. He was convicted in February, 1921.

United Auto Stores' Sale Postponed Until April 7

PHILADELPHIA, March 25—Petition of the receivers of the United Auto Stores, Inc., for permission to sell the assets of the company resulted in the sale being held over until April 7 by Federal Judge Thompson.

Stockholders are given opportunity by this postponement to formulate a plan for reorganization, in the meantime. According to Samuel A. Whitaker and Francis F. Burch, the receivers, sale of the company's assets is imperative in order to put a stop to the payment of rentals on the 58 stores in the company's chain, none of which is earning money at this time.

Executives Further Plans for Zeder Car

Confer on Promotion of Company—Experimental Work on Product Not Completed

NEW YORK, March 27—Negotiations for the promotion of a company which will build, at the plant of the Cleveland Tractor Co., a new six-cylinder automobile selling at about $2,000 and to be designed by F. M. Zeder, approached completion at a series of conferences held here within the past few days. A complete announcement of the plans which have been worked out is expected in the near future.

Among those prominent in the conferences here were Clement Studebaker, Jr., Rollin H. White, president of the Cleveland Tractor Co.; R. T. Hodgkins, vice-president of the same company; Earl B. Wilson and Zeder, with several other engineers who have been associated with him for years. The identity of capitalists other than Studebaker and White who will have a share in the enterprise has not been disclosed.

After the preliminary negotiations have been completed it will be necessary to submit the entire proposal to the stockholders of the Cleveland Tractor Co., although this is expected to be largely a formality in view of the fact that acceptance of the plan will be recommended by the officers and directors. It has not been determined in just what way the present stockholders will be connected with the new enterprise.

Separate Plant for Car

It is probable the new car will be built by an entirely separate company in the Cletrac plant.

Experimental work on the Zeder car will not be completed for at least nine months. Designing work will be done at the Newark offices of the Zeder-Skelton-Breer Engineering Corp., but the experimental models will be built in the Cletrac factory.

Associated with Zeder in the development of the new car will be O. R. Skelton and Carl Breer, who went with him from the Studebaker Corp. when he was engaged by the Willys Corp. to design the Chrysler Six. When they severed their connections with the Willys Corp. they formed the engineering corporation to keep their organization intact. It is asserted positively by Zeder that the car which will bear his name will not in any sense be a copy of any developed heretofore, but will be an entirely new product worked out along scientific lines as the result of his own experience and that of his associates.

TRACTORS AND LITHUANIA

LONDON, March 14 (*by mail*)—The Lithuanian Minister of Agriculture considers that the wider introduction of tractors will result in the doubling of Lithuania's crop production.

40-Hour Week, New Ford Plant Policy

Because of It Company Will Give Employment to 3,000 More Men

DETROIT, March 27—A forty-hour week of five days, with a shutdown Saturday and Sunday, hereafter will be the permanent working policy of the Ford Motor Co. and all other Ford interests. All employees will continue to receive the $6 a day minimum wage. Approximately 50,000 men will be affected and additional workers will be necessary under the new policy.

As soon as the new schedule can be put into effect at the Highland Park plant it will be extended to the other factories. In making the announcement, Edsel Ford said:

Every man needs more than one day a week for rest and recreation. The Ford company always has sought to promote ideal home life for its employees. We believe that in order to live properly every man should have more time to spend with his family.

Right now market demands warrant the operation of the plant six days weekly, but we are satisfied that the five-day week is practical and it has been adopted as a permanent policy of the company. Adjustments, naturally, are necessary. In equipment and in man power the plants will have to be placed on a basis where they can take care of production in five days weekly. It will mean work for 3,000 more men. It will mean more machinery. The goal cannot be fully realized at once. But as soon as possible it is the aim of the Ford company to adjust its business so that it can be carried on without work on Saturday and Sunday.

Demand for Trucks Increased

While Ford passenger car production now is considerably ahead of production at the same time last year, I believe the increased demand for trucks is a better indication of improvement in business conditions.

The demand for trucks has become more insistent each week. The truck is a business vehicle and increased demands must mean better business conditions.

Production at the plant of the Lincoln Motors Co. is now averaging from twenty to twenty-five a day. The market would warrant an output of sixty cars a day. Gradually the methods employed at other Ford plants are being installed, but it is doubtful if production ever will exceed fifty cars daily. Just this week a new aluminum casting plant for the Lincoln went into commission at River Rouge. Parts for the Lincoln will be cast at River Rouge and machined at the Lincoln factory, as is done with parts for other Ford vehicles.

The Ford company is co-operating with service organizations in seeing that deserving ex-service men receive first consideration in the matter of employment.

Will Include Lincoln Plant

DETROIT, March 27—The Ford five-day week will ultimately include the Lincoln Motors Co., but it will require considerable organizing to meet production demands before it can become effective. At present Lincoln is about 2000 cars behind on orders and will not catch up, working the full week and extra time in some departments, until well into the summer. A schedule of 700 has been fixed for April.

Privileges of the Ford investment plan now have been extended to Lincoln employees, thereby effecting a new bond between the new and old Ford enterprises. There is now $10,000,000 invested by 18,000 Ford employees under the investment plan. Interest and special returns of $1,250,000 have been paid to investors in the two years the plan has been in operation.

The Ford Motor Co. is working on a schedule of 67,000 cars and trucks for March. Foreign plant totals for February show Buenos Aires with 1245 cars and trucks; Manchester about 2000, and the Ford Motor Co. of Canada, 4000 cars and trucks. Bordeaux, Sao Paulo, Cadiz and Copenhagen were reported to have had good months.

BATTLESHIP AND FORD WILL OPERATE AS ONE

DETROIT, March 27—"If satisfactory arrangements can be made it may not be long before metal that was once a part of an American battleship will be running around in the form of a Ford car or tractor," says a statement by the Ford Motor Co. "The quality of the metal in war vessels will permit this.

"It can be remelted, carefully tested as to its suitability for mixing with other quantities of molten metal and poured into cylinder blocks and various castings. This ore that was mined, converted into metal and used in ship construction at great expense will not be an entire loss. Some, at least, of the taxpayers' money will be returned to the Treasury and, in addition, useful tractors built."

Transport Completes New Line of Trucks

MT. PLEASANT, MICH., March 27—The Transport Truck Co has a new line of trucks ready for distribution to dealers. There is a new Rapid Transport of 1-ton capacity for high speeds and heavier models, which differ from the previous line in capacity and are considerably lower in price. The following table shows the old and new models:

New Models		Old Models	
15, 1-ton	$1,295	20, 1-ton	$1,395
25, 1½-ton	1,495	30, 1½-ton	1,995
35, 2-ton	1,885	50, 2½-ton	2,785
55, 3-ton	2,385	70, 3½-ton	3,885
60, 3½-ton	2,585		
75, 5-ton	3,485		

The rear axle of the Model 15 is of bevel gear type. On the former line, all models had internal gear axles. The heavier models still retain this form of final drive.

No Ownership Change for American Dunlop

President Dissipates Rumor That Ford Will Buy—Production Prospects Indefinite

BUFFALO, March 27—The Dunlop Tire & Rubber Co.'s plant here will be operated as a Dunlop institution by the company which was formed for that purpose, Frederick Wolcott, president, declared upon the occasion of a visit to this city. Upon his arrival from New York he went into conference immediately with Perry D. Saylor, vice-president of the corporation.

"I am unable to say at this time when production will begin," Wolcott said. "We are working on plans which will lead to production, but it would be foolish for me to fix a date when we will begin producing tires in commercial quantities. The date will depend on a number of circumstances and conditions.

"It is my hope to be able to make a definite announcement within the next three or four months. I am very hopeful that this announcement will be very favorable to Buffalo.

"Sale of the plant to Henry Ford or any other person or corporation is not even being considered," Wolcott added. "Any rumors that the plant is to be sold are entirely without foundation. The factory will be operated as a Dunlop institution by the company which was formed for the purpose."

Puts End to Many Rumors

Wolcott's statement puts an end to many rumors which have been in almost constant circulation for many months. It has been repeatedly rumored that Henry Ford would take over the plant to produce tires for Ford cars. There have been numerous other rumors of sale of the plant, but heretofore there has been no official denial or confirmation of the reports.

The coming of Wolcott to Buffalo was rather unexpected. At 8 o'clock in the morning Saylor was not aware that he proposed coming. Wolcott arrived on an early train and went direct to the plant, where he planned to remain until after a conference had been held with the firm's attorneys.

Wolcott is in charge of all the Dunlop tire interests in the United States. The American branch of the British corporation is partly financed in this country, but is under control of the British Dunlop interests.

Production Never Undertaken

Commercial production of tires has never been undertaken at the River Road plant, although experimental manufacture has been in progress for many months. It is said the company is planning to specialize in a small size cord tire, when production begins, and that this tire will be sold at a price close to the present cost of fabric tires of the same size.

Reorganization Plan of Premier Delayed

In Meantime Suit Is Started by Bank to Collect Skelton's Insurance

INDIANAPOLIS, March 24—Reorganization plans of the Premier Motors Corp. which were scheduled to have been completed at a meeting of the reorganization committee March 21, have been delayed, and the official statement that was promised by a member of the reorganization committee for Wednesday has not yet been made.

On that day at Martinsville, Ind., a suit was brought by the Fletcher American Bank of Indianapolis against the Travelers Insurance Co., the American Life Insurance Co. and the Premier Motors Corp., to collect a policy for $200,000. The policy was taken out by the late L. Sherman Skelton, former Premier president, and was transferred by him to the motor corporation which in turn transferred it to the Fletcher American Bank. The insurance companies are fighting payment because they assert Skelton withheld certain facts concerning his health at the time he took out the policy.

Same Bank in Charge

It was understood that the bank that was expected to handle the details of the proposed reorganization is the same one that is suing the insurance companies and the Premier corporation. M. A. Whipple, vice-president of Premier, the spokesman for the reorganization committee, stated early this week that the reorganization was practically complete, that mere details were still pending, that 75 per cent of the merchandising creditors had agreed to the plans, that three or four new directors were to be named, and that about $500,000 of new money would be supplied for working capital.

All these things were to have been finally set by the meeting proposed for last Tuesday, and an official announcement was promised by Wednesday. Since then no further details could be obtained, except with reference to the suit referred to above and intimations that the statement, when made, would be announced by the banking institution handling the deal. The management after the reorganization, according to Whipple, had not been agreed upon by Wednesday afternoon.

Marlin-Rockwell Tax Dispute Is Adjusted

NEW YORK, March 28—The following statement has been issued by the Marlin-Rockwell Corp.:

"The tax dispute of the Marlin-Rockwell Corp. with the Government has been adjusted and the tax paid," according to H. C. Pryer, treasurer. "The corporation officers and directors state that the attitude of the treasury department has been fair and reasonable."

It states further:

The future policy of the corporation will be to confine itself to the ball bearing business which it operates under the Standard Steel & Bearing, Inc., of which it owns all the stock, and the liquidation of those assets which are unnecessary to this industry.

The management states that the bearing manufacturing facilities of this corporation are the largest of any of the companies engaged in this business except the General Motors, and the newest and most modern.

The corporation's present business reflects the general revival in activity in the automotive industry which it serves. Guy W. Vaughan, president and general manager of the Standard Steel & Bearing, Inc., has been elected vice-president of the Marlin-Rockwell Corp.

The Government's original claim is understood to have been in the neighborhood of $8,000,000.

Special Delivery Car Brought Out By Buick

FLINT, MICH., March 29 — Buick Motor Co. has brought out a special delivery car on a 4-cylinder chassis, with three types of bodies. The open express is priced at $945; the canopy top delivery with roll curtains, $965; canopy top delivery with screen sides, $1,015; panel side delivery with steel panels, $980 and panel side delivery with vehisote panels, $1,005.

The bodies are especially designed for strength and rigidity achieved by the extra strong bracing and steel binding of panels, flare boards and tail gate. An additional re-inforcement is assured by heavy steel angles running the entire length of the body along each side to form a side frame. The rear end is entirely sill-bound and scuff strips extend well into the body and bend over to join the reinforcement construction.

The vestibule has steel sash drop windows, which are cushioned to prevent rattling. The doors may be secured back for summer driving. The engine, starter, clutch and other units are identical with the four cylinder passenger car chassis.

Purchaser of Quality Tire to Resume April 1

ANDERSON, IND., March 27—The International Rubber Co. of America, incorporated in Delaware, whose bid of $200,000 for the Anderson plant of the Quality Tire & Rubber Co. has been accepted, is making preparations to operate the factory here probably by April 1. J. D. Wiggins, president and general manager, formerly was connected with the American Can Co. M. D. Ganger of Cleveland will be vice-president and general manager. They will move here at once. A. L. McKee, secretary and treasurer, also of Cleveland, will come here later.

The sale of a factory at Elyria, Ohio, which also was owned by the Quality company, has been agreed to at Elyria but the deal will not be closed until an Ohio form of transfer is submitted, according to Neal M. McCulough, local banker and trustee for creditors.

Star Will Be Built in All Durant Plants

Expansion of Long Island City and Lansing Factories to Be Undertaken

NEW YORK, March 28—Announcement is made by Durant Motors, Inc., that the new Star car will be built in all its divisional plants. This includes factories at Long Island City, Lansing, Muncie, Oakland, Cal., and Toronto.

The Long Island City and Lansing plants will be expanded to provide a production of 20,000 cars a month by Jan. 1 next, including the Star and the Durant Four. The expansion of the Lansing factory will be undertaken immediately. The same will be true at Long Island City, provided the land required can be obtained at what is considered a reasonable price. The engineers and contractors who built the Lansing factory now are in this city looking into the situation.

Reports that Durant Motors have acquired from the receivers of the Willys Corp. the huge factory at Elizabeth, N. J., which never was occupied, are at least premature. Durant engineers have inspected the property carefully, however, and it is understood they have reported it would meet the needs of the company. It is not likely that Durant will acquire the Elizabeth factory unless it can be obtained at a fraction of its original cost of $10,000,000.

Production of the Star and the Durant will be completely segregated, although it is desirable from a manufacturing point of view that they be built as near together as possible in view of the fact that materials will come from practically the same sources.

Durant Motors also announces that it has placed with the Continental Motors Corp. of Detroit an order for 250,000 motors for use in the Star. This is one of the largest, if not the largest, single order for motors ever placed.

Quantity Output at Lansing

LANSING, MICH., March 27 — The Durant Motor Car Co. of Michigan now has launched into actual quantity production. Arrangements have been made by M. B. Leahy, the Durant general sales manager, for trainload shipments to Kansas City and Cincinnati.

The train to Kansas City will be made up of thirty-six freight cars, carrying a total of 180 4-cylinder Durant phaetons, to the Hathway Motor Co. The shipment to St. Louis will be made up of twenty-five freight cars and will total 125 phaetons.

MOTOR FUEL FROM WINE

LONDON, March 18 (*by mail*)—The stagnation in the South African wine industry has led to the establishment of a plant at Paarl for the purpose of converting wine into a gasoline substitute. Last year 10,000,000 gallons of unsaleable wine were produced in the Union.

Truck Tire Business Gaining, Akron Says

Is Taken, in Conjunction with Survey, as Indication of General Improvement

AKRON, March 27—That a widespread general increase in the prosperity conditions of the United States is apparent with strong indications of a continued upward trend in all lines of business, is the opinion of Akron tire manufacturers, based upon surveys being made in all sections of the country in connection with district conferences with sales representatives and branch managers.

"Skepticism is abating. Business is picking up encouragingly. We face a big period of prosperity and production along all lines will have to be increased," states W. A. Johnson, tire sales manager of the B. F. Goodrich Co.

Optimism Soundly Based

"The kind of prosperity that is founded neither on guess nor upon the unjustified hopes of optimists, is returning to the country at a steadily increasing rate," says L. G. Fairbank, general sales manager of the Firestone Tire & Rubber Co.

Johnson also says regarding the situation:

One of the best proofs of a return of conditions more nearly normal is the fact that bankers everywhere are advancing money. Tire dealers are paying their bills and are stocking up in anticipation of a heavy trade this spring and summer. Tires are moving much more rapidly than for months. There were over 220,000 passenger cars and trucks built the first two months of this year. This was an increase of 200 per cent over the same output for the corresponding months of 1921, and meant 880,000 tires as original equipment, and another 220,000 truck and motor car tires to go along with such new vehicles as spare equipment.

The downgrade movement has stopped. Automobile sales are speeding up and this increase has its direct reflection in Akron.

Manufacturers here say the truck tire sales constitute a good barometer of general business conditions. They report truck tire sales increasing heavily and accept this as proof that commercial houses employing trucks are again using them extensively and that such renewed truck use in turn reflects a healthier condition in business.

Price Changes Considered

There is still talk of approaching tire price increases. Some dealers, expecting future requirements, are stocking up now so as to be in position to take advantage of the increases in prices when they come. Manufacturers agree that from the standpoint of making money for their stockholders, prices should be increased. It is also admitted that the price slashing war carried on vigorously by competitive tire companies last year, was carried a trifle too far and that the last of the series of price cuts made, which was enforced last December, was excessive.

Move on Upgrade

NEW YORK, March 27—Sales by Mack Trucks, Inc., are running well ahead of last year at this time. If business continues at the current rate, substantial profits are expected for the second and third quarters.

NEW YORK, March 27—H. Alpern, export manager of the King Motor Car Co., reports that foreign sales for February were the largest for any month in the last five years. Agencies have been established in five additional countries. Twenty cars recently were shipped to the dealer in Switzerland.

KENOSHA, WIS., March 27—The Nash Motors Co. reports that shipments for March will exceed the same month last year by approximately 67 per cent. Factory records show that 2081 Nash cars were ordered by dealers and distributors in March last year, while this year's orders for March shipment totaled 3486. These figures include both four and six-cylinder models.

AKRON, OHIO, March 27—The General Tire & Rubber Co. reports that sales for the first quarter of this year have been 65 per cent larger in dollars than for the same period in 1921. In units the sales increase has been 100 per cent. All tires manufactured are sold through dealers to users.

DETROIT, March 23—Chevrolet Motor Co. has started a night shift at the Flint plant for the first time in several months. Nine hundred axles a day are now being made for shipments to the various assembly plants. It is planned to build 800 engines a day by April 1. All engines and axles for Chevrolet cars are now being made at Flint.

DETROIT, March 27 — The Fisher Body Corp. reports that it has been compelled to refuse several new orders because of a shortage of manufacturing facilities. Some of the Detroit plants are working overtime while others are not yet at capacity. The average for the Fisher factory is about 95 per cent of capacity.

L. G. Fairbank of the Firestone company does not predict a business boom nor a return of the superficial prosperity of 1920, but says he believes the United States is on the eve of a broad, substantial increase in business that will mean much to every one by reason of the fact that it is founded upon hard work and the creation of new economic values, and not on fictitious and speculative gains in the value of stocks, etc.

Renewal of Demand Felt in Truck Lines

Call Reported to Be for Lighter Types, Principally for ¾-Ton Capacity

MILWAUKEE, March 27—Encouragement is found daily in reports from manufacturers of passenger cars and the parts industry as well, which indicate that the improvement which set in 30 to 40 days ago is going forward. A little better feeling also has been injected into the motor truck industry by something akin to a renewal of demand, although this is yet far from satisfactory. So far the principal call has been for the lighter types, with sales of the ¾-ton capacity predominating.

Tractor Prospects Better

The manufacture of tractors has not yet been resumed on anything like a real scale, but prospects are growing better as the surplus stocks in hands of makers and jobbers are steadily being wiped out by the much better movement of these machines into farmers' hands. This is being accomplished, of course, through drastic price reductions which are far below immediate replacement value, but opinion seems to be that current reductions probably will hold effect until May 1 or June 1, when production doubtless will have been resumed on a scale sufficient to enable producers to gage true costs on the readjusted basis.

Authentic reports from representative Milwaukee industries indicate that the iron, steel and machinery trade is moving steadily into a stronger position.

Conditions Everywhere Improved, Wollering Says

NEW ORLEANS, March 29—"Conditions the country over, North, South, East and West, are showing improvement, gradually but decidedly," declared Max F. Wollering, vice-president in charge of manufacturing, of the Studebaker Corp., during his visit here as the guest of Fred Perkins, local Studebaker distributor.

Wollering asserted that the country was on the eve of a period of prosperity, and that manufacturers and dealers who exercise the initiative to establish their business on a sound basis will reap big benefits.

HIGHWAY BODY TO MEET

NEW YORK, March 27—Reports of various committees which have been studying different phases of highway transport will be heard at the annual meeting of the National Highway Traffic Association, which will be held at the Automobile Club of America in this city, May 12. The reports will cover regulations relating to speeds, weights and dimensions of motor trucks and trailers; license fees and motor vehicle taxation; and highway transport franchises.

International Trade Improves Materially

Total Shipments 3550 in February Are Almost Equal to Same Month, 1921

NEW YORK, March 27—Overseas shipment of approximately 1350 passenger cars were made during the month of February by the General Motors Export Co. from its plant in Canada. Of this number, a total of 824 were shipped to all parts of the world except to England, to which was shipped between 500 and 600 more, the exact figures for the English shipments not being available here. The totals were announced here to-day by the export company, following the receipt from Washington of the figures for the February shipments from the United States.

The Washington announcement does not include, of course, these Canadian shipments which, added to the total of 3096 announced for the United States, show that the short month of February saw the overseas movement of approximately 4500 automobiles. No month's export sales since January, 1921, have even approached this high figure.

WASHINGTON, March 25—The belief that international trade in automobiles and automotive equipment had improved materially was amply borne out by the February shipments from the United States, the figures for which were announced to-day by the Bureau of Foreign and Domestic Commerce through the automotive division. Striking gains were shown over January, 1922, and for the first time in many months the shipments of automobiles were comparable with those of the same period of the previous year.

The February trade in passenger cars totaled 3096 and trucks 454, a total of automotive vehicles of 3550. The same month in 1921, when the last dispatch was being made on the unfilled orders piled up during the boom years of 1919 and 1920, saw the outbound movement of 3587 automobiles, of which 2492 were passenger cars and 1095 were trucks. The trade by volume in February in this year, therefore, was the largest since January and February of 1921 and almost double that of some of the low months during the latter part of last year. A comparison follows:

Passenger Cars

	No.	Value
Feb., 1922	3,096	$2,556,555
Jan., 1922	2,407	2,025,974
Feb., 1921	2,492	3,165,170

Motor Trucks

	No.	Value
Feb., 1922	454	$391,738
Jan., 1922	464	461,193
Feb., 1921	1,095	1,952,736

Exports, Imports and Reimports to Automotive Products for February, 1921 and 1922, and for Eight Months That Preceded

	Month of February				Eight Months Ending February			
	1921		1922		1921		1922	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobiles, including chassis	3,587	$5,117,906	3,560	$2.962.135	90,998	$119,972,935	22,892	$20,506,229
Electric trucks and passenger cars	....	.....	10	13,842	....	.....	36	54,967
Motor trucks and buses, except electric	1,095	1,952,736	....	.....	15,499	26,496,400	2.727	2.851,223
Up to 1 ton	....	.....	286	117,187	....	.....	508	231,254
Over 1 and up to 2½ ton	....	.....	141	210,264	....	.....	361	497,735
Over 2½ ton	....	.....	27	66,347	....	.....	49	123,942
Total motor trucks and buses, except electric	1,095	1,952,736	454	391,738	15,499	26,496,400	3,645	3,704,154
PASSENGER CARS								
Passenger cars, except electric	2,492	3,165,170	....	.....	75,499	93,476,535	13,708	12,164,579
Value up to $800	....	.....	1,890	958,814	....	.....	3,220	1,649,879
Value over $800 and up to $2,000	....	.....	1,096	1,217,578	....	.....	2,090	2,273,457
Total passenger cars, except electric	2,492	3,165,170	3,096	2,556,555	75,499	93,476,535	19,211	16,747,108
PARTS, ETC.			Pounds					
Parts, except engines and tires	....	3,426,517	*12,138.682	2,838,259	....	55,699,086	....	19,141,425
Station and warehouse motor trucks	23	14,514	6	11,137	431	248,286	75	87,886
Trailers	....	.....	26	19,230	....	.....	59	40,233
Airplanes	....	.....	....	.....	53	386,955	19	126,165
Parts of airplanes, except engines and tires	....	24,213	*22,758	10,146	....	.....	....	68,104
BICYCLES, ETC.								
Bicycles and tricycles	....	199,705	237	4,783	....	3,106,761	...	429,502
Motorcycles	1,000	333,437	969	259,347	21,870	6,862,488	5,023	1,386,762
Parts, except tires	....	.....	*209,921	108,971	....	.....	*439,839	240,648
Gas engines	123	39,774	222	16,673	2,630	500,116	1,021	183,801
Traction engines, except agricultural	4	6,244	2	4,813	254	446,855	12	32,045
Automobile engines	881	153,258	2,764	331,479	9,888	1,794,304	8,181	1,283,548
Aircraft engines	....	.....	1	200	....	.....	4	5,475
Complete tractors, except agricultural	1,453	1,577,979	6	32,201	18,889	18,662,999	141	237,919
Other internal combustion engines	1,157	281,592	335	39,395	11,723	1,862,592	3,096	399,653
IMPORTS								
Accessories, parts	....	.....	279,708	164,797	....	.....	940.144	387,006
Automobiles	59	76,181	26	44,960	919	981,274	339	530,003
Parts, except tires	....	81,663	....	58,495	....	941,790	....	405,274
All other	....	11,192	....	7,202	....	392,123	....	194,630
REIMPORTS								
Automobiles (free of duty)	23	27,720	200	294,357	2,155	3,251,608	2,289	3,482,359

*Pounds.

Parts

	Value
Feb., 1922	$2,838,259
Jan., 1922	2,060,619
Feb., 1921	3,426,517

Thus it is shown that the foreign sales of American automotive equipment are again approaching appreciable levels and that overseas trade is stabilizing itself

(*Continued on page* 742)

SHORTAGE OF SKILLED WORKMEN

DETROIT, March 25—Shortage of men for skilled positions is taken by the Employers' Association of Detroit as an indication of a return to normal in general business. There is unemployment, the report declares, but mostly of men of no special training. For the week 79 firms report 3273 men employed.

Gray Phaeton, $490; $760, Coach Price

Company Has Completed Its Financing and Withdrawn Stock from Sale

DETROIT, March 28—Gray Motor Corp. has fixed the prices on its phaeton and coach at $490 and $760 respectively and will get into quantity production on its schedule for 1922 in May. In connection with the fixing of the prices, it was announced that the car will be powered with a 4-cylinder Gray engine and will have Timken axles front and rear.

D. Henry Bonner has been named sales manager of the company. Bonner was formerly in charge of all branch production for the Ford Motor Co. and served latterly as assistant production manager to William S. Knudsen.

President Frank L. Klingensmith, formerly Ford executive vice-president and treasurer, said the company has completed its financing and has withdrawn its stock from sale. The company is capitalized at $4,000,000 and has sold $2,600,000 in stock, assuring ample financial strength.

Production in Detroit

All production and assembly of the car for the present will be at the Gray plant in this city. There is a present capacity for 250 engines and 100 cars daily which will be increased in anticipation of 1923 business. Assembly plants in the New York, Boston, Philadelphia and St. Louis districts are expected to be opened before December with others to follow in 1923.

As designed for production, the car will weigh about 1600 lbs. and will have a wheelbase of 100 in. Artillery wood wheels have been substituted for disk as more becoming the lines of the car. Under test the car has travelled 20 miles to the gallon of gasoline and 25 miles per gallon has been fixed as normal expectancy.

The coach type closed car has been selected as most economical to manufacture on a quantity basis. In both open and closed models the body lines have been kept low. The open model has a one-man top. The gearset will be Gray made three speeds forward and reverse. With the exception of body, wheels and axles, the car will be practically a Gray manufactured product.

Material Contracts Placed

Contracts for all material for the complete years production have been placed.

Among the dealers thus far named by the company are: Albert Hirst, New York; Brown Motors Co., Boston; Louis C. Block, Philadelphia; Anderson Strauss Co., St. Louis; Charles E. Baker, Detroit; John S. Keown, Louisville and Edward P. Wilson, Columbia, S. C.

All applications for foreign sales rights have been deferred pending the meeting of domestic sales demands.

FORD CUT IN BRITAIN HAS NO U. S. BEARING

LONDON, March 20 (By mail).—Price reductions ranging from £10 to £15 (normally from $50 to $75) on the various Ford models have been announced here. The biggest cut is on the sedan.

DETROIT, March 28—The Ford Motor Co. said to-day that the reduction of prices in England had no significance so far as the United States is concerned. It was asserted that the drop was based on the January reduction here, which was only $5 on the phaeton.

Organization of a company personnel will be held to a minimum with Klingensmith in charge of all financial matters, F. F. Beall, former Packard vice-president, in charge of manufacturing and Bonner in charge of sales.

Maxwell Will Build 250 Daily in April

DETROIT, March 25 — Walter P. Chrysler, former executive vice-president of Willys-Overland Co., will devote all his efforts in the automobile field to his work as chairman of the board of the Maxwell Motor Corp.

"We are going to make 250 Maxwells a day in April to meet the steadily growing demand for our product," he said. "Sales are extending all the time as the value of the new lines becomes known. We have now got our organization developed to a point where every detail is properly cared for and, after a year of hard work, we are getting the results hoped for."

Chalmers business in April will show a large increase over former months despite increased price, Chrysler said. There has been considerable business in March due to orders being placed to get in before the increase, he said, but April business already placed will show an increase over March business.

Merchandising plans are being developed whereby the factory will be enabled to co-operate completely with the sales organization in the field in developing Maxwell business. Under this plan, service will be a leading factor and genuine parts will be constantly available to all owners.

TO SELL HARTFORD PARTS

HARTFORD, CONN., March 29—Because of the failure of stockholders and creditors to come to terms on plans for a reorganization, Federal Judge Thomas has ordered the sale at public auction on May 3 of all assets of the Hartford Automotive Parts Co. The upset price has been fixed at $325,000, not including a mortgage of $75,000.

Jordan Cut Restores Pre-War Price Level

Reduction Affects All Models But One—Company Plans 1,000 Output for April

CLEVELAND, March 29—Price reductions on the different Jordan models announced by the Jordan Motor Car Co. range from $300 to $400. This reduction brings prices back to the pre-war level. Owing to increased production and improvements the cars as produced to-day can scarcely be compared with those of pre-war days, excepting in the matter of price.

The new prices are:

	Old Price	New Price
5-passenger	$2,095	$1,795
Playboy Roadster	2,095	1,895
5-passenger Sedan	3,200	2,785
Brougham	3,200	2,785
Landaulet	2,995	2,695

The Playboy roadster is standard equipment with disk wheels, wire wheels being optional; special colors, and nickel lamps furnished. The price of the seven-passenger Jordan models has not been reduced.

Jordan production will approximate 800 this month and the schedule for April is 1000.

TWIN CITY MODEL REDUCED

MINNEAPOLIS, March 24—Minneapolis Steel & Machinery Co. announces a reduction in the price of its Model 12-20 Twin City tractor from $1,395 to $1,200.

O'BANNON REORGANIZED

NEW YORK, March 29—The O'Bannon Corp., manufacturer of coated fabrics, which has been operating under a receivership for several months, has been reorganized as the O'Bannon Co. The personnel of the operating departments will remain largely the same, but the company will be under the management of the Russell Co. of Boston.

ASKS OWEN REPAYMENT

WILMINGTON, DEL., March 27—Application has been made by the Wyoming National Bank of Wilkes-Barre, Pa., for repayment by the receivers of the Owen Magnetic Motor Car Corp. of expenses it incurred in having the first sale of the personal property set aside. The amount sought is $2,960.

MEXICAN CHAMBER FORMED

NEW YORK, March 27—The Mexican Chamber of Commerce of the United States has been incorporated in New York State with the approval of the State Department in Washington. Its object will be to promote business and economic relations between Mexico and the United States by the dissemination of information of mutual interest.

Men of the Industry and What They Are Doing

Mosher Remains as Director

F. E. Mosher, whose resignation as vice-president and treasurer of the Covert Gear Co., Inc., was announced last week, will continue as a director of that company until the annual meeting in August. Mosher, who went with the Covert Gear Co. in 1916 as secretary and general manager, will become assistant to the president and general manager of the Dosch Chemical Co., Inc., of Louisville on April 3. He was made secretary and treasurer of the Covert company in 1919 and the following year was elected to the position which he now is relinquishing.

Hornby with Rickenbacker

Fred Hornby has been appointed superintendent of the final assembling division of the Rickenbacker Motor Co. He was engaged in similar work with the old E. M. F. Co., later joining the forces of the Maxwell Motor Co. in an executive production capacity and subsequently becoming research engineer for the Willys-Overland Co.

Willis Made H. C. S. Sales Manager

Frank B. Willis, who has been prominently identified with automobile factory sales organizations of Michigan and Ohio, his connection at one time being with the Chalmers Motor Corp. as vice-president and with the Saxon Motor Car Corp., has returned to Indianapolis to become general sales manager of the H. C. S. Motor Car Co. Harry Ford, whom he succeeds, is still with the sales organization, and will devote most of his time on the road and in field work.

Elgin Motors Appoints Leach

K. J. Leach, for three years connected with the McFarlan Motor Co. as southwestern district manager and previous to that association engaged in the same work for the Cole organization, has been appointed district representative for the Elgin Motor Car Corp. His territory includes Texas and New Mexico, with headquarters at Dallas.

New Battery Sales Head

W. Melville Taylor, until recently connected with the Philadelphia Storage Battery Co. of Philadelphia, has been appointed to the managership of eastern sales of the Foster, Merriam & Co., Meriden, Conn. E. W. Shepherd, who has been associated with the sales promotion department, is manager of western sales for the company.

Webb Promoting Hinkley Sales

Paul St. Elmo Webb has been added to the organization of Hinkley Motors, Inc., Detroit, as sales promotion manager. Webb's experience has covered a broad range of service in the field of heavy duty transportation, both as an executive of sales and service and as a transportation engineer with the Diamond T. Truck Co. of Nashville. In his new position, Webb will pay close attention to the application of trucks and buses equipped with Hinkley engines to the various problems continually arising. He will also work in close touch with dealers and distributors of vehicles so equipped who may desire data, information and advice.

Haggott Becomes Field Engineer

William S. Haggott, for several years cable sales manager of the Packard Electric Co., Warren, Ohio, has been transferred from the home office to the field organization of the company in the capacity of field engineer. His headquarters will be in Detroit. Haggott has been prominent in the work of the Society of Automotive Engineers and the Automotive Equipment Association. He is at present chairman of the S. A. E. subcommittee on standardization of automotive cables and represents the society on the cable committee of the American Engineering Standards Committee. The work Haggott leaves at the home office will be absorbed by W. F. Parker, general sales manager, and B. N. MacGregor.

Witherbee, Marko Sales Head

Thomas S. Witherbee has been named general sales manager and director of advertising of the Marko Storage Battery Co. He is a pioneer manufacturer of storage batteries for automobile starting, lighting and ignition. Witherbee has been in the battery business since 1897 and is the inventor and patentee of the Witherbee storage battery igniter, which was produced and sold by the Witherbee Igniter Co., founded by him.

Maloney Joins Parish & Bingham

John E. Maloney, widely known in equipment trade circles, has joined the Parish & Bingham Corp. as assistant sales manager. In assuming his new connection Maloney severs a connection of some ten years with the Hydraulic Pressed Steel Co. and its interests, during the latter part of which he was general manager of the pressed steel end of the business.

Clark Back from Trip

W. W. Clark, export manager of the Hart-Parr Co., has returned from a four months' trip to the Philippine Islands, Australia and intermediate points in the interests of the company.

Swanson Leaves Fox

H. O. Swanson has resigned as chief engineer of the Fox Motor Car Co. of Philadelphia.

Reeves Tours Plants; Surprised at Output

Convinced Production Will Exceed 1921 Greatly—Finds New Spirit Prevailing

NEW YORK, March 29—Genuine surprise at the current volume of production, both of passenger cars and trucks, was expressed by Alfred Reeves, general manager of the National Automobile Chamber of Commerce, upon his return from a two-weeks' trip through the factories in Michigan and Ohio.

While Reeves has been consistently conservative in his estimates of passenger car production for 1922, and believed until he started on his trip that it would not greatly exceed that of 1921, he now is convinced that the total will be considerably larger. He feels no doubt that that truck production will be materially increased.

Conservatism Shown

Concerning conditions, Reeves says:

Everywhere I traveled I found a new spirit among the manufacturers and dealers. Production was increasing; dealers were writing in for cars; some factories were duplicating some of the 1920 figures by trainload shipments to the coast and elsewhere; more than 3,300 additional men were added to the payrolls in Detroit in one week and in some cities there was an actual shortage of experienced automobile workers, although still a large surplus of unskilled labor.

Notwithstanding all this, the makers are going along with a spirit of conservatism and with no idea that the spring business will continue for the remainder of the year, although with every indication that the last six months would be better than the same period of 1921.

The big keynote for this year is going to be the dealer and that manufacturer will succeed best who spends money to back his dealer into better financing, selling and general business methods.

Any plan the manufacturer contemplates should be predicted entirely on whether it is going to be best for his dealers. I don't believe we will ever have an opportunity again to build up dealers as we have during the past and each one lost now will cost a great deal of money to replace.

RECEIVER FOR HALLADAY

NEWARK, OHIO, March 29—A receiver has been appointed for the Halladay Motors Corp., which is capitalized at $400,000. The proceedings were instituted by the Barber Asphalt Paving Co. of Pennsylvania. The motors company admitted its obligations and joined in the petition for the appointment of a receiver. Edward Kible, an attorney, was appointed, and his bond was fixed at $30,000. The Halladay company came here three years ago from Attica, Ohio, and was heavily financed by Newark residents.

Goodyear Tire Shows Profit of $9,640,235

Ratio of Current Assets to Current Liabilities Is More Than Ten to One

AKRON, March 27—For the first ten months of operation of the Goodyear Tire & Rubber Co. of Akron under the financing control which succeeded the Seiberling régime under the company's reorganization and $85,000,000 refinancing program, sales totaled $82,195,550, while a net profit of $9,640,235 is reported, according to the annual Goodyear statement made public to-day by President E. G. Wilmer. The report is for the ten-month period ending Jan. 1, 1922.

The $82,195,550 in sales are exclusive of all subsidiary companies and compare with sales of nearly $205,000,000 in 1920 for Goodyear under the presidency of Frank A. Seiberling, founder of the company. During the last year of the Seiberling régime, however, due to heavy losses on commitments, a deficit of $15,647,653 was reported.

Net Balance of $3,620,043

After deduction of interest and fixed charges, including miscellaneous adjustments in respect of investments in subsidiary companies, there remained out of the net profit of $9,640,235 a total net balance to surplus of $3,620,043, according to President Wilmer's report. Cash and the United States Treasury certificates are listed at $23,892,820. Although current liabilities included accrued interest and premium on bonds amounting to $1,371,574, the ratio of current assets to current liabilities is more than ten to one, Wilmer announces.

The adjustment in respect to investments in subsidiary companies, aggregating $1,508,820, in a large part reflects additional write-downs of inventories in both domestic and foreign subsidiary companies to a basis dictated by current market values, as well as substantial losses in the export business due to depressed exchange.

The Goodyear Tire & Rubber Co. of California and the Goodyear Tire & Rubber Co. of Canada, Limited, the company's principal operating subsidiaries, continue to show satisfactory current earnings, and the company's export business has been restored to a profitable basis, Wilmer reports. Neither the parent company nor any of its subsidiaries to-day has any bank indebtedness.

Officers Re-elected

All officers are re-elected, while three new directors are added. These are Francis Seiberling, Akron attorney, cousin of F. A. Seiberling and legal counsel for Goodyear under the Seiberling régime; Russell L. Robinson of the Robinson Clay Products Co. of Akron, and H. H. Springford, assistant to the president.

Old directors re-elected include Roger Hyatt, Paul W. Litchfield, G. M. Stadleman, Grayson M. P. Murphy, Robert Schaffner, Armin A. Schlesinger, A. H. Scoville, G. P. Steele, and Ralph Van Vechten. Stadleman and Litchfield are vice-presidents, having served in similar capacities under Seiberling and being the only old Seiberling executive officers to remain under the Goodyear reorganization. Litchfield is factory manager.

Executive officers are E. G. Wilmer, president; G. M. Stadleman and P. W. Litchfield, vice-presidents; H. H. Springford assistant to the president; P. H. Hart, treasurer; P. R. H. Leroy, assistant treasurer; C. A. Stillman, secretary; W. D. Shiltz and C. F. Stone, assistant secretaries; C. H. Brooks, comptroller, and C. L. Weberg, H. D. Hoskin and A. F. Eggleston, assistant comptrollers.

California Subsidiary Report

AKRON, March 25.—The Goodyear Tire & Rubber Co., of California, a subsidiary of the Goodyear Tire & Rubber Co. of Akron, which started operations at Los Angeles in July, 1920, as the first major tire factory on the Pacific Coast, in the ten-month period ending Dec. 31, 1921, reduced its net deficit from $3,157,762 to $1,672,453 by applying thereon the company's net earnings for the same period, which totaled $1,485,309, according to the annual report of the California company.

The western company, President E. G. Wilmer states, is in a strong position financially, at present the ratio of current assets to liabilities being approximately 13 to 1. The company lists current assets of $7,045,952 and current liabilities of only $538,935. The company has wiped out its bank indebtedness and announces that all trade accounts payable are being currently discounted.

Total net sales for the California company for 1921 were $14,333,500, compared with $16,128,850.

This Will Be Better Year Than 1921, Bank Asserts

MILWAUKEE, March 27—"This will probably be a somewhat better year in the automotive industries than last year," is a significant statement in the current issue of *Business and Financial Comment*, monthly business review issued by the First National, the largest bank in this city. It goes on to say:

> Because agricultural prospects are looking up, the demand for tractors and farm implements bids fair to improve. The leading makers of farm machinery have made drastic reductions in prices in order to get down to the level of farm purchasing power, although severe competition among manufacturers also is partly responsible.
>
> Assuming that a tractor lasts on the average six years, the replacement demand in the present year would not be much over 10 per cent of possible manufacturing capacity, figuring that in 1920 a total of 200,000 tractors were produced. The tractor manufacturing business, therefore, is dependent to a very large extent upon the development of new demand. In the motor car business, by contract, replacement demand has come to be a much more important factor.

M.A.M.A. Group Plan Will Be Abandoned

Directors Base Action on Policy and Expediency—Long Released from Duties

NEW YORK, March 28—Directors of the Motor and Accessory Manufacturers Association have decided, on the ground of policy and expediency, to abandon the group plan of organization for manufacturers making products of the same general character. Notices have been sent to members informing them of the action taken.

Considerable progress has been made in developing this form of organization and associations whose members produced springs, sheet metal, wood wheels and headlights had been taken into the M. A. M. A. as groups. The latest to affiliate were the makers of headlights, who acted during the Chicago show, and the Automotive Wood Wheel Manufacturers Association, which voted during the New York show to dissolve its organization.

Long Was Named Manager

After the wheel makers came in, Hargrave A. Long of Chicago, who had been secretary and treasurer of their association, was appointed manager of the industrial group department of the M. A. M. A. He has now been relieved of these duties and will return to Chicago.

No information is available as to whether the associations which were dissolved to continue the same general activities with the M. A. M. A. will be reorganized. No statement has been made by the directors of the M. A. M. A. as to the motives which prompted their decision to abandon the group plan. It is understood, however, that it was felt it would prove unwieldly. The nebulous state of the Federal law in relation to trade association activities also is believed to have had some bearing on the action.

N. A. C. C. Asks Distribution of Data in Foreign Fields

NEW YORK, March 27—The foreign trade committee of the National Automobile Chamber of Commerce has asked export managers of member companies to co-operate in the distribution abroad of information which will stimulate interest in the use of American motor vehicles. One purpose will be to familiarize foreign countries with the various utility uses to which motor vehicles are put in the United States.

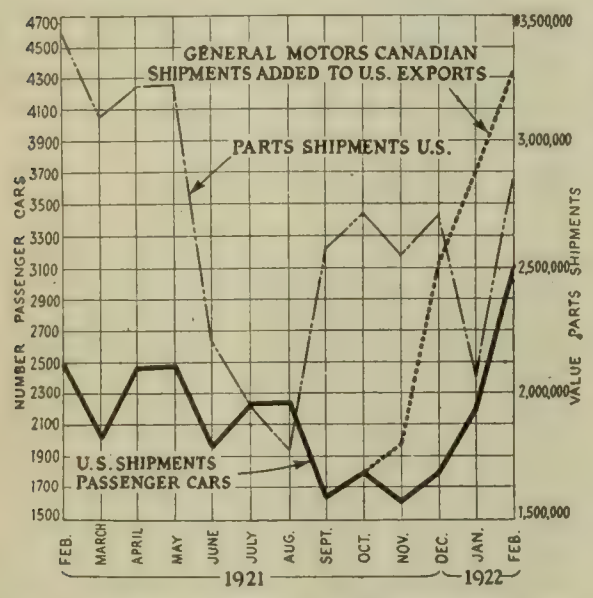
Information on road development also would prove acceptable, it is believed. This campaign will be conducted through export managers and their dealers abroad. In preparation for the work, members of the chamber have been asked to submit suggestions and lists of foreign cities in which they are represented.

International Trade Improves Materially

Total Shipments 3,550 in February Are Almost Equal to Same Month, 1921

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in line with the post-war development in industry and agriculture. New orders have come through from many territories where the stocks of cars and equipment have been sold out, necessitating new purchases to meet current demands. These demands throughout most of 1921 were met by the stocks sent through immediately after the boom broke and, as these stocks have now disappeared in numerous centers, shipments are necessary to keep cars on the dealers' floors and equipment in the stockrooms and warehouses.



The upward swing of passenger car exports

Details of the February shipments are shown in an accompanying table, and the chart herewith reveals how the overseas trade is again building up to a higher volume. The month of February was notable in an upswing of exchange for practically all countries of the world, except for the former enemy and the new succession states of Europe, and the rise naturally was accompanied by heavier shipments.

Some Recessions in Exchanges

Since the month closed, some recessions have been made in these international currencies, but March is closing with most of them at or within a small percentage of the high point reached in the earlier upswing. Consequently, except for the seasonal variations that may be expected from the various buying territories, there seems little doubt but that the shipments will hold up or grow larger as the better business situation makes itself more clearly felt throughout the world.

The February shipments continue the improvement begun some months ago, as the following comparison of shipments during the last year will show:

1921	Passenger Cars	Trucks	Parts
Feb.	2,492	1,095	$3,426,517
March	2,019	606	3,097,890
April	2,469	609	3,195,734
May	2,479	462	3,204,723
June	1,964	418	2,211,528
July	2,224	339	1,952,525
Aug.	2,237	381	1,786,886
Sept.	1,631	239	2,570,860
Oct.	1,791	254	2,702,002
Nov.	1,616	226	2,546,424
Dec.	1,784	161	2,683,850
1922			
Jan.	2,407	464	2,060,619
Feb.	3,096	454	2,838,259

In addition, the General Motors group have announced the shipments from Canada of the following number of cars not shown on the U. S. totals: November 371, December, 1338 and January 1300.

Denver Dealers Survey Cost of Doing Business

DENVER, March 25—A survey of the cost of doing business in the wholesale and retail automobile and truck fields has been undertaken by the Denver Automobile Dealers Association. The survey is being conducted separately for the distributor organizations of Denver and the dealer organizations of the Rocky Mountain territory. The work is being directed by the extension division of the University of Colorado.

The university is sending to Denver distributors and Rocky Mountain dealers questionnaires covering several pages, on which they are requested to give detailed information regarding total investment, total sales for 1921, sales of used cars, parts and sundries, repair labor, etc.

Another division of the questionnaire requests information as to the relationship in percentages of total sales to the cost of salesmen's salaries, advertising, sales management, commissions, salaries, instructions and sales expense, traveling, administration, guarantee expense, etc.

Other divisions ask for information regarding administrative and fixed expenses, with a recapitulation of the percentage relationship of selling expense in every department to the sales of that department and of administrative and fixed expense to the total sales.

April Will Surpass March in Business

(*Continued from page* 732)

basis. They have learned that the agricultural districts will take a considerably larger number of vehicles than was thought possible only two or three months ago. The same is true of the export field.

Sane and intensive sales efforts are being made. Greater attention than ever before is being given to service questions and economy of operation. The industry now realizes that the buying public is "motor wise." This is an important factor when it is considered that a very substantial part of the business this year will be in replacements.

Owen Tire Insolvent, Receiver Tells Court

Files Statement Showing Assets of Company Are $713,245 and Liabilities, $987,597

CLEVELAND, March 26—The assets of the Owen Tire & Rubber Co., of this city, are placed at $713,245 and the liabilities at $987,597 in a statement filed in the United States District Court here by M. M. Scott, receiver.

More than 150 pages of claims against the company are included in the report, most of the claims being for small amounts.

The company was organized during the war and got into production when trade in the industry slumped. Before the filing of an involuntary petition for bankruptcy in the Federal Court, the company had made certain transfers of property to creditors. It was claimed these were undue preferences and that the company at the time the transfers were made was insolvent.

Referee Made Report

C. D. Friebolin, referee in bankruptcy, was made a special master and, after conducting an investigation, reported that the company was insolvent in July and August, 1921, at the time the transfers were made. He also recommended that the petition for the adjudication of the company as a bankrupt be granted.

Because of this all creditors of the company will share on equal terms in the assets of the corporation.

Among the assets listed are accounts receivable of $11,176; accounts receivable, personal, $1,000 and notes and trade acceptances of $4,000. The liabilities include, in addition to claims reaching as high a figure as $587,168, note and trade acceptances, $39,448; trade acceptances, secured, $15,000, and acceptances payable of $100,000.

Time Payment Figures Show Sales in Chicago

CHICAGO, March 27—Figures compiled by the Central Auto Finance Association of Chicago show the steady increase in the sale at retail of automobiles in Chicago and Cook County since Jan. 1. The figures are based on time sales as indicated by the number of chattel mortgages on automobiles filed with the county recorder. C. L. Wolf, secretary of the association, estimates from long study of the automobile financing business that the time sales, including truck sales, represent about 75 per cent of total sales.

The number of chattel mortgages filed by weeks ending on given dates follows: Jan. 7, 302; Jan. 14, 410; Jan. 21, 458; Jan. 28, 442; Feb. 4, 493; Feb. 11, 442; Feb. 18, 517; Feb. 25, 486; March 4, 524; March 11, 719, March 18, 873.

Wolf said that within the last few weeks the records indicate a substantial increase in the sale of trucks.

Sales in New York Far Exceeding 1921

In Cases They Triple Business—Cars Below $2,500 in Price Take Big Jump

NEW YORK, March 27—Passenger car sales in the New York territory are following a normal curve for early spring, with the March sales records running with some cars almost twice what they were in February, and with all makes substantially ahead of last month. The indications are plain that the metropolitan trade will have at least a good spring business, and there are some pointers to a larger volume than dealers anticipated when the year opened.

Fifteen makes of cars are running far ahead of all others in their price classes, and 15 others are making what might be termed good sales records. Sales in the remaining classes are low.

In the aggregate, sales in the metropolitan area for the first three months of the year will run between two and three times the total for the same period of 1921.

County Figures

New passenger cars registered in 10 counties in and around New York numbered 4806 in January and February, as compared with 2247 in the same months last year.

Registration figures compiled by Sherlock & Arnold, publishers of the Automobile Sales Analysis, largely subscribed to by dealers, may be tabulated as follows:

Cars Below $2,500	1922	1921
January	2,019	483
February	2,231	1,409
Total	4,250	1,892
Cars $2,500 and Above	**1922**	**1921**
January	283	273
February	145	210
Total	556	355

Pulcher Elected Head of Truck Association

DETROIT, March 27—Martin L. Pulcher, vice-president and general manager of the Federal Motor Truck Co., was elected president of the new National Association of Motor Truck Industries at a meeting here this week. The purpose of the association is to improve conditions existing in the motor truck industry.

H. T. Boulden, vice-president of the Selden Truck Corp., was elected first vice-president; B. A. Gramm, vice-president of Gramm-Bernstein Motor Truck Corp., second vice-president; Moie Cook, secretary of the Service Motor Truck Co., secretary; A. S. More, president, Denby Motor Truck Co., treasurer. Don F. Whitaker, former general manager of the National Association of Motor Truck Sales Managers, which is merged into the new association, is retained as manager of the new organization.

These officers, with J. W. Stephenson, vice-president of the Indiana Truck Corp.; Homer Hilton, vice-president of Winther Motors, Inc.; F. G. Elder, vice-president of the Day Elder Motors Corp. and J. E. Tracy, vice-president of the Parker Motor Truck Co., comprise the board of directors.

Files Petition Asking Receiver for Harley Co.

BOSTON, March 30—A petition asking the appointment of receivers for the Harley Co. of Springfield, manufacturer of castings, has been filed here by Frank D. Zell of Philadelphia. He also asked an injunction to prevent the company from paying out any money while the proceedings are pending. The petition asserted that the company is solvent, but that its assets are likely to be dissipated by attachments by creditors. The plant is said to be worth approximately $1,000,000.

It is stated authoritatively that the action was taken to avert attachments and the foreclosure of a mortgage for $725,000 held by the Hendee Mfg. Co. The company is said to have quick assets of more than $200,000, and that its debts, exclusive of the mortgage, do not exceed $100,000.

Announcement was made on Jan. 4 of the transfer of the Harley Co. from the Hendee company by a syndicate headed by A. W. Morris and including R. E. Northway. The consideration was said to have been $1,100,000.

Industry Expansion Wide in Canada During 1920

OTTAWA, ONT., March 27—A preliminary report covering the automotive industry for 1920 has just been issued by the Dominion Bureau of Statistics, showing that during the year there was great expansion in the industry in each of the three sections under review.

Manufacturing firms increased their output from $80,619,846 in 1919 to $101,465,846 in 1920; automotive supply and accessories from $8,571,890 to $19,361,882 and repair plants from $12,004,970 to $16,592,623 or an increase of $36,223,645 for the three sections. Total capital invested was $89,183,306.

There were 3,759 open 2-3-passenger cars constructed at a value of $3,270,319; also 67,319 open 4-7 passenger cars valued at $65,084,212; closed cars numbered 7,957 valued at $9,721,247 and chassis, 4,601 valued at $2,407,206; trucks under 1-ton, 546 valued at $535,732 and over 1-ton 9,628 estimated at $7,617,785 with 334 specials, $75,220; 4-cylinder engines numbered at 54,121 and 6-cylinder, 4,904.

ENGINEER SUES FORD

MIAMI, FLORIDA, March 30—Damages amounting to $11,000,000 are asked in a suit filed here against Henry Ford by Edward S. Huff, an electrical engineer. Huff asserts that he originated the magneto now in use on Ford cars and that he never has been paid in full for his invention.

Miniger Will Offer to Buy Auto-Lite

Proposal Is Now Being Considered by Creditors' Committees of Willys Corp.

TOLEDO, March 29—Clement O. Miniger, one of the receivers for the Willys Corp., will make an offer to the Federal court for the Electric Auto-Lite division, with plants here and at Fostoria. The amount of the bid has not been determined, but the proposal now is being considered by committees representing bank and merchandise creditors.

Miniger, who has been a vice-president of the Willys Corp. and general manager of the Electric Auto-Lite plant, probably will have several associates in the deal, but he declines to name them. Several weeks must elapse before the negotiations can be completed, as advertisement for 30 days is required under the Ohio law. Miniger now is a director in two or three companies, which are subsidiaries of Durant Motors, Inc.

The general plan for the liquidation of assets of the Willys Corp. includes the sale of the properties now being operated and later liquidation of securities owned by the corporation. The Auto-Lite division has been the most profitable of the properties owned by the Willys Corp. The liability of the division to the Willys Corp. has been fixed at $5,405,596. The division now employs about 2000 men and has made preparations to add 300. Profits from operations in February amounted to $167,206 and for January to $158,881. Cash on hand amounts to $655,636 and the net current assets to $4,129,616. The total assets are $6,573,813.

S. A. E. Hears Electric Wiring Standard Favored

BUFFALO, March 25—Standardization of electric wiring for automobiles was advocated by W. S. Haggott of the Packard Electric Co. of Detroit at a meeting of the Society of Automotive Engineers held here.

"In conformity to the general tendency to standardize motor parts," Haggott said, "it is proposed to consider plans for a standardization of the electrical wiring of different automobiles, particularly wire and cable construction and methods of installation. Two years have already been spent in designing suitable cable."

He continued to say:

The wiring of an automobile is different from the wiring in a house or a factory. Tendency is strongly toward the use of braided covered high-tension cable, the braid, being filled with a good baking varnish. It is preferable to run high-tension wire open. There is a tendency to use armored cable on lighting circuits.

The use of a main line circuit breaker is strongly advised. Standard color schemes for various circuits should be used by all manufacturers of automobile wires.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Call money was easy both at the beginning and the end of last week. On Tuesday, however, rates began to rise and held up until Friday, when the tendency was downward. This rise was attributed principally to the action of the interior banks, especially in the Middle West and Canada, in recalling funds from this center. There were also rather heavy withdrawals of Government deposits from New York banks.

The quotations for call money ranged from 3½ per cent to 5½ per cent, as compared with 3 per cent to 4 per cent in the previous week. There was no essential change in time money rates, the quotations being 4½ per cent for 60-day maturities and 4½ per cent to 4¾ per cent for 90-day and four, five and six months' maturities, as against 4½ per cent for 60 and 90-day, and 4½ per cent to 4¾ per cent for four, five and six months' in the previous week. Trading was reported as dull and featureless, and although offerings were plentiful no large transactions were recorded. Prime commercial rates were quoted at a new range, from 4½ per cent to 4¾ per cent. For the previous two weeks, the rate was 4¾ per cent, and previous to that the range of 4¾ per cent to 5 per cent had been ruling since Jan. 10.

The Federal Reserve statement as of March 22, 1922, showed an increase of $681,000 in gold reserves and $3,213,000 in total reserves. The total reserves of the New York institution increased $26,399,000 and the gold reserves $27,402,000.

The U. S. Steel Corp. is reported to be now operating at 70 per cent of capacity, and incoming business thus far in March is 30 per cent in excess of that for February. In July, 1921, operations were 29 per cent of total capacity.

On March 23 German marks reached a new low level for the year, and the lowest point in history at 29⅝ one-hundredths of a cent. This downward trend was attributed in some quarters to a feeling that recent developments in the reparations situation might react unfavorably on German financc.

G. M. Declares Dividend Upon Its Preferred Stock

NEW YORK, March 29—Directors of the General Motors Corp. at a meeting here yesterday declared the regular quarterly dividend upon the preferred and debenture stocks. The dividend on the common again was passed.

At the close of the meeting the following statement on the business outlook was made by Pierre S. duPont, president of the corporation:

The position of the corporation is very satisfactory to us. Bank loans, which now stand at $41,140,000, have been reduced $7,800,000 since the beginning of the year, and cash, which now stands at $37,000,000 decreased only $3,000,000, making a net improvement in cash position of $4,800,000.

While it may be several weeks before final figures of sales of motor cars for the first quarter of 1922 will be available, the preliminary figures are most encouraging. Sales for January were 16,080; February, 20,664 and sales for March will be approximately 30,000 cars, a total of 66,000. This compares with 58,488 cars in the previous quarter and, further, with 30,023 for the first quarter of last year.

All divisions of the corporation are enjoying a substantial increase in business, and reports from our distributors and dealers indicate a strong retail demand for our product this spring and summer.

Seek to Keep Kentucky Wagon Firm from Merger

LOUISVILLE, KY., March 29—Following the filing of two suits in Circuit Court by four minority stockholders for a receiver and for an injunction to prevent the merger, plans for the merger of the Kentucky Wagon Manufacturing Co. with several other similar plants over the country have been practically completed, it was announced to-day.

The receivership proceedings were begun by J. Hardin Ward, Wilfred Bowser and Ossian P. Ward, plaintiffs in one petition, and C. D. Karsner, plaintiff in the other. Attorneys would not say when the matter will be taken before one of the chancellors for a hearing.

The petitioners alleged that the outstanding indebtedness of the corporation, including mortgage liens, notes and other forms of indebtedness, approximate $3,450,000, while the officers of the company claim the full extent of its liabilities is only $2,600,000 and that its tangible assets total $5,000,000.

It was said that James R. Duffin, a guiding hand in the merger, is now in the East closing a deal for the transfer of the cash, and that the money will be on hand before the time expires whereby the corporation will have to make a legal reply to the petition of the stockholders.

Tractors in New England Prompt Course by College

NORWICH, CONN., March 27—Rapidly increased use of the tractor on New England farms and in the rural districts is indicated in the announcement that a brief course on the management and use of the tractor has been scheduled for this spring at the Connecticut State College at Storrs. This institution is the recognized agricultural institution of the state.

The course, to comprise two lectures daily, followed by laboratory work and augmented by practical talks by experts on oiling systems, ignition systems and the like, will be inaugurated April 11.

FORD AT SOUTHAMPTON

NEW YORK, March 30—A dispatch from Southampton, England, states that representatives of Henry Ford have agre d to purchase from the city government a site for an automobile factory to cost £500,000.

FINANCIAL NOTES

Advance Rumley Co. in its annual report for the year ended Dec. 31, 1921 shows gross profits from operations of $1,353,452 compared with $4,971,129 in 1920. After allowing for all expenses, inclusive of selling and administrative costs, bond interest and inventory adjustment, there was a net loss for the year of $1,964,215 against a net profit of $1,277,231 the year before. The loss was stated to be due solely to conditions in the agricultural districts. The company's inventories have been reduced from $10,489,972 at the close of 1920 to $6,937,004 at the close of last year. In the previous year the company wrote off inventory to the extent of $837,936 and in 1921 to the amount of $1,279,197.

Republic Motor Truck Co., Inc., consolidated balance sheet as of Dec. 31, 1921, shows cash as $260,186 against $493,281 in 1920; notes and accounts receivable, $519,909 compared with $773,878; inventories as $3,842,995 against $6,612,392; notes payable, $1,562,149 compared with $2,029,873; and accounts payable, $571,697 against $486,779.

Hupp Motor Car Corp. for the year ended Dec. 31, 1921 reports net profits of $890,278 after Federal taxes and other charges. This amount is equal to $1.59 a share on the common stock after allowing for the preferred dividends. There is outstanding $5,192,100 common stock of $10 a share par value.

Republic Motor Truck Co. committee for first mortgage and collateral trust 7 per cent serial notes has announced that the time for the deposit of notes had been extended until April 5, 1922. The noteholders' committee states that on March 21 notes to the amount of 80 per cent had been deposited with it.

McGraw Tire & Rubber Co., directors at a meeting here, decided not to do any new financing for the present. While the company lost money in February it is breaking even in March, with the prospects much better for April, judging from orders already booked.

Chicago Yellow Cab Co., Inc., has declared a monthly dividend of 60 cents a share payable April 1 to stock of record March 23, 1922. Previous payments were at the rate of $1.75 quarterly.

Empire Trust Co. has been appointed depositary for claims against Consolidated Distributors, Inc., under an agreement entered into March 10.

Reo Motor Car Co. has declared the regular quarterly dividend of 2½ per cent, payable April 1.

Motor Transport Future Is Outlined to Students

BOSTON, March 27—The prediction that 4000 specially trained men will be needed in the next ten years for service in the highway transport business, was made by F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, in an address before the students of the Massachusetts Institute of Technology.

Fenn said during his talk:

It is fairly certain that the next great development in this country in transportation will be therefore a national delivery service for picking up traffic at the point of origin and making delivery at the store door of the consignee. The motor truck offers the best solution of this problem in the opinion of many railroad officials.

INDUSTRIAL NOTES

International Steel Products Co. stockholders at a special meeting instructed the directors to take immediate steps looking to the disposition of the property. The company was organized in 1918 to manufacture mufflers and built a two-story modern factory. The decline in the commercial muffler market obliged the company to enter other lines, but while a fair business was done in 1921 the losses of the previous year were not overcome and stockholders declined to invest the additional funds required to maintain it as a going institution. The property will be offered for sale Saturday, April 15, at 2 p. m., at the plant offices in Hartford, Wis.

Master Tire & Rubber Co. reports that for the six months' period ending Feb. 25 it had manufactured 13,400 tires, a greater output than it has before produced in a like period. It states that these tires have met a ready sale at a reasonable profit to the company, with the profit and loss statement showing a very substantial net profit for this period. It also states that there is every reason to believe that the company will work out of its receivership with a stronger dealer organization and with its position better than ever before.

Wisconsin Castings Co., Sheboygan, Wis., has been incorporated with a capital stock of $125,000 by Harry W. Bolens, president of the Gilson Manufacturing Co., Port Washington, Wis., who recently purchased at receiver's auction the foundry and machine shop of the defunct Globe Metal Products Co. for $65,000. The Globe plant will be placed in operation as soon as readjustments and improvements can be made and will be devoted largely to manufacturing parts as well as complete farm tools and specialties.

Montana Tractor Co., Oconto, Wis., has elected John B. Chase, mayor of Oconto, president to fill the vacancy caused by the death of George Beyer. The Oconto factory was established about two and a half years ago by the concern, then located at Tyndall Park, near Chicago. Oconto stockholders gradually have taken over the ownership and have now made disposition of the Tyndall Park factory to other interests in order to concentrate production and administration at the main works in Oconto.

Starkweather-Snook Corp., Moline, Ill., has increased its capitalization from $100,000 to $200,000 with local bond houses underwriting the issue. The S. and S. shock absorber has been on the market for four years and a dozen agencies have been established from coast to coast. The new capitalization will provide facilities for the growing business and is the first move toward enlargement of the plant.

C. A. Shaler Co., Waupun, Wis., has made preliminary plans for the construction of a new plant to replace its works, destroyed by fire recently. These plans call for an ell-shaped structure, 50 x 300 and 50 x 150 ft., of brick and steel construction, with steel sash, fireproof throughout. Work will be put under way at once. The investment in buildings and machinery will be about $300,000.

Multibestos Co., Walpole, Mass., stockholders have elected C. W. Bunker treasurer of the company. The officers and executives are now as follows: Stoughton Bell, president; C. W. Bunker, treasurer and assistant to the president; T. J. Daley, secretary; T. H. Bateson, superintendent; E. C. Miner, assistant sales manager: J. Posternock, purchasing agent.

Lee Rubber & Tire Corp. re-elected directors at the annual stockholders' meeting. The company reports that its production since Jan. 1 has been at the rate of 2000 tires a day, which compares with 500 tires daily at this time a year ago. It also reports an improvement in sales.

Jelly Electrotype Battery Co., Inc., New York, has been placed in the hands of Joseph C. Bonner as receiver. The company, which manufactures storage batteries, has filed a petition in bankruptcy listing its liabilities as $52,654 and its assets $18,481.

A. J. Gillespie & Co. has been established at Cleveland for sales engineering service. The service will embrace both the executive and sales branches of industries and, in addition, direct sales representation for automotive products will be undertaken.

Oakland Motor Car Co. has changed its San Francisco distributorship into a direct factory branch with its territory including northern California and western Nevada. L. S. Shoup, formerly Oakland branch manager at Indianapolis, will be branch manager.

Laher Auto Spring Co. is contemplating the erection of a new factory at Spokane for the manufacture of automobile springs. The site for the plant has not been selected.

New Company to Make "No Ceem" Inner Tube

NEW YORK, March 27—The Corrugated Rubber Corp. has been organized to manufacture the "No Ceem" corrugated inner tube, a product which is described as being "moulded in one perfect ring oval in cross section, without splices, seams or creases." The tube is corrugated on the outside to facilitate circulation of air between the tube and shoe and to prevent sticking. Headquarters of the company will be in New York and a plant will be erected at Poughkeepsie.

The company is capitalized at $1,500,000. W. L. Fairchild, inventor of the process by which the tube will be made, will be vice-president. The Edward A. Cassidy Co., manufacturers' sales agent located in New York, will distribute the product.

Sounding Out Executives On Export Combine Plan

NEW YORK, March 25—Regional meetings of automotive executives at New York, Detroit, Chicago, Cleveland and perhaps other centers are being planned and soon will be held for consideration of the export combine under consideration by the National Automobile Chamber of Commerce.

All member companies of the N. A. C. C., as well as their foreign sales managers and other companies interested in the proposal, have been furnished a prospectus of the combine plan and the trade is quietly being sounded out concerning its possible adoption in preparation for the forthcoming meetings. Some modifications of the plan as it was originally presented last January, principally referring to the financing of international shipments, have been made in an effort to clarify it.

Promotion work in regard to the proposed combine is under the direction of a committee headed by A. S. More, president of the Denby Motor Truck Co. of Detroit, and George F. Bauer, foreign trade secretary of the Chamber.

METAL MARKETS

APPARENTLY the chief steel market interest approves of the advance in sheets which a number of independents have notified the trade would become effective April 1. Judge Elbert H. Gary's recent statement to the effect that "it will be our principle and policy to follow increases in the selling prices of others up to the point which we believe will be fair and reasonable and just to the purchasers and not any further" is interpreted to mean that the corporation's subsidiaries will shortly revise their prices upward to the levels recently announced by the independents. Brier Hill Steel Company, Wheeling Steel Products Company, and other independents who announced the advance of black sheets to 3.15c., galvanized to 4.15c. and full-finished automobile sheets to 4.50c., effective April 1, took special pains to afford to the trade every possible opportunity to place orders at the old prices, which were $3 a ton lower.

It is safe to say that the bulk of the sheet business for the second quarter has been placed at the previously prevailing figures of 3c. for black, 4c. for galvanized and 4.35c. for full-finished automobile sheets. Undoubtedly intimation of the advance has resulted in adding to the backlog of nearly all the mills. Until a representative tonnage of orders has been placed at the new prices it would be premature, however, to pass any sort of judgment on the market's tone. What has taken place so far is simply that the mills have revised their asking price on sheets upward to the extent of $3 a ton. There has been no buying at the new levels.

Of course, it will be well to bear in mind that the present movement differs from previous attempts to elevate steel prices to somewhat higher levels, in that it appears to have the full support of the leading interest. It may also be well to bear in mind that the corporation's judgment affecting price policy is always based upon a survey of the probabilities in the way of demand rather than upon sentiment. From the producer's point of view the market has turned the corner, which impression is based on the unanimity of sellers in asking higher prices. From the consumer's point of view the new prices are still on trial.

Pig Iron.—General demand is expanding. Automotive foundries continue to buy conservatively. So far the market is steady rather than strong.

Steel.—Announcement of impending advances in sheets was preceded by a $2 advance in sheet bars to $31. In this the principal corporation subsidiary, the Carnegie Steel Co., took the lead. There has been a slight let-up in specifications on strip steel by automotive buyers, especially on the hot-rolled. Orders for cold-drawn steel bars are larger, many buyers apparently believing that sooner or later the price for this product must be affected by the higher tendency of the basic product, ordinary steel bars. Somewhat more firmness is noted in the market for bolts and nuts.

Aluminum.—The undertone of the market is firmer and 17.50c. has now come to be an inside price for foreign virgin ingots, 98 to 99 per cent. American metal has been resold at 18.50c., which is also the level at which small tonnages of British ingots changed hands. The supply of German metal has somewhat increased, interests which for a time were out of the market again offering metal. Sheets are in fair demand at steady prices.

Copper.—Domestic demand is very quiet. The market is again easier.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia. Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 4-5—Boston, Safety Conference, under auspices of Massachusetts Safety Council, State House.

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, April 28, May 26.

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Orders New Dividend for Standard Parts

With Its Payment, Creditors Will Have Received Total of 25 Per Cent

CLEVELAND, March 29 — Federal Judge D. C. Westenhaver to-day gave Receiver Frank A. Scott, of the Standard Parts Co., authority to pay creditors of the company a dividend of 5 per cent. About $500,000 will be paid to creditors of the company under this order. With the current payment the receivers will have paid creditors a total of 25 per cent, and $2,400,000 has been disbursed to holders of claims during the administration of Receiver Scott.

Scott had planned to ask the court for permission to disburse 10 per cent this time. Recent releases on contracts from customers, however, led him to cut the disbursement in half. As a result, the receiver will have $500,000 to aid in financing plant activities of the next few months.

When plans for refinancing the H. J. Walker & Co., makers of automobile motors, were announced, it was rumored that other automotive parts and accessories makers were to be helped. It is stated that Standard Parts Co. is one on the list to receive a helping hand and that important developments which will greatly strengthen the company are likely to come within the present year.

RICHELIEU TO MOVE

ASBURY PARK, N. J., March 29—Announcement is made here that the Richelieu Motor Corp. will be transferred to Rahway, where it will be operated as a unit of the United Auto Body Corp., of which Elmer H. Mohn is president. A holding corporation of the two companies has been formed, and the Richelieu car will be built for the present in the plant of the body company which will make all bodies for the automobile. The Richelieu Motor Corp. is headed by William Beckman as president and Mohn as managing director. The general sales manager is N. G. Rost, who was president of the Richelieu Motor Car Corp.

Road Accidents to Come Before Safety Meeting

BOSTON, March 27—A safety conference will be held at the State House here on April 4 and 5 under the auspices of the Massachusetts Safety Council, in co-operation with the departments of labor and industries and public safety. Wednesday afternoon will be given over to a program dealing with "Accidents on the Highway," John N. Cole, commissioner of public works, presiding. The program is as follows:

1.30—"How the Police Can Reduce Accidents," John L. Sullivan, chief of police at Pittsfield.

2.00—"Help Us Save a Hundred Lives this Year," Frank A. Goodwin, state registrar of motor vehicles.

2.25—"The Public Street as a Playground," Mrs. James D. Tillinghast.

2.50—"Educating the Jay-Walker to Become a Pedestrian," Franklin Collier, cartoonist of the Boston Herald

3.20—"Is the Automobile or its Driver Dangerous?" David F. Butler, assistant secretary, Automobile Mutual Liability Insurance Co.

3.50—Movies.

SELLING PAN-AMERICAN CARS

DECATUR, ILL., March 25 — Edward Danner, former president of the insolvent Pan-American Motors and a receiver of the company, has been granted court permission to sell 30 cars inventoried at $1,000 for $630 each to the Woodbridge Co., Boston. The car was designed to sell to the trade for $2,000.

Year Started Well for American Bosch

In Its Annual Report, However, Corporation Shows Effects of 1921 General Slump

SPRINGFIELD, MASS., March 27—American Bosch Magneto Corp. reports that because of the new starting and lighting and battery ignition equipment, forward business has increased 35 per cent over a year ago and that unfilled orders on Jan. 1, 1922, were more than $8,500,000 as compared with $6,300,000 Jan. 1, 1921. It states that January shipments were the best in sixteen months and that improvement is expected each month from now until summer.

The corporation felt the effects of the slump in business during the past year, for although it did not lose a single account, it states in its annual report that gross business during the year was but 25 per cent of the 1920 total. Against profits of nearly $1,500,000 in that year the company had an operating loss of approximately $200,000 in 1921. Including inventory adjustments, dividends and write-off for experiments and research work, there was a net reduction in profit and loss surplus of $2,000,000.

The financial position of the company was comfortable at the end of 1921 as a result of liquidating efforts and the sale of $2,000,000 notes. Quick assets totalled $5,000,000, or nearly five times the rising $1,000,000 of liabilities. Inventories were reduced to $3,300,000, or about 25 per cent.

In his remarks to the stockholders, President A. T. Murray states that every aid is being given the Government in its investigation of the sale of the company by the alien property custodian.

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Production Program or Quotas —Which Comes First?

Description of methods employed by manufacturers to establish quotas. In current practice quotas are adjusted to a predetermined production figure. Analysis shows inherent weakness of this method and proper approach for solution of the problem.

By Norman G. Shidle

THE annual production of each passenger car manufacturer is distributed to branches or distributors and by each branch or distributor to the various dealers within the given territory. There must be some basis for allotting cars to these distributors or branches, some method of determining how many cars shall go to each. The simplest method would be to divide the total proposed production by the number of distributors. This would give an equal number of cars to each one. The vital objections to such procedure are obvious. It becomes necessary then to determine the best possible method of making these allotments, the best possible method being that which enables the manufacturer to achieve the most efficient and least costly production and distribution.

The practical value of an accurately established quota is not sufficiently recognized in the industry at present. The methods used for establishing quota in many cases grew up out of the necessities of heavy demand during peak production times. Distributors and dealers were clamoring for cars. It was difficult to "stall them off." So certain specific quotas were laid down on one basis or another chiefly to give the sales manager some sort of reason to refuse more cars when necessary.

The fundamental reason for establishing quotas in any manufacturing business, however, is to determine as accurately as possible the probable market for the product during the given year or production period. A properly established quota will aid in the determination of the production schedule. Consequently it cannot be dependent upon a previously determined production schedule. To be of maximum value a quota should be so established that it will show with some accuracy the probable market in a given territory for the given car.

The term quota is sometimes used to mean different things. It may be built up to determine:

1. Maximum possible sales.
2. Minimum satisfactory sales.
3. Probable sales.

For the purpose of this discussion the first definition will be utilized, because it is fundamental. From it can readily be derived either of the other two, provided they are more desirable for practical use.

Uses of Quota

Too frequently the possible uses of a properly established quota are not recognized. Usually, passenger car quotas serve no purpose other than that of fur-

nishing some basis upon which to distribute a predetermined production of cars. Sometimes the quota is used to check up distributor performance to a certain extent. Quotas as now established in most cases, however, do not constitute proper standards by which to gage sales performance.

The scientifically established quota, however, has a practical financial and economy value. It can aid in determining what shall be the production for the year, which will in turn enable the manufacturer to take advantage of long range buying, to stabilize his labor force, to facilitate financial plans and to increase production and marketing stability all along the line.

It can be used, moreover, as a proper standard of performance for distributors and dealers, enabling the manufacturer to check with some real degree of accuracy the excellence or lack of ability of his distributor organization.

Before proceeding to a discussion of how such an accurate quota may be built up, it is worth while to survey the methods now in use. Nearly every plant has a different method of procedure.

In one factory quotas are established by taking the actual number of cars sold by a given distributor last year and adding to that number "as many more as the factory thinks he can handle in view of his selling ability and conditions within his territory." The number of cars to be produced by the factory, however, is determined before these quotas are established, so that the sum of the distributor's quota must arbitrarily be brought to that predetermined production total.

In another case, the distributor is expected to take a number of cars equal to a given percentage of sales of competitive makes to the total sales of the competitive group in his territory during the preceding year.

Another factory practically allows the distributor to say how many cars he will take.

Still another bases its quotas upon the number of cars taken last year by the given distributor, plus a certain number which is determined in conference with the distributor.

One company sets its production schedule and then gives to each distributor a proportion of that predetermined number based on the percentage of production absorbed by that distributor during the previous year.

One successful manufacturer likewise bases quota on the percentage of past production taken by the given distributor. Production is based upon "a number of factors compiled by the statistical department."

Another company relies very largely upon the intimate personal knowledge of the field possessed by a capable sales manager, correlated with the past performance of the distributor and the opinion of the district sales manager.

Still another method is found in basing quota upon the percentage of the given make of cars sold in the territory as related to total sales during the previous year plus a certain per cent.

A few companies use more detailed methods. One successful, conservative organization, for example, establishes distributor quota in this way: The percentage of registrations in a given territory to the total car registrations is first determined. The factory then determines the percentage of its own production absorbed by that territory during the previous year. When these percentages are about the same, as they are in many cases, the distributor is allotted that percentage of the year's production. When the two percentages do not agree, however, a compromise percentage is given, arbitrarily fixed with due regard to conditions within the territory, the number of cars that the distributor himself believes he can sell, road conditions and other factors.

Very elaborate market analysis work precedes the establishing of quota in one or two cases. Comprehensive and accurate data are collected concerning a large number of factors affecting sales possibilities. These data are listed, a certain weight is given to each of the factors and the factors are correlated to give the quota for the given territory.

Evaluating Present Methods

Brief analysis will show that in every case, except the last mentioned, the basis used in establishing the quota makes the quota useless so far as concerns its being an aid in determining the most economic production schedule or in acting as a standard of distributor sales performance.

This is true because the quotas are established on the basis of a predetermined production schedule, which in turn has not been based upon any very comprehensive market analysis; or they are based upon past performance as related to the given company itself. The basis of establishing quota is *relative* in almost every case, rather than *absolute*. It is not useful as a standard of performance for this reason.

In most cases only a few of the factors affecting sales are utilized in establishing the quota, which consequently becomes a necessary tool rather than a useful standard.

This condition is natural at the present stage of the automobile industry. The industry is comparatively young as a whole, while the necessity for a study of marketing problems is less than two years old. The industry has arrived at a point, however, where procedure must be based upon more fundamental factors.

Methods of Establishing Quota

In establishing accurate quota, which can be of maximum use, the problem should be approached from two angles:

1. Past performances.
2. Market analysis.

As explained in previous articles in AUTOMOTIVE INDUSTRIES, the slowness with which buying habits and human nature change makes it possible to determine with a high degree of accuracy probable trends for a year or two in advance on the basis of past performance, provided data concerning that past performance are available over a long period of time. A complete discussion of this phase of the subject is contained in AUTOMOTIVE INDUSTRIES of Nov. 17, 1921.

Thus the probable production of cars in a given price class for the coming year can be determined with a high degree of accuracy by a proper correlation of past statistics. Statistics showing the probable production by price classes for 1922 appear in the Statistical Number of AUTOMOTIVE INDUSTRIES, published Feb. 16, 1922.

In our issue of March 23 we showed how the individual company can compare its growth with that of its price class, and how it can determine its probable production for the coming year on the basis of past performance. It is unnecessary to cover these phases in detail here, but a thorough understanding of this previous material is essential to a proper reasoning through of the entire problem.

We may assume then that the Sennett company, for example, has determined its probable sales possibilities for 1922 on the basis outlined above. The figure so determined will be very nearly correct, because varying conditions throughout the country, whether favorable or unfavorable in various sections, will probably balance one another. There is not likely to be a radical change

throughout the country. There is a possibility of radical change in a small area, however, and for this reason market analysis is essential to the establishing of proper quotas.

The smaller the unit under consideration the greater the possibility of variations in the prediction made solely on the basis of past performance, because the accuracy of the prediction depends chiefly upon the occurrence and balancing of many plus and minus factors over a long period.

Therefore the third step in establishing quota is to make a thorough territorial analysis of each distributor's territory. This analysis will consider all those factors affecting sales. The method of making it will be discussed in a following article. Thus the maximum sales possibilities will be determined for the given price class in the given territory. This number is based on an *absolute*, not on a *relative*, study.

If the Sennett company has sold 5 per cent of the cars in its price class during the preceding year, it is fair for practical purposes to apply that percentage to the absolute figure determined as a result of the market analysis of an individual territory just discussed.

When this is done, the resulting figure will give the economically possible Sennett sales for 1922 in the given territory. This figure will serve the factory as a fairly accurate standard of performance.

Human factors are not equal in all territories, however, and the quota actually set up for the distributor should be established after considering the personality and ability of the distributor, the general attitude of the public toward the car in the given territory, etc. The result of this adjustment will give the actual quota.

The sum of these actual quotas should be somewhere near the probable Sennett production figure previously determined on the basis of past performance. If there is a wide discrepancy adjustment should be made in both the production and the quota schedules.

TOO frequently the possible uses of a properly established quota are not recognized. Usually, passenger car quotas serve no purpose other than that of furnishing some basis upon which to distribute a predetermined production of cars. Sometimes the quota is used to check up distributor performance to a certain extent. Quotas as now established in most cases, however, do not constitute proper standards by which to gage sales performance.

The scientifically established quota, however, has a practical financial and economy value. It can aid in determining what shall be the production for the year, which will in turn enable the manufacturer to take advantage of long range buying, to stabilize his labor force, to facilitate financial plans and to increase production and marketing stability all along the line.

The absolute quota can serve as a maximum performance standard in each territory, while the actual quota, which includes consideration of the human factors, can serve as the guide in establishing production.

The market analysis serves as a check on the probable production figures and vice versa. The probable production estimate cannot take into account very unusual circumstances, economic or human, which may arise in a given territory, in the management of a given company, or in the design of a given car. The market analysis can take into account these factors.

The basis of establishing quota and the various steps in the procedure may be summed up as follows:

1. *Probable* total price class production can be determined from past performance (A. I., Dec. 22, 1921).
2. Probable Sennett percentage of total price class production can be determined from past performance (A. I., March 23, 1922):
3. Distributor's absolute territorial possibilities can be determined from territorial analysis. That is, maximum price class possibility in territory can be determined on absolute basis.
4. For practical purposes, probable Sennett percentage of total price class production (No. 2) can be applied to individual territory.
5. This will give an absolute quota or economically possible Sennett sales in given territory for 1922.
6. Actual quota can then be established by considering dealer ability, etc., in connection with absolute quota.
7. Sum of actual quotas should be somewhere near total Sennett U. S. production. If not, adjustment should be made both in production and actual quota schedules.
8. Sum of absolute quotas and separate absolute quotas serves as a standard of performance.

With this outline of procedure in mind, the next step is to consider in some detail the matter of actual market analysis and methods of correlating the factors involved.

Tire Market in Yokohama, Japan

IT is estimated by Consul General Scidmore, Yokohama, in a report to the Department of Commerce, that there are between 7500 and 8000 passenger automobiles in Japan, 5500 of which are in and around Yokohama. Of this number 25 per cent is equipped with metric clincher tires, 40 per cent with inch clinchers, and 35 per cent with inch straight sides. American-made straight-side tires are freely available in the district, while Dunlop's branch factory at Kobe and the Yokohama Rubber Co. are now making this type.

While American firms are still shipping some cars to Japan, the last 18 months has shown a marked decrease. As yet no cars other than American have come in on straight sides. There are about 3000 motor trucks in the country, of which 2200 are in and around Yokohama; 20 per cent of these trucks operate on pneumatic tires, while 80 per cent are equipped with solids. The tires manufactured by the Dunlop branch factory at Kobe, financed by English and Japanese capital, dominate the market. Most of the imported tires are of American manufacture.

Straight-side tires are very little used in Japan, for the reason that Japanese chauffeurs—there being very few owner-drivers—always run on underinflated tires—about 45 pounds for a 4-inch tire—because of the better riding conditions secured by this practice. The straight-side fabric tire soon breaks down under these conditions. Cord tires are not used because of the high price and the fact that there are no facilities for repairing them in Japan.

Powerplant in New Stutz Model Incorporates Many Changes

Lighter pistons, redesign of jackets and cylinder head and better fuel vaporizing means, among other changes, have resulted in increasing the power, speed and fuel economy. Heavier crankshaft, machined combustion chambers and stiffer cylinder block help minimize vibration.

By J. Edward Schipper

A NUMBER of changes have been made in the Stutz car, particularly in the powerplant. The latter have resulted in increased power output from the engine, lower fuel consumption, better comparative acceleration and hill climbing ability and higher maximum speeds. The changes are not radical in any sense, but include the adoption of up-to-date construction in the way of lighter pistons, better handling of the fuel, the adoption of detachable head construction and better design of the cylinder block with respect to the circulation of water, resulting in elimination of hot-spots or steam pockets.

Power output is now 50 per cent greater than before while the speed range has been increased at both ends, being five miles per hr. as compared with 10 miles per hr. at the lower end and 75 miles per hr. as compared to 60 miles per hr. at the other extreme. Cold weather performance has been improved by the adoption of a new vaporizing device. The chassis is now more quiet, due to the extensive use of anti-rattle features throughout the chassis, and the accessibility of a number of units has been notably increased as hereinafter noted.

The pistons are now considerably lighter due to decrease in length and thinner walls. The piston pin is a floating type, the pin being retained by means of a groove and spring retainer as heretofore.

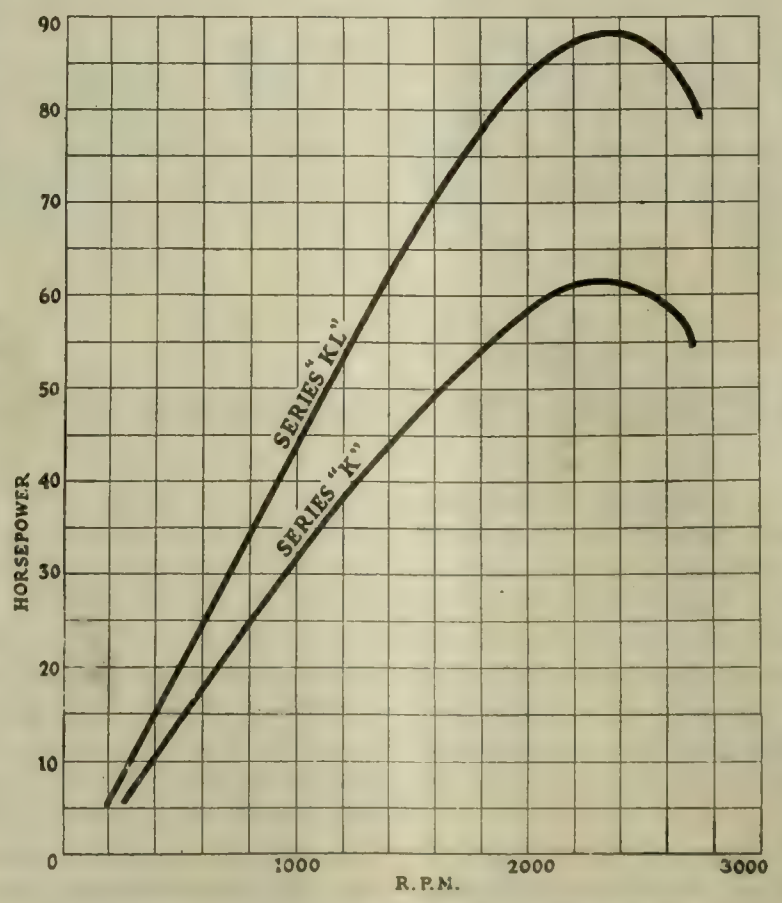
The connecting rods are 14 in. in length from center to center. The crankshaft diameter has been increased by 3/8 of an in. The bearing lengths of the crankshaft are now 3 3/8 in. at the forward main bearing, 2 3/4 in. at the center main bearing and 4 1/2 in. at the rear main bearing, while the diameter is 2 1/2 in. The bearings are supported in the aluminum crankcase and in addition there is a reinforcement by means of special shoulder bolts which run completely through the crankcase to the cylinder block, thus tying the entire structure together.

It is estimated by the Stutz company that the rigidity of the crankcase has been increased by 50 per cent. This has been accomplished by extensive ribbing.

The inlet manifold is designed to create an eddy in a circular chamber. The liquid particles are broken up as they come in contact with the hot internal fins. These fins are heated by exhaust gas drawn through a tube running directly across the engine between the central cylinders. This tube is in a dead air pocket, which tends to decrease radiation from the tube itself and permit a maximum amount of heat to be carried over to the heated fins. The heated fins of the intake are placed at an elbow, so as to trap the liquid particles in the intake stream without adding much heat to the air.

New Intake System

The intake has been designed with the passages sloping away from the cylinders so that all drainage is back toward the carbureter, and the manifolding is cast in aluminum in order to take advantage of the good heat conduction properties of this metal. The intake manifold is attached to the engine by means of an aluminum flange intended to transfer heat from the engine to the intake system. About one-fourth of the exhaust is used to heat the inlet, the arrangement being such as to prevent undue back pressure on the exhaust. The exhaust pipe is carried forward toward the radiator, in order to help keep the engine heat out of the front compartment of the car.

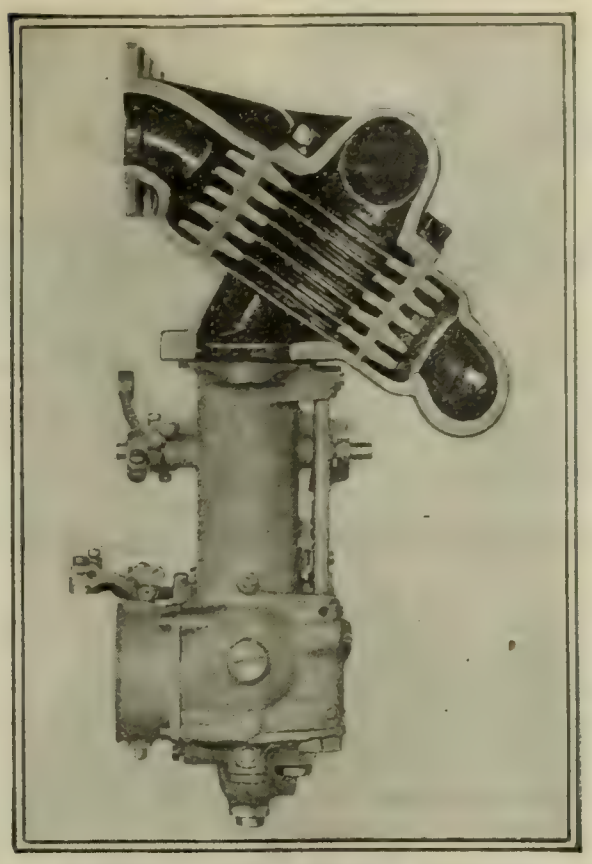


Horsepower-speed curves showing how the new series "KL" engine compares in performance with the earlier model "K."

The adoption of a detachable cylinder head has permitted the use of completely machined combustion chambers, with resultant equalization of cylinder compression and consequent decrease in vibration. The ability to secure smoother surfaces in the combustion chambers has also resulted in less adhesion of carbon particles and in more uniform cooling of the chamber walls. The cylinder head is extensively ribbed and a large number of studs are used to hold it in position and prevent gasket leakage.

The water spaces have been designed to produce small ed-

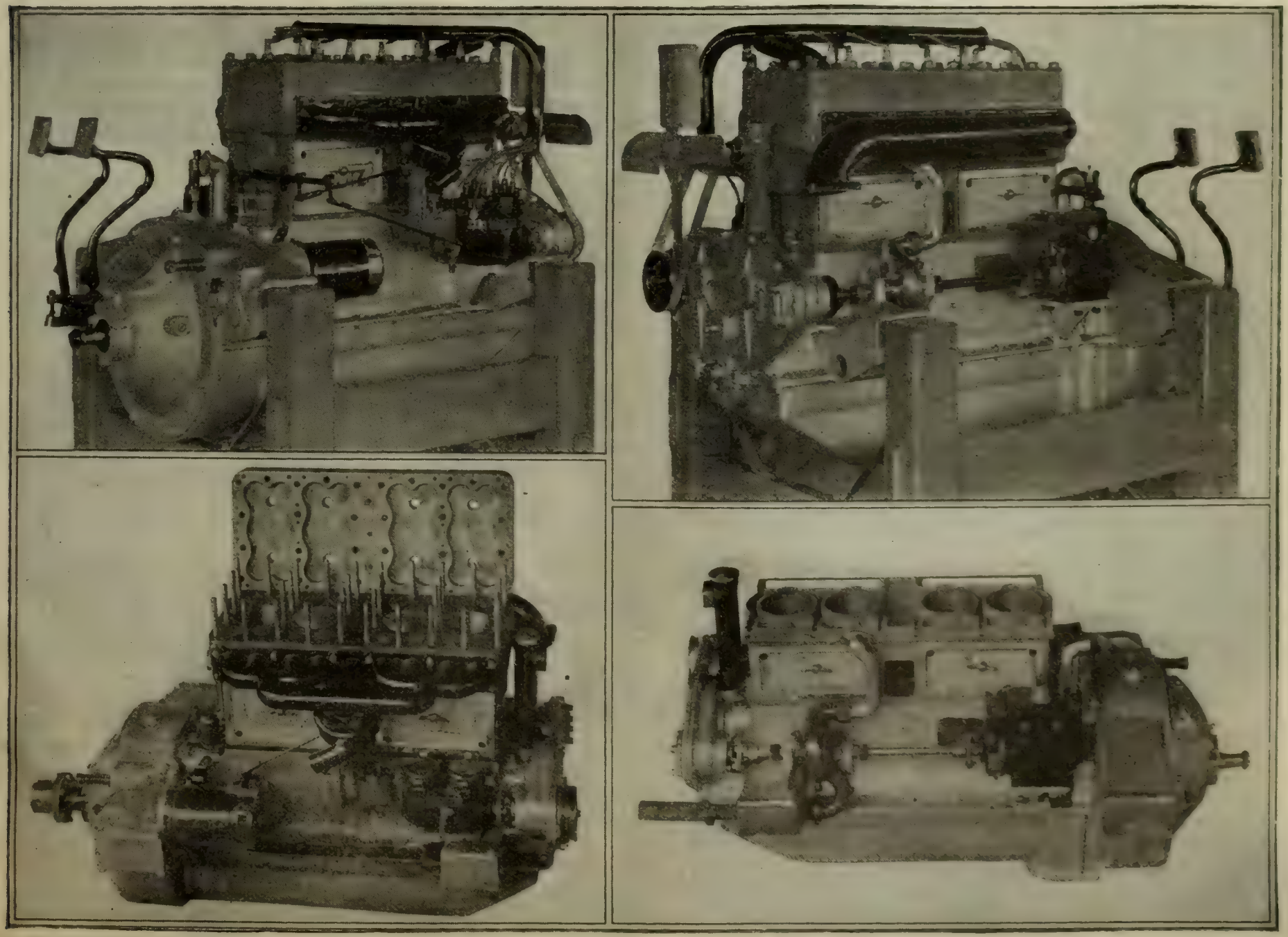
dies within the main body of water in order to equalize the cooling effect. The water is circulated by centrifugal pump. The fan incorporates a centrifugal feed oiling system, which carries a supply of lubricant sufficient for a season's running without replenishing. A pressure feed lubricating system distributes oil through integrally cast steel tubes, so that exposed tubing, unions and solder joints are avoided. The oil leads run to the hollow crankshaft and also the camshaft bearings from which oil is sprayed constantly upon the valve operating mechanism. The entire distribution system is lubricated by oil supplied through the hollow stud of the central idler gear of the six-gear train. Since the engine has four valves per cylinder, there are two camshafts. The idler gear has holes drilled from the hollow stud to the face of the gear. Through these holes, oil under pressure is fed directly to the meshing gear surfaces and thence supplies the entire forward gearcase.



Sectional view of the exhaust heated inlet manifold used on the new Stutz.

The auxiliaries are now arranged so that the twin ignition unit is driven from the timing case, but is entirely separated therefrom. The water pump and generator are on the opposite side of the engine and are now completely accessible without disturbing each other. These units are driven by auxiliary shafts provided with flexible couplings. The starting motor is also mounted individually to increase the accessibility. The ignition is the Delco dual synchronized system, with two spark plugs for each cylinder located in the center of each half of the combustion chamber.

The chassis and general construction of the Stutz car embody few changes outside of those in the powerplant. The cylinder dimensions are 4⅜ by 6 in., the engine being a T-head type. The clutch is a Warner, the gearset is of Stutz manufacture, providing three forward speeds. The car is driven through a torque tube with a single universal joint. The gearset is mounted in unit with the rear axle, and in order to obtain quietness all of the constant mesh gears are ground. The car weighs, with the seven-passenger touring car body, 4010 lb. The wheelbase is 130 in. and the tire size 32 by 4½ in. all around.



Four views of the new Stutz powerplant showing type of manifolds, redesigned cylinder head, increased jacket space and several other modifications.

A New Line of Bevel and Internal Gear Axles for Trucks

Seven new axles, three of the bevel gear type, intended for light trucks, and four of the internal gear type, for either truck or bus chassis, have recently been added to Russel line. One of the bus axles is arranged for 71 in. tread and underslung springs to facilitate low body mounting.

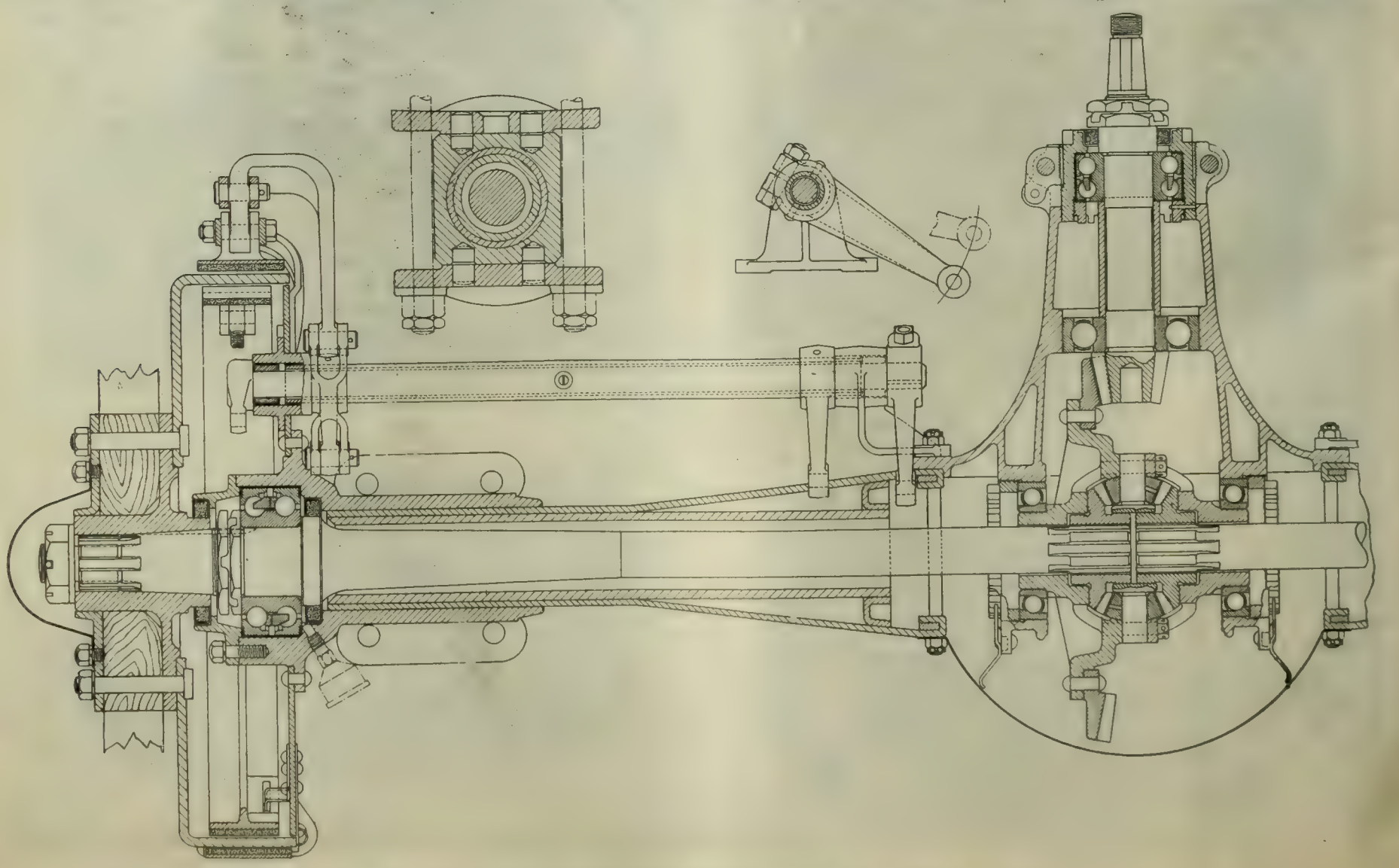
THREE new integral gear-drive axles for pneumatic tire equipped trucks have been added to the line of the Russel Motor Axle Co. The new models are very similar in design to the regular line of Russel axles described in AUTOMOTIVE INDUSTRIES of Nov. 10, 1921, but have larger brakes and smaller gear reductions, making them suitable for speed trucks or buses. In addition to these, three entirely new bevel gear axles for pneumatic tired trucks have also been added. These embody several features which are new practice for the Russel company. These six new models are now in production.

The three new double reduction, internal gear axles are for trucks of a nominal rating of 1, 1½ and 2 tons, and are designed for maximum loads on the spring pads of 4500, 6500 and 8000 lb., respectively. The maximum axle torque permissible is 5000 in.-lb. on the 1-ton model, 8250 in.-lb. on the 1½-ton model and 9000 in.-lb. on the 2-ton model. These axles are all designed to have both torque and drive taken through the springs.

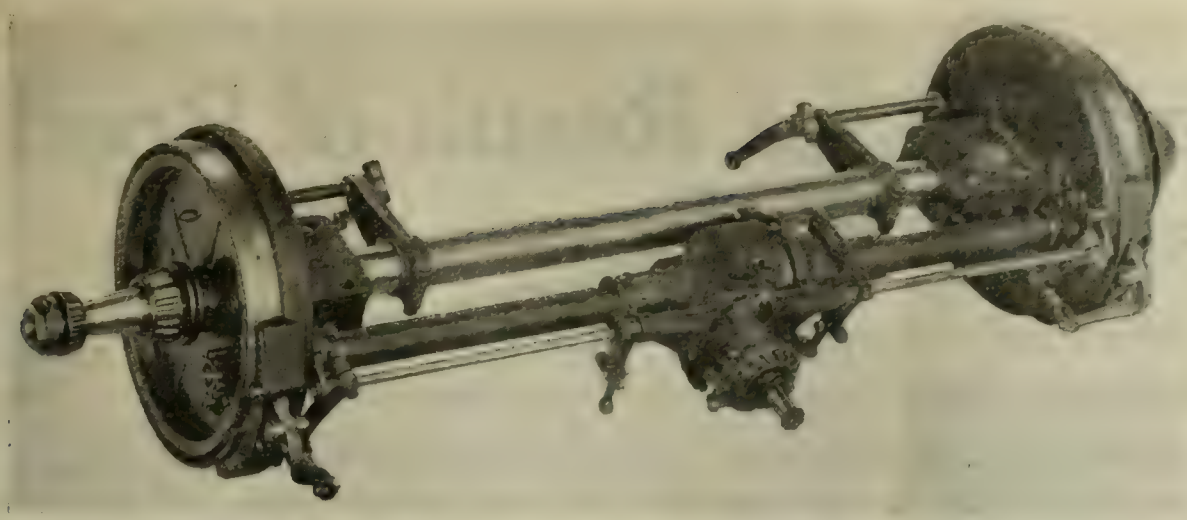
Of the bevel gear axles, the smallest one is intended for the speed truck type of vehicle having a capacity of ¾ ton, while the larger axles are intended for 1¼-ton vehicles. These axles are all of the semi-floating type with pressed steel housings reinforced by heat treated, chrome nickel steel tubes extending to within 7 in. of the center. The housing is ribbed and electrically welded over the entire length. The ribs are riveted and at the center of the housing nickel steel bolts extend through both sides to insure rigidity.

The differentials are of nickel steel with spiral bevel drive gears of coarse pitch. The axles are mounted on ball bearings and are equipped with both internal and external brakes.

Another new product of the Russel Motor Axle Co. is a motor bus axle of the internal gear type. This is of the same general design as the internal gear drive truck axles of the company. One of the differences is that the tread is wider, being 71 in. This is made necessary because of the fact that bus bodies are wide and must be



Sectional view of the new bevel gear Russel axle for light trucks



The new Russel internal gear axle intended especially for bus applications

placed low. For the same reason the springs are underslung. The load to be carried by the rear axle is equivalent to that of a 2½-ton truck. Because of the frequent stopping, it has often been found desirable to use both the internal and external brakes for service work and to install an emergency brake at the rear of the transmission. This is said to impose greater loads upon the differential and drive shafts. Bearings of increased capacity have therefore been provided for the bevel pinion, and the single row bearing adjacent to the bevel pinion is of a larger series than that for the outer bearing.

The drive shafts are increased in diameter to provide against additional deflection because of the increased length. Taper roller bearings are used in the wheels and the recently adopted S. A. E. recommendations for wheel bearing mounting have been used.

It is gratifying to note that the axle manufacturers are sensing the growing demand for motor buses and are doing their part to meet the special requirements of that particular line of motor transport.

SPECIFICATIONS OF NEW RUSSEL AXLES

Model	Nominal Rating Without Load	Maximum Load on Spring Pads in Lbs.	Diameter of Brake Drum	Gear Ratio
Internal Gear Types:				
3000-SI	1 ton	4500	15½	6.15 to 1
4500-SI	1½ ton	5500	16½	6.6 to 1
6000-SI	2 ton	8000	18	7.4 to 1
Bevel Gear Types:				
2400-B	¾ ton	3400	15½	6.33 to 1 5.28 to 1
3000-B	1 ton	4000	16½	6.33 to 1 5.28 to 1
3600-B	1¼ ton	4600	18	6.33 to 1 5.28 to 1

A Large Double-Crank Toggle Press

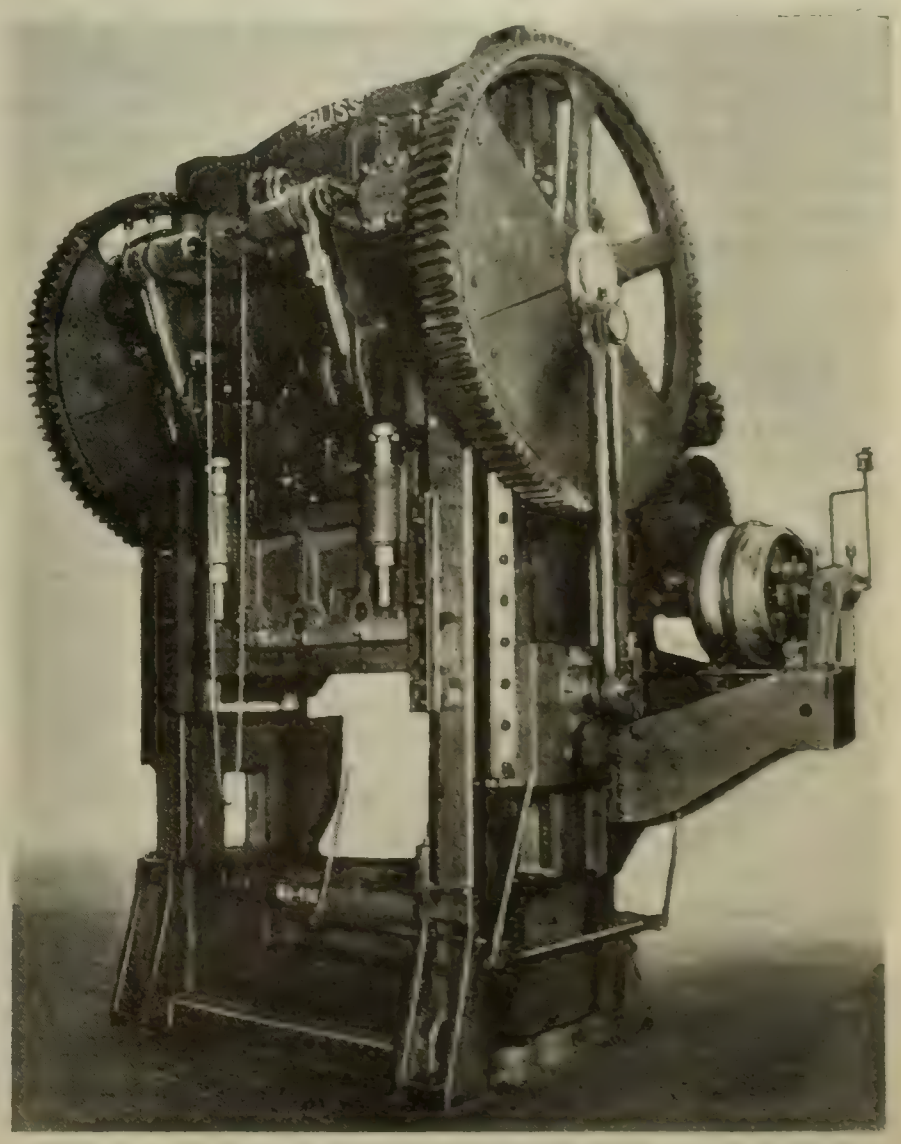
DURING the past several years rapid strides have been made in the use of steel stampings for all classes of light machinery, and particularly in the automobile industry. The use of stampings has been extended to lines of industry dealing with very large units, and to keep pace with this progress the manufacturers or builders of power presses have put out machines of sizes and capacities that a few years ago were not dreamed of.

The accompanying illustration shows a double crank toggle drawing press recently completed by the E. W. Bliss Co. It is of tie-rod construction, twin-driven and triple geared, and has a gear ratio of 85 to 1. The gears are all of steel and have machine-cut teeth.

Power is transmitted from the main drive gears to the outside slide or blankholder through a series of toggles, and a dwell of 120 deg. is obtained. The number of toggles and connections used is said to be the least possible for efficient results. In wide presses, to avoid torsional strain, the power is transmitted to the outside slide from both ends of the press. This method is also followed out in connection with the crankshaft which operates the inner slide, this being twin-driven by means of a gear on each end.

The small number of connections or links used in transmitting power to the outer slide makes for economy in power consumption, and to minimize wear in the connection pins they are hardened and ground. Adjustment of the inner slide or plunger is made by a 15-hp. motor mounted on the front of the crown. The machine itself is driven by a 100-hp. motor and operated by a powerful hand-actuated friction clutch of the double-grip type, by means of which the operator has the moving parts at all times under control.

The photograph gives an idea of the huge size of the machine here described, some of the principal dimensions of which are as follows: Distance from bed to the inner slide with the stroke down and the adjustment up, 59 in.; distance from the bed to the outer slide with the stroke down and the adjustment up, 56 in.; stroke of inner slide, 28 in.; stroke of outer slide, 20 in.; area of bed, 60 by 116 in.; area of face of blankholder, 60 by 102 in.; area of face of plunger, 36 by 86 in.; weight, about 600,000 lb.



Bliss double-crank toggle press

Experience Gained as a Result of Road Tests of Railcars

Information as to limitations and performance in actual service can be gained from such tests especially when the simple apparatus here described is employed. Data regarding special conditions to be met in railroad service and some useful comparisons with steam propelled equipment are given.

By Donald A. Hampson

RAILCARS are subjected to road tests for much the same reasons that other automotive vehicles are, and for other reasons peculiar to railroad conditions. These reasons may be summed up as follows:

1—To note the action and fit of wheels on the rails.

2—To locate any weakness or maladjustment in the car structure or power line.

3—Speed test.

4—To run in various working parts.

5—To determine the power as a self-propelled unit and as a motor car.

6—To furnish ocular proof of "roadability."

7—Braking tests.

8—To compare actual performance with theoretical data.

No. 1 includes a variety of details. The gage of an automobile is relatively unimportant—the "gage" of railroad wheels is of vital importance. Fig. 1 shows the elements of wheel and rail mating; the former is the standard adopted by the Master Car Builders' Association and the latter is the Civil Engineers' shape of rail head and spacing, which is the only "standard gage" of track in use by steam and electric roads. It will be noted that there is no shoulder to shoulder contact between wheel and rail simply rolling contact between the wheel on the concave portion of the flange with a corner of the rail rounded to a smaller radius.

The track gage is measured between vertical faces. On

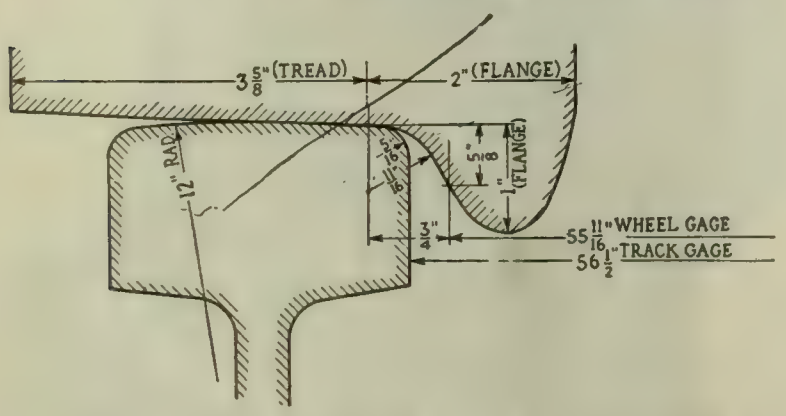


Fig. 1—Detail of rail and wheel flange, showing where gage is measured

the wheels, a gaging point has been selected arbitrarily about half way up on the flange and the wheels are so placed on the axles that these points on two wheels are a fixed distance apart. Shop men and car inspectors are supplied with gages made by Pratt & Whitney and other tool makers; by this means, the contour can be held within close limits. When wheels are new, they are only free enough (on track that is spiked up to gage) to roll easily; as they wear, the flange takes on the curve of the rail head, allowing greater freedom, until the wear amounts to about ¼ in. at the gage point when, according to "Rule 74," the wheel is condemned and taken from service.

Now, wheel gage is not such a serious matter within the M.C.B. limits, but taken in conjunction with worn rails, track out of gage, rotted ties, the allowance made on curves and special track work for the long rigid wheelbase of locomotives, it merits all the attention given it. If the tread of a car wheel (see Fig. 1 for the difference in application of the term) is narrow or broken out and the flange on the opposite wheel is badly worn, the wheel on the inside of the curve can run off and drop between the rails. A wheel hub out of true, a slightly bent axle, bolts unevenly drawn up, a wheel inaccurately machined—any of these causes would be passed over as unimportant on a motor truck (probably laid to the rubber tire), but might result in derailing the same truck if placed on the railroad.

Wheel Tests on Track

Hence, it is very desirable to test newly assembled wheels on a track that is right. If this track happens to be the road that is to use the car, a trip should be made over it regardless of previous tests and, in so doing, particular attention paid to those sections which are known to be badly out of gage. Spring frogs should be given careful attention if there are any that the motor car has to open; a frog may have its spring set up so tight that the relatively light weight of a motor car will not let the flange open it, and derailing will result.

Wheels for steam roads have a wide tread which projects outside the rail when both are in correct relation. If this same wheel were run over street car tracks, the projecting tread would soon ruin the bricks of pavement laid close up to it. For this reason, and because the confined location helps keep the track to gage, most street car wheels are made with a tread of only 2½ in., with interurbans an average of 3 in. Street car flanges of the A.E.R.A. standard are approximately one-fourth less in size than the one shown by Fig. 1. The openings in the grooved rails can therefore be less, making a smoother street for other vehicles, and the tendency to fill up with street dirt is not so serious.

It is necessary to know the details of track structure when supplying the wheels for a railcar. It was doubted in one case we have in mind whether a gasoline railcar could make a certain hairpin curve of but 36 ft. radius. This curve had a rise of 10 ft. between tangents and, with the two grooved rails, the wheel friction is so high that electric cars draw an average of 200 amperes in passing the curve. The motor railcar had flanged steel rims with proper size of flange for the rail. In spite of the fact that the curve was greased, the car made it without trouble; its construction avoided entirely the cause of the enormous power consumption with electric cars and their

fixed axles—the differential at the rear and the swivelling front wheels enable the car to pass such a curve with none of the wheel slipping so productive of power loss and stresses.

A few hours or a few days spent in test running of different kinds is time well spent. Every piece of machinery "finds" itself after a limited amount of usage in the field of its application and then requires minor adjustments, taking up of nuts, refitting, etc. Moreover, dynamometer or similar tests do not reflect the true conditions until the first newness is off and lubricants begin to act to best advantage. In the case of a railcar, it is far easier to give it these attentions before the body is on than afterward, when other fittings are in the way of both action and observation. Then, there is the matter of finish. The spatterings of oil and grease on a bright new body coat leave unerasable marks when mixed with the dust from the roadbed.

Maintaining Scheduled Speed

Speed is a detail that may be foretold with accuracy. That is, mere speed in miles per hour. But ability to maintain a schedule is quite another matter. Whether a car can be handled, with ordinary help, at terminals in the lay-over time allotted; whether it can accelerate at so many miles per hour per second, without slipping the wheels when the load is light and has sufficient power for this same acceleration when the car is overloaded; whether the brakes are so designed as to permit a high rate of deceleration; whether due regard for other traffic shatters a time card when the machine is driven by a man of average skill and temperament—these are points that must be considered in connection with speed. The best time for a conclusive speed test is on a damp day—rails are then greasy, carburetion may be slightly affected, other traffic need greater attention—a run on schedule time on such a day is the best evidence of a car's performance under adverse conditions—and a run with chassis only should include several seconds extra time at each stop to allow for the slowness of passengers bundled up and with dripping umbrellas.

Speedometer readings are an aid to the driver, once he has learned the road and knows what time he must maintain between stops to make his schedule. By a glance, he knows whether it is necessary to speed up a few miles per hour to make up for a lost minute or two.

Correct Speedometer Drive

In many cases, a change from rubber tires to metal wheels involves also a change in diameter; sometimes there is made a change in gear ratio as well. In such cases, the gears driving the speedometer cable must be changed. The best arrangement for speedometer drive on railcars is one off the transmission shaft.

Running in is a part of the general road test, as mentioned above. It has another significance from the railroad standpoint, namely, smoothing up the rail surface of the wheels. It is customary in railroad car practice to send passenger coaches out on a slow freight, for a fifty-mile run, after new wheels and axles have been put in before putting them in high speed service, so the wheels will become polished and lose that disagreeable noise peculiar to them without it.

Fig. 2 shows a 1922 Model 30 Gramm-Pioneer 3-ton railcar chassis as taken out for road tests. The weight of the car as illustrated is 6300 lb., of which 2900 is at the base of the rear wheels. The body for this car, with maximum seated load, totals 7800 lb., most of which comes on the rear wheels—this gives a high factor of adhesion for the car in service, which could not well be realized during the tests, though 1100 lb. of old rails were piled over the rear axle to increase traction at the time. Drivers are of iron with chilled treads, selected because of their economy and wearing qualities and in preference to steel whose slightly greater adhesion was of little moment with an engine of the size employed. Stock cab, fenders, muffler, and step later give way to body, special wheel guards, heater pipes, step inside body, etc. Fire extinguisher, bell, sanders, lights, and couplers, remain to be added.

This Gramm model has a 4¼ x 5½ engine. The gearset is four speed, with individual clutches. Wheels are 33 in.



Fig. 2—The Gramm-Pioneer railcar chassis used in one of the tests described

in diameter and the worm drive has a reduction of 4½ to 1, which is the overall high speed ratio, with a low ratio of 21.3 to 1. Conservatively figured, the tractive force delivered at the circumference of the drivers is 282 lb. on high, increasing to 1130 lb. on low. Taking a value of 25 lb. per ton as the starting resistance of the (new) truck on the rails, its total resistance with two men is practically 100 lb., which must be subtracted from the 1130 lb. above in calculating the amount of pay load which can be hauled on or behind the chassis. The weight at the drivers is 4000 lb. The coefficient of friction between iron wheels and steel rails may be taken as .24 when dry and clean, which gives us a theoretical available tractive effort of 960 lb., and as this is less than the 1130 lb. delivered by the engine, the latter can slip the wheels.

Drawbar Pull and Tractive Effort

In locomotive practice, "drawbar pull" and "tractive force" (or "tractive effort") are widely different terms, tractive force being the sum of the available drawbar pull and the resistance of locomotive and tender. For instance, 57,200 lb. is the rated tractive force of the newest Mountain type passenger locomotives on the Norfolk & Western; these are in service on a 150 mile run out of Roanoke with grades as high as 1.32 per cent and haul a 577 ton train at an average speed of 40 miles per hour. The locomotives weigh 257 tons, which at that speed offers a resistance of 2570 lb. on a level tangent as against a resistance of 4000 lb. for the train under the same conditions. The sum of 2570 and 4000 represents the tractive effort expended at the time and of this about two-fifths was expended in moving the locomotive and tender while the remainder (4000 lb.) is the drawbar pull. A power unit offers more resistance than a pulled unit of the same weight.

The railcar was first attached to a 26-ton box car. Cold and in average condition, such a car has a starting resistance of 650 lb. This box car was started easily and without perceptible slip of the driving wheels—its resistance plus that of the motor car is considerably less than the available tractive effort. Once under motion, the speed was brought up to that of the next gear and the clutch shifted.

The next heavier car in the railroad yards, convenient at the time, was a steel gondola stenciled "Wt. 72,000 lb."

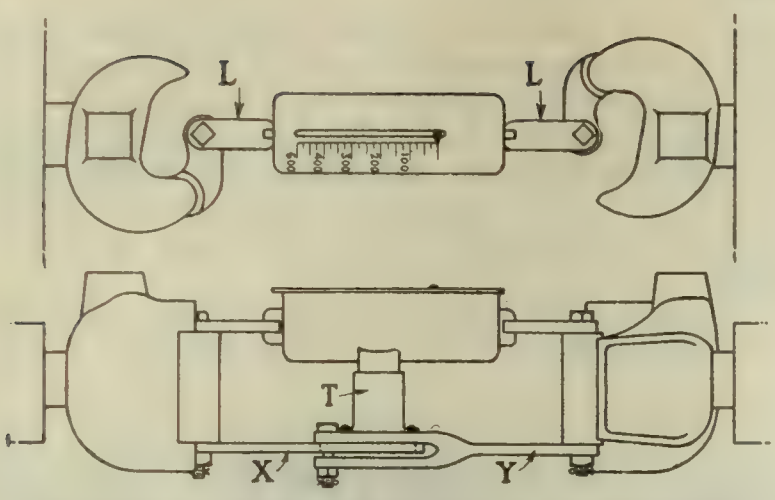


Fig. 3—Sketch showing simple form of drawbar dynamometer which can be used to advantage in road tests of railcars

The resistance of this plus that of the Gramm itself is just 1000 lb. Backing the railcar up to the gondola, it was found that the wheels slipped and would not start the latter. But when the rails were sanded, it was possible to move the gondola and to reach a speed at which a gear shift could be made in a distance of 100 feet. A poor driver could not have attained this result, for he would have raced his engine, thus spinning the wheels and lowering their adhesion greatly—a good driver, on the other hand, was able to show in practice 100 per cent of the theoretical power, or nearly that, as judged from the tests.

Test Device for Railcars

Fig. 3 shows a device used to check the resistance on one railcar when hauled by another or the drawbar pull exerted by the forward car. It is so arranged that an observer can occupy a position of safety throughout the run and take readings from the start up to the maximum speed of the power unit. Shoulder bolts were made up to pass through the hole in the coupler knuckles and two pairs of links fitted to these, the links *L, L* being attached to a spring balance, and links *X* and *Y* providing the safety feature. Link *X* is slotted so that a bolt through the fork end of *Y* will strike the end of the slot in either direction before the upper links can be drawn out so far or pushed together enough to damage the scale.

A piece of pipe *T* is attached to the upper face of the link *Y* and inside it is a spring plunger with a concave top face partially surrounding the spring balance case and supporting the latter so that its weight does not cause binding and possible error from that source. The advantages of such a test unit for motor cars are at once apparent. With fuel carefully gaged, it is possible to determine the consumption with light loads and heavy, over divisions with numerous grades and curves, to check theory with practice, and to plot performance curves of direct value. The decreased resistance of a car after it has been in service a couple of months may be noted and this, compared with fuel consumption, will show whether or not the engine is showing an economy in proportion and when a tuning up is necessary to maintain engine efficiency. A device of this kind does not interfere with train operation and it forms an inexpensive, quite reliable means of collecting data for those who are removed from or cannot afford dynamometer tests. It will show, among other things, that a country which "looks level" is neither flat nor level, but slopes enough to create a track grade of one-half per cent or more.

It is not suggested that any rail motor cars be used for moving freight cars—such action ought to be vigorously discouraged—but the freight cars serve as a convenient means to an end.

Railcars ride smoothly, as quietly as any passenger coach on a branch line, show an acceleration equaled only by an electric car, and dispel entirely the ideas formed by riding on a locomotive or motor truck or a bus.

Braking Tests

Braking can be demonstrated and tested as a portion of road tests. Without a weight equal to the full load or the body load on the rear, the front wheel brakes assume the greater share of the work during a test. In fact, to insure 100 per cent braking on a railcar, commercially at least, front wheel brakes are absolutely necessary. The average running time is increased by good brakes and high braking pressures. Air brakes supply this need more thoroughly than manually operated brakes. An advantage of the air brake is that it is not subject to fatigue, as is a driver; further, it is possible to more easily effect a gradual release of brake pressure as speed decreases and the coefficient of friction rises, maintaining throughout the most effective pressure which is at a point just before the wheels begin to skid.

In conclusion, there are a few suggestions to be made that will assist in daily service, which is the real road test of the road car. Truck and automotive units are not available out of stock to give a high enough road speed except by the use of large wheels. Large wheels increase the floor height and raise the center of gravity. Wider use of rail cars will come when there is available an axle that is geared higher, is more rugged and simple, and comes minus the differential.

Service

More and better service will be realized from rail cars when a separate department, though small, is created for their maintenance. To expect a freight car repairman or a mechanic used to rough work on thousand pound locomotive parts to intelligently cope with adjustments and repairs on the railcar is unreasonable, to say the least. The truth of this is found in air brake work which more nearly approaches automotive work in size and accuracy than any other work done in railroad shops. Such work is handled by separate groups of workmen who make a specialty of this and are provided with all necessary facilities for repairs and testing, housed in separate departments under highly trained specialists.

Resistance of Battery Separators

MEASUREMENTS of separator resistance on a number of samples of different kinds of wood which were submitted by the manufacturers have been completed by the Bureau of Standards. A comparison of these results with those obtained on similar samples last May shows excellent agreement and proves that the method for measuring the resistance is reliable. The soft woods, such as poplar and basswood, have the lowest resistance; cedar and cypress, on the other hand, have considerably higher resistance, but are known to have better lasting qualities when used in storage batteries.

In determining the durability of the separators in sulphuric acid solutions of different densities, a number of samples have been cut to a specified size and immersed in an acid solution of known concentration. One set is being kept at room temperature and a similar set at 45 deg. C. At the end of periods of one month, three months and six months samples will be withdrawn from the solution to determine the decrease in tensile strength of the separator material.

Design and Functioning of Laminated Automobile Suspension Springs

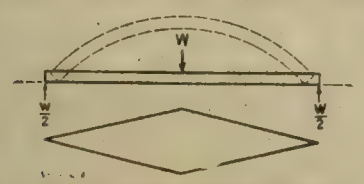
Part I

The character of laminated springs as well as their theoretical and actual functioning is dealt with herein. The author offers suggestions for improvement in design and urges a more serious consideration of the subject.

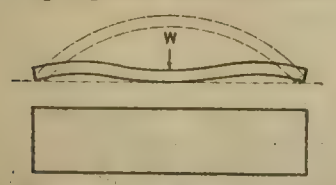
By A. A. Remington*

THE actual invention of laminated springs is shrouded in mystery. They were undoubtedly first used on the road vehicles probably invented for them, as at the date of their invention, about the year 1750, no other types of vehicles existed. Between the years 1750 and 1790 laminated vehicle suspension springs came into general usage, and we find that in the year 1768 Dr. R. L. Edgeworth was awarded three gold medals by the Society of English Arts and Manufactures for demonstrating the advantages of sprung vehicles, and in the well known work by William Felton entitled "A Treatise on Carriages," published in 1790, it states that an industry for the manufacture of laminated carriage springs had at that date been started.

The modern conception of elasticity, with particular reference to springs, appears to have begun with Robert Hooke about 1678, and he was followed closely by Mariotte, who in 1686 originated the term "fiber stress." In 1744 James Jurin published a paper entitled "On the Action of Springs"; but the most important investigator in connection with laminated springs was a Frenchman, by name E. Phillips, whose researches were published in 1852 in the *Annales des Mines*. Phillips applied the theory of elasticity to the particular case of the laminated spring, and was the first to propound the rhomboidal plan for a beam of uniform thickness and uniform stress, and



A.—Spring with rhomboid plan.



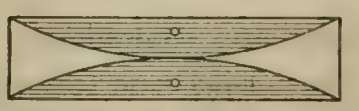
B.—Spring with rectangular plan.

FIG. 1



A.—Beam of low flexure.

$$Z = \frac{bt}{2} \times \frac{2}{3}t \times \frac{1}{2} = \frac{bt^2}{6}$$



B.—Beam of high flexure.

$$Z = \frac{1}{2}(\text{area} \times \text{moment}) = \frac{bt^2}{4}$$

FIG. 2.

to demonstrate the sub-division of the rhomboid into a series of laminations to form a laminated spring.

The data found in all our modern pocket-books, and most of the scanty treatment of the subject in more pretentious text-books, are based on Phillips' work, slightly amplified by later writers, and it is time the subject was given the independent and serious treatment which it deserves.

A semi-elliptic spring is a special case of a beam. Assuming it to be loaded at the center and supported at the ends, and that it is flat when loaded, the bending moment is $WL/4$. The condition of maximum economy is fulfilled when all the material is uniformly stressed, which in a beam occurs when the resisting moment is equal to the bending moment on all sections. Phillips showed that this condition is complied with for a beam of uniform thickness when the plan is a rhomboid, and a beam of this form, if cambered to a circular curvature, will lie flat when loaded as shown at *A*, Fig. 1, whereas a similarly cambered rectangular section beam will take the form shown at *B*, and will not lie flat from any camber. The beam shown at *B* contains twice the material of beam *A*, and for a given deflection the maximum change of curvature is greater, and therefore the greatest stress is higher.

The spring shown at *A*, Fig. 1, although flat and touching its support all along, will only bear on it at its tips, and the pressure will be $W/2$ at each end.

The resisting moment Z of a beam is $\frac{1}{2}I$, and for a rectangular beam under static conditions this value is $bt^2/6$, the formula being derived from the stress triangles as shown at *A*, Fig. 2, from which it is seen that—

$$\frac{1}{2}I = \frac{bt}{2} \times \frac{2}{3}t \times \frac{1}{2} = \frac{bt^2}{6}$$

As applied to beams of small flexure, say a maximum of 1 to 400, this formula is found to be sufficiently accurate. For spring plates, however, which in extreme cases may deflect as much as 1 to 5, and rectangular beams having considerable flexure, it is extremely doubtful if it holds good without modification, as the stress is far from uniform throughout the section, and consequently the beam does not behave as one composed of two triangles, but more of the section becomes effective and modifies the conception to a form approximating that shown at *B*, Fig. 2, and with it the formula expressing the stress, which in extreme cases may become $bt^2/4$.

Tests made on spring blades show that the stress cannot be so high as the results given by the unmodified beam formula, as single blades will, without taking a permanent set, carry loads representing a fiber stress as calculated by this formula approximating their maximum tensile strength. For example, the standard test provided for carbon steel railway springs** necessitates a theoretical stress of 68 tons per sq. in., and allows a margin before permanent set takes place in a properly tempered test piece of about 15 per cent.

*Paper presented to the Institution of Automobile Engineers. Slightly condensed.

**B. E. S. A. report No. 24, part 3, pp. 6 and 7.

Phillips showed that a rhomboidal beam can be cut longitudinally into any number of pieces superimposed as shown in Fig. 3 to form a laminated spring without effect on its action as a beam or spring. A laminated spring so formed is uniformly stressed throughout, and if made with circular curvature, the curvature under deflection will, due to the uniformity of stress on all sections, remain circular but of increasing radius until pressed flat, the blades only touching each other at the tips. This statement requires a little modification, as on account of the thickness the radius at the back is greater than that at the front by the thickness of the blade, so that when "nipped" up there is, at the free position, a small positive stress in the shorter plates and a small negative stress in the longer plates, but this effect diminishes with loading until, when flat, all the blades are stressed uniformly.

The behavior of a spring as a component part of a suspension depends on a number of external factors, all of which affect the smoothness of riding of the vehicle. The ideal to be aimed at is that while the wheels will follow the inaccuracies in their tracks on the road, and maintain uniform adhesion, the sprung portions of the vehicles will float along without vertical movement, rolling or pitching. This ideal is not attained, and in practice all three movements occur; it is therefore the object of the designer so to proportion the parts that road irregularities will cause as little disturbance as possible, and to reduce the more objectionable disturbances to the greatest extent possible, even at the expense of some increase in the less objectionable ones. To avoid temporary separation between the vehicle and the load (in the case of a passenger vehicle, the passengers involuntarily leaving their seats), it is necessary to insure that the vertical acceleration of that portion of the vehicle carrying the load shall never exceed that due to gravity.

Vertical Acceleration

The vertical acceleration depends on the periodicity and the amplitude of the suspension. The former is a function of the design of the spring or springs, and the latter is governed by the magnitude of the external forces imposed on the suspension, and principally arises from the wheels passing over obstructions. The amplitude is therefore in reality outside the designer's control, but he can assess it for the conditions likely to be encountered.

Amplitude in itself is not an objectionable feature provided that the maximum acceleration is less than that due to gravity, and in practice it is found that this value is seldom exceeded if the periodicity of the suspension is 90 complete oscillations per minute, represented by an initial static deflection of the mass of 4.4 in., on a spring with a "straight line" load deflection curve.

Periodicities lower than this are preferable from the point of view of period of oscillation *per se*, and as regards the resulting increased amplitude, not objectionable except for the difficulties introduced in connection with mudguard clearance, ground clearance, and universal joint action. Too low a periodicity has, however, one very objectionable and little expected effect, namely, the reduction of the continuity of the adhesion between the wheel and the road. The adhesion that will cause slip or spin, either intermittent or continuous, for a given road wheel torque is determined, on all but a perfect road surface, by the periodicity of the wheels and the axle as between the elastic tire and the spring, and a lower suspension period reduces the wheel period, lessens the adhesion and consequently conduces to wheel slip.

Nomenclature

The existing nomenclature as applied to laminated springs is not very definite and varies in different shops and districts. The nomenclature and symbols preferred by the author and adopted for the purpose of this paper are shown in Fig. 4.

The word "camber" is commonly used in several ways, but the author confines its use to reference to the actual curve of a blade, and prefers to use the word "height" to define the vertical distance from the bed to the center of the eye of a complete spring.

The term "flat" is frequently used and varies in definition. The author understands that when a spring is loaded till it is "flat" the flatness refers to the main blade, and that a spring when flat is as shown at *A*, Fig. 5, not as at *B*.

The usual beam formulæ put in suitable form for making calculations on laminated springs, together with some convenient tables, are given in Appendix I.

Determination of Stress from Strain in Bending

Strain is the distortion, and the ratio of stress to strain within the elastic limit, where strain is assumed to be proportional to stress, is termed the "modulus of elasticity," or Young's Modulus. For steel in tension this is found to be an approximately constant quantity whatever the intensity of the load or the quality, composition or state of the steel, and can be assumed to be 27,500,000 in lb.-in. units. A representative stress/strain diagram to an exaggerated scale is shown at *A* in Fig. 6.

When a plate is bent, the outer side is stretched and the inner side contracted, one line within the material, the "neutral axis," being neither stretched nor contracted; this, for the present purpose, may be considered to lie at the mid-thickness of the plate.

Let us assume that a plate of rectangular section of uniform width and uniform thickness is to be bent to a complete circle as shown at *B*, Fig. 6. The dotted circle is the neutral axis and has length $2 \pi r$. The outside will have length $2 \pi r + \pi t$, and similarly the inside will have length $2 \pi r - \pi t$. The total extension (elastic extension assumed) or strain of the metal i will depend on the thickness, length and radius, or camber, of the plate, and, by using an approximation, substituting the length of the half-chord for the arc as shown at *C*, Fig. 6, will be found to be $4dt/l$, the stress f to be Ei/l, or by substitution $(E \times 4dt)/l^2$.

This applies to all beams having uniform bending and within the limits of the approximation is correct for perfectly elastic material uniformly stressed; it therefore holds good for a beam of uniform thickness with rhomboidal plan loaded at the center, as well as for the usual case of a beam of uniform thickness and width uniformly loaded, but is not applicable to a rectangular section beam loaded at the center, or any irregularly strained beam, for example, a laminated spring that is not in conformity with the "rhombus" law.

Weight and Reliability

The suspension is one of the heaviest sections of a chassis, and a set of suspension springs frequently totals 200 lb. in a chassis weighing between 2250 and 2750 lb. It is greatly to the designer's interest, therefore, to reduce the weight of the springs, if it can be done without reducing their effectiveness or reliability. The effectiveness depends primarily on the rate of deflection and the reliability on the maximum stress at the most highly stressed point.

The reliability of the spring must not be judged by the amount of metal in it, as this may only be a measure of its inefficiency, and if the stress distribution is irregular the surplus metal may actually reduce the reliability by causing local overstressing, which would not occur if the strain were more evenly distributed.

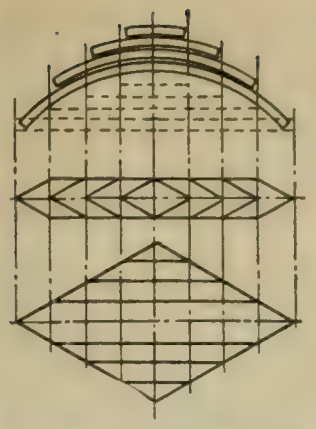
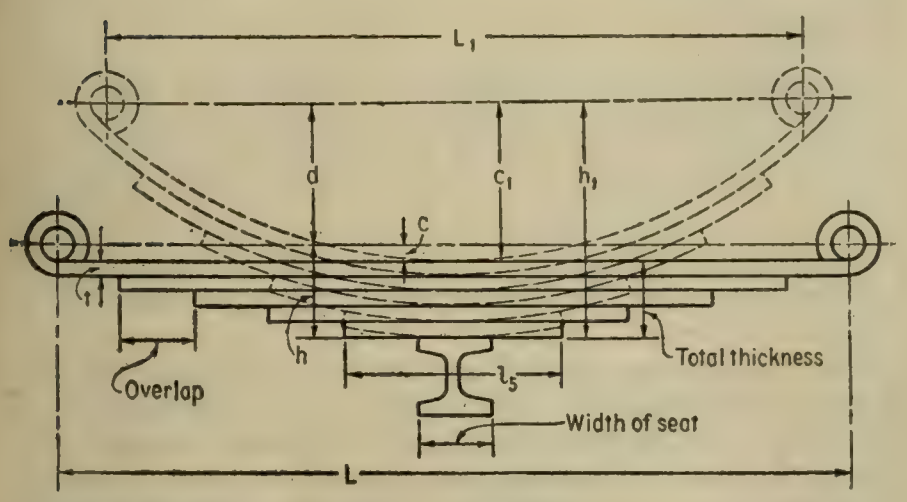


FIG. 3.—Laminated spring with rhomboidal plan.



Length (loaded)	L	Breadth	b
Thickness of blade	t	Load	W
Length (light)	L_1	Max. safe load	W_1
Camber light	c_1	Modulus of elasticity	E
Camber loaded	c	Stress	f
Height light	h_1	No. of oscillations per min.	P
Height loaded	h	Time of one oscillation	S
Length flat	l	Rate of deflection	D
Deflection	d	Total thickness	T
Overlap	o	Weight of Spring	w
$d = c_1 - c = h_1 - h$		Gravity 32·2	g

Blades are designated by number, the main blade being No. 1. Thus in the 5-blade spring shown, the length of the shortest blade is l_5.

FIG. 4.

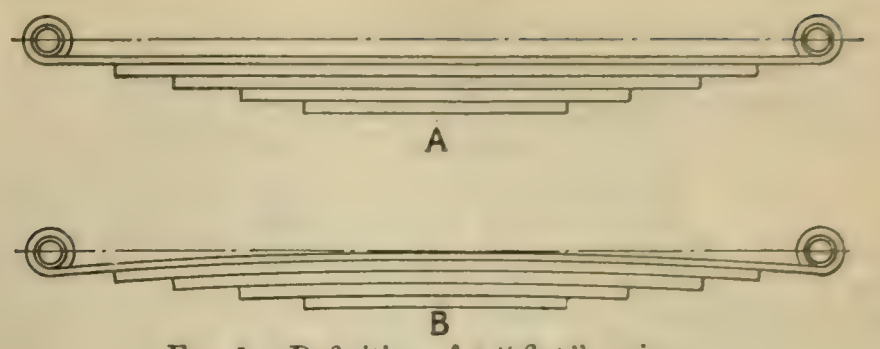
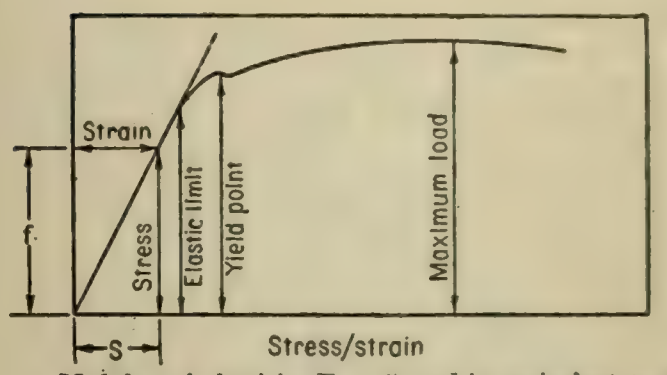


FIG. 5.—Definition of a "flat" spring.



Modulus of elasticity $E = f/s$ and is equivalent to the stress that would produce unity extension (i.e., double the original length of the specimen) if strain remained proportional to stress.

A

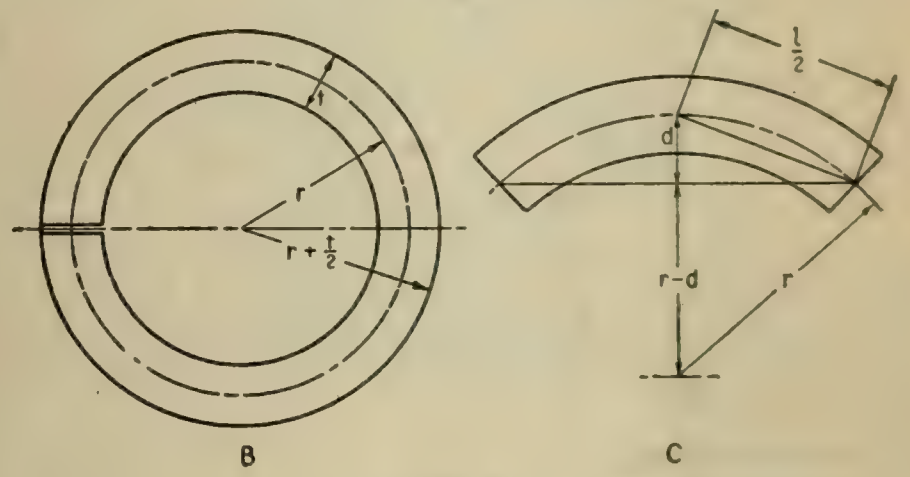


FIG. 6.

The index to the weight of a spring and the best basis for comparison of weights is the volume of the primary rhombus, which is—

$$(lbnt)/2$$

or, as $nt = T$, if based on the full thickness of the spring—

$$(lbT)/2$$

To obtain the actual weight of the complete spring, this must be multiplied by the weight of unit volume and additions made for the eyes and clips and for the excess over rhombus weight, as the main blade is full width throughout, and also if the second blade is full length.

For springs as ordinarily made, including allowance for clips and bushes and one full length blade in addition to the eye blade, the total finished weight varies between 1.45 and 1.55 of the rhombus weight.

Strength, Stiffness and Resilience

The strength of a spring refers to the safe load it will carry, while the stiffness refers to the amount it deflects from the free position either at a specified load or at the maximum permissible load. Resilience refers to the work stored in a deflected spring.

Rankine shows (1) that the strengths of similar beams are directly as their widths and the square of their depths and inversely as their lengths; (2) that the deflections of similar beams under equal loads are as the cubes of their lengths and inversely as their breadths and the cubes of their depths; (3) that the resilience of a beam is half the product of the deflection and the static load producing that deflection.

The formulæ expressing the above statements are:

$$\text{Strength} \ldots\ldots f = [(WL)/(bt^2)] \times C$$
$$\text{Deflection} \ldots\ldots d = [(WL^3)/(Ebt^3)] \times C$$
$$\text{Resilience} \ldots\ldots i = (dW)/2$$

C is a constant which varies for the section of beam and the method of support.

Ratio Between Static and Maximum Stress

The deflection of a spring under an imposed static load is easily predetermined or measured, but the amount which the spring is going to deflect beyond this point in service depends on a number of external, indeterminate factors. Apart from possible artificial mechanical limits, the limitation is the amount of discomfort that will be tolerated by the "load" under adverse conditions.

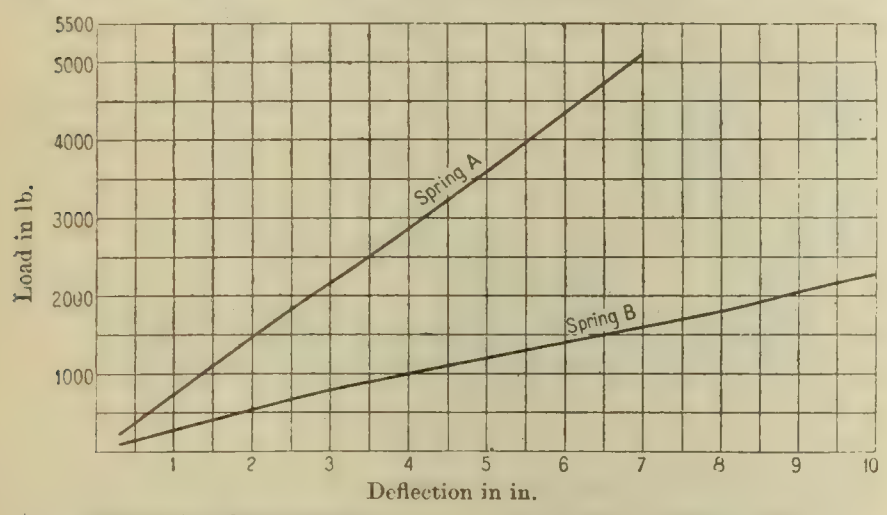
The author has made tests on the road with a device for recording spring deflection, and finds that with normal suspension it is necessary to provide, both as regards clearance and stress considerations, for total deflection on the rear springs of from one and three-quarters to twice the static deflection, and on the front springs of from two and a half to three times the static deflection. Since the front springs are stiffer than the rear springs, the deflections will be of less magnitude, and consequently the maximum deflection will usually be less than the maximum rear deflection.

TABLE I

TABLE OF SPRING DEFLECTIONS UNDER VARYING CONDITIONS

Car—4-seater, nominal 20 hp. with 4 passengers.
Weight—Front, 16 cwt.; rear, 20 cwt.

	Front Suspension			Rear Suspension		
	Deflection in.	Relative Value	Displacement in.	Deflection in.	Relative Value	Displacement in.
Static	1.2	1.0	0	4.7	1.0	0
At 20 m.p.h. on smooth road.	1.7	1.4	0.5	6.1	1.3	1.4
At 20 m.p.h. on rough road..	2.4	1.8	1.2	7.0	1.5	2.3
Driven off a 4½-in. curb at 30 m.p.h..	3.2	2.8	2.0	9.4*	2.0	4.7



Spring A. Chromium steel. 37 in. long. 2 in. wide. 8 blades.

Spring B. Chromium steel. 52 in. long. 2 in. wide. 9 blades.

FIG. 7.—Deflection curves of springs.

Table I shows the static deflection and the additional deflection measured under varying conditions in a particular case of normal semi-elliptic suspension, as an example of the methods adopted in the determination of the foregoing values.

Permissible Stress

The permissible static stress for a rear spring is therefore from 0.5 to 0.6 the maximum safe stress, and for a front spring from 0.3 to 0.4 the maximum safe stress.

The maximum safe stress can approach the point at which permanent set takes place, and the author finds from experience on cars under working conditions and from over-stressing actual springs in a testing machine that the following figures are practicable:

Minimum tensile breaking strength—

Carbon steel, 80 tons per sq. in.
Alloy steel, 90 tons per sq. in.

Maximum safe stress—

Carbon steel, 50 tons per sq. in.
Alloy steel, 65 tons per sq. in.

Maximum permissible normal static stress—

Carbon steel, front springs, 20 tons per sq. in.
Carbon steel, rear springs, 30 tons per sq. in.
Alloy steel, front springs, 24 tons per sq. in.
Alloy steel, rear springs, 36 tons per sq. in.

These stresses are calculated on the formula:

$$f = (6WL)/(4bt^2)$$

The working stresses appear high in relation to the breaking strength of the material, but it must be remembered that they are calculated by the ordinary beam formula which gives values which in extreme cases are possibly 50 per cent higher than the real stress, and also that the laminated spring is stressed in one direction only, and the over-stressing in this direction during the first "scragging" operation has the effect of raising the point at which permanent set takes place when the spring is re-stressed.

A schedule showing a few examples of the stresses adopted in various springs taken from current practice is given in Appendix III. The values given as maxima are for properly designed springs in which the stress is reasonably uniform throughout, and if it is required to apply them to springs in which the ratio between maximum stress and mean stress is not negligible, due allowance must be made.

Flexibility

The property of the steel that is called into play in a spring is its ability to bend, which is effected by stretching the fibers on one side of the blade and compressing those on the opposite side to an approximately equal extent. It is probable that little, if any, actual stretching or compression takes place, most of the movement being due to alteration in form rather than alteration in volume.

When springs are loaded so that the strain exceeds the limit of proportionality, the modulus of elasticity alters, and while it is probably constant for a given material for any particular fiber stress, and variations below the elastic limit are so small as to be negligible for the present purpose, it is not the same at all fiber stresses.

Deflection

The deflection of a spring within the elastic limit follows exactly the same laws as a beam. The deflection is proportional to the load and is expressed by the formula:

$$d = (WL_3)/(4bED^3)$$

For the case of a laminated spring nt is conveniently substituted for the depth of the beam D, when the formula becomes:

$$d = (WL_3)/(4bEnt^3)$$

The length of a cambered spring changes with alteration in load, so that although the spring theoretically follows a straight line law for load deflection, in practice, due to this length alteration, the load deflection curve may not be quite a straight line. For this reason it is usual for the rate of deflection of a spring to be defined by dividing the normal load by the deflection at normal load.

Typical load deflection curves are shown in Fig. 7, where the particulars of the springs tested are given in detail.

Departure of the load deflection curve from a straight line, due to change in length with change in camber, has been taken advantage of to secure a variable rate of deflection, but the resulting high cambered spring is objectionable and the riding is not so smooth as that obtained from a flat spring that articulates on each side of the flat position.

TABLE II

TABLE OF SPRING DEFLECTIONS AND PERIODICITIES**

Deflection in in.	Periodicity Complete Oscillations Per Minute	Deflection in in.	Periodicity Complete Oscillations Per Minute
39.1	30	2.5	120
14.1	50	2.1	130
9.8	60	1.8	140
7.2	70	1.5	150
5.5	80	1.25	160
4.4	90	1.2	170
3.5	100	1.1	180
2.9	110		

*Limit of clearance.

**See also table given by Dr. F. W. Lanchester, Proc. I. A. E., Vol. II, p. 192.

In automobile practice, where springs are practically flat in the loaded position, it is usual and sufficiently accurate to take the straight or sector length as the value of L both in the strength and in the deflection formula. In this latter formula, where L^3 is the expression, one L is the sector length derived from the bending moment WL, while the other two L's represent the curved length of the blade. The use of the sector L only, the smaller of the factors, introduces an inaccuracy which approximately compensates for the fact that the value t in the expressions bt^2 and bt^3 is conveniently taken as the normal thickness of the plate, which is greater than the actual mean thickness on account of the concavity.

The tendency of these inaccuracies to balance one another does not make a satisfactory arrangement from the mathematical point of view, and would introduce serious inaccuracies in calculations for any but approximately flat springs made of blades of commercial dimensions, and, therefore, the use of the simple formulæ given must not be extended to general applications without having appropriate corrections applied.

Periodicity

The rate of oscillation of a spring suspended system is dependent on gravity, and follows the same general laws as the pendulum and the governor. The basic formula for expressing the time of an oscillation is $t = \pi \sqrt{l/g}$, where t is the time of one oscillation and l is the deflection, which is the amount by which the spring is deflected statically by the load under the action of gravity from its free position. This formula is only strictly applicable to theoretical conditions, represented by infinitely small oscillations of a frictionless spring in a vacuum, but the modifications to represent actual practice are small, and may be neglected. The formula ignores amplitude, and within the limits of laminated suspension springs amplitude makes little alteration to the periodicity, its principal effect being to modify the friction effect.

For spring calculations, the formula can be more conveniently expressed in inch-minute units as $P^2 = 35230/d$, P being the number of complete oscillations per minute and d the static deflection.

The relation between the rate of oscillation and the amount of deflection calculated from this formula is shown in Table II and graphically in Fig. 8, from which particulars the comparatively close practicable limitations of suspension period can readily be seen, these being at the one end excessive deflection and at the other extremely rapid oscillation.

The periodicity of a spring can be readily measured to a considerable degree of accuracy by means of a device such as that shown in Fig. 9. Representative diagrams taken with an apparatus of this type are shown in Fig. 10, and these give some idea of the way in which the spring oscillations die out due to friction when the exciting cause is removed.

Periodicity of a Suspension

The periodicity of a suspension has to be considered as a whole, as all portions act in unison to produce a resultant, and the separate components cannot oscillate independently of each other.

A suspension has different natural periods in the several planes, normally one period only for each plane. In the case of a motor car, these can be divided into:

1. The front suspension vertical period.
2. The rear suspension vertical period.
3. The rolling period.
4. The pitching period.

Each of these will be different, and furthermore it will be found that the rear and front springs interact, and that, for example, the rear vertical period will be slower if the front springs are free than if they are locked, as the movement of the free front spring alters the amplitude of the mass and so modifies the time of swing to an extent that depends upon the weight distribution and other variables.

The rolling period and the pitching period both result from the combined action of all the springs, front and rear. The former is largely influenced by the height of the center of gravity above the suspension level, and is usually considerably slower than either of the vertical periods, while the latter depends on wheelbase and weight distribution longitudinally.

The difference between the rolling and the rear vertical periods and the small practical range of periodicity constitute the principal disadvantages of normal suspension systems and indicate the most promising directions in which to seek for improvement.

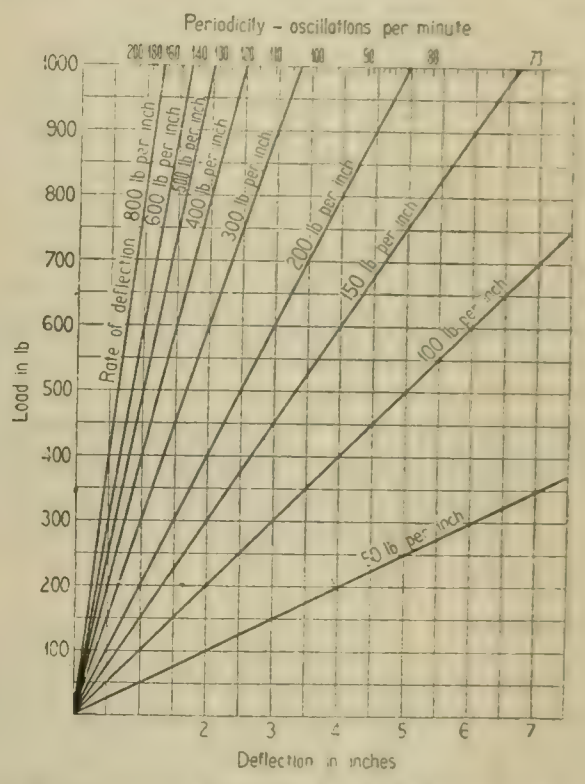


FIG. 8.—Relationship between load, deflection and period.

Internal Friction

The effect of friction between the leaves is to damp out the oscillations gradually as is seen by the graphs shown in Fig. 10 already referred to. This effect has been investigated by Mr. G. H. Baillie,* who tested springs with varying amounts of internal friction and also ascertained experimentally the effect of frictional shock absorbers.

The amount of friction in a laminated spring as ordinarily made is small, but is useful in damping out oscillations more quickly than would otherwise be the case. It is doubtful if any considerable increase of friction, either by a modification of spring design or by the addition of shock absorbers, is desirable except in extreme cases, such as on racing machines, where wheel adhesion and ability to hold the road take precedence over comfort.

Resistance to Torsion

Laminated springs present considerable resistance to torsion, especially when under load, due to the lessened tendency for the leaves to separate, and this resistance, on account of the methods of mounting adopted, stiffens the usual forms of suspension in their resistance to rolling. In this respect the semi-elliptic spring is superior to the cantilever, as both ends of the former are effective, and as the greatest possible resistance to rolling is desirable, this lessened torsional resistance may be considered a defect of all simple cantilever suspensions.

*See Proc. I. A. E., Vol. VII, p. 451.

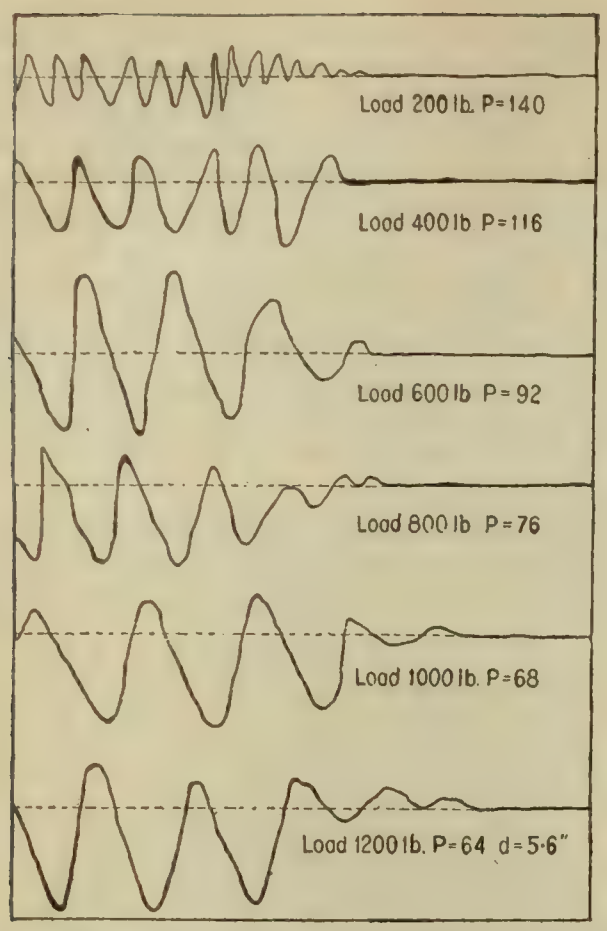


FIG. 10.—Actual periodicity diagrams from a 52 in. by 2 in. 9-blade spring.

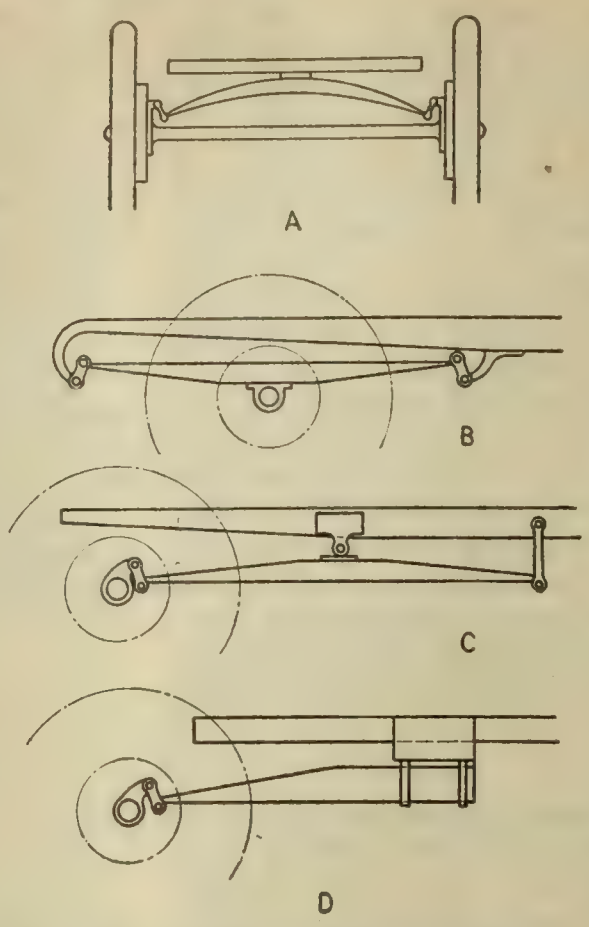


FIG. 11.—Forms of suspension.

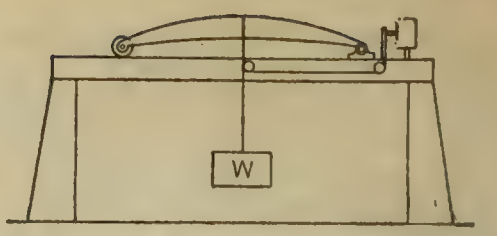


FIG. 9.—Periodicity machine.

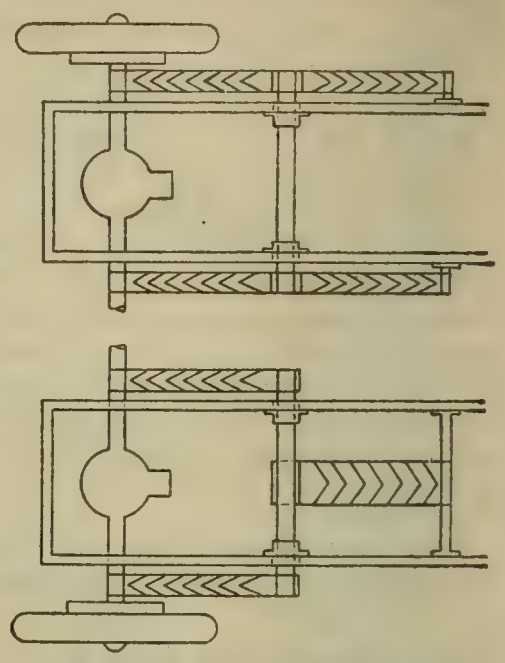


FIG. 12.—Anti-rolling suspension.

The author regrets that he has not been able to carry out experiments in order to provide quantitative results in regard to the resistance of normal springs to torsional deflection, but hopes to contribute some data on the subject at some future time.

Effect of Mounting

Other factors remaining unchanged, the type of spring and the manner in which it is mounted have little effect on the suspension. The method of fixing or pivoting the springs on the frame affects the resulting action, but only in so far as it modifies the degree of freedom or direction of articulation of the parts.

The usual forms of normal rear suspension can be expressed by four groups, as shown in Fig. 11.

(a) A transverse spring fixed to the frame at the center and linked to the axle at each end.

(b) Two semi-elliptic springs, one at each side, pivoted to the axle at the center and linked to the frame at each end.

(c) Two cantilever springs, each linked to the axle at one end, linked to the frame at the other, and pivoted on the frame at the center.

(d) Two half-cantilever springs linked to the axle at one end and fixed to the frame at the other.

These four forms of suspension make no difference to the external effect provided that the rate of deflection is the same, and that the axle is articulated in respect to the frame in the same manner, but they only modify the internal effect, particularly as regards the stresses and stress distribution in the various members.

Articulation of, or interconnection between, the various springs, by altering the degree of freedom, affects the suspension, usually more particularly in the direction of degree of stability; for example, if in the case of group (a) the spring were pivoted on the frame at the center, instead of being fixed to it the suspension would lose all lateral stability, or resistance to rolling; and if in group (c) the springs, instead of being independently pivoted on the frame, were interconnected at their centers by a shaft fixed to each of them and carried in bearings on the frame as shown in Fig. 12, the suspension would not be altered as regards vertical movement but would have enhanced resistance to rolling. This latter arrangement is covered by patents taken out by the author and in use by Messrs. Wolseley Motors, Ltd.

The primary rhombus is equally and similarly stressed on every section, as shown in Fig. 13 at *A*, where

$$WL = f(bt^2/6)$$

Also, a laminated spring conforming to the rhombus law is in a similar condition, as shown at *B*, where

$$WL = f(bnt^2/6)$$
$$Wl = f(bt^2/6)$$
$$Wnl = f(bnt^2/6) = WL$$

Each blade, except the shortest, is loaded in a similar manner, as shown at *C*, where again

$$WL = f(bt^2/6)$$

the bending moment being proportional to the section throughout, and constant where the section is uniform. The fiber stress on every section being the same, the load on the tip of each blade must also be the same and is the load carried by the spring, the maximum bending moment being proportional to the number of blades, *i. e.*, to the number of sections into which the rhombus is divided.

Departure from Primary Rhombus

When the primary rhombus is departed from, or the blades are cambered to differed radii, the uniformity of stress distribution disappears, and the effect of such departures can be foreseen. For example:

1. Full width instead of spear-shaped blades will increase the bending moment and the fiber stress on the short blade, and reduce the stress on the other blades.
2. Overlength blades will have the same result.
3. "Nip" will have the same result.
4. "Grading" without "nip" will reduce the stress in the shorter blades and increase it in the longer blades.
5. Additional full length blades will have the same effect as overlength blades.

A spring proportioned according to the rhombus law is shown in Fig. 14 at *A*, and one with overlength blades at

B. If truly cambered to a circular curve, the overlength blades will bend irregularly, due to the irregularity of stress, and will not remain in contact when the spring is loaded. "Nip" seriously affects the stress distribution, but has little effect on the load-deflection curve. At *D*, Fig. 15, a three-blade spring with all full-length blades is shown. If this spring is made without "nip," the stress

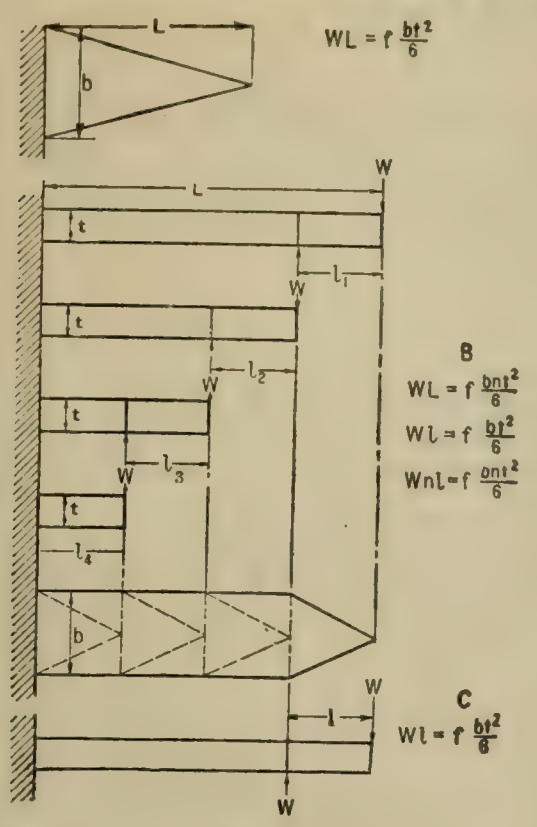


Fig. 13.

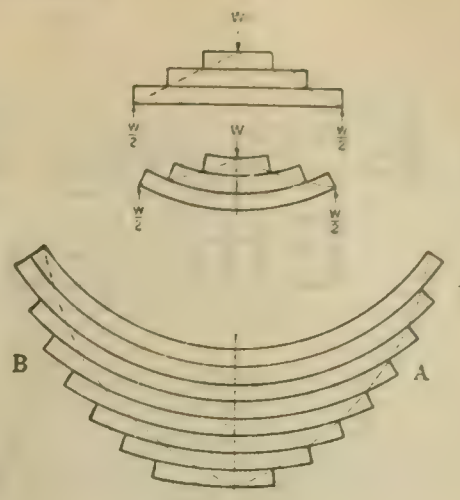


Fig. 14.

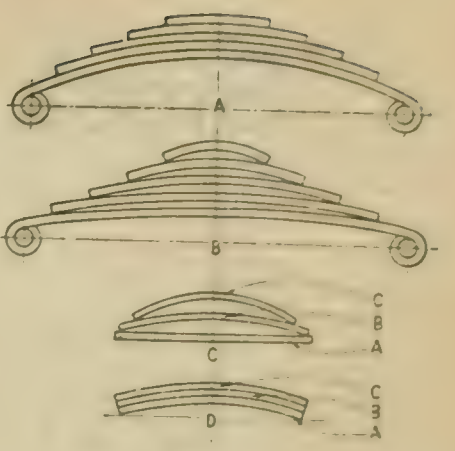


Fig. 15.

in each blade will be the same when it is loaded, but if a second spring is made with "nip" as shown at *C*, although the nipped up springs will appear identical, and the load deflection curve within the elastic limit will be the same, the stress distribution will be entirely different.

Taking the proportions shown, when pressed flat the lower blade of the spring with "nip" will not be stressed at all, and the whole of the stress that would be carried by it if the spring were made without "nip" will be carried by the topmost blade, which will thereby be stressed to twice the amount to which it would be if the spring were made without "nip." Therefore, in this particular extreme case, the maximum stress in the spring with "nip" will be twice the mean stress, and while the load deflection curves will be identical, the maximum safe load for the one spring will be only half that for the other.

A Foreign Book on Fuel and Lubricants

BOOKS intended for both scientists and laymen, as a rule, are not very practical because they will either be above the heads of the latter or else of no use to the scientist or engineer. Dr. J. Formanek, Professor at the Bohemian Technical High School at Prague, has, however, written a thoroughly practical manual. This book, entitled "Benzine and Mineral Lubricants," has been translated from the German by Charles Salter and is being published by Scott, Greenwood & Son. D. Van Nostrand Co. is the American agent.

The "benzine" with which this book deals is really gasoline, and it is hard to understand why the translator did not choose the word petrol instead of benzine. The book is addressed on the one hand to automobile owners, owners of internal combustion engines, automobile engineers and all who have to do with the testing of fuels and oils, and, on the other hand, to chemists who are called upon to report on motor fuels and lubricants. Owing to this double purpose the author has endeavored to keep down the size of the work.

The average automobile owner in this country may not be particularly interested in the chemistry, production and scientific testing of gasoline and other motor fuels, but in judging this phase of the author's appeal the fact must be taken into account that it was originally written during the war period in one of the Central Empires at a time when getting fuel for a car was not merely a matter of driving a block or two to the nearest filling station, but when practically any liquid that would serve as fuel in internal combustion engines was given a trial. It is not hard to understand that under those conditions private owners of motor vehicles were willing to go somewhat more extensively into the science of motor fuels than the average automobile owner in this country to-day.

The book will probably be of particular interest to petroleum chemists, as it deals chiefly with the methods in use in the Galician oil fields and the refineries supplied by them. It should, however, also prove of interest to the automobile engineer, in view of the constantly changing character of our fuel and the many problems raised thereby. It deals especially comprehensively with testing methods. The following list of chapters will give a good idea of the field covered: Petroleum, Its Composition and Treatment; Coal Tar Products; Brown Coal, Shale and Peat Tar Products; Products from Petroleum and Tar Residues; Testing Benzine and Benzol; Judging the Quality of Benzine and Benzol; Testing Mineral Lubricating Oils; Judging Mineral Lubricating Oils; Properties and Uses of Fuels; The Consumption and Efficiency of Various Fuels in Internal Combustion Engines; Suggested Improvements in Motor Car Equipment; Safe Storage of Benzine and Benzol; First Aid in Cases of Gassing with Benzine.

AMONG other conclusions, in a monograph "China: Automotive Conditions and Good Roads Movement," the author, J. Morgan Clements, American Trade Commissioner, states that although China's increasing interest in road building is an encouraging sign, American manufacturers should by no means jump at the conclusion that an immediate market will be created for large numbers of motor cars and trucks.

This monograph may be obtained on application to the Automotive Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

Stock Keeping System an Aid to Efficient Service

A description of a system which has proved its worth by reducing the capital invested while increasing the efficiency of the service rendered. This stock department handles yearly a large volume of parts at low expense.

By Philip H. Smith

THE ever-increasing importance of service and the stress laid upon it brings to the fore the value of efficient stock handling. The problem of service is the sum total of the problems of the repair and stock departments. To the degree that the problem of handling stock is solved, so also the problem of giving service in an efficient manner will approach a solution. An efficient stock system has a definite service value.

The primary object of a stock department should be to supply necessary parts on demand at all times, without friction and with the least possible expense to the company. The ability to supply parts on demand determines the efficiency of the department's service. The problem lies in getting the proper balance between the ability to supply parts and the minimizing of expenditure; neither must be achieved at the expense of the other.

Because it is carrying approximately 22,000 different parts, and because it is supplying parts to cars and trucks even as far back as of the vintage of 1907 with an efficiency claimed to be as high as 98.7 per cent, the Parts Department of the Long Island City Service Station of the Packard Motor Car Company of New York deserves attention, and anything that may be written about it cannot fail to furnish something of a worth-while nature to those who are trying to solve the stock handling end of the servicing problem.

This stock department furnishes parts to seven branches and 29 dealers located in the states of New York, New Jersey, Connecticut and Massachusetts. The department itself occupies one large floor, which carries the main supply, and there are sub-stock rooms located in the car repair, truck repair and coach shop.

Stock is divided into three groups: Active, excess and surplus. Definitions of the groups and approximate percentage of the total stock carried in each group are:

1. Active—parts with a turnover within one year, 94 per cent.
2. Excess—parts which turn over in one to four years, 3 per cent.
3. Surplus—parts which turn over in four years or over, 2 per cent.

The advantages of this grouping are that active parts do not depreciate because they have numerous turnovers within a year, and that the value of inactive parts is really increased due to ready sale through centralization.

Of the active stock, approximately 85 per cent is carried in the main stock and 5 per cent in each of the sub-stocks. This supply of parts in the sub-stocks fills about 80 per cent of the requirements of the respective shops. In general, they carry the light and medium weight parts only, and the heavy parts are kept in the main stock. All the excess and surplus stock is carried in the main stock room and no effort is made to replace it when it is depleted. It serves only as a convenience to drivers of very old cars.

Stock bins are built in sections, each section bearing a letter. Parts are kept in units as far as possible; thus, for example, all clutch parts would go in one section. This arrangement has reduced the force by one man, because each sale is usually comprised of several parts for one unit. The individual bins are filled according to piece number sequence and run from top to bottom and from left to right of section. Besides bearing a tag with the piece number and name of part, each bin has a separate bin number.

A master file, containing a card for every part carried, is located near the stock bins. Each card bears the name, piece number, bin location and section, and is filed numerically according to piece number. Other special cards such as Discontinued Assembly (Fig. 4), Obsolete Part (Fig. 5) and Part Not Stocked (Fig. 6) are filed numerically within the master file in the same manner. The discontinued assembly card shows an assembly now carried as separate parts. It

PIECE No. | NAME | DANGER LIMIT

MAIN STOCK

PLUS W.T. | LIST | COST | DATE | SUB STOCK

BASE | 1ST | 4TH | 5TH

SECT. | BIN | CARD No.

ORDERED

DATE	ORDER No.	AMT.	REC'D	BAL. DUE	MAIL ORDER

RECEIVED AND DISBURSED

DATE	ORDER No.	AMT.	BAL.	DATE	ORDER No.	AMT.	BAL.

TOTALS

Fig. 1—Stock record card

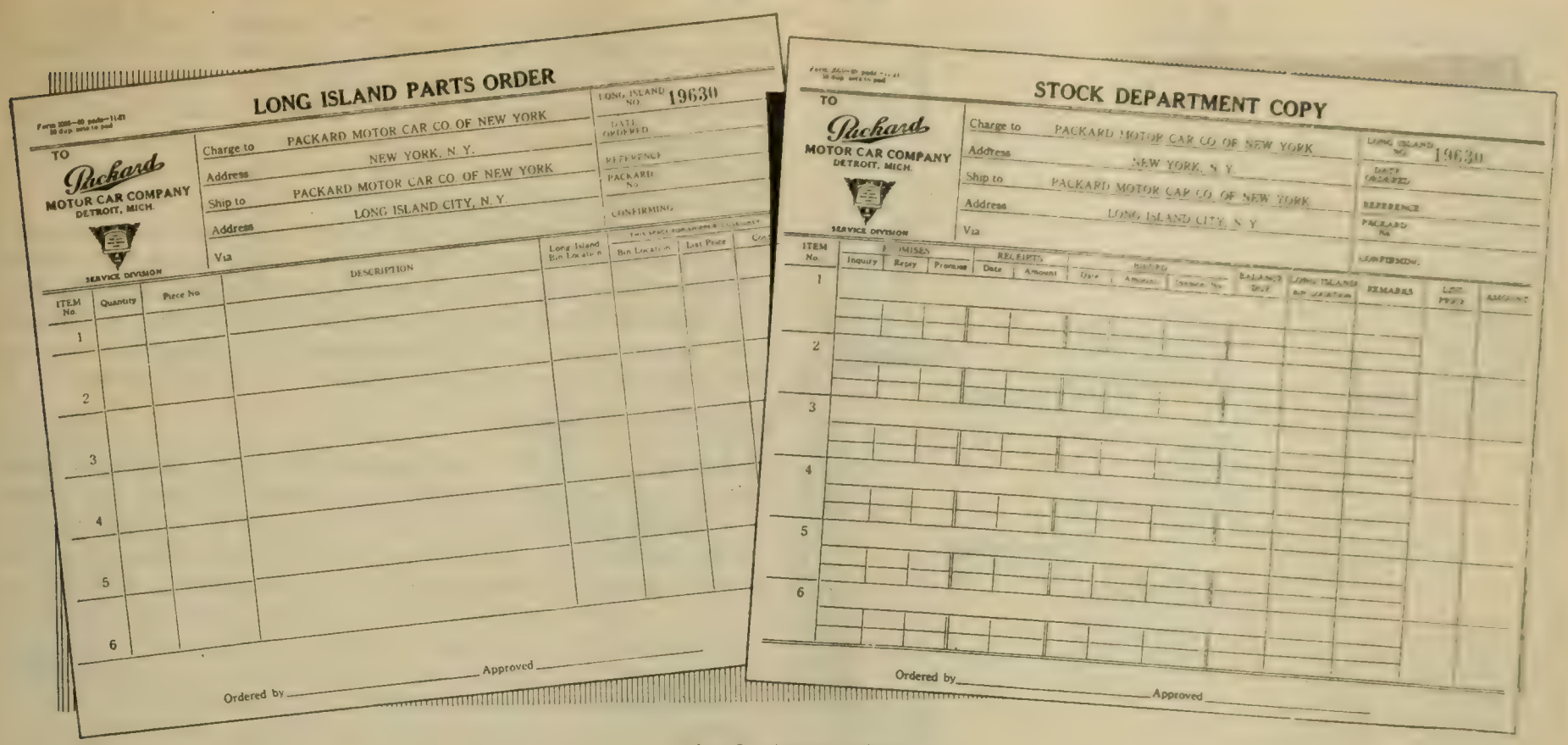


Fig. 2—Parts order

facilitates making up an assembly, when so desired, by listing the piece numbers, names, amount used and location of all the component parts. The obsolete part card advises the piece number, name and location of the superseding part. The parts not stocked card gives piece number, name and reason for not stocking. This master file serves to give to the employees all information regarding parts and their location.

Stock Record System

The key to the entire stock keeping system is the stock record card, and it is essential that this be understood before going on to describe the system. Every part stocked by the stock department has its own record card (Fig. 1), which is kept in the stock record office. This card contains the following information regarding the part: Piece number, name of part, location in bin, list and cost price, columns for all information regarding ordering, receiving and disbursement and main and sub-stock room danger limits. A danger limit is a predetermined figure showing the lowest amount of each part that can be carried safely. When the balance of parts on hand bears the same figure as the danger limit, the record clerk attaches a red tag to the card. This danger limit is determined by the length of time that it takes to obtain shipments from the factory, which varies from two to four weeks, according to whether the material comes by express or freight.

The installation of a danger limit insures getting parts before the supply runs out and eliminates guesswork in ordering.

The same system of recording stock is used for parts stocked in the sub-stock rooms. In the recording office a separate file is kept for each sub-stock room and in each file is a record card for every part stocked. The method used in keeping this record card file will be dealt with as the various factors connected with it are outlined.

Ordering

All parts, whether coming from the factory or locally, are ordered by the order clerk. Very few parts are purchased locally, but the system is the same in any case. The order clerk collects the red-tagged record cards daily and immediately makes out an order from them in duplicate (Fig. 2). This order shows the quantity ordered, piece number, name of part, bin number and location in stock room and a place for the factory invoice number. The original copy is forwarded to the factory and the duplicate to the invoice clerk. Every effort is made to order in such a way that parts are brought through in carload lots. This brings shipments faster than broken carload lots and practically secures express service at freight rates. As each part is ordered it is entered on the stock record card with the following information: Date of ordering, order number and quantity ordered.

Receiving

When parts are received from the factory they are immediately unpacked in the receiving room. A tally sheet accompanies the shipment, which is a carbon copy of the factory invoice to Long Island. The tally sheet is forwarded to the invoice clerk, who fills in the bin location which is obtained from the factory order, at the same time checking it against the factory order for quantity received, change in piece numbers and prices. To indicate a change in piece numbers a card (Fig. 3) is used which is filed in the master file in the main stock room. In this way any superseded piece numbers will be caught and new record cards installed before the parts are placed in the bins. After this is done, the tally sheet is returned to the receiving clerk, who checks in the parts, inspects and verifies the quantities as shown on the tally sheet. Parts are then put away, using the bin location furnished on the tally sheet.

When stock is received, the following information is entered for each part on its respective record card: Order number (in red), quantity actually received, balance due, if any, and factory mail order number on which the parts arrived. The mail order number and quantity received is then copied on the disbursement side of the record card, showing the new balance.

Disbursement

There are three distinct divisions in the disbursement of stock. In order to show how this part of the work is handled, each division will be taken one at a time.

The crew of men who disburse parts from the sub-stock rooms began in the department by receiving and checking in, and in that way have become acquainted with the different parts, the method of stocking and their location.

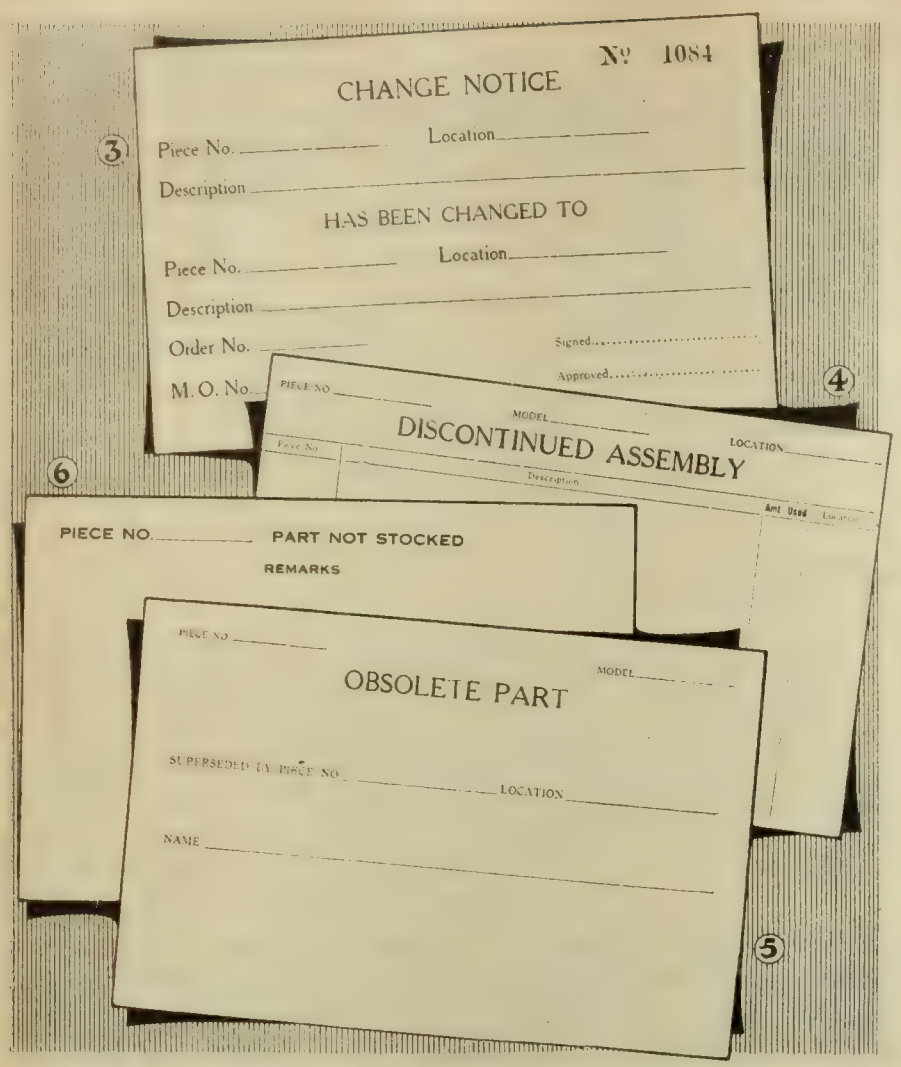


Fig. 3 — Change notice card. Fig. 4 — Discontinued assembly card.—Fig. 5—Obsolete part card. Fig. 6—Part not stocked card

As the stock from the sub-stocks is disbursed solely to the shops and hence used for replacement in repair work, every request for a part must appear on a requisition and bear the order number of the job in which it is to be used. The requisition is made out in triplicate, the original and duplicate copies are forwarded to the record office, where they are priced, then the former is sent to the cost department, where it is put in the job order envelopes, the latter remaining in the office. The third copy remains with the requisition writer as his reference.

All requisitions filled from sub-stock are stamped with a rubber stamp indicating it. The requisition is then forwarded to the record office, and from the information thereon the proper disbursement is made on the stock record card. When the supply shown on the record card reaches the danger limit, the record clerk makes out a transfer to replenish the sub-stock from the main stock. This transfer itself is made by the night man. This system has two advantages: the sub-stock man is not engaged in handling records and orders and can devote his entire time to waiting on the shop, and the stock is transferred at night without confusion.

The parts ordered by dealers, branches, mail, telephone and telegraph customers are drawn from the main stock and the proper disbursement entries made on the stock record cards. Stock thus drawn is sent to the shipping department, checked and shipped in the usual way. The men who handle these orders have been promoted from the sub-stock rooms.

Direct customers, the third division, are cared for by a group of men who have been through the entire system and are ready to give expert service as a result of their previous stock experience. Customers' orders are written on cash sale or charge part orders. In the case of cash sales, the order is written in triplicate. All copies are priced and the original and duplicate handed to the customer, who, after paying the cashier and having it stamped, returns the copies. The triplicate is wrapped and delivered with the parts. The original and duplicate are forwarded to the accounting and record office respectively, the latter giving information from which to make the proper disbursement on the record cards. In the case of charge accounts the system is the same, only in place of paying the cashier, the customer has the orders approved by the credit department.

In order to facilitate the handling of parts for large fleet owners who operate in several states, one man handles all these so-called national accounts. His only other duty is to take charge of returned parts. The national accounts man becomes personally acquainted with the representatives and a closer contact is secured by this system.

Branch Stock System

A close supervision is maintained over the branches, and in order to understand the system of stock handling it is well to know that the same record card system is used.

The method of handling stock at the branches used previously to the one about to be described is briefly as follows: Parts were ordered directly from the factory, and there was no absolute limit as to the maximum supply of each part to be kept on hand, this being left largely to the discretion of the branch stock manager.

Difficulties arose from that method for several reasons. In the first place, the tendency was to carry far too much stock, thereby cluttering up the stock room and tying up more capital than was necessary. Also, the stock managers were constantly being bothered by salesmen in an effort to make the branches carry a different line of locally bought stock, such as brake lining, accessories, etc. It meant that the stock managers had to be better buyers than the New York purchasing agent, or the branches would suffer from inferior goods, or goods not up to the standard set by the factory.

A maximum-minimum system is now used and it is required that all parts be ordered directly from the main office at Long Island. The amount of stock necessary for each branch to carry has been determined from three sources, as follows, on a basis of:

1. Sale of parts for the previous three months.
2. Sales for the corresponding three months of the previous year.
3. The number of cars in the locality.

By taking the figures from these three sources and blending them a very accurate figure capable of caring for the increase per year, local and seasonal business, is obtained. Having determined the maximum amount of parts to be stocked, a minimum is set as well as a danger limit determined, the latter being approximately half way between the maximum and minimum figures. Here, again, the danger limit is determined by the length of time that it takes to replenish the supply.

A record file is kept at the Long Island record office, containing a card for every part stocked at the branches. These cards (Fig. 7) are filed numerically according to piece number, each card containing the names of the branches and the maximum, danger limit, and minimum figures for each branch.

When an order comes in from a branch it is possible to tell by a glance at the branch file whether the stock manager has ordered more than enough to reach the maximum, in which case the surplus is not sent, and the man risks losing his position. Of course, stock suddenly depleted below the danger limit must be replenished, but a notation to that effect would accompany the order.

Let us see the advantages accruing from this system. The investment in parts is kept at a minimum and yet good service is assured. The purchasing responsibility rests on one man, who is a specialist. Only active parts are carried and the inactive parts are centralized in the excess and surplus divisions of the main stock room and

not lying fallow at the branches. The flow of parts is facilitated by quantity ordering, as duplication and friction is avoided and better express and freight rates secured.

Assuming that the main office is not able to furnish an exceptionally large order of a certain part, it is possible, knowing the branch minimums, to wire the nearest branches to ship their minimum to the given destination. This brings the branch supply down to the danger limit and immediately an order is sent to the factory to replenish the main and branch stocks. In the meantime the customer has had real service.

In connection with branch stock it would be well to mention that this maximum-minimum system has been carefully worked out and is at the disposal of the company's dealers, if they care to adopt it. Any wide-awake dealer can see the advantage of giving maximum service at minimum cost, and it is also to the advantage of the company, in the long run, to aid the dealer in reducing his capital investment in parts and yet give service as it should be given.

Inventory

The taking of inventories has always been more or less of a nightmare to most concerns, hence any system which removes some of the difficulties has secured a measure of success.

A thorough inventory has been taken in two days and a night. The method consists in filling up the sub-stock supply, closing the main stock for inventory and during that day supplying parts from the sub-stock. After the main stock has been inventoried, all drawing of stock is made from the main stock while the sub-stocks are closed and inventoried.

The taking of an inventory starts with the making up of a bin index (Fig. 8), which is simply sheets of paper with columns of numbers from 0 to 100. These sheets can be expanded indefinitely for each bin section by the mere addition of a numerical suffix to the numerals. Piece numbers are then written on the sheets beside the numbers which correspond to the respective bin numbers. This is done for every bin and acts as a positive check on the stock room. The next step is to write an inventory count card (Fig. 9) for every stock record card in the record office, giving the piece number, name of part and location.

BROOKLYN					
WHITE PLAINS					
NEWARK					
PATERSON					
JERSEY CITY					
HARTFORD					
NEW HAVEN					
NEW LONDON					
SPRINGFIELD					

Fig. 7—Main office branch stock card

This should give a count card for every piece number in the bin index.

Having completed the bin index and inventory count cards, the latter are arranged in numerical sequence (bin number sequence) and according to sections. The cards are then checked against the bin index to check for piece numbers and locations, also to insure having a count card for every piece number. Any stock without a count card

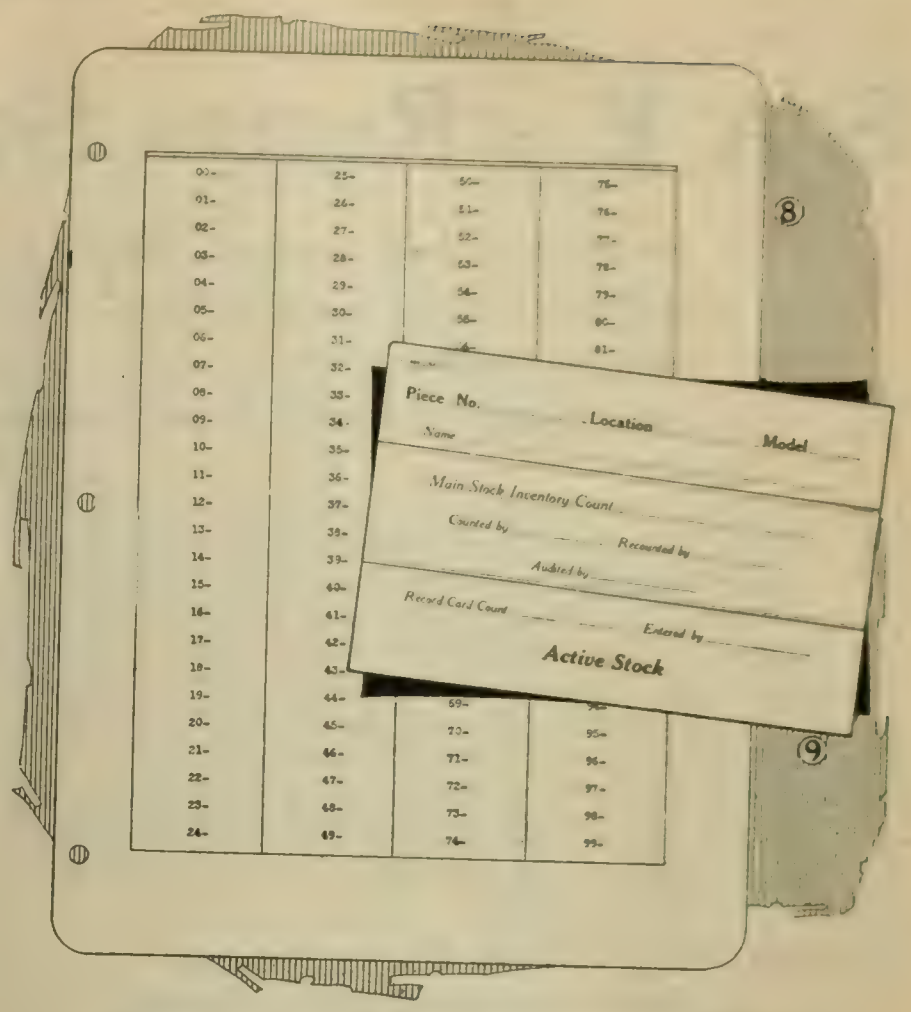


Fig. 8—Bin index sheet. Fig. 9—Inventory count card

shows bad location of stock, misplaced stock record card or a lost count card.

The inventory count cards are placed in their respective bin locations according to bin number and section, or, in other words, in numerical sequence. The parts are counted, recounted by a second man and finally audited by a man from the accounting department, each man initialing card after counting. The cards are then taken out of the bins in their numerical sequence and returned to the record office, where they are checked against the bin index to insure the return of all cards.

The final step is to enter the inventory count from the count cards on to the stock record cards. If there is no discrepancy, the balance on hand on the stock record card and the inventory count on the inventory count card should be identical. Inventory sheets are then made up to show the total inventory.

If the system has been kept up with care during the year there is no reason why there should be a big discrepancy between the actual inventory and the inventory that the books show.

Conclusions

To the question: "Doesn't this system require an abnormally large force to handle all the necessary records properly?" Mr. F. Preston, the manager of the stock department, replied that it requires fewer employees than the average system. In connection with this, the service rendered, investment involved and volume of business should not be forgotten. The present system has resulted in a decreasing of one-third of the capital invested in stock, while the efficiency of the department has steadily increased. This may certainly be said to be traveling in the right direction.

A DESCRIPTIVE Handbook on General Instrument and Oxygen Equipment for aircraft has been issued by the Air Ministry (Directorate of Research) of Great Britain. Copies can be obtained from H.M. Stationery Office, London.

S. A. E.'s Recent Standardization Work

Revision in ball bearing standards to secure agreement with the German standards under consideration. Iron and Steel Division discussing Bessemer steel and wire spring stock. Distributor, magneto and bumper mountings, motorboat controls and passenger car frames considered by divisions.

THROUGH the efforts of the Sectional Committee on Ball Bearings of the American Engineering Standards Committee an attempt is to be made to secure uniformity between present and proposed German and American ball bearing standards. The Sectional Committee has made certain requests to the sponsor bodies for ball bearings, the Society of Automotive Engineers and the American Society of Mechanical Engineers, and as far as the S. A. E. is concerned the requests will be considered at the next meeting of the Ball and Roller Bearings Division of the Standards Committee. The requests made are as follows:

Requested Changes in Ball Bearing Standards

"That the Society investigate the German extra light series of ball bearings and give careful consideration to the advisability of establishing a corresponding S. A. E. standard.

"That the society make a careful study of the proposed German light series extra large standard, and if possible change the outside diameter for the corresponding S. A. E. standard to agree with the outside diameters adopted by the German Standards Committee; and that the widths adopted by the German Committee should be thoroughly considered. The Sectional Committee believes, however, that the narrow widths will not permit satisfactory design of radial bearings carrying an appreciable thrust-load and that they are not suitable for the design of double-row ball bearings with spherical outer races.

"That the Society make a careful study of the proposed German medium series extra large standard, and if possible change the outside diameters of the present S. A. E. standard to agree with the outside diameters adopted by the German Standards Committee.

"That the Society make a careful study of the proposed German heavy series standard and change the outside diameters for S. A. E. bearings above 85 mm. bore of the heavy series to agree with the outside diameters adopted by the German Standards Committee.

"That the Society consider (a) changing the outside diameters of the light, medium and heavy series double-row bearings to conform with such outside diameters as are finally adopted for the single-row bearings; (b) changing the S. A. E. Standard to bring the widths of the S. A. E. and German standards together, or to change the inch widths to millimeters; (c) investigating the possibility of a demand in America for a narrower series of double-row ball bearings than the present S. A. E. Standard.

"That the Society consider changing the S. A. E. Standards so that they will conform with the corner radii adopted by the German Standards Committee, particularly in view of the fact that it is stated that the S. A. E. corner radii are too small.

"That the Society consider the German standard width-tolerances and indicate what recommendation should be made for standard width-tolerances in American practice, as well as what would be the result in America if the closer German tolerances were adopted."

In connection with the size standards the Sectional Committee suggests that in studying the possible change of outside diameters the Society endeavor to omit some of the intermediate sizes, particularly in the heavy series, and that the outside diameters of the series be selected so that as few outside diameters as possible are necessary, to reduce the necessary tool equipment.

In the present S. A. E. Standard for distributor mountings it is specified that the distance from the base of the distributor body to the end of the coupling tongue shall vary to suit conditions. It had been suggested that this dimension be standardized, and a subdivision of the Electrical Equipment Division consisting of W. A. Chryst has now recommended that the following revisions be made:

(1) Specify a dimension of 27/32 in. for the distance from the base of the distributor body to the end of the coupling tongue of the Type-B ignition-distributor.

(2) Change the limits for the bore of the collar from 0.4930 in. maximum and 0.4920 in. minimum to 0.4915 in. maximum and 0.4905 in. minimum.

The dimension of 27/32 in. is in accord with present practice. The revision in limits does not affect the actual manufacturing tolerances now specified for each part, but results in closer fits, 0.0020 in. maximum and 0.0005 in. minimum instead of 0.0035 in. maximum and 0.0020 in. minimum, between the collar and the shaft. As it is thought that the fit of the tongue and the groove is more important than that of the collar and the shaft because there is more wear between the former than between the latter, no revisions of the present limits are recommended.

Passenger-Car Bumpers

In 1921 a questionnaire was sent to passenger-car builders as to the feasibility of standardizing a plain bolted-on connection for passenger cars using the conventional type of pressed-steel frame. Although it was pointed out that the adoption of such a standard would necessitate providing holes in the passenger-car frame in conformity with whatever standard was proposed, these holes to be used either by the passenger-car builders for mounting bumpers as standard equipment or by the owners for mounting bumpers as accessories, over 90 per cent of manufacturers replying to the questionnaire recommended the formulation of such a standard bumper-mounting.

A Subdivision, consisting of F. G. Whittington and E. W. Weaver, appointed for the purpose, has recently made the recommendation given in the accompanying figure:

Two 33/64-in. diameter bolt holes shall be located on or near the neutral axis of the frame section.

The first bolt-hole from the frame horn shall coincide

with the first or second rivet hole and shall be located at least 1 in. above the frame-horn lug. Clearance must be provided for the bolt-head inside of the frame channel.

The second bolt-hole shall be located on a line passing through the center of the first bolt-hole at an angle of 15 deg. plus or minus 2 deg. above the horizontal and at a distance from the first bolt-hole of from 3¼ to 4¾ in. In cases where the second bolt-hole is to be used for mounting a shock absorber, the hole shall be located not more than 1 7/16 in. from the bottom of the frame channel at the nearest point.

There should be normally a clearance of ¼ in. between the side rail and bumper bracket so that the latter will clear the rivet heads.

In case passenger cars are not equipped with bumpers as standard equipment, it is intended that a flat-headed

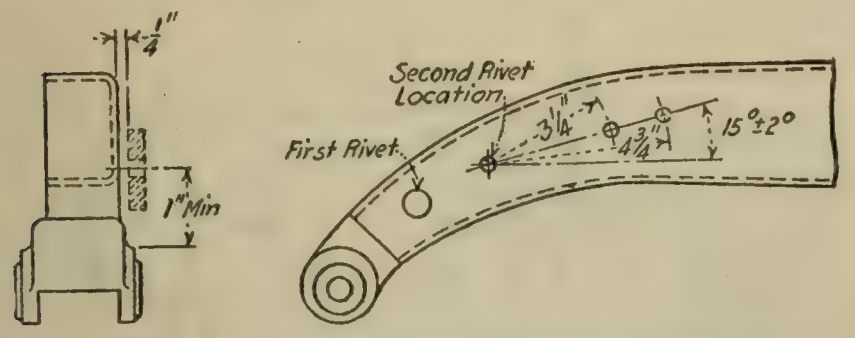


Fig. 1—Proposed recommendation for passenger-car bumpers

bolt shall be used in place of the first or second rivet to facilitate mounting bumpers as accessories.

Iron and Steel Specifications

The matters outlined below were brought out at the February Iron and Steel Division meeting:

Chemical Compositions.—The suggestion made by E. A. Johnston of the International Harvester Co., to reduce the standard carbon-steels to the least number required was discussed in connection with present practice among steel producers and parts manufacturers. A conference on the subject is to be arranged between the members of the Division and representatives of the International Harvester Co. and other implement manufacturers.

It was stated that at the present time there is no composition in the carbon steel group suitable for steel spring wire. The steel used by the steel-wire manufacturers ranges around 0.65 per cent carbon and 0.75 to 1.05 per cent manganese, but it is thought that if there were an S. A. E. Steel designated as Steel 1065 concerted effort among steel mills would practically bring about its universal use. S. A. E. Steel 6150 is easily obtainable and used to some extent for the purpose in mind, but the greater volume of spring wire is made from carbon-steel. It is understood that the steel-wire mills required the specially high manganese content in the carbon steel because of difficulties in the drawing operations encountered with lower manganese steels.

Chairman Gilligan of the division appointed a subdivision with A. L. Danse of the Cadillac Motor Car Co. as chairman to investigate the practice of the steel wire mills and prepare a tentative report for the division.

Bessemer Steels.—Attention was given to the subject of standardizing bessemer-steel specifications, as the following comments had been submitted:

Outside of S. A. E. Steel 1112, screw stock, which could be a bessemer steel, the automotive engineers are strongly in favor of the open-hearth process, due largely to the low phosphorus content possible in open-hearth steels. However, the attitude toward bessemer stock is not altogether justified, as perhaps 85 per cent of the steel going into the products of a large number of the implement manufacturers is bessemer steel.

The opinion was expressed that if bessemer steels were included in the specifications, there would be danger of automobile manufacturers using them when open-hearth steels are not readily obtainable. The Division members present were of the opinion that it would be unwise to mix steels such as the bessemer types, which are used by the agricultural implement manufacturers, with those now included in the S. A. E. Steel Specifications which are used by the automobile and tractor industries. As it was deemed inadvisable to make a final decision, it was voted to table the subject until further information should have been received.

Cast Iron.—The suggestion that the Division take up the matter of the adoption of standard specifications for cast iron was discussed. Previous attempts of the Division to prepare such specifications were mentioned and the opinion expressed that before the subject is taken up, tentative specifications for as many grades of cast iron as may be considered necessary should be submitted. It was noted that the tendency is toward specifying the grades of cast iron according to the Brinell hardness instead of by chemical analysis.

Sheet Steel.—A progress report was submitted from W. C. Peterson that data are being collected for a general specification for sheet steel and that a tentative report should be ready for consideration by the Division at the next meeting.

Leaf-Spring Stock

At the Iron and Steel Division meeting held on Oct. 21, 1921, M. P. Rumney explained that there is lack of uniformity of practice in rolling leaf-spring stock and that the following proposal, which had been submitted by the Leaf-Spring Group, is the best compromise that could be made between the varying practices in different mills. It was decided to circularize the proposal among manufacturers and users of leaf-springs for comment.

Rolling Tolerances for Concave Automobile Spring Steel

The finished bars shall be of double-concave section with round edges. The radii of the arcs of the two concave surfaces shall be of equal length.

Rolls to produce the round edges shall be turned to a radius equal to two-thirds the thickness of the bar.

All bars ordered to gage shall be rolled to the Birmingham wire gage.

All bars must meet the width and thickness tolerances specified in Table 1.

TABLE 1—WIDTH AND THICKNESS TOLERANCES

Width of Flat, in. Over	To, Inclusive	Width, in. Plus	Width, in. Minus	Thickness,[1] in. Plus	Thickness,[1] in. Minus
0	2¼	1/32	0	0.005	0.005
2¼	3	3/64	0	0.006	0.006
3	5	1/16	0	0.007	0.007

The difference in thickness between the two edges of each bar shall not be greater than those given in Table 2.

TABLE 2—DIFFERENCES IN THICKNESS

Width of Flat, in. Over	To, Inclusive	Difference in Thickness, in.
0	2	0.002
2	3	0.003
3	5	0.004

Spring-steel bars shall not have more than 1 in. curvature in 20 ft., or 1¼ in. in 25 ft., or 1½ in. in 30 ft.

[1]Thickness measurement to be taken at edge of bar where concave surface intersects round edge.

The concavity, the difference between the thickness at the edges and at the center of the bar, shall be as specified in Table 3.

TABLE 3—ALLOWABLE VARIATIONS IN CONCAVITY

Width, in.	Nominal Concavity, in.	Maximum Concavity, in.	Minimum Concavity, in.
1½	0.007	0.009	0.004
1¾	0.008	0.010	0.005
2	0.010	0.012	0.006
2¼	0.011	0.013	0.007
2½	0.013	0.015	0.009
3	0.016	0.018	0.012
3½	0.018	0.020	0.013
4	0.021	0.023	0.016
5	0.029	0.031	0.023

Motorboat Controls

Further standardization of motorboat controls has been suggested. It would be helpful if a standard reverse-control mechanism could be provided on all standard marine engines so that the motorboat builder could connect standard bridge-deck controls direct to the engine builders' control equipment, which it is impossible to do on any standard marine engine to-day, for it is necessary for the motorboat builder to throw the regular reverse lever away and build his own controls from the bridge-deck control position all the way to the reverse gear.

The same conditions apply in every respect to the spark and throttle controls, as the engine builders only provide brass levers here and there wherever they can be mounted.

Passenger Car Frames

The S. A. E. Recommended Practice for Passenger Car Frames was reviewed by the Frames Division at a recent meeting, and it was found that although certain parts of the Recommended Practice are in accord with present practice, much is obsolete. It was decided to circularize the industry for information as to present passenger car frame practice, and the information on the subject in the possession of the Society has been referred to the subdivision. There is now a tendency toward the use of frames with straight parallel side members, and if the data received indicate a sufficient use of this type, a recommendation for its standardization will be made by the Division.

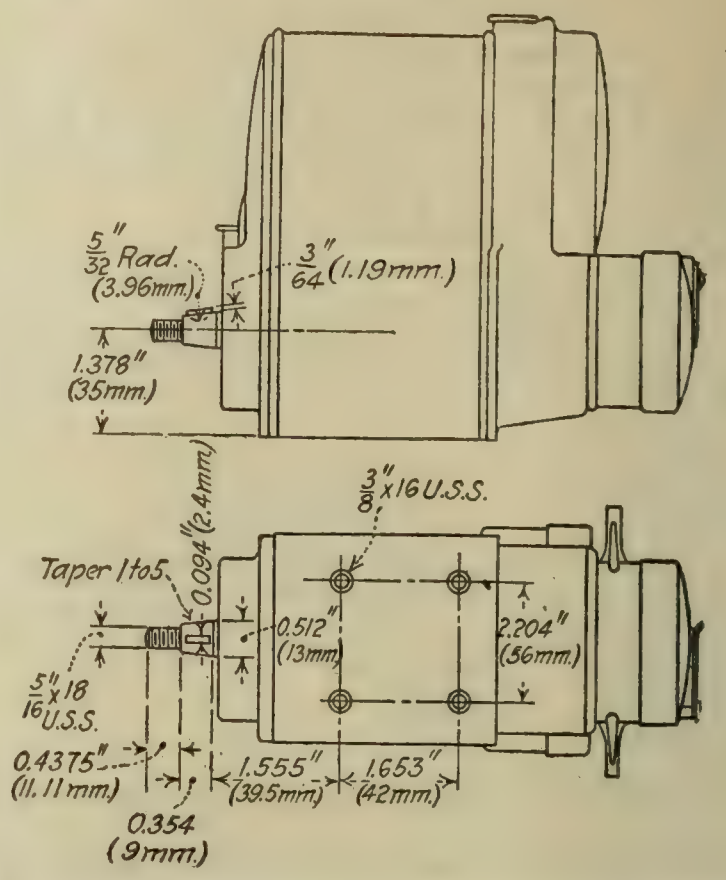


Fig. 2—Preliminary proposal for a standard magneto mounting

The standardization of magneto mountings for stationary engines, isolated electric-lighting plants and small tractors is one of the most important problems before the Electrical Equipment Division. At the meeting held recently in Chicago by the subdivision appointed to formulate a recommendation a preliminary proposal, Fig. 2, was approved. This has been submitted to engine and magneto manufacturers for comment.

The proposal will be considered at the next meeting of the Division.

A Handbook on the Airplane Engine

THE rapid advance in the design of aircraft engines in recent years has rendered handbooks on the subject written previous to the war obsolete. Research work carried out by the aircraft departments of all the belligerent governments added enormously to the stock of practical data bearing on engine design, and the keen competition between designers developed many new features of construction and new operating methods. Much of the information developed is scattered in voluminous and sometimes padded official reports, from which it can be obtained only at great difficulty. Prof. Lionel S. Marks deserves the thanks of the aircraft industry for having written an up-to-date handbook on aircraft engines. In this book, entitled "The Airplane Engine," McGraw-Hill Book Co., the author presents the results of war-time and later developments in this line, together with information of an elementary character on internal combustion engines. Where there is so much material to draw upon as there was in this case, there is always a temptation to use the scissors and pastepot rather freely, which usually results in an unsystematic compilation, and some of the volumes on aircraft subjects which have made their appearance since the war suffer decidedly from this fault. Of Professor Marks' volume it can be said that the material it contains has been thoroughly digested and arranged in a logical manner, thus forming a very readable and instructive book.

The author states in the preface that his work serves two objects: To formulate existing knowledge of the functioning of the airplane engine and its auxiliaries, and to present and discuss the essential constructive details of those engines whose excellence has resulted in their survival. The first sixty pages are devoted to the general theory of the internal combustion engine. Then in a chapter on Engine Dimensions and Details is given an outline of the different types of engines used for aircraft, and this section of the book contains brief specifications of most of the engines that achieved prominence during the war and since. Next, the author takes up the different component parts of the engine, as well as the various lines of accessories, dealing with each subject in considerable detail. The final chapters of the volume deal with such topics as Supercharging, Geared Propellers, Starting, Manifolds and Mufflers.

The book is well illustrated and contains a wealth of tabular matter, and it should prove helpful to the designer of aircraft engines, as well as to other students of the subject under discussion.

The Use of Alcohol as Fuel in Exported Vehicles

Alcohol is less expensive than gasoline and kerosene in many Central and South American countries, and has been used as a substitute in numerous cases. Several problems which should be considered by automotive exporters are met in its use. Some are discussed and remedies suggested.

By Herbert Chase

THE high price of gasoline and even kerosene in South and Central American countries, the West Indies and some other localities in which there is abundant raw material from which to produce alcohol, but no developed petroleum reserve, has led to a considerable use of alcohol as a motor fuel, and there are reasons to believe that such a fuel will see a wider application in the future, especially in view of the probable advance in the price of all petroleum products. In Cuba and in the Pernambuco district of Brazil, in particular, alcohol has already been extensively used as a motor fuel, and there is a growing interest in this possible substitute for gasoline, especially in sugar-producing communities, where a cheap raw material, which is now a more or less useless by-product of the sugar refineries, but can be converted into alcohol, is already at hand. The low price to which sugar products have recently fallen increases the interest in supplying national needs from local resources, and most of the countries in question are keen, for patriotic and other reasons, to develop these resources and to free themselves from dependence upon imported fuel, which is usually so expensive as to materially curtail the use of passenger cars, trucks and tractors.

Use of Alcohol

Alcohol is in many ways an excellent fuel for automotive purposes, but there are certain drawbacks to its use which can, however, be largely if not wholly overcome by relatively minor changes in design. The purpose of this article is to point out some of the conditions in this regard which must be met, and to suggest means for meeting them, as it is believed that automotive sales to the countries in question can be greatly stimulated by intelligent efforts to accommodate the product to the fuel which is available or will be made available when vehicles intended for its use are in the market. Manufacturers of trucks and tractors, as well as passenger cars, have an excellent possibility of increasing their export business, not only as a result of early sales which are likely to be made possible by the fact that their product is especially suited to the use of fuel alcohol, but due to the good will which such a product would create, both because of the cheaper fuel which it makes available or more readily usable, and because of the fact that patriotic peoples favor the use of products which are adapted to the use of home-produced fuel.

Recent reports from Cuba, collected by *El Automovil Americano* from consular and other sources, indicate that the consumption of fuel alcohol there has reached a total of over 600,000 gallons per month, although this fuel, which retails at 22 to 27 cents per gallon, has to meet the competition of gasoline at 41 to 46 cents per gallon, a much lower price for the latter than is prevalent in most Central and South American countries, in which gasoline often brings 70 to 90 cents. This is significant as showing the extent to which a native product is employed in the face of competition with a fuel for which the vehicles are primarily designed. The formula for denaturing motor alcohol, known officially in Cuba as "espiritu motor," provides for the addition to 95 per cent alcohol of 10 per cent of gasoline or sulphuric ether and about 1 per cent of other diluents, including formol, piridine and a coloring matter, which distinguishes this fuel from alcohol used for ordinary industrial purposes. However, other alcohol mixtures are permitted and extensively sold.

Cuban Motor Alcohol

Motor alcohol is made from the lower grades of molasses, which now sell at about 2 cents per gallon, and about 2½ gallon of this material is said to be required to make 1 gallon of alcohol. It is thought that it may later prove profitable to manufacture alcohol from the pressed cane fiber (bagasse), which is now largely consumed as fuel for sugar mill furnaces. Under present conditions alcohol is produced to sell in bulk at about 20 cents per gallon, but it is being so extensively used that the producers contemplate early increase in prices.

Reports as to the relative performance of cars using alcohol as compared to those using gasoline vary, but the rapid increase in the consumption of the former indicates that it can be used, at least for a time, with reasonable satisfaction by simply increasing the size of the fuel jet. As will be explained later, cars which use alcohol with only such a change will usually travel fewer miles per gallon of fuel, but there are some reports that the total consumption is not increased. In some cases this may be due to the fact that the gasoline consumption was higher than necessary, had the adjustment of the carbureter been correct.

Under normal conditions the cost of alcohol production in Cuba may be higher than at present, and the price of competing gasoline may also vary, but imported gasoline is now heavily taxed. Gasoline made from imported crude petroleum, refined in Cuba, is not, however, under the same handicap. Nevertheless, because of the appeal to local patriotism which a native product has, it seems quite likely that cars, trucks and tractors which show an equal or better performance on alcohol as compared to gasoline will find a ready market, providing, of course, arrangements for the proper distribution of the native fuel are made. In at least one case an American tractor manufacturer has already found a considerable market for his

product when the latter was equipped with special facilities for economically burning alcohol.

According to reports* dated January, 1922, received from C. R. Cameron, United States Consul at Pernambuco, Brazil, about half the automobiles operating in and about that city were using alcohol as fuel during the first few months of last year. The fuel is described as "42-deg. cane alcohol," to which was added as a denaturant 5 per cent of kerosene, gasoline, benzol, sulphuric ether or castor oil. Some 20,000 gallons of this fuel per month are reported to have been consumed. It is estimated that about 90 per cent of the cars which did employ this fuel have discontinued its use and are again using gasoline, which is considerably more expensive. The following reasons are assigned for the change from alcohol back to gasoline:

1—Fewer miles per gallon. 2—Decrease in power, with consequent difficulties on grades or under heavy loads. 3—Difficulties in starting with engine cold. 4—Solvent or chemical action of the fuel on tanks and fuel lines, with consequent clogging of fuel pipe or carbureter. 5—Rusting and wear of cylinders, ascribed to lack of proper lubrication. 6—Lack of reliable standard fuel which contained varying quantities of diluents. 7—Difficulties of securing a sufficient supply of high-grade fuel on short notice.

Overcoming Difficulties

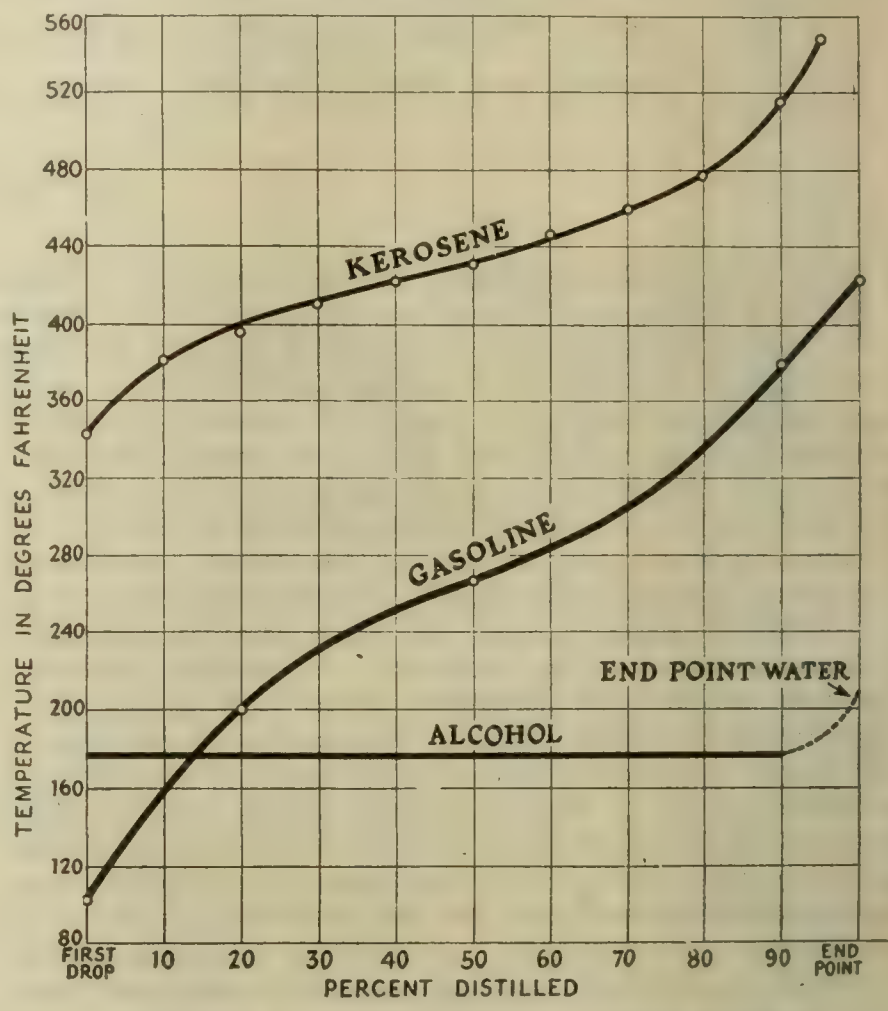
The report states that it is claimed that all these difficulties are overcome by the use of an engine especially adapted to burn alcohol, the adoption of a standard fuel of approved merit and by giving notice to the producers long enough in advance to enable them to meet the demand. In spite of the difficulties encountered to date, there is still a strong belief that alcohol will be the future automobile fuel, while the Brazilians regard it as a patriotic duty as well as an economy to use the native product. Accordingly, American manufacturers of passenger cars, trucks and tractors which can be adapted to the use of alcohol as fuel are advised to investigate the Pernambuco market. That it is an excellent market for automotive products is demonstrated by the fact that there are now in use in that district at least 1300 passenger cars and 200 trucks, most of which have been acquired since 1919.

Adapting Vehicles for Use of Alcohol

The difficulties encountered in the use of alcohol as fuel for automotive vehicles in Pernambuco are by no means insurmountable, but are such as might be expected whenever a fuel for which the vehicle is not primarily designed is employed. Alcohol is in some respects a better fuel than gasoline, but it requires somewhat different handling and some relatively minor changes in design and construction to produce the best results. These include, in general: (1) A considerable increase in the compression of the engine, obtainable either by the use of longer pistons, or, better, in the case of an engine with separate head, of a shallower combustion chamber; (2) provision for supplying more heat to vaporize the charge than is ordinarily used; (3) slight changes in carbureter adjustment, and (4) provision for preventing or minimizing the corrosive or solvent action of the fuel on metal and other parts. In some cases special aids to starting may be required unless the diluents used to denature the alcohol are sufficiently volatile to serve this purpose.

Considering, in order, means by which these conditions can be met, we find:

1—Alcohol can be used with a compression ratio of about 6 to 1 without producing detonation, and is, of course, productive of much higher efficiencies when so used. Gasoline cannot be used with such high compression without violent knocking, hence a larger clearance or compression chamber is required. It is a simple matter, however, to provide for the increased compression by furnishing a special head, and it might in some cases be desirable to furnish two heads, one designed for use with alcohol, and a second which could be applied in case some temporary local condition made it necessary to use gasoline. With the high-compression head it is possible to secure both a higher power and a better economy. The thermal efficiency increases with increase in compression ratio, and it is possible for this reason to secure more miles per



Distillation Curves for Alcohol, Gasoline and Kerosene

gallon of fuel, although alcohol contains less heat units per gallon than gasoline. To accomplish this result involves, of course, a proper carbureter adjustment and other favorable conditions in the preparation of the charge prior to combustion. Unless the compression is raised, the consumption of alcohol will usually be greater than that of gasoline, though the matter of correct carbureter adjustment in both cases may be the controlling factor and account for the conflicting reports as to relative mileage per gallon on the two fuels.

It is entirely possible to secure more power with alcohol than with gasoline even without a higher compression, but the difference will be greater when the compression is raised. The lack of power attributed to the use of alcohol in the report from Pernambuco quoted above may have been due to a variety of reasons, some of them resulting directly or indirectly from alcohol, but not insurmountable or necessarily inherent in alcohol fuel.

2—Alcohol requires more heat for its vaporization than any other of the more common hydrocarbon fuels, but it is completely vaporized at a much lower temperature than is required to vaporize the heavier ends of present-day gasoline and kerosene. On the other hand, it does not contain the volatile ends which are characteristic of gasoline, and, therefore, it is not so easy to start when alcohol is used as fuel as when gasoline is employed. To meet these conditions it is desirable to provide an inlet manifold which is well heated by exhaust gases, and install

*The full report on the subject as applied to Pernambuco can be obtained from the Automotive Division of the U. S. Bureau of Foreign and Domestic Commerce by referring to Exhibit No. 48027.

means for carrying a volatile fuel to be used for starting only, or some type of priming device which provides enough heat to volatilize alcohol in starting when the engine is cold. Once started, sufficient heat can be taken from the exhaust to vaporize the alcohol, providing a properly designed exhaust jacket for the inlet manifold is used. A. W. Scarratt of the Minneapolis Steel & Machinery Corp., which has developed tractors for using alcohol, has secured good results by using an inlet manifold design similar to that employed on kerosene-burning tractor engines.

In case an exhaust-heated manifold would provide more heat than is desirable for operation on gasoline (and gasoline may have to be used at times in localities where fuel alcohol is not uniformly or regularly distributed), it is an easy matter to provide means for shutting off all or a part of the heat. Aids to starting are not always required, especially when the car is to be used in very warm climates or when the denaturant used in the fuel provides the light ends which facilitate starting.

Distillation Curves

One of the curves given in the accompanying chart shows the temperature at which alcohol containing about 5 per cent of water (commercial alcohol contains varying percentages of water) distills. For comparison, similar curves for the average gasoline sold in this country and also that for a representative sample of kerosene are also given.

3—The changes in carbureter adjustment required in changing from gasoline to alcohol involve in general an increase in the size of the fuel jet, or what amounts to substantially the same thing in some carbureters, a decrease in air supply, either of which changes results in the use of a richer mixture. Of course, if the adjustment used for gasoline is excessively rich, as, unfortunately, it is apt to be in some cases, it may be possible to operate on alcohol without a change in adjustment.

4—That fuel alcohol, even when mixed with gasoline or kerosene, has a corrosive action on metals frequently used in the fuel system seems to be a well-established fact. This is attributed to an electrolytic phenomenon, and is apparently most serious in the case of galvanized sheet steel, such as is often used for fuel tanks. In this case particles of zinc are dissolved from the surface and may cause stoppage of fuel lines, carbureter passages and the like. In time the fuel tank will be sufficiently corroded to leak and thus require renewal. Copper is said to be affected to some extent, brass rather less and aluminum little if at all. Some reports regarding lead are to the effect that it is not injured, but tern plate (sheet steel coated with a tin-lead alloy) is said not to give satisfactory results. Steel parts sometimes used in float valves are apt to show corrosion, but brass, monel metal or even high nickel steel alloys can probably be substituted with satisfactory results in most cases, though precise information in this respect is lacking. Tanks of aluminum, lead-coated steel, brass or even copper will probably give satisfactory life in most cases and are certainly much more durable than galvanized iron. Brass is probably better than copper for piping between tank and carbureter, while the brass and bronze parts of carbureters, so far as we have heard, give satisfactory service. Shellac coatings on cork floats are soluble in alcohol, but some other coatings may be satisfactory. In general, however, metal floats are said to be preferable.

So far as we have learned, parts above the carbureter are not seriously affected, although some corrosion of valves and possibly some surfaces of the combustion chamber may occasionally occur. This may be due to the presence of acetic acid in the products of combustion, a fact which may also account for the muffler rusting out in one or two cases which have been reported. Such trouble is probably not serious in many cases, especially as the parts affected are not usually expensive and can be readily replaced.

On the whole, it is probably neither difficult nor expensive to make the slight changes in construction desirable to prevent any serious trouble from the corrosive action of alcohol. The freedom from carbon deposit in the cylinders, which is characteristic when alcohol is used as fuel, will probably more than offset any slight difficulties which may result from corrosion when the materials suggested are employed.

Trouble, which may in some cases result from a lack of uniformity in the alcohol fuel employed in various localities, cannot always be guarded against, but will probably not often occur if the changes referred to in respect to equipment are made. It may well be that some of the troubles laid to lack of uniformity in fuel are due rather to the cumulative effect of corrosion causing stoppage of fuel lines and the like than to actual variation in fuel quality. On the other hand, it is well to remember that alcohol and water are readily miscible, while gasoline and water are not, so that unreliable vendors may cause some trouble by diluting fuel with water, although a moderate amount of such a diluent may have no ill effect. Nearly all commercial alcohol contains 5 per cent or more of water. Other ordinary diluents, such as benzol, gasoline, kerosene and sulphuric ether, will probably not have ill effects unless the proportion used is excessive, and this is not likely, since they are apt to be more expensive than the alcohol itself.

There is a possibility of trouble from the use of castor oil, which is reported to be one of the denaturing agents used in Pernambuco, as this is relatively non-volatile and is apt to form a leathery carbon deposit. It may also form an emulsion which would cause trouble in the fuel system. Rusting and wear of cylinders referred to in the Pernambuco report and attributed to insufficient lubrication may be due in part to inadequate oiling, but the formation of rust is more likely due to the presence of acetic acid in the products of combustion, which would probably not do any serious injury to wearing parts, except perhaps if the car is allowed to stand idle for long periods after running on alcohol.

Conclusion

From the foregoing it will be apparent that the use of alcohol as automotive fuel is not without certain drawbacks, but that most if not all of these can be overcome or are not serious, providing reasonable precautions are observed and the vehicle properly adjusted and adapted to the conditions to be encountered. Some experimental and development work will be required in most cases, but the manufacturer who seriously and intelligently tackles the problem should in the end profit accordingly.

RESEARCH work looking to the production of a national motor fuel is being continued in France under the auspices of the "Scientific Committee." The work has been assigned to sub-committees and is being carried on at the National Powder Factory, at the College of Arts and Trades, at the National Agricultural College in Douay and at private laboratories. The Minister of Agriculture has placed 50,000 francs at the disposal of the Douay school and the Minister of Finance has contributed 400,000 francs to a research fund and 500 hecto-liters (12,500 gal.) of alcohol for the experiments. The use of alcohol for the motor bus service in Paris is being continued, the daily consumption being in the neighborhood of 8500 gal.

Exports of Passenger Cars, Trucks, Tires, Tractors,

COUNTRIES	GASOLINE PASSENGER CARS						GASOLINE TRUCKS						PARTS	ELECTRIC PASSENGER CARS AND TRUCKS	
	Up to $800		$800 to $2000		$2000 and over		1-ton inc.		Over 1 to 2½-ton		Over 2½ tons				
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value
Europe															
Austria													$105		
Azores and Madeira Islands													1,651		
Belgium	111	$52,148	9	$9,042					19	$8,193			6,243		
Denmark			21	20,193					1	1,000			37,064		
Far Eastern Republic															
Finland					1	$5,000									
France	2	750	3	2,808	2	10,500							56,258		
Germany					1	3,000							75		
Gibraltar													1,339		
Greece															
Iceland and Faroe Islands													461		
Italy			1	1,465	1	10,309							4,564		
Malta, Gozo, and Cyprus Islands					1	3,000							27		
Netherlands	29	15,217	9	9,647			42	$21,607					6,892		
Norway	3	2,224	13	11,200									3,793		
Poland and Danzig													665		
Portugal													80		
Roumania													716		
Spain	4	1,245	21	23,031	5	12,122	1	1,116	1	1,100			31,638		
Sweden	14	7,978	29	29,282			1	396					9,991	6	$8,750
Switzerland					1	3,000							2,306		
Turkey in Europe	10	3,258							2	734			1,832		
England	2	1,583	22	23,519	1	2,100			1	2,014			342,661		
Scotland			4	3,628	1	2,500							407		
Ireland	1	350											6,622		
Yugoslavia, Albania, etc.													1,045		
North and South America															
Bermuda													44		
British Honduras													212		
Canada	60	35,878	126	146,198	39	133,895	2	1,245	32	34,374	8	$18,738	987,619		
Costa Rica			4	3,232			1	500	2	2,424			1,913		
Guatemala	6	4,800	5	5,329	2	4,641			2	2,600			2,450		
Honduras											1	3,800	3,677		
Nicaragua													220		
Panama	6	2,849	7	9,434			6	2,597					8,910		
Salvador									1	3,220			2,669		
Mexico	269	112,452	69	75,683	5	11,759	55	22,545	18	28,738	2	7,059	93,237	5	3,300
Newfoundland and Labrador			1	1,498									708		
Barbados													976		
Jamaica	28	12,530	9	10,376	2	7,000	3	1,286					7,597		
Trinidad and Tobago	3	1,234	5	4,236			12	5,097	1	1,530			3,836		
Other British West Indies	6	2,331	3	3,603	1	5,065			1	1,700			3,625	1	441
Cuba	19	8,515	12	13,324	4	12,500	4	1,423	1	500	2	6,960	26,927		
Virgin Islands of U. S.													918		
Dutch West Indies	2	745					2	861					2,129		
French West Indies													855		
Haiti	2	1,390	2	1,616									2,457		
Dominican Republic	2	882											4,654		
Argentina	4	2,940	33	38,295	2	6,000			1	1,500			93,204		
Bolivia													104		
Brazil			36	35,291	1	2,110							8,955		
Chile			1	975									4,509		
Colombia	3	1,167	1	1,034			2	710	1	934	1	5,700	5,803	1	575
Ecuador													2,354		
British Guiana	3	1,306											1,169		
Dutch Guiana													71		
French Guiana	1	640													
Paraguay													89		
Peru	1	310	2	2,848	1	3,000							5,960		
Uruguay	2	1,456	9	9,204			10	2,654			1	4,805	4,443		
Venezuela	51	23,233	5	4,590	1	6,000							4,781		
Asia															
Aden			1	1,108									315		
Algeria and Tunis															
Armenia and Kurdistan	30	11,331													
Ceylon	4	2,333	8	6,464									469		
China	29	15,341	19	18,810	1	2,200			2	5,115	1	1,516	10,076	2	1,603
Kwantung, leased territory			3	2,940									828		
Chosen														10	22,680
British India	21	15,205	52	46,964	2	8,365	2	2,198	25	28,547			23,692		
Straits Settlements			7	7,164									4,207		
Other British East Indies															
Other Dutch East Indies			6	5,505									8,709		
French Indo China													763		
Hejaz, Arabia, Mesopotamia													2,239		
Hongkong			3	3,042									1,329		
Japan	103	41,125	3	2,921	1	4,157	51	24,788	11	32,887			29,146	1	3,776
Java and Madura	9	3,000	19	22,788	2	5,700							13,519		
Palestine and Syria	10	3,777	8	6,932			1	515	2	2,226			10,258		
Persia															
Siam					1	5,000	1	1,400					254		
Turkey in Asia	6	2,266											101		
Australia	382	256,570	249	272,818	3	7,707	12	15,078	92	121,205	5	8,017	71,282		
New Zealand	17	10,388	78	72,229					3	5,310	1	3,000	31,628		
Other British Oceania	3	1,491											85		
French Oceania															
Other Oceania													388		
Philippine Islands	1	443	15	18,867									9,399		
Africa															
British West Africa	3	1,306	5	4,688			5	2,123	1	1,680			10,763		
British South Africa			47	51,075									13,476		
British East Africa													70		
Canary Islands	1	520	9	10,983	1	2,400	2	2,868					1,889		
French Africa	4	1,447											2,079		
Morocco													3,583		
Portuguese Africa	2	890											1,267		
Portuguese East Africa													733		
Egypt	61	24,221					7	3,060					4,562		
Total	1,330	$691,065	994	$1,055,879	83	$279,030	222	$114,067	220	$287,531	22	$59,595	$2,060,619	26	$41,125

Motorcycles and Aircraft for January, 1922.

TIRES						FARM TRACTORS		PARTS	MOTORCYCLES		AIRPLANES AND SEA-PLANES		PARTS	COUNTRIES
Casings		Inner		Solid										
No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value	No.	Value	Value	
														Europe
														Austria
100	$1,505							$6,149	68	$21,812			$2,207	Azores and Madeira Islands
915	24,818	1,296	$4,537	110	$3,060			136	106	30,760				Belgium
60	810	50	150											Denmark
														Far Eastern Republic
820	10,669	614	2,537	8	355	54	$21,481	2,534						Finland
														France
				4	143									Germany
236	3,175	263	601	6	150									Gibraltar
30	345	10	75					223						Greece
12	110	10	66					200						Iceland and Faroe Islands
12	419	12	34						2	690				Italy
168	2,802	23	75			2	1,111	204	145	41,143				Malta, Gozo, and Cyprus Islands
172	5,055	36	142	22	1,102			103	1	75				Netherlands
				714	36,738									Norway
		3	14						10	3,000				Poland and Danzig
														Portugal
1,355	18,796	939	1,912	51	2,297	2	1,355	712	60	16,796				Roumania
1,548	27,914	1,223	2,578					460						Spain
									12	3,267				Sweden
116	1,487	258	427	32	1,110									Switzerland
24,812	321,848	1,922	5,112	400	11,032	173	14,373	64	51	13,738			15	Turkey in Europe
120	572	5	11			3	3,200		4	1,068				England
								22,965						Scotland
28	688	85	186											Irleand
														Yugoslavia, Albania, etc.
														North and South America
								17						Bermuda
25	242	38	85											British Honduras
7,654	98,572	12,467	20,253	391	14,759	50	53,955	41,080	11	2,586			7,579	Canada
55	1,258	32	85					84					10	Costa Rica
688	20,201	265	757	16	407				8	2,287			22	Guatemala
54	1,036	56	285					60	3	699				Honduras
34	734	55	111						30	4,464				Nicaragua
692	10,984	1,121	1,332	14	383			199	4	1,038				Panama
486	8,414	51	194	8	287									Salvador
1,993	42,730	4,080	12,346	24	643	22	36,695	9,883	37	10,150			10	Mexico
1	10													Newfoundland and Labrador
44	662	32	164											Barbados
778	10,701	542	1,020	42	1,250				1	75				Jamaica
559	8,570	806	1,760	310	9,478				3	800				Trinidad and Tobago
33	489	56	275	7	242				2	668				Other British West Indies
4,971	74,342	3,077	7,045	455	16,374			480	3	695				Cuba
42	683	34	78					1,511						Virgin Islands of U. S.
124	1,491	88	138										101	Dutch West Indies
175	2,151	32	53	2	44									French West Indies
272	3,458	500	965	2	98									Haiti
755	8,714	876	2,046	18	316			176	1	155				Dominican Republic
6,528	70,357	6,727	10,786	30	711	32	40,615	4,345					200	Argentina
78	1,876	145	476											Bolivia
1,688	22,076	332	1,246	16	400			81					1,325	Brazil
672	9,823	32	100	4	284			644						Chile
489	7,300	238	620	10	323	1	601							Colombia
41	787	270	699					305						Ecuador
74	776	20	58											British Guiana
50	787	56	144											Dutch Guiana
														French Guiana
														Paraguay
706	13,298	250	616	4	190			656						Peru
1,288	13,101	860	1,213			10	5,448				1	$5,000	10	Uruguay
1,118	17,287	981	2,070			2	12,778		1	394				Venezuela
														Asia
2	297							2,530						Aden
						10	12,744							Algeria and Tunis
									4	1,200				Armenia and Kurdistan
73	1,255	5	25			3	4,400							Ceylon
						2	1,393							China
						1	1,100							Kwantung, leased territory
530	7,469	104	192	162	8,285	3	3,306	115	8	2,034				Chosen
897	9,472	955	1,308	383	12,833			65						British India
									1	715				Straits Settlements
24	193					1	371							Other British East Indies
														Other Dutch East Indies
														French Indo China
														Hejaz, Arabia, Mesopotamia
1,030	15,255	60	145	199	3,431	1	1,096	321	90	26,100				Hongkong
1,072	10,920	1,178	2,546	36	1,084			309	3	434				Japan
1,160	8,719	209	521			4	2,314	49						Java and Madura
		20	52											Palestine and Syria
83	1,910	10	10											Persia
														Siam
1,788	29,406	737	4,907	23	1,339	6	2,541	1,191	240	69,523				Turkey in Asia
3,363	46,757	132	306	222	13,839			74	74	22,193				Australia
														New Zealand
														Other British Oceania
24	365													French Oceania
2,426	36,836	2,787	16,273	121	2,997			140	11	3,102				Other Oceania
														Philippine Islands
														Africa
753	21,690	844	2,742	24	889									British West Africa
4,209	79,638	116	359					352	3	818				British South Africa
98	1,162	161	330						2	624				British East Africa
188	2,277	449	621	20	726				1	300				Canary Islands
														French Africa
									10	1,480				Morocco
														Portuguese Africa
														Portuguese East Africa
								485						Egypt
$80,511	$1,148,616	48,935	$116,385	3,890	$147,599	382	$220,877	$98,902	1,010	$284,883	1	$5,000	$11,479	Total



Calcium Chloride Non-Freezing Solutions

Editor, AUTOMOTIVE INDUSTRIES:

I was particularly interested in your editorial entitled "The Year-Around Chassis" in the issue of Feb. 23, 1922, because it appeared so soon following the completion of a long series of tests for the purpose of developing a non-corrosive anti-freeze compound.

The investigation soon narrowed down to compounds in which calcium chloride was the principal ingredient. Other inorganic compounds do not produce the desired lowering of the freezing point; and substances such as alcohol, glycerine, kerosene and xylene were discarded on account of inflammability or high cost. The work was highly gratifying in that it developed a calcium chloride compound which had no corrosive action on steel, cast iron, copper, brass or solder, and but very slight action on pieces of brass and copper soldered together with a relatively large exposed area of solder.

In the course of this work, the compounds available on the market received comparative tests. While almost all of these compounds are put out by concerns of good repute, their corrosive action on soldered brass and copper was far from satisfactory. In every case the metal in close proximity to the solder, and particularly the solder itself, showed severe attack. Chemical analysis of the compounds seemed to indicate that their development must have been a "hit-or-miss" proposition, with no proper consideration for the factors involved.

The best commercial calcium chloride obtainable to-day in large quantities is slightly alkaline in action and contains about 1.5 per cent sodium chloride with less than 0.5 per cent of inert insoluble matter. It is well known that sodium, ammonium and magnesium salts present in calcium chloride brine will increase to a large degree the corrosive rate. Why, then, should one compound to-day on the market contain a sodium salt which reacts with calcium chloride to form an almost insoluble calcium compound with corresponding increase of the sodium chloride content? A test made adding the complementary radicle of the sodium salt combined with calcium instead of with sodium showed less than half the corrosion of the original.

The problem is essentially one of reducing not only chemical but electrolytic corrosion. The first depends on temperature, concentration and dissociation; the second, all of these, with the addition of the factor of electric conductivity. Since it may be assumed that the corrosive action of calcium chloride solutions is due to the concentration of chloride and hydroxyl ions, then the logical step is to add some substance which, without being harmful in itself, will decrease the dissociated portion or the *active* portion of the chloride and hydroxide present. In the case of the calcium compounds this is simple, but with sodium considerable study and tests are involved. A prepared sample of sodium-free calcium chloride, to which was added a substance which greatly decreased its dissociation, exhibited an almost inappreciable corrosion.

The factor of temperature is obviously not subject to control in the case of radiator compounds; and the concentration is fixed by the desired freezing point. The electric conductivity can be very much reduced, however, by the addition of organic agents which are well known to every electrochemist.

A point I wish to emphasize is the desirability of keeping the metal surface of the radiator free from films or deposits of insoluble matter. In this connection, one compound examined produced in a very short time a deposit which was nowhere less than .002 inch in thickness. From the thermal conductivity of the deposited substance, it was calculated that in a radiator made of .009-inch gage copper, the cooling efficiency would be reduced in the ratio of 80 to 1! A radiator is placed on a chassis for a definite purpose, and this purpose should never be forgotten. Protection of the radiator by coating the metal with an insoluble film is not logical and will not be successful.

To summarize, a calcium chloride compound for radiator use should contain ingredients: (1) To greatly reduce the dissociation of chloride and hydroxides, (2) to decrease as much as possible the electric conductivity of the solution, (3) which preferably form insoluble compounds (if any) with all the metals in question, but not with calcium, (4) which will not result in decreased cooling efficiency by deposits of scale or any insoluble matter, (5) which are not of such nature as to spoil perfectly good paint jobs in case the radiator is allowed to boil over, and finally, (6) the calcium chloride used should be of the highest quality commercially obtainable.

N. JULIEN THOMPSON,
Development Engineer, Stamford Rolling Mills Co.

Stability of Four-Wheel Drive Tractors

Editor, AUTOMOTIVE INDUSTRIES:

In your publication of March 9, 1922, in the second sentence on the article on page 554, I wish to call your attention to an error, as under the design of tractor indicated the tendency to rearing is not eliminated, it seems to me, for the reason that if the driving torque were sufficient to raise the front end of the tractor, such action would not relieve the torque from the back wheels because the front wheels are positively chained to the back ones, and if the front wheels were in the air they would merely be acting as a countershaft for the back ones and the tractor would be essentially a rear driving machine. I will be interested to know if your writer agrees with me in this understanding.

H. W. RILEY.

We agree that if the weight distribution in the four-wheel drive tractor is the same as that in the two-wheel drive tractor, the tendency to rear will be the same in both. But there is no reason why the weight distribution should be the same. We have a parallel case in the four-wheel drive truck, and it is well known that there is always much more weight on the front axle of such a truck than on that of a two-wheel drive truck of the same total weight.

In a rear wheel drive tractor, as only the weight on the rear wheels is effective in giving traction, designers place

as much of the weight as they dare on the rear axle. The small amount (about 10 per cent) remaining on the front wheels when the tractor is pulling a full load, is necessary for surety of steering under these conditions. The tendency to rear increases as the distance from the rear axle to the center of gravity decreases. In a rear wheel driven tractor the center of gravity must be kept close to the rear axle for the above reason, while in a four wheel drive tractor there is no such restriction on its location and it would be placed farther ahead. In such a tractor it is evidently desirable to have the front wheels carry considerably more than half of the total weight when the tractor is at rest.

With the same weight distribution there does not seem to be any difference in the tendency to rear as between a two wheel and a four wheel driven tractor. Let us consider the two wheel drive tractor. At the moment the front wheels leave the ground all of the weight originally on the front axle has been shifted to the rear axle. Now, torque on the front axle has exactly the same effect in transferring weight as torque on the rear axle. Evidently any less combined torque in the four wheel drive tractor than that which caused the rearing in the two wheel drive tractor would not move the machine, and as soon as the combined torque reached this value all of the weight would have been transferred to the rear axle and the tractor would rear.—EDITOR.

Positive Steering Mechanism for Track Laying Vehicles

Editor, AUTOMOTIVE INDUSTRIES:

Mr. Darnell, in the March 2 issue of AUTOMOTIVE INDUSTRIES, says he believes that the power required for handling the steering gear suggested by me in the Jan. 26 issue will be considerable, and that the speed of the steering worm for short turning will be inconveniently great.

I wish to say, that these suppositions are contradictory; furthermore, the only resistance in steering is constituted by the friction inside differential box 2, and the small secondary friction in the steering-gear train, caused by the primary steering friction inside differential box 2. It is an easy matter to calculate the steering resistance for a given machine, and it will then appear that this resistance compares very favorably with the power required for declutching and braking in present day "steering" mechanisms for track laying vehicles.

It is obvious that this eliminates the possibility of the speed of the steering worm for short turns being excessive.

It is quite unnecessary to use friction disks or any kind of "servomoteur," and the mechanism, therefore, not only *looks* very simple, but it *is* simple.

As I did not ask a patent for this construction, it may be used by any one.

H. C. OLIVIER, A.S.A.E.,
Holland.

Paint Standardization

Editor, AUTOMOTIVE INDUSTRIES:

Referring to your letter of March 17 outlining Mr. Franklin's idea of standardizing automobile painting materials, also your query as to what method of specification would be the best and most effective, chemical properties or physical properties:

It has been thoroughly demonstrated in the past that specifying chemical properties does not, by any means, insure a uniform varnish. This is due to the fact that no matter what raw materials are used, the quality and uniformity of the varnish is also dependent upon many other factors, such as temperature at which varnish is cooked, atmospheric conditions and the human factor.

Broadly speaking, any two varnish makers using the same formula and raw materials will produce two varnishes that will differ largely in physical characteristics.

The Government has recognized this fact, and their specifications as now issued, are based on a list of physical tests, which have been adopted after extensive experiments both by the Government's laboratory and the varnish manufacturers, both co-operating to obtain efficient and positive method of determining the quality of any varnish.

N. J. FAGAN,
Superintendent, Hildreth Varnish Co.

Paint Standards Desirable

Editor, AUTOMOTIVE INDUSTRIES:

The suggestion that the Society of Automotive Engineers take steps toward standardizing automobile painting materials and operations will doubtless be of value if properly followed out, with the co-operation of the manufacturers of these materials, although it will be a long time before definite standards can be laid down.

The first thing to be done, and the one which will take the longest time, is to establish as nearly uniform conditions of operation as possible, for all standardization of materials must be based upon operating conditions. Whether such uniformity can ever be satisfactorily attained is a question, for the factors affecting these operating conditions are so many that it will not be easy to control them in such a way as to bring about the introduction of uniform schedules. A commercial job of automobile finishing may be produced with a quality satisfactory in the minds of some, for a low priced car, with three coats of material, applied by flowing, while others consider that the only satisfactory finish requires ten or a dozen coats. Some plants are equipped for handling the majority of their materials by the spray process, while others have no such equipment. Some can bake; others must air dry. A further difficulty arises from the fact that necessary differences in pigment composition, due to the different colors demanded, cause differences in the working and drying properties of the japan colors or enamels used. The more one considers the complexity of the situation, the more stupendous the problem of standardization becomes.

With relation to the basis of standardization, we stand without question for a reference to physical properties, rather than to chemical formula. The production of finishing materials is an art which is in a state of constant improvement. New materials are becoming available, which in many cases are superior to those formerly used, and of these some are becoming extinct. The setting of a chemical formula standard would discourage further efforts at improvement, and would make it impossible for a manufacturer to supply a composition of different formula, which had been proved by thorough test to produce better results at lower cost than the one specified. On the other hand, if the standard established is based on the fulfillment of definite physical properties corresponding with what is actually required of the goods in use, improvement can readily be made.

More than one-half of the net success in use of any finishing material is due to its proper application and treatment in the hands of the user, and in issuing S.A.E. ratings, upon which a job shop could depend, this fact cannot be too strongly emphasized.

C. R. BRAGDON,
Chemical Director, The Ault & Wiborg Co., Varnish Works.

Methods More Important Than Figures in Marketing Plans

Correct basic statistics are essential to proper marketing plans. Difference in efficiency between the plans of various manufacturers, however, lies rather in the methods applied to the use of statistics than in variation in the statistics themselves. Relative efficiency of these methods discussed.

By Harry Tipper

THE individual manufacturer, considering carefully the methods to be used in his marketing of his product, finds it difficult to assure himself on many of the basic figures required for his operations. If the tendency of registrations is to be considered in estimating the probable future market, then the tendency must be calculated from accurate sources and the tendency determined from accurate methods of calculation. The same thing is true of production. The matter becomes a little more difficult when the study is extended to take in the conditions involved in the various territories and, consequently, the individual tendency of business in each territory in relation to any price group or any group of products.

The great difference in the efficiency of marketing plans, however, arises not so much from miscalculation based upon erroneous basic figures, but rather from the methods by which the market is to be reached and the variation in the efficiency of these methods.

The manufacturer may have a very excellent picture of the tendency of car registration, the tendency of car production, the condition of the business in the various territories, the growth of closed-car models, the relation between the new car and the used car in the market, and other items dealing with the general economic status. These are valuable, however, only as they point the way to accurate methods of reaching the market and maintaining it. This manufacturer may neglect the dealer, or put the weight of his pressure upon the wrong portions of the territory. He may put the extensive sales pressure or a competitive effect where the basic facts would indicate that this effort should be lessened, and, in fact, the success of his plan will depend almost entirely upon the way in which his basic facts are used to work out his plans in accordance with the things which they suggest.

In the last article which appeared in AUTOMOTIVE INDUSTRIES of March 23, the probable market for the manufacturer was indicated in an example given at the end of the article. This probable market was divided into the states by a further example and this article proposes to take up the matter from that point, showing how the manufacturer should use this information in relation to his plans of action.

The car manufacturers mentioned in March 23 article had a prospective market, arguing from past experiences, of a certain number of cars within their price group. The object in front of these manufacturers in making their marketing plans for the year is to accomplish this sale with the least cost per car and, at the same time, build the distributing elements into the skeleton of permanency as much as possible. Manufacturer "B" had a market probability of 2690 cars for 1923. His cars at present are being sold by five distributors through 250 dealers, mainly in the large cities and towns of 100,000 or over. Certain circumstances must enter into the plans at this stage in order to apply the basic figures of market differences to the particular case of this manufacturer's operations for 1923. So far the manufacturer has determined the following:

1. The percentage within his price group is four per cent. The total number of cars to be sold in his price group in 1923 is 72,000.
2. On the basis of a total new production of 1,800,000 for the whole industry.
3. Car manufacturer "B" has discovered that these figures, in comparison with his past activity, give him a market probability of 2690 cars.
4. Car manufacturer "B" has also figured each State in regard to its proportion of the 2690 cars and, consequently, whether the State is growing in activity or decreasing.

With this information before him, it is necessary for this car manufacturer to make certain decisions upon his sales work, his advertising work, his methods of distribution, etc. In order to do this, however, further information is necessary to bring these broad facts down to the unit of merchandising operation. The manufacturer must decide:

1. Whether he will continue to sell other distributors or deal direct with dealers.
2. What type of a dealer he desires to secure.
3. How he will lessen the mortality in his distribution.
4. What efforts he will make to maintain a full line of distribution, whether he will extend his present distributing area or intensify on the present area.

In order to make these decisions intelligently he must add to this accumulation of information a further knowledge on these points:

First—The relative efficiency of distributors and his own branches for his own particular business, considering its size and its position within the price group.

Second—The mortality in the dealer field, the number of changes to be expected in the functions of dealers, the number of new connections he must make in order to keep his distributing intact, the distribution of the car populations in his price group as between rural and urban, and as between large and small cities; the distribution of the dealer population available for his purposes, and the distribution of his present outlets in relation to the general field.

These facts are just as important to a reasonable development as the more general economic facts previously considered. They are not quite so easy to secure, however, and are subject to a larger degree of possible error than the registrations and production, all of which can be determined closely. The relative merits of distributors and branch representatives depend so much upon the personal equation in the particular considerations of an organization that there can be no standards of examination fitting the general situation closely enough to be of great value to the individual manufacturer.

Similarly, the number of dealers coming into and going out of the field within a year is variously estimated at figures so widely apart as to be useless unless they are further examined. Of course, the same thing is true as to the number of dealers in the field at any given time. Various sources of information will present figures so widely separated as to be useless unless they are verified by some establishment of standards or reasons.

The same difficulty surrounds all proper accumulation of information regarding the distribution of cars of any price group in town and cities of various sizes, and the relation between these elements of the business and the manufacturer's distribution. Discussions on these points will require, consequently, a larger development than is possible in this article, and most of these factors will be considered separately in succeeding articles so that they may be determined more definitely in their relation to the economic status in the field. It is possible, however, to consider the question of what is a dealer at this point as this question almost governs all the rest of the calculations to be made by the manufacturer if his marketing plans are to be properly based.

The automotive business, as we have pointed out in these articles, is the first industry for the manufacture of complicated machinery and the sale of it through dealers to the general public. Sewing machines, typewriters, washing machines, etc., are very simple in comparison and they do not run to the volume. As a consequence of this, the dealer is not retailing goods over the counter only. He is keeping the car running and doing a good many jobs required in that connection. A list of all the people who buy anything to resell in this business, who do service in any way, who repair or who buy at the dealer's discount, would run probably close to 150,000 but a large number of these could not be considered as dealers in any ordinary sense of the term as it is understood by the manufacturer securing distribution in this field.

The word "dealer" is a misnomer, anyway, as a term used to cover the multifarious activities required in keeping the car and the truck running on their way to the junk pile. These dealers should be classified and grouped into subdivisions before there is any real possibility of understanding their value, and some minimums should be set up which must be met before a man can be classified as a dealer so that the thousands of concerns who get a dealer's discount but buy only for themselves and thousands of others who sell a very limited number of accessories, etc., can be rightly placed and rightly estimated in any consideration of the matter.

Most of these should be eliminated entirely, and the list of dealers will be valuable to the manufacturer only as he knows:

First—What are the standards required to get on the list.

Second—How are the subdivisions arranged, and,

Third—What are the methods of keeping up with the changes.

When the number of dealers in this field is variously estimated at from 70,000 to 140,000, the basis for estimating offers no real security to the manufacturer unless he analyzes the list very definitely in relation to the basis so that their value to him may be determined carefully and thoroughly. The dealer establishment, as we conceive it, is an establishment devoted entirely to be the distribution and maintenance of automotive products at retail for the owners and buyers of such product. This dealer establishment must keep a stock and equipment, a place of business, a line of custom, and some kind of credit in order to be classified in this way.

In all the further analyses on planning for the market, the dealer will be determined from this standpoint, and any figures considered as to the number of dealers or the mortality among dealers will be based upon that standard requirement.

The Perpetual Inventory

THE perpetual inventory, or stores control system, is strongly urged by the Fabricated Production Department of the Chamber of Commerce of the United States as a better method in manufacturing establishments than the annual physical inventory, with its general disorganization and shutting down of the plant.

A practical pamphlet on the subject, which has just been issued under the title of "Perpetual Inventory or Stores Control," goes at length into the advantages of perpetual inventory and carries a series of illustrative forms. Doing away with the annual inventory of materials is only one of a number of benefits derived from the system as set forth by the department.

"The perpetual inventory test is an important link in a chain that makes less frequently necessary the burdensome and often inaccurate annual physical inventory. The annual physical inventory entails a general dislocation of plant and frequently a shut down lasting as long as three to seven days; and the results are not dependable. Hence the desirability of eliminating the annual physical inventory as far as possible.

"This is accomplished by independent checking of the material indicated as on hand on the perpetual inventory and bin tag records through a physical count of selected items of stores, and noting and correcting any discrepancies between stock actually on hand and the quantity shown by the bin tag and perpetual inventory records. These inventory tests are made periodically and systematically, preferably at times when the material selected is lowest, and the attempt is made to cover each item of supply at least once a year and important items oftener. It is possible by these tests, as supplementary to the bin tag and perpetual inventory records, to secure an accurate count of material without the burdensome annual inventory."

Copies of the pamphlet may be had in limited quantities free of charge from the Chamber of Commerce of the United States, Mills Building, Washington, D. C.

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THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
David Beecroft, Directing Editor
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
Norman G. Shidle, Managing Editor
P. M. Heldt, Engineering Editor
Herbert Chase

DETROIT OFFICE
J. Edward Schipper

WASHINGTON OFFICE
816 Fifteenth St., N. W.

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—317 Fort Street, West, Phone Main 1351
Cleveland—538-540 Guardian Bldg., Phone Main 6432
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Aviation Control Necessary

NOTHING more seriously demonstrates the necessity for Federal control of civil aviation than the hydroairplane accident on the route from Miami, Fla., to Bimini recently when five passengers were drowned due to breaking of a propeller when perhaps not 10 miles from land. The plane was operated by a pilot who presumably owned the plane and operated it as an aerial jitney. It was a single engine plane and he did not carry a mechanic and apparently had no signal system, such as is used by day or night. It is reported that a storm was predicted and the pilot should not have started on the 45-mile hop from Miami to Bimini.

The Aeromarine Airways, which operates a hydroairplane service from Miami to Bimini 45 miles and Nassau 187 miles and Havana 250 miles, and also from Key West to Havana 100 miles, uses two engines on each of its boats with capacity for 11 passengers, carries two pilots and two mechanics. They are equipped with distress signals for day or night and never leave on any trip without a weather report from the point of destination. The Aeromarine had 30 boats in service and since its start two years ago has never lost a passenger. It uses single-engine planes for sightseeing along the Florida coast, but not for cross-sea hops.

Aerial navigation should be regulated so that passengers are assured every protection by way of all safeguards that marine or land navigation calls for. A few accidents such as the recent one will work serious injury to the development of aerial transport. Accidents will give the plane a set-back similar to that suffered by airships due to the Roma and Z R 2 disasters.

Cooperation

THE proprietors of a suburban garage were asked whether they did not contemplate taking the agency for a car. They replied, "We inherited the agency for the Sennett when we took over the garage. We sold several, but the manufacturer maintained the position that as soon as we took the cars off his hands he was through with them and, as a result, servicing the cars as they had to be serviced the first few months ate up all the selling profit and we discontinued the agency."

Something is dead wrong. These brothers are usually well educated, keen men. They have made a reputation for themselves in the community for being honest automobile men, and as a result have secured a fast growing, stable clientèle. The car which they handled was a well-known low-priced one which would sell well in that locality, but the sales are all going to a competitor who backs his dealer.

If manufacturers will not realize the responsibility that retailing a car through a dealer entails he can never hope to have the loyal dealer organization so essential to success. When dealers understand the fundamental value of service they should be given every incentive to practice what they believe. It is only by such procedure that the manufacturer is going to attain the permanency of market which is so valuable.

The Cart Before the Horse

THE adjustment of sales quotas to absorb a predetermined production program has always been a more or less hit-or-miss proposition. It may be likened to putting the cart before the horse. The results secured are similarly awkward and equally uncertain. Both impede steady movement.

From time to time articles have appeared, and will continue to appear, in AUTOMOTIVE INDUSTRIES giving facts which show how essential it is to know the market and plan production accordingly. In these articles, manufacturers are given the benefits of research on a comparatively unknown subject, that of distribution with relation to production.

Until recently it has not been necessary to adjust production to market possibilities. As long as production was only limited by the ability to produce the common method was adequate. Recently the horse has slipped around behind the cart without our full

appreciation of the fact. It becomes vitally important to forget the method which places production as the prime factor and adjust the latter according to the market consumption.

Diesel Engine Development

CONSIDERABLE interest has been aroused in automotive circles by the work done by Sperry and others in attempting to reduce the weight of Diesel engines and to adopt them to construction in smaller units. When the Hvid engine appeared on the market some years ago it was felt that the Diesel principle had reached a state of development such that its introduction for automotive purposes was imminent, and the frequency of discussions on Diesel engines before the S. A. E. in recent years lends support to this view. But the distance from even the submarine type of engine—undoubtedly the most refined and developed up to the period of the war—to a practical road vehicle engine is a long one, and it will no doubt take a good many years more before the Diesel type of automotive engine is applied commercially to any large extent. Nevertheless, automotive engineers are keenly interested in any progress in the movement to make these engines lighter and more flexible.

It is natural that, since the Diesel engine is now being successfully used for marine propulsion, any smaller and lighter types developed should see their first application to motor boat work. In the marine field high operating speeds and consequent light weight are not so essential as in the automobile line, and lack of flexibility is not such a serious handicap. In this particular field, moreover, there seems to be a demand for engines of all outputs from those of several thousand horsepower down to the small outboard motors used on rowboats, and the size of the engine can be reduced step by step and the manufacturer be assured of a market for any size he may put out if it is otherwise of merit and can meet competitive prices.

Showing pictures of simple Diesel engines of low speed alongside of compound engine and claiming the difference in weight and bulk to be due to the compounding, may, however, give a wrong impression. One can imagine the compounding of an automobile type of Otto engine and then comparing it with a simple Otto engine. These engines are being built in small output, stationary types weighing several hundred pounds per horsepower, while simple Otto engines for aircraft work have been built weighing less than 2 lb. per hp. It will thus be seen that there are other factors influencing the weight—and incidentally the bulk—of internal combustion engines besides the splitting up of the expansion between two cylinders.

During the war a great deal of experience with Diesel engines was gained in all the large industrial countries, and it is little wonder that the firms engaged in this line of work are now seeking to enlarge the field of usefulness of that engine. Peculiarly enough, the Diesel engine seems to be limited as to size at both ends of the scale. It has been found that when a certain size of cylinder is reached further increase is practically impossible because of the difficulty of maintaining the working parts at suitable temperatures. At the lower end of the scale it is rather the comparatively high weight in proportion to output that is holding back further commercial development. That these limitations are gradually being overcome is shown by the results of Sperry's work and is also indicated by a report to the effect that a well-known British engineering firm is building a Diesel engine to weigh not over 5½ lb. per hp.

Distributors and Factory Branches

INVESTIGATION does not bear out the rumor, recently current, that many manufacturers are intent upon the elimination of the distributor and the installation of factory branches. While a certain number of factory branches are operated by manufacturers, there is no real tendency to operate entirely on this basis. Whatever trend there is appears to be in the opposite direction.

The composite opinion of about ten representative companies on this subject may be summarized about as follows: "We have no intention whatever of eliminating distributors and of substituting factory branches. In certain cases it may be impossible to obtain suitable representation in a given territory and a factory branch may be necessary. This is a matter of self-defense, however, rather than of desire to eliminate the distributor. We will never disturb a good distributor."

Certain factors of cost are sometimes neglected in discussing the relative economic merits of the two plans. The advantage of the initiative and ability of the man in business for himself as opposed to the man on salary, for example, has an important bearing.

Tribute

THE following sentences which appeared in a recent copy of a London newspaper may well be given a few moments' notice by American manufacturers:

"Motorists have a good deal for which to thank the American car manufacturer. For instance, the importation of transatlantic cars in relatively large numbers in recent years has had a marked effect on the value which our producers are offering to the motorist. Another lesson to which we would do well to pay careful attention is the interchangeability of parts in American cars and their supply, together with general chassis accessibility. Much improvement has recently been made here."

The feeling of self-satisfaction which may be enjoyed will probably be followed by a realization that the British manufacturer is also reducing prices and that the appreciation of our engineering features is likely to result in pursuit along the same lines. In other words, competition is going to be met more and more. Continued success of the American low-priced car in the export field means that we must always keep two jumps ahead.

March Biggest Month in Two Years

Carload Shipments Approximate 25,000

This Mark Has Been Equalled Only Three Times in Last 26 Months

NEW YORK, April 4—March was the best month the automotive industry has had since March, 1920.

Ford output was well over 70,000 and practically all other large producers turned out more motor vehicles than in any 30-day period in a year and a half.

This applies to all branches of the industry — passenger cars, trucks, tractors and parts. Passenger car output for the first quarter ran far ahead of the same period in 1921. The first quarter of 1920 was the largest the industry ever had. Truck production in the first three months of this year gained even more in comparison with the opening quarter of 1921.

Parts Sales Big

Sales of parts manufacturers in March were as large as in any month of 1921 and probably larger. The February total showed an increase of more than 100 per cent over the same month last year and was larger than in March of last year, which showed an increase of 93 per cent over February. A gain of only about 20 per cent for March of this year over the preceding month would put parts sales on a level with the banner month of last year. There is little doubt that an even larger increase will be shown.

Carload shipments of automobiles and trucks by all makers in March approximated 25,000. There have been only three months in the past 26 which have equalled this record. They were January 1920 with 25,057; February 1920 with 25,505 and March 1920 with 29,326. While the carload shipments in January and February 1920 were little larger than in March 1922, the number of driveaways was much larger. The comparison follows: March 1922, 15,800; January 1920, 29,283; February, 43,719; March, 57,273.

Carload shipments of automobiles and trucks in February numbered 19,600. The only months in a year and a half which have exceeded this figure were September, 1920, with 20,804; April, 1921, with 20,187; June, 1921, with 20,269; August, 1921, with 20,350, and September, 1921, with 20,150.

(Continued on page 789)

Business in Brief

NEW YORK, April 4. — Steel production continues to increase. Present rate of ingot production is somewhat above the levels of 1912 and 1913, the best pre-war years.

General freight tonnage carried by the railroads continues to increase, but the coal strike will bring about a sharp curtailment in the total tonnage carried. Car loadings for the week ending March 18 were 823,369, compared with 691,396 for the same week in 1921, and 855,060 for the corresponding week of 1920.

Railroads have released orders for 8,000 cars.

A return of 4½ per cent on the estimated valuation of Class 1 railroads is indicated by returns of 170 carriers for the month of February.

General indifference to the coal strike is still manifested in all industries.

Building operations, which already had approached record proportions, are increasing with the coming of spring.

Bank clearings for the week ending March 30 aggregated $6,156,364,000, a loss of 9.6 per cent from the previous week, but a gain of 20.9 per cent over the same week last year.

Stocks are buoyant, bonds higher and money and exchange steady.

Marked improvement in the condition of the agricultural industry and a better outlook for business generally are indicated in April 1 reports received by the War Finance Corp. from all parts of the country. Live stock growers and farmers are much more confident.

Strong demand for cattle has developed. Sheep and lamb markets continue strong.

Meat stocks in cold storage are unusually small.

Cash wheat and corn markets continue strong.

Cotton market remains quiet with a slight drop in prices.

Wool and textile markets are quiet.

Unemployment is decreasing in the Middle West, and farmers are absorbing considerable surplus labor.

April Schedules Call for General Increase

Detroit Hopes to Exceed March Production Figures by One-Third

DETROIT, April 3 — Tentative April production schedules in Detroit motor vehicle factories call for a general increase over all recent months, and the March figures will be exceeded about one-third in practically every plant. The new Jewett and the new Columbia will be in quantity production for the first time.

One or two additional models in existing lines are scheduled to be brought out, Buick being ready to present a new sport phaeton accompanying its sport roadster first exhibited at the New York show and Liberty having a new roadster which will follow the lines of its new phaeton and which will sell at the same price.

Jewett will turn out about 1200 phaetons, which with 1800 Paiges scheduled will give that factory an April total of 3000. In March 250 Jewetts and 1750 Paiges were shipped. Columbia will build 500 of the new line in April and about 700 of the former models.

Ford will put over its first hundred thousand month of 1922 in April, the March total for all plants, domestic and foreign, running about 70,000. There is a pressing demand for inclosed cars, the Ford company declares, and orders on them are 30 days ahead of possible output.

Dodge Brothers will continue on a capacity basis of 550 cars daily and is also far behind on inclosed cars. To speed up production, the company is reported to have discouraged the sale of inclosed cars for the next two months to permit it to reach highest production on the open models.

Hudson-Essex, with a total production in March of about 5000, will increase this in April to a point that will give the company the largest April in its history.

Maxwell will build 250 cars daily in April, increasing from the approximate 200 daily schedule in March. Chalmers, in March has been speeded up to a point schedule materially higher for April than for recent months.

Studebaker will build 11,000 cars in April and has scheduled the balance of the summer on that basis. Production in the face of a price increase, reports a which gives the company 440 a day going into April.

(Continued on page 788)

All Recent Records Shattered

Factories in Flint Show Big Gain Made

Output for Months of First Quarter Leaps Far Above Last Year's

FLINT, MICH., April 4—Proof that the automobile industry is in a much healthier state than it was this time last year, and that its chances for improvement are good is evident from the statements of motor car company heads and the heads of allied plants.

"Our business for Feb., 1922, was 242 per cent greater than that of February last year," said H. H. Bassett, president and general manager of the Buick Motor Car Co. "March production was double that of last March, and there is every indication that our business will be better than the calendar year of 1921."

Chevrolet on Night Shift

Chevrolet Motor Car Co. has a schedule of close to 10,000 cars for April delivery, and last week started a night shift for the first time in several months. Nine hundred axles are now being turned out per day, and a production of 800 motors per day is the goal.

The Dort Motor Car Co. states that January showed an increase in production of 336 per cent as compared with Jan., 1921. February showed an increase of 150 per cent over January, and March made an equal gain over February.

Announcement has been made that the plant of the Flint Motor Axle Co. will soon be running on full time. The plant has been on a limited schedule for several months.

According to a statement made before a Chamber of Commerce group by John Edgerly, general manager, business for the Flint Varnish & Color Works, 95 per cent of whose output goes to motor car manufacturers, has improved 75 per cent.

Walter Heginbottom of the Marvel Carbureter Company reported good business conditions in the sales field for his company.

The Stewart Body Co. this week requested all of its mill employees to report for work.

Spark Plug Business Grows

Since January 1 the business of the A. C. Spark Plug Co., which before April 1 was known as the Champion Ignition Co., has steadily increased, according to B. de Guichard, assistant general manager. "This has been true both of shipments to jobbers and to manufacturers for original equipment," he said. "Business is more than double what it was this time last year."

Albert C. Champion is at present on a trip in Europe, and one of his duties is to perfect the organization of the A. C. factory being started in Birmingham, England. It is probable that a branch factory will be started in Paris, France, in the near future.

Highway Legislation Now Before Congress Embodies Ideas of Automotive Industry

By Roy D. Chapin

President of the Hudson Motor Car Co. and Chairman of the Highways Committee of the National Automobile Chamber of Commerce

DETROIT, April 3.

PASSAGE by the United States Senate of a highways appropriation bill fixing allotments of $50,000,000 for the fiscal year of 1923, $65,000,000 for 1924 and $75,000,000 for 1925, meets with the approval of the highway committee of the National Automobile Chamber of Commerce, and if accepted by the House will mark an important forward step in the development of a national system of highways.

It has been our earnest effort for several years to obtain the enactment of legislation which would guarantee to the States of the Union the continuance of Federal aid in the construction of highways over a period of years. In this present bill we have been successful.

To insure favorable action by Congress on the measure it devolves upon each and everyone in the industry to indicate his interest in the subject to his individual Congressional representative. Letters urging the early passage of the bill should go forward at once.

The steady growth of the highway system of the United States is a most important factor in the advance of the automobile industry. Federal participation in the highway plans and the assurance of it for future years is a vital force in stimulating the individual States to action.

Rolls-Royce Adds 200 Men to Machining Department

SPRINGFIELD, MASS., April 3—Rolls-Royce, Inc., is adding 200 men to its machining department this week. Increased production is also reported in bodies for the chassis. This expansion comes as the result of recent gains in sales and the improved prospects for spring and summer business.

Particularly worthy of note is the recent increase of business reported in the Chicago district, indicating that the North Central States are making a recovery from the agricultural depression that for months has retarded business.

Export Trade Picking Up, Wichita President Says

WICHITA FALLS, TEXAS, April 1.—Inquiries for trucks are greater than at any time since 1919 and export business is picking up, according to J. G. Culberson, president of the Wichita Truck Co. Culberson states that the plant is now turning out more than 60 trucks a month and that he expects soon to increase the output to the capacity of the plant, which is about 400 a month.

The company is doing business in half the States of the nation and is making shipments to several foreign countries.

Trucks Make Steady Strides to Recovery

Establish Gains Through Lighter Vehicles—Releases on Parts Increasing

DETROIT, March 29—The truck industry is making steady strides toward recovery and is coming back principally through the medium of the lighter vehicles. Every month this year has seen increased releases to the parts makers, March business doubling February, and April releases, already indicated, will double March.

Most of the releases are for parts for 1½-ton vehicles. There is considerable business in 2 to 3-ton sizes, but after three the business is light. For the present the heavy-duty truck has entirely given way before its lighter brethren.

Explanations for the buying of lighter trucks give it as an indication of a return of general business, but on a lighter basis than formerly and requiring more frequent deliveries of smaller shipments. It is also declared that many truck buyers, unable to finance the purchase of a heavy truck now, are using the lighter trucks temporarily.

All of the specialized unit truck builders are declared to be getting a volume of business, the amount depending largely upon their merchandising methods and the character of the clientele in which they specialize.

Nash Contract Has Price Cut Clause

Gives Dealers Six Months' Protection—Not to Be Rewritten Each Year

KENOSHA, WIS., April 3—A dealer contract which does not have to be rewritten each year, but holds good as long as the relationship between the factory and the dealer is mutually satisfactory and which gives dealers six months' protection on price reductions has been adopted by the Nash Motors Co.

Regarding the new contract, which is expected to be ready for distribution within a short time, Nash Motors to-day made the following statement:

The contract, once written, is continuous in the sense that it does not have to be rewritten each year, but holds good as long as the business relationship it cements is mutually satisfactory to the factory and the dealer.

The thought of the Nash Motors Co. behind this clause is that it wishes the Nash dealer to feel the permanency of his relationship with the factory and that he may retain this valuable franchise as long as he continues to give the Nash company satisfactory representation.

The second important feature of the new Nash contract is that the dealer is given protection on all current models of new Nash cars that he may have on hand and which may have been shipped him from the factory during a period of six months immediately prior to the announcement of any price reduction by the factory.

Saxon Leases Quarters in Ypsilanti Factory

DETROIT, April 3—The Saxon Motor Car Corp. has decided to remove its plant to Ypsilanti, where it has leased quarters in an automobile manufacturing factory already established. The company owns no real estate in Detroit and has rented the property it occupies here.

The Saxon company has requested its creditors to grant an extension of time on their claims. It believes that if this relief is granted, it will be able to extricate itself from its present difficulties. The plan proposed will not be put into operation unless 80 per cent of the creditors consent.

Protesting Methods Used, A. A. A. Secretary Resigns

WASHINGTON, April 1.—Resigning as secretary of the American Automobile Association and as editor of the "American Motorist," as a protest against the new methods of obtaining membership in the Washington district, the action of William Ullman has provoked widespread discussion in the automobile trade, especially among car dealers and owners.

Ullman has been prominently identified with organization work of A. A. A. for a number of years.

Simultaneously with his resignation several prominent individuals connected with the local division of the A. A. A. likewise severed their connection.

According to the statement issued by Ullman, his resignation was due to the employment of professional membership promoters by the A. A. A., under a contract signed by George C. Diehl, national president. Ullman said that the management of the local district division was removed from control of the advisory board and placed in the hands of professional promoters and the annual dues increased from $5 to $10. He claimed that hundreds of protests were received as to the methods used by the promoters against the increase of membership dues.

Denial that the organization was being commercialized has been made in a formal statement by Diehl. He contends that the increase in dues which Ullman protested was made to put the District of Columbia on an equality with other clubs which pay the $10 rate. Diehl insisted that it was a legitimate campaign which had been authorized.

A. E. A. Committee Works Toward Uniform Practice

CHICAGO, April 1.—The Standardization Committee of the Automotive Equipment Association met last week at Cleveland and adopted recommendations concerning 109 items of automotive equipment. The recommendations have to do with packing, marking and the elimination of sizes and types. The purpose of the committee is to endeavor to establish uniform practices among manufacturers as to sizes and types and methods of packing and marking. The elimination of unnecessary sizes and types is expected to result in considerable saving to makers and dealers.

The committee is now at work on the preparation of a handbook in which the recommendations it has adopted will be listed. The book also will contain extracts from the recommendations of the Society of Automotive Engineers. It will be a loose leaf book and additional sheets will be published as new recommendations are made.

KERN TO MAKE STATEMENT

WASHINGTON, April 3—The Alien Property Custodian announces that investigation of the sale of the Bosch-Magneto Co. to Martin E. Kern of Allentown, Pa., is still far from complete. Upon his return from Europe, Kern came immediately to Washington for a conference with officials of the department. He has stated that he soon will issue a statement of his case.

RECEIVER FOR LEASE MOTORS

NEW YORK, April 3—A petition in bankruptcy has been filed against the Lease Motors Co., Inc., manufacturers of motor trucks at Long Island City. The liabilities are said to exceed $75,000 and the assets, $50,000. The petitioning creditors have claims aggregating $1,600. Judge Knox has named Ely Newmann receiver.

Holders of Chalmers Notes Form Committee

Company Defaults in Payment of Interest—No Bearing on Maxwell Finances

NEW YORK, April 3—A committee to protect the interests of note holders of the Chalmers Motor Corp. has been formed here as the result of the default by the company in the payment of $94,000 interest due April 1 on $3,150,000 first mortgage, 6 per cent gold notes. The committee is headed by M. N. Buckner, chairman of the board of the New York Trust Co., with Alfred A. Cook as counsel. The other members are Philemon Dickinson of C. D. Barney & Co. and Martin F. Stern of J. S. Bache & Co.

It is stated by the committee that in its judgment "it is imperative that prompt and concerted action be taken by the note holders for their protection and that the notes should be deposited immediately." In order to participate in the benefits of the protective agreement, holders of notes must deposit them on or before April 20 with the New York Trust Co.

Maxwell Merely Stockholder

Walter P. Chrysler, chairman of the board of the Maxwell Motor Corp., stated to-day that he had no statement to make at this time in reference to the default on the Chalmers notes. It is asserted, however, that it has no direct bearing on the Maxwell finances, as the latter company simply occupies the position of stockholder and creditor toward the Chalmers company, having no liability for Chalmers notes or accounts.

When the reorganization plan to effect a merger of the Maxwell Motor Co., Inc., and the Chalmers Motor Corp. was declared effective, the first mortgage Chalmers notes were left undisturbed by the plan. The Maxwell Motor Corp., which was incorporated in West Virginia a year ago, owns more than 95 per cent of the capital stock of the Chalmers corporation. The Chalmers first mortgage notes, which are dated Sept. 1, 1917, were issued to provide $3,000,000 in cash to be used by the Maxwell Motor Co., Inc., under the terms of its lease of the Chalmers plant. They constituted a first lien on the real estate, buildings, plants and other assets formerly leased by the Maxwell Motor Co., Inc., and now a part of the property of the Maxwell Motor Corp.

Officers of the Maxwell corporation assert that its financial position is extremely strong. This is reflected in its ratio of quick assets to demand liabilities which are between six and seven to one. It is expected that capacity production will be approached in the next few months.

Aim Is Constructive Action

DETROIT, April 5—B. E. Hutchinson, vice-president and treasurer of both the Maxwell and Chalmers corporations, said

(*Continued on page* 791)

Stewart-Warner Wins Another Patent Suit

Decree Concerning Vacuum Feed Tanks Issued Against Ireland & Matthews

DETROIT, April 3—The application of the Stewart-Warner Speedometer Corp. for an injunction to prohibit the manufacture and distribution of vacuum gasoline feed tanks by Ireland & Matthews Manufacturing Co. of this city has been granted by Judge Tuttle in Federal Court here. The decree also ordered the Ireland & Matthews company to render an accounting to the Stewart-Warner company on account of infringement of the latter's patents.

It was held by the court that the Webb Jay patents covering the vacuum gasoline feed system, owned by the Stewart-Warner company, were infringed by the Weinberg tank, which was the type manufactured by Ireland & Matthews. Stewart-Warner has won a number of other similar suits against other manufacturers.

Opinion of Court

The interlocutory decree entered by Judge Tuttle is as follows:

1. That United States letters patent No. 1,132,273, granted to Webb Jay, dated March 16, 1915, for improvement in fuel feeding devices for internal combustion engines are good and valid letters patent as to claims nine and fourteen thereof.

2. That the complainant, Stewart-Warner Speedometer Corp., possesses the full right to said invention as covered by said patent No. 1,132,273, by virtue of an exclusive license thereunder from the complainant, Webb Jay, that the complainant Webb Jay is the owner, subject to said exclusive license, of the whole right, title and interest in and to said patent 1,132,273.

3. That the defendant, Ireland & Matthews Mfg. Co., has, by making, selling and using devices substantially such as shown in said United States patent 1,132,273, infringed claims 9 and 14 of said patent and has violated the exclusive rights of the complainant thereunder.

4. That the complainant recover of the said defendant all the gains and profits made by it and all the damage sustained by said complainant by reason of said infringement by said defendant of said claims 9 and 14 of said patent 1,132,273; that said cost be referred to William S. Sayres, Jr., having experience and special fitness in matters of accounting, residing in Detroit, Mich., as master pro hoc vice to ascertain and report to the court the number of said infringing devices made, used or sold by said defendant since said March 16, 1915, from infringing the said exclusive rights of said complainant by the manufacture, use or sale of devices infringing said claims 9 and 14 of said United States patent 1,132,273 and also the damages which the complainants have suffered by reason of said infringement.

5. It is further adjudged, ordered and decreed that a writ of injunction in accordance with the prayer of the bill of complaint herein be issued by, from and under the seal of this court perpetually restraining and enjoining the defendant, its agents, employees, servants, workmen and all others acting under or by its authority, from any further acts infringing the said claims 9 and 14 on said patent 1,132,273.

6. That the complainant upon said accounting aforesaid have the right to cause an examination of the said defendant or its employees or any of them and also to examine the account books, vouchers and documents of the defendant for the purpose of ascertaining the character and amount of such infringements and that the defendant and its employees and all other persons having custody of such account books, vouchers and documents of the defendant attend for this purpose before the said Master in Chancery at such time as said Master in Chancery shall direct.

7. That said complainants recover of the defendant their costs, charges and disbursements in this suit to be taxed.

GOVERNMENT TO FILM STORY OF PRODUCTION

WASHINGTON, April 6—Plans have been completed for the production of a motion picture film to be called "The Story of an Automobile," produced under the direction of the Automotive Division, Department of Commerce. It is part of their plan to interest the public in production methods. It has been announced that the work of filming the various processes will be started April 18.

Arrangements have been made with Dodge Brothers to show the complete methods of manufacture of an automobile from the new material to the finished product, and will bring out in a clear way the efficient methods used in this connection, as well as present in a graphic way the welfare work being carried on in the industry. No pictures will be released without complete approval of Government officials, and every effort will be made to give wide circulation to the films.

This line of endeavor on the part of the Automotive Division is in keeping with the policy of Secretary Herbert Hoover of placing every resource of the Government at the command of the automotive industry to promote the export trade and maintain the supremacy of American automotive products in the markets of the world.

Bassick Company Moves to New Chicago Plant

CHICAGO, April 3. — The Bassick Manufacturing Co., manufacturer of the Alemite lubricant system for automobiles, has moved to its new plant at 2630 North Crawford Avenue. The new plant has 70,000 square feet of floor space. It is one story high and of sawtooth construction, and so designed that artificial light will rarely be necessary. The ground area covers about 160,000 square feet, which allows for expansion.

The officials of the company state that there is an increased demand for their product and that 300 automobile dealers are using their equipment.

Reynolds Spring Co. Enters Radio Field

Accepts $5,000,000 Contract to Make Apparatus for New York Concern

DETROIT, March 31—Reynolds Spring Co., one of the largest manufacturers of automobile cushion springs in the industry, has accepted a contract from the DeForest Radio Telephone & Telegraph Co., New York, for the manufacture of its radio apparatus and parts over a period of ten years. An initial order approximating $5,000,000 will be shipped between April 1 and Dec. 31, 1922.

To manufacture the radio apparatus the company will employ its former plant in East Avenue, Jackson. Manufacture of its automobile springs was transferred recently to a new plant in Water Street, that city. The manufacture of the two differing lines will thus be kept entirely separate.

Announcement of the company's new activity was contained in a letter sent by President Wiley R. Reynolds to stockholders, in which he expressed the belief that the radio business will make rapid strides. No new financing will be necessary to enable the company to proceed with its radio business.

A license for the manufacture of bakelite has been obtained from the General Bakelite Co., New York, under which the company will begin the manufacture of new parts for the automobile industry as well as for radiophone purposes. The bakelite products will be marketed through a separate selling organization. From 300 to 500 employees will be added.

Trade Bodies to Discuss Exports with Gordon Lee

NEW YORK, April 3—A meeting of the export committees of all the automotive trade associations has been called for April 13 at Washington by Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce. The purpose of the conference will be to exchange ideas on how best to promote sales abroad of American-made automotive products. The advisability of holding periodical meetings of export managers at Washington also will be considered.

The organizations which have been invited to send representatives to the meeting include the National Automobile Chamber of Commerce, The Motor and Accessory Manufacturers Association, the Society of Automotive Engineers, the Motorcycle and Allied Trades Association, the Aeronautical Chamber of Commerce, the National Association of Motor and Engine Manufacturers, the National Association of Motor Truck Industries, the Association of Automotive Equipment Manufacturers and the Class Journal Co.

International 1921 Profit, $4,149,000

Was Derived Entirely from Foreign Trade—Gross Sales Declined

CHICAGO, April 3—The International Harvester Co. for 1921 reports gross sales of $121,215,000, a reduction of 46 per cent from the total for 1920. The net profit for the year was $4,149,000, compared with $16,655,300 the year before. The business done in this country produced no profit, says the report, the profit shown having been derived entirely from the company's foreign trade.

The net profits for the year fell far short of dividend requirements, which called for cash payments of $4,215,673 on the preferred stock, $5,112,786 on the common stock, and $3,645,414 for stock dividends. These amounts, less the profits reported, were charged to the profit and loss surplus, which reduced the account to $59,526,787 at the close of 1921, compared with $68,350,741 at the end of 1920.

Current assets were listed in the balance sheet at $179,554,282 and current liabilities at $27,507,540, leaving net working capital of $152,046,742. The assets included: Inventories, $114,085,765; accounts receivable, $56,283,380; investments, $823,484, and cash, $8,361,651.

Harold F. McCormick, president of the company, in his remarks to stockholders, said that the year 1921 was the "worst in the history of the agricultural implement business." Continuing, he stated:

Shipments to Russia

Notwithstanding the conditions adverse to foreign trade, the volume of the company's business abroad in 1921 compared much more favorably with 1920 than did the business in the United States. During the year the company sent machines to Russia, receiving the entire purchase price of approximately $1,600,000 in United States money. This is the first transaction of this kind in some years. Substantial shipments were made to Poland, credit being granted for part of the purchase price under guaranty of the Polish Government.

Representatives of the company visited the works at Lubertzy, near Moscow, Russia, during the fall of 1921. The Russian works have not been nationalized and have been continuously under the management of the company's employees. The property is reported to be in excellent condition. Agricultural machinery is being manufactured there and distributed to the Russian trade.

McCormick in his remarks in general said that the "rapid and severe decline during that period in the price of practically all farm products greatly diminished the purchasing power of the farmer and had a depressing effect upon the implement business, which is dependent for its success upon the prosperity of its ultimate customer—the farmer."

Company Returns to Kentucky

LOUISVILLE, March 30—The return of the International Harvester Co. to Kentucky will be marked by the opening of bids on the new office and warehouse building, to be erected here. The company moved its Louisville plant to New Albany about eleven years ago, following the enactment by the Kentucky Legislature of several anti-trust laws. Since then, however, the laws have been modified or repealed, and the officials of the company were induced to bring the plant back to Louisville.

J. L. Gardner, general manager of the New Albany factory, states that the cost of the building is uncertain. It will have a frontage of 174 ft. and will be four stories high. The floor space will amount to 70,000 sq. ft.

$250,000 Back Royalties Awarded to Inventor

MINNEAPOLIS, April 3.—R. B. Hartsough of Minneapolis has been awarded more than $250,000 in back royalties and interest on the "Happy Farmer" tractor, in a suit begun in 1919 in the Federal court for western Wisconsin and carried through to the Circuit Court of Appeals for the Seventh District, sitting in Chicago. The suit was brought against Albert Hirschheimer, of La Crosse, and others.

He claimed to have designed the tractor and to have built it in small quantities prior to 1915, when he entered into agreement with the defendant whereby the latter received the manufacturing privilege and was to pay Hartsough on the basis of 3 per cent on the retail selling price of each machine. It was alleged that Hartsough was induced in 1916 to cancel his contract, following which Hirschheimer reorganized the company and resumed manufacture as the La Crosse Tractor Co. The contract is restored and the cancellation set aside by the court action.

Charge of Auto Stores' Head Not Sustained

PHILADELPHIA, April 3—Albert E. Williamson, Boston, and Adolph Maymayer, Brooklyn, whom Edward B. P. Carrier, president of the bankrupt United Auto Stores, Inc., had arrested for alleged conspiracy to wreck the concern, have been discharged by a magistrate.

The former head of the Auto Stores charged that Williamson, whom he had brought in to reorganize the United Guaranty Corp., the stock-selling agency for the Auto Stores, and Maymayer, who had been head of the sales force, had thrown the business into a receivership for their own gain. After reviewing the testimony, the magistrate asserted that he found no grounds for holding Williamson and Maymayer.

SANCTIONS AUSTIN PLAN

LONDON, March 17 (*By Mail*)—The High Court has formally sanctioned the plan of the creditors of the Austin Co. for the continuance of the business on approved terms. The effect of this decision is to close the protracted litigation affecting the company, to affirm that, in the court's opinion, the company can carry on its business at a profit and to leave it free to do so. The company is reported to be making a fair net profit, the new "Twelve" model having proved a great success.

Translates Balance Sheet for Dealers

Hart-Parr Co. Sets Out Facts So They Can Be Understood Readily

CHARLES CITY, IOWA, March 31—The Hart-Parr Co. has made a departure from the usual method of handling annual financial statements and has translated it into the simplest terms, so that it can be understood readily by distributors and dealers to whom it has been sent.

The balance sheet, as it has been prepared by the Hart-Parr Co., follows:

We have cash in bank	$190,232.23	
Certificates of deposit and miscellaneous notes and accounts (less allowances)....	225,516.74	
Merchandise Inventories	515,057.19	
The above total represents our current assets as separated from fixed assets, buildings, etc.....	930,806.16	
This gives us total net quick assets of..		$769,970.19
In addition to the quick assets we have a total investment, (less depreciation) in buildings, equipment and miscellaneous property which we term as fixed assets of	1,326,859.63	
Against these fixed assets we have liabilities of.....	524,597.09	
These liabilities include reserves set up not paid, money owing on buildings, which is being paid off yearly, none of which is past due, and equipment. The net credit balance on fixed assets is.....		802,262.54
This makes a total of net assets of.....		1,572,232.73

This amount of money is the value of the stockholders' investment in the company after paying all obligations. In our assets there is no item of good will, patents or anything else but that is a tangible asset.

Sterling Knight Buys Accurate Machine Plant

CLEVELAND, April 3—The Sterling Knight Motor Car Co. has purchased the $1,000,000 plant of the Accurate Machine Co. here. Engineering and mechanical experiments have been carried on for more than two years by James G. Sterling, vice-president and treasurer of the company, assisted by a number of men who have been with him in other ventures.

The Knight engine has been changed in some respects and the idea of the company will be to build distinctive custom chassis, using this type engine. No price has been set, as the early production will be priced to the particular job.

Washington Active on Trade Body Work

Congressional Committee May Aid in Defining Rights of Associations

WASHINGTON, April 5 — A resolution providing for the creation of a committee to investigate existing conditions of industry and commerce in the United States for the purpose of recommending to Congress legislation defining the rights and limitations of cooperating organizations as distinguished from illicit combinations in restraint of trade, has been introduced by Senator Edge of New Jersey.

A similar resolution has been introduced in the House by Representative McArthur of Oregon.

Outgrowth of Court Decision

This action is the direct outgrowth of the Supreme Court decision in the hardwood lumber case, which left in an exceedingly nebulous state the question of what activities are permissible for trade organizations.

A committee appointed by the Chamber of Commerce of the United States, of which Alfred Reeves, general manager of the National Automobile Chamber of Commerce, is a member, is holding a meeting here today to discuss what can be done to determine definitely the activities in which trade associations may engage.

Secretary of Commerce Hoover has called a conference here for April 12 of representatives of trade associations to consider the compilation and dissemination of statistical information concerning various industries.

McArthur's Resolution

The resolution introduced by Representative McArthur follows:

Whereas the revival of the industrial activities of the United States is essential to the welfare of the individual as well as the nation, and whereas business has been suffering severe depression from which its reconstruction should be stimulated by every legitimate means, and whereas business procedure that will without protecting monopolies, eliminate waste in production or distribution, lower costs, simplify and standardize methods, increase efficiency and the morale of business, is a beneficial factor in economic progress, and

Whereas, Congressional action has already been taken to assist in agricultural co-operative marketing and distribution; and

Whereas, The industrial tendency is toward the substitution of research and scientific business methods and previous uncertainty and ignorance; and

Whereas, business is hesitating because unable to secure guidance, legal or governmental, which will clearly indicate the proper lines of conduct in business association; and

Whereas, business is entitled to know in definite terms what it legally can and cannot do;

A joint committee of Congress be created, to be composed of six members from each branch, whose duty it shall be to investigate existing conditions of industry and commerce in the United States and the markets of foreign countries, insofar as the same directly affect industry and commerce of the United States, including questions as to production, distribution, labor and business methods, and to report to Congress and to suggest such legislation, if any, as it may deem best upon these subjects with special reference to the most effective ways and means to revive industry and to stimulate foreign and domestic trade, to stabilize business conditions as to the future, to minimize the danger and distress of recurring periods of business depression with their resultant cycles of general unemployment, and to define the rights and limitations of co-operative organizations as distinguished from illicit combinations in restraint of trade.

Lincoln-Ford Company Formed for $15,000,000

DETROIT, April 4—The Lincoln-Ford Motor Car Co. has been incorporated in Michigan as a successor to the Lincoln Motor Co. It is capitalized at $15,000,000, all in common stock, of which $250,000 has been subscribed and paid for in cash.

All but three of the 2500 shares of stock already issued are held by Edsel B. Ford. The other stockholders are Henry Ford, Henry M. Leland and Wilfred C. Leland, each of whom holds one share.

Officers of the new company are: President, Henry M. Leland; vice-president and general manager, W. C. Leland; second vice-president, Edsel Ford; secretary and treasurer, W. T. Nash; assistant secretary and treasurer, B. J. Craig. The directors are the Lelands and the Fords. The Lelands continue in the positions they held in the original Lincoln company as does Nash. Craig is secretary of the Ford Motor Co.

It is understood that it has not been determined how the stock of the new company finally will be distributed between the Ford and Leland families.

Ohio Halts Stock Sale by Seven Rubber Firms

AKRON, April 3—Further stock sales by seven Ohio rubber companies with an aggregate capital stock of $12,979,925, have been ordered stopped at once by Arthur L. Stewart, Ohio state securities commissioner. Stewart's action in withdrawing permission for further stock sales, in addition to these rubber companies, affects 23 miscellaneous companies with a total par value for the 30 companies' stock of $17,917,555.

The seven rubber companies whose sale of stock has been stopped by Commissioner Stewart's orders are:

D. & M. Cord Tire Co., Cleveland; Phoenix Rubber Co. of Akron; Glamorgan Tire & Rubber Co. of Orville; Avalon Rubber Manufacturing Co. of Akron; Andes Tire & Rubber Co. Cleveland; Nu-Air Tire & Rubber Co. of Cleveland; Maguire Tire & Rubber Co., Cleveland and Tuscora Rubber Co. of Denver.

Among the miscellaneous companies whose stock sales have been halted are:

Halladay Motors Corp. of Newark; Tuscora Rim & Machine Co. of New Philadelphia; Twin Dry Cell Battery Co. of Cleveland.

Timken Prepares Way for Profitable Year

Readjustment Indicated in Balance Sheet—Inventories and Accounts Payable Cut

DETROIT, March 29—The balance sheet of Timken-Detroit Axle Co. as of Dec. 31 last shows total assets of $19,105,138 as compared with assets of $21,494,864 at the end of 1920. Current assets were $8,350,104 and current liabilities $2,427,301. Net working capital of $5,922,803 compares with $8,762,148 a year ago.

Inventories carried at $10,932,521 have been reduced to $7,258,281. Accounts payable of $3,458,647 a year ago have been decreased to $438,824, a large part of this, $1,950,000, by substituting bank loans for the accounts.

Cash position is $502,986 as compared with $671,151 in 1920. Customers' notes and accounts receivable total $503,064 against $733,278. Marketable securities of $85,772 were added to the assets. Accrued expenses and dividends increased from $36,573 to $38,477. Other assets were $480,276 as against $601,910.

Accumulated surplus was $8,736,737 as against $9,866,662, the difference being accounted for by writing down inventories to market values, payment of dividends at 7 per cent on preferred stock and 2 per cent on common, and the taking of a moderate operating loss on the year.

Outstanding preferred stock was reduced from $4,975,000 to $4,962.700. Outstanding common stock is $2,978,400.

President A. R. Demory says:

We feel we have readjusted ourselves to a position where this year should show a profit. Specifications for immediate delivery of axles have increased very materially. We have acquired some new customers, retained all our old ones, and feel confident that we are in shape to work out this very trying problem and maintain the very strong standing we have always enjoyed. We should end the year 1922 with a very satisfactory showing.

Spicer Reports Profit

NEW YORK, April 3—Spicer Manufacturing Co. for the year ended Dec. 31, 1921, reports an operating profit of $12,674 after administrative and selling expenses and plant depreciation. The net loss, after interest charge deductions, was $435,257, the first to be reported since the formation of the company.

The general balance sheet shows current assets of $5,589,824 and net current liabilities of $1,881,368. The former consists of $4,067,128 inventories; $1,136,842, accounts payable; $80,936, investments, and $304,918 cash. Among the current liabilities are notes payable amounting to $1,321,000.

C. A. Dana, president, states that sales for the first three months of 1922 were approximately double those of the same period last year. Orders are coming in at such a rate at the present time that the company has put on a night shift at its Plainfield, N. J., plant.

April Schedules Call for General Increases

Detroit Plants Will Exceed March Production Figures by One-Third

(*Continued from page* 782)

Hupp Motor Car Corp., with a production in March of slightly over 3000, has scheduled 4000 for April. The March total ran considerably higher than scheduled, and April is also expected to run higher.

Liberty will build about 600 cars in April. March figures after a late start ran higher than 350.

Cadillac, at capacity since the early part of the year, will continue its schedule of about 100 cars daily.

Lincoln has scheduled 750 cars for April, all that the factory in its present state of reorganization can build. Orders already covering production to July 1 are on the books at the factory.

Rickenbacker, with an output of over 300 cars in March, has scheduled between 500 and 600 for April. The factory is now fully equipped to meet production requirements.

Steady Flow of New Business

There is a firm feeling among the sales executives at the factories that steady business in automobiles is assured for at least the summer period. Though the bulk of the demand is from present owners, there is a steady flow of new business from persons without cars to exchange.

Most of the new business is in the big industrial centers, officials declare, with a good demand, however, from the smaller cities and considerable buying in the rural districts. Cities in the Middle West, which were thought to have reached a point where replacement business was for the most part the only business to be expected, are reported showing a surprising volume of first sales.

Toledo Plants Active

TOLEDO, April 3—The Willys-Overland Co. has led all Toledo automotive plants in getting back into large scale production during March. The plant took on 1200 employees during the month and now has a total of 7525 at work.

Milburn and Chevrolet held their own, while many of the accessory plants took on more employees and boosted output.

The Electric Auto-Lite division of the Willys Corp. increased its employees by 300 last week and has about 2000 at work now.

In a recent survey of 130 Toledo plants it was found that 30 were at 100 per cent production, 69 were operating at 75 per cent or better. Many of these were in the automotive group. Malleable iron foundries have shown a big pick-up in production.

The Bock Bearing Co., Doehler Die Casting Co., Bunting Brass & Bronze Co., and many others are among these operating with two or three months orders ahead and with increasing working forces.

The outlook for spring manufacturing is very good.

Trend is Upward

BRISTOL, CONN., April 3—The New Departure Manufacturing Co. is steadily increasing its output and there now are 2300 men on the payroll, an increase for the first three months of this year equal to the increase in the entire previous year. The number now is nearly twice as large as in any pre-war month.

MARYSVILLE, MICH., April 3—C. H. Wills & Co., manufacturers of the Wills Sainte Claire car, announce that February business was 50 per cent over January; the first twenty days of March showed an increase of 60 per cent over February, and April orders already booked give a definite increase in business of 100 per cent over March.

MOLINE, ILL., April 3—The Deere Co., producing tractors and farm implements, has greatly increased its forces and is operating on a basis of five and one-half days a week. Orders on hand will enable the company to maintain the present force and time schedule for several months.

SALEM, OHIO, April 4—Mullins Body Corp. reports that it has received sufficient new orders for its product to increase production to 70 per cent of its plant capacity.

DETROIT, April 4—Kelsey Wheel Co. has contracted with the Ford Motor Co. to supply 360,000 sets of wheels during the current year.

Budd Will Be at Full Capacity for 10 Months

PHILADELPHIA, April 3—The Edward G. Budd Manufacturing Co., maker of all-steel bodies, has enough unfilled orders to keep its plant operating approximately at capacity for the next ten months. Business has been increasing to such an extent that some of the working force is employed at night.

The ratio of high, medium and low-priced bodies being sold is normal. Prices have been reduced about 40 per cent on the average, which has contributed to cuts in the prices of completed motor cars. The majority of medium and high-priced models, according to the company, reaches ultimate consumers in Eastern and Middle Western Cities. Most of the low-priced models are distributed eventually west of the Mississippi. The Budd company is doing no foreign business.

Canadian Shipments 1,442 in January

With Those from United States Total Exports Aggregated 2,871 Vehicles

OTTAWA, ONT., April 3—Export shipment was made during the month of January of 1442 passenger cars and motor trucks from Canadian factories. The details of these shipments have just been issued by the Department of Trade and Commerce and show that the United Kingdom, Australia, Argentina, India, British South Africa and New Zealand were the principal buyers. The figures follow:

MOTOR TRUCKS

To	No.	Value
United Kingdom	32	$13,792
Australia	15	6,856
India	26	11,885
Ceylon	6	2,745
Strait Settlements	12	5,486
Dutch East Indies	3	1,370
Other Countries	4	1,828

PASSENGER CARS

To	No.	Value
United Kingdom	564	$358,599
United States	5	7,240
Argentine Republic	102	62,968
Australia	367	248,156
Brazil	6	2,662
India	115	76,388
British East Africa	8	2.766
British South Africa	45	35,741
China	10	8,642
Dutch East Indies	15	7,723
Japan	10	8,839
Netherlands	4	2,878
New Zealand	36	32,049
Norway	4	3.698
Siam	2	1.850
Spain	5	5,120
Sweden	12	5.490
Other Countries	34	33,858

AUTOMOBILE PARTS

To	Value
United Kingdom	$131,133
United States	2,907
Argentine Republic	473
Australia	4,992
India	29,470
Straits Settlement	936
British East Africa	4.750
British South Africa	2,118
British West Africa	182
Dutch East Indies	9 621
New Zealand	154
Other Countries	2,187

Automotive exports from the United States during January were 2407 cars and 464 trucks, a total of 2871 vehicles. Thus, combining the United States and Canadian shipments. the overseas trade in January was 4313 automotive vehicles.

"GOVERNOR" BILL KILLED

NEW YORK, April 3—The Board of Aldermen have killed the proposed ordinance to have motor vehicles equipped with a governor to regulate their speed through the city streets. A special traffic committee is framing in its place an anti-speed ordinance.

Equipment Trade Runs Ahead of 1921

Increase of 20 to 40 Per Cent Along Atlantic Seaboard Is Reported

NEW YORK, April 5—Wholesale business in automotive equipment for the past three months of the year has been running 20 to 40 per cent ahead of last year in volume in different sections along the Atlantic seaboard. Jobbers from Maine to the District of Columbia, who attended the meeting of the Eastern Automotive Equipment Association, unanimously reported steadily improving conditions.

Owing to lower prices money volume so far has not been much greater, and in some districts not as great as last year, but it is increasing every day and indications are that April and May will be far better months from a revenue standpoint than the same period a year ago.

The jobbers reported that more than half the territory, at least, was being covered with meetings in the sales promotion campaign, with frequent showings of the "Ask 'em to Buy" film.

A resolution was forwarded to the Automotive Equipment Association in Chicago, suggesting that in future the manufacturing division of the organization should finance the general administration of the sales promotion campaign, inasmuch as the members of the jobbers' division are supporting the local and sectional meetings.

Hudson and Cadillac Export Business Gains

DETROIT, March 30—Hudson export business is showing very satisfactory activity, President Roy D. Chapin said this week. Every foreign agency of the company is reporting renewed interest in automobiles, and shipments are already going forward in a gratifying volume.

The company has increased to some extent its representation in foreign fields and retained all its force through the period of depression. By keeping closely in touch with conditions at all times, Chapin said, Hudson-Essex has been able to reap the early benefits of the return of trade.

Cadillac Motor Car Co. reports a large increase in shipments of parts to foreign territory over last year. In Buenos Aires the increase was 213 per cent; Christiania, Norway, 37 per cent; Geneva, Switzerland, 135 per cent; Havana, 315 per cent; London, 138 per cent; Sydney, 420 per cent, and Utrecht, Holland, 651 per cent.

FORD TO RESUME AT ATLANTA

ATLANTA, GA., April 5—Preparations are being made to resume operations at the Ford assembly plant in this city, in which no cars have been put together in more than a year. Between 300 and 350 men will be given employment. Ford business in the southern states has increased more than 100 per cent in the past 30 days, it is stated. This indicates decided improvement in general business and financial conditions.

TOTAL CARS AND TRUCKS PRODUCED IN MARCH WERE 190 PER CENT OF SAME MONTH, 1921

NEW YORK, April 5—Carload shipments of automobiles and trucks by all makers in March are estimated at 25,000. Production for the month by members of the National Automobile Chamber of Commerce were 135 per cent of February and 190 per cent of March 1921. The factory shipment figures for the first three months of 1920, 1921 and 1922 follow:

	Carloads			Driveaways			Boat		
	1920	1921	1922	1920	1921	1922	1920	1921	1922
January	20,057	6,485	15,241	29,283	3,185	7,397	....	93	154
February	25,505	9,986	19,600	43,719	7,507	9,950	....	99	169
March	29,236	16,287	25,000	57,273	9,939	15,800	....	75	264

Factory shipments for the other months of 1920 and 1921 follow:

	Carloads		Driveaways		Boat	
	1920	1921	1920	1921	1920	1921
April	17,147	20,187	64,634	14,197	....	1,619
May	21,977	18,608	74,286	15,193	....	2,381
June	22,516	20,269	60,746	18,834	8,350	3,947
July	23,082	19,470	52,342	15,320	8,702	3,725
August	23,386	20,350	34,060	14,290	7,095	3,565
September	20,804	20,150	24,431	13,550	5,469	3,580
October	17,209	17,323	14,127	11,257	2,519	2,300
November	13,253	14,061	9,497	10,509	659	1,385
December	11,802	12,100	6,469	7,500	89	134

Carload Shipments Approximate 25,000

(*Continued from page 782*)

While it is not to be expected that the sale of motor vehicles will continue to show such astonishing gains for the rest of the year as compared with 1921, it now can be stated definitely that the volume of business will be larger than last year. Unless some entirely unforeseen obstacles arise to retard the general recovery of the country from industrial depression, truck manufacturers and parts makers are certain to have a materially larger volume of business than they did in 1921.

The only element of doubt is in the passenger car field, and it now appears highly probable that earlier predictions that the volume of sales would not exceed those of 1921, when they approximated 1,500,000, were too conservative.

Within the past few weeks strong impetus has been given to the sale of small and medium sized tractors. This reflects improved conditions in the agricultural sections of the country. The same improved tone has been apparent in the truck market in these districts, and farmers are even showing renewed interest in inexpensive passenger cars.

Dealers in all sections of the country report better business.

High Level Is Reached In Studebaker Sales

13,000 Cars Sold in March — Quarter 100 Per Cent Better Than 1921

NEW YORK, April 3—Sales by the Studebaker Corp. of approximately 22,000 cars for the first quarter of 1922 exceeded sales for the same period of last year by approximately 100 per cent. March sales of 13,000 cars established a new record. The figures were disclosed by President A. R. Erskine upon his arrival here to attend the annual meeting of the corporation.

Improvement General

"New sales records were established in practically every city in the country," he said, "while business from rural sections and export markets showed very much strength and improvement. Production in March was 10,433 cars, a new record, and for the quarter, 26,675 cars, compared with 10,973 last year, an increase of 143 per cent. Stocks accumulated during the winter for the spring trade rapidly diminished in March and will be fully absorbed in the second quarter."

Retail sales figures for March in the following cities were given out by Erskine: New York, 1282; Newark and vicinity, 678; Chicago, 538; Detroit, 306; Los Angeles, 261; Cleveland, 184; Milwaukee, 145, and South Bend, 106.

New Director Chosen

C. L. Bockus was elected a director to succeed the late A. Barton Hepburn.

Erskine stated that the possibility of the payment of a stock dividend on Studebaker common stock has not been discussed by the directors. The dividend meeting is scheduled for April 29.

Men of the Industry and What They Are Doing

Henderson Leaves Martin-Parry

R. P. Henderson, since 1916 associated with the Martin-Parry Corp., has resigned as vice-president of that corporation and has moved from Indianapolis to Detroit. Two years after his association began, the success of the body builders attracted the attention of eastern capitalists to the importance of commercial bodies as offering an independent and profitable line of production, and as a result the Parry plant at Indianapolis and the Martin plant at York were taken over and operated under the name of Martin-Parry Corp. with Henderson as vice-president in charge of sales. Before taking up his work with the corporation, he was connected with the Cole Motor Car Co., of which he was a director. In 1913, following the successful coast to coast highway tour staged by the Indiana Automobile Manufacturers Association, Henderson was elected to the presidency of that organization.

Hannum and Nephler on Tour

George H. Hannum, president and general manager, and C. J. Nephler, general sales manager, of the Oakland Motor Car Co., have left for a three weeks' tour of the Pacific Coast, visiting the principal Oakland dealers and distributors and Oakland branches. In the course of the trip they will visit their recently created branch at San Francisco, which was changed from a distributorship.

Vail Reconsiders Resignation

At the request of the Waltham Watch Co., E. L. Vail has reconsidered his resignation at head of its automotive equipment division and has signed a contract covering a period of years as manager of the division. He will have immediate supervision over sales and service in that department. Vail practically created and developed the business of the company on Waltham automobile clocks and, later, introduced the Waltham speedometer. Retaining Vail's services is indicative of the company's plans to strengthen further and build up its automobile clock and speedometer business.

Jacobson Forms Rico Ignition

Edward B. Jacobson has severed his connection with the J. & B. Manufacturing Co., Pittsfield, Mass., and has organized the Rico Ignition Co., that city, to handle a full line of ignition specialties. Jacobson's entrance in the industry dates back twenty-seven years, when he began in the ignition business in Boston. Seven years later he moved to Pittsfield and continued to figure prominently in the trade of the country. He was instrumental in starting the Pittsfield Spark Coil Co. as well as the J. & B. company. Until recently he served as president and engineering expert in the latter organization. His assistant in the new enterprise, in charge of selling operations, will be Charles A. Mattison, who has been associated with the Pittsfield Spark Coil Co. for the last eighteen years. The company is beginning business with an initial order for 5000 sets of ignition.

Hildebrand Leaves Branch

C. C. Hildebrand, after serving as manager of the Minneapolis branch of the Ford Motor Co., has resigned to take up his residence in Hollywood, Cal., where his family has been living this winter. He will rest for a time before resuming active work. Upon his departure his employees presented him with a platinum set diamond ring and the dealers with a Lincoln car. He was also a guest at a dinner given by the road men. Hildebrand is one of the veterans of the industry. For two years he was associated with the Chalmers company as assistant general manager and for eight years served as sales manager for the Stevens-Duryea. Prior to that he was connected with the bicycle business. He is succeeded by S. A. Stellwagen, formerly manager at Omaha.

Church, Consulting Engineer

H. D. Church of Fairfield, Conn., formerly a chief engineer of the Packard Motor Car Co. and later vice-president of engineering of Hare's Motors, Inc., is now at work in a consulting capacity on several interesting engineering developments. A medium weight six-cylinder model, embodying advanced features of design, was completely developed by Church as vice-president of Hare's. It is understood his present activities include work upon another new light model. His services now are available as consulting engineer.

Marvin at Hot Springs

J. L. Marvin, assistant general manager of the National Automobile Chamber of Commerce, has been prevailed upon to go to Hot Springs, Va., to recuperate from an attack of influenza.

Dawson Assists Campbell

C. E. Dawson, who was formerly sales manager of the Chevrolet Motor Co. of Michigan, has been appointed assistant to Colin Campbell, general sales manager of the Chevrolet Motor Co. M. D. Douglas, previously sales manager at Flint, has been named to succeed Dawson in charge of factory sales activities.

Markle Handles Rickenbacker

Lafayette Markle, formerly identified with Olds, Buick and Studebaker retail sales in Chicago, and later serving as vice-president of the Republic Truck Co. and president of the Oneida Truck Co., has taken over the Rickenbacker franchise in Chicago.

Lagow Represents Hupp

Roger M. Lagow has been appointed factory representative of the Hupp Motor Car Corp. for South and Central America. A graduate of Indiana and Harvard universities, he traveled in Europe for several years before returning to this country as a professor of Romance languages at several colleges. His ability to speak fluently several languages convinced him that his opportunity awaited him in the business field. He has also had a diversified experience in business.

White in Own Company

C. M. White, Jr., for the last four years sales manager of the Firestone Steel Products Co., Akron, has resigned to organize White & Co., Inc., of which he is the president. The company, which will market several lines, including crude rubber, fabric, pigments, etc., and will cover the automobile and rubber trade, will have its headquarters in the Flatiron Building, Akron, and later will establish branches in New York and Chicago. The personnel of the company consists of men well known in the automotive and rubber industries.

A. G. Partridge Joins Goodrich

A. G. Partridge, who resigned recently as vice-president and general sales manager of the Star Rubber Co. of Akron, has been appointed special sales representative for the tire division of the B. F. Goodrich Co. Partridge was for many years vice-president and general sales manager of the Firestone Tire & Rubber Co., resigning a year ago to join the Star organization.

Sherratt in Charge at Pittsburgh

G. F. Sherratt has been appointed manager of the Pittsburgh office of the Chain Belt Co. and will be in charge of all the company's chain and engineering business in that territory.

Neill Goes to Texas

V. H. Day, general sales manager of the General Motors Truck Co., supervised the opening of a new direct factory branch in Dallas, Texas, Saturday. The branch will be under the direction of H. A. Neill, who has been manager of the Philadelphia branch and who recently was connected with the factory sales department. Howard Parks, who has been selling G. M. C. trucks in Texas, will be associated with Neill. Pierre Schon, direct factory wholesale representative in the Southwestern territory, will continue in that position.

G. M. INSURANCE BRANCH

NEW YORK, April 3—The General Exchange Corp., a subsidiary of the General Motors Corp., has been organized to carry fire and theft, liability, property damage and collision insurance for owners of automobiles.

Tire Makers Govern Production by Sales

Will Not Pile Up Inventories of Finished Goods—60-Day Supply

AKRON, April 1—Akron tire manufacturers have stopped expanding finished goods inventories, and are applying production direct to sales. Every company in the city has an inventory of about the right balance, with at least a 60-day supply of tires on hand.

In the application of production direct to sales many companies are shipping out tires which are wrapped and loaded in freight cars while still warm. With expansion of inventories no longer necessary, Akron companies are pursuing a "hand-to-mouth" policy, letting production fluctuate and be governed entirely by sales. This is resulting in brief spurts and slumps in tire building, layoffs of men for a few days, and rehiring of these and the employment of many more for brief periods.

Never again, manufacturers say, will they be caught, as they were in 1920, with a huge surplus of tires on hand. Scarcely a company has an inventory exceeding a 60-day tire supply based on normal sales, although a 90-day supply is not considered excessive.

The biggest improvement in the tire industry has been in export trade. For many months a losing proposition for all Akron companies, export business has been re-established upon a profitable basis this year and heavy export orders now are being turned out.

Committee Will Decide Best Course for Parenti

BUFFALO, April 5—A committee representing the creditors of the Parenti Motors Corp. has been formed to decide what will be the best course to pursue with respect to the future of the company. This committee now is studying the situation and will report in a short time.

At the first meeting it was suggested that two courses were open. One would be the appointment of a trustee to take over and adjust the affairs of the company and the other would be an attempt to raise enough money through the sale of cars to enable the company to continue in business. It was stated at the Parenti plant that the company has about 100 cars about 60 per cent completed.

N. A. D. A. APPOINTS SHAW

ST. LOUIS, April 5—Lynn M. Shaw, secretary of the Indiana Automotive Trade Association, has been appointed an assistant general manager of the National Automobile Dealers Association. Prior to his connection with the Indiana organization, Shaw served as secretary of the Youngstown Automobile Dealers Association and previously acted as assistant general manager of the Elton Motors Co., Cadillac distributor for the Youngstown territory.

RADIO TO TRANSMIT ROAD CONTEST RULES

WASHINGTON, April 5—Messages extending an invitation to all high school pupils to participate in the national essay contest on highway economics will be broadcasted from here to-morrow evening by radio telephone.

The apparatus owned by the Postoffice department will be used in sending out the information as to the rules of the contest, inasmuch as this Federal department acknowledges that delivery of rural mail depends upon the improvement of highways throughout the country.

The contest is under the auspices of the highway and highway transport educational committee.

Holders of Chalmers Notes Form Committee

(*Continued from page* 784)

to-day that the default in the payment of interest on the first mortgage notes of the Chalmers company, while primarily to conserve working capital, also will have the effect of bringing the actual situation confronting Chalmers to the attention of noteholders and creditors so that some constructive action can be taken.

Notice was given to bankers and creditors, Hutchinson said, of the intention to default payment so that no undue alarm should have been occasioned. He added that the position of the Maxwell Corp. had been set forth clearly. It holds a mortgage of $3,150,000, which will fall due in October and which Chalmers will not be able to pay under present conditions.

As a preliminary to a refinancing program for Chalmers, the entire situation will be placed before those financially interested in the affairs of the two companies. As a reassurance to Chalmers creditors, Maxwell has agreed to take over all purchase commitments pending a decision on what action shall be taken.

Hutchinson took pains to explain that Maxwell is acting only in the interest of its subsidiary, and that its own financial and manufacturing programs are in no way concerned.

HARLEY CO. SUED ON NOTE

SPRINGFIELD, MASS., April 5—Harry Tatnell of Philadelphia has brought suit against the Harley Co., A. W. Morris of Springfield and R. E. Northway of Natick for a breach of contract. An attachment for $100,000 on the Harley plant has been filed at the registry of deeds. The basis of the action is alleged non-payment of a note.

Further Price Cuts in Britain Unlikely

Manufacturers Say They Are Doing Business on Narrow Margin of Profit

WASHINGTON, April 1—No reduction in price of British motor vehicles is expected at the present time, according to reports received by the Automotive Division, Department of Commerce, from the American Trade Commissioner in London. British manufacturers insist that they are still doing business on a narrow margin of profit despite the low cost of labor and raw materials, and therefore cannot cut their selling price. The export trade of the British automotive manufacturers is very small and as its contracts run out no repeat orders are coming in.

There has been a fairly steady continuance of demand for small cars and motorcycles accompanied by virtual stagnation of the large car lines. Manufacturers of motor trucks have been inactive and little improvement is anticipated until the surplus war stocks have been cleared.

Under the new licensing plan purchasers of motor vehicles may take out licenses for one or more quarters of the year. Thus with the lapse of the quarter ending March 31, increased business is expected from purchasers who are not willing to pay the first three months' portion of the pound per horse power per annum tax.

Carter Product Planned to Compete with Ford

WASHINGTON, April 4—The Carter Motor Car Co. reports that while drawings of the car it proposes to make at Hyattsville, Md., have not been completed, it will be designed to compete with Ford.

The company's personnel includes: President, A. G. Carter, for the past 10 years president of the Washington Motor Car Co.; vice-president, H. J. Hogan, formerly with the Lorraine Motor Car Co.; treasurer and general sales manager, Major C. W. Search, formerly with the Jeffries Motor Car Co., and former sales manager of the Northway Motors Co.; general manager, F. L. Carter, formerly treasurer of the Washington Motor Car Co.

NATIONAL AGREEMENT LIKELY

INDIANAPOLIS, April 4—No date has been set as yet for a hearing upon the application filed by the Columbia Axle Co. for the appointment of a receiver for the National Motor Car & Vehicle Corp. It now is considered probable that the application will be withdrawn, inasmuch as a satisfactory agreement is likely between the creditors' committee, which is managing the National factory, and the axle company.

California Reports 70 Per Cent Growth

Truck Sales to Fleet Owners Feature Conditions in Northern Section

SAN FRANCISCO, April 5—Sales of passenger cars for northern California for the first quarter of 1922 are at least 70 per cent better than they were one year ago, and more than 50 per cent better than they were two years ago. Sales of motor trucks to fleet owners, and the establishment of truck fleets in the smaller towns, show nearly 100 per cent gain over the first quarter of 1920, but sales of trucks to individual owners, for their own uses, have not kept pace with fleet sales, and are not more than 50 or 60 per cent better than in the same period of 1920.

Automobile sales in California for February, 1922, were 254 per cent higher than they were for February, 1921. In February of this year the dealers of California sold 8159 cars, while in February, 1921, they disposed of only 3213 cars. The 47 counties of northern California are credited with 3298 sales in February, 1922, as compared with 1310 sales in the same month of 1921. The eleven counties of southern California show 4861 cars sold in February, 1922, against 1903 for February, 1921. Trucks to the number of 1075 were sold in California during February, 1922.

During February, 1922, the registrations for the entire state were 9234, as compared with 6694 in January, 1922, a gain of 2540. In Alameda county, in which is located the city of Oakland, and which holds a high record for automotive vehicle and equipment sales, 656 cars were sold in February of this year, compared with 463 in January, 1922.

Dallas Sales Increase

DALLAS, TEX., April 4—The retail automobile business in Dallas for March was as good as that for January or March, or for the three last months of 1921. Actual sales and deliveries were said to be slightly above those of February, partly because of the influence of the recent spring show.

The truck business was about up to the previous months. The tires and accessories showed some improvement, probably due to the approach of spring and the preparations for using cars which have been housed for a good part of the winter.

The tractor and trailer trade was rather slow, though there were some tractors moving to the farming belts in the Panhandle and the rice sections of southeast Texas.

MERGER RUMORS DENIED

NEW YORK, April 5—The sensational rise of the past few days in automotive stocks has brought numerous rumors in the financial district of impending consolidation. One of these was a revival of the old report that Mack Trucks, Inc., and the White Co. would combine. Another was that the management of the Pierce-Arrow Motor Car Co. would be taken over by C. W. Nash preparatory to a merger with the Nash Motors Co. Both these reports were emphatically denied.

IMPROVED BUSINESS REACHES OUT TO MAY

NEW YORK, April 3—The end of March brought no slackening in the business improvement reported in steadily increasing volume by parts manufacturers since Jan. 1. Practically all manufacturers have sufficient orders booked for April to insure a better month than March. Still more gratifying is the fact that many of them have received substantial commitments which will carry them through May.

Early in March there was considerable speculation among parts makers over the prospects after April, but developments in the past two or three weeks have made it certain that there will be no slackening in operations for another two months at least.

The number of parts plants in which operations exceed 50 per cent of capacity is increasing steadily, and a considerable number have been compelled to put on night shifts.

Throughout the parts branch of the industry the moderate optimism which has prevailed for the past three months is approaching a feeling akin to enthusiasm.

Springfield Factories Report Better Business

SPRINGFIELD, OHIO, April 4—Orders from France and Australia are being filled at the Springfield works of The International Harvester Co., Charles H. Smart, superintendent, states. The motor truck business is brisk at this plant, good sized orders having been received recently from foreign countries and various points in the United States. The plant is continuing its production schedule of 50 trucks daily. The force has been increased within the last week.

Motor truck business for March at the plant of The Kelly-Springfield Motor Truck Co. was the largest of any month during the past two years, General Manager E. O. O'Donnell says. A gradual improvement in business conditions is noted in reports received by the company from various parts of the United States.

"The first quarter of this year showed an increase of 100 per cent in business over the same period in 1921," said Karl A. Heinzen, advertising manager of The Westcott Motor Car Co., in speaking of the business of this company. "Orders on hand are twice as large as they were at the same time last year."

More Good Reports Received by N.A.C.C.

All Sections of Country Except Dakotas Share in Better Business

NEW YORK, April 6—Directors of the National Automobile Chamber of Commerce, highly gratified at the business done by the industry since Jan. 1, received additional encouraging reports at their monthly meeting here yesterday. These reports were contained in telegrams from distributors in all sections of the country, which stated that business ranged from "good" to "excellent" everywhere except in the Dakotas, where there have been heavy snows.

The manufacturers were told that the used car situation is clearing up rapidly because there is a good demand at the low prices which have been fixed. The decline of prices in the market has been comparable to the reductions in the cost of new cars. The agitation on the subject of used cars has resulted in dealers using greater care in trading, making it possible for them to sell at a profit.

Credit Conditions Easy

Credit conditions are easy everywhere. There appears to be plenty of money for all legitimate enterprises. It was reported that one New York bank believes the present automobile sales season will be the best for two or three years.

While the manufacturers naturally are greatly pleased with the upturn in business, they are not unaware of the fact that the industry now is in the midst of its spring trade and that sales cannot be expected to continue on the present basis after June 1. It is felt, however, that with the present bullish stock market, with general business conditions much better, with exports improving and with foreign exchange rising, business for the last half of year should be good.

The Essex Motor Car Co. was elected to membership in the chamber. It will be represented by Roy D. Chapin.

Alfred H. Swayne and George M. Graham were delegated as counsellors to attend the annual meeting of the Chamber of Commerce of the United States at Washington in May.

The directors sanctioned a meeting of the advertising managers in conjunction with the June convention of the Associated Advertising Clubs of Milwaukee.

J. Walter Drake and General Manager Alfred Reeves will represent the N. A. C. C. at a conference called by Secretary Hoover on April 12 to discuss trade association activities.

The next meeting of the directors will be held in Detroit, May 3.

GREATER FIRESTONE OUTPUT

AKRON, April 5—Announcement is made by the Firestone Tire & Rubber Co. that its production has been increased to 20,000 tires a day compared with 17,000 two months ago.

New European Cars Arriving in Japan

Agencies Giving Up American Products Because of Higher Horsepower Rating

TOKIO, March 2 (*By Mail*)—The approach of the end of the fiscal year has brought several Government departments into the field for new motor transportation. The Electric Bureau of Tokio has just purchased three new repair wagons. These will be mounted on the Packard EC chassis, with full electric equipment and solid tires, and the bodies will be of the modified bus type, capable of carrying 16 mechanics and considerable equipment. The Department of Communications, which is the largest user of motor transportation in Japan—with the exception of the Army—will soon be on the market again.

The local passenger car market remains very depressed. Sales are confined almost entirely to the smallest and lightest of the European light cars, and the popular choice centers on those cars having a taxation rating of less than 10 horsepower. Consequently American cars are not being sold, and agencies for them are being given up. In contrast, every week sees the arrival of some new European car.

German makes are again appearing, and Benz, Mercedes, Protos, Cyclonen and the Austrian Daimler and Fiat are all represented in the Tokio district.

Moline Plow Forecasts Early Reorganization

NEW YORK, April 5—Managers of the reorganization committee of the Moline Plow Co. have addressed a letter to stockholders and creditors explaining the delay in consummating the plan of reorganization. They say that the co-operation of the Willys-Overland Co., which owns 82 per cent of the common stock, could not be obtained because of that company's failure to obtain the consent of its preferred stockholders. The delay of the Willys-Overland was said to be due to pressure of other important matters.

The statement adds that the Willys-Overland Co. has submitted the question to the preferred stockholders, and that the reorganization plan has been recommended by its new board of directors. The managers of the reorganization committee say they feel confident that they "will secure early action in consummating the plan and the proper papers and notices are being prepared to that end."

PYRENE IN NEW PLANT

NEWARK, N. J., April 4—The Pyrene Manufacturing Co., Inc., has moved into its new factory at 520 Belmont Avenue, this city. The building is of thoroughly modern fireproof construction. The general offices formerly located in New York and all manufacturing departments will now be located under one roof. To improve, if possible, the service rendered customers, the company has installed a department for the sale of a complete line of safety devices, as well as the long line of fire fighting appliances.

REO DELIVERS CARS FOR FOILING BANDITS

LANSING, April 5—The Reo Motor Car Co. has delivered to the Adams Express Co. 14 chrome steel lined cars for its bandit-proof New York delivery service. These cars are the first of an order for 100. The enclosed body has specially closed windows and a windshield which is proof against 45-caliber steel jacketed bullets. Each car has eight portholes for automatic rifles. A lever in the rear makes it possible for a guard to stop the car should the driver be injured. The cars were built after the design of W. M. Barrett, president of the Adams company.

Durant Balance Sheet Shows No Liabilities

NEW YORK, April 5—A balance sheet as of March 31, 1922, issued by Durant Motors, Inc., shows that the company has no liabilities. The principal asset consists of participating contracts amounting to $20,988,000, representing the company's proportion of earnings of its associate companies valued on a basis of three years net profits conservatively estimated.

Other assets are: furniture, fixtures and equipment, $44,599; investments and advances to allied companies, $2,594,130; marketable securities, $4,225,902; cash, $3,028,747; notes receivable, $2,260,543; accounts receivable, $242,560; materials and supplies, $108,917. This makes total assets of $12,505,398, not including the participating contracts.

NEW TEMPLAR SALES MANAGER

CLEVELAND, April 5—Morris Bleiweiss has been named sales manager of the Templar Motor Co. to succeed Paul E. Ryan, who retired from the position on April 1. Bleiweiss went to Templar Motors as assistant factory manager two months after the company started production in 1917. He was promoted to service manager and assistant sales and advertising manager before being named to his present position. Ryan was formerly sales manager for the Aluminum Castings Co. He entered the employ of Templar last May. Templar has increased production since Jan. 1.

WILLS REACHES CAPACITY

DETROIT, April 5—C. H. Wills & Co. will build about 50 Wills Ste. Claire cars daily in April, which will be practically the plant capacity. This is an increase of about 75 per cent over March.

Peru and Australia Have Increased Tax

Former Will Use Revenue for National Defense—Latter for Maintaining Roads

WASHINGTON, April 3—Reports received by the automotive division, Department of Commerce, show that two foreign countries have increased taxes on motor vehicles. This added burden has a tendency to increase the sales resistance for American exporters in Peru and Australia.

Commercial Attache W. E. Dunn advises that the Peruvian Government has raised the ad valorem duty on motor cars 1 per cent when the price does not exceed Lp. 500, and 2 per cent on automobiles and carriages when the price exceeds this amount. In addition, an internal tax will be levied amounting to Lp. 1 for Ford cars for hire, Lp. 2 for other cars for hire and Lp. 5 for private cars, in accordance with a law which was put into effect on Jan. 25, 1922. This tax will be levied only on cars actually in use and but once. The funds obtained from these assessments will be dedicated exclusively to national defense.

The American Trade Commissioner at Melbourne has informed the division that a horse-drawn vehicle tax has been proposed which it is estimated will be assessed upon 200,000 vehicles in the State, and an increased registration tax amounting to 5s per hp. on motor cars, and 2s 6d per hp. on motorcycles.

Show in Mexico City Assured Many Exhibits

MEXICO CITY, MEXICO, March 31 (*By Mail*)—Applications for space reservations for the automobile show which is to be held in the National Theater, here, April 16 to 23, inclusive, are coming in rapidly and already it is assured that the exhibit will far exceed that of the first automobile show given here last year.

It is stated that up to March 18 space had been reserved for displaying thirty different makes of passenger cars. These are principally of American make, but there are three European manufacturers who have secured floor space through their local representatives. The European cars are the Fiat, Mercedes and Renault.

A department has been reserved for trucks and tractors, as was the case last year. These are all of American make. There will be exhibits of lubricants and automobile accessories, but no tires.

FORD VIEWS SUIT LIGHTLY

DETROIT, APRIL 3.—The Ford Motor Co. announces that it does not take seriously the suit filed by Edward S. Huff in Florida to recover $11,000,000, alleged to be due on magnetos. The Ford company says it knows nothing of Huff.

Makers of Electric Vehicles Hold Show

Cars, Trucks and Equipment Exhibited—New Design Shown of Taxicab

NEW YORK, April 3—The second annual show of electric vehicles and equipment is being held this week at the building of the New York Edison Co., this city. The two branches of the electric vehicle industry are almost completely represented, trucks being shown by seven makers and passenger cars by three. In addition, the show comprises exhibits of storage batteries, battery charging equipment, charging plugs, meters, lubricants and motor wear.

Few New Technical Features

There is not much new in a technical way in either electric trucks or passenger cars. These vehicles have been standardized by the different makers and factory changes are made only at rare intervals. In connection with the trucks the most interesting study is that of the drive employed on the various designs.

With electric propulsion, efficient transmission is of the highest importance, because the radius of operation of the vehicle depends upon it, but the designers evidently do not agree as to which is the most efficient drive, for practically all forms of drive are represented. Steinmetz uses the bevel and spur gear or double reduction drive, and Walker commercial truck the internal gear balanced drive with the driving pinion on the axle shaft in the one case and the armature shaft in the other, and two opposite intermediate gears meshing both with the pinion and the internal gear on the wheel; Ward uses the worm drive; Walter the regular internal gear drive and O-B and Lansden the chain drive.

Among the passenger cars the most recent design is the Electrocar, which is shown in taxicab form. This has the battery carried in an underslung cradle, instead of divided between the seat and the front compartment, as is usually the case in electric passenger cars.

Battery charging outfits for the most part comprise either a motor generator or rectifier and a charging panel. The charging plugs for electric vehicle charging and storage battery charging in general have been standardized.

Electric Trucks to Be Shown

Next week there will be a show of industrial electric trucks at the same building, at which six manufacturers will show trucks and tractors. Material-handling equipment will also be exhibited.

In connection with the show the second annual electric vehicle luncheon was held at the Hotel Astor on April 4. Arthur Williams, president of the New York Edison Co., acted as toast master, and addresses on the use of electric commercial and industrial trucks in various lines of industry were made by Robert Cowie, vice-president of the U. S. Railway Express Co.; F. H. Hotchkiss, who represented Gerson Marks, assistant to the general manager of the N. Y., N. H. & H. R. R., and J. E. Dann, president of the Pilgrim Laundry.

Cowie said that of all the vehicles purchased by his company for the metropolitan district the past year, 83⅓ per cent were electric vehicles. He had signed orders for no less than 104 such vehicles during the past month. He claimed that owing to the increasing congestion the electric vehicle had all the speed that could be used and that was safe in such a district. Another feature in their favor, he said, was that comparatively small stocks of repair parts sufficed. Cowie mentioned that his company still had in service throughout the country 17,500 horse-drawn vehicles.

FINANCIAL NOTES

Winther Motors, Inc., reports that there is about half of the stock authorized at the time of the consolidation last year issued and outstanding. The company is a result of the consolidation of the Marwin Truck Corp. and the Kenosha Wheel & Axle Co. with the Winther Motor Truck Co. under the name of Winther Motors, Inc. The consolidation was made purely as a matter of convenience and economy in operation. It has an authorized capital stock of $1,000,000 preferred stock and 600,000 shares of no par value common stock.

Marlin-Rockwell Corp. and subsidiary companies' consolidated balance sheet as of Dec. 31, 1921, shows cash on that date as $415,883 and, for the previous year, $544,413. Notes, trade acceptances and other accounts receivable were $305,832 in 1921 and $1,065,370 in 1920. Among the liabilities the notes and accounts payable, government taxes, etc., aggregated $1,783,139 as against $1,591,342. The earned surplus was $2,313,862 compared to $6,862,099.

Black & Decker Mfg. Co. has declared a dividend for the first quarter of the year at the rate of 8 per cent on the preferred stock. The company reports that sales two weeks ago were more than for any week for twenty-two months. It set its sales quota for 1922 $500 000 higher than its actual sales last year and for the first quarter has made 100 per cent of this quota.

Moon Motor Car Co. directors have declared the regular quarterly dividend of 1¾ per cent on preferred stock outstanding, payable April 1, 1922.

PEERLESS ASSETS LARGE

CLEVELAND, April 6—The annual report of the Peerless Truck & Motor Corp. as of Dec. 31 shows current assets of $7,065,665 against current liabilities of only $825,682. The surplus at the close of the year was $5,257,880. The income from sales was $12,055,904 and the cost of sales was $12,103,636, leaving a net loss of $47,742 on this item. The entire net loss for the year was $103,665.

STEWART-WARNER RE-ELECTS

RICHMOND, VA., April 5—Directors of the Stewart-Warner Speedometer Corp. were re-elected at the annual meeting of stockholders.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Last week's advance in call money rates was attributed largely to temporary conditions, such as government withdrawals from local institutions and disbursements of April 1. Call loans covered a range during the week of 4 per cent to 5½ per cent, in comparison with a range of 3½ per cent to 5½ per cent in the previous week. For fixed date maturities little change was noted, and the volume of transactions was small. Sixty and ninety days and four months' maturities were quoted at 4½ per cent, and five and six months' maturities at 4½ per cent to 4¾ per cent, as compared with 4½ per cent for sixty days and 4½ per cent to 4¾ per cent for all other maturities in the previous week. The prime commercial rate remained unchanged at 4½ per cent to 4¾ per cent.

The Federal Reserve statement as of March 29, 1922, showed a decrease of $1,348,000 in gold reserves and a decrease of $1,231,000 in total reserves. Total bills on hand increased $34,691,000 and total earning assets $33,387,000. There was an increase of $30,553,000 in total deposits and a decrease of $1,531,000 in Federal notes in circulation. The reserve ratio decreased from 78.4 per cent to 77.8 per cent.

The following increases were noted in the statement for the New York institution: $34,198,000 in total reserves; $17,980,000 in total bills on hand; $3,818,000 in total earning assets and $39,596,000 in total deposits. Federal Reserve notes in circulation decreased $70,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined, remained unchanged at 86.7 per cent.

The Federal Reserve Bank of Chicago has reduced its rediscount rate on all classes of paper from 5 to 4½ per cent, effective as of March 25.

A decrease in the total number of commercial failures was shown last week as compared with that of the previous week. Dun reports 511 insolvencies last week as compared with 544 in the previous week and 299 during the corresponding week in 1921. Failures decreased in all sections of the country, with the exception of the Pacific Coast, where an increase was noted.

DURANT BUYS TIRE STOCK

AKRON, OHIO, April 5—Frank A. Seiberling, president of the Seiberling Rubber Co., announces that W. C. Durant heads a syndicate of 15 men, each of whom has subscribed for $50,000 of Seiberling stock on a basis of 40 per cent preferred and 60 per cent common. This completes the Seiberling financing.

EDWARD P. MAGUIRE DIES

HUDSON, MASS., April 4—The death is announced of Edward P. Maguire, general manager of the Lapointe Machine Tool Co. since 1914 and associated with the business for many years before.

INDUSTRIAL NOTES

Republic Rubber Corp. reports, through its receiver, C. H. Booth, that shipments in March to the 25th were 40 per cent greater than for the corresponding February period and that the carry-over into April will be fully 75 per cent greater than from February into March. The company is producing inner tubes at a rate but slightly under the highest rate of output ever attained in its history. The Youngstown plant is operating only in its solid truck tire department but capacity is being approached at the Canton works which will mean the resumption of pneumatic tire production at Youngstown. Pneumatic tire production is in excess of 1,000 a day. None is made except against firm orders, the company declining to stock tires.

Sandvik Steel, Inc., has consolidated its general steel and steel belt conveyor departments in suite 2001, Woolworth Building, New York, with the following executive officers: President and general manager, W. D. Thomas, formerly manager of New York export sales of the American Rolling Mill Co.; vice-president, Anders Johnson, formerly staff engineer, conveyor department, Sandvikens Jernverks Aktiebolag, Sandviken, Sweden; secretary, Garrick M. Spencer; sales manager, Harry Carlson, formerly vice-president and general manager of American Galco, Inc., New York.

Standard Battery Manufacturing Co., Fort Worth, Texas, reports a daily output of more than 100 batteries with the plant facilities increased for a production of 200. There are 50 men employed. The company started in 1918 with two men on the payroll and an output of two batteries a day. In 1921 the business transacted amounted to $260,000 and this year is expected to reach $375,000. Four years ago the company had less than a dozen selling agents. It now has approximately 400 in a dozen states and old Mexico.

Dickinson Cord Tire Corp. has entered the field with a cord tire machine perfected by F. S. Dickinson, veteran in the industry. Every cord is laid by a machine, the cords then being laid in strip units, comprised of several separate cords. Each strip is so graduated as to compensate for the variable circumference between the bead and the crown of the casing, so that the full area is covered. These strips are laid in the path representing the shortest distance between the two beads.

C. A. Shaler Co. patents covering solid fuel vulcanizers have again been upheld by Judge Page in the United States District Court, Minnesota district, in a suit brought against Loren Risk and others, doing business as Risk's Riskless Vulcanizer Co. These patents have been in litigation for several years in various districts; there being at one time, it is stated, as many as thirty-five infringements on the market.

Bearing Service Co. has opened its second branch in Canada at Winnipeg, Man., using this point to cover the western section of the dominion. W. L. Spain, formerly associated with the Chevrolet Motor Co. as its district manager, is in charge. The company maintains a branch at Toronto but the growing use of motor vehicles in Canada has made western expansion necessary.

Detroit Seamless Steel Tubes Co. has established a branch sales office in the Canadian Pacific Building, New York City. H. C. Kensing, formerly manager of the steel tubing department of the Hungerford Brass & Copper Co. at the latter company's metropolitan branch, has been appointed district sales manager for the New York territory.

Isotta Motors, Inc., New York City, has been appointed the agent for the United States of the Isotta-Fraschini products. U. V. D'Annunzio is president of the company and Ede Paoli, associated for more than three years with the Fiat Co., is the commercial manager.

National Association of Farm Equipment Manufacturers has moved its offices from 72 West Adams Street, Chicago, to the Transportation Building, 608 South Dearborn Street, that city.

Urbana Tool & Die Co., Urbana, Ohio, has completed arrangements with W. C. Straub, manufacturer's agent, to represent it in the Cleveland district.

Disteel Wheel Corp. announces that its New York sales room and service station are now combined at 189 Academy Street, Long Island City.

Unemployed Engineers Are Aided by Bureau

NEW YORK, April 3—The Federated American Engineering Societies number among its activities a free employment bureau maintained at 29 West Thirty-ninth Street for the purpose of relieving unemployment among engineers. The organization includes the American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and twenty-seven other associations throughout the country, its aggregate membership being 50,000 professional engineers.

In 1920 the bureau placed 69 per cent of the 2300 applicants for employment, and last year positions were obtained for 71.5 per cent. Complete statement of the qualifications wished for are requested from employers while similar thoroughness is required from the applicant, who must be a member of an affiliated association. During the industrial depression the bureau carried on an intensive campaign in Greater New York and New Jersey. W. V. Brown is manager of the bureau.

FREIGHT RATES REDUCED

SAN FRANCISCO, April 3—Substantial reductions in transcontinental freight rates are announced by all the cross-continent lines having terminals here and in Oakland, on a number of articles, chief among which is automobiles. Reductions range from 10 to 30 per cent on automobiles from Chicago to the coast, the 30 per cent reduction being in force on cars sent here for trans-shipment to steamers for export.

SHOW STIMULATES SALES

YOUNGSTOWN, OHIO, March 31.—The Youngstown automobile show gave marked impetus to the sale of motor cars in this city. Actual sales at the show numbered 128 cars, of which only 36 were trade-ins. The value of the cars sold was $208,640. Dealers report an average of three or four sales a week since the show to prospects obtained at that time.

METAL MARKETS

So far there has been no buying of a sufficiently representative character to warrant the statement that the market for sheets is established at the higher asking prices which a number of independent producers proclaimed effective April 1. When Judge Gary made the statement the other day that the Corporation was disposed to follow the lead of the independents in an equitable upward revision of prices he took pains to make it plain that the independents must not merely secure publication of higher quotations in the newspapers but that they must actually book orders for representative tonnages at higher prices before they can lay claim to a market leadership that will inspire others to follow.

In the course of the next few weeks it should become apparent whether the momentum of demand has become sufficiently strong to overcome the resistance which many consumers offer at this time to higher prices or whether these higher prices will slowly vanish amid the apathy of buyers. Whether the contention of steel producers that the prices which have prevailed so far were inadequate and in some instances below cost is correct or not, will have precious little to do with settling the fate of the new prices. Validity of the latter will depend solely upon the demand over the next few months. If this demand should turn out to be sufficient to support the higher prices, it is highly improbable that the movement will stop there. Quite a few steel consuming industries which have been out of the market for some time are resuming purchases on a modest scale and the greater diversity of the demand will be magnified and resorted to as a handy prop for ascending prices.

In many quarters developments during the last few weeks have created an impression that the advent of the year's second quarter marks the end of one phase of the post-war deflation movement and that the steel market is merely leading in the natural reaction that has now begun to set in and which those who hold this view believe will eventually spread to other commodity markets. Attempts to lift the steel market to higher levels have not been confined to sheets; automotive consumers of hot-rolled strip steel who a few weeks ago had no trouble in covering their requirements at 1.75¢ are now being asked 1.90¢, base Pittsburgh level.

Pig Iron.—Automotive foundries are buying foundry and malleable in a routine way. Sellers contend that the trend is upward but admit that the immediate future may bring a temporary halt in buying.

Steel.—Higher asking prices have become general for nearly all steel products but no transactions worthy of note have so far been consummated at these higher levels. Steel bars came in for impressive demand at the 1.40¢ price level; no business at 1.50¢ has been done so far. The last actual business in sheet bars for which up to $31, Pittsburgh, is now asked was at a fraction better than $29. Bolt and nut prices are stiffening.

Aluminum.—The market is fairly active with 17.50¢ seemingly the inside quotation for 98 to 99 per cent pure virgin ingots. Importers and dealers have their ears to the ground for advance news regarding the fate of aluminum in the tariff bill, but consumers are apparently not disposed to stock up even though they believe that the rate of duty will be raised considerably.

Copper.—Semi-speculative holders are taking on additional tonnages when price warrants.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, April 28, May 26.

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Willys-Overland Co. Takes 1921 Losses

NEW YORK, April 6—The Willys-Overland Co. is another of those in the automotive field which has taken its losses and is now in a position to go ahead on a profit-making basis. Its business, which has been excellent for several months, still is moving upward.

Net Loss was $8,633,279

A detailed report for the year 1921 shows a deficit of $23,560,389, after inventory adjustment, interest, depreciation and other charges. Its net loss after all expenses was $8,633,279, as compared with earnings of $8,822,152 in 1920. To this loss has been added $1,742,653 for interest; $2,130,169 for depreciation, etc.; $733,922 for tool replacement and $10,320,364 for other adjustments. This compares with a total deficit of $5,480,-394 for 1920.

It is explained that in computing the net loss, all expenses, including reduction in price of cars, idle plant expenses, adjustment of inventory values and other extraordinary expenses, have been included. It also is explained that the other adjustments mentioned include $7,412,-275 for reduction in value of investments in affiliated companies, $759,468 for additional losses on commitments and $2,-148,621 for reduction in value of tools, dies, jigs and patterns.

Inventories Reduced

The statement of assets shows that inventories stand at $17,696,814 as compared with $35,309,825 on Dec. 31, 1921. Other current assets are: Accounts receivable $1,545,505; notes receivable $806,221; cash $5,128,403.

The two largest items of current liabilities are notes and bills payable amounting to $18,479,625 and accounts payable amounting to $2,770,262. Arrangements have been practically completed for taking care of the bank loans which approximate $16,000,000. With these obligations deducted, the company could pay all its current obligations with the cash on hand and still have a balance.

G. M. STOCK ENHANCED

NEW YORK, April 6—The rapid advance in the price of common stock of the General Motors Corp. on the stock exchange added $51,376,475 to the book value of the stock outstanding from the close of business last Tuesday to the close of business last night. The holdings of the duPont interests increased in value in this period $18,750,000. Their holdings amount to 7,500,000 shares.

GEAR MAKERS TO MEET

BUFFALO, April 6—The annual meeting of the American Gear Manufacturers Association will be held at the Lafayette Hotel, here, April 20, 21 and 22. The program will give special emphasis to business conditions in the gear industry and the outlook for the immediate future Reports will be made by committees on standardization.

GRUBB, VICTOR SALES HEAD

SPRINGFIELD, OHIO, April 5—H. A. Grubb, formerly with the Star Rubber Co., Akron, was to-day appointed general sales manager of the Victor Rubber Co., succeeding C. A. Swinehart who resigned. Grubb takes charge at once. Swinehart has been sales head of the Victor company for many years.

MONITOR MOTORS SUED

COLUMBUS, April 5—Suit to collect $29,051 has been filed against the Monitor Motor Co. and Ernest W. Pavey, receiver of the company, by Herschell-Spillman Co. of North Tonawanda, N. Y. The petition alleges that the defendant failed to keep a contract entered into for 1000 engines. In all only 42 engines were accepted.

Coal Strike Affects Motor Vehicle Sales

ALLENTOWN, PA., April 5—This city, on the outskirts of the anthracite coal region, is beginning to feel the effects of the strike, and reports in automotive circles indicate that curtailment of business is much more drastic in trade centers actually in the coal zone.

Here in Allentown, buying of cars and trucks for immediate delivery has slowed up considerably. Dealers are slowed up in making sales and most of the orders, while accompanied by deposits in the regular way, are for delivery "when the strike ends."

Reports of New Gasoline Methods Boost Stocks

NEW YORK, April 6—Sharp advances in the quotations on the stocks of two companies have followed reports in the last few days that they have evolved processes for lowering the cost of operating motor vehicles. One of these corporations is the Davison Chemical Co., which, it is reported, soon will announce a new method of extracting gasoline from crude oil. The other is the Barnsdall Corp., which is reported to have perfected a new fuel for gasoline engines to be called "super gas" and which will sell for 7 cents or 8 cents a gallon.

Committees representing the Society of Automotive Engineers and the National Automobile Chamber of Commerce are reported to have been impressed with the new Greenstreet cracking process for extracting gas from crude oil.

FORD ASSEMBLING AT CHICAGO

CHICAGO, April 3—The Ford assembly plant here started at capacity production of 240 cars a day April 1. A. W. L. Gilpin, sales manager, announces that the number of cars turned out under the 5-day week will be slightly over the average.

AUTOMOTIVE INDUSTRIES
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Good Business for Rest of Year Seems Assured

Sales in all branches of industry large. Country recovering from depression. Repetition of 1920 slump improbable. Higher prices for farm products chief factor in recovery. Large farm market for low priced cars and small trucks. Parts sales large.

By James C. Dalton

BUSINESS is so good in the automotive industry that most of the people engaged in it are going around with their fingers crossed. It seems almost too good to be true and they're afraid they'll wake up to find it a beautiful dream. The transition has been almost as sudden and startling as the sun breaking through the clouds after an April shower, bringing a rainbow with it.

Even now, with a wonderful March business behind them, many manufacturers and dealers are supplementing their statements—in private—with the observation that it "may be only a flash in the pan."

It isn't.

The automotive industry has emerged definitely from the long period of depression. Many tangles remain to be straightened out and there are many problems to be solved, but business will be good for some time to come.

There are seasonal declines in the sale of motor vehicles just as in most other industries and the sales curve will not always move upward, but a period of years will elapse before it gets another such jolt as it did in 1920. If the industry has learned its lesson there may never be another such sickening loop-the-loop from the peak of prosperity to the slough of despond.

An astounding improvement in general business conditions in the United States has come in the last eight weeks. At the end of January it seemed that little progress had been made on the road to recovery. Then the wind changed, almost over night, and confidence was rolled up like a giant snow ball.

Confidence was all that was lacking. It hasn't come back in normal measure and most people still are hesitant, but they have ceased to shy at every shadow and they are not looking constantly for ghostly manifestations by evil spirits.

AUTOMOTIVE INDUSTRIES made the following prediction in its issue of Dec. 29, 1921:

"So far as passenger cars are concerned, the first quarter of 1922 will be materially better than the corresponding quarter this year; the second quarter a little better than in 1921, the third not quite so good, and the fourth considerably better. The truck market will improve with general business."

The first quarter of 1922 is history and it more than came up to expectations. There need be little hesitancy in saying now that the second quarter will do the same. April is certain to be at least as good a month as March, which was the best in two full years. It is practically assured that May will equal the volume of April and there need be little doubt about June.

Beyond June the outlook is somewhat obscure. It would not be surprising if July brought the midsum-

mer slump which has been perennial with the industry except in 1920 and 1921. Conditions last year were abnormal. Beginning with March, sales and production ran along on practically an even keel for eight months. There was no sharp falling off in the middle of the summer. In fact, the third quarter was a trifle better than the second. That condition may prevail again this year, but if it does it will be a distinct surprise.

In 1920 March was the biggest month of the year with shipments of 29,336 carloads and 57,273 driveaways. April brought a sharp slump with only 17,147 carloads but 64,634 driveaways. Part of the decline in shipments was due, however, to a shortage of freight cars. Shipments for the second quarter as a whole were not as large as in the third quarter.

Volume of Truck Sales Will Increase

The last quarter both in 1920 and 1921 showed a very marked falling off. The reverse is likely to be true this year. It would not be in any sense surprising if October, November and December brought a larger total of sales than the three preceding months. There is certain to be throughout the country a strong demand for enclosed passenger cars and the farm markets probably will be stronger than at any time during the year, especially in the South. So far as the agricultural districts are concerned, truck sales will increase in volume as the year progresses, probably reaching their peak at harvest time in the various zones, or immediately afterwards.

Considering all the factors involved, the automotive industry can safely view the remainder of 1922 with serenity. So far as passenger cars are concerned, the volume assuredly will be as large as last year and in all probability larger. The number of light trucks sold will be two or three times as large and in the heavy duty field last year's sales record undoubtedly will be doubled. The parts and accessory manufacturers can count on business at least double the aggregate of 1921 and in all probability much more than that.

While it is conservative to say that business in 1922 will be good for the industry as a whole, this is no time to take the brakes off and disregard caution. After the lesson of 1920 it is not likely any manufacturers will go very far in piling up an inventory. The same should be true in respect to surplus stocks of completed vehicles. Manufacture should be held closely to sales demand. The industry has plenty of factory space for a long time to come.

It probably will be at least a year before the industry is sufficiently stabilized to expect the placing of commitments for supplies for more than a month or two in advance.

Reasons for Prosperity's Return

The fundamental reasons for the return of prosperity and confidence are not hard to find. They were:

Higher prices for farm products, more cash and more buying in agricultural districts.

A general increase of operations in industrial centers and less unemployment.

This tells the whole epic story of the transformation from deep depression to comparative prosperity. The country as a whole is not yet out of the woods, but it is coming through. Conditions are vastly better than they were a year ago.

Higher prices for farm products, such as grain and cotton, wrought the change. There was an immediate increase in the purchasing power of the farmers who constitute half the entire purchasing power of the country. This reached back to the mills and factories which took on additional workers. When these operatives went back to work they began purchasing goods at retail. This brought more orders to the wholesalers which went back to the producers.

Thus the circle was completed. It was another demonstration of the time honored economic law that there can be no general prosperity when any one great section of the population is not prosperous.

In reporting the agricultural conference at Washington in its Feb. 2 issue, AUTOMOTIVE INDUSTRIES said:

"Motor truck manufacturers who study, analyze and develop farm markets will be the ones who will reap the rewards in the near future."

That prediction, improbable of fulfillment as it seemed at that time, was fully vindicated in less than six weeks.

Watch those farmers! They're coming back. They felt for two years with considerable reason that they weren't getting a square deal. They accused the whole world of skulduggery against them. They couldn't get enough out of their crops to pay the cost of raising them. They owed money to everybody who'd trust them. Their creditors needed the money. In a good many cases they were having a terrible time to keep three jumps ahead of the sheriff.

The farmer hates debt. It hurts his pride not to be able to meet his notes when they're due. He prides himself on his honesty. When he sold some wheat or corn or hogs he dragged the old automobile out of the barn, shuddered at the way it rattled and the engine knocked, pumped a little air into the decrepit tires, climbed into the driver's seat and called his wife to go along with him. He drove to town and stopped at the village bank. Then he dug his lean looking roll out of his pocket and went in to whittle down the notes again.

While the head of the family was paying for a fraction of the "dead horse," which might represent the seed he bought in the spring, his wife was window shopping. She was looking longingly at the ginghams and the dresses and the millinery. Looking was all she could afford. If she bought anything it was a pair of cotton stockings or something she couldn't get along without. Maybe they took home a bag of peanuts or candy for the kiddies. That was all except the canceled note.

The Tide Turns

Then the tide began to turn, as tides always do. With the exception of tobacco every agricultural product for which prices are given in the "Survey of Current Business" issued by the Department of Commerce, showed a substantial increase in February over January. Compared with December, the improvement is still more marked. The price of hogs in Chicago increased 45 per cent in two months. Sheep and lambs increased from 40 per cent to 70 per cent. Wheat and corn each rose about 20 per cent. Wool went up to 28 per cent while cattle and the minor cereals showed substantial gains.

Although cotton is slightly higher than in January, it is below the price reached in the last quarter of 1921. While February was a shorter month than January, the daily average consumption of cotton in the mills was about the same. Compared with a year ago, there was an increase of 20 per cent in consumption notwithstanding the widespread labor troubles in New England mills.

There were fluctuations in March in the prices for farm products, but on the whole they were high enough to take a good share of the gloom out of the farmer's heart. He always is happier in the spring, anyway, when he can get at his planting. But he is a lot more cheerful this spring than he was last. It begins to look to him as though the worst was over, that he will be able to pay his debts and have a little left to buy some of the things he wants but doesn't actually have to get.

Among the things the farmer wants more than any-

thing else are inexpensive motor cars and light trucks. He's going to have them if he can. A questionnaire sent recently to a large number of farmers in Washington, Oregon and Idaho brought the information that more of them proposed to buy motor vehicles than anything else except supplies needed for agricultural operations. This situation is typical.

After two long lean years the men in the rural districts who deal in motor vehicles, equipment, accessories and service, are going to find their business very much better in 1922. In fact, they may be better off than their city brothers.

The Farmer Is Going to Buy

The average farmer is going to buy something, at least, from them. And not all farmers are average. Thousands of them have money in the bank and there are many sections where they have been making some money right along. They have been disgusted at general conditions, however, and have refused to buy on general principles. Now they are convinced that the farmer is coming into his own and they are ready to go into the market.

But they must be SOLD the goods they want. It won't be enough to sit on the front porch and wait for them to come along. The merchandiser who does business with them has got to work and work hard. They will buy where they think they can get the most for their money.

It will pay to cultivate the farmers this year. Even in the Dakotas where they are poorer than almost anywhere else, there are prospects in every district. If the automobile dealer or service man will dig them out he can sell them something. From an automotive point of view 1922 won't be the best year on record in the agricultural sections, but it will be so much better than the last two have been that it will seem like genuine prosperity. Business will get better steadily as the year advances, reaching the peak at harvest time.

In selling automotive equipment to the farmer it isn't necessary to sell him on the value and utility of motor vehicles. He's sold already. All he needs is the cash or credit to buy them. He will think several times before he'll buy a passenger car on credit, but if he can be shown that a light truck will lower his marketing costs and increase his profits, he will buy one on time.

Trucks of one-half, three-quarters and one ton capacity are going to be mighty good bets in the rural communities, and it wouldn't be surprising if more money were made on them this year than on passenger cars. That's a market every dealer should study earnestly.

The villages of the country, except those which are close to big centers of population, are mainly dependent on the farms for their prosperity. As the farm market grows, their business expands. Even the doctors and dentists and lawyers in these towns have had to take notes from their farm patrons the last two years. With the payments made on these notes, they will be likely to buy the motor cars or equipment they need.

With the village merchant selling more goods, he'll have to order more freely from the city wholesaler or jobber. These orders will move back to the mills and there will be more work in the factory towns.

For example, when a few farmers in North Dakota sell their goods at what they think is a fair price, they may decide to buy sewing machines for their wives. If they do, it may be a big help to Elizabeth, N. J.

It is easy to see, therefore, that the automotive dealer in every part of the country is going to be helped by higher prices for wheat or pigs or eggs.

The United States has gone far in its readjustment from a war to a peace basis. That readjustment never can be finished completely until the rest of the world gets back to par, as it were. A long time must elapse before that much to be desired condition can be achieved, but steady progress is being made in that direction, and it is more rapid than appears on the surface.

Full prosperity never can be restored in this country until foreign countries can absorb the surplus of raw materials and manufactured products which the United States can produce. That makes all the difference in the world so far as profits are concerned. But the export market is improving rapidly. The American manufacturer of motor vehicles and equipment who is going after export business intelligently is getting it. The increase in the value of the British pound sterling has helped amazingly.

A lot of things remain to be done in this country before normal conditions can be entirely restored. Some of them are:

Sane revision of the tax system.

Reduction of governmental expenditures.

Permanent settlement of the tariff on a sane basis.

Reorganization of Federal machinery so it will give more efficient service.

The refunding of foreign loans so they can be reduced gradually.

Assistance to exporters and the safeguarding of foreign commerce.

Assistance to the farmers through supplements to the normal banking machinery and by the mobilization of private credit to finance cotton, cattle and other commodities.

Development of water power resources and the elimination of waste in production and distribution.

Legislation never can be a panacea for economic ills, but wise action by Congress will do much to solve some of these pressing problems.

The business world already has done much to right itself and the readjustment has come about with less disturbance than might have been expected. There has been no actual money panic, as there would have been except for the Federal Reserve system and as there always has been in previous periods of great depression.

CONSIDERING all the factors involved, the automotive industry can safely view the remainder of 1922 with serenity. So far as passenger cars are concerned, the volume assuredly will be as large as last year and in all probability larger. The number of light trucks sold will be two or three times as large and in the heavy duty field last year's sales record undoubtedly will be doubled. The parts and accessory manufacturers can count on business at least double the aggregate of 1921 and in all probability much more than that.

Automotive Industry Fortunate

So far as the automotive industry is concerned, it has been exceedingly fortunate. The percentage of casualties has been relatively light. Failures there have been, but they have been comparatively small and they have not shaken the structure of the industry. Last year was the third best the industry ever has had and this year will be fully as good. It will be considerably better except, perhaps, in the sale of passenger cars. The total in that field is not likely to go much ahead of last year, but it must not be forgotten that more than 1,500,000 cars were sold in 1921.

Factories are co-operating with dealers as they never did before. They are considering the questions of finances, used cars, service and satisfied customers. They are thinking in terms of quality and their engineers are working on mechanical improvements. Greater mileage per gallon of gasoline and lower maintenance costs for motor vehicles have become mighty big factors. Keen competition is a business stimulant.

Manufacturers are competing for competent dealers. They are glad to make contract concessions to get the right men, and they are looking at the vital problems of the industry in a broader way. They realize that all its component parts must be prosperous and happy if it is to be happy and prosperous as a whole.

Builders of motor vehicles have liquidated their inventories and taken their losses, staggering as they have been in some cases. They have done everything possible to lower production costs and overhead expenses. The consequence has been that they have been able to make drastic price reductions. These reductions have been passed on to the ultimate purchasers and they have not been absorbed by the middleman as they have been in most other industries. As a result purchasers have no grievance. Even the farmers admit automobile makers have been fair on the question of prices.

Prices seem to have been fairly well stabilized in the passenger car field, although reductions may be expected here and there throughout the year. Truck and tractor makers have brought their prices down as sales have felt the stimulus of improved business conditions generally and competition has forced them to act.

The hearts of the great basic industries are throbbing with a stronger beat. Idle freight cars are rapidly decreasing in number. Bank vaults are bulging with funds awaiting investment in sound enterprises. Interest rates are going lower all the time. The nation finally has conceded that motor vehicles are essential to its life and that even passenger cars are not "pleasure" vehicles.

There are a few clouds left on the automotive horizon, but the sun has broken through and there are big patches of blue sky. The automotive merchant who whistles as he works and who works hard will have a good year and when he balances his books at the end of December he will find he has prospered.

Bristol Gas Starter for Multi-Cylinder Aircraft Engines

THE Bristol gas starter, designed for starting aircraft engines of six or more cylinders up to 500 hp., is a product of the well-known British aircraft manufacturing concern. It may be operated from inside the fuselage and during flight, may be installed in any convenient position, away from the engine if necessary, and weighs only 40 lbs. Inasmuch as the hand magneto and dope pump required when no motor type of starter is fitted are dispensed with, it is claimed that there is really a saving in weight.

The starter consists of a small air-cooled single cylinder two-stroke engine, and a pumping cylinder. The latter draws combustible mixture from the carbureter, supplying the two-stroke power cylinder, and pumps the mixture under pressure to the main engine cylinders.

Interposed between the pumping cylinder and the main engine cylinders is a small disc valve distributor, driven by suitable gearing from the main engine, at one half engine speed, and which passes the compressed gas to each cylinder:

(1) When on its firing stroke.
(2) When on a portion of its induction stroke.

To avoid loss of pressure through the open inlet valves on the induction stroke, the port in the distributor in communication at this period is controlled by a spring loaded ball valve, arranged to open at about 40 lbs. pressure. A non-return valve is fitted to each cylinder, which effectively isolates the starting apparatus when the main engine is running.

The gas starter is fitted with a two-cylinder magneto, from which one ignition lead is taken to the spark plug of the two-stroke power cylinder, while the second lead is taken to the central terminal of the distributor on one of the main engine magnetos.

Method of Operation

The two-stroke engine is started by means of the lever provided, and under the pressure of gas supplied to the cylinders the main engine begins to turn. At the same time gas is admitted into the cylinders during the period of the induction stroke, this gas passing through the cylinders and open inlet valves, and filling the induction system. After one complete revolution, therefore, the whole induction system is filled with gas, which is drawn in on the next induction stroke, and by opening the short circuit switch between the starter magneto and main engine magneto, the engine will fire and pick up on its own carbureters. It will thus be seen that the gas starter supplies both gasoline and ignition to the main engine for starting. It is claimed that engines up to 500 hp. when cold are turned round at the rate of 12-15 r.p.m. The induction pipe of the gas starter is so arranged that the pumping cylinder gets a richer mixture than the power cylinder, which is necessary on account of the subsequent dilution when the mixture reaches the main engine cylinders.

Construction

Both power and pump pistons are of aluminum, of 3 in. diameter and a stroke of 2½ in. The big ends of the connecting rods are mounted on roller bearings, and are located side by side on one common crank pin.

The cast-iron power cylinder is of the three port type, the crankcase being used to compress the mixture. The cast-iron pump cylinder draws its mixture through a port uncovered by the piston as it reaches the bottom of its stroke, and discharges through a non-return valve in the head.

The crankshaft is in two parts with integral balance weights, and is mounted on ball bearings. From one end the two-cylinder magneto is driven direct, while the fly-wheel and starting gear are carried on the other end.

The starting gear consists of a quadrant attached to the starting lever, which is brought into mesh with the pinion connected through a free wheel to the fly-wheel. When not in use, the quadrant is entirely out of mesh with the pinion.

A cast-iron fan fly-wheel is fitted, with integral blades, which deliver air to the power cylinder at sufficient velocity to enable the engine to be run continuously under full throttle.

The fly-wheel is also provided with a Vee belt rim which may be used for driving auxiliaries. The "petroil" system of lubrication is used (oil mixed with fuel).

Trend of French Cycle Cars and Light Cars

Heavy taxes on cars with piston displacement of more than 67 cu. in. and weighing over 770 pounds has revived interest in cycle cars. Industry tends toward the four-cylinder, water-cooled type, with standard transmission and drive. Description of leading French cycle and light cars.

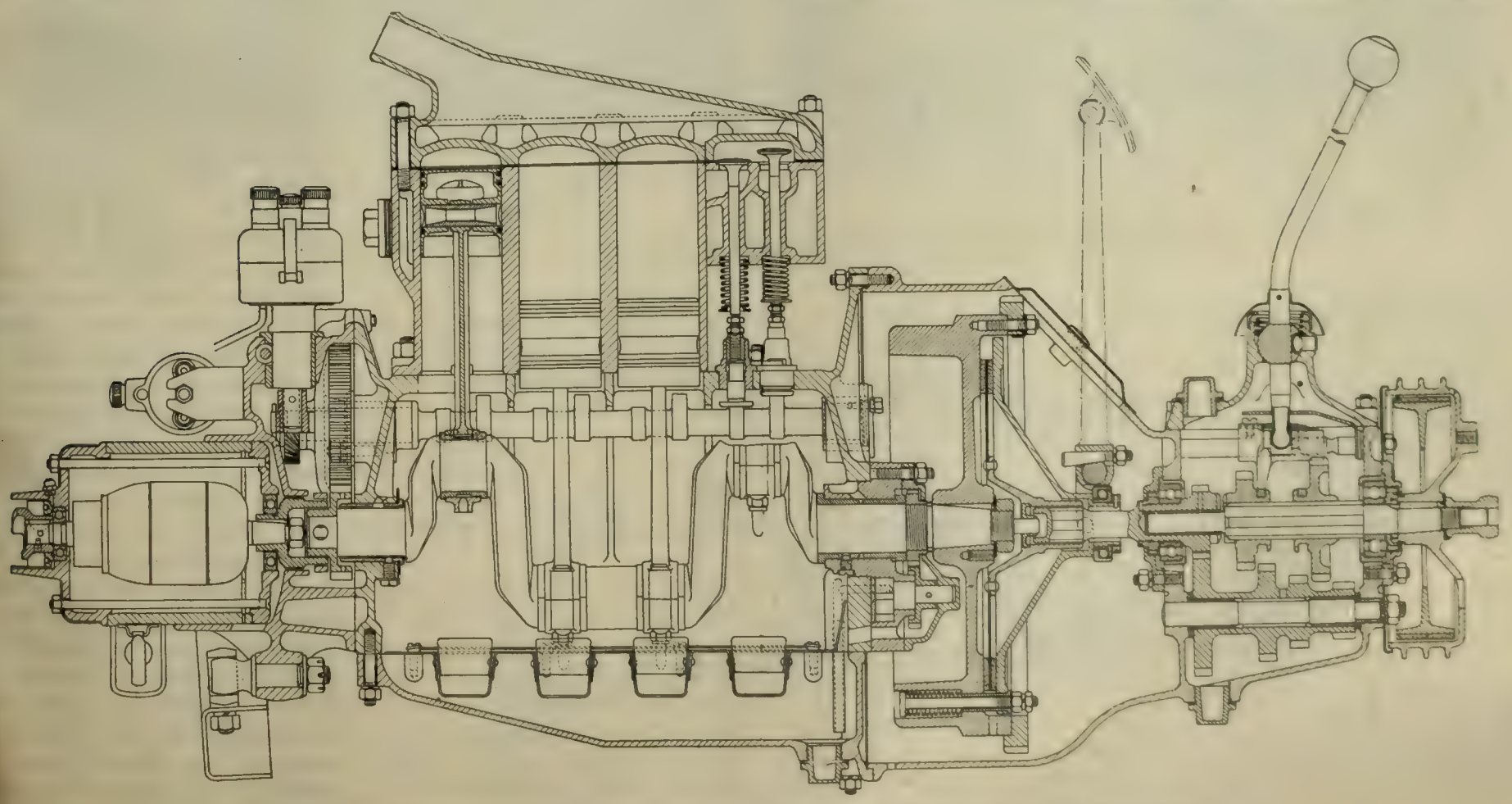
By W. F. Bradley

FRANCE, in common with other European countries, is interested in the development of light two-seater automobiles commonly designed as cycle cars. This term does not imply the adoption of any specific mechanical features, for under the French Government definition any two-seater automobile with a piston displacement not exceeding 67 cu. in. and weighing not more than 770 lb. is a cycle car and entitled to the benefit of the reduced tax of 100 francs per annum. Unless coming within these two limits, the machine is classed as an automobile and pays higher taxes, varying according to district, but certainly not less than 400 francs.

The decision of the Government to give special treatment to 67 cu. in. 770-lb. machines has been responsible for a wonderful revival in cycle car production. French engineers, however, are not showing much interest in pure cycle cars, that is, in light three and four-wheelers having more of the characteristics of the motor cycle than of the automobile. By a pure cycle car is meant a machine with an air-cooled engine with less than four cylinders, a simplified type of change-speed mechanism, and chain or belt drive.

In England considerable importance is being attached to air cooling for small powerplants. In France the tendency is entirely in the opposite direction. Other Continental countries—Italy, Belgium, Austria, Germany—are also showing a preference for water cooling. There is not a single maker of any standing in France who has preferred air-cooled to a water-cooled engine, even when he has to keep his piston displacement down to 67 cu. in. and is limited to a total weight of 770 lb.

The line of thought of the French engineers is that as piston displacement is decreased thermal and mechanical efficiency must be increased. It is an easier task to produce a 67 cu. in. high-speed high-efficiency water-cooled engine than an air-cooled powerplant of the same size. With air cooling the compression must be kept lower to avoid pre-ignition and spark plug troubles. The air-cooled engine will need decarbonizing at more frequent intervals and it will be more difficult to keep in tune. Its oil consumption will be higher, and this is an important matter when a good oil costs at least 5 francs per litre. To obtain good cooling the engine will have to be either a V or horizontal opposed. If four cylinders are adopted, there must



Sectional view of Citroen 5-hp. power plant. Cylinder dimensions, 2.2 by 3.5-in.

be some system of blower to direct a draft of air on the cylinder heads; this absorbs considerable power and complicates the design. While a twin-cylinder air-cooled engine with a simplified type of transmission is attractive from a cheap production point of view, the French industry is pinning its faith on a more elaborate design comprising a four-cylinder water-cooled engine and car type of transmission and drive.

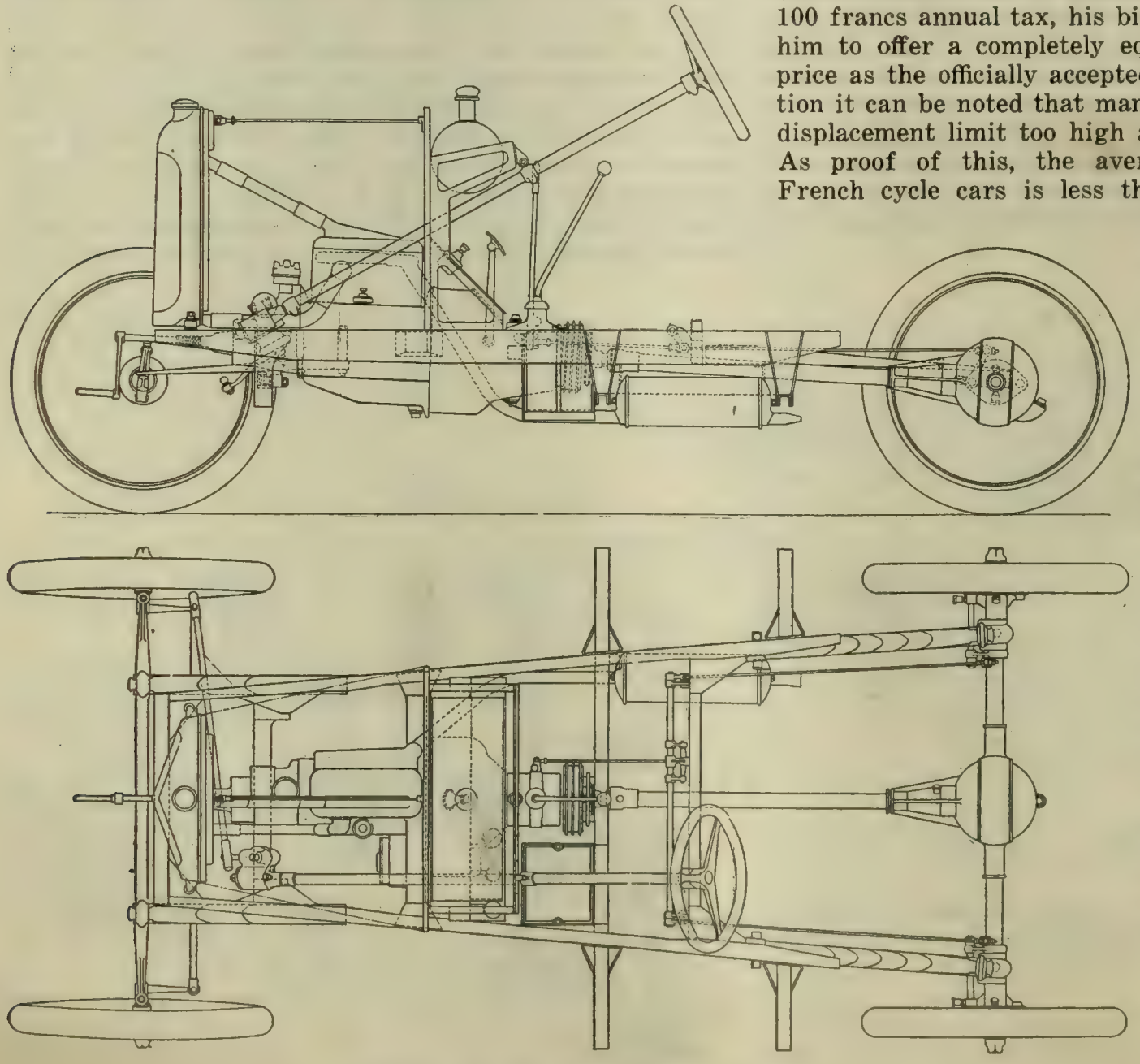
The 67 cu. in. machine has attracted the attention of several important French makers. The most notable example is Citroen, who recently purchased the big Clement Bayard factory in which to produce his four-cylinder 52 cu. in. two-seater light car. This machine, although coming well within the piston displacement limit, is not officially recognized as a cycle car, for it exceeds the 770 lb. weight limit. Nevertheless it comes in direct commercial competition with the pure cycle cars. Peugeot also has a small two-seater with a piston displacement of only 41 cu. in. This is a four-cylinder water-cooled model with worm-driven rear axle. Mathis markets a 46 cu. in. cycle car the mechanical features of which are practically identical with those of his larger cars.

Another important firm interested in this class of machine is the Salmson Aviation Co. Soon after the war this company secured the manufacturing rights, in France, of the English air-cooled G.N. cycle car. This is still built, but the firm is just about to go into production on a 66 cu. in. four-cylinder, water-cooled, shaft-drive model which almost certainly will drive out the firm's air-cooled chain-driven car.

There are no standard dimensions for French cycle cars and light cars. Track varies from 40 to 43 in., and wheelbase is from 86 to 100 in. Wheels are nearly always wire, with 650 by 65 mm. tires (25 by 2½ in.). To get accommodation for two persons, the seats are nearly always staggered. To keep the selling price as low as possible, these machines are generally sold without electric lighting and starting. Some of them are designed to take a starter and lighting set as extras, while a minority have these as standard equipment. Owing to the weight limit of 770 lb. it is difficult to include electric lighting and starting with the machine. If this is added later, thus making the machine overweight, the manufacturer is not responsible if the tax collector takes action.

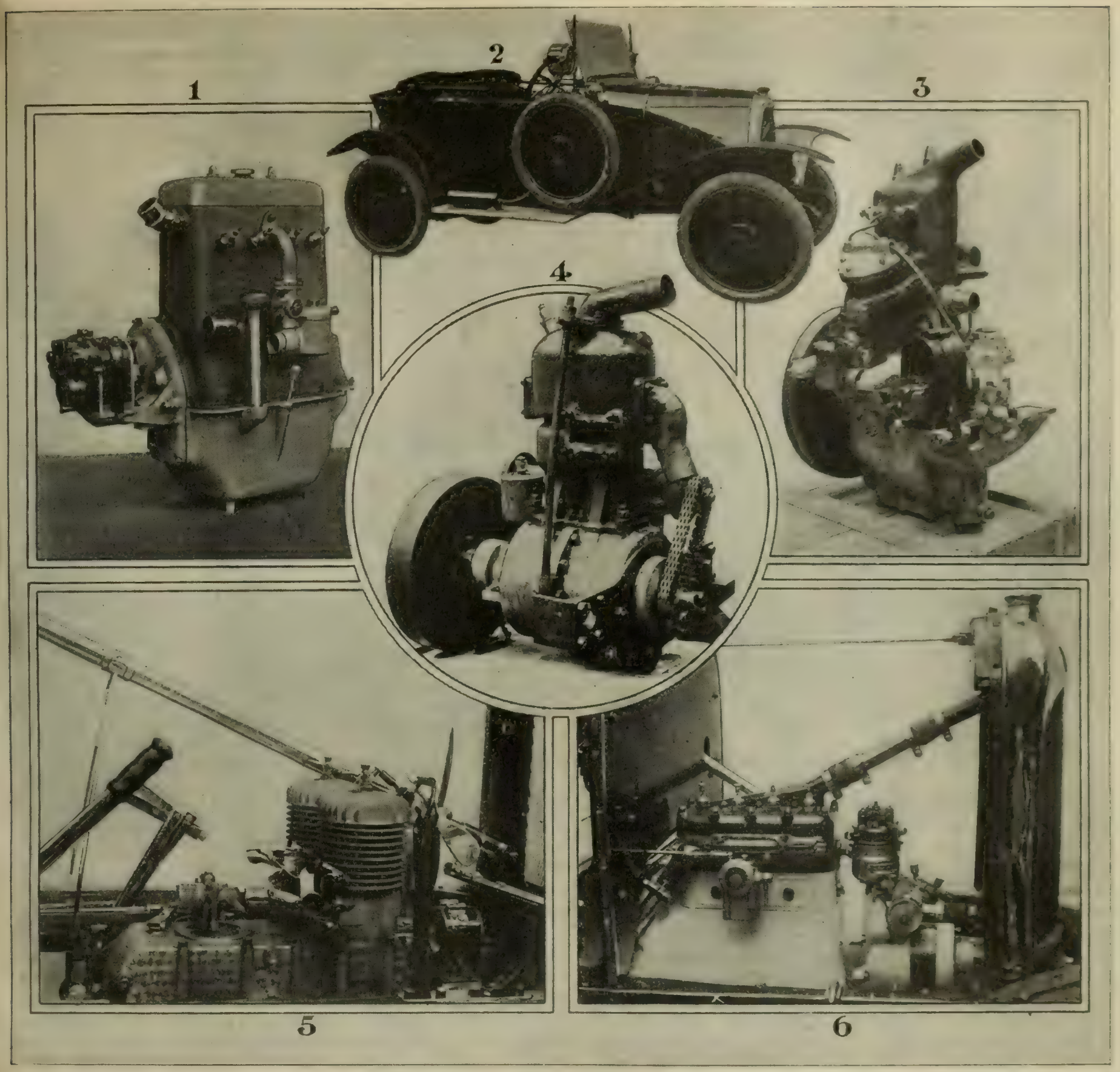
Citroen's 52 cu. in. light car has the same general features of design as his 10-hp. car. The four-cylinder engine measures 2.2 by 3.5 in. and has a detachable head, an aluminum crankcase and a 1.6 inch crankshaft with two bearings of 1.7 and 2.3 in. length. One of the features in which it differs from the bigger car is in the adoption of Delco lighting and starting. The Delco distributor is driven by helical gears off the camshaft and is carried just ahead of the forward cylinder. The generator is driven from the front end of the crankshaft. The car has a unit powerplant with three speeds and reverse, final drive being by Citroen herringbone gears. A differential is used, Citroen's experiments having shown that an axle without one is unsatisfactory. Rear suspension is by quarter elliptics.

It would appear that Citroen's first idea was to get into the official cycle car class, but the decision, taken after long experiments, to make use of a differential, and to supply electric lighting and starting as standard equipment, brought the weight beyond the official figure. While Citroen cannot sell in France with the advantage of the 100 francs annual tax, his big means of production enable him to offer a completely equipped machine at the same price as the officially accepted cycle cars. In this connection it can be noted that many makers consider the piston displacement limit too high and the weight limit too low. As proof of this, the average piston displacement of French cycle cars is less than 60 cu. in., while all the makers have difficulty in getting inside the weight limit.



Elevation and plan of Citroen 5-hp. chassis

Overhead valve engines are found plentifully in the modern French light cars and cycle cars. The new Salmson is a good example. The cylinders, 2.4 by 3.5 in., are of the detachable head type mounted on an aluminum base chamber, with valves inclined in the head. The front end of the crankshaft carries a helical gear which meshes with another pinion on a transverse shaft. The magneto is driven from one end of this shaft, while at the other end there is a second helical gear driving the camshaft. Four cams are used, each one serving for both the intake and the exhaust. The exhaust valve is opened in the normal way by the upward movement of an external push rod operating an overhead



1—M. A. S. E. overhead valve engine. 2—Francon two-seater with two-stroke engine and friction drive. 3—Francon two-cylinder two-stroke engine showing compressor. 4—Two stroke engine of Monroe friction drive cycle car. 5—Twin-cylinder two-stroke engine used on Bleriot cycle car. 6.—Citroen 5-hp. power plant

rocker arm. The intake valve is opened by the action of two coil springs having their extremities attached to the rocker arm and cylinder head respectively. Only the inertia of the valves has to be overcome for closing, and as the weight of each valve is only 1.7 ounces, the engine can run at a high number of revolutions. The plugs are mounted in the head of the combustion chamber, and the whole of this overhead mechanism is inclosed by an aluminum cover.

The transmission is a three-speed type, forming a unit with the engine, but with an open well for the flywheel and the cone clutch. Standard lines of construction are followed in the rear axle, with the exception that no differential is used. In addition to saving weight on the axle itself, this simplifies the brakes, which are of the internal expanding type on the wheel drums, one being operated by hand and the other by foot. In addition to being used on its own chassis, the Salmson powerplant has been adopted by two other French manufacturers, Bignan and Sigma.

Engineer Cauzan, a French specialist in high-efficiency engines, is responsible for the powerplant of the M.A.S.E. cycle car. This is an overhead-valve engine with cylinders and upper half of crankcase in one casting. The push rods go through the cylinder casting and operate the vertical valves by means of rockers. The plugs are inclined just below the valves and the magneto is driven off the end of the camshaft. This 67 cu. in. engine weighs 127 lb. complete and develops 25 hp. maximum.

The M.A.S.E. chassis, built under Le Grain license, has a selective three-speed gearbox. Final drive is by inclosed propeller shaft with fabric universal joint at the front and bevel gearing rear axle without a differential. Cantilever springs are used at the rear. A couple of transverse springs, mounted one above the other, with a central bridge piece between them, fill the functions of the front axle, the steering pivots being carried between

Elevation and plan of Francon cycle car chassis

the outer extremities of the two springs. Steering is direct, with a spur gear reduction contained in a housing immediately under the wheel.

Engineer Picker, a motor specialist, is responsible for the powerplant of the Hinstin-Sup cycle car. This is another overhead-valve job, with external pushrods, detachable head and two-bearing hollow crankshaft with forced-feed lubrication. The three-speed transmission forms a unit with the engine, but with an open well for the flywheel and cone clutch. There are no special features in the chassis, which has a transverse front spring and quarter elliptics at the rear. The rear axle is bevel-gear type without a differential. The horsepower obtained from this engine is stated to be 22, and as the weight of the chassis is 573 lb., there is sufficient margin for a comfortable two-seater body without exceeding the official limit of 770 lb. With this high power and low weight a very snappy car is obtained having a maximum speed well over 50 m.p.h.

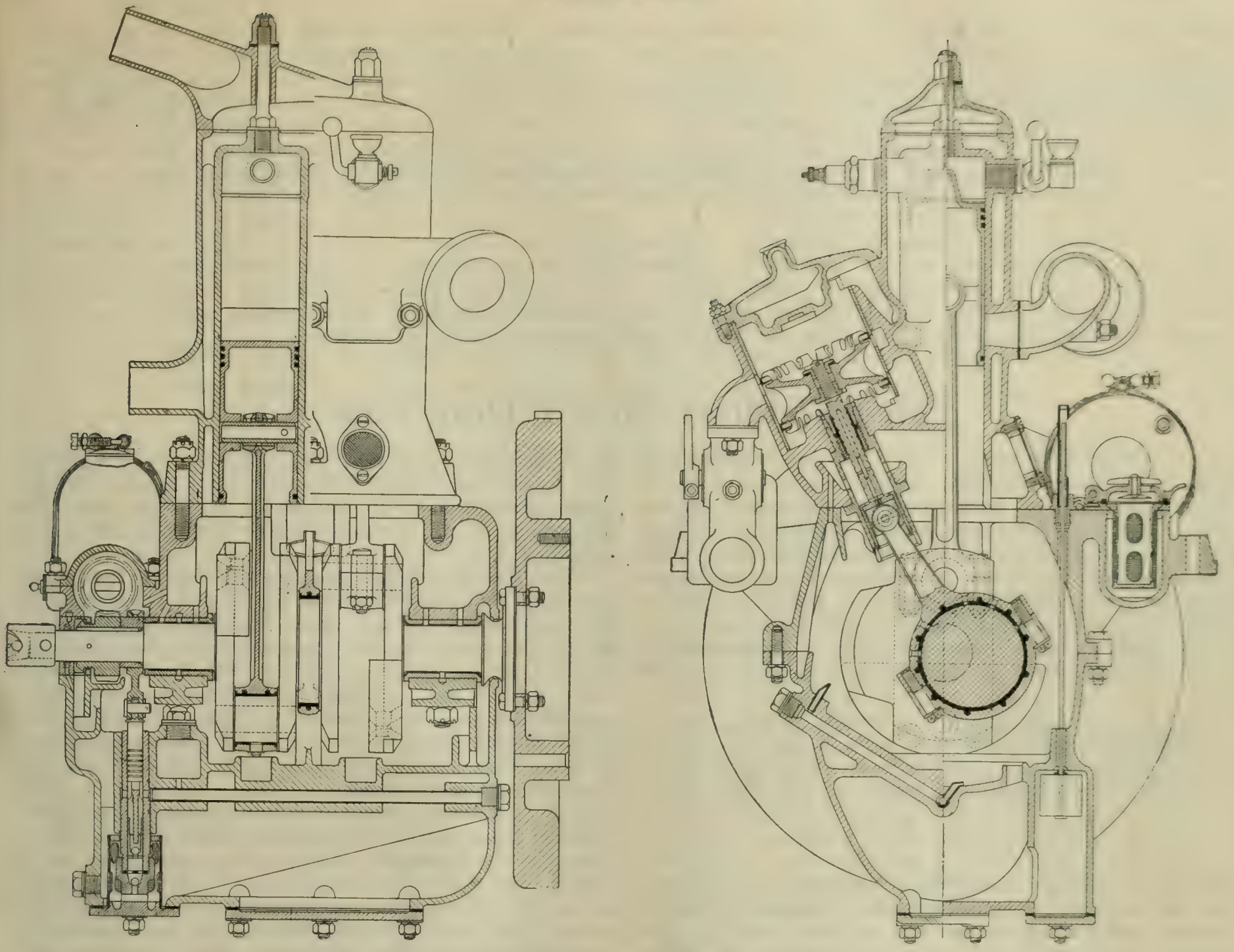
Another successful machine is the Amilcar, built entirely on standard lines, with a 55 cu. in. water-cooled engine having valves on one side and a detachable head. The E.H.P. and Derby are other machines falling into the same standardized type.

In addition to the cycle cars built on what are generally accepted as standardized big car lines, there is an intermediate class of machine having the external appearance of a big car in miniature, but with a simplified type of transmission or drive. One example of this is the Carteret, with a normal type water-cooled L-head engine. The rear-axle housing is of aluminum alloy and contains straight bevel gearing without a differential. On top this car drives straight through from engine to rear axle by a cone clutch and propeller shaft. There is no gear box, but the clutch shaft is designed so that after completely disengaging the cone it can be raised to any desired angle and a frictional contact obtained between the flat face of the driving member and the bevelled edge of the driven member. As friction drive is only employed for the short periods when the direct gear ratio is too high, this system appears to be satisfactory. The Fournier has a standard type of 55 cu. in. four-cylinder water-cooled engine, friction transmission and single-chain drive, without anything very distinctive in its makeup. There is a similar system of transmitting the power to the rear wheels in the Mourre cycle car. This, however, has a special two-stroke water-cooled engine, built under Violet patents, with two vertical cylinders having a common combustion chamber. The engine has been very successful in races, but has not sold very largely as yet.

The most original machine in this intermediate class is the Françon designed by Engineer Chedru, who for several years was attached to American automobile factories and later was with Panhard-Levassor. The Françon has one of the smallest engines on the French market, the two cylinders, which operate on the two-stroke principle, measuring 2.1 by 3.9 in., giving a piston displacement of only 28 cu. in. On this engine Chedru has an interesting type of double-acting compressor and distributor driven by eccentric from the center of the crankshaft. This consists of an aluminum piston with one ring at the top and one at the bottom which compresses the charge and delivers it to the two working cylinders. The upper face of this piston acts for one cylinder and the lower face for the other cylinder. This construction calls for a crosshead and a gland, and advantage is taken of the piston-type crosshead to automatically lubricate the gland. According to official test carried out by the Automobile Club of France, the engine develops 10 hp. at 2000 revolutions, and its oil consumption varies from 10 to 13 oz. per horsepower-hour.

The friction transmission and single-chain drive adopted by Chedru have distinctive features. It has been sought to obtain complete protection and extreme rigidity, and with this object in view the driving and driven members are mounted within a rigid casting forming an aluminum well bolted to the two frame members. Provision is made for locking the driven disk in four positions on its shaft. The driving shaft has a fore-and-aft movement, under the influence of the clutch pedal, and is maintained in contact with the driven member by two coil springs, both of which are in operation for the reverse and two lower ratios, and one only for the two higher ratios. Final drive is by means of a chain contained within an aluminum housing which, in addition to completely protecting the chain, forms a radius member.

Frame members of the Françon are of ash. Semi-elliptic springs are used at the front and a double type of



Two sectional views of Francon two-stroke engine

quarter elliptic at the rear. The main spring consists of six leaves clipped below the frame members and immediately above this a second spring with three leaves having reversed camber. The two springs slide in blocks respectively above and below the axle housing. The lower spring and the main leaf of the upper spring carry all the load, the other leaves of the upper spring acting as a rebound check. The arrangement has proved satisfactory.

Cycle cars on motorcycle lines are not very common in France. In this class the three-wheel Morgan, of English origin, is one of the most popular. For the French market the machine with a twin-cylinder water-cooled engine is much more satisfactory than the corresponding machine with twin air-cooled engine.

Bleriot has a twin-cylinder two-stroke air-cooled engine, with the vertical cylinders set side by side on a com-

French Small Cars

MAKE	No. of Cylinders	Bore and Stroke	Piston Displacement	Valve Location	Cooling	Clutch	No. of Speeds	Transmission	Drive	Suspension	Differential	Wheelbase	Track	Wheels
Amilcar	4	2.1x3.7	55	L	Water	Disk	3	Gear	Bevel	¼ El.	No	94	43	Wire....700x80
Bedelia	2	3.1x3.9	61	L	Air	None	3	Frict.	Belts	¼ El.	No	95	40	Wire....650x65
Benjamin	4	2.1x3.2	46	L	Water	Plate	3	Gears	Worm	¼ El.	No	90	34	Disk....650x65
Bignan	4	2.4x3.5	66	I	Water	Cone	3	Gears	Bevel	¼ El.	No	102	40	Wire....650x65
Bleriot	2*	2.7x3.7	45		Air	Disk	3	Gears	Belt	¼ El.	No	79	50	Wire....710x85
Carteret	4	2.2x3.7	59	L	Water	Cone	3	Frict.	Bevel	Cant	No	94	43	Wire....700x75
Citroën	4	2.2x3.5	52	L	Water	Plate	3	Gear	Bevel	¼ El.	Yes	90	44	Disk....650x65
Derby	4	2.2x3.3	55	L	Water	Cone	3	Gear	Bevel	¼ El.	No	95	43	Wire....700x80
E. H. P.	4	2.1x3.7	55	L	Water	Plate	3	Gear	Bevel	Cant	No	90	43	Wire....710x90
Fournier	4	2.1x3.7	55	L	Water	Frict.		Frict.	Chain	¼ El.	No	90	43	Wire....650x65
Françon	2	2.1x3.9	28		Water	Frict.	4	Frict.	Chain	¼ El.	No	90	43	Disk....650x65
G. N.	2	3.3x3.8	66	L	Air	Plate	3	Bevel	Chains	¼ El.	No	95	40	Wire....650x65
Griffon	2*	3.3x3.4	60	L	Air	Disk	2	Gears	Belt	½ El.	No	86	40	Wire....650x65
Hinstin-Sup	4	2.4x3.5	67	I	Water	Cone	3	Gears	Bevel	¼ El.	No	96	43	Wire....700x80
Maze	4	1.9x3.8	67	I	Water	Cone	3	Gears	Bevel	Cant	No	98	43	Wire....650x65
Mathis	4	2.1x3.1	46	L	Water	Disk	3	Gears	Bevel	½ El.	No	90	43	Disk....700x80
Morgan	2	3.2x4	64	I	Water	Plate	2	Gears	Chain	¼ El.	No	80	43	Wire....700x80
Peugeot	4	1.9x3.3	41	L	Water	Disk	3	Gears	Worm	¼ El.	No	90	36	Wire....650x65
Salmson	4	2.4x3.5	66	I	Water	Cone	3	Gears	Bevel	¼ El.	No	102	40	Wire....650x65
Sénéchal	4	2.1x3.7	55	L	Water	Plate	3	Gears	Bevel	½ El.	No	83	40	Wire....650x65
Sigma	4	2.4x3.5	66	I	Water	Cone	3	Gears	Bevel	½ El.	No	102	40	Wire....650x65

*—Two-stroke engine.

bined base chamber and gearbox. On this machine use is made of single rubber belt drive to the rear axle. Griffon makes a similar type of machine with twin V-type air-cooled engine, a motorcycle gearbox and single-belt drive. Bedelia, a pioneer in the cycle car field, has returned after several years' absence with a machine embodying an air-cooled engine, a system of friction drive from the main shaft of the engine to a lay shaft, and very long belts from the lay shaft to the rear wheels.

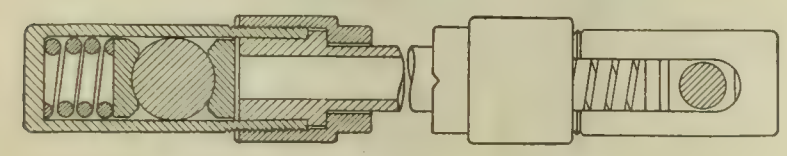
The G. N., a machine of ingenious design, has been the most successful of the pure cycle cars on the French market. This has a twin-cylinder air-cooled engine, a plate clutch and a counter shaft with dog clutches, by means of which single chain drive to the rear axle is obtained. Four chains are used, one being for reverse and the others for the three speeds forward. While this machine has been successful, it is significant that its French makers, the Salmson Co. have thought it necessary to bring out a four-cylinder water-cooled model of the same piston displacement designed throughout on car lines.

Reviewing the situation broadly, the cycle car, as it was known eight or nine years ago, has failed to make good in France. A type of machine which, while officially recognized as a cycle car, but in reality having little or nothing in common with motorcycle development, is proving its worth. These machines are generally diminutive automobiles with all frills removed and all the parts simplified to the lowest degree.

New Weldless Type of Drag Link

AN improved design of a "weldless" type of drag link for automobile steering, brought out by the Smith & Johnson Mfg. Co., is claimed to have a greater factor of safety than drag links now in use. Referring to the accompanying cut, it will be seen that the component parts are the same for both ends, and spring action in both directions is obtained by the positioning of the springs in the sleeve—one inside and the other outside the ball.

The springs are of standard design and furnished to customer's specifications as to weight, etc. The bearings



Detail of weldless type of drag link

are steel stampings made from a hemispherical blank and are pack-hardened to resist the wear of the ball. The lock washers are steel stampings and are heat treated so that the locking tongue will stand at least 8 bendings before breaking.

The sleeves are thimble-shaped steel stampings with the open and externally threaded and a slot in one side wide enough to permit free action of the ball arm. The nuts are steel stampings with one end hexed and the other end formed with 12 serrations to accommodate the tongue of the lock washer and cut with an internal, tapered thread. The connecting tube is of seamless steel tubing, with its ends upset hot and then machined with a back taper. The finished nuts are placed on the tube before the last end is upset.

When this drag link is assembled on the car, the spring, bearings, ball, lock washer and end of tube are inserted in the sleeve from the open end. The nut is then screwed on the sleeve until the end of the sleeve and inner shoulder of the nut are tight against the ring boss of the tube end. As this nut is screwed on it forces the sleeve down against the back tapered end of the tube and rigidly holds the units together. The tongue of the lock washer is then forced into one of the serrations on the end of the nut and locks the nut to the sleeve.

Increased safety is claimed for this design of drag link because there are no welds and no large ball opening in the side of the sleeve. It is easy to assemble on a car because the angle of the ball opening is adjustable and the same drag link can be used for either right or left-hand drive. The link is also adaptable for use as a tie rod, as the short distance from the center of the ball to the end of the sleeve gives clearance for any type of wheel.

This drag link is furnished in four ball sizes of 1, 1⅛, 1¼ and 1½ in. diameter. Grease cup bosses may be specified either on the side or the end of the sleeve, and where adjustment for length between centers of balls is required a special nut is used on one end of the drag link.

New Denby Truck Model

THE Denby Motor Truck Co. recently started production on a new 2½ to 3-ton chassis mounted on 155-in. wheelbase. The new chassis incorporates the Continental C-2, four-cylinder, unit power plant, with 4⅛ by 5¼ in. cylinder dimensions. The chassis is designed to cover a wide range of purposes and is provided with plenty of room behind the seat. The length of the frame behind the driver's compartment is 144-in. The frame width is 33¼ in. and it is made of pressed steel, 6½-in. deep by 2½-in. wide. The frame is pressed from ¼-in. stock. Allowance for a body weight of 1500 lb. is provided in giving the 3-ton rating. The weight of the chassis is 4500 lb.

This truck is designed to have a speed range up to 25 miles per hr. on pneumatics and 18 miles per hr. on solid. The engine develops 39 hp. at normal speeds. Ignition is by magneto, cooling by centrifugal pump and lubrication by combined pump and splash system. The clutch is a Fuller, multiple disk, dry plate type lined with Raybestos. The gearset provides four forward speeds and one reverse and the rear axle is a Clark, model 2-D internal gear type providing an 8 to 1 reduction. The Hotchkiss drive system is utilized. The service brakes are on the propeller shaft, the brake drum being 8½-in. in diameter by 4-in. in width. The hand or emergency brake is an external contracting type on the rear axle. The front springs are 44 by 2¼ and the rear, 52 by 3½. The wheels are steel and the tires either pneumatic 36 by 6, front and 42 by 9 in. rear, or solid, 36 by 4-in., front and 36 by 7-in., rear. The regular equipment includes solid tires, oil lights, hand horn, bumper, towing hooks and tools and sells for $2795 f. o. b. Detroit.

ON Jan. 1, 1921, the public transport services in Paris and suburbs was taken over by the Department of the Seine, which transferred them to a new company. During the first ten months of working under the new management the motor omnibuses conveyed 200,000,000 passengers against 135,000,000 in the corresponding period of the previous year. The receipts increased from 40,000,000 francs to 67,000,000 francs.

Design and Functioning of Laminated Automobile Suspension Springs

Part II

The writer deals with the different spring steels and the various component parts. In concluding he gives specifications for a standard testing procedure for testing raw spring material and the finished product.

By A. A. Remington*

TO insure maximum economy of material in a spring, it is necessary that the maximum stress of which the material is capable shall be carried by every section, or, in other words, that no one section shall be stressed more severely than any other section, so that the mean fiber stress shall be the maximum fiber stress. We have seen that this is attained by the basic rhombus, and therefore theoretically by a laminated spring strictly obeying what may be termed the "rhombus law."

Springs so designed are, however, not generally used in automobile work, but in adopting modifications it is desirable that they shall affect the stress distribution as little as possible, as every divergence between maximum and mean fiber stress involves using more spring steel for a given performance, resulting in greater weight and cost, a lowered efficiency and less reliability for the same mean fiber stress.

Any deviation in a spring from strict conformity to the "rhombus law" increases the stress at certain points and decreases it at others, and while the load-carrying capacity of the spring as represented by a certain amount of deflection under a certain load may not be affected, the modification in stress distribution may so increase the stress at certain points as to seriously reduce the safe maximum load that can be sustained by the spring.

Grading

In order to produce springs which will possess the ability to rebound past their "no-load" position without separation of the leaves, it is usual to provide "nip" by giving an increased camber to each successive blade. If the blades are all of the same thickness, this results in an increased stress in each successive blade, as when the spring is "nipped" up, the stress in some blades is negative, the negative and positive stresses balancing each other to produce equilibrium, as shown in Fig. 15 already referred to. When, therefore, such a spring is loaded externally, the load produces stress, which must be added to the initial stress, thereby producing a greater stress in the more highly cambered blades.

This cause of irregularity in the stress distribution can be minimized but not eliminated by grading the thickness of the blades. The stress in a blade varies with the thickness, so that increased camber and with it "nip" can be embodied with successively thinner blades without increase of stress, and this is frequently done in the lighter classes of automobile springs in which rebound past "no-load" position is assumed to be more likely to occur.

*Paper presented to the Institution of Automobile Engineers. Slightly condensed.

Owing to the variation in blade thickness adopted, the grading is seldom proportionate to the amount of "nip," so that the thicker blades are usually unduly stressed, and in the author's opinion it is preferable to keep all the blades of uniform thickness and the "nip" to the minimum practical amount, and have in consequence a somewhat higher stress in the shorter blades and a lower stress in the longer blades than the mean calculated figure.

The way in which "nip" tends to interact with grading in maintaining greater uniformity of stress is illustrated in Fig. 16, where the stress/strain curves for two hypothetical cases are superimposed, showing that whatever proportions are adopted, while the stresses in blades of varying thickness may be made more nearly uniform by providing a certain amount of "nip," they will only be identical at one deflection, *i. e.*, where the lines cross in the diagram, which is shown for a two-blade spring with one blade twice as stiff as the other.

Stiffness

The stiffness of a spring is its resistance to deflection, and primarily depends on the modulus of elasticity of the material. The basic formula for deflection in convenient

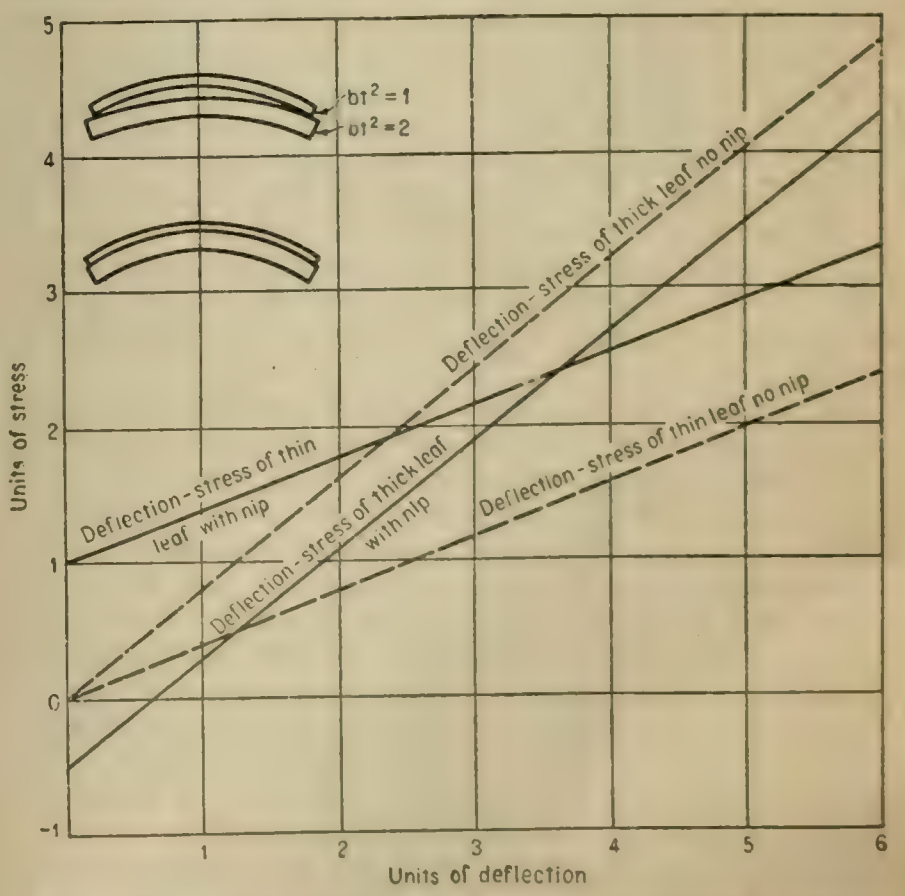


FIG. 16.—Chart showing effect of "nip" in tending to equalise stress in blades of different thicknesses.

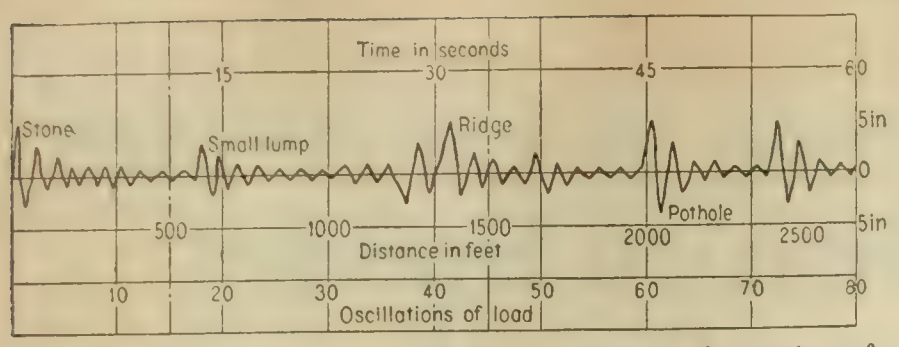


FIG. 17.—Imaginary graph of the movements of a spring of a vehicle travelling at 30 m.p.h. on an ordinary road. Period = 80 per min. = 1 complete swing per 0·75 sec. or per 33 ft.

form for laminated spring calculation has already been given, namely:

$$d = (WL^3)/(4bEnt^3).$$

It is found in practice that this formula requires adjustment, and it is convenient to make the adjustment in the value of E, which, instead of 27.5×10^6, the mean value for the steel, is found to vary for actual springs according to details of construction from about 18×10^6 to about 25×10^6, the low value being due principally to the difference between the nominal and the actual dimensions of the section and to variations in blade lengths and thickness. Quite small variations in blade thickness affect the deflection considerably, as deflection varies as t^3. In calculating deflection in the absence of exact information, it is advisable to adopt a mean figure, say, 22.5×10^6, in conjunction with the nominal blade thickness, and a table of the values of nt^3 for the usual blade thicknesses adopted is given in Appendix I.

This table is equally useful for a graded spring, as the value nt^3 is the sum of the nt^3 values for the separate blades of which the spring is composed, for example:

2—½ in. blades	$\ldots 2t^3 = 0.250$
3—7/16 in. blades	$\ldots 3t^3 = 0.252$
4—⅜ in. blades	$\ldots 4t^3 = 0.212$
	$nt^3 = 0.714$

Material

Many different compositions of steel have been used for automobile suspension springs. In use, the material must be capable of considerable bending in a part having reasonably uniform stress distribution, and if over-stressed it should preferably take a permanent set and not break. It must withstand an almost unlimited number of stress cycles between a low and a high stress, with occasional reversals, the stress being deducible from the diagram in Fig. 17, which has been plotted to illustrate spring action from the author's imagination guided by tests made with an apparatus which measured maximum deflection in service.

The material must also have a high resistance to cracking, and as it is essential to use material with a high yield point and therefore comparatively little ductility to obtain sufficient elastic bending, cracks are liable to cause trouble; the material should, therefore, preferably be of such a nature that if a crack occurs or exists in a blade its liability to extend is as small as possible. This is best obtained with a laminated plate, and such laminations can be obtained by using a rolled steel containing "slag" inclusions, providing they are suitably rolled out along the plate. In such a steel a crack is to some extent intercepted by the "slag" lines which cause a certain amount of discontinuity, and is therefore less liable to extend.

The steels most largely used in the manufacture of laminated springs may be divided into three groups by compositions:

1. Carbon steels, basic and open hearth, the carbon content ranging between approximately 0.50 and 1.0 per cent.
2. Carbon chromium steels, with or without the addition of a small percentage of silicon or vanadium, the carbon content ranging between approximately 0.45 and 0.6 and the chromium content between 0.50 and 1.50.
3. Silico-manganese steels, having a carbon content ranging between 0.50 and 0.80.

The steels are used in the hardened and tempered condition, being usually hardened in oil and tempered in a lead bath.

The chemical compositions and physical properties of various spring steels are given in Tables III and IV, and a tempering curve for one characteristic steel, showing the effect on the resulting physical properties of tempering at different temperatures, is given in Fig. 18.

The modulus of elasticity of the steel itself is substantially the same for all steels, and a suitable mean value is, as has already been mentioned, 27,500,000 in lb.-in. units. Variations due to inaccuracies in the determination of this value are probably greater than variations due to differences in composition of the steel.

American Spring Steels

The American Society for Testing Materials publishes three specifications for spring steel bars, but only specifies method of manufacture and composition.

These three specifications cover:

Carbon steel in two grades.
Silico-manganese steel in two grades.
Chromium vanadium steel in two grades.

The standard compositions are shown in Table V.

This Society has not published any data in regard to the physical properties of spring steel, but publishes in addition a specification for laminated elliptic springs for automobiles which includes an elaborate testing procedure. This specification provides for a maximum test load of twice the normal load, and specifies that the flexibility shall be measured by determining the height under 75 per cent and 125 per cent normal load and dividing the difference in loads by the difference in heights. This and other provisions in the specification make the testing an unnecessarily complicated procedure.

The provision of an arbitrary test load of twice the normal static load is unnecessarily severe in certain cases, and if insisted on would necessitate the use of a lower working stress than would otherwise be permissible, resulting in such cases in unnecessarily heavy springs.

Test of Material

The usual tensile, Brinell and Izod tests on the standard specimen, as adopted for structural steels, are, with the exception of the Brinell test, not directly useful for spring blades. The Brinell test, although it does not indicate directly any particular property, is a convenient means of checking the accuracy of the heat-treatment and is therefore to be recommended, and spring blades tempered to a suitable Brinell range for the steel employed are more likely to give satisfactory service than those either above or below. If below, the permanent-set point will be reached before sufficient bending has taken place, and if above, the plate is more liable to develop cracks from quenching strains or to have insufficient ductility.

The Brinell range for all steels is much the same, and the useful range for existing steels may be considered to lie between Brinell hardness Nos. 363 and 461. It is well known that the Brinell hardness number gives a very close approximation to the tensile strength when multiplied by

a suitable factor, but that the factor varies with the hardness and condition of the steel. For hardened and tempered spring steels the factor is found to be 0.22, and Table VI has been calculated on that basis.

Unfortunately, no standards at present exist on which to form a basis of comparison or to enable specifications to be prepared for tests that are suitable for spring steels, so that it is usual to depend on the composition, a standard heat-treatment and a hardness check, the remainder of the testing being carried out on the manufactured spring itself. Under these conditions, it is obviously necessary to control the temperatures comparatively closely, and, unfortunately, owing to the methods usually adopted in fitting springs, there is liable to be considerable variation in the maximum temperature reached and in the actual quenching temperature. This results in undesirable variations in micro-structure, which may affect the endurance of the blade and may not be capable of being detected by the Brinell test or in fact by any of the usual physical tests, and may even increase the apparent ductility as measured by elongation percentage in the tensile test.

Tests of Springs

At a first test it is usual to "scrag" a laminated spring cold by loading it rapidly to a test-load greater than its designed static load a number of times in succession. It is then measured for load at standard deflection, which checks its conformity to the drawing and also its rate of deflection. It is then "overloaded" and again tested for load-deflection as a safeguard against permanent set.

These tests have no particular meaning, except that they prove the particular spring as far as load-carrying capacity and freedom from permanent set are concerned, but if some uniformity were exhibited in the ratio between theoretical stress and maximum deflection under the "scrag" they could be made to indicate the quality of the material. If springs are made to identical design in carbon and alloy steels respectively, it is possible to find a load that will produce a permanent set in the carbon steel spring, but which the alloy steel spring will withstand without injury.

Springs can be made to carry out the desired load-deflection to a considerable degree of accuracy, and it is reasonable to expect that a series of springs will be alike within a variation from the specified load of plus or minus 5 per cent at a specified camber.

Blade Ends

It is usual in this country to taper the blade ends in thickness, presumably to obtain the rhomboid characteristics by reducing the blade thickness instead of the blade width. To do this accurately would involve making the open end of each blade as a parabola, a form difficult of accomplishment, and in practice the thinning is usually overdone and necessitates a sudden change of camber if "opening at the ends" is to be avoided. It would seem to be better practice to use full-thickness blades and adopt a "spear" of suitable form for this construction.

Eyes

It is usual, in fact almost universal, practice to use rolled eyes in automobile springs. In the best practice it is not unusual for the blade to be slightly thickened and widened at the eye and for a short distance down the blade as shown in Fig. 19. The thickening reduces the tendency of the end of the main blade to "give," thus reducing the necessity of "full-length" blades to support it, a practice which is liable to result in a disproportionate spring and the consequent use of an unnecessary amount of steel.

After rolling, the eyes should be bored through, and in the best practice a gun-metal bush is pressed in and reamed to size, and the ends of the bush and eye faced down to the normal breadth of the spring, within narrow limits. This enables the shackle and shackle-pin to be made to fine limits, and insures a good tight fit at a point where only too many cars early develop squeaking and rattle.

Center-Bolt

Many schemes have been proposed, and some are in use, to do away with the center-bolt and the consequent weakness which it is supposed to introduce. The center-bolt requires to be made of high-class steel as it must be kept reasonably small, and is depended on in "shear" to keep the blades in position longitudinally as well as in tension to hold against the "nip" until such time as the spring is clipped to the axle or other retaining member.

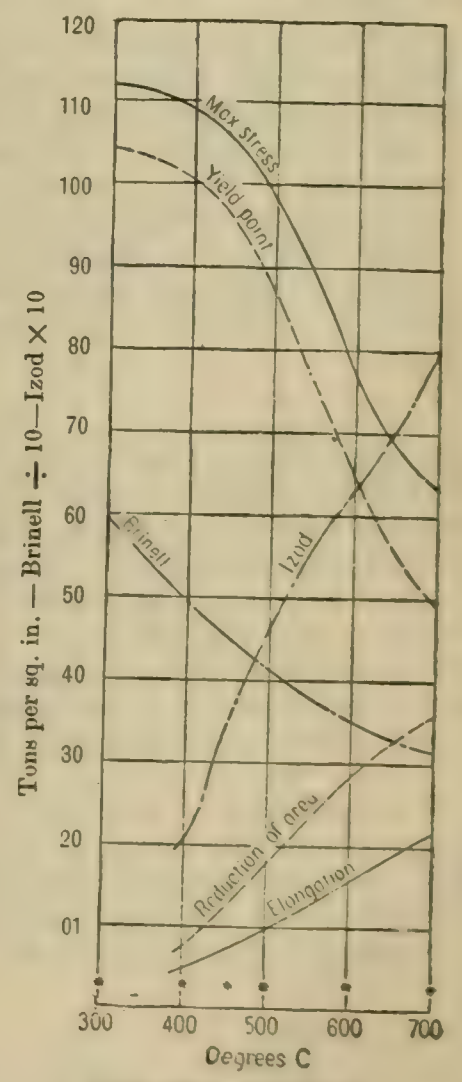
The relations between spring width and center-bolt diameter have been standardized in America.

Clips

It is usual to fit a "slip" near each end of a spring to hold the longer blades in position laterally and also to assist in preventing them from separating on rebound. These "slips" are commonly used in two forms, one involving a rolled eye, and the other rivets through the blade, as shown respectively at *A* and *B* in Fig. 20.

Spears

The more usual forms of "spear" are shown in Fig. 21. The semi-circular, segmental and gothic spears are usually used in conjunction with tapered blades, and the pointed spear with full-thickness blades; in fact, the latter is not



Silico-Manganese Steel.

Carbon	0·76.
Silicon	2·17.
Manganese	0·56.
Sulphur	0·035.
Phosphorus	0·038.

Test bars 1⅛ dia.
Test pieces 0·564 in. × 2 in.

Oil hardened 830°. Water quenched from temperatures indicated.

FIG. 18.—Tempering chart.

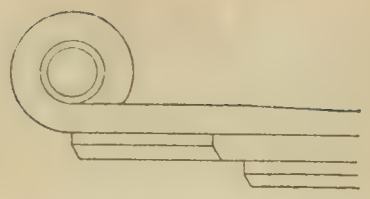


Fig. 19.—Spring end showing thickened eye.

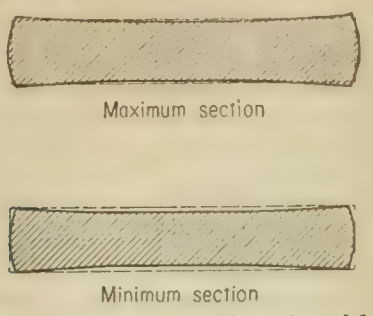


Fig. 22.—Sections of spring blades.

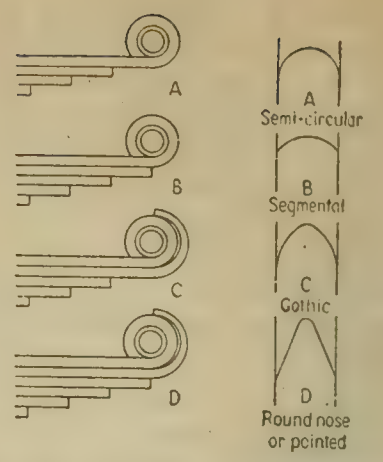


Fig. 21.—Blade ends and spears.

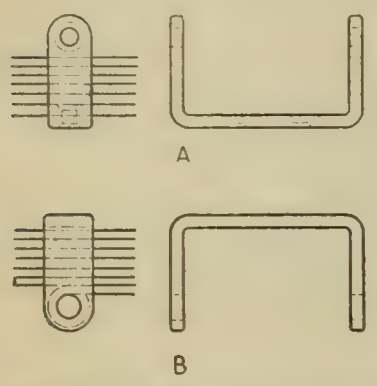


Fig. 20.—Usual forms of spring clip.

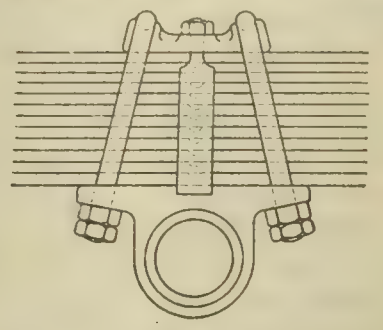


Fig. 23.—Suggested method of mounting a heavy spring.

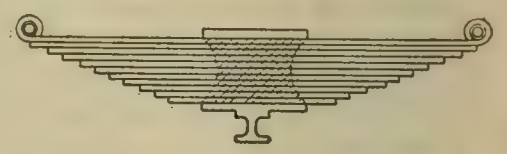


Fig. 24.—Loss due to wide bed.

suitable for tapered blades, and it will be observed that it will conform to the rhombus law if made of suitable proportions, without any thinning of the blade:

Effect of Essential Factors

In considering the best proportions for a spring, the effect of the various factors must be taken into consideration, and the principal of these are:

1. Full-length top blade.
2. "Nip."
3. Grading.

These three factors, as has been shown, affect the stress distribution, and the object of the spring designer should be to balance the antagonistic characteristics so as to maintain the maximum possible uniformity of stress throughout the spring.

The adoption of any proportion that alters the stress distribution necessitates more material in proportion to the ratio between the maximum stress at any point and the mean stress, and so results in a lowering of the safe static mean stress.

Proportions

From current practice it would appear that laminated automobile suspension springs should have not less than five blades and not more than sixteen, and that the width should be between 1½ in. and 4½ in., and be such that the total thickness of the spring should be not less than half nor more than twice the width.

The amount of flexibility and the permissible stress has already been considered, and it is clear that an infinity of springs can be designed to comply with any given specification.

There is little indication that a multiplicity of blades makes better riding, and therefore it is probably best to adopt a length and breadth that will provide a spring with a moderate number of blades and a thickness not much exceeding its breadth as producing the most satisfactory spring.

Deflection Under Load

To ascertain accurately the deflection under load of blades of different lengths and thicknesses, separately and in combination, the author has prepared a series of straight blades of different lengths so as to make up proportionate two-blade, three-blade and four-blade springs, and loaded all the blades, first separately so as to get a load-deflection curve for each blade, and then in combination, so as to obtain the loads and reactions at the blade tips. In this manner it is quite simple to plot a bending-moment diagram for each blade under any load, and to ascertain the degree of compliance with the "rhombus" law and the actual variation in stress in the different blades which results from alterations in relative blade lengths, etc.

A research somewhat on these lines was carried out in America by David Landau,* who found non-compliance with the "rhombus" law and irregularity of stress in non-speared springs with blades of uniform thickness, as might have been expected. The author confirmed Landau's results and established experimentally that springs can be made with uniform stress. At some future date he hopes to extend the research to investigation of the effect of "nip" in combination with grading on the stress distribution, so as to verify on actual spring blades the accuracy of existing theory.

It is probable that general practice in regard to "nip" and "grading" is susceptible of great improvement in the direction of increased uniformity of stress and resulting economy of material by permitting higher mean stresses without any reduction in endurance.

Maximum Test Load

Automobile springs should be designed so that a test load in excess of the normal static load by a definite amount may be applied without overstressing. This test load will vary between 1.75 and three times the normal load for reasons already considered, and should be applied to every spring as a standard test.

Standard Test

A suitable specification for a standard testing procedure, including the foregoing provision, is as follows:

1. *Material.*—The temper of the spring blades shall be verified by the Brinell test.

2. *Scragging.*—All springs shall be "scragged" before load-testing by means of a power "scrag," which shall deflect the spring rapidly not less than four times to an extent not less than its calculated deflection under the test load.

3. *Testing.*—Springs for test shall be mounted for load-test so as to permit free horizontal movement while remaining in the position selected for test.

Cantilever springs, when tested one end at a time, and quarter-elliptic springs shall be clamped to a pressure-block in the form of a stiff beam of sufficient length to maintain the spring in position.

All measurements for height shall be made between the surface of the pressure-block and a line joining the centers

*See Journal of the Franklin Institute, April, 1918.

of the eyes, or, in a quarter-elliptic spring, between the centers of the eye and the pressure-block measured at right angles to the surface of the block.

The clamping of springs for test shall provide sufficient rigidity for accurate measurement of deflection.

When measuring the deflection of a spring, the load shall be applied gradually and in such a way that the required load shall not be exceeded.

4. *Test Load.*—The specified test load shall be applied to all springs.

5. *Loaded Height.*—The loaded height shall be the height measured when the normal load is applied after scragging.

6. *Permanent Set.*—After the "scrag" test has been applied, and the loaded height has been measured, the maximum test load shall be applied and fully released, and the loaded height again measured, the difference being the permanent set.

7. *Rate of Deflection.*—The rate of deflection shall be determined by measuring the height under normal load and dividing the normal load by the distance deflected from the free position.

8. *Free Height.*—The free height is governed by the rate of deflection.

Accuracy of Dimensions

The bars from which the blades are made are rolled concave on the faces, as shown in Fig. 22, so as to insure a close fit at the edges and to leave space for lubricant. The exact amount of concavity is not important, and to avoid a multiplicity of rolls of different radii it is usual to permit considerable tolerance. The usual practice results in the blade being about 0.012 in. to 0.018 in. thinner in the middle than at the edge, and the total tolerance on thickness permitted is usually about 0.008 in.

Although there is at present no standard, it is best practice to provide the thickness tolerance all on the plus side, to assist in compensating for the loss of section due to concave rolling as shown in Fig. 22, where the nominal size is shown in dotted lines.

To ascertain the accuracy to which springs are actually made, the author has analyzed and measured many springs in detail, and a selection of these measurements is given in Appendix II.

Fixing

The fixing of a spring on an axle is an important matter. In the case of heavy springs with many blades, a wide bed renders a considerable portion of the center of the spring inoperative, and therefore wastes a considerable amount of spring steel. It is, however, necessary to have a fairly wide bed, especially when there is a center bolt, as the bending moment must not be permitted to come on the blades at the center where they are weakened by the hole.

A method of fixing which provides a wide bed and yet renders most of the center portion of the spring operative is shown in Fig. 23. The clips, it will be observed, are placed on an angle and are made of a form which avoids weakening them by bending them over sharp corners. A scheme that is in general use for avoidance of the center bolt is also shown, and the author believes this to be the best way of fixing heavy springs.

Where a wide bed and equally wide top plate are used, the spring becomes, in effect, two half-cantilever springs of a length somewhat greater than the unclipped length, as shown in Fig. 24, and the advantage in the direction of weight-saving by utilizing more of the spring as is the case with fixings of the type shown in Fig. 23 is obvious. In the case of small springs which are comparatively thin and which can consequently be used with comparatively narrow beds, the same difficulties do not arise, and the loss of effective spring steel is, of course, proportionately less.

In connection with spring fixings, it is advisable to avoid a sharp edge across which the spring has to bend, in fact, a considerable radius is preferable. The use of soft packing, either above or below the spring, is to be deprecated, and the rounding of the bed and clip plate is a preferable expedient and minimizes any tendency for the clips to work loose. It is, of course, imperative that the clips shall always be tight, as in most designs it is the friction between the spring and the axle that is depended upon to keep the two parts in their correct relative positions. Although the center bolt head may be recessed, this can only be considered a location, and should not be depended on to take load.

Appendix I

Formulæ and Tables for Calculating Semi-Elliptic Springs

$$d = \frac{WL^3}{4bEnt^3}$$

$$f = 1.5\,\frac{WL}{bnt^2}$$

$$f = \frac{6Etd}{L^2}$$

$$W = \frac{4bEdnt^3}{L^3}$$

$$E = \frac{WL^3}{4bdnt^3}$$

$$T = \pi\sqrt{\frac{d}{12g}}$$

$$= \pi\sqrt{\frac{WL^3}{4bEnt^3}}\ 12g$$

$$P = \sqrt{\frac{35{,}230}{d}}$$

$$nt^2 = \frac{1.5\,WL}{bf}$$

$$nt^3 = \frac{WL^3}{4bEd}$$

W = load in lb.
L = length in in.
E = modulus of elasticity (modified value) in lb. per sq. in.
P = rate of oscillation (number of complete oscillations per minute).
T = time of one complete oscillation in seconds.
f = stress in lb. per sq. in. (as given by the beam formula).
b = breadth of blade in in.
n = number of blades.
t = thickness of blade in in.
d = deflection in in.
g = acceleration due to gravity in ft. per sec. per sec. (32.2).

Appendix II

Investigation of One Representative Front and One Representative Rear Semi-Elliptic Spring Taken at Random from a Batch Delivered by the Makers

Characteristics

	Front	Rear
Loaded length.....	37 in.	52 in.
Width	2 in.	2 in.
Leaf number.....	8	9
Leaf thickness.....	1 3/8 in.	2 5/16 in.
Leaf thickness.....	1 5/16 in.	3 3/16 in.
Leaf thickness.....	2 3/16 in.	4 1/4 in.
Leaf thickness.....	4 1/4 in.	.....
Total thickness....	2 3/16 in.	2 1/2 in.
Static load.....	900 lb.	1200 lb.
Loaded height.....	2 3/4 in.	2 1/8 in.
Free height.....	4 1/8 in.	7 3/4 in.

Chemical Composition and Mechanical Properties of Main Leaves

	Front	Rear
Carbon	0.60	0.64
Silicon	0.32	0.25
Manganese	0.54	0.54
Sulphur	0.019	0.025
Phosphorus	0.022	0.023
Chromium	0.51	0.56
Maximum stress, tons per sq. in.	85	86
Yield point, tons per sq. in.	80	83
Elongation, per cent.	8.5	8.0
Reduction of area, per cent	27	24
Brinell number	372–388	388–415
Izod ft.-lb.	14–16	12–14

Brinell Hardness Number of Leaves (tested at the centre of length)

Blade	Front	Rear
1	372	388
2	363	388
3	388	388
4	388	388
5	363	388
6	363	363
7	415	352
8	388	363
9	—	388

Deflection Test on Portions Cut from Leaves

	Front						Rear					
	12×2×0.295			12×2×0.270			12×1.995×0.298			12×1.985×0.260		
Load, Lb.	D	P	f	D	P	f	D	P	f	D	P	f
10	0	0	.....	0	0	.....	0	0	.....	0	0	.....
100	25	0	10,300	44	0	12,300	25	0	10,100	44	0	13,400
500	130	0	51,700	186	0	61,700	135	0	50,800	209	0	67,100
1,000	278	0	103,500	374	0	124,000	258	0	102,000	414	4	134,000
1,200	336	0	124,200	449	2	150,000	315	2	122,000	510	10	161,000
1,400	393	0	145,000	526	7	173,000	373	4	142,000	608	26	188,000
1,600	452	2	166,000	605	14	198,000	437	10	162,000	...	..	.....
1,800	512	3	186,000	685	30	223,000	...	..	.....	...	..	.....
2,000	575	7	207,000	...	..	.....	...	..	.....	...	..	.....

D = deflection in thousandths of an inch. *P* = permanent set in thousandths of an inch. *f* = calculated stress in lb. per sq. in.

Deflection Test on the Complete Spring

	Front			Rear		
Deflection in in.	Load in lb.	Loaded Length in in.	Permanent Set in in.	Load in lb.	Loaded Length in in.	Permanent Set in in.
1	714	37.0	0	330	51.5	0
2	1,444	37.2	0	510	52.5	0
3	2,098	37.3	0	785	53.1	0
4	2,840	37.0	0	1,013	53.5	0
5	3,578	36.8	0	1,195	54.0	0
6	4,372	36.3	0	1,405	54.2	0
7*	5,124	35.8	0.25	1,610	54.3	0
8	....	...	..	1,808	54.4	0
9	....	...	..	2,014	54.4	0
10	....	...	..	2,214	54.2	0
11†	....	...	..	2,590	54.1	0.25

*Equivalent to 3⅞ in. reverse camber on front spring.
†Equivalent to 3¼ in. reverse camber on rear spring.

Periodicity Test on Complete Springs

Load, lb.	Complete Oscillations Per Minute: Front Spring	Rear Spring
200	160†	140
400	160	116
600	136	92
800	112	76
1,000	92	68
1,200	..	64

†Doubtful as regards accuracy. Result is probably too low as a regular swing is difficult to maintain.

Modulus of Elasticity of Steel Calculated from Deflection Tests

Leaf Dimensions, in.	Modulus, lb. per sq. in.
12 × 2.000 × 0.295	28,750,000
12 × 2.000 × 0.270	29,250,000
12 × 1.995 × 0.298	30,850,000
12 × 1.985 × 0.260	30,000,000

Appendix III

AN ANALYSIS OF DIMENSIONS OF A NUMBER OF ACTUAL SEMI-ELLIPTIC SPRINGS TAKEN AT RANDOM FROM CURRENT PRACTICE SHOWING THE MEAN STRESSES ADOPTED

	Loaded Static Load, lb.	Length in.	Width, in.	Number and Thickness of Leaves, in.	Mean Static Stress Per lb. sq. in.
Rear 5-ton truck	7,280	54	3.5	13 1½ 6 7/16 6⅜	75,000
Front 4-ton truck	2,000	42	2.5	8 1 7/16 4⅜ 3 5/16	51,400
Rear 3-ton truck	4,700	54	3.5	11 2½ 4 7/16 5⅜	62,000
Rear 4-ton truck	5,600	54	3.5	9 7/16	75,000
Front 40-hp. car	900	37	2.0	8 1⅜ 1 5/16 2 9/16 4¼	39,000
Rear 40-hp. car	1,200	52	2.0	9 2 5/16 3 31/32 4¼	71,000
Front 12-hp. car	400	34	1.5	5 5/32	56,000
Rear 12-hp. car	600	42	1.5	6 7/32	87,000

The stress shown in the last column is the average static stress due to the static load, assuming equal stress-distribution throughout the spring based on the formula—

$$f = (1.5\,W\,L)/(bnt^2),$$

which includes the value—

$$bt^2/6,$$

and is therefore the stress value obtained by the ordinary beam formula which, as has been shown, may be considerably greater than the actual fiber-stress sustained by the material.

The maximum stress sustained by the spring is that due to the test load, and in normal practice this should be obtained by multiplying the normal static stress by a factor which should vary from 1.75 to 2.25 for rear springs, and from 2.5 to 3.5 for front springs.

A Comprehensive Highway Transport Outline

A COMPREHENSIVE outline of highway transport has been prepared for the Highway and Highway Transport Education Committee.

Although making no pretense of being complete, the outline treats exhaustively of the various phases which make highway transport one of the dominant subjects of the day. It was prepared by Professor Lewis W. McIntyre, Assistant Professor of Civil Engineering, University of Pittsburgh, at the urgent insistence of schools of engineering and economics, highway engineers and highway officials, and is expected to be the forerunner of text books on the subject, to which many of the leading economists and engineers in the country are giving their attention.

This outline may be adapted for classroom exercises and lectures, or it may be used by engineers and business men actively engaged in the manufacture of motor vehicles or the construction of highways.

Subdivided into five divisions, it treats of the field of highway transport, the highway and the motor vehicle, legal phases of the subject, principles of successful operation and the selling of transportation.

The booklet is being distributed by the Highway and Highway Transport Education Committee, from its offices in the Willard Building, Washington, D. C., first to colleges and universities and then upon request to manufacturers and business men.

Function and Operation of the Vibrating Voltage Regulator

The development and characteristics of this type. The writer states that the early causes of failure were either mechanical or due to variations in output and explains the methods used to overcome these difficulties.

By W. P. Loudon*

THE purpose of the vibrating regulator in an automobile lighting system is to maintain the voltage at a nearly constant value regardless of the load or battery conditions. The result of this type of regulation is that charging current is furnished to the battery in inverse proportion to its state of charge, that is, a high current to a discharged battery and a low or practically zero current to one nearly full.

The main object of such a system is, of course, to bring an exhausted battery to its fully charged state in the shortest time, without introducing injurious effects which would shorten the service life of the battery. It is essential that the battery be always nearly fully charged in order to obtain the maximum efficiency from the starting apparatus, the lights, and, in cold weather, to eliminate danger of freezing.

The "Tapering" Charge

Theoretically, in a constant potential system, the battery is charged most efficiently by starting with an initial current flow in amperes equal to the ampere hour rating (5 ampere discharge rate) of the cells — and gradually decreasing this amount in proportion to the state of charge, so that when charging is completed, the current will have dropped to zero. Obviously, this would necessitate units capable of generating and carrying relatively large outputs, and which for the greater part of the time would be operated at far below their normal capacity. Such a course would naturally be not only expensive, but would add considerable excess weight to the car, and would be unjustified, even though sufficient space were available for the installation of the larger units.

As in nearly all engineering problems, it is necessary to effect a compromise. The initial rate is, then, so chosen as to permit the use of normal sized units and at the same time insure the charging of an exhausted battery in from eight to ten hours.

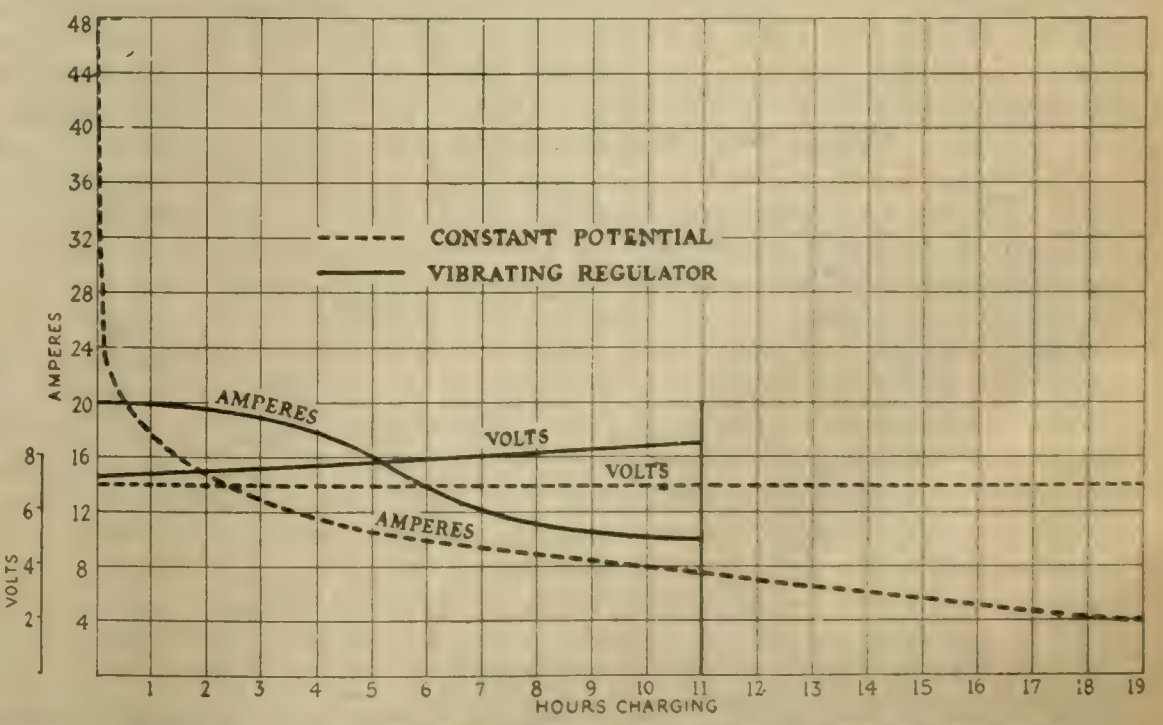
Two Functions of Regulator

The regulator has, in fact, two functions to perform, dependent upon the battery condition. They are in a certain measure different, but at the same time bear a definite relation to each other. For instance, the voltage of a discharged battery is below that for which the regulator system is set. Consequently, the current which will flow in the circuit will be limited only by the voltage drop due to the resistance of the various units. A voltage responsive coil alone would not operate in this case, since the potential of the generator will drop to nearly that of the battery and the contacts will not open. At moderate or high speeds, therefore, the generator voltage would be absorbed in IR drop—the current reaching an excessive value.

To overcome this difficulty, a current responsive (or series) winding of few turns is added so that the regulator contacts will be opened whenever the current tends to increase above a definite value. This winding also acts, in a measure, in the form of a reactance, opposing rapid fluctuations of the current and tending to steady the flow. The regulator under these conditions, therefore, is a current regulating device.

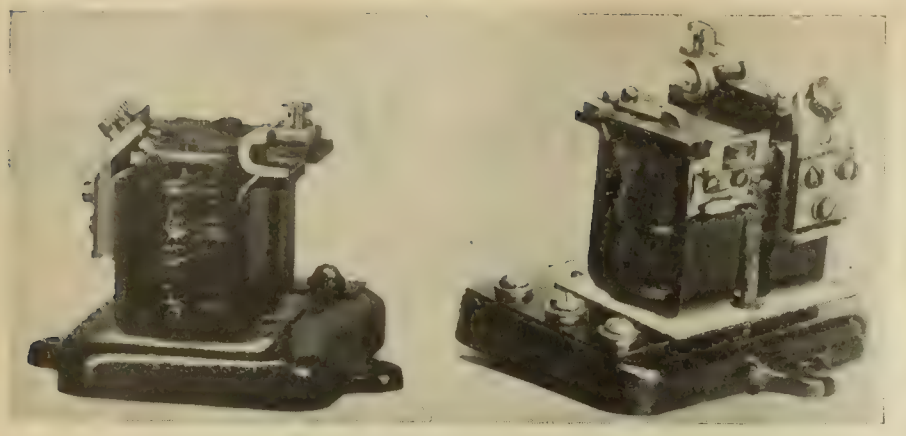
On the other hand, the voltage of a full battery while charging is above that of the regulator system setting, and whenever the contacts are closed, the generator voltage attempts to rise and the voltage responsive windings cause the contacts to open. With open circuit and resistance load conditions the regulator characteristics will follow principally those present with a charged battery, since in the one case the voltage responds and in the second case both current and voltage tend to increase

This compromise does not have such serious faults as might at first appear, but, on the contrary, the situation is improved to a marked degree. The current and voltage responsive means both contribute to a given setting of the regulator with a low battery. On the other hand, in the case of no load (or open circuit) operation, the voltage

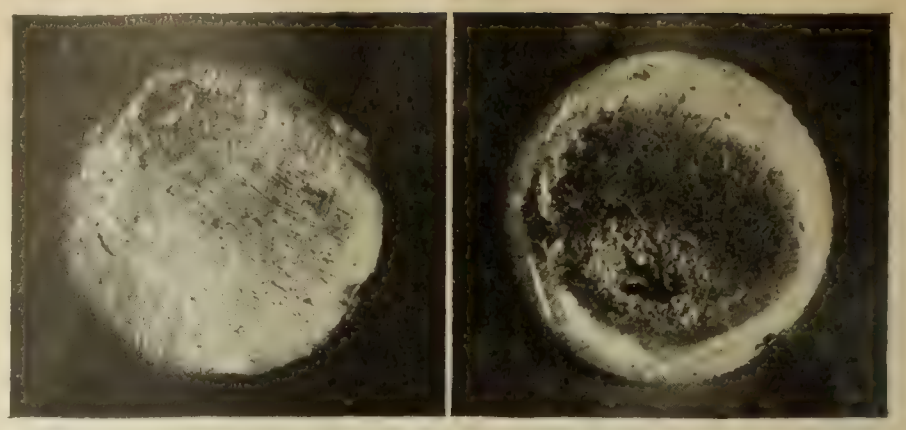


1—Charging curve, comparing vibrating and constant potential regulators

*Engineer, Automotive Engineering Department, Westinghouse Elec. & Mfg. Co.



2—Picture of regulator and cutout.

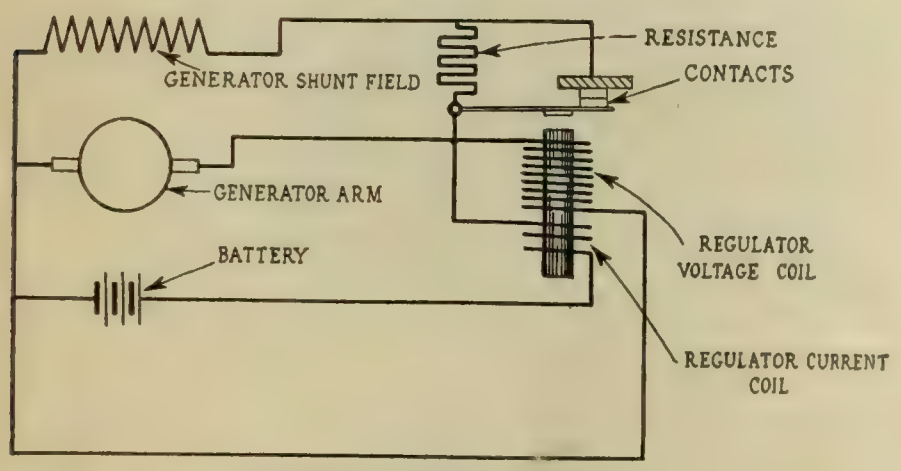


4—Microphotograph of contacts.

must rise slightly to compensate for the loss of the pull formerly contributed by the current winding. In actual battery charging, this combination cuts down the initial current, but raises the final current, since the voltage has also risen slightly. Consequently, the battery is charged at a faster average rate than in the true constant potential system as will be seen by Fig. 1. No harm can come from this method as long as the final rate does not exceed a value of current which a fully charged battery can receive continually without destructive gassing or heating.

The use of vibrating voltage regulators for governing the output of generators is by no means new. They are commonly met in power generating stations for the purpose of keeping constant the line voltage of the generators, regardless of the load being used. Many other types of these regulators will be found serving varied purposes—power factor regulators, load distribution regulators, railway car lighting, etc.

The introduction of the vibrating type regulator to automobile generators, in quantities, dates back to about 1912, and this regulator is still in active use in many systems. Many variations and adaptations of this type have been devised and offered, and considerable ground has been covered in the art. The earlier types of regulators



3—Diagram—elementary regulator.

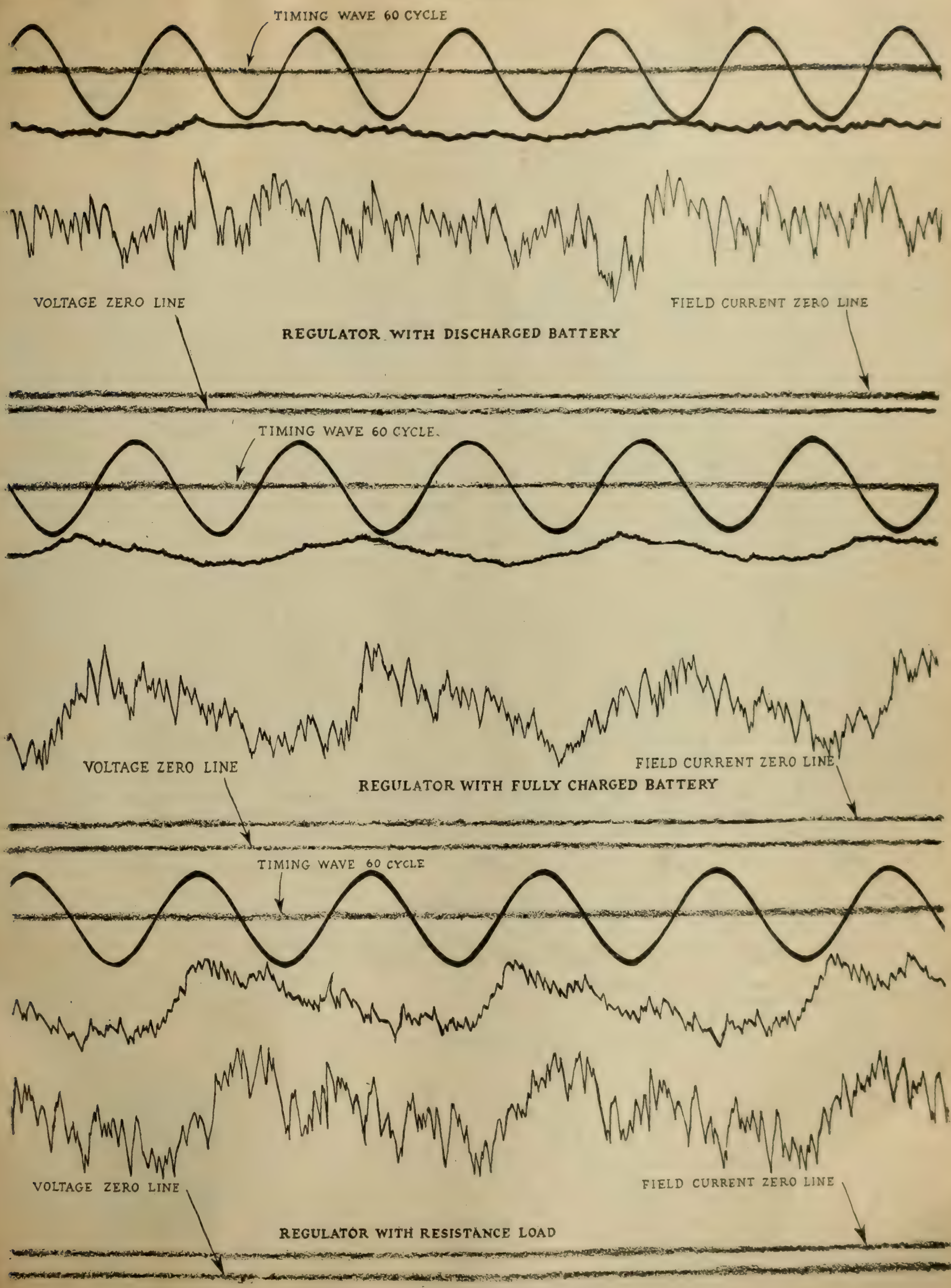
were subject to numerous failures which for a time threatened the popularity of the system and nearly caused its abandonment in favor of the other types with methods of regulation having non-movable parts.

Causes of Early Failures

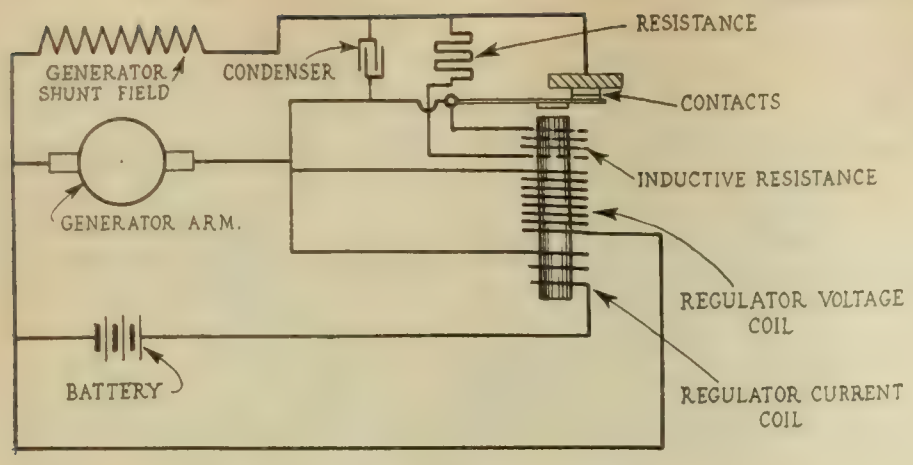
The main causes of failure were either mechanical, sticking or freezing of the contacts, or variations in output caused by the settings changing. At first glance, the problem would appear to many to be the simple matter of causing a pair of contacts to be opened and closed rapidly, in order to insert resistance intermittently into the generator shunt field circuit, and thereby control the output, holding it at an average value equal to the desired amount. However, there are many intricate problems which present themselves in the designing of a successful regulator. Perhaps the most vital and difficult to overcome is the sticking or freezing of the contacts, inasmuch as failure at this point means an excessive rise in output and liability of ruin of both the generator and battery. On the other hand, the attempt to cure the fault should not swing too far in the other direction, and interpose high resistance contact conditions in the field circuit such that the generator cannot deliver its output. The best combination seems to be, as with a shaft and bearing, a relatively hard contact and a soft contact, the hard contact being the movable member. For this purpose tungsten and silver are used, the latter forming the positive contact. A slight rubbing effect should be imparted, and to accomplish this the armature carrying the movable contact is mounted on a very thin leaf form of hinge and the contacts are set at a 45 deg. angle. This gives the desired wipe, not enough to cause grooving, but sufficient to have a cleaning effect and prevent the building up of tips in the silver. The angle also permits the displaced material or oxide powder to be brushed from the contact surfaces. Other combinations of inexpensive contacts have been tried without improvement in the results. Perhaps the only case worthy of special mention were two similar tungsten contacts. These were free from sticking, but after a short time tungsten oxide, which is an insulator, formed on the face of the positive contact and ultimately inserted too great a resistance into the field circuit, interfering with generation.

Condenser in Shunt to Vibrator

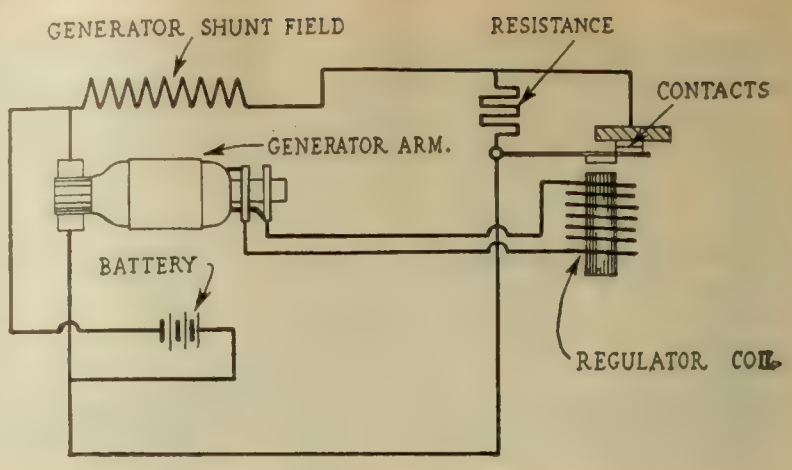
The use of a condenser, with and without series resistance to change its time factor, has been tried (and in some cases with apparent success) for the elimination of the arc which is drawn each time as the contacts are opened. A peculiar observation in this connection is that in many instances contacts will stick with great persistency even when no arc is discernible, while in other cases a destructive arc may be present and the contacts never stick, but rather fail from being consumed by the arc. It was almost invariably noticed that the sticking occurs in charging a low battery; *i.e.*, in the case where the battery voltage is below the system voltage and the regulator is controlled by the current winding only. This leads to the assumption that in such cases the generator voltage collapse, on the opening of the contacts, is so rapid that the contacts are in reality not opened except sufficiently to draw an arc and maintain it, until the metal is volatilized and finally fuses. In order to overcome this point, it is therefore necessary to so proportion the regulator parts that a very strong pull is always exerted on the contacts. As a further proof of this point, a regulator which ran successfully for 1800 hours on a resistance load failed in three minutes when connected to a discharged battery. In the resistance load charging, the voltage varied sufficiently to permit the contacts to actually open and close so as to disrupt the arc, and no difficulty was encountered.



7—Oscillogram of straight regulator.



5—Diagram with inductive resistance.



6—Diagram with A. C. tap.

It was thought possible at first to overcome this point by winding a part of the resistance cumulatively around the core, so that when the contacts parted, the inductive voltage would cause a momentary rush of current in this winding and increase, temporarily, the magnetic pull so as to insure the positive opening of the contacts and thereby damp out the arm. In fact, the idea worked too well, the contacts were opened widely each time, but the frequency of vibration was reduced to a very low order, so that the current variations were too great, and, lastly, an arc was produced each time which rapidly consumed the contacts. Variations of condenser capacity within reasonable sizes failed to alter the spark appreciably. However, failure from sticking was entirely eliminated, proving that the arc itself is not always the controlling factor, but rather that it is the steady maintenance or floating of the arc which causes the damage.

Another method, which has been previously tried, is to excite the regulator shunt field with either A.C. or pulsating D.C. current, obtained from taps on the armature whose voltage it is desired to regulate. The effect of this is to hammer the contacts, since the exciting voltage and current rises above the average voltage each cycle and also drops to zero. This positively insures the opening of the contacts each time, but introduces complications in the generator armature. Other electrical difficulties, particularly at high speeds and with fully charged batteries, were encountered in the regulator characteristics. One noteworthy feature in this connection is the fact that with the A.C. type of excitation it was possible to use both contacts of tungsten, because the hammer effect jarred any formation of oxide which tended to form, from the face of the contacts.

Working in the other direction, a regulator with a heavy pull was designed, which operated correctly as concerns the above observations. However, a tendency of the current to increase would cause the contacts to open widely, so that the armature struck the core. If this repeated several times rapidly, the contacts would be found welded after one of the closings. Removing the condenser entirely removed the welding or sticking. In this instance the effect was produced by what is known as percussive welding; *i.e.*, a quantity of electricity is discharged rapidly through two contacts which are pressed firmly together.

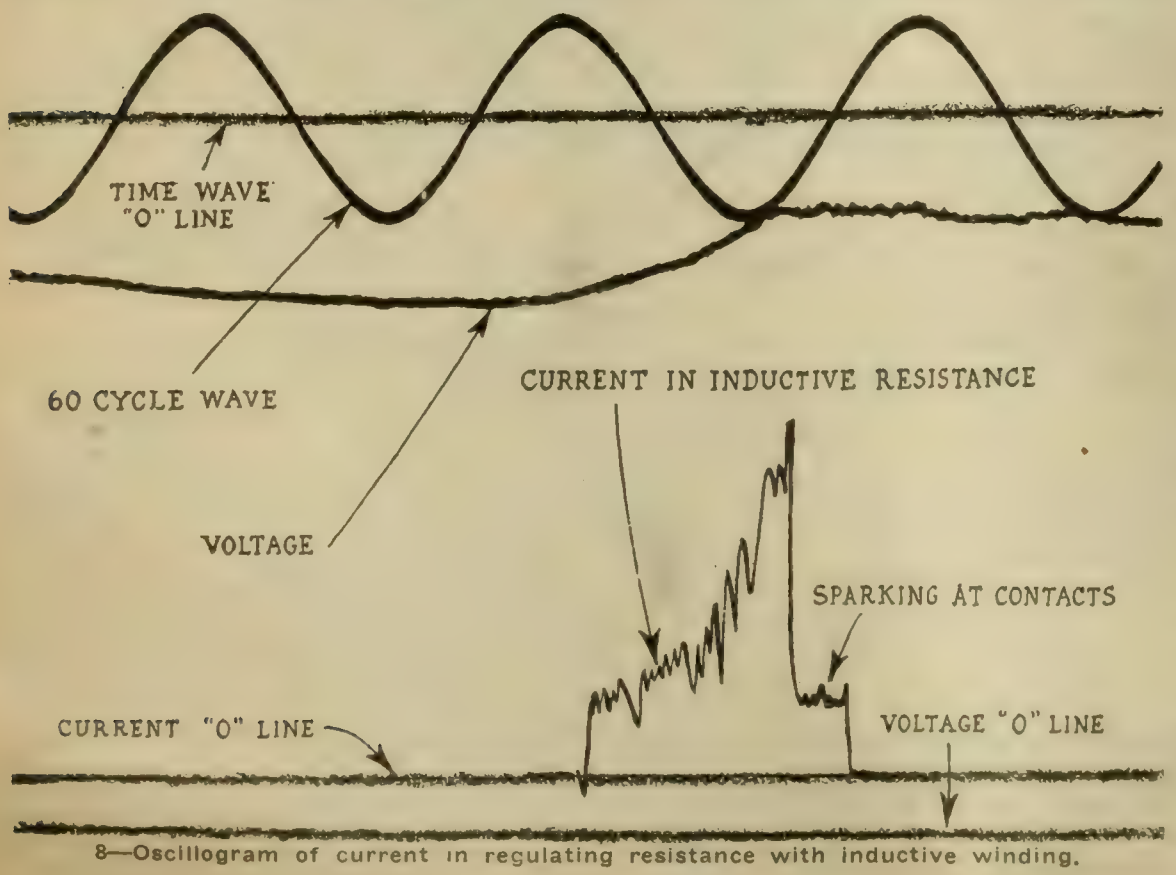
Temperature Compensation

Another problem to be considered is the compensation for the effect of the heating of the regulator shunt coil. The resistance of this winding is raised when heated and in consequence its pull is decreased. To overcome this it is necessary to decrease the counter pull of the spring which holds the contacts together. It has been found in this connection that a certain minimum spring pressure is required to insure that the contacts will properly seat, and that the field current will flow without trouble from contact resistance. Therefore if, to compensate for heating, the spring pressure is reduced to somewhere near this value, the regulator will be unstable and the generator output will vary between wide limits. The pull should therefore be made several times stronger than the required contact pressure, and this ratio has been found to work favorably in this case.

Vibration of the contacts at a high frequency is another desirable feature. It tends to insure stability; *i.e.*, closeness of regulation and the holding of the current or voltage variations close to the average. It also seems to work out well in the problem of sticking contacts, since a strong spring and strong magnetic pull are required to obtain the high frequency, resulting in a more positive action.

Regulating Resistance

The last electrical problem is one of the proper amount of resistance to place in parallel with the contacts. This should be sufficient to control the output at the maximum desired generator speed with a fully charged battery, and yet should not be too great; otherwise, at the lower speeds, when the regulator is just commencing to function, the output characteristic will be unstable and the current (or voltage) will vary between wide ranges until the speed has increased suffi-



8—Oscillogram of current in regulating resistance with inductive winding.

ciently to raise the frequency of vibration to a stable point. Again, excessive resistance approaches the point where the field is nearly open circuited and this will in itself cause inductive arcing at the contacts, which is very destructive.

Lastly, the unit must be mechanically rugged, so that the vibrations and shocks caused by the car motion will not alter the setting or loosen any of the parts. Simplicity and ease of adjustment and repair should be paramount in the design.

A Double Diaphragm Vibrator Horn

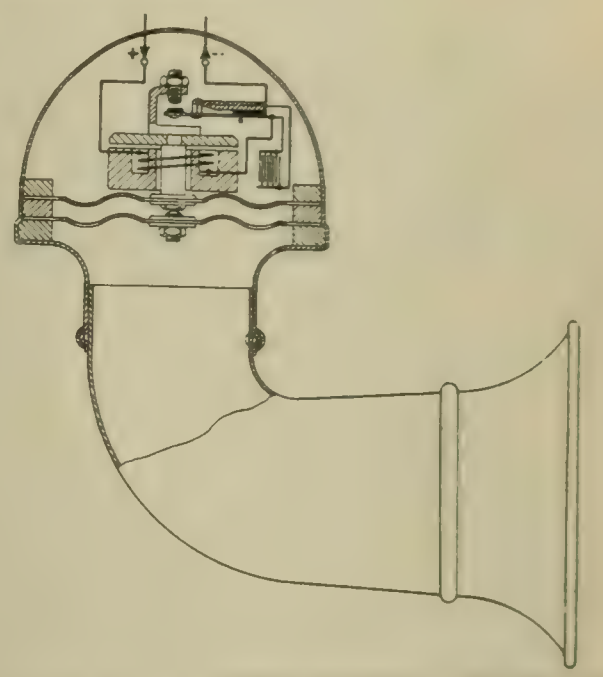
A VIBRATOR horn with a double diaphragm, which it is claimed is unusually penetrating and effective, yet not giving a note such as to create offense, is among the newer products of the Robert Bosch Magneto Co., Inc.

The horn consists of a hemispherical housing containing the tone-producing mechanism, including an electro-magnet, a vibrator and the diaphragms, and a trumpet secured to same. To a clamping band surrounding the housing is secured a flexible member by means of which the horn is supported upon some structural part of the vehicle.

If the horn button is pressed, the circuit of the electro-magnet forming part of the operating mechanism is closed and broken in quick succession. The result is that the armature of the electro-magnet and the diaphragm connected to it are set into rapid vibration, imparting to the air column in the trumpet a rate of vibration which acts upon the ear as a deep note. The diaphragm to which the armature is connected is rigidly held at its circumference by being clamped between two metal rings in the housing. The motion of the interrupter is controlled by the diaphragm, so the vibrations of the two members are synchronous.

Mounted directly in front of the fundamental note diaphragm is located a higher note diaphragm which receives its motion from the former. This higher note diaphragm is claimed to make the tone effective, penetrating and far-carrying. It is claimed that this secondary diaphragm does not produce merely a supplementary noise, but a true musical tone. Owing to the fact that the secondary or high note diaphragm is not loaded with extraneous masses, such as the armature and core, its rate of vibration is much higher, though it is otherwise of substantially the same form as the fundamental note diaphragm. A very exact adjustment insures that the secondary diaphragm is given regular impulses, so that it does not create a noise but a musical tone which, though higher than the fundamental note, bears a certain relation to it as regards rate of vibration.

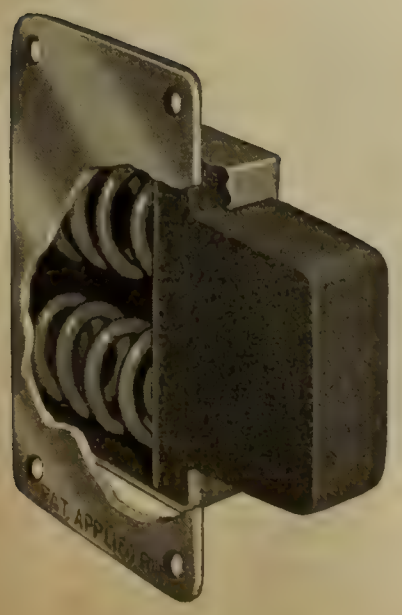
Road tests are said to have demonstrated that the tone of the Bosch horn becomes particularly effective through these higher notes. In order that the fundamental note may not be impaired in its effectiveness by the higher note diaphragm, the latter is provided with openings of suitable size and number.



Sectional view of double diaphragm vibrator horn

The fundamental note diaphragm makes about 300 vibrations per second. To the housing of the mechanism is fitted the trumpet, which is bent at right angles and whose length is proportioned to the rate of vibration of the diaphragms. This results in a resonance effect which is claimed to add materially to the fullness of the tone. The trumpet is rotatable relative to the housing, which facilitates the mounting of the horn on the car.

Spring Type Car Door Cushion



Hushadoor door cushion

A SPRING type of cushion for the doors of motor car bodies has been placed on the market recently. Referring to the cut-away view shown herewith, two small but rather stiff springs are anchored in the plunger box, which take up the recoil of a heavy block tongue of rubber. The idea is to reinforce the checking action of the rubber tongue by the springs, and the pressure of the springs and the rubber together when the door is closed is claimed to be particularly effective in holding it against vibration and rattling.

Among the advantages claimed for this design of door check are that it is unusually compact, that it fits flush within its recess, that it is powerful enough to take up the heaviest slam and that it has a double compensating rebound which automatically takes up wear. The cushion is furnished finished in black enamel, nickel or in natural metal, and is the product of the Velguth Metal Parts Co. of Milwaukee.

Methods Used in the Assembling of 150 Engines per Day

A description of the assembling, inspection and testing operations and equipment employed in fabricating the powerplant used in new Jewett car. Special machine is used to simultaneously grind in twelve valves in one minute. Fan brake employed for final run in and block test of engine.

By J. Edward Schipper

IN the manufacture of engines, as in other products, it is essential to see that savings made possible by the utilization of the best machinery and methods in manufacture are not offset by inefficient methods in assembly.

The manufacturer has working with him specialists on machine design. He is also favored by having competition between manufacturers of various types of machines who eagerly work with him for the purpose of cutting down expenses in manufacture, because these men know full well that the machine which makes the best showing from an economy standpoint is very apt, other things being equal, to be the one purchased.

After this machinery has all been purchased and installed, however, the engine manufacturer has on his own hands the problem of efficient assembly. This is practically all manual labor and involves, consequently, an almost boundless opportunity for the introduction of practical motion study and routing.

With this thought in mind, it is interesting to make a study of the assembly system as laid down for one of the newest engines to be a factor in the automotive field. This is the light six Jewett engine which is made in the engine plant of the Paige Motor Car Co., Detroit. This six-cylinder engine is typical of L-head construction and the methods in use are broadly applicable in this field. The cylinder block casting upon which the engine is built is identical with that of the Paige, which is manufactured as described in AUTOMOTIVE INDUSTRIES some time ago.

The first operation in assembly is to press in the camshaft bearing on an arbor press. The cylinder block interiors are then painted with a special sealing paint which is mixed with alcohol to give it the desired quick-drying properties. The paint employed is red crankcase enamel, made by the Royal Varnish Co., Toledo. This provides a clean, interior surface to work upon, any loose coarse sand, dirt, etc., being permanently sealed to the walls so that it becomes a simple matter to wipe out the engine at any point along the production line or by use of an air blast to blow out particles of foreign matter which do not readily adhere to the smooth surface.

On this particular engine, the valves are inclined to the axis of the cylinders. In order to make the top surface of the block, which carries the valve seat, in a plane at right angles to the valve stem, an arbor is used which fits into the valve guide hole and pilots the cutter which is slipped over the arbor, Fig. 1. This is a hand operation which trues the face of the block, making it possible to cut in the valve seat at the proper angle. In order to maintain accuracy, three arbors are provided. One of the three is so sized that it fits the valve guide hole exactly to line up the operation of cutting away the metal for the valve seat.

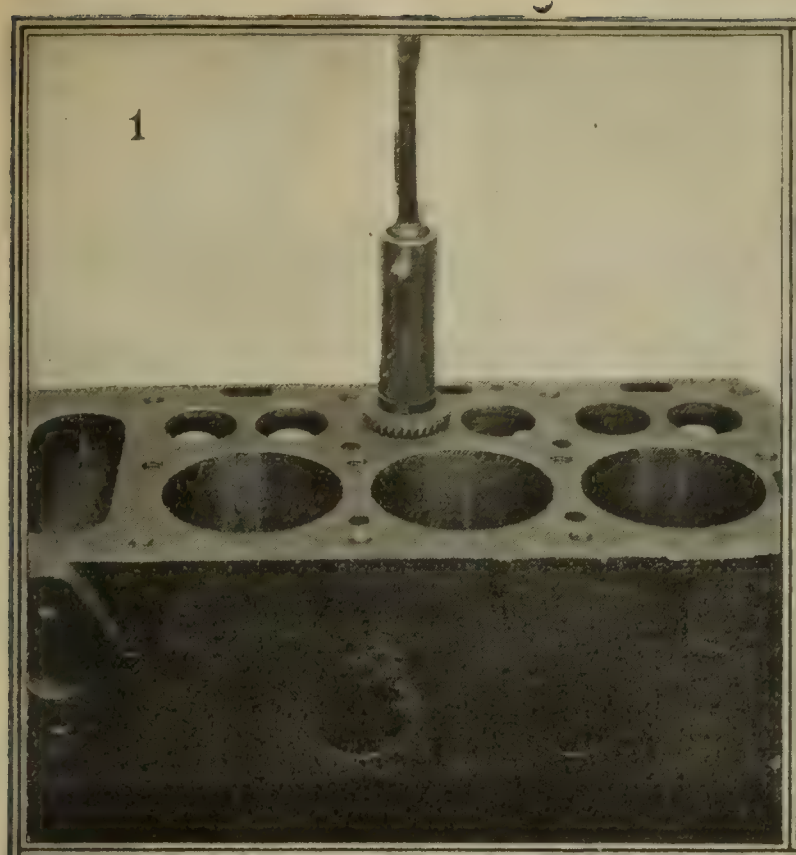
After the preliminary facing by hand, the top of the cylinder at the point where the valve seat is cut is rough faced with an air machine. The valve seat is then rough cut in by hand, and is then given a finish cut with another air machine. This gives a fairly close valve seat and the valves are then selected and stamped with numbers to indicate their position in the block before the grinding operation shown in Fig. 2 takes place. This operation is performed on a special Defiance valve grinding machine which grinds in all twelve valves at a time, giving the back and forth motion used for valve grinding. The twelve valve seats can be ground in 1 minute. After the seats are ground, the block is inspected and the valves all checked with Prussian-blue to assure a clean, even seat around the entire periphery of the valve face.

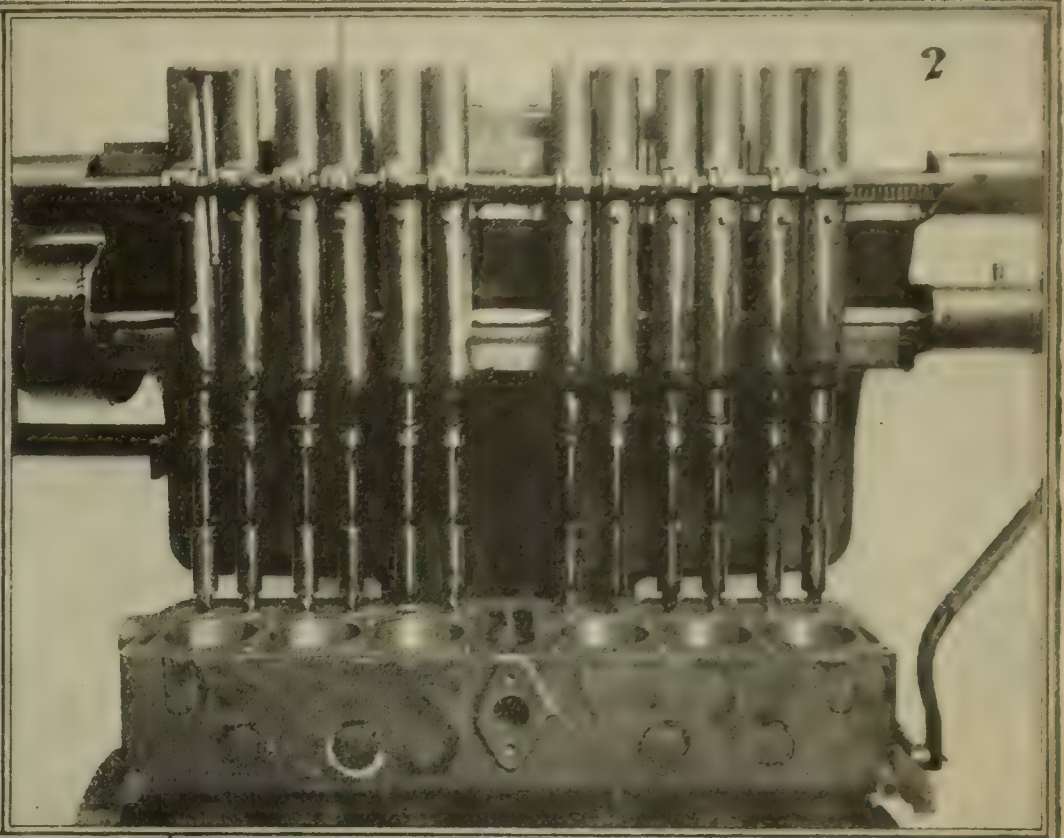
After the valves are inserted, a false head, which can be seen in Fig. 3, is put over the top of the block to protect the valves and permit the block to be turned upside down and slid along the conveyors without injuring the surface of the block itself. A recess is provided in this false head to prevent contact in any way with the heads of the valves. The main bearings are put in and reamed as are also the camshaft bearings on Martell line reamers, Fig. 3. After the rough and finish reaming operations are completed, an air blast is utilized to clean out the chips. In order to check the reamers, plug gages are put in the bearings of every second case coming through.

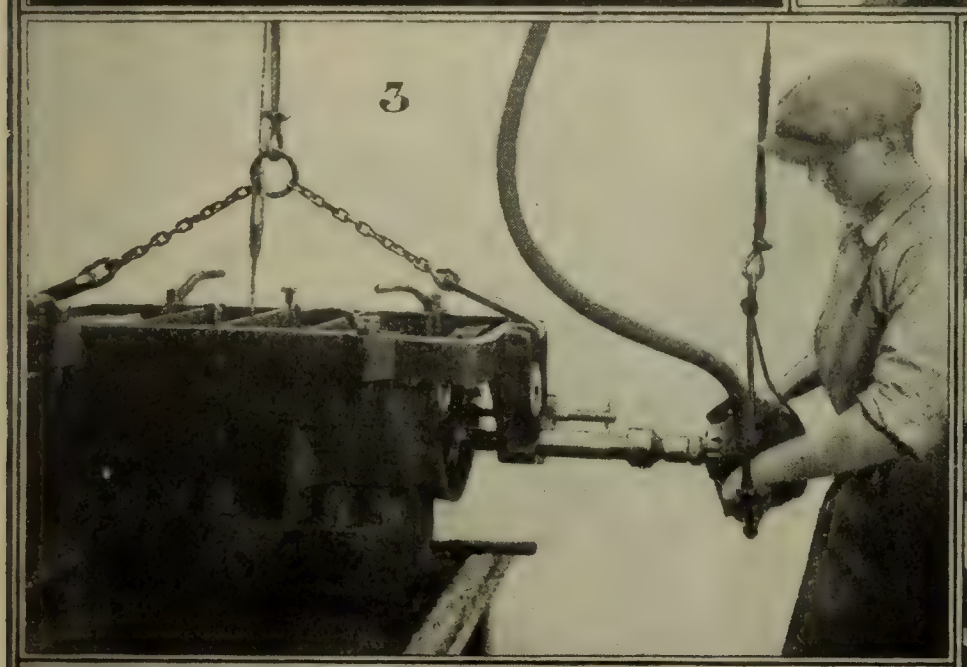
The flywheel housing is put on and this housing is then bored and faced for proper alignment with the transmission shaft, Fig. 4. Location for this boring and facing operation is by two dowels which fit into the front and rear main bearings. Thus, the transmission shaft is piloted accurately in alignment with the main crankshaft bearing.

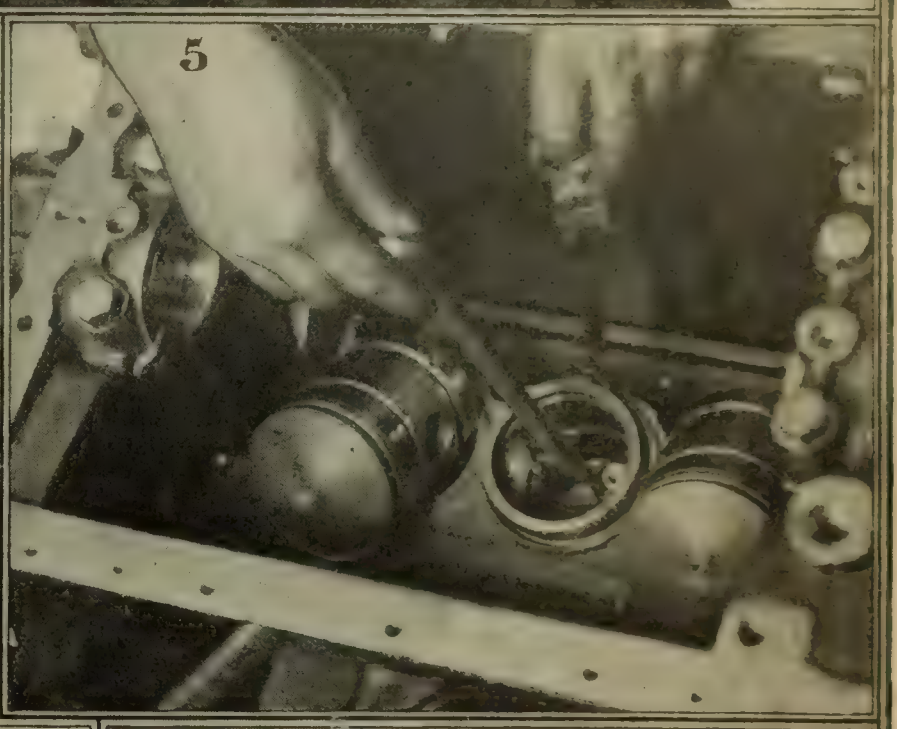
The pistons are selected to fit the cylinder bores by the use of a feeler ribbon, .004 in. thick, Fig. 5. The pistons must fit snugly against this ribbon. The pistons are weighed in manufacture and held within a limit of one-eighth ounce. The fitting of the pistons is followed by an inspection operation for fit, as well as for weight and clearance.

The crankshaft sub-assembly consisting of the crankshaft, flywheel and crankshaft timing gear is then bolted in place. With this in place, the engine assembly is put on a small conveyor. While on this conveyor, which is shown in Fig. 6, a small group of assembly operations are carried out. The conveyor carries the blocks around in a short elliptical path, during which time a few of the units are added to the block. The water pump assembly and the crankshaft, flywheel, connecting rods and pistons are put on and a driver added to the flywheel for belting in pur-

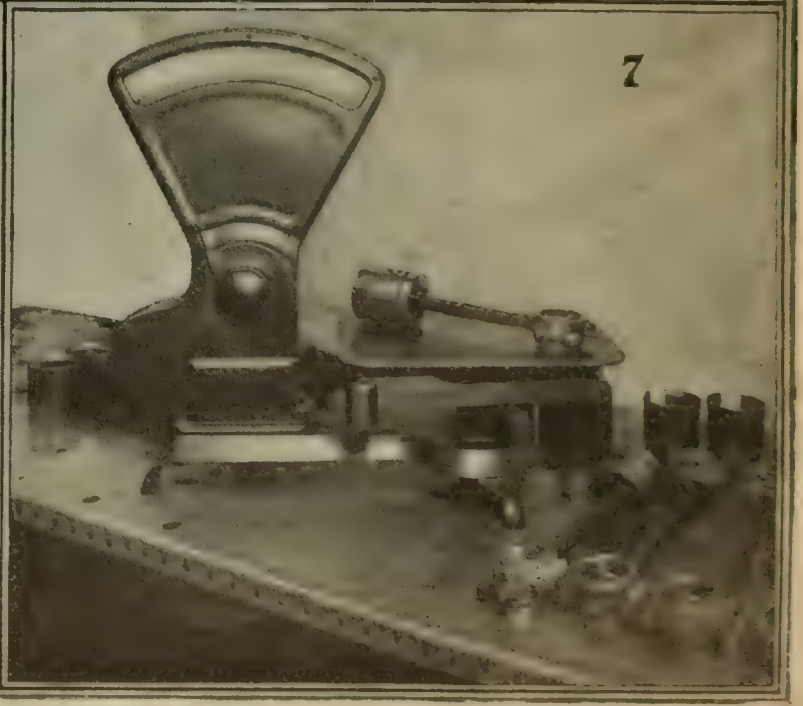








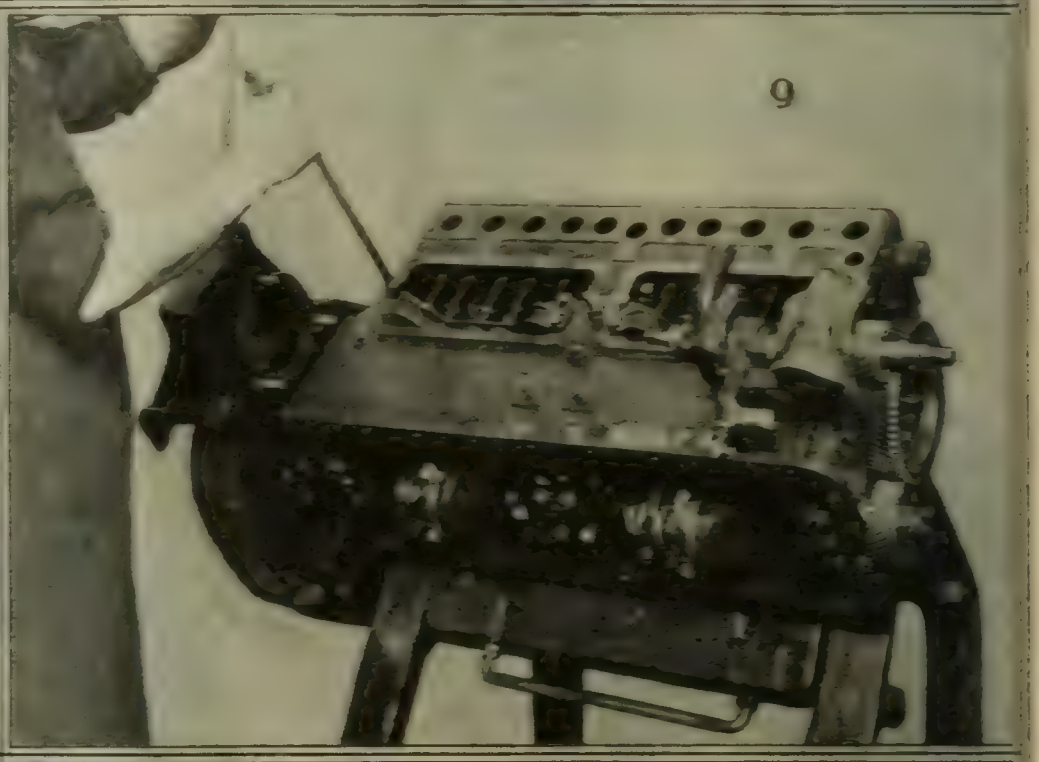


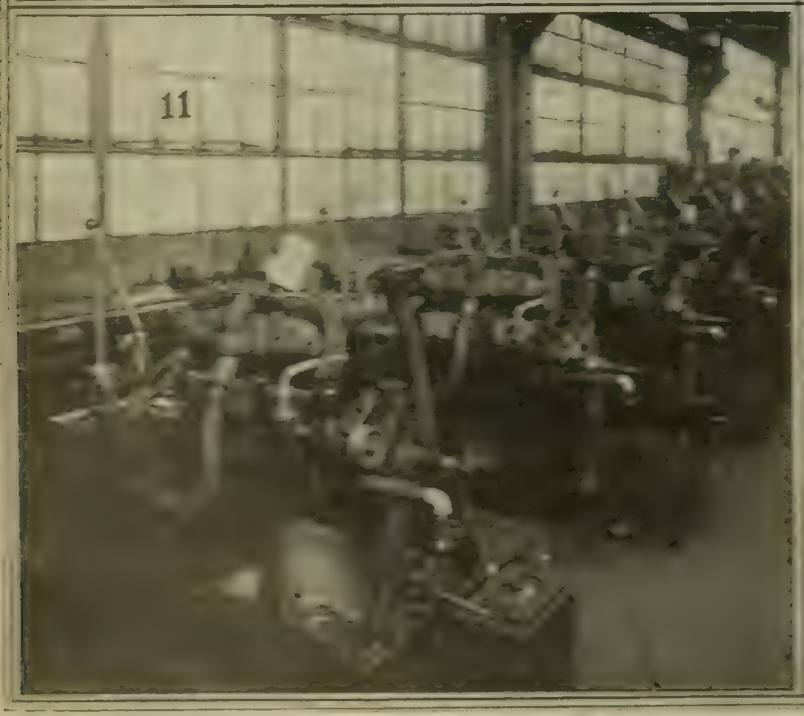


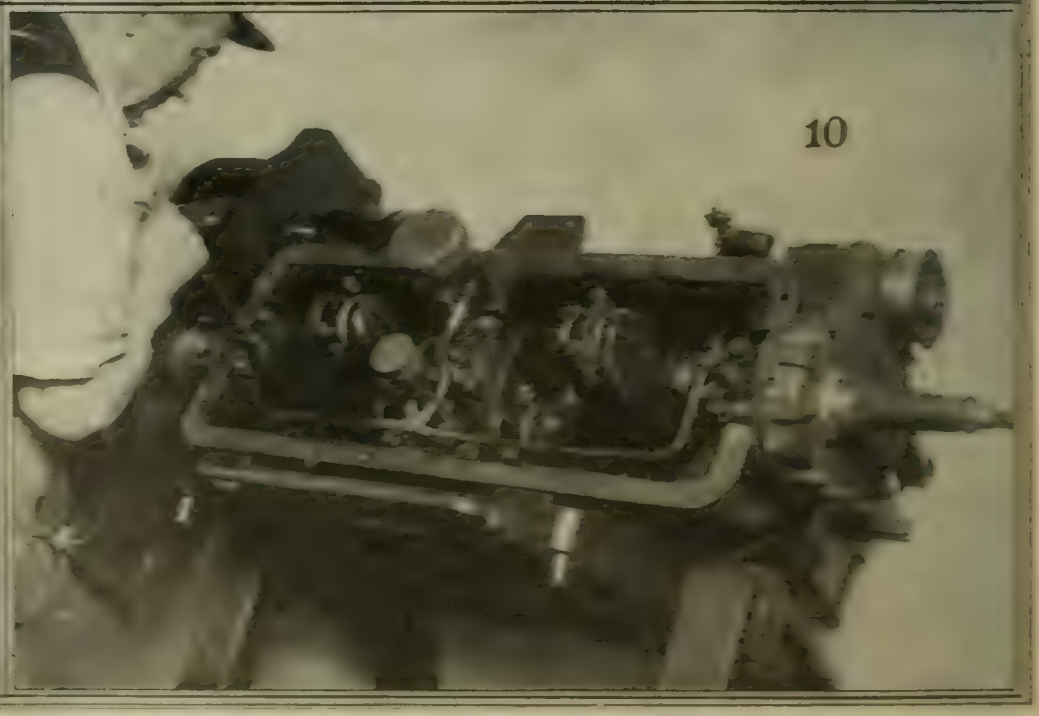
1—Hand tool used for cutting top surface of block at right angles to inclined valve stem axis. 2—Grinding all twelve valves simultaneously on a Defiance valve grinding machine. 3—Line reaming the main and camshaft bearings for the Jewett engine with Martell reamer. 4—Boring and facing flywheel housing. Location for this operation is on two dowels which are not here visible but which fit into the front and rear main bearings. 5—Fitting pistons into Jewett cylinder block by means of a .004 in. feeler strip. 7—The Jewett connecting rod assembly is held within a maximum variation of ¼ oz. by weight, ⅛ oz. being allowed for the piston and ⅛-oz. for the rods and bearings











6—Small elliptical conveyor system. The units are pushed along this elliptical track on the racks, as shown, and as they progress, the water pump assembly and connecting rods and pistons are put on and a driver added to the flywheel for belting in purposes. The flywheel is put on with the crankshaft assembly. 8—Fixture used for securing squareness of piston and for taking any bends out of the connecting rods. 9—Engine mounted in rack on final assembly line. The universal rack is so designed that the engine can be tilted to any position. Note that the timing gears, water pump and valve tappet assembly have been put in place. The operator is shown just finishing the operation of putting in one of the valve tappet assemblies. 10—Engine turned upside down on final assembly rack to permit access to oil lines and lower parts mounted before under pan is put on. Operator is shown packing rear main bearing. 11—Final block test of Jewett engine. The skid conveyor which brings the engines to the blocks, is shown behind the engines running along under the window.

poses. The connecting rod assembly, consisting of the pistons and rings, connecting rods and piston pins, has come in from a spur in the assembly layout. The connecting rods are weighed, Fig. 7, and held within one-eighth ounce total weight, the big end of the rod being held within one ounce. Thus, a total variation is allowed of one-eighth ounce for the connecting rod and one-eighth ounce for the piston, giving a maximum variation of one-quarter ounce for the entire assembly.

Selective fits are used for the piston pin, this being a light running fit in the bushing which is located in the top of the connecting rod. The connecting rod bearings are put in place and reamed with a Martell reamer on a gage which is piloted to assure squareness of the bearing holes. These rods are reamed, one at a time, in this jig.

In fitting the piston assembly to the cylinder block, an allowance of .003 to .010 in. is permitted in the ring gap. The connecting rods are checked for squareness on a special gage, Fig. 8, and all of the pistons are measured with micrometer for roundness before they are placed in the cylinder bore. Another precaution taken before putting the piston and connecting rod assembly in the cylinder bore is that they are thoroughly cleaned, this being effected by washing them in gasoline, drying them and then flushing them in oil. After the piston and connecting rod assembly has been fitted to the cylinder block, the unit goes on the stand where it is belted-in, in oil. The length of time this belting in process takes places depends on the condition of the motor and perhaps averages an hour.

The driver, which was attached to the flywheel, is then removed and the connecting rod and main bearing cap bolts are keyed and wired in place. The dummy head is removed and the block is placed on a conveyor which takes it down to the beginning of the final assembly conveyor line. Before starting on this line, which is a traveling conveyor, carrying universal racks for the engines, the blocks are again thoroughly cleaned with gasoline and blown out.

The timing gears are next fitted, these including the cam, water pump and crankshaft gears. The stand is so tilted that these operations are very accessible and inasmuch as the engine can be easily turned over, either the top or bottom can be worked upon with equal facility. The valve tappet assemblies are put in, as shown in Fig. 9. There are two of these, each taking care of six valve tappets. The studs for different units such as the heads, manifolds, etc., are placed, and immediately following this the head is put on, also the manifold, hot-air stove, plugs, high tension leads, the horn bracket, starter, priming cocks, etc.

As the engine moves along the distributor, coil units and other small units are added with the engine in the upright position. The engine is then turned over, Fig. 10, to provide access for the parts going on the bottom. The front gear cover is put on, all of the oil lines, the oil pump, packing in the rear main bearing, oil float, etc., are put in place. The clutch and gear-set are attached and the engine is taken over to a slat conveyor which runs along the outside wall of the building, carrying it along to the test blocks.

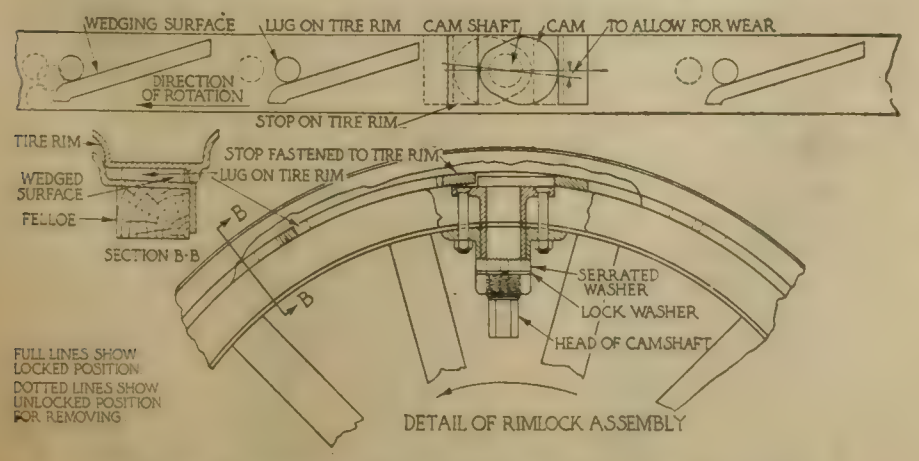
On the way to the block testing stand, the carbureter, name plate, clutch pedals, throttle rods, etc., are put on and the engine is then ready for the test. There are forty of these blocks, Fig. 11, taking care of the production of 150 engines per day. Some engines receive a slightly longer block test than others, as certain requirements have to be met in the way of performance, particularly as regards silence and responsiveness to the carbureter. An average test of approximately two hours is given on the block, a majority of which time the engines are operating under wide open throttle. The engines operate against fan blades, which are carried on the ends of the propeller shafts outside of the building. The load on these fan blades is such that the engine shows r.p.m. equivalent to about twenty-five miles per hour on the road, with wide open throttle.

After leaving the block test, the engine receives another inspection, the tappet covers are put on and other finishing touches given. A final inspection is made just before reaching the shipping room, the latter inspection including the checking of the transmission lock, which is in unit with the transmission. The engines leave this final inspection and are placed on trucks and carried over to the main plant where chassis assembly takes place.

A New Demountable Rim

A RIM in which a single cam takes the place of six or eight lug bolts usually employed to hold a demountable rim in position is being offered for consideration of rim and wheel manufacturers by H. N. Moody.

The wheel band is made with ten wedging surfaces which engage against lugs on the tire rim. These surfaces are brought into engagement with the lugs by relative movement between the wheel band and the rim, brought about by turning the cam. This forces the lugs behind the wedging surfaces and is said to give a high factor of safety against lateral stresses. When the rim is in position, the cam is locked by tightening the nut, threaded over the end of the camshaft, which projects radially inward through the felloe. The nut presses against a lock washer which, in turn, bears against a second washer, the under surface of which is serrated and engages with mating serrations in the sleeve or bushing in which the camshaft turns, as shown in the accompanying cut.



Details of Moody demountable rim and tire band showing cam action operated from a single point to lock the rim in place

THE Bureau of Foreign and Domestic Commerce reports that the final entry date for the Barcelona Automobile Show has been postponed to May 15. Up to date 13 entries have been made by American firms and 25 by concerns of other nationalities.

The show will be held from May 24 to June 5. The following are the minimum prices for exhibits:

	Pesetas
Passenger cars, 40 cubic meters space.....	2,600
Motor trucks and tractors, 25 cubic meters space	625
Motorcycles, tires and accessories, 10 cubic meters space	450

Additional space will be available at proportionate prices.

The Philippines as a Market for Automotive Products

The Islands have felt the depression but a general optimistic feeling prevails. The author describes the present situation as to marketing, roads and financial condition and discusses the local problems in full.

By Roy C. Bennett

THE Philippine Islands, probably the most thoroughly motorized part of the Orient, had a total of considerably more than 13,000 motor vehicles, exclusive of tractors, in operation at the beginning of this year. The last registration receipt issued by the automobile division of the Bureau of Public Works in 1921 showed 13,341. This number included motorcycles. Tractors are not registered with the bureau, and there is no accurate count of their number.

The year 1921 was not an active one for the motor car business in the islands, which fact is accounted for by the general dullness of insular commerce, accompanied by a shortage of money. Some of the largest dealers in automobiles had a close call, although the close of the year found all of them breathing easier, due to the fact that business had picked up to some extent and the prospects were generally brighter. The early part of the year has brought no boom but a general optimistic feeling prevails.

The following is the Bureau of Public Works tabulation of motor registration to the end of the year:

	Old	*New*	*Total*
Private cars	5,446	1,020	6,466
For hire cars	1,838	228	2,066
Public utility cars	172	5	177
Private trucks	726	146	872
For hire trucks	407	52	459
Public Utility Trucks	685	61	746
Garage cars	364	33	397
Garage Trucks	207	13	220
Government cars	326	49	375
Government Trucks	383	67	450
Private motorcycles	682	75	757
Government motorcycles	240	116	356
Total	11,476	1,865	13,341

In this table new cars include all not formerly registered in the Philippines, which means that people coming from the United States and bringing their cars with them would register it with the Bureau of Public Works as a new car on their arrival. This is done in relatively few cases except with army people, who can bring their automobiles free of charge on transports, and many officers do so. Some offer them for sale immediately upon their arrival, believing that, due to the cost of shipping which dealers must add to their prices, they can get ready sales. This theory was correct until the slump of business threw a large number of second-hand cars on the market.

Dealers in the islands do not look for any rapid recovery or sudden boom of their business, although they think the worst was passed months ago. Broadly speaking, they are marking time, resting content with the windfall sales which come their way and living in hopes that an improvement of business conditions generally will restore health and vigor to their own line sooner or later. The markets for Philippine products started to recover early this year and there is hope that the movement of Philippine produce, of which sugar is the most important, will improve materially.

Filipinos, who are proud in the extreme, are lovers of automobiles. Manila dealers sell a few cars to Americans and foreigners, but it is the Filipinos who give them the largest business. When sugar was high, Filipino planters had money in quantities they had never before dreamed of, and they bought cars. Hundreds of automobiles, many of them high-priced, went to the provinces, meaning the rural districts.

A car is more of a necessity for the average man in Manila than for the average man in a city of the same size in the United States. Climatic conditions—the heat when maximum and the floods in the rainy season—make it almost impossible for one to walk any distance to and from work. Street car service is inadequate and the street rigs, which are two-wheeled horse-drawn vehicles, are unable to handle the crowds at rush hours.

Relatively fewer persons appear to drive their cars in the Philippines than in the United States, partially because it is customary to have more servants here and partially because chauffeurs are cheaper than at home. Filipino chauffeurs get from 40 to 80 pesos (a peso is roughly a half dollar) a month. They are not the best chauffeurs, particularly as to mechanical upkeep of cars, neither are they particularly poor. The cost of upkeep of a car is about the same as in an American or European city. Gasoline is about twice as expensive, storage is cheaper; tires are higher, but garage charges compare favorably. The climate is hard on cars, as it also is hard on the roads over which they travel.

The status of roads and the history of road building can be understood through a study of the following table from the Bureau of Public Works:

PHILIPPINE PUBLIC WORKS STATISTICS

	Total mileage of roads in the Philippines			
	First Class roads	Increase Per cent	Second Class roads	Third Class roads
1907	(a) 303			
1908	423	40		
1909	609	44		
1910	764	25	(a) 641	(a) 2,074
1911	987	29	664	1,837
1912	1,143	16	1,342	1,999
1913	1,303	14	1,264	1,938
1914	1,593	22	1,258	1,787
1915	1,906	20	1,294	1,896
1916	2,137	12	1,271	2,138
1917	2,323	9	1,278	2,109
1918	2,542	9	1,253	1,944
1919	2.796	10	1,234	1,932
1920	2,920	4	1,266	1,914

(a) No accurate statistics before 1907 and 1910, respectively.

Years preceding 1914 are for twelve months ending June 30, 1914, and following years are for twelve months ending December 31.

Note:

First-class roads in this table include not only First-class roads officially designated but also First-class roads not officially designated as such.

W. Cameron Forbes, strong advocate of road building and a believer in the theory that one of the weaknesses of the Philippines was poor transportation, started extensive highway construction when he was Secretary of Commerce and Police in the Philippines, and when he advanced to the position of Governor-General of the archipelago he made this one of his hobbies. The road system has reached the point where maintenance is a serious problem and engineers are puzzled over the question of the proper kind of road. At present macadam is in the lead, but the heavy traffic, motor vehicles and bull carts, breaks up the surfacing rapidly. The heavy rains in the rainy season do immense damage, while the long dry seasons permit rapid wear through blowing dust.

Cars are used pretty much throughout the islands, but naturally the largest number is to be found in Manila. The drive from Manila to Baguio, a mountain resort, is popular with residents and tourists, as the mountainous part of the drive is scenically most beautiful.

The medium-priced car is the most popular, with the exception of the Ford. However, a number of expensive cars are in use.

Local dealers fear no strong competition from European cars, and the American manufacturer has a sure market, because of the heavy duty on them. This duty amounts to about 25 per cent, and even without this duty the American car is more popular with the Filipinos, who prefer the appearance of American cars, according to a dealer who has handled both and who had several French cars in his salesroom when he made the statement.

Motor trucks are important in the commercial life of the islands. In the first place they play an important rôle in the freight business. This should be fully understood when one recalls that horses large enough for wagoning are extremely scarce, mules are strangers and the railroad service in the islands falls far short of what it should be. These conditions also have constituted a call for the motor truck to enter the interurban passenger and freight business. It performed its task so well that it has incurred the enmity of the railroad, and remember that the railroad in the Philippines is government-owned. This means that the truck lines, represented in the foregoing table of registrations by "public utility trucks," have the government in opposition to them. Many handicaps are put in the way of the man who wants to start a truck line, if the railroad has a line which might by any possibility be injured directly or indirectly by his competition. It is necessary to get a permit from the government to operate any line of trucks under the head of public utility, and there are a thousand and one technicalities through which the issuance of permits may be delayed or on which they may be denied. This explains why hundreds of applications for permits have piled up in the office of the public utility commissioner awaiting action. The small number of trucks licensed for public utility purposes in 1921 tells the story.

The height to which the price of sugar soared was responsible for an abnormal interest in growing cane. This brought about a heavy demand for modern machinery, including farm tractors. For a time the importer who sold tractors was the one who could supply them fast enough. At that time a good tractor agency was looked upon as a gold mine, but when the sugar business deflated it carried with it the tractor business. To-day the warehouses of importing companies are filled with tractors, and there has been some talk of sending some of them back to the United States, believing that they can be sold there more readily than in the Philippines.

Peru a Market for Tractors

TRACTOR selling in Peru has been retarded by serious handicaps during the past year due to the adverse rates of exchange and to the general business depression, according to a report compiled by the Agricultural Implement Division, Department of Commerce. Few sales have been made in the past few months, resulting in the accumulation of considerable stocks. The American tractor has a practical monopoly of the market, as it was first introduced and is best known. The only European tractors now offered are the Fiat (Italian), Renault and Somua (French) and the Austin (British). A German tractor was exhibited during the recent centennial industrial exposition, but did not make a favorable impression on account of its apparent clumsiness. The Fowler steam tractor is used to a considerable extent for heavy plowing on sugar plantations.

Only 30 to 35 per cent of the haciendas on the coast are supplied with tractors, so that the possibilities are far from being exhausted. But few tractors are used in the interior provinces. A few are working satisfactorily in the high altitudes, although at an elevation of 10,000 feet or more it has been found that the efficiency of the motor is affected, making it necessary to use large pistons to secure the desired compression. The mountainous nature of the interior valleys constitutes a further obstacle to the use of modern machinery. However, the accessible coast valleys are the most important regions, agriculturally, of the country, and a return to normal conditions may be expected to be followed by a greatly increased use of tractors and other agricultural equipment.

There are now 14 makes of American tractors represented in Peru. There are few first class houses available as representatives of additional tractors and the manufacturer wishing to enter the market should send his own representative in order to make a satisfactory connection.

With few exceptions all tractors used in Peru to-day are of the wheel type, and any other type, it is stated, is not likely to be purchased without considerable propaganda. The first tractors brought to Peru were of the track-laying type, but did not find favor, possibly due to the fact that the machines were not properly handled and demonstrated. Only one American tractor of this type is on the market, and one European, the Renault, which has but recently been introduced. The medium weight, solidly-built wheel tractor of from 20 to 35 hp. is said to be the best adapted to the average Peruvian plantation. The lighter types have sold well on account of their low cost. Heavy and powerful tractors are not favored, as cultivated tracts are comparatively small. Garden tractors are not used.

Two and three-bottom tractor plows are most common and the mold boards are usually 12 or 14 inches, although the latter is considered by some to be too large. But few tractor disc plows are used, the chief criticism against them being that they break up weeds into such small pieces that their removal with harrows is difficult.

What the Industry Thinks About Used Car Plans

An analysis of answers to a questionnaire sent by the N. A. C. C. and the N. A. D. A. to manufacturers and dealers. A brief outline of the attitude of the industry toward proposals for improving the used car situation.

A VERY great deal has been said on the subject of used cars and there will undoubtedly be more in the future. The value of the matter written has not always been great, but the indirect value, that of bringing the problem out into the open, has had a value which should be more apparent as time goes on. It is necessary that manufacturers and dealers take an interest in the subject if any improvement is to be brought about and one of the best ways to do this seems to be to give wide publicity to ideas and methods which members of the industry are considering or actually using.

In order to determine just how manufacturers and dealers felt regarding the various plans proposed, a country-wide survey was made by the National Automobile Chamber of Commerce and the National Automobile Dealers' Association. This survey was made by sending out a questionnaire bearing sixteen questions. The replies from manufacturers and dealers were taken each as a group and analyzed. Each group was given equal weight and the answers combined to give what may be taken as the industry's vote on each of the sixteen questions.

The results of the questionnaire are given in percentages in the accompanying table.

An analysis of the table would lead to the following conclusions as to the industry's belief in the feasibility of each method:

1. Manufacturers heartily in favor of local appraisers, dealers slightly less so, and the industry standing two to one in favor.

2. Both manufacturers and dealers about equally opposed to dealers' co-operative reconditioning. Four to one against it as a whole.

3. Manufacturers more opposed to manufacturers' co-operative reconditioning than to No. 2, dealers somewhat less, the industry standing against as in No. 2.

4. Manufacturers three to one against factory reconditioning; dealers not quite two to one and the industry not more than two to one opposed.

5. Manufacturers favor dealer reconditioning nine to one; dealers four to one, and the industry as a whole in favor five to one. The industry shows greatest interest and closest agreement on this question.

6. Manufacturers evenly divided on used car exchanges; dealers slightly in favor; the industry seven to six in favor.

7. Manufacturers two to one against trading only own line; dealers about two to one against, and industry two to one against.

8. Manufacturers favor advertising used car value three to two; dealers seven to four and the industry eight to five.

9. Manufacturers opposed fourteen to one against longer discounts; dealers nine to seven in favor and the industry combined two to one against.

10. Manufacturers evenly divided on dealers' co-operative advertising; dealers slightly more in favor and the industry ten to nine in favor.

11. Manufacturers two to one against manufacturers' co-operative advertising; dealers in favor four to three. The industry seven to five against.

12. Manufacturers favor used car guarantees eight to one; dealers about two to one and the industry combined ten to three. Great interest expressed.

13. Manufacturers in favor of used car shows three to one; dealers not quite two to one and the industry slightly more than two to one in favor.

REVIEW OF USED CAR REFERENDUM

	Compared by Percentages — Manufacturers				Dealers				Combined				Summary of Vote		
	Yes	No	Doubt	No Ans.	Yes	No	Doubt	No Ans.	Yes	No	Doubt	No Ans.	Mfrs.	Dealers	Combined
1. Local appraisers	63	23	9	5	51	36	6	7	57	29.5	7.5	5	Yes*	Yes	Yes
2. Dealers' co-operative reconditioning	12	66	11	11	15	67	4	14	13.5	66.5	7.5	12.5	No*	No*	No*
3. Manufacturers' co-operative reconditioning	6	80	3	11	21	55	8	16	13.5	67.5	5.5	13.5	No*	No*	No*
4. Factory reconditioning	17	57	11	15	28	50	6	16	22.5	53.5	8.5	15.5	No*	No	No*
5. Dealer reconditioning	74	6	14	6	67	16	3	14	70.5	11	8.5	10	Yes*	Yes*	Yes*
6. Used car exchanges	37	37	9	17	45	33	11	11	41	35	10	14	Tie	Yes	Yes
7. Trading own line only	23	63	6	5	30	56	5	9	28	59.5	5.5	7.5	No*	No	No*
8. Factory evaluating used models	49	34	17	0	52	30	9	9	50.5	32	13	4.5	Yes	Yes	Yes
9. Longer discounts	6	83	3	8	48	37	8	7	27	60	5.5	7.5	No*	Yes	No*
10. Dealers' co-operative advertising	40	40	9	11	44	36	6	14	42	38	7.5	12.5	Tie	Yes	Yes
11. Manufacturers' co-operative advertising	23	60	3	14	43	33	7	17	33	46.5	5	15.5	No*	Yes	No
12. Used car guarantees	71	9	17	3	57	29	9	5	64	19	13	4	Yes*	Yes	Yes*
13. Used car shows	60	17	14	9	51	31	9	9	55.5	24	11.5	9	Yes*	Yes	Yes*
14. Accepting dealers prospect estimate	46	26	28	0	54	16	10	20	50	21	19	10	Yes	Yes*	Yes*
15. Refusing old truck trades	34	11	9	46	60	11	4	25	47	11	6.5	35.5	Yes*	Yes*	Yes*
16. National used car markets	11	51	9	29	48	22	6	24	29.5	36.5	7.5	26.5	No*	Yes*	No

*Indicates that vote was more than 2 to 1.

14. More manufacturers in doubt than say "no" to accepting dealers new car quota estimate; dealers in favor three to one and the industry two to one.

15. Many did not answer the question of refusing old truck trades, but comparing only the "yes" and "no" votes the manufacturers are in favor three to one; dealers six to one and industry four to one.

16. Manufacturers four to one against national used car markets; dealers two to one in favor and the industry as a whole six to five against.

As may be seen by a glance at the answer to question No. 15, both manufacturers and dealers are against trading in old trucks and the industry is against it with a ratio of four to one. If it is going to be possible to bring about this condition in the merchandising of trucks it would be well to see wherein are the fundamental differences which would permit it with trucks when it is generally considered to be impossible with passenger cars.

The report of the survey goes on to say that many dealers believe that the used car situation is their problem and that the manufacturers can only help in one way, and that, to refrain from overloading them with new cars. If this is done they believe that overtrading allowances will not have to be resorted to. It may be seen by reference to question No. 14 that dealers registered emphatic approval to having manufacturers accept their estimates of new car quotas, believing no doubt that this would indirectly ameliorate overtrading.

In connection with this subject of the manufacturer helping the dealer solve the used car problem it might be well to quote from an article appearing in AUTOMOTIVE INDUSTRIES of Jan. 26, 1922, page 160.

How the Manufacturer Can Help

"Since the actual solution of the problem lies with the dealer the manufacturer's part is to help the dealer and make conditions for him as favorable as possible. This can be done in several ways, important among them which are the following:

"1. General educational methods, showing the dealer the folly of over-allowance from the standpoint of sound business methods and profits.

"2. By urging the dealer to recondition cars properly before making a resale and to give a guarantee with his used cars commensurate with what he honestly believes the performance of the car will warrant.

"3. By urging the dealer to build confidence in used cars by keeping used car sales, service and advertising methods at the highest level both ethically and materially.

"4. By aiding the dealer in market analysis methods; showing him how to properly estimate the buying capacity of his territory. In some cases the manufacturer's organization can make market analyses and pass them on to the dealer for his use.

"5. By aiding the dealer in actually reconditioning cars. This is not practical in every case, of course, but may properly be considered in many instances.

"6. By selling parts for rebuilding cars at a lower price than that charged for regular repair parts.

"7. By planning and adjusting factory production on the basis of comprehensive market analyses, so that there will not be a temptation to overload the dealer."

The report mentions that many emphatically recommend that all manufacturers stop making trade-in allowances to their dealers. Undoubtedly this practice works unfairly to those who do not receive this allowance and it may be said to run counter to the efforts that are being made to lessen the used car evil, namely, to deflate values and put them on a sound basis where values would have a meaning which is readily understood.

"Very many think altogether too much is being made of the used car problem—that it is a bugaboo—whereas actually it is but a business condition for which the manufacturers are somewhat to blame. When new cars go down, the dealer has no protection on his used car, showing dealers should promptly dispose of used cars. The whole business they aver will rectify itself when general business conditions are better."

Some Suggested Plans

The survey report contains many suggested plans which may be well to mention briefly.

Mr. H. H. Brooks, sales manager of the Nordyke & Marmon Co., offers a national used car company plan which is briefly:

"A national used car corporation formed and operated under the supervision of the passenger car manufacturers, dealers and bankers, its sole business to be to buy, recondition and sell used cars. It will have a central headquarters with main branch houses in various zones, according to geographical conditions and potential markets. The branch houses will be reconditioning plants distributed so that cars can be driven in instead of shipped. Sub-branches will be purely retail establishments, except for minor repairs and adjustments. . . ."

A certified car plan was proposed by Homer McKee, the object being that certifying a car would remove the stigma from the used car business, and that a car must reach a certain standard of condition before it could be certified. "The Certification Board would be composed of fair, competent, unprejudiced mechanical experts."

Among other plans proposed are the National Appraisal Company plan, the Scranton plan, Used Car Auctions, Taylor Selling Service, Boston, Saginaw, Oklahoma and Cincinnati plans.

"A rather drastic and perhaps visionary proposal is to retire all cars over five years old, the manufacturers and dealers to provide capital for junking such used cars, the dealer being compensated by saving the expense of carrying used cars indefinitely and being enabled to carry larger new stock and the manufacturer by the salvage of parts usable for service."

The words "drastic" and "visionary" are well advised, for a careful consideration of this proposal cannot help but show up many inherent weaknesses as well as hidden dangers. It would seem impossible to carry out any plan of this nature without causing inflation and other troubles that the industry is trying to get away from.

FOLLOWING is a complete list of the places and countries to which letters may be sent at the rate of 2 cents an ounce or fraction thereof:

Alaska
Antigua
Anguilla
Argentina
Aruba
Bahamas
Barbados
Barbuda
Bermuda
Bolivia
Bonaire
Brazil
British Guiana
British Honduras
Canada
Canal Zone
Colombia
Costa Rica
Cuba
Curacao
Dominica
Dominican Republic
Dutch West Indies
Ecuador
England
Grenadines
Grenada
Guam
Haiti
Hawaii
Honduras (Republic of)
Ireland
Jamaica
Leeward Islands
Martinique
Mexico
Montserrat
Newfoundland
New Zealand
Nevis (Leeward Islands)
Nicaragua
Panama (Republic of)
Peru
Philippines
Porto Rico
Redondo (Leeward Islands)
Saba (Dutch West Indies)
Salvador
Samoa
Shanghai, China
Scotland
St. Christopher
St. Lucia
St. Martins (Dutch part of)
St. Vincent
St. Croix
St. Thomas
St. Kitts
St. Eustatius
Tobago
Trinidad
Virgin Islands (British)
Virgin Islands (U. S.)
Wales
Windward Islands



Aluminum, Forged and Cast

Editor, AUTOMOTIVE INDUSTRIES:

I am sorry that Dr. Rosenhain construed my criticism of his article as one of hostility to the proper function of the metallurgist.

I am the last man to raise the question of engineer vs. metallurgist, except to maintain time-honored traditions good for both, as I am very familiar with, and appreciative of, the assistance given by the metallurgist to the engineer. Nevertheless when things go wrong where the use of metals is concerned the engineer is usually and rightly held responsible, so that the metallurgist should consider his recommendations very carefully.

May I remind Dr. Rosenhain that out of a humble effort of mine came the Automobile Steel Standardization Committee of which I was Chairman, thus bringing together the metallurgists and engineers in the British automobile industry as never before to their mutual benefit and the clarification of the automobile steel situation.

Incidentally it afforded me an excellent opportunity of noting how my metallurgical friends differed and disputed with each other upon points that I in my blissful ignorance had thought were settled.

Dr. Rosenhain complains that it is useless for me to "demand vehemently" "that the metallurgist should state the value of all materials in terms of the *steel* the engineer knows." Misquotation does not help controversy and I would refer him to my letter in your article of December 8, 1921, in which I said "it is particularly the field of the metallurgist to develop the alloys of aluminum and to give to the engineer a clear idea of the properties of these alloys in terms of the materials he is already using and with which he is familiar" which is quite a different thing as the argument is far wider than that of replacing steel by aluminum. This is my vehement and useless demand. It may be useless but hardly vehement.

I would also quote Dr. Rosenhain's statement "Mr. Pomeroy wants to know what takes place before failure begins, but what the engineer really wants to know is at what stress failure really will begin."

Again referring to my letter I actually said "The engineer wants to know what happens before failure commences or rather precisely where it commences on the stress strain diagram?"

I cheerfully agree with Dr. Rosenhain in that my ideas on stress or mechanical hysteresis are distinctly vague. I have read most of the work on this and allied subjects that has come my way for many years past and the further I go the hazier I get. My lack of understanding persuades me that I may be a typical engineer after all!

I had certainly no intention of "attacking" Dr. Rosenhain in general terms for putting forward suggestions as to the utilization of new materials upon which he is an authority, but if it is a retrograde step for anyone to criticise in a perfectly specific manner what strikes him as a very dubious suggestion, then I am all for retrogression not only as an engineer but as a human being. But what really inspired or rather actuated my letter was Dr. Rosenhain's advocacy of the forged aluminum piston on the grounds that forgings were stronger and more reliable than castings.

This reliability it appears from his last letter is in respect of foundry wasters. I would only say that I am intimately acquainted with a plant which produces more aluminum pistons for automobiles in a week than are absorbed by the whole British industry in three months and that the percentage of machine shop wasters due to foundry defects is less than 1 per cent.

I am prepared to buy Dr. Rosenhain a perfectly good dinner if he will accept it on my next visit to England if his percentage of scrap at the N. P. L. in preparing forged aluminum test pieces with screwed ends is not considerably greater than this. I submit this as an example of quasi production of a simple order.

Dr. Rosenhain's authority is so world wide that I think it a very great pity that he should have advocated the forged aluminum piston *on the grounds* he has set forth. The aluminum piston confers more improvement upon an engine for less expenditure than can be obtained possibly in any other way. It has had its troubles due to causes very remote indeed from those cited by Dr. Rosenhain and these troubles have by patient investigation and unwearied experiment been gradually overcome. I suggest that the best advice to Dr. Rosenhain's production engineer is to get after the foundry and see whether or not the fault lies there.

On the general question of castings and forgings, Dr. Rosenhain is quite mistaken when he thinks my "attack" on him is due to his not agreeing with me on the desirability of employing castings for frame construction. If only he had seen what I have of the fantastic abuse a cast aluminum frame will stand he will realize that his disagreement in face of an accomplished fact would not be a cause for irritation.

He asks me if in pre-aluminum days I would have used cast iron in place of steel. The analogy is, of course, unfair as the alloy used in my cast aluminum frame has considerable ductility and a relatively high tensile strength although not a heat treated alloy, but if I had thought of it I should have investigated a malleable iron frame.

Incidentally may I ask if in the said pre-aluminum days Dr. Rosenhain would have recommended the use of steel pistons for automobile engines in place of cast iron pistons on the grounds of strength and reliability. This *is* a perfectly fair analogy.

I know the idea of a cast aluminum frame is a little startling, but the first consideration underlying frame design is stiffness rather than strength and the second, reliability of fastenings. The average stress in a frame is really very low and in a cast frame may be more or less uniform. The problem of fastenings with a cast frame is, of course, very simple as most of these can be made integral without incurring foundry difficulties. I suggest that there is no practical difficulty in producing a frame section 4 feet long of 8x2½ in. overall dimensions having a mean thickness of 9/32 in. with box sections at points of relatively high stress. The heavier parts where the sections are bolted together can be chilled without trouble and core prints can be provided ad libitum.

The net result is that in at least one case a frame has been made which weighs some 160 pounds complete while a corresponding steel frame weighs about 300 pounds. Of the reliability and strength of this cast frame I am convinced after some 32,000 miles of brutal testing. I would, however, view with apprehension the task of reducing the weight to say 120 pounds by using forged aluminum on account of the difficulties involved in securing to a comparatively soft and thin section parts such as engine brackets, cross members and spring horns.

I do not understand Dr. Rosenhain's statement that "a different ratio of density to elastic modulus may bring with it unexpected results" in connection with springs. The ratios of density to elastic modulus for forged aluminum and steel are approximately as 106 to 108 respectively and it is difficult to see that this can have much effect.

My calculation is not limited to material under uniform stress but applies equally well to say a laminated spring in which the maximum stress is reached in every section. While experiment frequently reveals considerations not disclosed by accepted theory it is at least worth while to start with some clear idea of the latter.

May I repeat that what the engineer wants is information not necessarily in terms of steel but in terms of the materials with which long experience has brought some degree of familiarity.

The principal difficulties in using modern aluminum alloys broadcast for automobile purposes are not related to their stress resisting qualities, but to softness and lack of wearing capacity and some ingenuity is required to overcome these characteristics. In these matters alone there is ample room for discussion and if Dr. Rosenhain can give us the benefit of the metallurgists' viewpoint and experience I should be very happy to pursue the congenial role of devil's advocate.

Dr. Rosenhain seems to interpret all the engineering problems to which he has referred in terms of the capacity of the parts in question to withstand stress.

Automobile engineering particularly abounds with instances where stress considerations are secondary to others, as for example a crankshaft where stiffness and resistance to wear are the determinants and a low carbon steel crank is amply strong enough in most cases if it would only withstand wear. Similarly with connecting rods, wrist pins, pistons, gears, camshafts, cylinders, flywheels, clutches, hubs, brake drums, frames, etc. Very few of these are stressed at all highly. In fact the principal parts of an automobile which really have to work for their living from the stress point of view are the axle springs, valve springs, transmission shafts and swivel axles, and in most of these be it noted wrought material is used in its very simplest geometrical form. It is this reasoning which underlies the case for the casting in general and the aluminum casting in particular as against the forging for very many parts. Metallurgists in general seem obsessed by the stress resisting qualities of the materials they advocate and specify and in so doing exhibit what is in my considered opinion a lack of realization of the problems before the designing engineer.

I think that if a fraction of the energy which has been devoted to the determination of the straight physical properties of materials had been spent on the investigation of the idiosyncrasies of materials in the fabricated form, i.e. upon macrostructure rather than microstructure, the engineer would have a wealth of data he does not now possess.

If Dr. Rosenhain has the time and inclination to continue this discussion I trust he will do so with two things quite clear in his mind. One, that apart from a certain degree of good humored satire which is the salt of discussion I have nothing other than a profound respect for the metallurgist, the mysteries of his science and the work he has done; two, that Dr. Rosenhain's eminence is so unquestioned that I hope he will accept criticisms, without regarding them as attacks, personal or otherwise, of suggestions which I venture to think are rather outside his life's work from one who at least can talk from the viewpoint of a fairly extended experience of the problems of automobile design.

LAURENCE H. POMEROY.

The Garden Tractor

Editor, AUTOMOTIVE INDUSTRIES:

In your issue of March 2 there is an article by Fred C. Ziesenheim on the garden tractor. We would like to call your attention to the statement that the writer makes wherein he states a 9-in. plow is a minimum size moldboard plow that can do satisfactory work. We should like to advise that a good many hundred users of our device are doing satsifactory work with the Utilitor handling an 8-in. plow.

Another statement is made that the engine should develop 5 h.p. to handle a 9-in. plow 8 in. deep. This is deeper than it is possible to do good work with a 9-in. plow. Our machine handles a 10-in. plow satisfactorily and we do not have 5 h.p., but 2 1/3 h.p., approximately at the drawbar. It is not a question of horsepower—it is a question of how much traction you can get, and with our job we can slip the wheels with the horsepower available.

Plows, however, are generally considered O.K. when turning a furrow one-half their width in depth.

To further quote this article: "The tractors which cannot pull a 9-in. moldboard plow should be definitely designed and marketed as a non-plowing type until such time as some other form of plow is available which will permit narrower furrows." We should like to ask why. Isn't any machine capable of pulling a plow a plowing type? One which does not handle a plow is known in the trade as a cultivator or a motorized hand cultivator. The writer further mentions the disk type plow for tractors as holding possibilities for small tractors. Why not the moldboard type? Does he realize the impracticability of his suggestion? Does he know what the demands are by a disk plow on a garden tractor? Under ordinary circumstances three, and probably four, horses are required to pull a 16-in. disk plow. These plows are made in 14-in., 16-in., 18-in., and 24-in. sizes.

He further mentions "A proposed method of attachment for small tractors is to place the implements in front of the tractor." Our new model does this. With us it is not a proposed method.

We further take exception to all of paragraph two on page 508, as it is not based on facts.

Your writer further states that: "The small tractor is not strictly a general purpose machine, as it can only be designed to meet a limited class of service." If there ever was a general purpose machine we think it is the type we make. Can your writer show us a machine of greater utility?

LON R. SMITH, Vice-President,
MIDWEST ENGINE COMPANY.

ANYONE seeking information on the source, structure, chemistry or uses of coal will find a very complete compilation of these facts in the "Coal Manual" by F. R. Wadleigh, recently appointed head of the Coal and Coke Section of the Bureau of Foreign and Domestic Commerce.

This manual will be of particular value to salesmen, buyers and users of coal because it is written in a non-technical, practical way for convenient reference. The National Coal Mining News, Cincinnati, is the publisher.

The Method of Analyzing Territorial Markets

Careful study must be applied to territorial markets and the different factors which have direct bearing on them. In order to make the involved considerations apparent, the method of analyzing markets is applied to a specific company and territory and followed through in each detail.

By Harry Tipper

THE statistics from examinations which have been made previously in these articles concerning the marketing of automobiles and the bases of marketing plans require further extension into the territorial development, in order to show the effect of this consideration upon the layout for the future marketing in the next sales period. In order that the consideration involved may be pointed and specific, we are taking the example of the Jones car, manufactured in Ohio, in the $2,000 to $3,000 price group, which company has been securing 20 per cent of the market of this price group with the expectancy of 20 per cent, plus, for 1923 in the total company. The expected requirement for cars in this class for 1923 is 72,000 cars. The expected market for the Jones car for the same period is 15,000 cars. One of the important territories of the Jones car is the Pacific Coast, which has been handled up to the present time by one large distributor located in San Francisco, with branches in Portland, Ore., and Seattle, Wash. This distributor showed the following position for 1921 in each of the three states represented:

CALIFORNIA.—At the beginning of 1921 this distributor had 30 dealers, of which 15 gave up the agency, went out of business or were otherwise eliminated. He has secured 6 new dealers, so that at the beginning of 1922 there are 21 dealers in the State of California. The expected market for the Jones car in California for 1921 was 750. The sales of the distributor were 650, of which 30 per cent were at retail in San Francisco—or 195 cars —leaving 455 cars sold at wholesale through the dealers. The 15 dealers who remained on the books throughout the year took 320 out of the 455 cars, or an average of something over 20 cars each The 15 dealers who went out during the year sold between them 75 cars before they went out, while the 6 new dealers put on during the year sold 60 cars.

WASHINGTON.—At the beginning of 1921 this distributor had two dealers, one of whom went out of business. The expected sale was 75 cars; the actual sale was 100 cars, of which 80 were sold at retail by the Portland branch; 15 were sold by the dealer who remained in business, and 5 were sold by the dealer who went out before he gave up the agency. No other dealers had been secured at the end of 1921.

OREGON.—The distributor's branch had three dealers, two of whom went out in 1921 and one was secured to replace. The expected market was 110 cars. The actual sale was 100 cars, of which 50 were sold at retail by the branch; 25 were sold by the dealer who remained in business through the year; 15 were sold by the two dealers who went out and 10 by the dealer who came in to replace.

In order to maintain its position on the Pacific Coast, the Jones company must conduct the following business through their distributor:

CALIFORNIA.—	The present number of dealers	21
	Expected mortality	6
	New dealers to be secured	15
	Number of dealers required	30
	Total sales of cars in this price group for 1923	4,692
	Expected sale of Jones car for 1923	938
	Expected sale at retail by the distributor in San Francisco	300
	Cars to be sold through dealers	638
WASHINGTON.—	Present number of dealers	1
	Mortality (not figured)	
	Number of dealers required	2
	Total sales of cars in this price group for 1923	411
	Expected sale of Jones car	105
	Probable sale through branch	75
	Sale through dealers	30
OREGON.—	Number of dealers at the end of 1921	2
	Expected mortality	1
	Number required	3
	New dealers to be secured	2
	Total sales of cars of this price group for 1923	576
	Expected sale of Jones car	130
	Probable sale through branches	50
	Sales through dealers	80

In view of these facts it is necessary for the Jones Company to determine whether the present organization for distribution will be able to secure the number of sales to be expected from the market conditions. The weakness in the sales of 1921 through California and the large mortality in the dealer organization in that state must be overcome by better contact with dealers and through the effectiveness of the merchandising plans, and by intimate consideration with the distributor of the measures to be taken to overcome that weakness. The Jones Company, through all their territories, will need the same information in order to lay plans for the whole company on a broad basis that will have in mind strengthening the dealer organization in order to lessen the mortality and increase the stability of sale, developing the facts as to the dealer's position so that the arrangements and contracts will enable him to make a reasonable profit and assure him of

reasonable support. The considerations will involve all questions of service, contracts, used cars, and all the other problems connected with the retailing of the automobile in each individual case, but the country-wide program will be concerned with the problems of maintaining an intimate contact with the trade so that changes in agencies can be made without expensive interludes, losses of value through the character of the dealers, or other items. The contact should be so thoroughly established that the mortality will be lessened because a better class of dealers can be secured. Analysis should include the consideration of the means to be taken to increase the actual sales to the expected quota, the establishment of quotas in accordance with the expected sales, and the actual strength of the dealer organization in each locality, and matters of this kind. On the basis of such figures, a reasonable basis can be arrived at for all business with the trade and for all promotion to the trade.

The mortality statistics of the dealers should be compared with the general statistics of mortality for the year in the automotive field, so that the difference between the mortality shown by the Jones Company and the mortality of the general field can be considered as to its indication of weakness or strength in the Jones Company's distributing plan. For instance, if the mortality in the United States among car dealers for the year 1921 was about 50 per cent, the mortality as shown for California, Oregon and Washington is not out of the way and does not indicate any special weakness or any unusual strength in the distributing plans of the Jones Company. Other territories may show a larger mortality in which case the reasons for this increased mortality should be examined. In some territories the mortality may be less than the average, in which case the reasons for the particular strength should be determined.

The weakness in the Jones Company's distributing plan, as it stands at present, lies in the inability to secure a sufficient number of dealers to replace those that have gone out of business or given up the agency. The general statistics in the automotive field show that there were about as many car dealers at the end of the year as there were at the beginning of the year. In other words, new dealers come in or new people take on agencies in sufficient numbers to offset those going out. On the Pacific Coast, the Jones Company has not been able to secure a sufficient number of dealers to offset the mortality due to those actually going out or giving up car agencies and the consequence is that the number of distributing outlets is now considerably smaller than it was at the beginning of 1921.

The same comparison should be made for each territory so that the plans for sales and promotion activity in 1923 may be arranged to take care of these conditions and provide a proper number of the right kind of distributing outlets, before the quota is established for the Pacific Coast distributor by the Jones Company. The entire United States should be classified in the same way that these three States have been classified and measures to correct the weakness of sales should be determined so that they may be taken into account in dealing with the quota question and the other questions that will arise with this distributor.

It may be that the Jones Company will find the loss in the total number of dealers confined to this territory, and that in the other territories those dealers going out have been promptly replaced by others coming in. In that event, the particular weakness is local and additional pressure may be necessary from a local standpoint by a discussion of the distributor's plans of action and his methods of dealing with the retailers. On the other hand, if the same condition shows up in other territories, whether to the same extent or not, the general plans of action will necessarily include more pressure on the dealer population in the automotive field so that the Jones proposition may be thoroughly understood and a keener examination made of the proposition itself so that the company may be assured that it is of the right kind to attract the efficient dealer.

The whole question of sale depends upon the maintenance of the proper distributing outlets and the weakness of the Jones distribution in California is reflected in the failure of the sales to reach the expected number of cars. There is no evidence in the statistics that the sale will be more likely to reach the expected number in 1923 unless the dealers are sold more thoroughly on the value of the Jones proposition and the distributor is equipped to take proper care of them. More and more, the importance of adequate and stable distribution becomes visible; consequently, the Jones Company should collect statistics upon this point with the utmost care, at the same time determining the reasons for the strength and weakness that may show up in the different territories.

ALL questions of service, contracts, used cars and all other problems connected with the retailing of an automobile should be considered in each individual case, and the contact with the trade should be so thoroughly established that dealer mortality will be low due to securing a better class of dealers.

Analysis should include the consideration of the means to be taken to increase actual sales to the expected quota, the establishment of quotas in accordance with the expected sales and the actual strength of the dealer organization in each locality. On the basis of such figures, a reasonable basis can be arrived at for all business with the trade and for all promotion to the trade.

Italian Motor Car Taxes Reduced

UNDER a socialistic impulse the Italian Parliament some time ago passed a law imposing such a high tax on privately owned motor cars that the future of the industry was seriously threatened. A car rated at 10-15 hp. is taxed at $240, nominal exchange; 15-20 hp. at $450 and a six-cylinder 24-hp. car, $950. After two years' experience the Italian authorities have realized that high taxes are not only seriously handicapping the motor movement, but that they are less remunerative to the State than the more moderate taxes in force before the war. In consequence, a technical commission presided over by the Under-Secretary of Finance has decided on a reduction of 50 per cent on the motor taxes applied to small and medium-powered cars, as well as to motorcycles and motor-assisted bicycles. It is also proposed to abolish all taxes on electric cars for a period of five years, providing the vehicles are of Italian construction. There will be some reductions in the taxes on motor trucks, although these imposts have never been high compared with private cars. As an example, a 1½-ton truck is at present taxed only $65 per annum, while a private car of the same engine size pays $1,000.

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W. I. Ralph, Vice-President — E. M. Corey, Treasurer
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David Beecroft, Directing Editor
U. P. C. Building, 239 West 39th Street, New York City

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Exports Picking Up

STATISTICS pointing out the improvement that has been accorded to the automotive industry are always of interest and value. Consequently a good deal of satisfaction and assurance for the future may be obtained from the following figures as to the international business in American passenger cars during the month of February:

Shipped from the United States	3096
Shipped from Canada	2719
Ford assembly at Manchester, England (both cars and trucks)	2000
Ford assembly at Buenos Aires, Argentina (both cars and trucks)	1245

The total is 9050, a figure that has not been approached in our foreign trade for many months. It would be materially larger if the Ford assembly at Sao Paulo, Brazil; Cadiz, Spain; Bordeaux, France; Copenhagen and other cities were added. However, these statistics reveal United States and Canadian shipments of 5815 passenger cars, to which an additional business of 718 trucks were sold from the two countries. Going back into previous shipments, the last month with a comparable total was January, 1921, with 5249 passenger cars, and December, 1920, with 7753.

Stow the Hammer

THE entire automotive industry has suffered much from adverse rumors during the period of business depression. Many rumors have been founded on fact, but more have been started by persons speaking unthinkingly to those who assumed that the remarks were made in good faith. So it behooves us all to refrain from knocking when we do not know the facts.

It is the duty of a concern to be a credit to the community in which it is located and at the same time any concern which does conduct itself with credit deserves outspoken moral support. This applies to our competitors as well as ourselves, for the strength of the industry depends on the strength of the individual concerns. This may be carried to the ultimate point by saying that that which benefits the community benefits the nation as a whole.

In the days to come let us not forget that the industry needs an every-day application of the old adage: "Stow the Hammer and Sound the Horn."

Automatic Production

MOST industrial ills are the result of a failure to understand the fundamental processes of human and economic laws. Present necessities frequently loom up so large because of proximity that their true relative importance is obscured. The difficulties arising from this fact can be readily traced through the marketing, production and labor problems of the automotive industry.

The predominance of automatic machinery in modern industry, for example, has unquestionably reduced materially the necessity for individual skill and for individual responsibility on the part of the worker. This trend has produced increased efficiency in production up to a certain point. Consequently, many engineers are assuming that this efficiency will continue to increase in proportion as the development of automatic machinery progresses and the necessity for the exercise of individual judgment and responsibility grows constantly less.

A more comprehensive study of fundamentals, however, shows this theory to be a fallacy. There is a very definite point at which, even from the immediate production standpoint, the monotony and nervous fatigue of repetition work offset the increased efficiency gained by the worker in repetitive production processes.

Stepping outside of the individual shop, moreover, the effect of maximum development along present lines will be to slow down the mental process of the mass of individuals comprising our civilization to a point where the necessary leaders and foremen could be obtained, to where the lack of interest in the work in hand will be so great as to offset the production efficiency gained by repetitive work, and to where

industry and production will suffer from a gross inefficiency, unlike pre-machinery inefficiency in kind, but equal to it in degree. As the responsibility of the individual worker is decreased, the necessity for supervision increases.

The purpose of industry is to serve the individuals comprising the human race. It is fundamentally incorrect to assume that man is to serve industry. Procedure based upon this latter assumption, if persisted in long enough and spread over a wide enough area, can result only in revolt—gradual or sudden—according to the strength of the economic forces operating in opposition to human desires and necessities.

That factory will operate most economically over a long period of time which provides within its working program the best opportunity for individual mental and intellectual development among its employees.

Necessary Statistical Data

THE need for accurate statistical data in the automotive industry is greater than ever before. The thorough study of marketing costs and distribution methods which must take place calls for the compilation and segregation of data that has previously been considered unnecessary. Production schedules must be correlated with sales possibilities and a proper balance of all organization activities must be obtained. The necessity for a detailed analysis of many of these problems has come to the industry only recently.

Comprehensive statistical data can be provided only through the concerted efforts of all agencies within the industry. There should be a wide exchange of experiences and of the results of surveys. Marketing studies should be made by many companies and co-operation encouraged in correlating the results of such studies. The field is almost virgin and the necessary development along these lines will be much more rapid if experiences and data are freely exchanged. The result will be advantageous to individual companies as well as to the industry as a whole.

Valve Capacities

IN automobile engines the inlet and exhaust valves generally are of the same diameter and also have the same lift. Designers undoubtedly have been led to the use of equal sized valves by the advantages of interchangeability and to equality of lift by the consideration that the lift should be made as high as possible and still have substantially noiseless operation at maximum engine speed.

The question has sometimes come up in the past, especially in connection with racing engines, as to which should really have the greatest capacity, the inlet or the exhaust. Judging by practice when valve capacities are unequal, the impression has prevailed that the inlets should be the larger or have the largest capacity. Until recently there seems to have been no experimental data on this available to the public.

The problem is somewhat involved, as there are conflicting requirements. In a racing engine or other type which operates under nearly full load all the time, the size of the exhaust valve is limited by the ability to cool it effectively, and we therefore find cases where two exhaust valves are used per cylinder and only a single inlet valve, which might create the impression that the exhaust capacity should be larger than the inlet capacity. There is, of course, no use in making the exhaust valve so large that it cannot be cooled, but this difficulty can always be avoided by using dual and triple valves, and does not affect the question of the relative valve capacities required at all.

Some light has been thrown on the above question by experiments made at McCook Field and reported in a recent S. A. E. paper by S. D. Heron. The experimental engine had two inlet and two exhaust valves to the cylinder and could be operated with all four valves, with two inlet and one exhaust, with one inlet and two exhausts or with only a single inlet and exhaust. The inlet and exhaust valves were not of exactly equal diameter and lift but were not very much different. It is interesting to note that the engine developed considerably more power with two inlets and one exhaust valve working than with one inlet and two exhausts.

That such would be the case might be expected, for the reason that the charge has to be drawn into the cylinder under comparatively small pressure, while the bulk of the exhaust is forced out under a high one.

Further confirmation of this relationship was furnished by tests in which only a single valve of each type was used. This, of course, gave very small valve capacity in proportion to the size of the cylinder. One of the valves was 1⅜ in. and the other 1 9/16 in. in diameter, and the lifts were the same for both. With the bigger valve for the inlet the engine gave approximately 10 per cent more power than when that valve acted as the exhaust. Thus it seems to be established that for maximum power the inlet valve should always be larger than the exhaust valve; or, to express the matter in a somewhat different manner, if an engine has inlet and exhaust valves of substantially the same capacity or size, more can be gained in the way of power by increasing the inlet than by increasing the exhaust valve size.

Progressive Conservatism

THE upward trend of car and truck production is in itself sufficient to warrant considerable optimism as regards the automotive industry during 1922. But conversations with factory executives reveal an even more fundamental reason for predicting sound progress from now on.

Factory executives throughout the industry are speaking in conservative terms concerning immediate production and sales possibilities. They are not overconfident; they recognize the limitations of the present upward trend of business and are laying future plans on a sane, conservative basis. Predictions concerning production probabilities are being made on a conservative basis that indicates sound progress.

If this same conservativism that undoubtedly pervades the minds of automotive executives could be translated into the publicity statements sent out by the various concerns, public opinion would be molded more favorably toward the automotive industry.

Outlook Bright for Second Quarter

Volume of Business Likely to Increase

April Will Be Better Than March —May and June Probably Will Show Further Gains

By James Dalton

NEW YORK, April 11—The automotive industry enters the second quarter under decidedly encouraging auspices. Orders on hand, factory schedules established and orders given for supplies, make it certain that April will be as good as March, if not better. Parts makers already have received commitments which indicate that there will be no slackening in May. Prospects for June are good.

If sales continue at the present rate for another three months it would be surprising if there were not a mid-summer decline in business. Such a seasonal falling off has been perennial in the industry except for the last two years. There was none in 1921 and in 1920 it came in the second quarter.

Manufacturers and dealers are just beginning to realize how big a month March was. To find a parallel it is necessary to go back to March, 1920, which was one of the three or four best months the industry ever had. All carload shipment records since that time were broken last month. They were materially larger than in any month of 1921 when the highest total was in August with 20,350. Last month's total was approximately 25,000. The biggest month in 1920, after March with 29,326 was August with 23,386.

March production by Ford was more than 70,000 and it is expected to reach 100,000 this month. The other large makers showed a greater gain over February than did Ford.

One of the most encouraging incidents for the week in the whole industrial field was the reopening of the Ford assembly plant at Atlanta after being idle for a year. This step was justified by a 100 per cent increase over February in sales in the Southern States.

A conservative estimate of the volume of sales for the industry as a whole in 1922 would be something like the following:

Passenger cars: At least equal to 1921 and probably considerably in excess.

Light trucks: An increase of at least 200 per cent over 1921.

Heavy trucks: An increase of at least 100 per cent.

Tractors: An increase of at least 200 per cent.

Parts and accessories: An increase of at least 100 per cent and probably much more.

Tires: A considerable increase.

Business in Brief

NEW YORK, April 11—Confident forward steps have been taken in the last week by such basic industries as building and its related lines, iron and steel and agriculture. Retail trade has felt the impulse of spring. This has been reflected in jobbing and manufacturing lines.

A great boom in building continues. Expenditures in 109 principal cities for March were $194,661,072 as against $99,219,326 for February and $91,875,757 for March a year ago.

Bank clearance for the week ending April 6 aggregated $7,191,119,000, a gain of 16.8 per cent over the preceding week and of 11.3 per cent over the same week last year.

Pig iron production in March totaled 2,034,794 tons, compared with 1,629,991 tons in February. It was the first month since January, 1921, to pass the 2,000,000 mark. Orders for steel products as a whole have been heavier in the last two weeks than at any time since 1920.

Stocks continue buoyant, bonds higher, exchanges steady and time money slightly easier.

With favorable weather winter wheat has improved in all sections. Private estimates of yield are from 550,000,000 to 580,000,000 bushels. Prices in all grain markets showed gains for the week.

Official statements by 935 Iowa banks show that conditions have improved considerably.

Textiles have continued quiet in primary markets.

Car loadings for the week ending March 25 totaled 846,035 with 508,653 loaded with miscellaneous freight and merchandise. This was an increase of 10,996 over the preceding week for the same classes of freight and a gain of 61,956 for the same week of 1921.

Ford April Schedule Is Placed at 101,164

Will Exceed Last Year by 10,000 —Other Plants to Increase Production

DETROIT, April 10—The production schedule of the Ford Motor Co. for April closed with 101,164 cars and trucks, which will exceed last year's production by 10,000. An increase of 200 men daily has been made for two weeks at the Highland Park plant, and the employees now total nearly 40,000 men. Tractor production has reached 400 daily.

Ford officials say that the business now in sight will justifiy making 110,000 cars and trucks. The Canadian factory is expected to run at its capacity of 225 cars a day for the next three months.

General Motors, with a combined output of 66,000 cars for the first quarter, will materially increase production the second quarter.

The estimated production of Dodge Brothers for the second quarter is 52,000, or more than double the second quarter of 1921.

Hupp shows 6344 cars for the first quarter and expects to make 12,000 in the second, as against 4500 in the same period last year.

Packard made 2234 cars and trucks in the first three months of 1922 and expects to turn out 4000 in the second quarter, as against 2200 the same period last year.

Maxwell has a schedule of 200 a day, or a total of 15,000 for the second quarter, compared with sales of 4500 in the second quarter of 1921.

Willys-Overland is turning out 400 cars a day, or at the rate of about 30,000 for the second quarter, which will double the second quarter of 1921.

QUARTER'S OUTPUT, 207,560

NEW YORK, April 10—In the first quarter of 1922, with March partly estimated, members of the National Automobile Chamber of Commerce produced 207,560 cars and trucks, which was 220 per cent of the same period for 1921. All manufacturers reporting produced 371,798 cars and trucks in the first quarter, which was 162 per cent of the same period for 1921.

AUSTIN PAYS OFF RECEIVER

LONDON, March 27 (*by mail*)—Austin has just paid off the receiver and is now in a flourishing condition. Orders, exceptionally large in number, are coming in at a good rate, and last week's turnover was the best for 12 months.

Production Trend Steadily Upward

Indianapolis Plants Going Ahead Rapidly

March Reports from Manufacturers Indicate That February Was Far Surpassed

INDIANAPOLIS, April 7—There has been a sharp upturn in automotive manufacturing in Indianapolis during the last few weeks. Reports for March from a dozen representative manufacturers of cars, parts, accessories and engines show that March records far surpassed those of February, and in some cases ran ahead of the best early season records of last year.

Cole reports that February and March exceeded 1921 records by 50 per cent. March itself was far better than the same month last year, while its production and shipment figures exceeded those of February, 1922, by more than 100 per cent.

H. C. S. advises that January, February and March of this year doubled the records made last year, while April shipments apparently will be 100 per cent in excess of those of March.

Marmon's production and shipment figures for the early part of this year are double those of the 1921 period. March and April shipments are far ahead of the output for the same period last season. The present production monthly average is close to the maximum point reached last year, even when revised prices went into effect.

Stutz 20 Per Cent Ahead

Stutz's first quarter production and shipment were more than 20 per cent ahead of the same period last year. March, 1922, showed an increase of 50 per cent over February. April business is expected to keep up to March and probably pass it.

Lafayette's first buying spurt began at the New York show and the orders and consequent shipments have kept up. March business was better than the preceding months of this year. A higher schedule was put into effect thirty days ago.

Automotive Parts Co. reports that February and March business was up to the peak reached during the boom period. April will be the biggest month the concern has ever had, night shifts working at least three days a week.

Oakes Manufacturing Co. within the last three or four weeks has experienced a very sudden and large demand for its products. Production and shipment are now within one-third of the volume of boom times and far ahead of the same period last year. Nights shifts are also being operated.

Steady and Well Defined Flow in Buying Reached, With No Halt Apparent

By Charles D. Hastings

President of the Hupp Motor Car Corp.

Detroit, April 11.

UNLESS some unusual and totally unforseen economic condition arises in 1922 there is no reason why the automotive industry and business generally in the United States should not continue to progress toward a happy point of prosperity.

There is nothing unusual about the present business in the automotive field except, perhaps, that a certain amount of it is deferred business which ordinarily would have developed in 1921 but for the lack of firmness in the business structure generally.

Business is now on a more stable footing. Deflations have been accomplished. Buying which started on a light and scattering scale in the fall of 1921 has been extended gradually until now it has reached a well defined and steady flow. There is nothing which would indicate that this flow of business will be interrupted.

In the automobile field price stability is a real factor in stimulating demand. The marginal buyer who has to anticipate market conditions is convinced that present prices represent ultimate declines and is buying. Then, too, the improvement in business tone has caused those who withheld buying cars against a protracted business slump to come into the market.

Because of its general appeal, the automobile market is the first to ride on an incoming business wave and the last to fall in a decline. The rise of business from the decline of 1920 is definitely under way. With the marketing of crops this fall the period of prosperity for all business should be well under way.

Midwest Engine Co. reports a light production during January, which increased at least 12 per cent during February and an equal amount during March. April will show more than a 20 per cent increase over last year. New contracts on which delivery will start in a little more than a month have been received together with orders from old customers who are now buying more engines than in previous months.

Robert H. Hassler, Inc., states that production and sales for the first quarter were about 25 per cent beyond figures for last year. Except for seasonal fluctuations, the annual output has risen steadily during the last three years.

Wheeler Schebler February and March production shows a gain of 100 per cent over November and December, and April will show a further gain of 25 per cent.

Burpee Johnson shipment and production figures for the first quarter are 100 per cent better than last year.

SHALER WORK RESUMED

WAUPUN, WIS., April 10—Production of Shaler vulcanizers, headlight lenses and other automotive equipment and appliances by the C. A. Shaler Co. has been resumed in temporary quarters pending the completion of the new plant which will replace the group destroyed by fire early in March with a loss of nearly $300,000. Actual construction work on the new factory is already under way.

Durant Will Produce 200,000 Stars in 1923

Sample Cars To Be Turned Out This Month—Sales Plan Considered

NEW YORK, April 11—Durant Motors, Inc., has informed its stockholders that it has entered into contracts with the Star Motor Co. of New York, the Star Motor Co. of Michigan, and the Star Motor Co. of California to produce the Star car, which will sell at $348, in the divisional plants of Durant Motors and under the same management. The production schedule of the Star for the calendar year 1923 has been tentatively fixed at 200,000. The production schedule for Durant fours and sixes for next year has been placed at 80,000.

Detailed plans as to the sales policy for the Star probably will not be announced for two months. It is proposed to turn out 100 sample cars this month, 500 in March and 1000 in June. After that production will be increased as rapidly as possible so that deliveries to purchasers can begin.

When the sales plan is evolved it probably will call for the establishment of divisional factory branches which will have direct charge of sales in territories

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Parts Makers Feel April Improvement

Consensus Is That It Will Probably Exceed March Which Was Good Month

NEW YORK, April 10—Following are paraphrases of reports made by credit representatives of some of the leading parts manufacturers at a recent group meeting at which business conditions were discussed:

"Our March business was the biggest we have had—bigger than in any month in 1921. We feel that April is going to be a great deal larger than March. We sell to a lot of people in the South, and of late they seem to be coming through. Our collections indicate there is going to be a big improvement down there."

"We, too, are very optimistic about the future. March was a very good month and I believe April is going to be still better."

"March was very encouraging to us. Our April business already scheduled also is very encouraging. As a matter of fact March and April are going to be the best months we have had in a year and a half."

Sees April Biggest Month

"Our business for February and March was very good and we expect April to be the biggest month we ever have had. We can't get material fast enough for automobile manufacturers."

"Each month this year our shipments to automobile manufacturers have shown a material gain over the preceding month. The orders we have booked indicate that April will be at least equal to March and May will be good too."

"April is going to be a very good month. In fact it probably will be bigger than we can handle. We have had a night force in some departments to take care of April specifications."

"We feel very good about the prospects for April and May."

"Since the first of the year our production has increased steadily, month by month. April will be as good as March if not better. We believe this condition is general and that we can expect a continuance for at least 60 days after which we expect the usual lull."

"I have sounded our New York banks and they are very optimistic as to the future, much more so than they have been in a long time. Trucks are being moved and in places where we thought we had frozen loans we find we are getting substantial reductions. Another gratifying feature seems to be that dealers are not being overloaded beyond their capacity to sell."

Improvement Steady

"Our business has shown a steady improvement every month this year. We are now running three days a week whereas for several months we have been running only two days. We have some orders for delivery in April and May."

"Our outlook for April is that we will have a better month by far than we did in March."

"April orders from our principal customers are much higher than for March. It has been our experience that we cannot get anything like adequate notice on shipping requirements. They simply won't order until they have sold. They won't buy until they have sold. This is common to all branches of the industry. We won't tie ourselves up for large quantities of material until we can see our way out."

"Our business is showing a steady improvement, nothing very startling but quite satisfactory nevertheless. The great trouble with our business is to keep a uniform manufacturing practice. We will get an order on a certain number of units today and tomorrow we may get a cancellation on a part of them. Automobile purchasing agents seem to be very much up in the air as to just what they will require and when they will require it. On the whole, however, we feel that we are going to have a very nice increase over the first six months of last year."

"We have been very much encouraged by our sales both to manufacturers and dealers."

"The automobile manufacturing end of our business was very good in March and April will be much better."

"The machine tool trade seems to be picking up. The truck industry also is improving and passenger cars are satisfactory."

Peerless Position Good Stockholders Are Told

CLEVELAND, April 10—In submitting to stockholders the annual report of the Peerless Truck & Motor Co., the following statement was made by President R. H. Collins:

Taking into consideration the general business depression, we feel that stockholders should be well satisfied with the showing and financial condition of the corporation. It will be the policy to continue to build and market one of the finest eight-cylinder cars, and the interest in our line, as reflected by actual sales since Jan. 1, is ample evidence of the excellence of our product and an indication that the country as a whole is gradually returning to normal conditions.

The recent declaration of the dividend for 1922 at the rate of $3 per share, your president feels, is fully justified by present prospects and the excellent financial condition of the corporation.

Republic Truck Division Will Solicit Rail Trade

DETROIT, April 7—Republic Motor Truck Co., Inc., has organized a public utilities division under Ralph M. Sparks, to merchandise the Republic Knight-motored bus. This department will devote itself exclusively toward merchandising the bus to railway lines which have a problem of feeder service to meet.

Sparks is a well known passenger transportation man, having been connected for a number of years with a prominent railway line in the East. The efforts of this division will be fortified by the factory sales department and the distributor organization.

EMPLOYMENT IS GREATER

WASHINGTON, April 10—A survey by the Federal Employment Service of conditions in the automotive industry for March showed an increase in employment of 8.4 per cent over February, with the addition of approximately 15.000 to payrolls during the month by the companies reporting. The survey indicates that there will be greater activity in April. The employment service declared that industry as a whole took up considerable slack in March.

Business Is Taking Long Upward Swing

Slow Progress in Milwaukee Encouraging to Manufacturers —No Sharp Setbacks

MILWAUKEE, April 10—A continuance of the progress made by the automotive industries in Milwaukee and vicinity during March, with respect to increased output, is reported in the first ten days of April. This is true as well of passenger car and motor truck factories as the makers of engines, frames, gears and other parts. The most favorable showing, however, is being made by the manufacturers of automotive equipment, who are getting good orders from the jobbing trade as the result of renewed buying interest among consumers being reflected into retailers' orders.

Although it would ordinarily be expected that slow progress makes a less satisfactory feeling than rapid advancement, representative men in the automotive industries locally are of the opinion that the gains now being established slowly furnish a most encouraging feature of the situation. Experience of the past year has shown that spurts are less substantial than the long upward swing, slow as it may be, they explain. The present trend has been unusual in that so far there have been no sharp setbacks, as before.

Local Trade Excellent

There is an extraordinary unanimity of opinion among distributors and dealers in this city relative to the comparative excellence of the state of retail business in this territory. Most dealers are able to say that they sold more passenger cars in March than in November, December, January and February put together. This March was a much better one for retail business than the corresponding month of 1921.

The improvement generally has been accentuated, in some instances rather sharply, in the past week. Better weather and more seasonable climatic conditions have contributed considerably to make this true.

On the other hand, the feeling is growing among owners that the bottom of the price decline not only has been reached, but may be subjected at any moment to a reversal. Consequently many of them are entering the market to take advantage of present prices on new cars and allowances being made on used vehicles. From 75 to 80 per cent of deals at this time involve trade-ins.

WHEEL MAKER BUYS PLANT

WOOSTER, OHIO, April 11 — The Pneumatic Disk Wheel Co. of Richmond, Va., has purchased the Wooster plant of the Kelley-Springfield Tire Co., the consideration being $150,000. The plant, which has been closed for some time, will be reopened July 1, and disk wheels for automobiles will be manufactured.

DuPont Expresses Confidence in 1922

Tells Stockholders That Year Had Auspicious Opening for the Industry

NEW YORK, April 11—"The officers of General Motors Corp. believe that recovery from the depression of 1921 is reasonably assured and look forward with greatest confidence to a successful business in 1922."

This optimistic statement is the closing paragraph of a communication addressed to the stockholders by President Pierre S. duPont in submitting to them the final report of the corporation for the fiscal year ended Dec. 31. In his statement duPont says:

Industry Passes Test

Last year occasion was taken to call attention to the rapid growth of the automobile industry and to compare the volume of sales for the year 1920 with the annual sales of other important products. At that time the country was on the eve of a period of depression and liquidation, the extent of which was beyond accurate prediction. The importance and stability of the automobile industry during such periods had not been tested, therefore the outcome of business for the year 1921 was looked upon with confidence, doubt or apprehension, according to the viewpoint of the individual making the forecast. It must be conceded that the industry as a whole has withstood the test remarkably well.

In the first place, the increase of registrations of automotive vehicles from 9,211,295 in 1920 to about 10,488,000 in 1921 (an increase of 13 per cent) shows that the generally depressed conditions did not result in disuse of the automobile as a means of transportation. In fact, the number of cars in use actually increased in a period of rapidly declining values, unemployment and general business depression. Secondly, the value of automobiles produced, which stood at $2,233,000,000 in the banner year of 1920, decreased in 1921 to an estimated $1,222,000,000, or a decline of about 45 per cent. Thirdly, the number of cars and trucks produced fell from 2,205,000 to 1,680,000, or about 24 per cent. Fourthly, the domestic consumption of gasoline for 1921 as reported by the Bureau of Mines was 4,506,706,000 gallons, an increase of 6 per cent over 1920.

The above facts emphasize the importance of the automobile and establish the automotive industry as a permanently important factor in the country's development and activities.

Position in Market Satisfactory

General Motors Corporation has held its share of business with respect to the medium and high-grade cars. As a whole, its proportionate volume is slightly less, due to the fact that it is not as large a producer of low-priced cars as those of high and medium grade. The low-price field has naturally been the most active in depressed times; therefore, it is not surprising that General Motors Corporation shows a slight falling off from the average of the industry. However, its maintenance of position in the field is considered satisfactory.

Sales of passenger cars, commercial cars and tractors for the year 1921 totaled 214,799, compared with 387,190 in 1920; 406,158 in 1919; 246,834 in 1918, and 324,503 in 1917.

During the year 1921 it became apparent to the executive committee that the operations of certain divisions were in conflict with newly formulated plans for conducting the business of the corporation. Consequent changes and the reorganization of these divisions on the lines established have resulted in loss, not only in profits, but also through liquidation and scrapping of inventories and the abandonment of car, truck and tractor models not suited to the adopted rules for quality and performance. Some of these changes have been radical, but the executive committee has faced the reorganization without fear and in full confidence that the future would thoroughly justify the complete readjustment of unsatisfactory conditions.

Divisions Closely Knitted

It has been the effort of the officers of the corporation to knit more closely its different divisions in order that the greatest benefit might result from the co-operative conduct of this large business. Much is left to be done, but the foundation for closer co-operation has been laid and benefits are already accruing. Systematic study has been given to the relations of the several divisions to each other and duplication or conflict of effort has been avoided. As a whole, much has been accomplished and many plans laid that will develop to the future advantage of the corporation.

In the last annual report attention was called to the large accumulation of inventories toward the end of the year 1920 and the liquidation that had been accomplished on Jan. 1, 1921. This liquidation has gone steadily forward, so that inventories have been reduced from $164,684,000 to $108,762,000 (a reduction of $55,922,000) during a period of comparatively small sales volume. This liquidation has been accompanied by reduction in payables as follows:

Current accounts payable have been reduced	$9,702,000
Notes payable have been reduced	23,446,000
Total reduction in current indebtedness	$33,148,000

The outstanding feature in the report of operations for the year 1921 is liquidation—liquidation forced by the sudden contraction of business to an abnormally low level throughout the United States, in face of declining values. The accomplishment of this liquidation in orderly manner is a tribute to American industry and the officers and employees of General Motors Corporation are to be commended for their effective work in the liquidating program. The corporation met the shock of abnormal retrenchment and stood it well.

The outlook is now brighter. The year 1922 opens with inventory accounts reduced to current basis and old commitments provided for or adjusted. The opening months of the year show substantial increase in demand and sales, not only with respect to corresponding months of 1921, when business was nearly at a standstill, but also as to several of our divisions even in comparison with the record year of 1920.

The officers of General Motors Corporation believe that recovery from the depression of 1921 is reasonably assured and look forward with greatest confidence to a successful business year in 1922.

MAIBOHM PLAN ADVANCES

TOLEDO, April 9—With only three more creditors to assent to the reorganization plan proposed for Maibohm Motors Co., Sandusky, it is believed the plan for Sandusky capital to take over the plant there will be approved in a few days.

Akron Tire Output Has Reached Normal

Factories, However, Are Not Running Full Blast—Goodyear Still Leads

AKRON, April 8—Tire production in Akron to-day is at the rate of 22,500,000 casings and 25,000,000 tubes a year.

Figures of the Rubber Association of America show slightly over 21,000,000 tires manufactured in the United States in 1921, Akron making more than 16,000,000 of that number. If this same proportion of tire production holds good for the entire year, based on Akron's estimated tire production, there will be close to 35,000,000 American tires built in 1922.

Daily Output 73,000

A census of Akron tire companies shows the following present production tickets: Goodyear, 22,000 a day; Firestone, 21,000; Goodrich, 14,000; Miller, 6000; General, 2000; Seiberling, 2000; all others, 8000.

The Seiberling production includes the local plant and the Lehigh plant at New Castle, Pa.

Figuring normal tire production in Akron at about 75 per cent of the peak of production of 1920, for there has not been a normal year in Akron upon which to base comparisons, then Akron's tire production to-day is normal. This does not mean, however, that the factories are running at full blast. Although Goodyear heads the list with 22,000 casings a day, Firestone becomes the virtual leader in proportion of peak output now being obtained, for whereas Goodyear's peak was 33,500 tires daily, Firestone's peak was 28,000.

All companies report heavier tube production. Goodrich is making between 18,000 and 19,000 tubes. Other companies show not quite so large a ratio of tube production, although it exceeds casing production.

Firestone has increased production 5000 tires a day within the past five weeks. Goodyear has increased from 18,000 tires at the beginning of the year.

General Doubles Production

General Tire is turning out twice as many tires as ever before in its history, and reports sales to-day more than 65 per cent greater than ever before. General will reach a basis of over 2000 tires daily by April 15. This will include daily production of 1000 special small sized tires.

The new Seiberling company is gaining production of Seiberling cords at the rate of 44 a day. Portage tire production at New Castle is approaching the thousand mark daily, while Seiberling cord production at Barberton exceeds 1000 a day. By June 1 the company expects to have a production of nearly 5000 tires daily. Orders are far in excess of production on Seiberling cords, it is reported.

Truck tire orders are getting heavier.

Stockholders to Act on Overland Plans

Meeting Called to Consider Bond Issue and Sale of Certain Holdings

TOLEDO, April 9—The plans of the Willys-Overland Co., relative to the sale of its assets, which are represented by securities in affiliated companies and property not needed in the actual conduct of the business of the company, will be presented to preferred stockholders at a special meeting called for April 24, to be held at the Administration Building here.

The preferred stockholders at this time will also consider the approval of the plan to issue $17,500,000 bonds or secured notes at 7 per cent to pay off bank loans which have been extended from time to time for more than a year.

The bonds would mature Dec. 1, 1923. Whenever stocks in affiliated companies and real estate pledged by the company under the terms of the bond security may be sold the proceeds are to be applied to reducing the outstanding bonds.

To Scale Down Plow Securities

In order to protect the interest of Willys-Overland in the Moline Plow Co., control of the common stock of which is held by the Overland, the preferred stockholders have been asked for written assent to a reorganization of the Moline Plow Co. by which its securities would be scaled down.

The Toledo directors of the Overland point out that this is the only hope for the Moline Plow Co. and the only way to keep it out of the courts. With the betterment in the agricultural machinery outlook and reorganization it is hoped to put the stock back to a basis where it may be sold. Consent of 75 per cent of the Willys-Overland preferred stockholders is necessary to permit the reorganization plan. Creditors of the company have agreed to the plan.

Notwithstanding the apparently poor showing in the annual report, most Toledo business men and bankers feel that Willys-Overland is in a very much better position to-day and that with the increase of sales and activity in the plant the losses of last year will be made up within a few years.

The plant here has been unable to get sufficient help the last week and has had to advertise in newspapers in all parts of the country for workers in the paint shop, woodworkers, body builders and trimmers. More than a dozen trades in these departments are short of men.

The annual stockholders' meeting has been announced for May 9, at the Administration Building. Election of directors will be the principal business of the meeting. Stock transfer books close April 27.

CURTIS R. HATHAWAY DIES

BOSTON, MASS., April 10 — Announcement is made of the death at Pinehurst, N. C., of Curtis R. Hathaway, one of the organizers of the General Motors Corp. and of the Chevrolet Motor Co. He was sixty-three years old. Hathaway was born in Suffield, Conn. After his graduation from Amherst, he was a law student at Columbia University. He then became treasurer of General Motors, but retired in 1909 on account of ill health. Two years later, however, he became associated with Chevrolet.

Stark-Inland Assets Sold to New Company

ST. LOUIS, April 7—The Inland Products Co., a new corporation organized under the laws of Missouri and capitalized at $500,000, has purchased the assets of the Stark-Inland Machine Works, manufacturer of piston rings and other automotive products.

Clyde C. Miner has been elected president and general manager. Under his management, it is expected that other products eventually will be added to the company's lines.

The company plans to erect a new factory which will be ready for occupancy within 90 days and will afford ample capacity to take care of the anticipated increase in production and sales.

Link Belt Sues G. M. C. Charging Broken Contract

WILMINGTON, DEL., April 10 — Claiming that the General Motors Corp. violated its contract, the Link Belt Co., an Illinois corporation, has brought an action in the United States District Court here asking damages of more than $1,250,000.

It is charged that General Motors contracted with Link Belt for the manufacture of certain parts for the Samson tractor, but that before the contract was completed the design of the tractor was changed so that the special parts were no longer required. General Motors, therefore, it is stated, canceled the contract.

Link Belt claims to have erected special machinery to produce the parts.

OVERLAND MEETING CALLED

TOLEDO, April 10—A special meeting of the stockholders of the Willys-Overland Co. has been called for April 24 in this city, to take action on a proposal to issue $17,500,000 in notes or bonds to mature not later than Dec. 1, 1923. Proceeds of the sale of new securities will be used to liquidate bank loans and provide new working capital.

TIRE RECEIVER REMAINS

ST. LOUIS, April 8—The motion of several stockholders, one creditor and the two receivers appointed by the Clayton Circuit Court for the Surety Tire & Rubber Co. for the removal of the receiver appointed in Federal bankruptcy proceedings, was overruled by United States District Judge Faris.

New Working Funds Provided National

Petition for Receivership Withdrawn—Concern in Strong Position, Officials Say

INDIANAPOLIS, April 7—Coincident with the withdrawal of the receivership suit brought against the National Motor Car & Vehicle Corp., George M. Dickson, president, and M. E. Elstun, secretary-treasurer, announced the successful completion of the refinancing plans started some time ago by which the corporation receives more than $450,000 of new working capital. This, together with the balance of the $750,000 bond issue authorized by the stockholders, which has not yet been used in its entirety, places the concern in a strong position, according to the officials.

The officers say that the new capital, plus the balance of the bond issue which will become available at a later date, will enable the company to take advantage of the increased demand for its products which the revival in buying has brought. Increased factory production will go into effect at once.

Suit Was Misunderstanding

The suit for the appointment of a receiver instituted by an indemnity company on behalf of the claim of the Columbia Axle Co., was never heard in court. The action has been withdrawn on behalf of the plaintiff, which originally informed the indemnity concern, before the filing of the case, to delay action until plans then under way for the satisfaction of the claim were worked out. The day before the suit was filed a representative of the parts company had been in Indianapolis and reached what was considered a satisfactory settlement with the automobile company. Acting contrary to instructions that it is said had been given it, the indemnity concern started the action the next day.

The elimination of this suit and the new working capital the National now receives places the institution in a position to progress as it has done through a long period. National is one of the pioneers of the industry and exhibited in the first Madison Square Garden show.

Adria Reorganization Returns Old Officials

BATAVIA, N. Y., April 10—Another reorganization of the Adria Motor Car Corp. has been brought about under which Louis M. Vremsak again becomes president and Willard C. Wheeler, treasurer, displacing Timothy J. Dailey and his son, Harry. Alexander Gray of Ontario, who once was secretary of the corporation, also has returned to Batavia.

Most of the 600 stockholders in the company live in this vicinity. When the Daileys took charge of the plant, it was understood they were to pay the creditors and get the factory in operation.

Merger Will Include More Tool Companies

Manufacturers Aim for Stabilization—To Centralize Selling Organization

CLEVELAND, April 11—Merger of the larger machine tool manufacturers of the United States has been enlarged, since the first announcement of the project, to include the Colburn Machine Tool Co., Cleveland; Lodge & Shipley Machine Tool Co., Carlton Machine Tool Co., Newton Machine Tool Works, Betts Machine Co., Hilles & Jones Co., and the Dale Machinery Co.

"This is without doubt the largest merger of machinery manufacturing concerns that has ever been effected," said H. W. Breckenridge, vice-president and general manager of the Cleveland concern. He also said that the uniting of these organizations would effect a great stabilization of the machine tool industry of the country.

The selling organization of the corporation will be centralized with offices in New York.

"The new corporation will receive the advantage of keeping the present management of the plants instead of breaking in new men for the work," said Breckenridge. The present personnel of each plant will be retained.

The capitalization will be placed at $35,000,000, all stockholders of the subsidiary companies turning in their stock and receiving in return its value in stock of the larger corporation.

F. Handley Page States German "Gotha" Was Copy

LONDON, March 31 (By Mail)—The Handley Page Co. has a claim before the Commissioners on Inventors' Awards concerning the "O" and "V" type of biplane as made by others during the war, by direction of the war-time authorities.

F. Handley Page, managing director of the company, testified in connection with the claim that the German "Gotha" was a copy of his machine and until the Germans captured a Handley Page, all complete, and were able to fly with it, they were not conversant with the structural details or convinced of the aerial dynamics in regard to big machines.

Two Directors Added to Kelly Truck Board

SPRINGFIELD, OHIO, April 11—R. J. Westcott, president of the Westcott Motor Car Co. and treasurer of the American Seeding Machine Co., has been elected a director of the Kelly-Springfield Motor Truck Co. to succeed J. B. Cartmell, who resigned owing to increased business in banking circles. Westcott is also a director of the Citizens' National Bank and was formerly mayor of Springfield. Alfred G. Hare, senior member of Hare & Chase, Philadelphia, succeeds Emlen F. Hare as a director.

James M. McCarthy of Quebec, capitalist and engineer, has been elected vice-president, the anticipation being that the election will result in a closer affiliation with Canadian business men.

Charles M. Young, president of the company, was present at the meeting of the board when the elections took place, as was James L. Geddes, chairman of the board, who is recovering from a long illness.

An excellent outlook is reported at the factory, the company having enjoyed the largest business last month than at any time for more than a year. The force is being augmented by the addition of skilled workmen.

Trustee Handles Parenti for Creditors' Benefit

BUFFALO, April 10—The affairs of the Parenti Motor Corp. have been placed in the hands of the Marine Trust Co. as trustee, for the benefit of creditors. The corporation has 11,000 stockholders here and in near-by cities.

Albert M. Saperston, representing the trust company, said it had not been decided whether the business would be continued or liquidated. Liabilities, he said, were approximately $200,000 and assets $400,000. The assets include a new factory and considerable raw material, but there is no cash in the treasury.

"The statement of the company shows it to be absolutely without funds," says a statement issued by the trust company.

The Parenti company was organized three years ago. An extensive stock-selling campaign marked the first two years of its existence. About 100 cars have been made, chiefly for demonstration purposes in connection with stock sales.

Buell Will Liquidate Assets of Sandow Truck

CHICAGO, April 8—Under an agreement with creditors, Edward D. Buell has been appointed as trustee to liquidate the assets of the Sandow Motor Truck Co. Buell estimates that the total liabilities, including $164,000 indebtedness to banks, will amount to $207,000.

The bank creditors have agreed to wait until the general creditors have received 50 cents on the dollar before they participate in the proceeds of any of the assets, except those pledged to secure bank loans. The physical assets of the plant will be sold at auction April 14. The trustee expects that all creditors, including the banks, will realize about 50 cents on the dollar.

RUBBER, CHINA CLAY FOR ROADS

LONDON, March 28 (*by mail*)—Experiments have been made testing the value of a compound of rubber and china clay for road surfaces. The tests promise well and, pending final trials, several rubber companies are considering the advisability of erecting plants to supply the material.

G.M.C. Acquires New Factory in England

Business Growth Leads to Occupancy of Grahame-White Plant in London

LONDON, March 31 (*by mail*)—The intentions of General Motors, Ltd., the English subsidiary of General Motors Corp., to consolidate assembly here, have culminated in the acquisition of the Grahame-White aircraft factory at Hendon, London, N. W. All G. M. C. passenger cars are now being imported from Canada in partially disassembled condition are to be finally assembled, tested and distributed from the Hendon plant, except Cadillac cars and G. M. C. trucks, which are still imported from the United States.

The company's new plant has approximately 35,000 sq. ft. of floor space, with three assembly lines already organized and two more contemplated. Spare parts to the value of more than $500,000 have been transferred from the Thurloe Street property previously occupied.

The company's decision as to the price of its assembled cars, notably the Chevrolet which at £260 is the only serious competitor here with the Ford, will be awaited with great interest, the more so as many dealers are perplexed over the Ford company's recent action regarding price reductions with no allowances to dealers on cars in stock and acquired at the old price.

Trade Exceeds Expectations

NEW YORK, April 10—In confirming the acquisition of the Grahame-White plant, officials of General Motors here declared that their present business in the British Isles was much in excess of what had been expected only a few months ago. Actual shipments to England made in March from the Canadian plant totaled more than 1000 cars, this showing a very large gain over the previous month.

Attention was called by the officials to the fact that the plant will not be used for complete assembly, in the same sense as this describes the Ford operations at Manchester. Completed cars or chassis will continue to be shipped from the Canadian plant and these will be uncrated, reassembled and made ready for operation at Hendon. Chassis, in some cases, will be fitted with special bodies made in England or to suit local needs. The plant will supply only the British Isles.

The cars being shipped from Canada are the Chevrolet, Buick, Oakland and Oldsmobile. This is in line with the recent decision of the corporation to supply export orders on these lines to practically all parts of the world from Oshawa.

The announcement was made that A. N. Lawrence, director of sales of the English company, is now visiting the United States to look over General Motors plants.

Ford Car and Truck Have Many Changes

New Type of Headlamp Is Important Feature—Mechanical Alterations Are Made

DETROIT, April 8—A number of detailed mechanical changes and refinements have been made recently on both Ford cars and trucks. The most important is the use of a new Type H headlamp for both cars and trucks, and for replacement on cars already in use. The lamp is equipped with a special design refracting type lens and a new 21 candlepower gas filled double filament bulb. The new lamps when properly adjusted are legal in all states, although there is great increase in road illumination.

Interior Finish Changed

The closed models are now being finished in walnut brown broadcloth, the seats being upholstered in the same material with a chalked ebony stripe. Heavy floor rugs are provided, and special design lifts have reduced the effort necessary in raising the windows. Door bumpers insure tighter fitting, and new door grips inside and out add to the convenience.

Mechanical changes are as follows:

The pistons and connecting rods have been redesigned and matched for weight before assembling to reduce vibration and give quicker pick-up. The new pistons are ¾ lb. lighter than the old.

The crankshaft surfaces are highly polished to reduce wear and make for smoother running.

A new carbureter gives increased acceleration with quicker pick-up and greater flexibility.

The wiring system has been completely redesigned, and all wiring is in loom where necessary to comply with underwriters' insurance rules.

Steering Wheel Additions

A 16-in. steering wheel is now regularly fitted and a steering wheel stop limits the travel of the steering wheel between the positions in which the front wheel spindles strike the front axle yokes. The full steering wheel motion is always effective in turning the front wheels, and the stop prevents straining or buckling the steering mechanism after the front wheels have reached the limit of their travel. Improvement has been made in the steering mechanism itself by the use of a taper construction on the steering ball bolt. The tapered bolt fitting into a special tapered seat in the steering connecting rod yoke provides a construction initially tight and prevents looseness and rattling in service.

Timken roller bearings are now used on models with demountable rims.

The radiator is now spring mounted and the fastening of the front radius rods has been improved by the use of tapered nuts in tapered seats.

The crankcase front end bearing has been redesigned, making it simpler and at the same time providing greater flexibility for the front spring. The new spring hangers are in one piece to maintain permanent alignment.

A new design cut-out is mounted directly on the generator.

The running-board brackets are of one piece, pressed steel, and make for body rigidity.

A dash weather trough prevents rain from reaching the coil terminals or the dash wiring.

Cord tires have been adopted as standard equipment on the rear wheels of the truck chassis.

A new spare tire carrier combines light weight with increased strength and rigidity.

In the equipment is to be noted a new license plate carrier, which will fit the tags of all states, a new jack and a new tire pump.

Essex Improves Design in New Phaeton Model

DETROIT, April 10—Several improvements have been made in the design of the Essex phaeton. The body is entirely new, being longer and wider. Body doors are wider and are hinged at the front. They now have inside as well as outside door handles, and the front pockets are enlarged to accommodate the improved storm curtains. The price is $1,095.

A new windshield, with a more handily operated top glass and forged side supports, is used. The shield and tops are both lowered. The head room remains unchanged, however, because the cushions are lowered and the general seating position is modified. A nickel robe rail is provided in the tonneau. Fenders of a new style, fully crowned and harmonizing with the general lines, are used.

Chassis changes include the adaption of a round gasoline tank, new type gasoline gage and carriers for a single tire. All new cars are equipped with the new type chassis oilers that replace the former grease cups.

NEW CLYDESDALE TRUCK

CLYDE, OHIO, April 8—The Clydesdale Motor Truck Co. is bringing out an all-steel truck which has a total capacity of 6850 lb., including the weight of the chassis, which is 3100 lb. This gives a carrying capacity of body and load of 3850 lb. The price is $1,485, which includes the starting and lighting system.

RAILWAY ASKS FOR BIDS

CHICAGO, April 10—The Southern Pacific Railway Co. has asked for bids on the construction of 2000 single sheated steel super-structure automobile cars of 50 tons capacity to be used on its system. These cars, which will be of the most modern type, will be equipped with double swing end doors and staggered side doors. The order is the largest ever placed by a Western road for this class of equipment.

Re-organization Plan for Earl Is Accepted

Lines of Credit Arranged—Company Has Orders on Hand for 2,500 Cars

DETROIT, April 12—Earl Motors, Inc., will begin a production schedule of 50 cars daily following the completion of its financial program, declared operative by banking interests this week in Chicago. The company declares it has orders on hand for 2500, to meet which it will employ a night shift starting immediately. Under the readjustment there is practically no current indebtedness. Sufficient funds are provided to permit capacity operation.

All important creditors of Earl Motors which became involved in the difficulties of the Fort Dearborn banks in Chicago have assented to the reorganization plan and have assigned their claims to the committee. Lines of credit have been arranged with Chicago, New York and Jackson banks.

Clarence A. Earl will continue as president of the company, devoting particular attention to the development of the sales organization.

George C. Scobie, recently with the Hayes Wheel Co. and formerly with Price, Waterhouse & Co., has been elected vice-president and comptroller and will have charge of the company's financial affairs. Other officers are Walter Mery, vice-president, and L. S. Westcoat, treasurer.

The banking interests and manufacturing creditors are largely represented among the new board of directors which has been elected. A sufficient amount of common and preferred stock has been pledged for deposit in a voting trust to assure the continuance of a directorate which is made up as follows:

Rumsey W. Scott, vice-president of the Chemical National Bank, New York; John O'Leary, vice-president of the Chicago Title & Trust Co.; J. E. Farrell, vice-president and treasurer of the Sinclair Refining Co., New York; William Sparks, president of the Sparks Withington Co., Jackson; Frank Joyce, vice-president of the American Auto Trimming Co., Detroit; Earl, Scobie and Westcoat.

Chassis of Overland 4 Redesigned for Trucks

TOLEDO, April 10—An Overland Four chassis, redesigned for truck use, has been brought out by the Willys-Overland Co. and will sell for $450 f.o.b. Toledo.

The truck chassis differs from the passenger car chassis in that it has heavier axles, stronger rear springs and a round gasoline tank mounted directly above the dash. The tank has been placed in this position to permit use of standardized types of truck bodies designed by various manufacturers for 100-in. wheelbase chassis.

Lincoln Motors Case Rouses Congressman

Impeachment Threatened Attorney General—Claim Results from War Contracts

WASHINGTON, April 11—Threatening the impeachment of Attorney General Daugherty for his "failure to prosecute the case of the Government against the Lincoln Motor Company," Congressman Roy O. Woodruff, of Bay City, Mich., Republican, to-day made a sharp attack upon the War Department, Department of Justice and former Attorney General A. Mitchell Palmer.

The Attorney General's failure to investigate contracts made with the War Department, Woodruff charged, has resulted in defrauding the Government out of millions of dollars. He said:

Charges Big Overpayment

The Lincoln Motor Company during the war received large contracts for the air service, and has been shown by the Government audit to have been overpaid to the extent of $9,188,561.90.

This concern some time ago was thrown into the hands of a receiver. The receiver has sold this property to Henry Ford for $8,000,000 cash which the receiver now holds.

This case had been turned over to the Department of Justice and by it referred to the District Attorney at Detroit for necessary action and suit had been started in the United States District Court against the receivers of the Lincoln Motor Company.

"We find the policy pursued in the past in some other cases, now being pursued by the Department of Justice in the case of the Lincoln Motor Company," Woodruff said, declaring that the case of the Lincoln company "has been taken out of the hands of the District Attorney at Detroit and has been returned to the Department here."

A new hearing is to be granted the Lincoln Motor Company, which will begin here to-morrow, and the speaker declared that unless the Attorney General "attended the hearing and represented the Government in the prosecution of the case," he would seek his impeachment for misfeasance of office.

The speech of Woodruff came in the nature of an appeal for support of a resolution which he introduced, preceding his speech, asking for the appointment of a select committee of Congress to investigate the Lincoln Motor contracts and all other contracts and expenditures made by the War Department, Navy Department, Alien Property Custodian and their departments during the war.

Involves Weeks in Bosch Sale

Woodruff also charged, in effect, that Secretary of War Weeks had been involved in the sale of the Bosch Magneto Co. and that Martin E. Kern, the original purchaser, had advised his agent to "take Weeks to Daugherty and put a quietus on this thing," meaning the proposed prosecution of the Department of Justice to set aside the sale of the German concern.

It was asserted by Weeks that the firm of Hornblower & Weeks, of which Secretary of War Weeks formerly was a member, has sold the bonds and figured in the rehabilitation of the American Bosch Magneto Corp. with a profit of $1,000,000 on the transaction.

Woodruff continued to say:

On December 31, 1918, nearly two months after the armistice, the capital stock of the Bosch Magneto Company was sold by the Alien Property Custodian to one Martin E. Kern for $4,150,000.

Kern was a close personal friend and client of Palmer, Alien Property Custodian at the time of the sale. It appears that Kern was not an American citizen, but was apparently of German birth and citizenship. It would also seem that he had served three terms in prison in the State of New York for felonies committed by him, and I hold here in my hand copies of his photograph appearing in the Rogues' Gallery in New York City. Apart from the fact, which seems to be admitted that Kern was not an American citizen, his conviction of a felony would deprive him of his civil rights and it does not appear that through pardon or other executive clemency such rights have ever been restored.

The trading with the enemy act, under the provisions of which the property was seized and subsequently sold, prohibits the sale of property to other than American citizens.

Following the introduction of Woodruff's resolution, it was referred to the Special Committee on Rules, who is expected to make an early report on it. Chances of the resolution being adopted and the appointment of a special committee to investigate all war-time contracts are reported favorable.

Daugherty Will Investigate

WASHINGTON, April 13—It was announced to-day at the Department of Justice that Attorney General Daugherty will personally investigate the war contracts of the Lincoln Motor Co. He will return here Friday and has ordered that the inquiry be postponed until 3 p.m. that afternoon so he can preside.

Before leaving Washington Sunday night, Daugherty made arrangements for a full hearing on the Lincoln contract before a court composed of Assistant Attorney General Goff and two assistants with attorneys for the receiver of the motor company. It has been planned that all interested parties shall be given opportunity to present their arguments.

ARABIC DEPICTS CAR

TOLEDO, April 10—What is said to be the first automobile instruction book to be printed in Arabic has been received by the Willys-Overland Co. at Toledo, from its dealer, Mr. Loukaitis at Cairo, Egypt. The book is illustrated with views of the engine and chassis and charts of the various mechanical operations that go to make up an automobile.

Senate Bill Retains Duties House Levied

Increases Taxable Automotive Products—Places Imports on Foreign Valuation Basis

WASHINGTON, April 11—The 25 per centum ad valorem duty, as carried in the House bill, has been approved by the Senate Finance Committee, in its report to the Senate on automobiles, automobile bodies, automobile chassis motorcycles and parts of the foregoing, whether finished or unfinished. The committee revised the House paragraph by adding motorcycles and including "finished and unfinished automotive products." Furthermore, it struck out the clause in the House bill which would assess an additional duty on countries where customs discriminated against American automotive manufacturers.

The 30 per cent ad valorem rate on airplanes, hydroplanes, motor boats and parts in the House bill was retained by the committee.

Flexible Tariff Provided

The fact that the Senate bill places ad valorem duty on a foreign valuation basis as contrasted with the American valuation basis carried in the House bill, makes the bill a far different measure than when it came from the House, and it may be expected that this feature will be the object of a vigorous contest between the House and the Senate before the measure finally is enacted into law. There are clauses connected with the Senate bill, however, which call for flexible tariffs or a different basis of assessing duties, and these may lessen the differences between the two branches of Congress. In many instances the Senate bill, being based on a foreign valuation basis, carries higher ad valorem duties than the House bill. The increases are estimated from 30 to 50 per cent.

Financing Association Reduces Its Annual Dues

NEW YORK, April 10—The Automobile Financing Creditmen's Association has decided to reduce its dues to $10 a month with an additional charge of three cents for each serial number card filed. These cards contain the serial number of automobiles financed, and when the card is filed with the association the first step taken is to determine whether any other member of the association has financed the same car. If this is found to be the case, both companies are notified immediately. The maximum charge against any member for membership is limited to $500 a year.

It also has been decided that where finance companies at a distance of more than 150 miles from New York form a local organization, the New York association will permit the local, if consisting of six or more members, to join it as a single member with all membership privileges except the right to vote.

Men of the Industry and What They Are Doing

Resigns Schrader Presidency

M. Charles Schweinert has resigned as president of A. Schrader's Sons, Inc., of Brooklyn, after a service of more than 35 years with the company as general manager, treasurer, director and president. Because of his wide knowledge of the business and his engineering skill, he has been retained by the corporation in an advisory capacity. Henry P. Kraft, vice-president and treasurer, who has been associated with the Schrader company for the past 39 years, will succeed Schweinert as president. The Schrader company has been in business since 1844 and in recent years has become a large manufacturer of automobile accessories. Schweinert will devote much of his time to looking after his personal interests.

Cole Returns From Europe

J. J. Cole, president of the Cole Motor Car Co. of Indianapolis, has returned from an extended pleasure trip to Europe where he visited most of the large cities. He says that American built cars are seen everywhere in Europe and he believes that talk about the superiority of European built cars is unfounded except as it relates to the care and hand work put on custom built bodies.

Sutherland With L. F. Benton Co.

R. W. Sutherland, former general manager of the Splitdorf Electric Co., has been elected vice-president of the L. F. Benton Co., which manufactures screw machine products at Vergennes, Vt. Sutherland retired from the Splitdorf company about six months ago after a service covering several years. He first represented the company on the Pacific coast, then in Europe during the war and later was in charge of its branches. When C. W. Curtiss resigned as general manager of the Splitdorf company, Sutherland was elected to succeed him.

Vincent Bendix Is Married

Announcement is made of the marriage of Vincent Bendix, inventor of the Bendix drive and director of the Parrett Tractor Co., to Mrs. Elizabeth Ashton at the home of the bride's parents, Mr. and Mrs. James Harrison Shannon in Chicago. Mr. and Mrs. Bendix will live in East Walton Place, Chicago.

Kraus Appointed Export Manager

H. L. Kraus has been appointed export manager for the Milwaukee Motor Products, Inc., Milwaukee, Wis., manufacturer of timers. Offices have been opened at 130 West Forty-second Street, New York.

C. W. Matheson Promoted

C. W. Matheson, who has been general sales manager of Dodge Brothers Motor Car Co. since 1920 has been promoted to vice-president in charge of sales. John A. Nichols, Jr., director of field operations, becomes general sales manager and John H. Gordon, director of distribution.

Smith on N. A. C. C. Committee

Frank E. Smith, president of the Republic Motor Truck Co., has been added to the membership committee of the motor truck committee of the National Automobile Chamber of Commerce.

Farrington Heads Branch

W. H. Farrington has been elected president and general manager of the Maxwell-Chalmers Sales Co., the Chicago factory branch of the Maxwell-Chalmers Corp. He succeeds J. H. Willson who goes to Dodge Brothers to have charge of the foreign sales. Willson formerly was in charge of foreign sales for General Motors Corp. Farrington has been with the Maxwell-Chalmers Sales Co. for five years and has been in the automobile business in Chicago for 16 years.

Sharon Adds Representatives

Two additional sales representatives have been appointed by the Sharon Pressed Steel Co. They are W. C. Aines, who will have his offices at 20 East Jackson Boulevard, Chicago, and Ralph E. Philips, whose headquarters will be at 66 Broadway, New York City.

Heffley at New York Office

C. C. Heffley has been appointed manager of the New York office of the Bethlehem Spark Plug Co., Bethlehem, Pa. In conjunction with looking after the general sales in that territory he will handle all export business for the company.

David Goes to St. Louis

J. W. David, for the past five years connected with the Philadelphia branch of the General Motors Truck Corp., has been appointed manager of the St. Louis branch to succeed C. E. Pagett, who has taken over the sales management for the De Luxe Auto Co., Oldsmobile distributor in St. Louis.

Flyum Succeeds Keller

G. M. Flyum, former manager of the Brooklyn branch of the Bearings Service Co., has succeeded N. B. Keller as manager of the Minneapolis branch. W. H. Richardson, former New York branch manager, has been named assistant sales manager and assigned to the Eastern district with headquarters at Detroit.

BOSCH DOUBLES FORCE

SPRINGFIELD, MASS., April 11—The American Bosch Magneto Corp. is employing twice as many workers as it did this time a year ago and is operating at about 50 per cent of capacity.

Highway Educational Committee Appointed

Plans Formulated for Propaganda Work—Conference Will Be Held in October

WASHINGTON, April 11—The appointment of the educational committee of the Highway and Highway Transport Committee, which met here on April 7, was announced to-day by the National Automobile Chamber of Commerce. The personnel is as follows: T. H. McDonald, chief of the Bureau of Public Roads; Roy D. Chapin, chairman of the Highways Committee of the N. A. C. C.; Dean F. L. Bishop, University of Pittsburgh; Col. W. Boggs of the War Department; Pyke Johnson, Washington representative of the N. A. C. C., and Dr. Walter C. John, acting director of committee.

Plans were formulated by the committee for the dissemination of educational propaganda for highway transport through the education of pupils in the fifth and sixth grades of the public schools, of which there are 16,000,000, according to a recent census.

The educational committee met with the two national program committees to outline programs for highway engineering and highway transport sections of the proposed second national conference on the educational aspects of highway transport.

The latter part of October was selected as the tentative time for the conference, to be held in Washington. It was proposed that the conference should last three days.

Electric Service Body Increases Membership

DETROIT, April 7—The Automotive Electric Service Association, comprising companies representing national manufacturers of electric equipment for cars, reports the addition of about twenty members since its annual meeting during the Chicago show, and is continuing vigorously its campaign for further enrollment.

Under its constitution, the association has been unable to entertain the proposal of the National Automotive Electrical Association to take over the entire membership of this organization, but has notified it that it will accept for membership all companies representing manufacturers affiliated with the Automotive Electric Association.

Sectional meetings of the association are planned as soon as the membership has been increased to a satisfactory point. A series of bulletins are now under way which will keep members and prospective members in touch with its activities.

Cooperation, Theme of Hoover Meeting

Conference at Washington Considers Possibilities of Trade Associations' Efforts

WASHINGTON, April 12—The automotive industry is well represented at the conference with Secretary Hoover today of representatives from trade associations in all lines of activity. The conference has been called to learn what trade statistics and data the Department of Commerce can hope to receive from trade associations and how best to disseminate this information when it is compiled.

While no place has been given on the program to a discussion of the rights of trade associations to gather trade statistics in view of the recent decision of the United States Supreme Court in the hardwood lumber case, it is not improbable that this highly important subject will be touched upon. The views of Secretary Hoover do not coincide entirely with those of Attorney General Daugherty on this question.

The National Automobile Chamber of Commerce is represented by J. Walter Drake, chairman of the foreign trade committee, and General Manager Alfred Reeves. The representatives of the Motor and Accessory Manufacturers Association include W. O. Rutherford, one of the vice-presidents; Sidney S. Myers, general counsel, and M. L. Heminway, general manager. The Rubber Association of America is represented by A. L. Viles, its general manager.

Lee to Hold Conference

All the associations within the industry which are interested in export trade will be represented at the conference called for to-morrow by Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce. The purpose of the meeting is to discuss how best to co-operate in promoting the sale of American made automotive equipment in foreign fields. The meeting will be attended by the chairmen of the various export committees and the foreign trade secretaries of the various associations which have export divisions.

Reeves had conferences yesterday with W. P. G. Harding, Governor of the Federal Reserve Board; Secretary Hoover and one or two other Cabinet officers as well as with the trade associations committee of the United States Chamber of Commerce. Last night he attended a meeting of the American Association of Trade Executives to prepare for the Hoover meeting to-day.

Survey of Activities Made

WASHINGTON, April 12—The National Association of Manufacturers has completed a survey of trade associations and their activities, based on a questionnaire sent out some time ago. The great number of replies discloses that the associations are not only willing but anxious to make public their activities, and for the most part are also desirous of co-operating with the Government as well as with their own respective industries.

The associations which replied to the questionnaire represent on the average 64.9 per cent of the business of the country in their particular lines. Most of the associations declare that the primary course is to improve and extend acquaintance among the members in a certain industry. The elaboration of purpose is mainly toward the nationalization of trade association methods and aims.

The National Automobile Chamber of Commerce reported it did not collect statistics on costs, prices, consumption or distribution, but confined its activities to statistics on production of complete motor cars and motor trucks, which are published at intervals and annually. The reply of the organization to the questionnaire was that they give freely of their services whenever information is desired on matters relating to the automotive industry.

As to the handling of legislative questions and litigation, both national and state, the N. A. C. C. pointed out that it opposed continuation of discriminatory Federal excise taxes on motor cars and trucks and parts; favored reduction in tariff on automobiles imported; supported modifications in highway act designed to concentrate Federal funds on most heavily traveled highways, thereby reducing waste; supported movement for uniform state laws governing the use of motor vehicles.

Reports from the Motor and Accessory Manufacturers Association showed that it has no statistical department and its educational activities are largely those common to other trade associations. They declared that legislative problems are undertaken with other associations in the automotive industry through the channel of the Motor Vehicle Conference Committee.

Draw Bar Work Shows Tractor More Valuable

WASHINGTON, April 12—Analysis of the preliminary report of the survey made by the Department of Agriculture on the relative value of tractors on the farm as compared with horse power for draw-bar work shows that of the 354 farm owners reporting, 75 per cent found the tractor more profitable.

The cost of tractor operation in this work, the land averaging 500 acres, was $484 for the year, or $1.60 a working hour. These farmers also kept an average of 8.3 head of workstock, the cost of which for the year was $541.

Based on a total of $1,025 for draw-bar power, figures show that the tractors furnished more than half the power for 40 per cent of the cost of the entire draw-bar work.

There were great variations in the practices and costs on individual farms, and the results indicate that often the expense of using the tractors and keeping the workstock was excessive for the amount of work done.

U. S. Registration Bill Is Submitted

Revenue from Anti-Theft Act Would Be Used to Build Post Roads

WASHINGTON, April 12—Federal registration of motor vehicles would be mandatory under a bill introduced in the House by Representative Mills of New York. The measure, which has been referred to the Committee on Ways and Means, would provide for a $2 tax which would provide revenue for the construction of post roads as provided in the Federal Aid act of 1916. Ostensibly the main purpose of the measure is to curb automobile thefts by providing a permanent number for every car, and make it necessary to file with clerks of the United States court bills of sale for every motor vehicle sold.

Motor Vehicle Defined

The Mills bill defines the term "motor vehicles" as vehicles propelled by any power other than muscular, except motorcycles, traction engines, road rollers and such vehicles as run only upon rails or tracks. It stipulates that applications which must be filed to obtain registration blanks shall give the following information:

(*a*) A brief description of the motor vehicle to be registered, including the name of the manufacturer and factory number of such vehicle, the character and amount of the motive power stated in figures of horsepower in accordance with the rating established by the Association of Licensed Automobile Manufacturers.

(*b*) Whether the engine or body or any other substantial part of such motor vehicle ever constituted a part of a former motor vehicle registered hereunder; if so, then a statement of such prior registration number and the cause of the dismantling of such former motor vehicle.

(*c*) The name, age, residence and business address of the owner of such motor vehicle. Such application and statement shall be acknowledged and sworn to by the applicant before a notary public or other officer authorized to the acknowledgments to deeds and shall be filed with said clerk within four months after this act takes effect for all motor vehicles then in use on said post roads. Then and thereafter every such motor vehicle must be registered hereunder before the same may be sold and delivered by the manufacturer thereof or used on said post roads. Failure to comply with any of the provisions of this section shall constitute a misdemeanor punishable by a fine not exceeding $1,000 or by imprisonment.

Number to Be Given

The bill provides further that any motor vehicle driven upon the post roads of the United States upon which the tax has not been paid and which has not been registered as required by this act shall be subject to forfeiture to the United States. It is also provided that the clerk of the Federal Court shall assign to such motor vehicle a distinctive number which must be marked on the engine and outside body.

New York Territory Gained in Quarter

This Year 11,792 Passenger Cars Were Registered—Last Year Total Was 6,330

NEW YORK, April 10—New passenger cars registered in the first three months of 1922 in ten counties in and around New York numbered 11,792, as compared with 6330 in the same period last year. March registrations also showed a gain of almost three to one over January and February, respectively.

Ten cars in the medium and low priced classes have registered more than 200 each since Jan. 1, four of these having more than 1000, one almost 1000 and the remaining five running from 225 up to almost 300. In the high priced class seven cars have registers of more than 40 for the three months.

A summary of registrations for the ten counties, taken from the monthly report of Sherlock & Arnold, publishers of the Automobile Sales Analysis, is as follows:

Cars below $2,500

	1922	1921
January	2,019	483
February	2,231	1,409
March	6,354	3,396
Total	10,604	5,288

Cars $2,500 and above

	1922	1921
January	283	145
February	273	210
March	632	487
Total	1,188	842

Durant Will Produce 200,000 Stars in 1923

(*Continued from page* 833)

which will include several states. These factory branches will appoint distributors and they in turn will appoint dealers. Each distributor will be required to name a large number of dealers who will agree to provide parts and service for the Star.

W. C. Durant has not yet decided definitely whether or not he will acquire the Elizabeth factory of the Willys Corp. for use as an assembling plant for the Star. Negotiations still are pending.

Awards Frame Contract

NEW YORK, April 13—Durant Motors, Inc., announces that the frame contract for the new Star car has been awarded to the Parish & Bingham Corp. of Cleveland.

800 Cars at Muncie for April

MUNCIE, IND., April 11—The tentative schedule for April for Durant Motors, Inc., at its plant here calls for the manufacture of 800 cars and it is the hope of the company to complete 5000 cars by August, the end of the company's fiscal year.

During March more than 500 Durant sixes were produced and shipped to points in the United States and Canada. There are now 460 persons on the payroll, which is an increase of 110 over March 1.

On the Up Grade

PHILADELPHIA, April 8—L. H. Gilmer, manufacturer of woven products, reports that total sales for February exceeded those for any month for a year and a half. March business showed an increase over February of more than $30,000, and on a tonnage basis the shipments exceeded any month in the company's history.

CHICAGO, April 10 — The Stewart-Warner Speedometer Corp. reports that its sales for March were the largest of any single month since June, 1920. The increase over March of last year was 140 per cent. The first quarter of 1922 showed 110 per cent increase over the corresponding period of last year. Orders received for April shipment indicate that sales this month will be greater than in any April in the company's history.

STOUGHTON, WIS., April 10—New orders for trucks for a wide variety of purposes, principally passenger buses, farm dairy and milk hauling vehicles and the lighter types of delivery cars for merchants, have made it necessary for the Stoughton Wagon Co. to increase its working force and also extend the schedules of its motor truck division.

DETROIT, April 8 — During March the Packard Motor Car Co. received more orders for both twin sixes and single sixes than could be shipped. Men on the payroll number 4700, and some departments are working nights. Truck sales continue to expand.

SYRACUSE, April 8—Franklin Automobile Co. shipments for the week ending April 1 exceeded shipments for the entire month of February. Shipments during the week were the largest for any week during the last nine months.

NEW YORK, April 10 — The Metal Stamping Co., manufacturers of Lion bumpers, reports that March was the biggest month in its history. The output of bumpers exceeded 34,000.

BUSINESS BEST IN TWO YEARS

PHILADELPHIA, April 11—According to David Ludlum, president of the Autocar Co., business is better now than at any time in the last two years. The crisis in business is now regarded as passed, and the future is particularly encouraging.

Used Car Situation Has Brighter Tinge

Dealer Responses to Paige Questionnaire Indicate Demand Is Strengthening

DETROIT, April 7—Responses received by the Paige-Detroit Motor Car Co. to a questionnaire sent out to leading distributors are taken by the factory to indicate a gradual increase in the used car demand and a very definite strengthening of dealer confidence in the ability to overcome the used car situation.

Continued stagnation in used car stocks is ascribed by the factory only to those dealers who have been unwilling to write off the differences between original allowances on cars and present market values. Where the dealer has reduced his prices to make them conform to newly created values he has had little difficulty in bringing his stock down.

Paige finds a practice growing among its dealers of taking in cars at allowance which permits them to make a quick resale at a small profit. Though there is is a great deal of competition for sales still, the questionnaires would indicate a great deal of conservatism in allowances made by dealers on the exchanged cars.

April Brings Chicago Best Week This Year

CHICAGO, April 7—A decided pick-up in the retail sales of automobiles in Chicago is indicated by the time-payment sales for the week ending April 1 in which 1003 chattel mortgages to secure deferred payments were filed for record. The time-payment sales for the preceding week were 672 and for the week before that 873, the highest for any week of this year up to that time.

C. L. Wolf, secretary of the Central Automobile Financing Association, who compiled the figures, said that low or medium priced cars predominated in the sales for the week ending April 1 to a greater extent, probably, than in any previous week.

Dealers also tell of increased sales of the lower priced cars and trucks. One dealer handling a car under $1,000 and one selling around $1,500 said his sales for March exceeded his total sales for the preceding three months combined.

ARGENTINE DEMAND BETTER

WASHINGTON, April 12—A cablegram received from Commercial Attache Feely at Buenos Aires says that the demand for moderate and low-priced motor cars in Argentina is improving. March imports from the United States of passenger cars, not including Ford, totaled 301, chassis three, and motor trucks three, as against 42 passenger cars, 28 chassis and eight motor trucks from Europe. Sixty-four motors cars of American and 22 of European makes were imported during the corresponding month last year.

Threaten to Punish Bus and Truck Users

Petitions Reach California Merchants—Railroad Employees Start Boycott

SAN FRANCISCO, April 10—What is looked upon as the most serious movement thus far to curtail the development of motor truck shipping and passenger transportation in California came to light recently at Roseville, Cal. Petitions have been circulated among the merchants of the town asking them not to patronize truck shipping lines under the implied threat of boycott and members of at least one union composed of railroad employees have been notified officially that a stage line has been put on the "We Don't Patronize" list, and if members use the stages they will be subject to fine.

Attempt to Throttle Competition

Roseville is similar to hundreds of "railroad towns" in the United States. The Southern Pacific has repair shops there and they are one of the chief sources of revenue to the community. California had a reputation for years as a railroad-owned state.

The railroads are leaving no stone unturned in their attempt to throttle motor competition. When an applicant for a stage or freight franchise appears before the State Railroad Commission his plea almost invariably is fought by attorneys for the Southern Pacific, Union Pacific and Santa Fe lines. Railroad representatives are addressing the Chambers of Commerce of the various cities and towns.

The most common appeal is that railroads have been responsible for the growth of the community and that freight trucks and stages are jeopardizing their investment. The chambers are told the motors not only are cutting into railroad revenue, but are wrecking the roads built by the people, and that the income derived by the state from these sources is far too small. It is evident that steam and electric carriers would have the motors so burdened by special taxes and the weight restrictions so severe that this competition would be killed by strangulation.

Bitter Toward Motor Vehicles

In addressing a meeting of the Progressive Business Men's Club at Bakersfield, Cal., recently, R. E. Kelly, representing the executive department of the Southern Pacific, protested bitterly against the motor carriers. After reviewing railroad statistics on investments, payrolls, taxes, etc., and pointing out that the railroads maintain their own roadbed and rights of way, and highways are built by public expenditure and are maintained in the same way, Kelly said:

> You are business men and know how much you benefit from the payrolls of the railroad companies and from their purchases of supplies here. Southern Pacific men and their families buy their groceries, their clothes and other necessities of life here. They buy or build their own homes and pay city taxes. When the railroad business prospers they prosper, and the city and other citizens benefit thereby. When the railroad business suffers, as it has in the last year, fewer men are employed, the payrolls shrink and this has a depressing effect on other business. The motor transportation problem is your problem. It is an important problem because it deals with dollars—your dollars.

Railroads have their agents, attorneys or other dependents in almost every locality, although it is estimated there are more than 200 towns in California wholly dependent on motor transportation.

The situation has reached such an extreme that there are boards of county supervisors in the state which have passed resolutions directed to the railroad commission petitioning that body not to issue franchises to motor carriers to serve the same communities that have railroad accommodations until such time as the motor carriers are made to pay their "fair" share of the state taxes. Chambers of Commerce, merchants' associations and other similar organizations throughout the state have been induced to pass similar resolutions.

At Roseville, for the first time on record, the cards have been placed on the table. In this instance, however, the railroads as such are not the active players. The way is left free to declare the action "unauthorized" and "unofficial."

Wages Are Involved

Employees are quoted as having said the railroads claim they cannot afford to continue paying the present wage scales because of inroads on their business by motor carriers. The deduction that employees themselves must take some steps to oppose motor competition if they want their wages maintained, is obvious.

Merchants of Roseville have signed a sworn statement to the effect that G. O. Seward, who represented himself as being president of the Brotherhood of Railway Clerks No. 1044, and a committeeman from the Roseville Labor Council, called on them at their places of business and asked them to sign an agreement not to patronize motor trucks hauling freight into Roseville and not to patronize the stages. The reason assigned for the request was that Roseville was largely supported by the railroad and that the members of the railroad forces were union

(*Continued on page* 846)

SAXON STARTS AT YPSILANTI

DETROIT, April 12—The Saxon Motor Car Co. has started operations in the plant taken over from the Apex Motor Corp. at Ypsilanti on a schedule of five cars daily. This total will be increased to 10 within two weeks. Harry L. Bill, vice-president, is in charge of operations, with Carl H. Becker in charge of sales and D. C. Bayne, secretary and treasurer. The company reports orders on hand covering several months' production. The new plant affords 32,000 sq. ft. of floor space in a modern reinforced concrete structure.

Industry Meets Film Makers at Washington

Department of Commerce Represented—Reels Would Be Used in Export Trade

WASHINGTON, April 11—Impetus to the movement by national organizations to advertise their products abroad through the medium of educational moving picture films was given when representatives of 25 associations met here with officials from the Department of Commerce.

The automotive industry was represented by Alfred Reeves, general manager of the National Automobile Chamber of Commerce; J. Walter Drake, chairman of the Hupp Motor Car Corp., and George F. Bauer, manager of the foreign trade department of the chamber.

In the automotive field it is proposed that educational films be made showing every phase of the manufacture of automobiles, their utility features and the importance and economics of highway transportation.

The delegates, while here, met with Governor W. P. Harding of the Federal Reserve Board and discussed credits and business conditions throughout the country, especially as they concerned the automotive industry.

The consensus of the delegates, following the interview with Governor Harding, is that the present gain in business "is a steady, healthy growth and is not a spurt."

Agricultural Inquiry Report Far Reaching

WASHINGTON, April 13—Chairman Anderson of the Joint Commission on Agricultural Inquiry announced to-day that the forthcoming transportation report would carry broad and far-reaching recommendations to Congress bearing chiefly on governmental contracts with all transportation systems and agencies, and about an equal number of findings and conclusions addressed to transportation management to producers and shippers.

It is said that the recommendations will include the question of highway transport development. Because of the effect of motor trucks on the extension of the farmers' market and the general growth of rural life, the commission gave particular attention to this phase of the transportation problem.

MAXWELL-CHALMERS SESSIONS

DETROIT, April 13—Maxwell-Chalmers sales supervisors from all parts of the United States are assembled at the factory for a three-day convention. Arthur E. Barker, vice-president in charge of sales, opened the convention. Other speakers were John J. Plath, Maxwell, director of sales, and A. T. Stanton, director of service.

FINANCIAL NOTES

Ajax Rubber Co. for the year ended Dec. 31, 1921, reports a total loss of $5,205,577 against $1,333,368 in 1920. The heavy loss was after deducting all expenses, making provisions for depreciation and for rebates due to price reductions and writing down the cost of fabric and crude rubber used during the year in excess of amounts charged to manufacturing costs, together with the amounts necessary to reduce inventories to market prices. In his statement to the stockholders, Horace De Lisser, chairman of the board, said: "The business of the company is now upon such a plane that the predictions of your management heretofore made as to the prospects for the year 1922 may be looked upon as reasonably likely of fulfillment, as rather substantial earnings have already resulted from business operations during the first quarter of the present year."

Stromberg Carbureter Co. reports net profits of $81,670 for the year 1921 after all charges for Federal taxes and interest. This is equivalent to $1.08 a share on the capital stock outstanding. Profits in the previous year were $340,101. The total income of the company for the year was $323,923 as compared with $787,443 for 1920. The profit and loss surplus at the close of 1921 was $2,434,339 against $2,344,943 at the end of 1920. Cash on hand amounted to $232,459, notes and accounts receivable $203,763 and inventory $522,117. Accounts payable totaled $55,894. Notes payable amounting to $150,000 were paid off during the year.

Keystone Tire & Rubber Co. for the year ended Dec. 31, 1921, reports net loss of $678,039 after expenses, interest and taxes as compared with net loss of $317,705 in the previous year. The balance sheet shows notes and accounts receivable of $1,353,473 against $2,437,903 in 1920, and an inventory of $368,265 on the 1921 date compared to $860,921 the year before. Notes payable are listed at $295,000 against $448,597, and accounts payable of $121,644 compared to $255,092.

Velie Motors Corp. has filed with the Illinois Secretary of State a certificate of the decrease of its capitalization. The par value of common stock has been reduced from $25 to $10 a share. The total stock value is lowered from $2,000,000 to $1,200,000.

Portage Rubber Co. creditors will receive an initial payment of 40 per cent on their claims from funds received from the purchasers of the plant and inventory. The payment will be made upon recommendation of the trustee in bankruptcy.

Fisher Body Corp. has declared the regular quarterly dividend of $2.50 on the common and 1¾ per cent on the preferred stocks, both payable May 1 to stock of record April 21.

Kelly Springfield Tire Co. has declared a quarterly dividend of $2 on the 8 per cent preferred stock, payable May 15 to stockholders of record May 1.

Dort Motor Car Co. stock to the number of 75,000 shares no par common is being offered through McClure, Jones & Reed for $20 a share.

Allis Chalmers Manufacturing Co. has declared a dividend of $1 on the common stock payable May 15 to stockholders of record April 24.

BETHLEHEM WINS SUIT

PHILADELPHIA, April 8—Charges of infringement and the use of unfair competitive methods brought against the Bethlehem Spark Plug Co., Bethlehem, Pa., by the Helfi Co., Belvidere, Ill., have been disposed of by the United States Appellate Court in a decision which declares invalid the patent rights claimed by the latter company. The decision affirms that of the United States District Court in 1921, from which the Helfi Co. took an appeal.

(BULLETIN)
PIERCE-LAFAYETTE MERGER

NEW YORK, April 13—Announcement was made here late to-day that directors of the Pierce-Arrow Motor Car Co. and the Lafayette Motors Co. have agreed, in principle, upon a plan to consolidate the corporations. C. W. Nash will become chairman of the board of the consolidated company and will have entire charge of the operating management. Nash Motors is not involved in the arrangement in any way.

Waivers Assure Success of Walker Financing Plan

CLEVELAND, April 8—Waivers to 70,000 shares of the stock of H. J. Walker Co. have been received from stockholders in response to the notification sent out by the company that the reorganization syndicate would proceed with the refinancing plan. The success of the plan was contingent upon releases being received to 65,000 shares.

Receivers Have Chance to Sell Texas Motors

FORT WORTH, April 8—Steps to remove the Texas Motor Car Association from receivership and to halt the bankruptcy proceedings so that the $4,000,000 plant here can be sold, have been taken before United States Judge Wilson.

The latter proceedings were begun before Judge Wilson by Chicago and Indianapolis creditors. At that time two receivers, who had been appointed by the State court, were in charge of the factory. The receivers now have a chance to sell, it is said, but cannot until the court renders a decision, which is expected in several weeks. In the meantime the plant is closed with the exception of the body department.

Bill Signed for Higher Fees in New York State

ALBANY, April 10—Governor Miller has signed a bill increasing from $10 to $16 the cost of registering a two-ton motor truck and providing an additional tax of $8 a ton for each ton above two. Another bill signed by him provides a fee of 30 cents per 100 lb. for the registration of automobiles of 3500 lb. weight or less and 75 cents per 100 lb. if the car weighs more than 3500 lb.

Other motor vehicle bills signed by the Governor provide for the approval by the State Tax Commission of headlights used on automobiles and directing the Tax Commission to make frequent inspection of motor trucks operating on state highways to detect violations of the law in regard to overloading.

Last week's local money market displayed continued ease. Call money

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

ranged between 4½ per cent and 5 per cent, as compared with 4 per cent to 5 per cent in the previous week. For time money the situation remained essentially unchanged, fixed date funds being in more liberal supply, but in small demand. The range continued the same as for the previous week, 4½ per cent for sixty and ninety days and four months and 4½ per cent to 4¾ per cent for five and six months' maturities. The range for prime commercial paper remained unchanged at 4½ per cent to 4¾ per cent.

The Federal Reserve statement as of April 5 showed an increase of $7,846,000 in gold reserves and $6,222,000 in total reserves. Total bills on hand decreased $15,370,000, while total earning assets decreased $6,530,000. There was a decline of $692,000 in total deposits, while Federal Reserve notes in actual circulation showed an expansion of $16,229,000. The reserve ratio declined from 77.8 per cent to 77.7 per cent.

The United States Steel Corp.'s monthly report of unfilled tonnage issued April 10 showed a total of unfilled orders on the company's books as of March 31, 1922, of 4,494,148 tons, the highest reported since last September. This total marks an increase of 353,079 tons during the month and compares with 6,284,765 tons on March 1, 1921.

The pig iron output in March reached over 2,000,000 tons, which is the first month since January, 1921, in which production passed the two million ton mark. The daily average reported output for the month of March was over 65,000 tons.

NEW ELGIN DIRECTORS

CHICAGO, April 13—Stockholders of the Elgin Motor Car Corp., which is getting its factory in shape for the production of a series of new models, have elected four new directors. They are A. V. Martin of the State-Lake Bank, Chicago; William Lister, an attorney, and H. W. Jones and J. F. Cornelius, Chicago business men. Members of the board re-elected are C. S. Rieman, president; F. L. Brown and W. G. Knoebler. Prices of the new line have not been announced except that of the phaeton, which will sell at $1,695, which is an advance of $300 over the present model.

WHITE 20 PER CENT BETTER

CLEVELAND, April 13—The White Motor Co. reports that its March orders were approximately 20 per cent higher than for any month since May, 1920, and that deliveries exceeded any month since September, 1920. Business for the first quarter in both orders and deliveries shows a material increase over the same quarter last year. Loans have been reduced since Jan. 1 to $3,300,000, with more than $2,500,000 cash on hand after a dividend payment of $500,000 on March 31. All branches reported decided improvement.

INDUSTRIAL NOTES

Universal Tool Co., a New Jersey corporation, has purchased the business conducted at Garwood, N. J., by the Universal Tool Co., a Michigan corporation, which has been in the hands of a receiver for several months. The sale included all the assets of the latter company except its accounts receivable, which should be paid to Thomas H. Keating, the receiver, in Newark. The company expects to enlarge the scope of its manufacturing in the immediate future. The officers are Robert E. Roseberry, president; H. R. McGraw, vice-president; Donald McGraw, treasurer, and G. J. Miller, secretary.

American Felt Co. has opened a modern unit in Detroit for the cutting and fabrication of felts of its own make for the automotive industry. The move is made as a result of the growth of its business in that section and through locating in the center of automotive activities the concern hopes to effect a number of economies as pertain to shipments. The company has also taken into consideration the better service possible and greater convenience for contact between automotive engineers and its own. Principal offices of the concern are located in New York, Chicago and Boston.

Martin-Parry Corp. has closed a lease with the New Orleans Metal Bed Co. whereby it comes into possession of 10,000 sq. ft. of floor space which it will use as a branch for its products, covering Louisiana and most of Mississippi. This is the fourth distributing center to be established in the South by the body builders, the others being at Atlanta, Houston and Dallas. A. Mitchell is manager of the New Orleans branch.

Industrial Engineering Co. has opened offices in the Peoples' Bank Building, Akron, as consulting and designing engineers on automatic, special and production machinery for the automotive and machinery building industries. Members of the firm are L. C. Hosfield, George C. Winchel, J. C. Sinclair and W. F. Clark.

B. F. Goodrich Co. will hold its annual meeting on April 19, when six three-year directors will be chosen by the common stockholders. A special meeting will be held on the same date for the purpose of conforming the certificate of reorganization to the state corporation law of New York.

Bull Dog Tractor Co., Fond du Lac, Wis., has filed an involuntary petition in bankruptcy. The concern originally was formed at Oshkosh but moved its offices and factory to Fond du Lac about 18 months ago. No statement of assets and liabilities is available at this time.

Eisemann Magneto Corp. will remove its Chicago branch to 2005 South Michigan Avenue on May 8. The change results from the necessity of occupying larger quarters. All repairs will be made in the new branch and a complete stock of magnetos and parts will be carried.

Standard Auto Supply Co., New York, creditors have filed a petition in bankruptcy against Louis A. Weinstein, trading under that name. It is stated that the liabilities approximate $60,000 and the assets $20,000. H. Willis Smith has been appointed receiver.

Duplex Storage Battery Co., Beaver Dam, Wis., has filed a voluntary petition in bankruptcy, scheduling its liabilities at $74,462 and claiming assets of $58,895. Unsecured claims amount to $67,497.

Missouri Car Co. of St. Louis has purchased a 10-acre tract in East St. Louis to manufacture street car equipment and to build bus and commercial vehicle bodies to specification.

Canton Art Metal Co. has removed its sales office from 200 Fifth Avenue, New York, to the Canadian Pacific Building, 342 Madison Avenue.

Wants Chicago Show Shifted to St. Louis

ST. LOUIS, April 9—A campaign to change the holding of the national automobile show from Chicago to St. Louis has been inaugurated by Webster Colburn, vice-president and general manager of the Dorris Motor Car Co. Colburn has urged the change in letters to Alfred Reeves, general manager of the N. A. C. C., as well as to each member of the chamber.

Colburn's letter to Reeves declares inadequate the Coliseum and Armory in which the Chicago show has been held for years. Visitors, he says, are obliged to walk through "Pneumonia Alley," which connects the buildings, a serious matter in the midwinter weather which prevails at the show season, and making necessary a system of time limit transfer.

He directs attention to the large Chevrolet building in St. Louis, used in the last two local automobile shows, which provided space on one floor for passenger cars, trucks and accessories.

"More Important" Work Halts Graham Resolution

WASHINGTON, April 11—Consideration of the Graham resolution placing a 90 per cent ad valorem tax an all reimported goods was postponed to-day, when it came up in the Senate, by objection of Senator King of Utah, who insisted that there was more important legislation pending.

Under the provisions of the resolution, which has been endorsed by automobile and supply dealers, as well as by practically every national association of retailers and manufacturers, would prevent the dumping and underselling of cheaply bought government war supplies, on the American market, after they had been purchased abroad.

DEALERS ORDERING TRUCKS

KENOSHA, WIS., April 12—Truck business of the Nash Motors Co. has shown a decided increase in the past 60 days. Dealers in practically all sections of the country, according to General Sales Manager C. B. Voorhis, are ordering trucks in larger numbers than at any time during the past 18 months.

CORRECTION

DETROIT, April 11—AUTOMOTIVE INDUSTRIES was in error in its issue of April 6 in giving the name of the newly incorporated successor to the Lincoln Motor Co. as the Lincoln-Ford Motor Car Co. The name of Ford is not included in the title of the new corporation, which is the Lincoln Motor Car Co.

METAL MARKETS

It is an old trade axiom that the steel market is either a feast or a famine affair, and recent press reports have tended to create the impression that it is once more in the midst of one of its feast periods. Market reporters have had to subsist so long on monotonously drab news that they may well be forgiven for waxing enthusiastic over the change in sentiment that has come over the market, and thus convey perhaps an exaggerated picture of its improvement, which, after all, lies more in the producers' point of view than in an abnormal betterment of the demand. As a basis for commitments on the part of steel buyers it will be well to bear in mind that the enhanced morale of sellers is predicated far more upon expectations than upon present conditions.

The best that can be said for mill operations, from which one may deduce the actual and not the anticipated demand, is that by and large they have reached the 1914 parity. Compared with what the demand was earlier this year this is a notable achievement. At the same time it is only two-thirds of total capacity.. Moreover, the steel now being rolled and the visible backlog of orders carry old prices and so far there are no indications of any representative buying at the advanced levels which became effective as asking prices on April 1. In some steel products higher asking prices, while justified on the basis of advances in the raw material, are out of alignment with the demand.

So, for instance, some producers of cold-rolled strip steel have marked their price up $3 a ton, although the demand, emanating almost solely from the automotive industries, is hardly in excess of 50 per cent of capacity. Naturally high prices make it just so much the more difficult for producers to augment the rate of operations. Undoubtedly there is a latent demand for steel from many industries, other than automotive manufacture, which has so far been suppressed either artificially or by force of circumstances.

Pig Iron.—Nearly all of the passenger motor car builders have figured recently as buyers in the foundry market, presumably at fractional concessions from the $20 level, which is now the prevailing quotation in the Chicago market.

Steel.—Higher prices are asked for virtually every steel product used in the automotive industries, but fresh buying at these higher prices appears to be in abeyance. Large tonnages of bolts and nuts were contracted for by automotive interests before advances became effective.

Aluminum.—There has been a noteworthy broadening of the demand from the automotive industries. The market has turned strong at previous quotations. Opinion in the trade is that Germany will be able to continue exportation of sheets to the United States, even though the proposed duty of 9 cents per lb. should become part of the tariff law, this because of her cheap labor. Importers are reluctant to quote on July and August deliveries because of tariff uncertainty.

Nickel.—Of considerable interest to the automotive industries is the recently announced reduction in nickel prices by the leading producer. This price cut should tend to broaden the use of nickel steel and nickel-chromium steel. The "outside" market had for some time ruled below the chief interest's quotations, but the latter's price cut is indicative of an energetic policy to broaden the use of nickel, especially in automotive construction.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

October — Paris, Automobile Show.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

Nov. 3-11 — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, April 21, May 26.

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Threaten to Punish Bus and Truck Users

Petitions Reach California Merchants—Railroad Employees Start Boycott

(*Continued from page* 843)

men. As such it was much better for them to have the railroads patronized in preference to the trucks and stages. The affidavit also says the subscribing witnesses were told by Seward that unless they signed the agreement employees of the railroad would be notified not to trade with them, and if the employees did deal with those merchants, Seward would use his influence to have the employees discharged.

As further evidence of the attempt at railroad union "blacklisting," there is cited copy of a notice signed by J. L. Longhurst, recording secretary, and said to have been sent to members of the United Brotherhood of Carpenters and Joiners of America. This notice states that at a meeting of Roseville Local No. 1147 action was taken authorizing a fine be levied on members who patronize the Roseville-Sacramento stage line. This fine is to be $1 for the first violation of the order and $5 for the second and subsequent offenses.

The outcome of these tactics is that some of the merchants of Roseville expect to comply with the demands of the unions. Others so fear the loss of railroad employee business that they say they contemplate advertising in the local newspaper "We are 100 per cent Southern Pacific Merchants." The operator of a truck freight line stated that previous to the action of the unions his income from daily haulage into Roseville averaged about $20, but since the manifesto it has been no more than $2. The driver of the Roseville-Sacramento stage reports the ban is being felt by him. The morning of March 25 he had only 44 passengers, nearly all women and salesmen, and he did not recognize one union man among his patrons.

Protest has been made to the Railroad Commission of California by representatives of the motor carriers, but that body claims to have no jurisdiction. There is some talk of taking the matter into the courts on the grounds of collusion, but this probably would be difficult to prove. Railroad employees claim they have not forgotten that at the time of the last railroad strike in California complete transportation stagnation was prevented solely by motor carriers. In the Roseville instance, some of them say, they are battling a foe common to both the interests of themselves and their employers.

AMERICAN PRICES LOWERED

PLAINFIELD, N. J., April 13—Reductions in the prices of its various models are announced by the American Motors Corp. They follow:

	Old Price	New Price
5-passenger Phaeton....	$2,195	$1,850
7-passenger Phaeton....	2,195	1,925
4-passenger Sport.....	2,250	1,995
5-passenger Sedan.....	3,150	2,695

MIDWEST REORGANIZATION

INDIANAPOLIS, April 13—Plans for the reorganization and refinancing of the Midwest Engine Co. are so nearly completed that for the purpose of clearing titles, etc., the reorganization committee has taken the final step and had receivers appointed. Business will be carried on in the usual manner. Production and sales activities will continue without interruption. Lon R. Smith will be sales manager under the direction of O. E. Stevens and Frederick Van Nuys, the receivers.

Federal Tax Greater Than Wage for Labor

For Every $1 on Payroll in 1921, General Tire Company Paid Government $1.10

AKRON, April 8—"Supporting American industry's contention that present high taxes tend to cripple development and even to drive active capital into hiding, we have compiled figures showing that for every dollar our company paid last year to our productive labor we paid $1.10 in taxes," announces William O'Neil, vice-president and general manager of the General Tire & Rubber Co.

The General company's total taxes exceeded the amount paid productive labor by 10 per cent, while the company's excise tax alone for 1921 was larger by $1,000 than the productive labor payroll. Total taxes paid by the company, O'Neil states, were over 88 per cent of the entire payroll covering productive and all other kinds of labor for the year.

In the last three years, the company estimates, General has paid nearly three times as much in taxes as in dividends to stockholders, all of whom paid one hundred cents on the dollar for their holdings. The General company was one of the few tire companies in the country to continue dividend payments during the slump period, General preferred stock earning 8 per cent dividends and common stock earning 10 per cent last year.

HARPER DISTRIBUTES DURANT

NEW YORK, April 11—R. H. Harper, who formerly was head of the Harper-Overland Co. in Washington, has been appointed distributor of the Durant line for the District of Columbia, Virginia and parts of West Virginia, Maryland and Tennessee.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Hoover and the Trade Associations

Secretary of Commerce has outlined functions of trade associations. He is promoting his ideals by co-operating with such organizations. Automotive industry Contact Committee formed on foreign trade. Program warrants manufacturers' support.

By Norman G. Shidle

HERBERT HOOVER is giving to many trade associations and to many trade association members a conception of the functions of such organizations that are very largely new. And the associations are rising to meet the Hoover ideal.

Hoover believes that the trade association has some fifty or sixty constructive functions, and he is quietly but constructively showing trade association members and secretaries how they can fulfill a larger field of usefulness than has been the aim or idea of many in the past. The Hoover trade association ideal is worth the serious attention of every automotive executive directly or indirectly connected with trade association activities.

Hoover has taken for granted the idea that trade associations have been formed primarily to perform the constructive functions which lie within their power. He believes in the fundamental honesty of the majority of American business men; that American business recognizes that in the long run the best interests of the public are identical with the best interests of business.

These opinions attributed to Mr. Hoover are not quotations, but rather an interpretation of the attitude of the Secretary of Commerce as noted in his various public utterances about trade associations in general and in his meeting with the trade association secretaries in Washington last week in particular.

Many trade associations were not formed primarily for the broad educational purposes outlined by Hoover as the real function of such organizations. Nevertheless, it is true that their future growth and progress depend primarily upon a recognition of these possibilities and an attempt to fulfill them to the highest degree.

Over 500 people, interested in or connected with trade associations in an official capacity, met with Hoover in Washington last week and discussed trade associations and their activities. The men at that meeting were given an accurate conception of what a real trade association might do in the way of public service and what assistance the Department of Commerce may be expected to render.

"The trade association is a college of business," Hoover stated. "So long as its activities are such as to fulfill that primary educational function, no question of law will ever bother it. It is when it steps outside of this educational field that it goes into the twilight zone.

"There are so many useful constructive functions

for a trade association to perform that it seems foolish to take the changes entailed in entering that twilight zone. Moreover, it is doubtful whether or not there is any real economic advantage to be gained by members of the trade association through the activities in this twilight zone. The commercial value to members of such activities has been greatly exaggerated."

By emphasizing the possible constructive functions of the trade association Hoover is focusing attention upon the really essential phase of the whole trade association discussion. The individual members of a trade association will benefit far more in the long run through constructive association activities useful to the public welfare than by the conduct of such secret activities as might give to those members a temporary commercial advantage. This fundamental fact is true regardless of the restraint of trade act.

Manufacturing organizations in the automotive industry are facing problems of marketing and production such as have never confronted them before. The amount of commercial and engineering research necessary during the next few years is tremendous. Trade associations capable of visualizing these problems and attacking them in a constructive way are a part of the automotive industry. Any organization busy studying and solving these problems will have little time left for illegitimate activities.

Whatever statistical data are needed for the illumination of such studies can be gathered without much danger of legal interference. Data for such purposes constitute part of the educational function of the trade association. Publication of such figures is desirable, if for no other reason than to make perfectly obvious the fact that compilation has been for purposes of research in keeping with the best interests of the entire social and business community. Prices are not nearly so essential as much other data, and Hoover believes an association wise to refrain from gathering price data.

Hoover says that legitimate trade association activity is vital and must be encouraged, and that of the 2000 trade associations in this country, a vast majority are concerned wholly with such legitimate activities. He emphasizes, however, the fact that the Department of Commerce, in its offer to receive statistics from trade associations and disseminate them to the public, cannot in any way deal with the so-called open price associations. Moreover, the Department has not and will not attempt to interpret the law.

The Department of Commerce is not only outlining the many constructive functions of the trade association, but is putting its ideas into practice. In its efforts to co-operate practically and constructively with American business, it is making excellent use of the facilities for contact and co-operative work given by the various trade associations.

There is no better example of this than the vital activities which are being carried on by Gordon Lee, Chief of the Automotive Division of the Bureau of Foreign and Domestic Commerce. The activities and general purposes of this division have been outlined previously in AUTOMOTIVE INDUSTRIES. Constructive work has been going on for over a year. Last week, however, organization was completed of a Contact Committee which will enable the Automotive Division to function even more closely and practically in the interests of the automotive industry.

On this Contact Committee is represented every section of the various groups comprising the automotive industry. The various trade associations of the industry have been utilized in its formation. Cars, trucks, motorboats, aircraft, motorcycles, parts, accessories, automotive equipment and automotive business publications are all represented on this committee which will advise with the Automotive Division constantly in the working out of the practical current foreign and domestic trade problems which come up from day to day.

Gordon Lee has been working on the formation of this liaison body for many months. Last week it held its first meeting. The event was more important than might be recognized at first glance. The gathering of this Contact Committee marked the first coming together of all groups of the automotive industry for a joint consideration of the problems and opportunities of selling American automotive products in foreign countries.

HOOVER seems to be more interested in having trade associations fulfill the constructive mission for which they have been formed than in discussing how near it is possible to come to breaking the law without actually doing so. He calls the trade association a "college of business" and says that "legitimate association work is vital and must be encouraged."

Constructive possibilities are being shown by cooperation between Automotive Division of Bureau of Foreign and Domestic Commerce and representatives of various trade groups within the automotive industry.

The committee consists of J. Walter Drake (Hupp Motor Car Corp.) and George F. Bauer, chairman and secretary of the foreign trade committee of the National Automobile Chamber of Commerce; W. O. Rutherford (International B. F. Goodrich Corp.) and M. Lincoln Schuster, chairman and secretary of the foreign trade committee of the Motor and Accessory Manufacturers' Association; W. G. McCann (Hendee Manufacturing Co.), chairman, foreign trade committee Motorcycle and Allied Trades Association; S. D. Black and G. W. Brogan (both of Black & Decker Mfg. Co.) of the Automotive Equipment Association; Luther K. Bell, secretary Aeronautical Chamber of Commerce; Ira Hand, secretary of the National Association of Engine and Boat Manufacturers, and George E. Quisenberry of the Class Journal Co. Additional members of this committee, but not present at the Washington meeting, are W. E. Green, representing the Association of Automotive Equipment Manufacturers, and Don F. Whittaker, secretary, foreign trade committee of the National Association of Motor Truck Industries.

The representatives of these various automotive organizations sat around a small table for eight hours and laid a firm foundation for the promotion of American automotive business abroad. They learned of the expert commercial information service that the Automotive Division is utilizing in all the principal countries of the world; how the needs of the different automotive manufacturers in the way of information and service were being met; how the Automotive Division has been turned into an efficient commercial organization functioning in a prompt manner.

The formation of this Automotive Division Contact Committee is typical of the way in which Hoover is promoting and utilizing the constructive features and possibilities of trade associations. The automotive industry is in an excellent position to benefit both by helping its trade associations to fulfill their very constructive aims and by co-operating with the Department of Commerce in its efforts to help American business.

British Oil-Cooled Car Engines

Originally introduced for motorcycles oil-cooling system is now applied to two and four cylinder car engines. It holds possibilities for higher efficiency, lower cost of production and greater ease of maintenance.

By M. W. Bourdon

AT the British Motorcycle Show of 1920 there appeared an engine utilizing the crankcase oil for cylinder and piston cooling. It was designed by Granville M. Bradshaw, whose success as a designer of air-cooled airplane engines during the war brought him into considerable prominence in England.

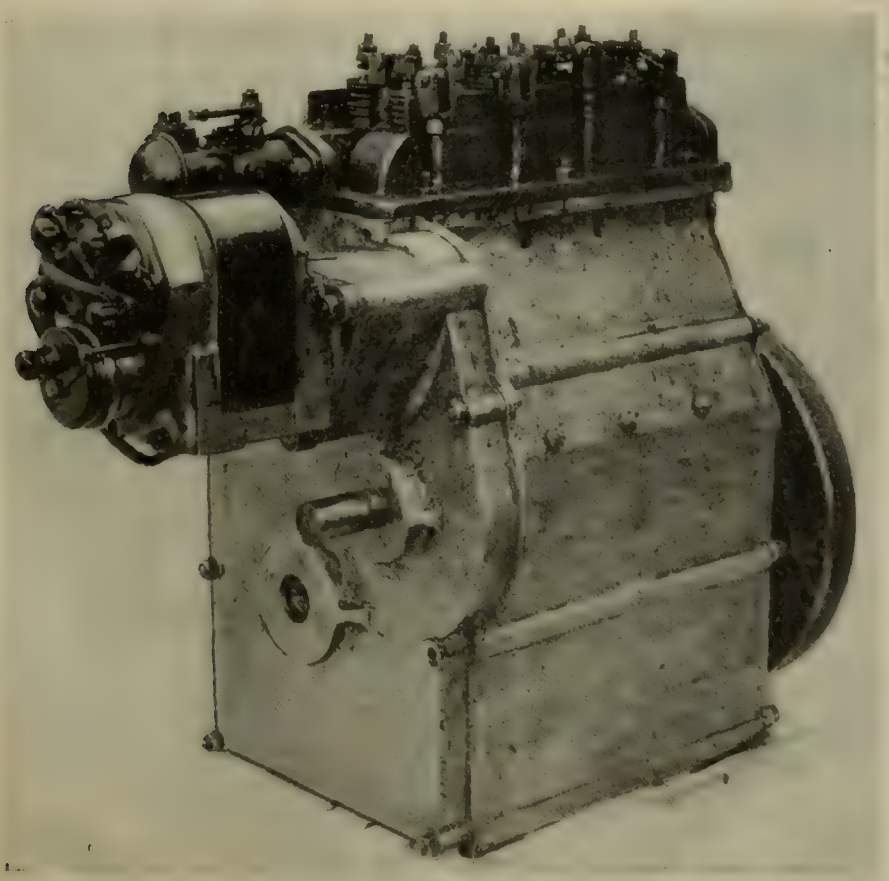
He became convinced that air-cooled engines are really oil-cooled, and that even water-cooled engines depend upon the lubricating oil quite as much as, if not more than, upon the water for conveying the heat away from the hottest part, the piston.

Bradshaw was led to this conclusion by experiments with an air-cooled stationary engine for driving wireless and searchlight dynamos. The first of these had a large fan placed at some distance for test purposes, with the result that it directed a portion of the air draught onto the crankcase. The engine ran on its first test under full throttle for 15 hours a day for ten consecutive days, without trouble. But later the design was modified to make a more compact unit with an enclosed centrifugal blower which directed the air through ducts directly on to the cylinder heads. The result was the engine would not develop the same power, nor run satisfactorily for long periods, and the crankcase became so hot that it actually melted the insulation of the magneto attached to it.

This experience showed that much of the heat absorbed by the combustion chamber walls is carried off by the crankcase oil. Later experiments by Bradshaw confirmed these results and subsequently Dr. Gibson, in his paper read before the I.A.E. indicated to what extent the crankcase and oil circulation assist cooling.

In two cases instanced he had proved that 40 and 47 per cent respectively, of the total heat absorbed by the walls was dissipated from the crankcase of engines in which that feature was not contemplated by the designer.

It occurred to Bradshaw, therefore, that if nearly half the cooling of an engine is accomplished by the crankcase unintentionally, a great deal more could be done in that way in an engine designed with that end in view, and he set to work to apply the idea in a practical form.



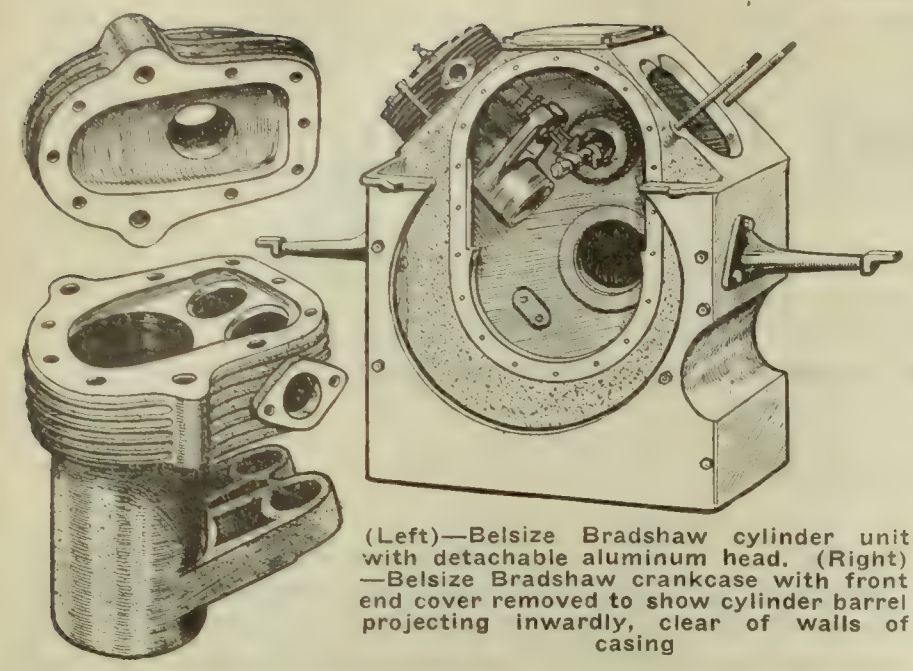
Marseal oil-cooled four-cylinder 2½ x 3½-in. engine, with ball bearing crankshaft. Cylinder barrel unit projects into crankcase, being secured by studs and nuts to underside of detachable cylinder head

Development of Oil-Cooled Engines

In the first attempt to make better use of the lubricating oil as a cooling medium (the motorcycle engine referred to) overhead pushrod-operated valves were used and dependence placed upon an air-cooled cylinder head for heat radiation. In his next move in connection with oil-cooling, he adopted an L head cylinder, and found that with this arrangement he was able to secure advantages which more than compensated for the loss of benefits generally ascribed to overhead valves; he was able to increase the area of parts cooled by oil and to include among these the valve seatings and stems, leaving air-cooling to take care of the top of the combustion chamber only.

At the Olympia Show in November last an oil-cooled two-cylinder Vee engine designed by Bradshaw was exhibited by the Belsize Co., one of the oldest of British motor manufacturers, with a plant capable of turning out about 50 to 60 chassis per week. Bradshaw, who is an independent engineer, was commissioned to design a light car with a two-cylinder engine; he submitted the oil-cooled engine, which was accepted after prolonged tests and put in production. Deliveries of the car began in December, and to all appearances, it is giving satisfaction to users.

The crankcase is an aluminum casting of exceptional size for an engine of these dimensions (3¾ x 4¾ in. approx. 83 cu. in.). It has a detachable end plate which supports the camshaft and crankshaft bearings at the front, while a forward extension of the main casting partially encloses the vaned flywheel, from which an air draft is directed upward to issue through sheet aluminum cowling. The cylinders are of cast iron with detachable die-cast aluminum heads and bronze bosses screwed into the aluminum for the spark plugs; only the heads and the finned combustion chambers project from the crankcase, the whole length of each cylinder barrel extending into the case, well clear of the sides of the latter. Cast with the cylinder barrels are lugs for the guides of the cam followers, and an important point is that the undersides of the valve seats in the cylinder casting are exposed to the crankcase interior.



(Left)—Belsize Bradshaw cylinder unit with detachable aluminum head. (Right)—Belsize Bradshaw crankcase with front end cover removed to show cylinder barrel projecting inwardly, clear of walls of casing

Two gallons of lubricating oil represent a full charge for the crankcase sump, and, at the normal engine speed (1000 r.p.m.), this is circulated at the rate of one gallon per minute by a centrifugal pump. The oil is delivered at high pressure via the main bearings and through the drilled crankshaft to the big-end bearings, whence a far greater quantity than usual is thrown off onto the inside and outside of the cylinder barrels, the inside of the pistons, the underside of the valve seats and the valve stems, as well as the camshaft, distribution chain, etc. All these parts are constantly drenched with oil. Instead of the heat from the piston crown, normally the hottest part of an engine, having to be carried off via the piston and cylinder walls, it is carried off directly from below by the large amount of oil which reaches it. Although cooling by this means occurs in any engine, usually there is insufficient lubricant in circulation in either of the latter types to be really effective as a piston cooling agent.

The large size of the crankcase serves not merely to allow the free circulation of the foam of oil about the cylinder barrels, etc., for it also provides a big surface—approximately 15 sq. ft.—from which the heat can radiate. In consequence, Bradshaw claims, the oil never exceeds a temperature of 190 deg. Fahr., and carbon deposit is not formed under the crown, which tends further to facilitate removal of the heat.

One of the objections to air-cooling is that the resonance of the unjacketed cylinder gives rise to excessive valve clatter and other noises. The large quantity of oil flying around in the Bradshaw crankcase serves as well as a water jacket in deadening sounds, and the engine runs as quietly as a water-cooled one of the same general type.

Bradshaw does not concern himself much with the cooling of the combustion chamber and cylinder head, but maintains that the prime essential is to keep the piston and valve seats cool. While, therefore, it is perhaps not quite correct to view this engine as oil-cooled alone, because of the air draught delivered on to the cylinder heads through cowling from the vaned flywheel in front, one is justified practically in almost ignoring the air-cooling feature.

It will probably be suggested that with so much oil in circulation, an excessive quantity will find its way into the combustion chamber and cause a smoky exhaust. But this does not occur in practice, at least not while the engine is comparatively new.

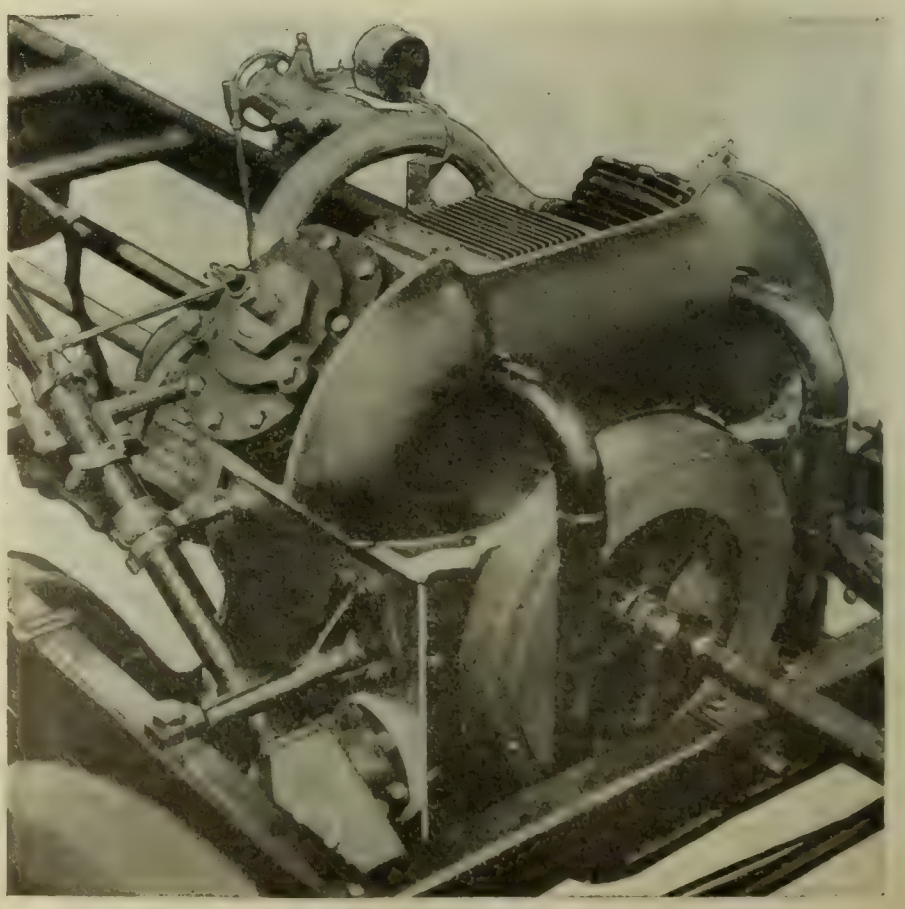
Nor is any very special means provided for preventing oil from working past the piston. The latter is of the usual cast iron straight-sided type and has two compression rings in the crown and a scraper ring in the skirt, the scraper having its upper edge chamfered off so that the oil film on the cylinder wall is but slightly disturbed on the upstroke, though the excess is cleared off on the downstroke. To prevent oil from being drawn up through the inlet valve guides when the engine is running on small throttle, the stem and spring of each inlet valve is guarded by a metal cover. It is the writer's opinion that "oil pumping" in both air and water-cooled engines is primarily due to cylinder distortion.

It will be observed that Bradshaw—differing in this respect from the designer of another oil-cooled engine to be referred to later—does not fit baffle plates to shield the lower ends of the cylinder barrels. He holds that their presence would prevent the efficient and direct cooling of the piston crown. As it is, the large quantity of oil thrown up against the inside of the piston prevents, to a marked extent, the formation of carbon on any part of it, and the crankcase oil in consequence keeps peculiarly free from gritty carbon.

Offhand it might be imagined that oil consumption would be excessive, but with the foregoing in mind it is not surprising to find the reverse is the case. Bradshaw claims that the oil temperature never exceeds 190 deg. Fahr. and under normal running conditions its average temperature is only 150 deg.

He also claims elimination of cylinder and piston distortion, and as a consequence of this and of the shorter time the combustion chamber walls and cylinder head take to reach their normal working temperature, reduced crankcase dilution.

An obvious development is a four-cylinder oil-cooled engine with vertical cylinders in line, and Bradshaw is known to be working on one. Such an engine has actually been built by another engineer. It is a 10-hp. 62 x 90 mm. motor (67 cu. in.). Overhead valves are used in a detachable head, the seats being partially exposed from below to the interior of the crankcase extension, which rises as far as the top of the separate block-cast cylinder barrels. The latter project 5½ in. into the crankcase, clear of the walls of the latter, and are cooled by oil delivered in large quantities upon them from two horizontal perforated pipes, one at each side just below the cylinder head inside the crankcase. The remainder of the parts are lubricated by simple splash; a positive cascade of oil falls off the lower



Front view of Belsize Bradshaw engine showing vaned flywheel and cowling directing air draught on to cylinder heads

ends of the cylinder barrels on to the big-ends and connecting rods, and there are no troughs. In this engine slotted baffle plates shield the lower ends of the cylinder barrels; no scraper ring is fitted to the piston, which has two compression rings only. The oil in circulation passes through a radiator at the front of the chassis, the type used being indistinguishable from a normal tubular radiator for water; but no fan is used for either the radiator or the cylinder heads.

The writer feels assured in foretelling that more will be heard of this system before long. Meanwhile it may be remarked that oil-cooling enthusiasts hold that their optimism was shown justified in the Grand Prix race in France last year, for the reason that Murphy, the winner, on his Duesenberg, ran without water in the cooling system while covering the last two laps, the radiator having been pierced by a stone thrown up by another car.

As to the possible advantages to be derived from oil-cooling, they may be summarized as: more uniform cooling, lack of distortion and compression leakage, more direct cooling of valve seats, lower temperature of lubricating oil and the longer retention by the latter of its original qualities, which together result in more efficient operation.

The system should also enable cost of production to be reduced.

To judge by the experience of the Belsize Co., the oil-cooled system appeals to the user by reason of its having the simplicity and other advantages of air-cooling without the drawbacks of the latter.

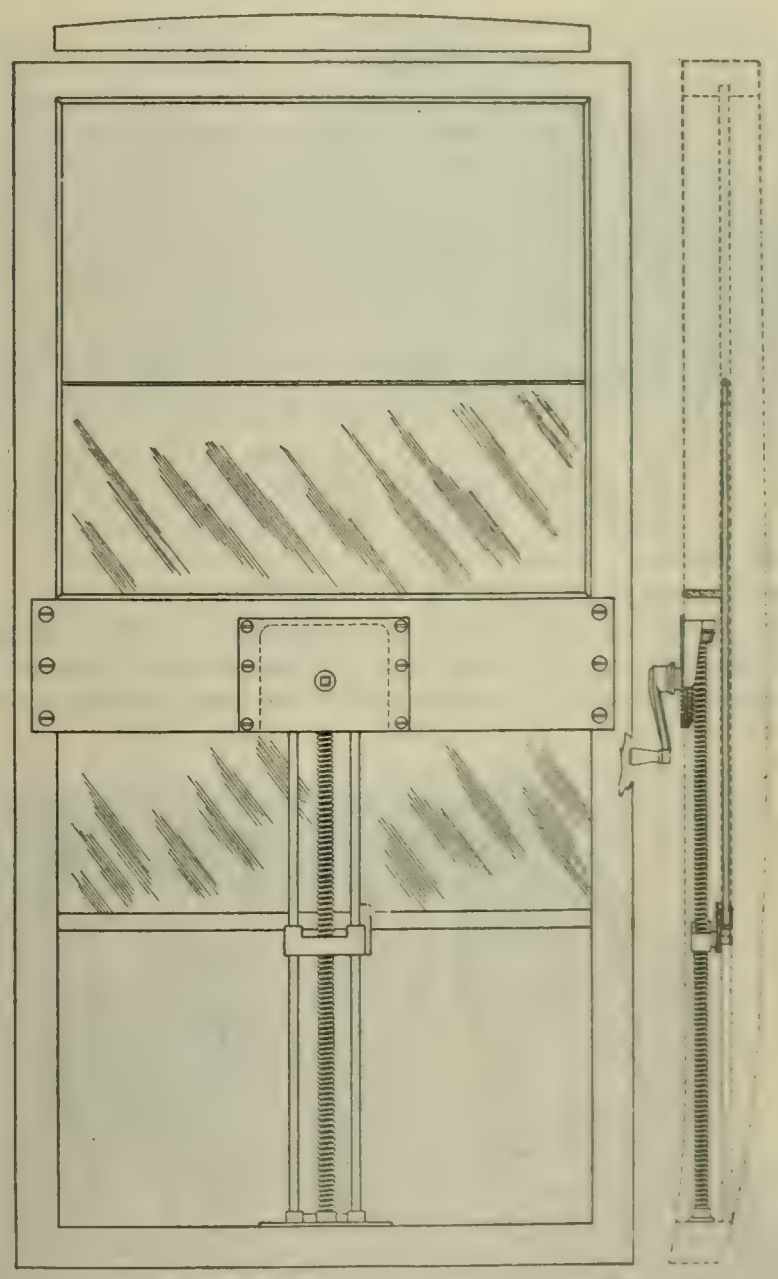
The Simplex Window Regulator

A WINDOW regulating device for use on the doors of closed automobiles is being marketed by the Joseph F. O'Brien Mfg. Co. As may be seen from the illustration herewith, it is of simple construction, and it is claimed that it is easy to install. A square, threaded rod and two guide rods extend from the bottom of the door to slightly above the height of the operating crank on the inside of the door. The two guide rods are secured in brackets at top and bottom, and the threaded rod has bearings in these same brackets, of which the bottom one is fastened to the door frame and the top one to the metal base on which the crank handle is mounted. The shaft of the crank handle is fitted with a bevel gear, which meshes with a bevel pinion at the top end of the threaded rod. Rotation of the threaded rod gives an up-and-down motion to a sliding piece which is fitted to the bottom of the glass channel.

Among the advantages claimed for this regulator are that it has no chains and counterbalances, but is ball bearing and easy to operate. The regulator is claimed to fit any construction and to be free from noise, and the window is said to absolutely stay in position after the hand is taken from the handle.

Another feature of this regulator is that it can be placed in any position on the lock board, either to the extreme right or to the extreme left, as well as in the center, and no additional sets of gears are necessary for the placing of this regulator for the raising or lowering of the quarter lights.

The device for locking the window to the regulator is a new departure. It is not necessary when lights are broken to remove the upholstery. By bringing the glass to the top and forcing over the movable lock which rests just below the molding, the glass can be lifted out without any further difficulty.



Detail of Simplex window regulator

FROM London comes the information that "the development of the passenger-carrying side of motor road transport in 1921 was noticeably rapid and satisfactory from many points of view, and that the movement had assumed considerable proportions by the end of the season may be judged from one instance alone, that the two motor coach stations which were established in Blackpool provided for some 300,000 passengers and accommodated 13,000 coaches.

"Young as this modern form of road travel is, it has already found fairly firm foundations. Novelty has ceased to be an asset. The average person who travels by coach to-day does not do so out of curiosity, but because he has found it to be the most agreeable mode of travel from place to place."

It is claimed that "a good sign for the future of motor coaching is that the demand to go farther afield from the local center is steadily on the increase, even to the extent of tours abroad. This is where light weight in comparison to carrying capacity, relatively high average speed, easy and quiet running, and a good margin of safety in freedom from brake failure, sideslip, and so forth, enter, for they are essential for successful long-distance coaching. The up-to-date small-type vehicle possesses these essentials, and it will be found that by its employment considerable stimulus will be given to the coaching branch of motor road transport in 1922."

An American Development in Large Bore Aircraft Engines

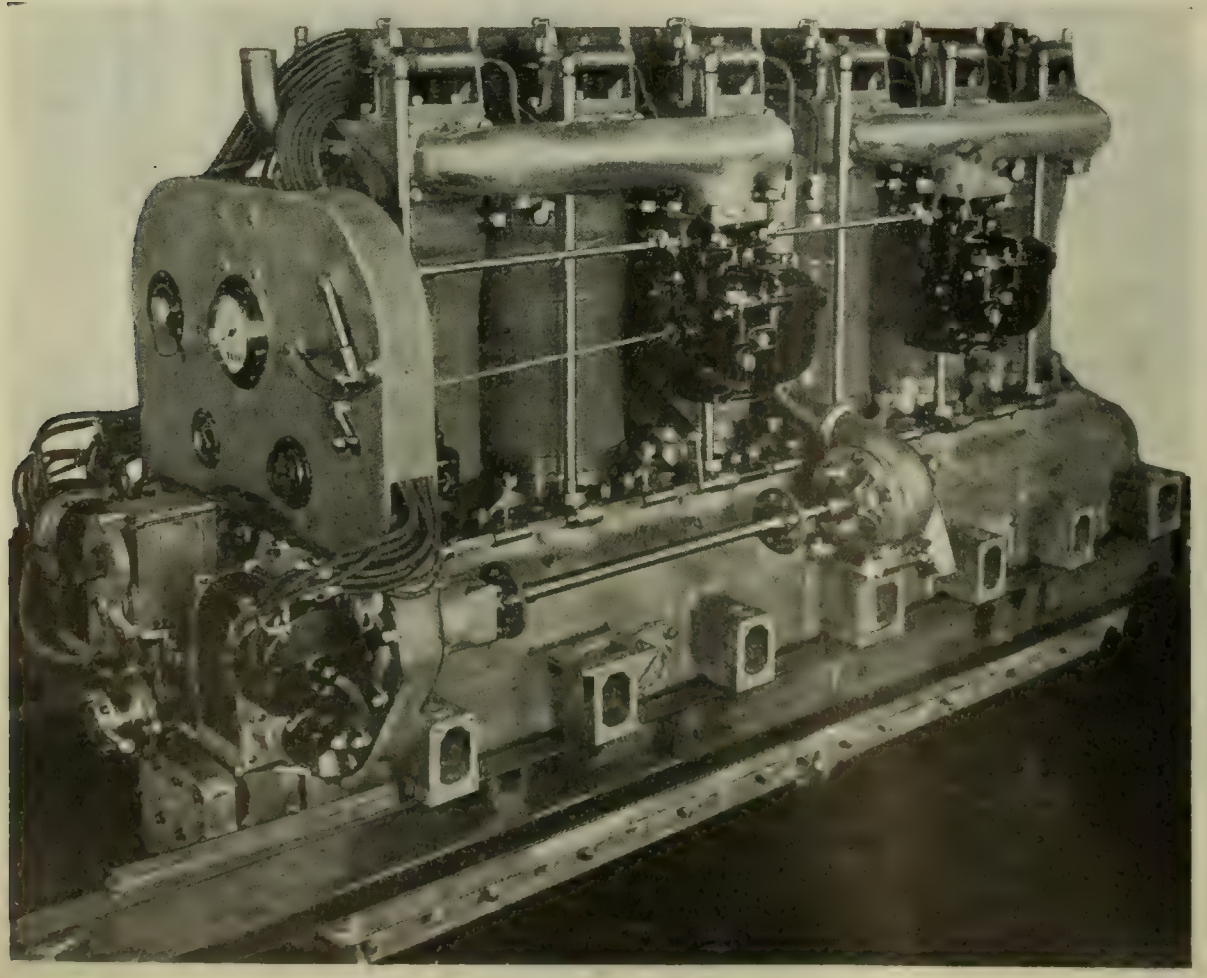
New product of Wright Aeronautical Corporation designed especially for use in ships of the Zeppelin type has cylinders which are probably the largest developed for aircraft use. Similar in some respects to the German Maybach engine, but embodies improvements and develops more power.

By Herbert Chase

A DISTINCTIVELY American development in engines, designed especially for propulsion of lighter than air machines, has recently been completed for the Navy Department by the Wright Aeronautical Corp. This is understood to be the largest heavy duty aircraft engine developed to date. It has six 7 x 8 in. cylinders arranged in line and develops 400 b.hp. at a speed of 1400 r.p.m. This is equivalent to 122 brake m.e.p., an unusual performance for an engine of such large bore. While the speed measured in r.p.m. is lower than is usual in airplane engines, the piston speed, 1867 ft. per min., is by no means low for an engine with so large a piston. The engine weighs 1320 lb. dry, or 3.3 lb. per b.hp. The jackets hold 37 lb. of water. The overall measurements are approximately as follows: Width, 25½ in.; height, 42 in.; length, 75 in.

The design of the engine is such that almost any part can be removed for repairs if necessary while the craft is in the air or without taking the engine out of the gondola in which it is mounted. To realize this condition placed certain restrictions upon the design and made it impossible to employ certain types of construction which are quite general in aircraft engines. It was not feasible, for example, to use an overhead camshaft, since this would interfere with removal of individual cylinders. In other words, accessibility was a controlling factor which made it necessary to add some weight in certain instances. Another requirement which imposed certain restrictions was that the engine be readily convertible from right to left hand rotation without using any more different parts than are absolutely necessary.

In general design, the cylinder resembles that of the Maybach engine, consisting, as it does, of a steel barrel screwed into a cast iron head and having a steel jacket 1/32 in. thick screwed and welded in place. The water space is very narrow. The joint at the base of the jacket is made with a flax packing of triangular section tightened by a ring threaded onto the lower end of the jacket. This joint takes care of the longitudinal expansion of the cylinder barrel. The jacket is machined from two solid forgings, the joint being welded after they are in place.



The new Wright 400 hp. dirigible engine. Note accessible arrangement of controls, hollow supporting arms forming channels for air to cool bearings and location of carbureters, water pump and other accessories

The cylinder heads are flat on the surface which forms the roof of the combustion chamber. The four valves which seat in the head have vertical stems running in long inserted bushings which, besides acting as guides, assist materially in keeping the valves cool. The coring is such as to provide ample water circulating space around all the valves and the full length of the guides without unnecessary restriction of the ports. Water, delivered by the pump through a pipe between the two center cylinders, flows fore and aft across the tops of each set of three cylinders to outlet pipes at each end of the engine, the respective cylinder heads being joined by a short hose connected to flanged nipples bolted to the cylinder heads. The flanges have slots instead of the usual bolt holes, so that the two flanges with their hose connection are easily removed after the nuts on the studs, which carry the flanges, are loosened. This construction facilitates removal of individual cylinders when this is required. Water in the jacket space around the cylinders is circulated by thermo-syphon action

only. Consequently, a drain cock is required at the base of each jacket.

The spark plugs, of which there are four per cylinder, are arranged around the circumference of the combustion chamber approximately 90 deg. apart. Their axes are horizontal and the inner ends of the plugs come just below the roof of the combustion chamber.

The exhaust valves have flat heads of 2 1/16 in. clear diameter and are spaced slightly farther apart than the inlet valves, which have tulip-shaped heads. All valves have hollow stems and are made from high chromium steel. The exhaust valves are mercury cooled. The valves are held to their seats by two concentric helical springs, and are actuated by rocker arms and tubular push rods from two camshafts in the crankcase. The rocker arms for each pair of valves form an integral forging, the central portion of which is tubular and bored out to receive a pair of small Hyatt bearings. The hollow shaft, which passes through these bearings, is fastened in forged supports which are bolted to the cylinder head. One of the fastenings is in the form of a small oil cup through which the entire assembly can be filled with lubricant. The rocker arms are drilled out so that oil is fed to all bearing points, including those on the upper ends of the valves and the push rods. The curved arm which contacts with the push rods is drilled before it is bent. The cup on the end of this arm is made deep enough to prevent the push rod from jumping out while the engine is running, in case a valve sticks in its guide.

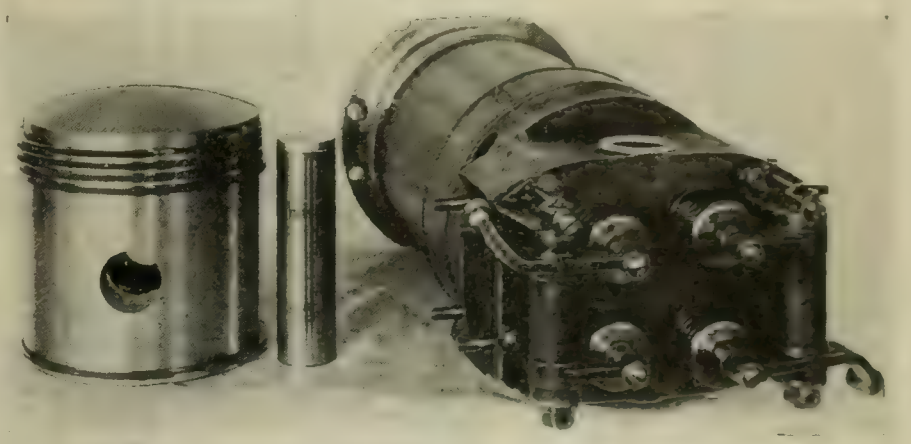
The pistons are of cast aluminum and carry four rings at the top and a single oil scraper ring at the base of the skirt. They have a heavy dome-shaped head and straight sides which are given 0.018 in. clearance over their entire bearing surface. The piston alone weighs 9 lb. Its total weight with rings and pin is 13.5 lb. The hollow pin is 1¾ in. in diameter and is arranged to float in both rod and piston. Bronze plugs are pressed into each end. The connecting rods are of the tubular type, drilled from the crank pin end, after which the central oil pipe and the plug which closes the hole in the rod are inserted. The rod is 14 in. long from center to center and weighs 9.3 lb., bolts included. The big end bearings are 3 in. diameter by 3¼ in. long.

The crankshaft is hollow and is provided with removable plugs to facilitate cleaning. All main bearings are 3 in. in diameter. Those at the center and driving end are 3⅞ in. long and the others 2⅞ in. The engine is designed to take the propeller thrust direct or the clutch thrust, a large deep groove annular bearing at the driving end being provided for this purpose. The plain main and big end bearings are of bronze with babbitt linings only 0.018 in. thick.

Oil is fed to each of the main bearings under 50 lb. pressure, and thence to the crank pins and piston pins, also under pressure. The pistons are lubricated by splash from the connecting rods only, the oil which issues from the main bearings being caught by the ledges cast for this purpose on the upper portion of the main bearing supports. This arrangement is said to account for the unusually low oil consumption. In a recent test, the engine is reported to have run for 50 hours with lubricating oil consumption of only 0.008 lb. per b. hp. hr.

The oil pumps, of which there are three, are driven directly off the end of the crankshaft. They are arranged in a neat readily accessible unit, consisting of six gears, an aluminum port plate and cover plate. Two of the pumps draw oil from the front and rear ends of the lower crankcase respectively, and the third delivers the oil from an external reservoir to the bearings through pipes cast in the crankcase. A branch pipe feeds oil to the upper two pairs of timing gears which carry it in turn to the lower gears of the train. The port plate is so designed that it is simply turned over and put back in position when the direction of rotation is changed. The idler gear which meshes with the gear on the crankshaft and the timing gears on the ends of the camshafts also drives a layshaft, which in turn drives a short cross-shaft through a pair of helical gears.

Two two-spark Simms magnetos are driven through flexible couplings, one off each end of the cross shaft. The magnetos can be retarded when starting by turning the handle on the rear end of the layshaft, but automatically shift to the full advance position when this handle is released. Each magneto fires two opposite plugs of each set of four, so that there are four simultaneous sparks in each cylinder. It will be noted that all control elements are centered on or just below the control panel at the rear of the engine, where they are within convenient reach of the operator. Nevertheless, there are certain automatic safety features, one of these being an oil-operated governor. This consists of a spring-loaded



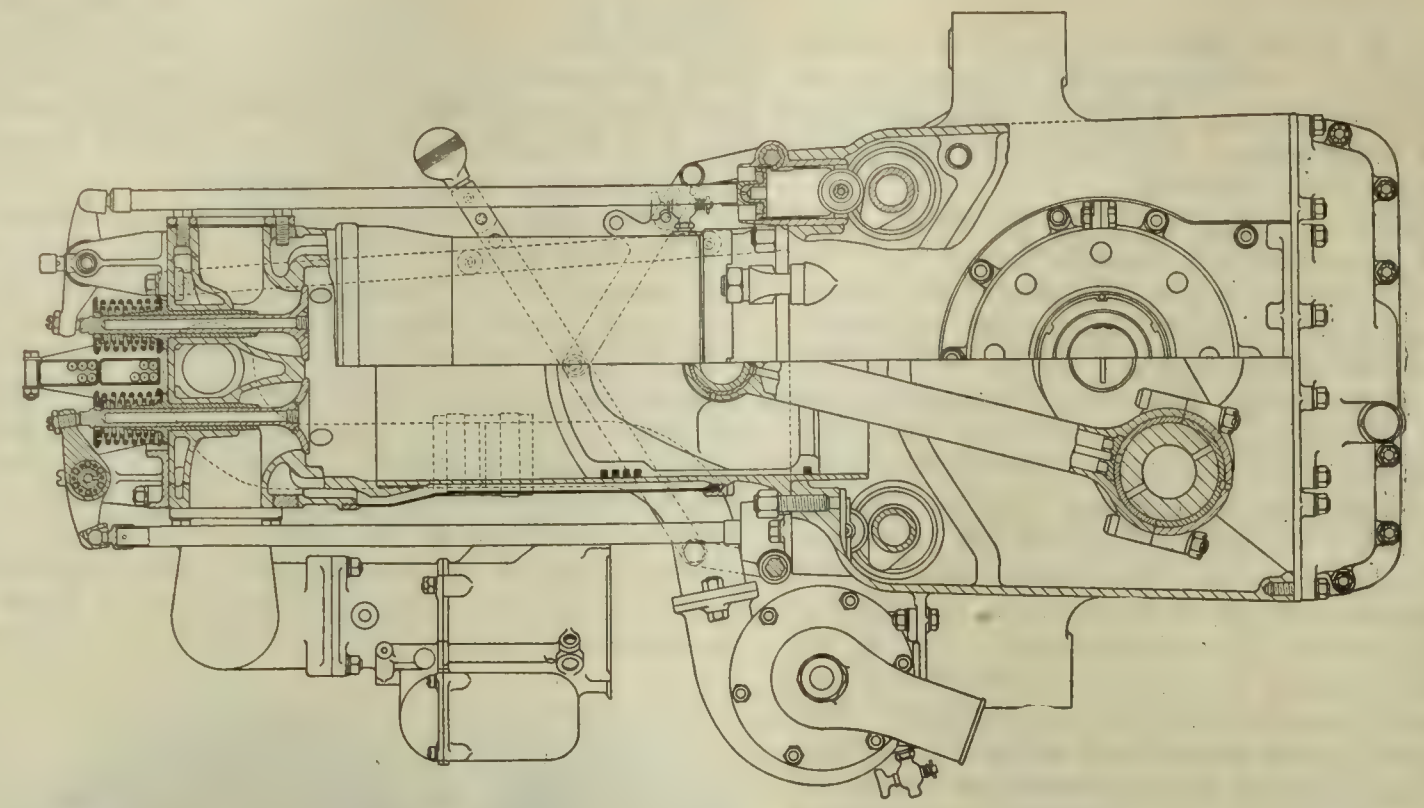
Piston, piston pin and cylinder assembly showing overhead rocker arms, valves, etc.

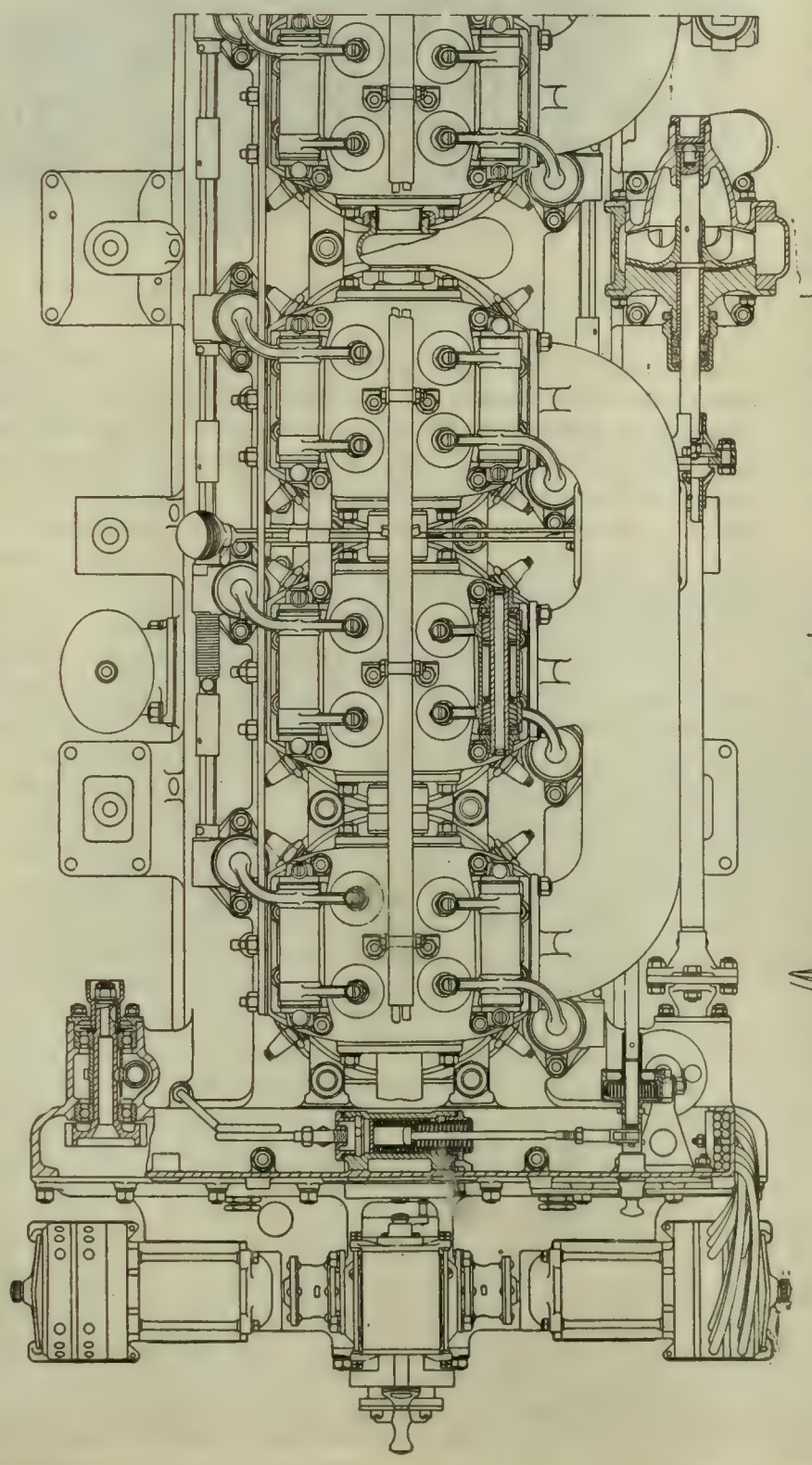
piston interconnected with the throttle in the manner shown in the drawing. In starting up, the throttle is opened by hand against the pressure of the spring and is held open manually until oil pressure from the pump acting upon the piston and in opposition to the spring is sufficient to hold it open when released by the operator. Should the oil pressure fail or decrease until below a predetermined amount, the throttle is at once returned to an idling position, thus preventing injury to the engine.

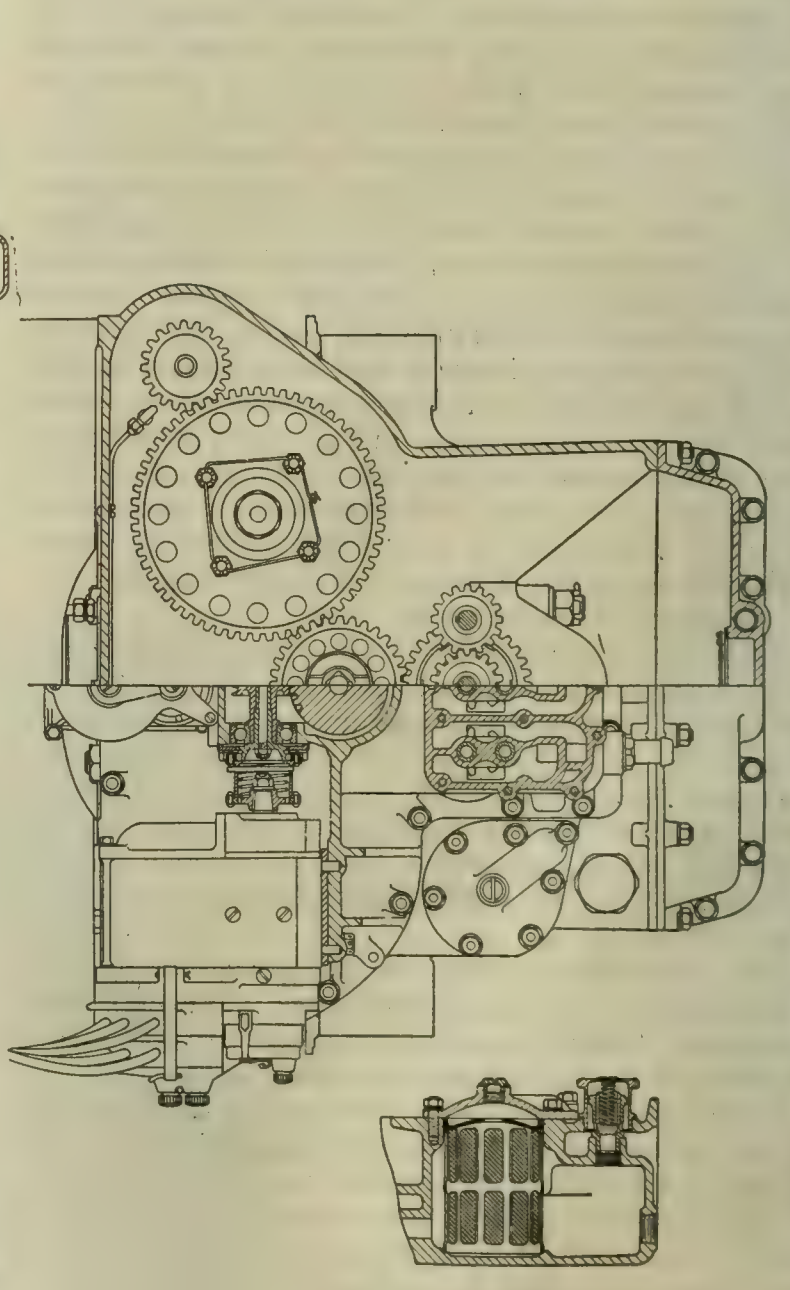
A second governor of the Pierce centrifugal type is provided to prevent overspeeding. This is so arranged as to have no direct effect upon the throttle position, but in case the predetermined speed is exceeded it actuates a pawl, which in turn trips a coiled spring, and the latter closes the throttle to the idling position, where it remains until the spring is reset. Both governors are located just forward of the control panel and can be seen in the plan view of the engine. The throttle shaft projects through the panel and is there attached to the hand throttle lever. The control panel also carries a carbureter control for maintaining a correct mixture with change in altitude, the ignition switch, a combined tachometer and revolution counter, oil pressure gage and a distance thermometer for indicating temperature at some point in the coiling system.

The timing gears have only a ¾ in. face but are amply strong for the loads imposed. The camshafts are hollow and are filled with oil which issues under pressure through small holes to the bearings. The cam follower is a light roller carried in a tubular tappet which is also very light. The head of the tappet is formed with a ball end which fits a cup-shaped recess in the lower end of the pushrod. The tappet guide is carried above the crankcase to prevent overflow of oil.

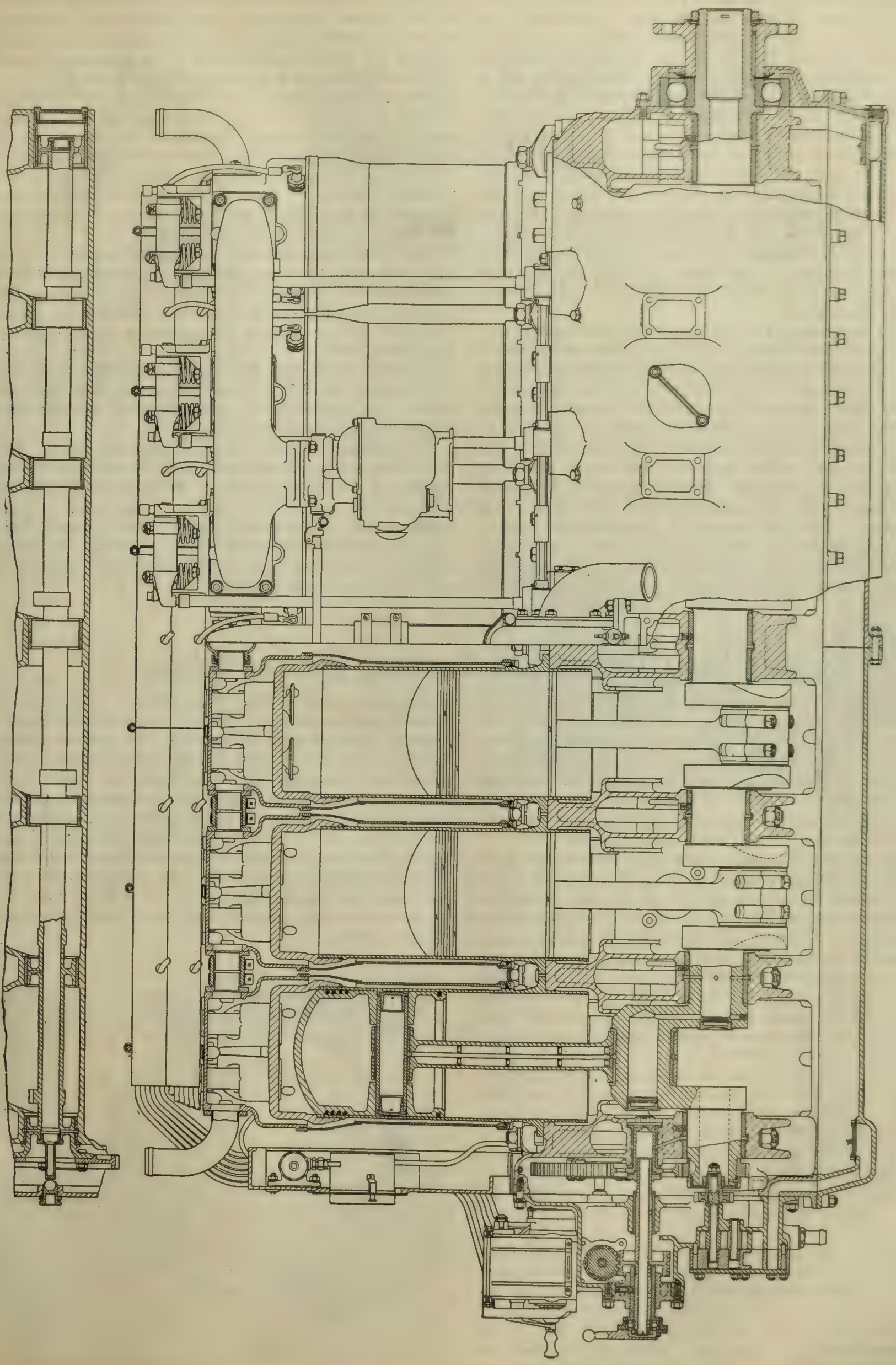
Special means are required for starting so large an engine, and the system employed is the same as that used on







Plan and transverse sections of Wright engine, showing details of oil pump, oil pressure governor, roller bearing rocker assembly, valves, cylinder head and other parts



Longitudinal section of the Wright dirigible engine, showing type of cylinder construction, piston, connecting rod, crankshaft and other details. Note box-shaped main bearing supports through which air to cool bearings is forced

the Zeppelin Maybach engines. The operation is as follows: All valves are opened by rotating, by means of the hand levers shown in the transverse section, two light shafts which run the length of the engine outside the crankcase and adjacent to the tappets. These shafts carry notched cams which engage the upper edge of a slot cut into the tappet and through which the cams project. The lip on the cam face raises the tappet clear of the cam which normally operates it and in so doing opens the valve. When the valves are open the outlet from the exhaust manifold is closed and a hand pump is employed to draw mixture through the carbureters and induction pipes and into the cylinders. The valves are then closed, the exhaust manifold outlet opened, and the hand magneto, located just back of the control panel is employed to ignite the mixture in the cylinder with piston in firing position. This results in starting the engine.

The main crankcase is a rigid one-piece aluminum casting of box section well reinforced. The bolts which retain the main bearings pass through the bearing supports and the yokes which help hold the cylinders to the crankcase. Additional studs passing through the cylinder flanges serve as the other cylinder fastening means. It will be noted from the longitudinal section of the engine that the transverse ribbing, which supports the main bearings, forms box-shaped passages directly over the bearing. These passages are continued through the supporting arms, as shown in the photograph of the assembled engine, and act as ducts through which air for cooling the bearing and the lubricant can be forced. Piping for conveying this air can be carried outside the gondola and into the slipstream, suitable manifolds being attached to the ends of the hollow supporting arms which are machined and tapped for connecting flanges. The underpan or lower section of the crankcase is made in two pieces to facilitate removal without interference with other parts.

The water pump, as shown in the cut of the assembled engine, is mounted on the central support arm on the inlet side. If desired, it can be placed on the other side, where a similar base is provided. The impeller has straight vanes and will, consequently, operate equally well when rotating in either direction. Base plates, upon which other accessories can be mounted if desired, are cast on other supporting arms as shown in the photograph.

The inlet manifolds are arranged to serve three cylinders each, and two separate 2¾ in. Stromberg carbureters are employed. Compensation for variation in atmospheric pressure with change in altitude is effected by a hand adjustment which controls the pressure on the fuel in the float chambers.

Ignition wires are carried across the top of the engine in Bakelite conduits, located between the two sets of valves, and come down to the magnetos through passages in the instrument board casting.

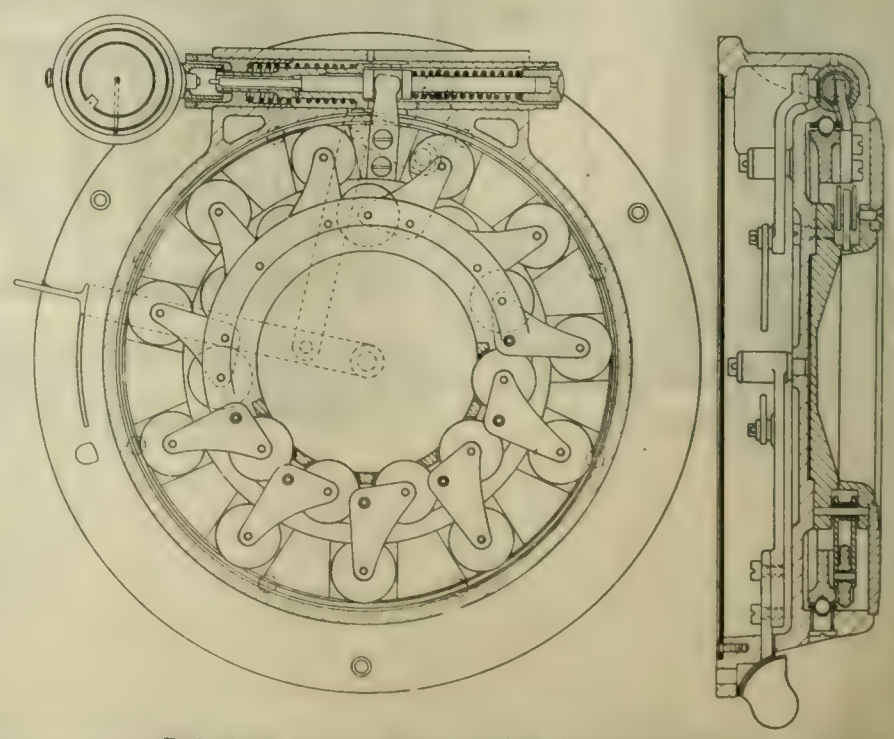
The engine has a 5½ to 1 compression ratio. In a recent Government acceptance test, it is reported to have run for the required period of 40 hours at 1350 r.p.m., developing 350 hp. (throttle partly closed), and 10 hours developing 400 hp. at 1400 r.p.m. The average fuel consumption for the entire 50 hours is given as 0.475 lb. per b. hp. hr., the fuel being a mixture of four parts aviation gasoline to one part benzol.

An Instrument for Testing Piston Rings

THE firm of Adolph Saurer of Arbon, Switzerland, has developed the piston ring testing instrument herewith illustrated. Its object is to determine whether the pressure exerted on the walls of the cylinder when the spring is compressed to its working diameter, is within allowable limits. It is purely a comparator, as it indicates whether the ring being tested has the same characteristics of stiffness as some standard ring known to be satisfactory.

Mounted on ball bearings inside the circular casing is a steel ring having radial slots in its upper face. A number of bell crank levers are pivoted to the casing, and a roller on the outer end of each lever fits into one of the slots in the ring. The other end of each lever also carries a roller which is caused to bear upon the outer circumference of the piston ring to be tested by the rotation of the steel ring already mentioned. The latter ring carries a projecting finger which engages with a plunger situated in a sliding tube. By pressing on a lever which projects from the casing, this tube is caused to move towards the gage shown on the drawing against the action of a spiral spring. The plunger is pressed up against a shoulder in the same direction by a spiral spring within the tube and is therefore carried along with the tube until the resistance to its further motion is sufficient to overcome the compression of the spring acting upon it. This occurs when the finger, carried along by the plunger, has rotated the steel ring sufficiently to cause the rollers to exert a certain pressure on the piston ring.

The gage of the instrument has two concentric dials, the reading of one being due to the motion of the tube and that of the other to the motion of the plunger. To set the instrument, a steel disc of the closed size of the ring to be tested, is inserted, and the lever pressed until the rollers are in contact with it. The dial is then rotated until the pointer stands opposite a zero mark. A piston ring of standard strength is then substituted for the disc and the lever is again pressed. When this ring has been compressed to the standard diameter, the pointer will again point to zero, but before this occurs the inner dial will have been actuated by the differential motion of the plunger, and will take up a position depending on the relation between the reaction of the piston ring and the initial compression of the spring which holds the plunger up to its work. This compression is adjustable, and when the machine is properly set, the effect of closing it on a ring of standard size and strength is to bring the pointer to zero on the size scale and between two limit marks on the strength scale.



Detail of piston ring testing instrument

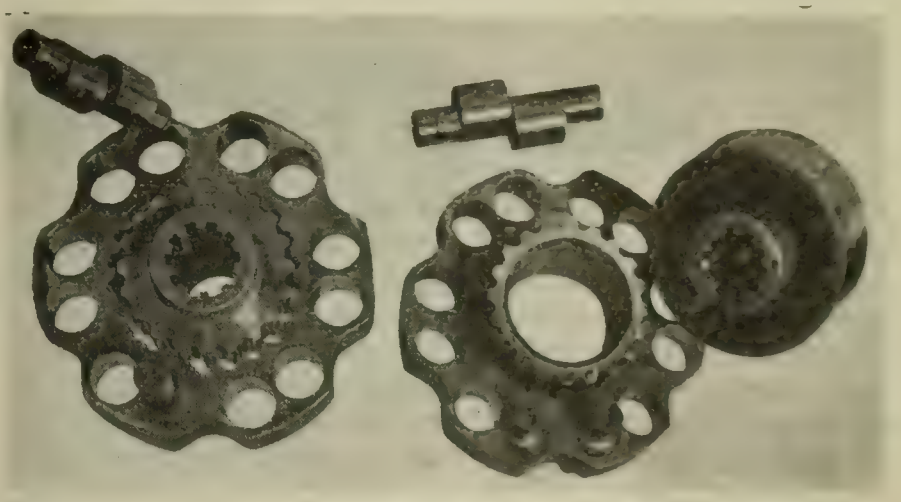
A New Type of Compensating Differential

The design is such that maximum differential action occurs at low axle speeds and the resistance increases with the speed. As compensation is made for variation in tractive ability, it is not a positive locking type.

A COMPENSATING differential has been placed on the market which utilizes the effects produced by fluid friction and is so designed that the maximum differential action takes place at low axle speeds. The resistance provided by the construction—which is not complicated—increases as the speed increases, tending to reduce the differential action at high speeds. The principles involved are apparent upon an examination of the construction.

This differential consists structurally of an outer case similar to that of an ordinary bevel gear differential, to which the power from the engine is transmitted in the usual way. It is of such general dimensions as to permit its installation in the average axle without alteration. Power from the engine is transmitted to the case, on which is mounted the conventional master gear. From the case it is transmitted through double eccentric rollers to two central driving plates provided with suitable holes for journaling these rollers. The two driving plates also constitute an external and internal gear, respectively, which mesh with mating external and internal gears fastened to the two axle drive shaft sections, respectively. The arrangement is such that the driving plate external-internal gear unit can swing around the axis of the double eccentric rollers when actuated to do so by the gears on the axle drive shaft sections.

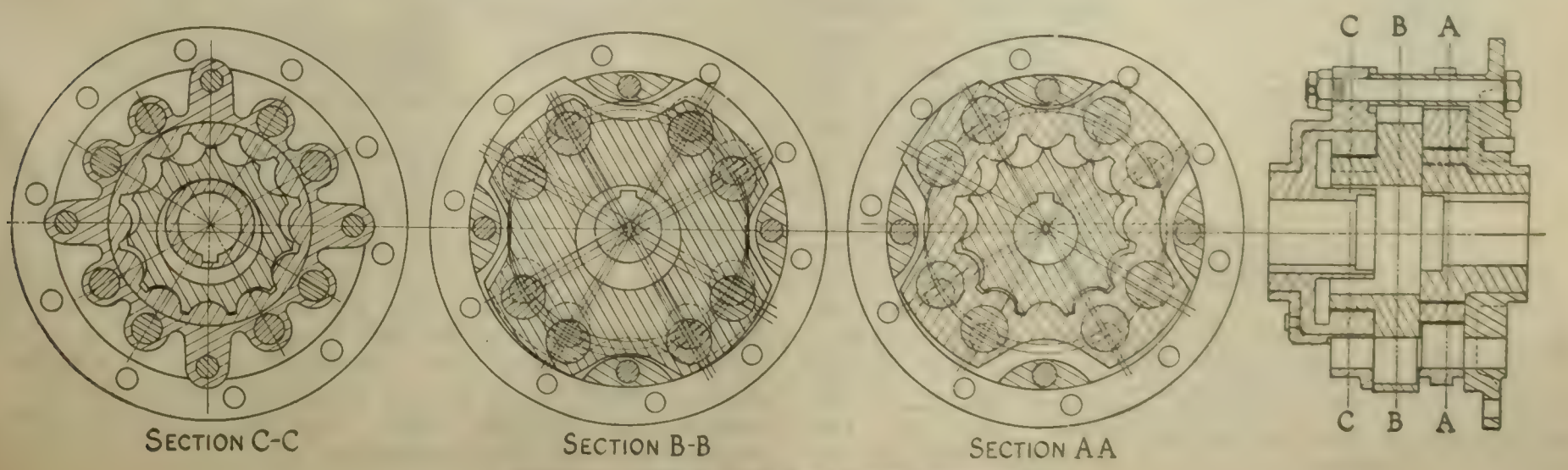
The double eccentric gearset forms a reverse motion as required in a differential. When motion in the differential is induced, as in turning corners, the internal gear on the end of one axle shaft and the external gear on the other axle shaft turn in opposite directions. The compensating action of the two gear plates between the two shaft gears consists in a swinging gyratory motion around the centers of the supporting rollers. This gyratory motion causes the rollers to rotate on their axes at a much greater rate than the shaft gear, the ratio on the Ford installation being 12 to 1. The degree of resistance offered can be varied by changing the ratio through the medium of a change in the eccentrics. The rollers being numerous and having comparatively large areas, when running in oil, offer considerable resistance to acceleration of speed. At the low speed of differential action the resistance to turning is low, but when the driving forces tend toward higher differential action abnormal resistance at an increasing rate is inserted, following the law of frictional resistance.



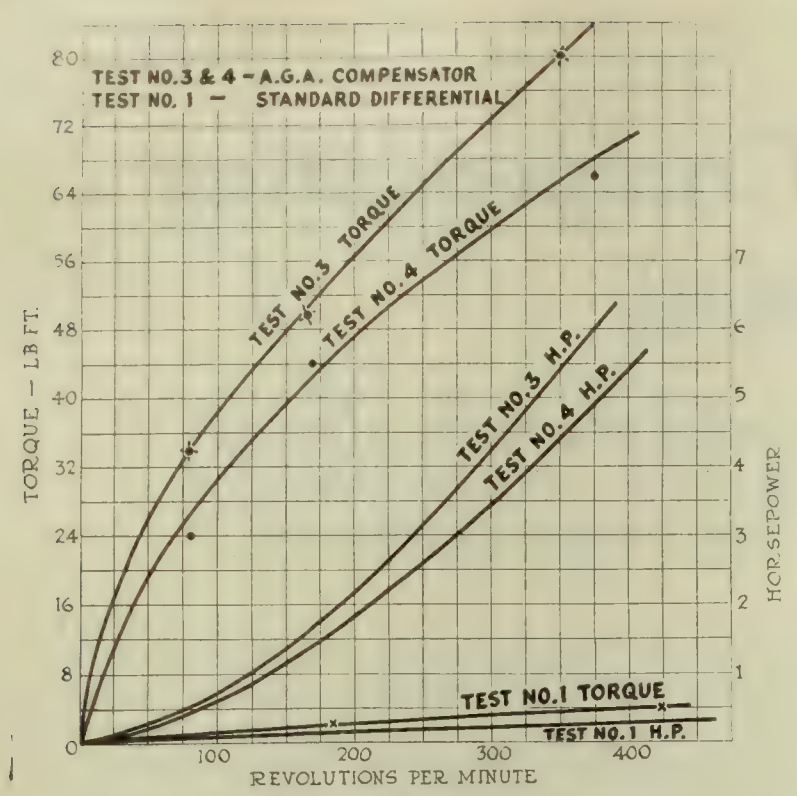
Parts of Ford type Krohn differential

In actual operation, when one of the wheels is off the ground momentarily or on a slippery spot, and differential action is induced by a difference in tractive ability, the tendency to accelerate this wheel is opposed by the internal resistance in the differential mechanism. It will be seen that it is not a positive locking differential but one in which some compensation is made for variation in tractive ability.

The Krohn differential is now being supplied by the H. McFarlane Co. of Chicago as a replacement for the



Sectional views of Ford type Krohn differential



Test curves of Ford type Krohn differential

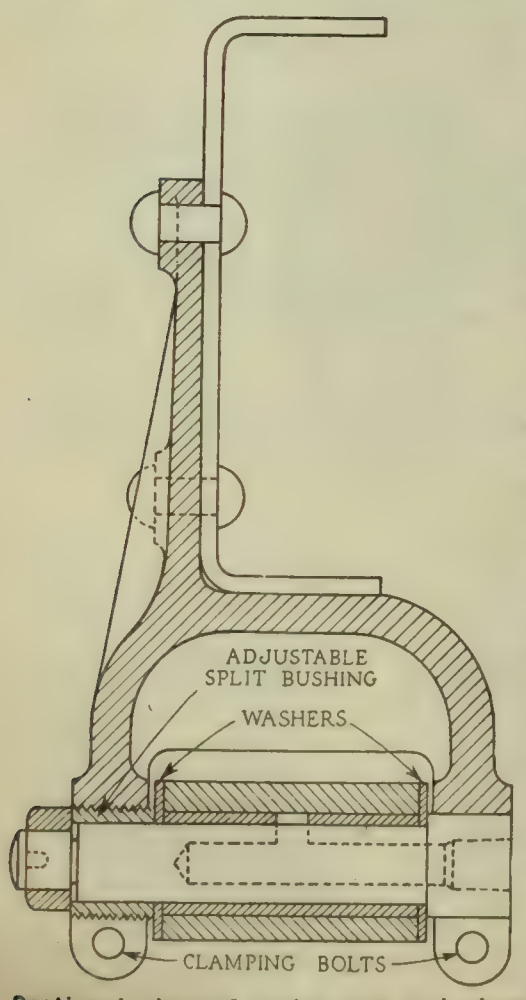
regular Ford differential, but the device is being built in several sizes for truck and passenger car installation. A test on a prony brake to determine the amount of power being delivered to the free or semi-free driving wheel was made and the graph shown represents the results of this test.

The tests referred to were based on the following reasoning: If an ideal compensator could be made, a car equipped with it could pass over otherwise impassable ground without noticeable interruption in its motion, provided that road conditions were not such that both wheels lost traction at the same time, when no amount of power applied to the driving wheels would pull the car out. A spinning wheel always has a slight amount of tractive effort, and in the Krohn compensator this reacts to increase the pressure of the rollers on their bearings. How much this actually benefits the action of the Krohn differential it is impossible to accurately determine in a block test such as that described here.

Tests Nos. 3 and 4 give relative values which tend to establish the assumption as correct. The curves of test No. 3 show the difference between the two scale readings and consequently, measure only the internal resistance of the compensator. In the standard bevel gear differential none of these conditions seem to apply, and this test was run with one wheel entirely free. The graph shows the torque curves obtained, as well as the hp. curves computed from the torque values.

Means for Taking Up End Play of Spring Eyes

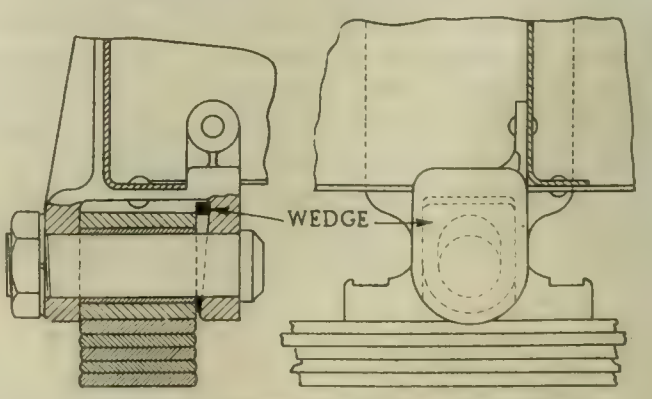
CENTRIFUGAL force puts considerable pressure on the thrust washers of chassis springs when the car is turning a corner at any speed, and as on rough roads there is a continuous rocking motion of the spring eyes relative to the thrust bearings, a good deal of wear occurs and spring eyes eventually develop considerable play. In the majority of cars there are no means for taking up this play; in fact, many cars have no special thrust washers on the spring bolts, and the result is that in time the car rattles.



Sectional view of spring eye end play adjuster

A. C. Schulz, who was formerly connected with the engineering department of the Locomobile Co. and about a year ago brought out the Navarre car, has invented a means for readily adjusting the spring bolts to take up the end play. Two different designs have been worked out. The spring bolt in each design is provided with a head which is clamped in one arm of the spring bracket. The other arm of the bracket is threaded and also split, and receives a split, threaded bushing. The spring eye is bushed in the usual way and two thrust washers are threaded over the bolt, one resting against the bolt head and the other against the split bushing. End play is taken up by adjusting the bushing, which is then locked in position by clamping the split yoke arm upon it. In one of the designs the spring bolt is provided with a nut, while in the other the bolt is held solely by clamping in the arms of the spring bracket. This latter is intended especially for front spring horns, where projections are objectionable.

A SIMPLE means for taking up wear at the ends of spring eyes and the inner side of the lugs of spring brackets has been invented by Hugo Gibson. It is well known that such looseness is the cause of annoying rattle



Sectional views showing wedge action

in many old cars. Mr. Gibson finishes the inner side of one lug of the spring bracket off at an angle and places a wedge-shaped washer over the spring bolt between the spring eye and the lug of the bracket. The washer is made with an elongated hole and of such thickness that when it is first put on when the car is assembled, all of the clearance space of the hole is above the spring bolt. Then, as wear takes place, the washer sinks to a lower position, thus taking up the looseness created and preventing side play and rattle. The device can be used equally well with spring shackles.

Rear Wheel Dynamometer Tests and Their Significance to the Engineer

A description of the car testing apparatus installed at the Sheffield Scientific School and the methods followed in its use. Results of tests of various cars with this equipment furnish much information regarding performance under road conditions which is worthy of careful study.

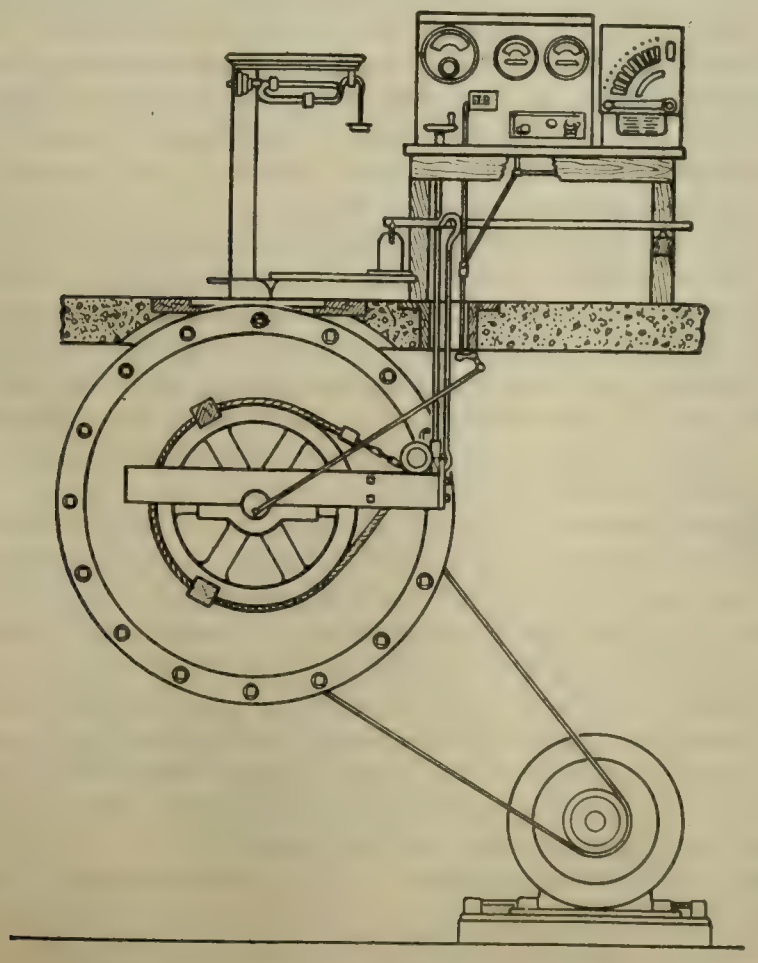
By Herbert Chase

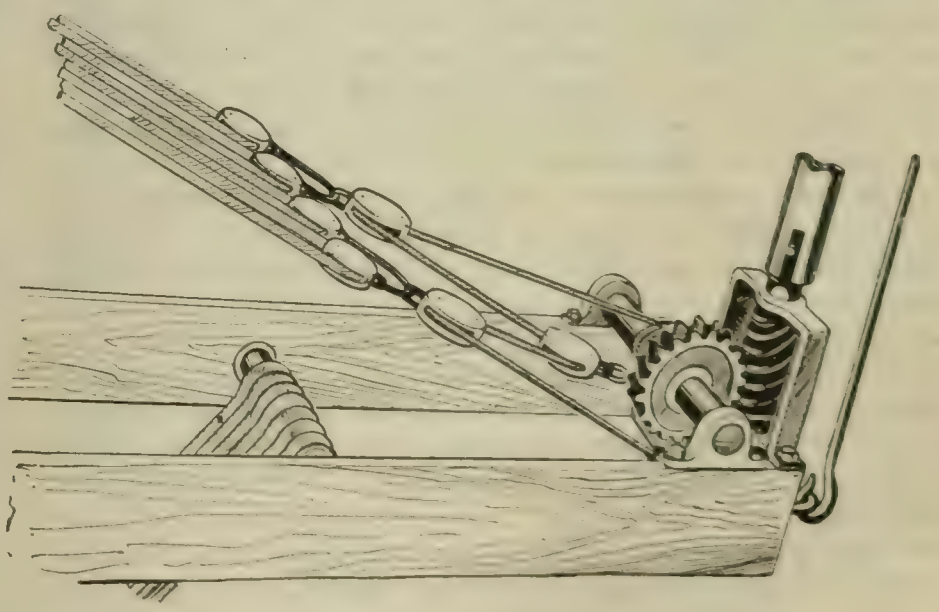
REAR-WHEEL testing dynamometers are not a new thing in the automotive industry, but it is surprising how few data regarding tests made with them have been published and how small a part of the information in this regard which does exist has resulted from tests made under conditions which approximate normal running on the road. As an illustration of the general lack of information along this line, it may be said that few engineers realize that it requires less than 3 hp. exerted at the rim of the driving wheels to propel most passenger cars on a hard level road at a speed of 20 m.p.h., and that, under these conditions the engine is required to develop seldom more than 6 hp. and often less than 5 hp. It seems safe to say that, were these facts and others of a closely related nature fully appreciated, more attention would be given to securing better economy at low loads and less to maximum load performance, a condition which is encountered so small a part of the time under normal operation.

With these facts in mind, let us first consider the simple apparatus required for rear-wheel testing, and then examine the methods employed and some of the results obtained by the use of such equipment in the Mason Laboratory at Sheffield Scientific School, Yale University. The dynamometer in question is in direct charge of Prof. E. H. Lockwood, who is responsible not only for the design of most of the equipment, but for the logical, if somewhat unusual, methods followed in making the tests here recorded.

The accompanying cuts give an excellent idea of the important elements of the testing equipment. A pair of paper pulleys measuring about 5 ft. 8 in. in diameter are mounted upon a heavy shaft carried in a pair of hangers with plain ring-oiled bearings. The hangers are so arranged that the face of the drums comes approximately flush with the floor on which the car to be tested is located. The drums upon which the car wheels rest have a 15-in. face and the circumference is such that the drums make precisely 300 revolutions per mile of travel of a point on the circumference. Being about twice the diameter of the average tire, the surface of contact with the tire is only slightly convex, and consequently it closely approximates a hard, smooth road surface. The compressed paper also affords good traction for rubber tires.

Overhung on one end of the drum shaft is a cast iron brake pulley 36 in. in diameter by 8 in. face. This pulley has flanges facing inward and thus forming a channel

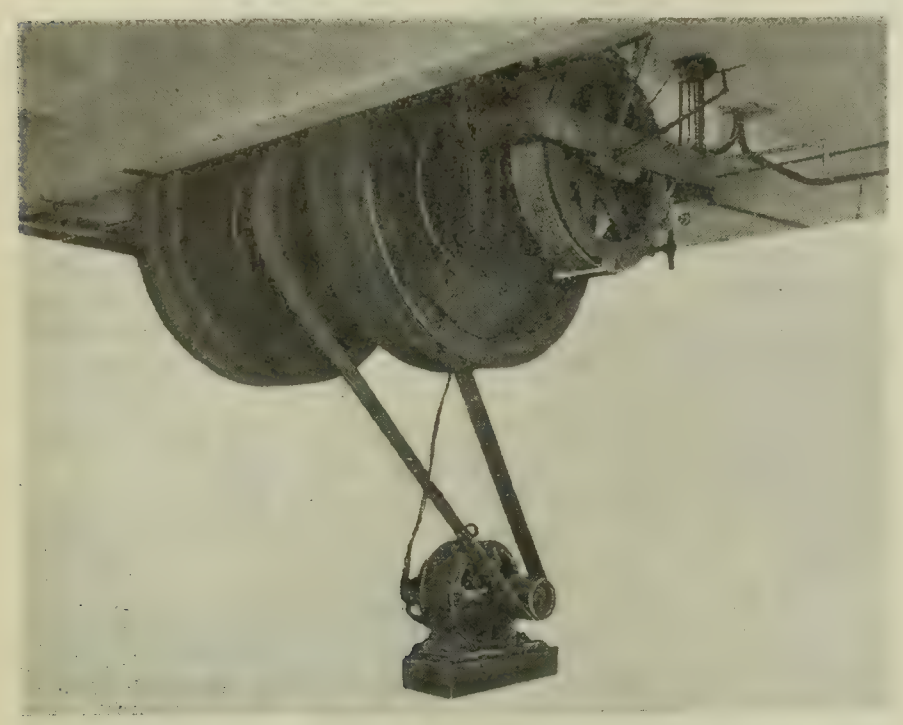




Left, diagrammatic view of the rear wheel dynamometer, showing rope type prony brake, drums, weighing and recording equipment, etc.

Above, detail sketch of the mechanism used for tightening the rope on the prony brake and thereby varying the load. The worm shaft is free to move vertically in the slotted sleeve which is connected to the hand wheel shaft on the control table seen in the diagram at the left.

which can be kept partly filled with water, the evaporation of which prevents the braking surface from becoming overheated. On this surface bear eight parallel bands of ¾-in. rope arranged in the manner shown in the accompanying cut. It will be noted that the ends of each of the four rope slings are attached to a bar carried between the side members of a box-shaped brake arm, while the loops are carried on four small pulleys attached to a small block and fall. One end of the light cable used in the block and fall is attached to the brake arm, while the other end passes around the horizontal shaft of a small worm wheel carried on the brake arm. The shaft of the meshing worm is vertical and carries a pin, the ends of which can move



View of the paper dynamometer drums suspended from hangers underneath floor of testing room. Note prony brake and motor used in driving drums when making measurements of rolling friction.

vertically without restraint in a slotted sleeve carried on the lower end of a shaft which projects upward through the floor to a control wheel on the floor above. Turning the hand wheel varies the pull on the cable of the block and fall, and thus tightens or loosens the rope slings with corresponding variation in the load imposed upon the brake. The pulley system of the block and fall serves to equalize the pull on the rope slings and assists in giving a smooth and easily operated brake. The wooden blocks shown on the brake surface are grooved to receive the rope strands, and act only as separators.

The slotted sleeve does not interfere with free motion of the brake arm, the pull on which is measured on a platform scales through the linkage shown, due allowance being made for tare.

Between the two drums and mounted upon the same shaft is a second pulley to which is belted a 15-hp. variable speed electric motor which is capable of driving the drums at any speed from 20 to 40 m.p.h. By its use it is possible to determine readily the rolling friction of both the front and rear wheels of the car. An electric tachometer driven off the drum shaft is used to make approximate speed readings, these being checked by means of a positively driven revolution counter and a stop-watch.

Fuel consumption is measured by determining the difference in weight of a tank containing the fuel at the beginning and end of runs. This tank rests on sensitive scales which are kept balanced while adjustments for the run are being made. When the scale beam falls it closes an electric contact which rings a bell and, through a system of magnets, starts the stop-watch and the revolution counter. The counterweight on the fuel scales is then reset to indicate a certain decrease in weight, usually four to six ounces. When the beam again falls, showing that the amount of fuel in question has been used, the electric circuit is again closed and the stop-watch and revolution counter are automatically stopped. This gives positive and simultaneous measurements of time, fuel consumption and revolutions of the drums, from which readings the speed and rate of fuel consumption are readily figured. The fuel tank is connected to the carbureter by flexible rubber tubing which does not interfere with weight measurement.

Very few cars have sufficient radiation and fan capacity to dissipate all the heat which is absorbed by the jacket water when the engine is operating under full load. It is therefore customary to connect to the radiator drain cock a rubber tube through which cold water from the street mains is mixed with hot water at the base of the radiator in sufficient quantity to prevent boiling of water leaving the engine jacket. It is thus possible to operate the engine with a fairly high jacket temperature but without danger from overheating.

How Tests Are Conducted

The object of the average test made with the apparatus described is to determine the power and economy of the car as a whole, as well as that of the engine under various loads including maximum load and at various speeds. By proper use of the measurements secured in making these tests it is possible to predict within close limits the performance of the car on the road, in particular to learn its rolling resistance and the amount of excess power available for acceleration and hill climbing. Perhaps the most interesting and enlightening tests of all are those made to determine rolling resistance, since it is these measurements, taken together with the computed wind resistance, which determine what load is to be imposed to duplicate the condition of driving on a level road at the various speeds to be considered.

The procedure is as follows:

The front wheels of the car are first placed on the drums and the back wheels are blocked to prevent any fore-and-aft motion. The tires are inflated to the pressure recommended by the tire manufacturer for the size and type of tire in question and this pressure is recorded. The band of the prony brake is slackened so that it is held in contact with the drums only by its own weight. The electric motor which drives the car drums is then started and the drums are turned successively at speeds of 10, 20, 30 and 40 m.p.h. At each speed the r.p.m., brake scale reading and the electrical power input to the motor, as indicated by readings of the voltmeter and ammeter, are noted. The car is then removed from the drums, and the same test repeated, except that the brake band is tightened to give precisely the same volt and ammeter readings as before at the same speed. The increase in the brake scale reading thus becomes a precise measure of the rolling friction of the front wheels, all question as to the efficiency of the electric motor and its belt drive being automatically eliminated so far as results are concerned.

Following this test, the rolling friction of the rear wheels is measured in precisely the same way, this test being made with the change gears in neutral position. The rolling friction of the rear wheels includes, of course, the friction of the reduction gears in the axle housing and that of the propeller shaft and its joints, and the primary shaft of the gearset. It is realized that the friction thus measured is not necessarily the same as that when the parts involved are driving under load, but the difference is probably small, especially at light loads.

Adding the rolling friction of the front wheels to that of the rear wheels and their connecting elements gives, approximately, the total rolling resistance of the car. If

to this be added the wind resistance, we have a measure of the total resistance to motion of the car on a hard, level road or the drawbar pull required to tow the car at the several speeds in question. For the purposes of the test the projected frontal area of the car in square feet is measured and this is multiplied by 0.003 times the square of the speed to give the total wind resistance.

The tractive effort, or reaction of the driving wheels against the ground at uniform speed on a level road must, of course, just equal the rolling resistance of the front wheels, plus the wind resistance at that speed. These factors having been determined from the tests and computations already described, it is an easy matter to make a test substantially duplicating road conditions by simply applying to the car the equivalent brake load. To do this the car is placed with its driving wheels on the drums and is anchored by chains attached to the rear axle and fastened to a horizontal shaft parallel to the rear axle of the car and about the same height above the floor to which it is firmly secured. The front wheels are again blocked and tests made at 10, 20, 30 and 40 m.p.h. as before. There are two tests at each speed, one with a load setting corresponding to level road resistance, and the other at wide open throttle. The difference in power developed as between these two load conditions is, of course, the power available for acceleration or hill climbing. Knowing this power, it is a simple matter to compute the maximum grade which the car can climb in high gear at the particular speed, or its ability to accelerate.

Adding the power developed at the rear wheels to the friction horsepower as computed from the rolling resistance of the rear wheels, already measured, we have the approximate brake horsepower of the engine. Knowing this and the rate of fuel consumption in each of the power tests referred to, the brake m.e.p., fuel consumption per b.hp. and the other data given in Table I are readily deduced.

A Study of the Test Results

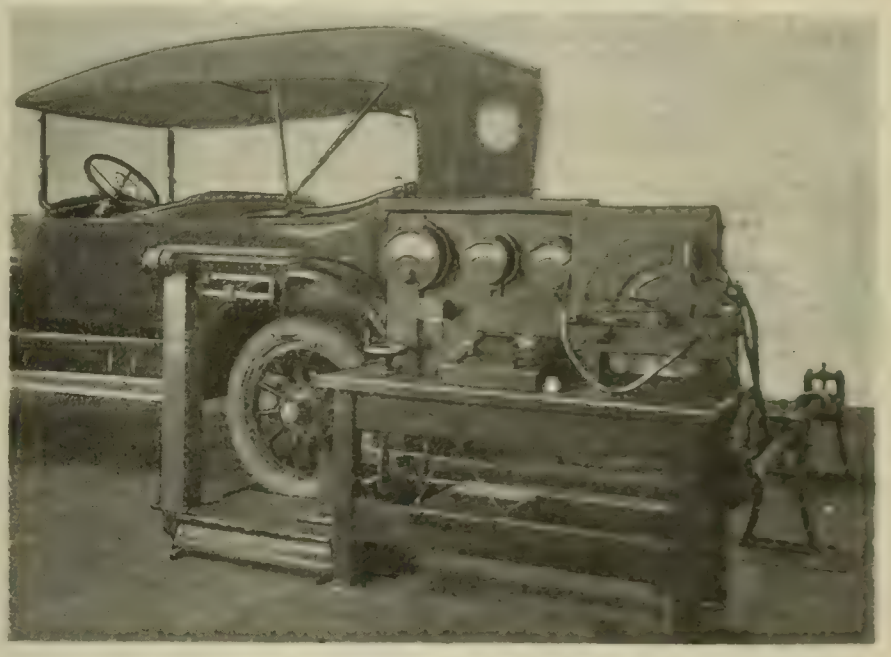
A study of the results of a number of the tests made during the last five years reveals many highly interesting facts which are worthy of study. During this period, upward of 100 cars and a number of trucks have been tested. From these tests some 20 covering a number of representative cars and trucks of various sizes and in various price classes have been selected for tabulation and comparison here. No special effort was made to select test data which reflected particularly meritorious performance, but the data given are thought to be, in general, fairly representative of average performance. In most cases the cars tested were not especially tuned up for the test, but were brought to the laboratory and tested without readjustment, in the same condition under which they were being used by owners. For this reason the tests are not to be regarded, at least in most cases, as indicative of the best performance possible, but rather of a general average performance encountered in normal service.

It will be noted that the cars to which the data applies are not of the same age and have not been operated the same number of miles. The price classification is only approximate and refers rather to the present prices of the same or equivalent chassis than to the price in the year when the car was manufactured. Thus, if a car purchased in 1918 cost $2,500 and the same or an equivalent new chassis now sells for $1,900, that car is placed in the $1,500 to $2,000 class. The price classification refers also to the open phæton, usually the five-passenger model, even though the particular chassis tested was fitted with a more expensive closed body. The weight given is, however, the actual weight of the car as tested.

Only a few of the possible comparisons which can be made will be discussed here, since it is evident that various readers will be interested from different angles, but it will be found that the figures are worthy of careful study as an index of general everyday performance.

Rolling Friction

The rolling friction of front wheels is made up of three elements which are not easily separated. They are the friction of the tire itself, friction of the bearings and windage of the wheel turning in the air. Frictional losses in the tire are encountered because of the kneading of tne fabric and the rubber as successive sections pass between the wheel and the road. If the casings were perfectly elastic these losses would not occur, that is, the work done in compressing the casing material would all be given back



Car in position for test on the dynamometer. The rear axle of the car is connected by chains to the shaft seen in back of the control table. The chains prevent the car from moving forward.

when the tire again assumes its normal shape. No solid materials are perfectly elastic, and even the best grades of rubber and fabric are a long way from being so, consequently there is a material loss in internal friction which, of course, manifests itself in heat. This frictional loss is much the greatest of the three front wheel losses, the other two being practically negligible at ordinary speeds. Tire losses increase with the load upon the tire and with decrease in inflation pressure, due presumably to the greater deformation under both of these conditions.

It is interesting to note that the rolling friction of a fabric tire is about 50 per cent greater than that of the same size cord tire. This is shown clearly by reference to the results given in the table under the head of rolling resistance of front wheels. Take, for example, cars F and G, which weigh about the same and have the same size of tires inflated to the same pressure, but F having the cord and G fabric tires. The respective rolling resistance is 20.4 and 31 lb. The rolling resistance of front tires is substantially the same in most cases at 20 and at 40 m.p.h., that is, the rolling friction is practically independent of speed, but, of course, the power loss increases directly as the speed. It amounts, in the cases cited, to 1.08 and 1.66 hp. respectively at 20 m.p.h. and to double this at 40 m.p.h. for both front wheels.

The highest front wheel resistance recorded for pneumatic tires is 38 lb. for 36 x 4½-in. cord tires carrying 2565 lb. This is equivalent to 30.2 lb. per ton. The lowest resistance for a pair of front wheels is 17 lb., the tires in this case being 34 x 4-in. cords carrying 1575 lb. or 21.6 lb. per ton.

The rolling resistance of the rear wheels, which, as explained, included the friction of axle bearings and reduc-

Table 1—Results of Rear Wheel Dynamom

CLASS	Speed M.P.H.	Under $600		$600 to $1000		$1000 to $1500			$1500 to $2000			$2000 to $3000		Over $3000					
Car		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Year—Model		1918	1921	1915	.....	1916	1922	1920	1921	.....	1916	1923	1916	1918	1921	1917	1920	1920	1916
No. of Cylinders		4	4	4	4	4	4	6	6	8	6	6	8	8	12	6	4	6	6
Bore and Stroke—Inches		3¾x4	3 11/16x4	3⅞x4½	3⅝x4½	3¾x5½	3⅝x4½	3⅜x4½	3⅞x5	2⅞x4¾	3½x5	3½x4	3¼x5	3⅛x5⅛	3x5	3¾x5⅛	3¾x6¾	4½x5½	4⅜x6½
Piston Displacement—Cu. Ins.		177	171	212	186	243	185.8	241.6	353.8	247	288	199	332	314	424	340	298	525	585
H.P. Rating		22.5	21.8	24.03	21	22.0	21	27.3	36	26.5	29.4	25.4	33.8	31.25	43.2	33.7	22.5	48.6	45.7
Wheel Base—Inches		100	102	108	109	119	118	118	126	120	123	116	125	125	135	136	132	142	143.5
Weight Lbs. on Wheels—Front		860	1050	1190	990	1575	1390	1440	1600	1510	1560	1380	.....	2000	2250	1800	1825	2300	2565
Weight Lbs. on Wheels—Rear		945	1200	1310	1120	1815	1610	1475	1800	1730	1660	1660	.....	2300	2585	2000	2235	3000	2615
Weight Lbs. on Wheels—Total		1805[1]	2250[1]	2500	2110	3390	3000	2915	3400	3240	3220	3040[1]	3675	4390	4835	3800	4060	5300	5180
Front Tires—Size		30x3½	31x4	33x4	30x3½	34x4	33x4	33x4	33x4½	34x4½	34x4	32x4	34x4	35x5	35x5	34x4½	32x4½	35x5	36x4½
Front Tires—Type and Tread		F-N	F-S	F-N	F-S	C-R	C-R	F-S	C-S	F-N	-N	C-R	.....	C-N	C-R	C-R	C-N	C-N	C-N
Front Tires—Infl'n Press.		60	70	60	65	60	65	65	65	70	80	60	65	60	60	55	45	80	80
Rear Tires—Size		30x3½	31x4	33x4	30x3½	34x4	33x4	33x4	33x4½	34x4½	34x4	32x4	34x4	35x5	35x5	34x4½	32x4½	35x5	37x5
Rear Tires—Type and Tread		F-N	F-N	C-N	F-N	C-R	C-N	F-N	C-N	F-N	-N	C-N	C-N	C-N	C-N	C-R	C-N	C-N	C-N
Rear Tires—Infl'n Press.		60	70	65	70	60	65	65	65	70	80	60	65	60	65	60	65	80	90
Gear Ratio		3.63	3.67	3.62	3.55	4.0	5.0	4.0	3.7	4.92	4.08	4.33	4.9	5.2	4.36	3.69	3.62	3.52	3.12
Frontal Area—Sq. Ft.		21.6[1]	24.1	20.4	16.	21.2	27.	21.2	21.3	18.	22.0	28.0[1]	22.5	25.	25.	20.	18.3	23.0	32.5
Miles Run to Date		5,000	300	50,000	1,050	34,000	4,800	3,500	10,700	.....	9,260	500	35,000	7,800	10,100	12,000	8,500	15,000	20,000
Rolling Resistance Front Wheels—Lbs.	20	20.4	27	31	20	17	20.4	31	17.3	32	35	21.6	34	30.5	28	27.	27.2	35	38
	40	20.4	.....	32	20	17	20.4	31	17.3	32	35	21.6	34	33.5	30	28.5	27.2	35	8
Rolling Resistance Rear Wheels—Lbs.	20	54.9[4]	34	33	25	34	28	44	44.4	52	46	32.5	34	56.5	57	40.5	61.0	79	47.5
	40	54.9	.....	35	27	34	35	44	44.4	54	48	35.5	34	57.5	57	40.5	61.0	79	50.0
Rolling Resistance Complete Car—Lbs.	20	75.3[4]	61	64	45	51	48.4	75	61.7	84	81	55.1	68	87	85	68.5	88.2	114	85.5
	40	75.3	.....	67	47	51	55.4	75	61.7	86	83	57.1	68	91	87	69.0	88.2	114	88.0
Wind Resistance, Various Speeds, Lbs.	10	6.5	7	6.0	4.8	6	8.1	6.4	6.4	5.4	7	8.4	6.7	7.5	7.5	6.0	.. ..	6.9	9.75
	20	26.0	29	24	17.2	25	32.4	25.6	25.6	21.6	26	33.6	27	30.5	30.5	24	22	27.6	39.0
	30	58.5	65	55	47	57	72.9	57.6	57.6	48.6	59	75.6	60	67.5	67.5	55	49.5	62.1	88.0
	40	104.0	.....	96	77	102	129.6	102.8	102.8	86.4	105	134.4	108	120	120	96	88.0	110.4	156
Tractive Effort, Level Road, Lbs.	10	26.9	34	37	24.8	23	28.5	37.4	24	37.4	42	30.0	40.7	36.5	34.5	33	.....	41.9	48
	20	46.4	56	55	37.2	42	52.8	56.6	43	53.6	61	55.2	61	61	58	51.5	49.2	62.6	77
	30	78.9	92	86	67	74	93.3	88.6	75	80.6	94	97.2	94	100	96.5	83	76.7	97.1	126
	40	124.4	.....	128	97	119	150.0	133.8	12	118.4	140	156.0	142	153.5	150	124.5	115.2	145.4	194
Maximum Tractive Effort Direct Drive—Lbs.	10	161	.....	202	232	305	290	356	380	412	413	267	.....	580	584	430	.....	.....	.....
	20	198	224	239	263	334	282	250	368	375	418	272	462	577	619	480	359	.....	653
	30	174	194	252	222	310	276	310	369	353	418	224	450	565	621	470	341	695	650
	40	124	.....	247	175	260	218	270	327	272	376	180	340	540	537	432	330	612	610
Maximum Grade Direct Drive—Per Cent.	10	6 9	.....	6.2	8.8	7.7	8.3	10.4	10	11.0	11.0	7.8	.....	12.0	11.0	10.0	.....	.....	.....
	20	7.8	7.0	6.9	9.8	7.9	7.3	9.6	9.2	9.4	10.6	6.8	10.4	11.3	11.3	10.8	7.4	.....	10.6
	30	4.9	4.2	6.3	6.8	6.4	5.8	7.2	8.3	7.5	9.6	4.2	9.3	10.1	10 5	9.8	6.3	11.0	9.7
	40	.....	.....	4.5	3.5	3.8	2.2	4.4	5.8	4.5	7.0	0.8	5.1	8.3	7.8	7.7	5.1	8.6	7.7
Rear Wheel H.P. Level Road	10	0.72	0.92	0.99	.....	0.61	0.76	1.0	0.63	1.0	1.12	0.8	1.1	0.97	0.92	0.88	.....	1.12	1.28
	20	2.48	2.99	2.93	.....	2.24	2.82	3.02	2.29	2.86	3.25	2.94	3.5	3.26	3.09	2.75	2.62	3.34	4.03
	30	6.32	7.36	6.88	.....	6.00	7.46	7.09	5.99	6.55	7.50	7.76	7.5	8.0	7.72	6.64	6.13	7.75	9.95
	40	13.29	.....	13.65	10.38	12.71	16.0	14.27	12.75	12.6	15.0	16.6	15.2	16.4	16.0	13.27	12.28	15.51	20.5
Rear Wheel H.P. Maximum Developed	10	4.3	.....	5.4	6.21	8.1	7.7	9.5	10.17	11.0	11.0	7 1	.....	15 45	15.6	11.47	.....	.....	.....
	20	10.6	12.0	12.8	14.13	17.8	15.1	18.7	19.60	20.0	22.2	14.5	24.7	30.8	33.0	25.60	19.1	.....	34.8
	30	13.9	15.5	20.2	17.78	24.8	22.1	24.8	29.60	26.8	33.4	17.9	36.0	45.0	49.7	37.60	27.3	55.6	52 1
	40	13.29	.....	26.4	18.65	27.7	23.3	28.8	34.90	29.0	40.1	19.2	36.3	57.5	57.2	46.1	35.2	65.2	65.0
H.P. Lost—Transmission and Rear Tires	10	1.47	0.91	0.88	0.64	0.91	0.69	1.17	1.17	1.36	1.23	0.87	0.91	1.49	1.52	1.08	.....	2.11	1.23
	20	2.93	1.81	1.76	1.34	1.81	1.49	2.35	2.34	2.77	2.45	1.79	1.81	3.02	3.04	2.16	3.26	4.21	2.60
	30	4.40	2.72	2.72	2.08	2.72	2.40	3.52	3.50	4 24	3.75	2.76	2.72	4.56	4.56	3.24	4.88	6.32	3.91
	40	5.86	.....	3.74	2.89	3.63	3.74	4.69	4.68	5.76	5.12	3.78	3.62	6 11	6.08	4.32	6.51	8.42	5.34
Brake H.P. Required Level Road	10	2.19	1.83	1.87	.....	1.52	1.45	2.17	1 80	2.36	2.35	1 67	2.01	2.46	2.44	1.96	.....	3.23	2.51
	20	5.41	4.80	4.69	.....	4.05	4.31	5.37	4.63	5.63	5.70	4.73	5.31	6.28	6.13	4.91	5.88	7.55	6.63
	30	10.72	10.08	9.60	.....	8.72	9.86	10.61	9.51	10.79	11.25	10.52	10.22	12.56	12.28	9.88	11.01	14.08	13.86
	40	19.15	.....	17.39	13.27	16.34	19.74	18.96	17.43	18.36	20.12	20.38	18.82	22.46	22.08	17.59	18.79	23.93	25.84
Brake H.P. Maximum Developed	10	5.8	.....	6.3	6.85	9.0	8.4	10.7	11.27	12.36	12.23	7.97	.....	16.94	17.1	12.55	.....	.....	.....
	20	13.5	13.8	14.6	15.47	19.6	16.6	21.1	21.94	22.77	24.65	16.29	26.51	33.82	36.0	27.76	22.4	.....	37.4
	30	18.3	18.2	22.9	19.86	27 5	24.5	28.3	33.12	31.04	37.15	20.66	38.72	49.56	54.3	40.84	32.2	61.9	56.0
	40	19.15	.....	30.1	21.54	31.4	27.0	33.5	39.58	34.76	45.22	72.98	39.92	63.61	63.3	50.42	41.7	73.6	70.3
Brake M.E.P. at Maximum Load	10	64	.....	64	73	74	73	86	67	82	83	74.2	.....	85	82	78	.....	.....	.....
	20	74	81	74	83	81	72	85	65	76	84	75.8	65.2	85	86	86	67	.....	89
	30	67	72	77	71	76	71	76	65	68	84	64.0	63.2	83	86	85	64	99	88.5
	40	53	.....	76	58	65	58	68	59	57	77	53.4	49.0	80	76	79	62	88	83
Fuel, Lbs. per B. H.P. Level Road	10	1.38	2.31	1.29	.....	1.63	2.3	1.05	2.25	1.65	1.59	1.40	1.80	1.50	1.78	1.35	.....	1.20	2 2
	20	1.14	1.50	0.97	.....	1.30	1.65	1.05	1.80	1.43	1.45	1.02	1.54	1.35	1.48	1 20	1.08	1.32	1.55
	30	0 96	1.14	0.85	.....	1.08	1.27	1.05	1.37	1.27	1.10	0.82	1.30	7.13	1.27	1.03	0.98	1.25	1.28
	40	0.91	.....	0.80	1.10	0.92	1.07	0.95	1.2.	1.15	0.85	0.72	1.09	1.06	1.11	0.95	0.90	1.05	1.09
Fuel, Lbs. per B. H.P. Maximum Load	10	0.96	.....	1.2	0.88	0.84	0.96	0.8	1.23	0.73	0.82	0.71	.....	0.73	0.78	0.67	.....	.....	.....
	20	0.76	0.99	0 90	0.85	0 81	0 97	0.8	1 04	0.86	0.72	0 62	0.83	0 74	0.74	0.66	0.69	.....	0.85
	30	0.76	0.97	0.88	0.92	0 79	0.98	0.81	0 991	0 97	0.66	0.63	0.84	0.75	0.76	0.65	0.67	0.67	0.82
	30	0.91	.....	0.83	1.06	0.77	1.02	0.82	1.08	1.05	0.67	0.72	0.95	0.76	0.79	0.64	0.65	0.71	0.77
Miles per Gallon on Level Road	10	21.1	14.6	25.6	.....	25.4	18.7	27.0	15.2	15.8	16.3	26.3	17.0	16.6	14.1	23.0	.....	15.9	11.0
	20	20.0	17.1	27.0	.....	22.9	17.4	21.8	14.8	15.3	15.3	25.6	15.0	14.5	13.5	20.7	19.3	12.3	11.8
	30	18.0	16.0	22.5	.....	20.2	14 8	16.5	14.2	13.5	15.3	21.4	13.8	13.0	11.8	18.0	17.7	10.5	10.3
	40	14.1	.....	17.6	16.8	16.0	11 7	13.7	11.2	11.6	14.3	16.75	12.0	10 3	10.0	14.6	13.6	9.8	8.6
Miles per Gallon at Maximum Load	10	11.2	.....	8.2	10 2	7.5	7.7	7.2	4.4	6.8	6.0	10 9	.....	4.9	4.6	7.2	.....	.....	.....
	20	11.9	9.0	9.6	9.3	8.1	7.7	7.3	5.4	6.3	6.9	12.2	5.0	4.9	4 6	6.7	8.2	.....	3.8
	30	13 0	10.4	9.2	10 1	8.9	7.7	8 0	5 6	6.12	7.5	14.2	5.7	5.0	4.6	6.9	8.6	4.3	4 0
	40	14 1	.....	9 8	10.7	9.5	9 0	8 95	5.75	6.8	8.0	14.9	6.5	5.1	4 9	7.6	8.6	4.7	4.5

[1] Closed body, all others open types.
[2] Steam car.
[3] Based on indicated horsepower.
[4] Has planetary gearset which produces abnormal friction when rear wheels are driven with lever in neutral position.
F—Fabric.

eter Tests.

STEAM	TRUCKS				CLASS
S[2]	Speed M.P.H.	T	U	V	Car
1918			1919		Year—Model
2		4	4	4	No. of Cylinders
4x5		3¾x5	4⅛x4½	4¾x6	Bore and Stroke—Inches
		220	240	425.3	Piston Displacement—Cu. Ins.
20		22.5	27.0	36.0	H.P. Rating
130		132	130	160.5	Wheel Base—Inches
1,705		1,585	1,700	4,520	Weight Lbs. on Wheels—Front
2,215		1,880	1,760	6,625	Weight Lbs. on Wheels—Rear
3,920		3,465	3,460	11,145	Weight Lbs. on Wheels—Total
35x4½		35x5	34x4½	36x5	Front Tires—Size
		F-N	F-N	-S	Front Tires—Type and Tread
		90	75	Solid	Front Tires—Infl'n Press.
35x4½		35x5	34x4½	40.5	Rear Tires—Size
		F-N	F-N	-S	Rear Tires—Type and Tread
		90	75	Solid	Rear Tires—Infl'n Press.
1.5		6.0	4.6	9.56	Gear Ratio
25.3		23	22	46.0	Frontal Area—Sq. Ft.
16,500		250		305	Miles Run to Date
20	10	31	26	83	Rolling Resistance Front Wheels—Lbs.
20	20	31	26	83	
63	10	64	35	201	Rolling Resistance Rear Wheels—Lbs.
63	20	64	36	212	
83	10	95	61	284	Rolling Resistance Complete Car—Lb.
83	20	95	62	295	
7.6	10	7	6.6	13.8	Wind Resistance, Various Speeds, Lbs.
30.4	15	16		31	
68.4	20	28	26	56	
121.6	25	43			
27.6	10	38	32.6	96.8	Tractive Effort, Level Road, Lbs.
5 .4	15	47		114	
88.4	20	59	52	139	
141.6	25	74			
763	10	413	300	1,009	Maximum Tractive Effort Direct Drive—Lbs.
367	15	400	322	870	
212	20	363	385	640	
143	25	315	360		
18.5	10	10.4	7.4	8.1	Maximum Grade Direct Drive—Per Cent.
7.8	15	9.8		6.7	
3.0	20	8.5	9.3	4.4	
	25	6.7			
0.74	10	1.01	0.87	2.58	Rear Wheel H.P. Level Road
2.70	15	1.90		4.55	
7.1	20	3.15	2.77	7.41	
15.1	25	4.90			
20.3	10	11.0	8.0	27.0	Rear Wheel H.P. Maximum Developed
19.6	15	16.0	12.8	34.8	
17.0	20	19.3	20.5	34.2	
15.3	25	21.0	24.0		
1.68	10	1.71	0.93	5.37	H.P. Lost—Transmission and Rear Tires
3.4	15	2.57	1.4	8.25	
5.0	20	3.42	1.92	11.30	
6.7	25	4.28	2.4		
2.42[3]	10	2.72	1.80	7.95	Brake H.P. Required Level Road
6.1[3]	15	4.47		12.80	
12.1[3]	20	6.57	4.69	18.71	
21.8[3]	25	9.2			
22[3]	10	12.7	8.9	32.4	Brake H.P. Maximum Developed
22[3]	15	18.6	14.2	43.1	
22[3]	20	22.7	22.4	45.5	
22[3]	25	25.3	26.4		
246[3]	10	79	65.0	77	Brake M.E.P. at Maximum Load
123[3]	15	78	69.0	68	
83[3]	20	71	81.5	54	
62[3]	25	63	77.0		
1.83[3]	10	1.08	2.50	1.50	Fuel, Lbs. per B. H.P. Level Road
1.55[3]	15	1.08		1.25	
1.35[3]	20	1.08	1.48	1.13	
1.17[3]	25				
	10	0.83	1.42	0.79	Fuel, Lbs. per B. H.P. Maximum Load.
	15	0.83	1.34	0.81	
1.17[3]	20	0.80	0.94	0.86	
1.17[3]	25	0.83	0.75		
15.0	10	20.6	13.7	5.2	Miles per Gallon on Level Road
14.1	15	18.9		5 8	
12.2	20	17.1	17.7	5.8	
10.3	25				
	10	5.75	4.9	2.4	Miles per Gallon at Maximum Load
	15	5.9	4.9	2.6	
7.8	20	6.7	5.8	3.1	
10.2	25	7.25	7.8		

C—Cord. S—Smooth tread.
N—Non-skid tread. R—Ribbed tread.

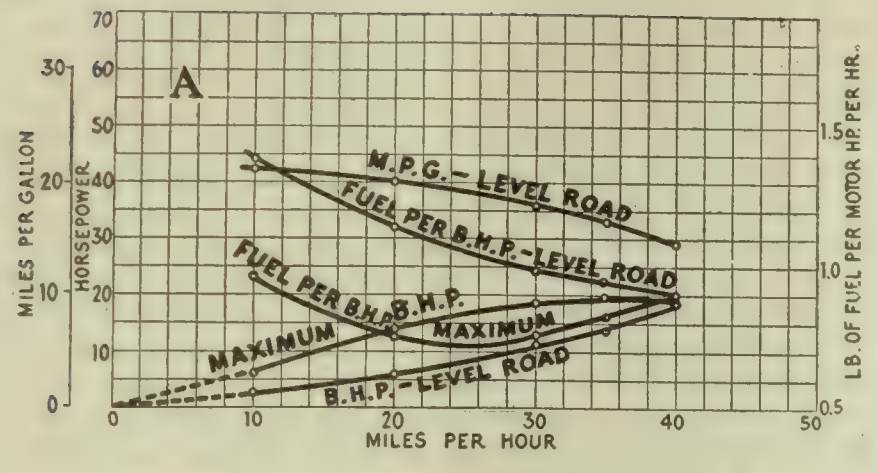
tion gears, propeller shaft and primary shaft of gearset, is in nearly all cases from 50 to 100 per cent higher than that of the front wheels, indicating that the friction of parts other than the tires is, in this case, a material factor. The divergence as between different cars is considerable, the resistance varying from a minimum of about 25 lb. to a maximum of 79 lb. in the case of pneumatic-tired vehicles. The weight of the rear wheels in these two cases was 1120 and 3000 lb. respectively, the resistance in pounds per ton being 44.7 in the first case and 52.7 in the second. In most cases the resistance is slightly higher at 40 m.p.h. than at lower speeds, but the difference is not great. Rolling resistance of the entire car is, of course, the sum of the resistance considered under the two preceding heads. That it varies materially as between various cars even of the same weight and tire equipment is at once evident from inspection of the tabulated data. A part of this difference is no doubt due to variations in adjustment and lubrication but it is a noteworthy fact that material differences do exist and that in many cases the cause could be easily remedied with considerable saving in power and fuel as well as in wear if the fault were more generally recognized.

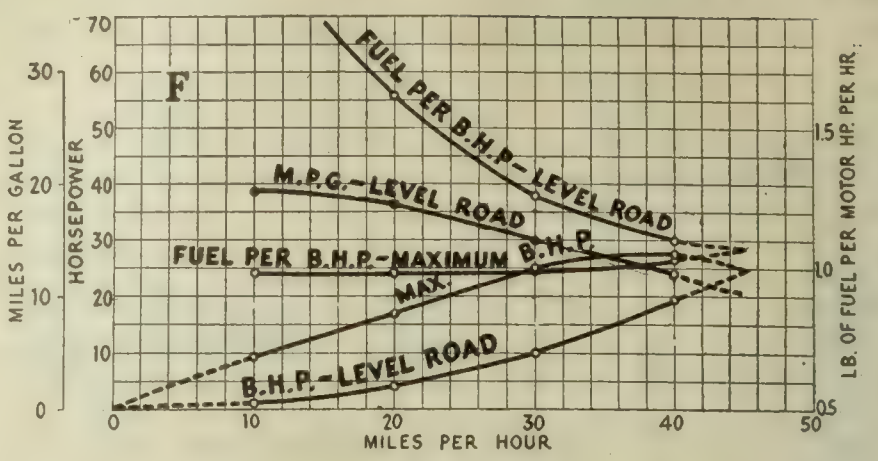
If the rolling resistance figures are reduced to a comparative basis, that is expressed in pounds per ton, it will be found in most cases that cars equipped with cord tires have an average total rolling resistance of about 35 lb. per ton as against 50 or more lb. per ton with fabric tires. If we compare some rather extreme cases, say that of cars E and G in the same price class and weighing respectively 3390 and 2915 lb. both having 4-in. tires, the first cords and the second fabric type, we find that car E has a total rolling resistance of 51 lb. or 30.1 lb. per ton, while car G has a resistance of 75 lb. or 51.4 lb. per ton, an increase of over 70 per cent. In terms of power required for propulsion on a level road, wind resistance not included, the figures are respectively 2.72 and 4.0 hp. actual, or 1.6 and 2.74 hp. per ton at 20 m.p.h. At 40 m.p.h. the power required is twice as great. The differences may not seem material as compared to the maximum power capacity of the engine, but when it is realized that under the light loads involved the engines in question use 1.05 and 1.30 lb. of fuel per b. hp. respectively it is evident that the economy can be materially improved by avoiding unnecessary power losses.

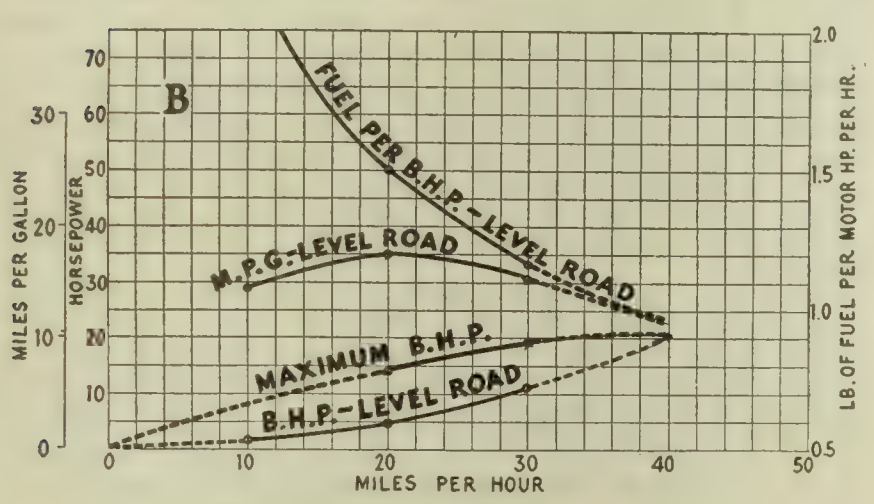
Wind Resistance and Tractive Effort

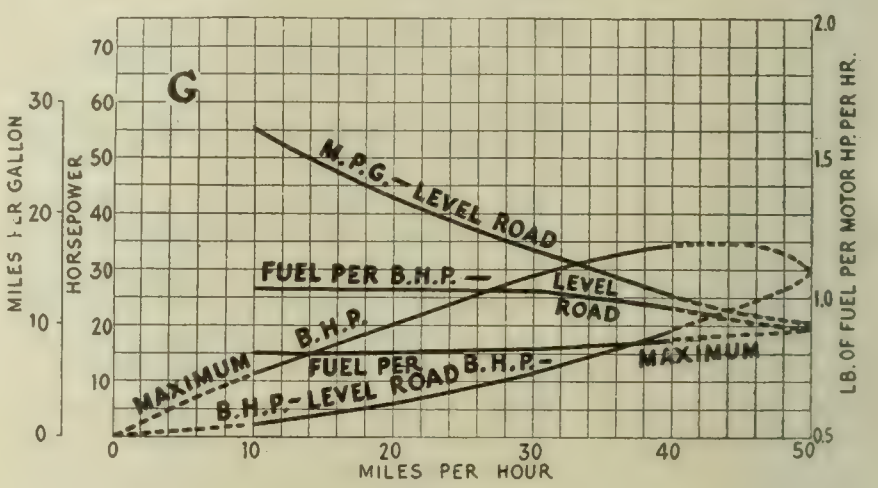
The figures on wind resistance in the table are computed, as already explained, by determining the projected frontal area of the car and multiplying the number of square feet by 0.003, the square of the speed in m.p.h. This, of course, is only an approximation, since the wind resistance is materially affected by the stream lines of the body, but it serves well enough for comparative purposes. According to the figures given frontal areas vary from 16 to 32.5 sq. ft. on the passenger cars listed. No doubt these areas could be decreased in some cases by improved body design, but precise methods of measuring wind resistance are needed before the effect of such changes can be predicted with certainty. It will be noted that the wind resistance becomes a factor of some importance even at speeds as low as 20 m.p.h. At higher speeds or when driving against the wind, the wind resistance, according to the method of figuring here employed, is shown to exceed in amount other level road resistance factors.

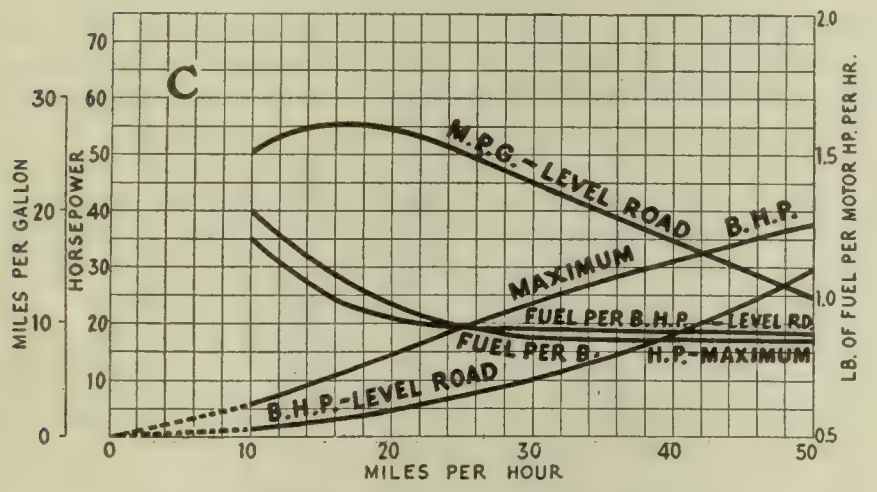
The figures in the column headed "tractive effort, level road," in the table are obtained by simply adding together the wind resistance and the front wheel resistance. This gives the pull which must be exerted at the periphery of the driving tires to propel the vehicle on a hard, level road at the various speeds indicated. In testing cars on

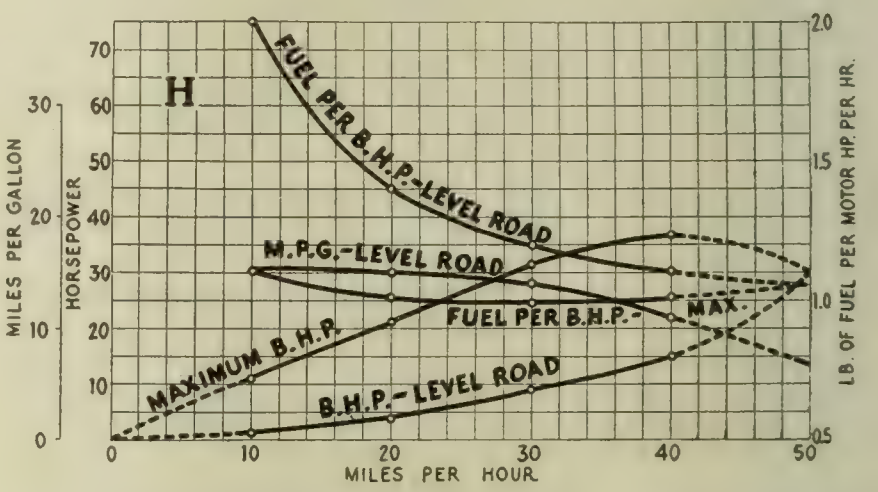


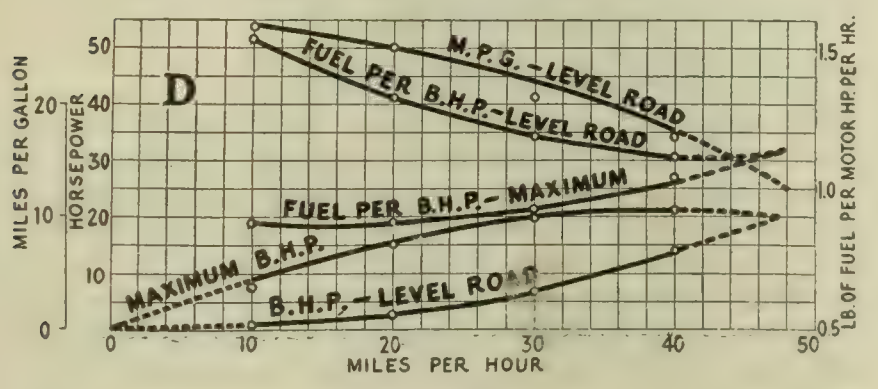


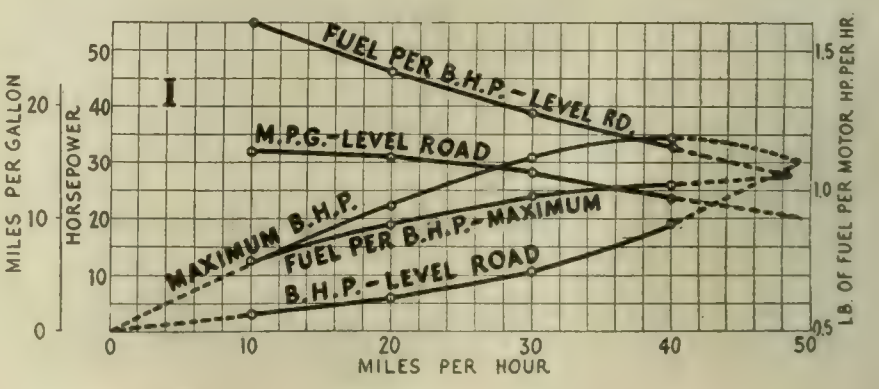


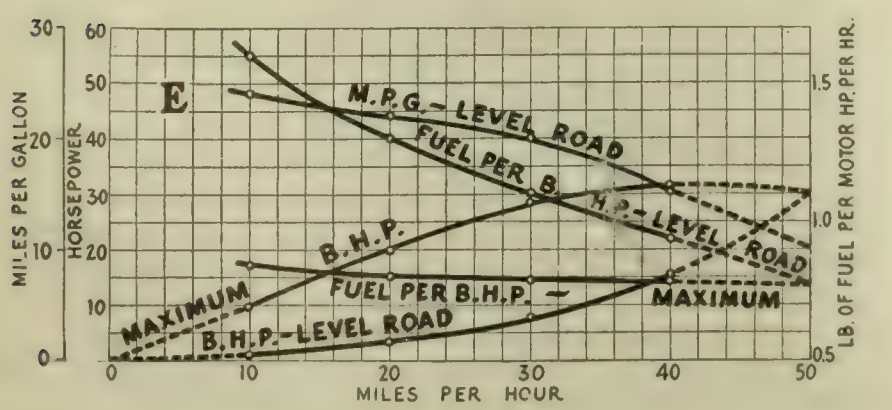


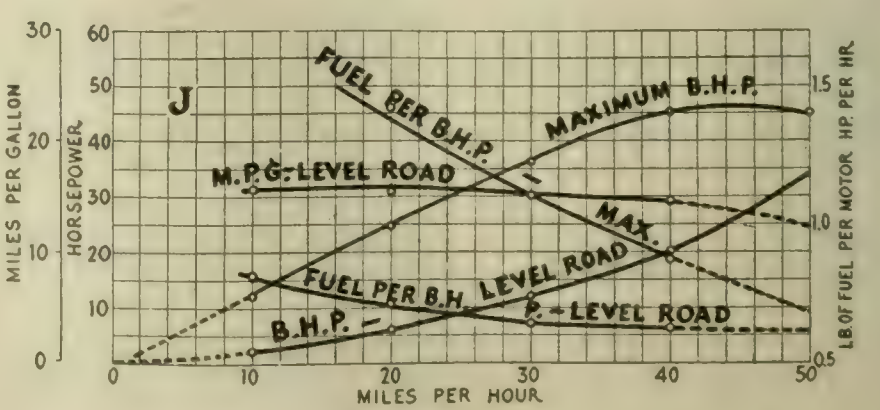




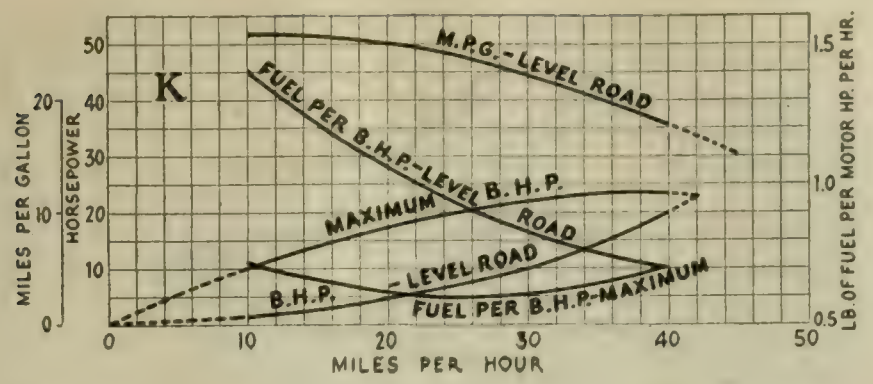


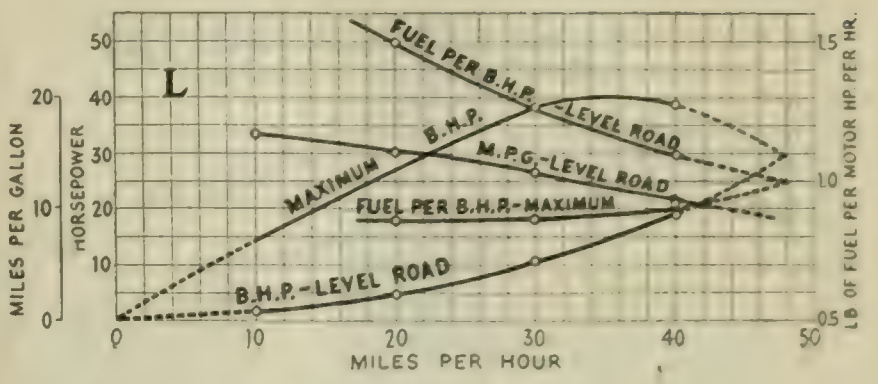


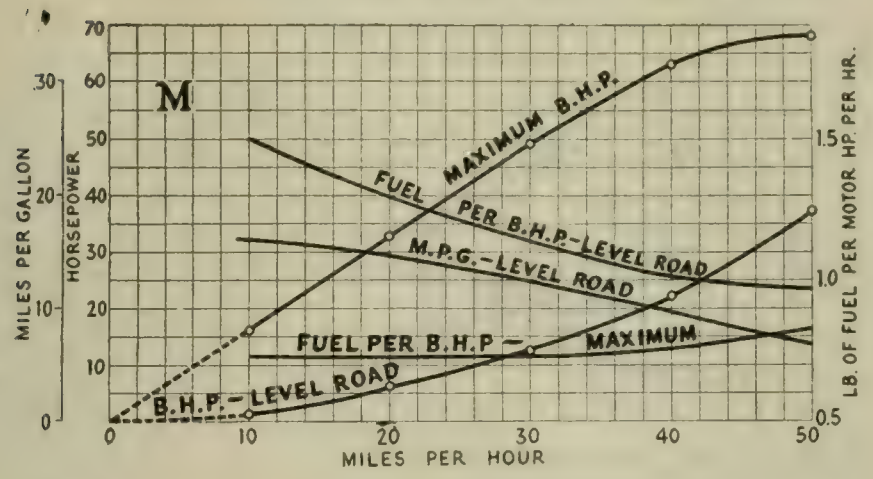


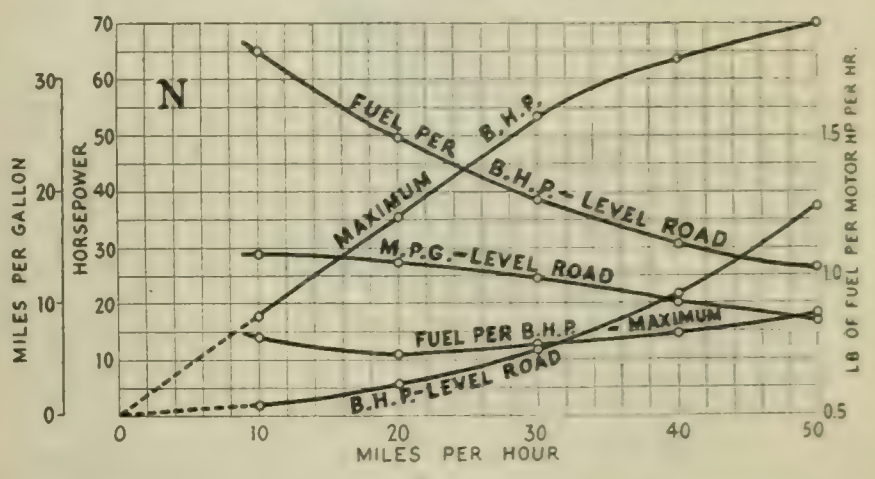


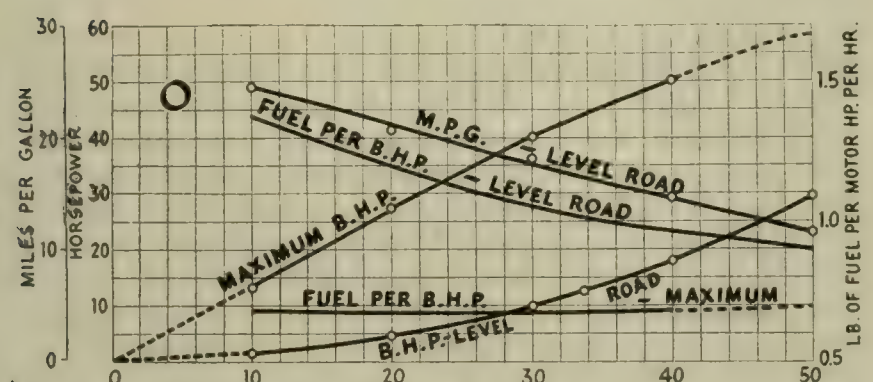
Performance curves of passenger cars A to J.

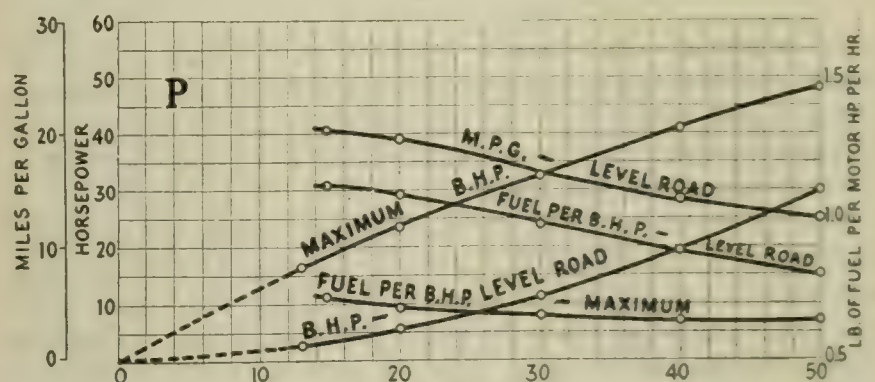


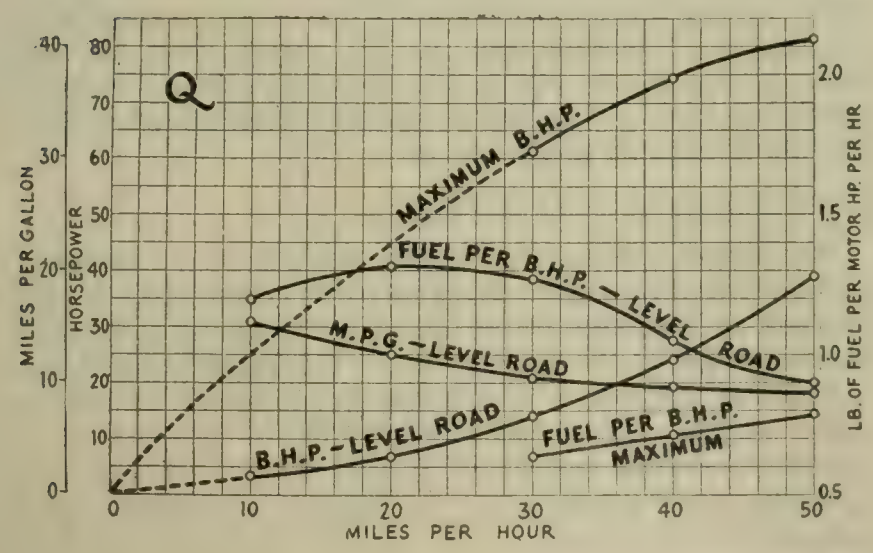


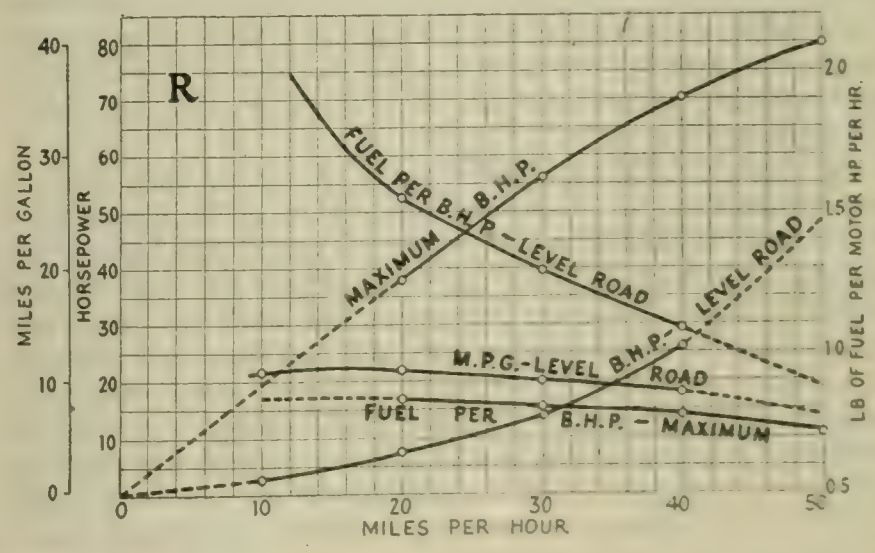








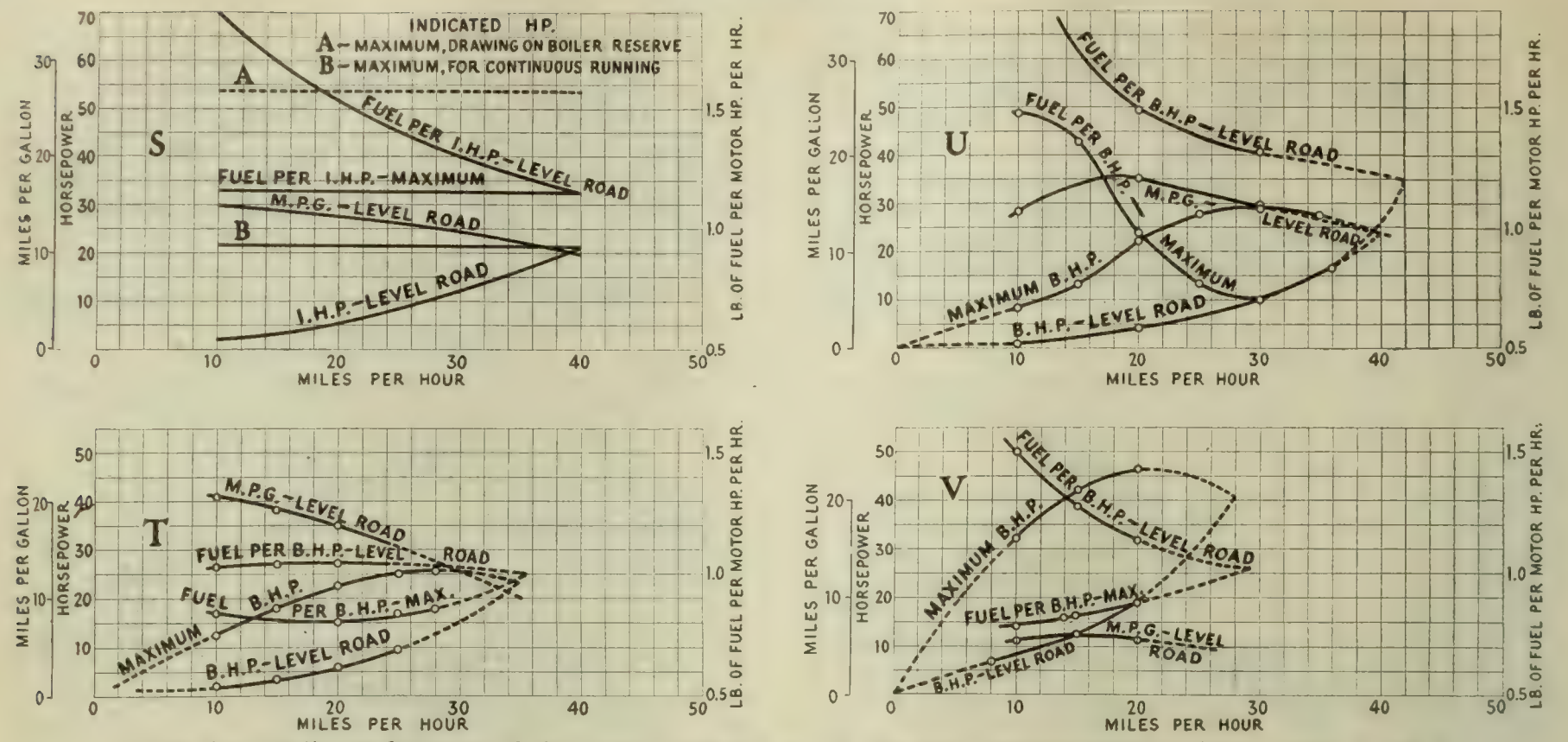




Performance curves of passenger cars K to R.

the dynamometer here described the brake is set to give a load equivalent to the tractive effort required for level road operation at the respective speeds, and the fuel consumption is then measured. The horsepower developed at the rim of the rear wheels under this condition is computed by simply multiplying the pull by the speed in m.p.h. and dividing by 375. The figures thus obtained are set down in the column headed "rear wheel hp. level road." In order to find the b.hp. required for level road operation it is necessary to add to the rear wheel hp. the loss in power between the engine and the road, including, of course, the power lost in the rear tires. This is assumed to be the same as the power consumed in the rolling resistance of the rear wheels and the parts driven by them when the gears are in neutral and is obtained by multiplying this rolling resistance in lbs. by the speed in m.p.h. and dividing by the constant 375.

That this is not a precisely correct method is probable, because the power loss when the gears are driving under load is presumably not the same as when they are running idle. It is doubtless true also that the tires consume a somewhat greater power when transmitting power than when rolling idle. Furthermore, when the engine is driving the car even on direct, the secondary shaft of the gearset is, in most cars, turning and consuming more or less power due to churning of the oil or grease in the gearset. When the wheels are driving the propeller shaft and the primary gearset shaft attached to it, the secondary shaft does not turn, hence the loss to this source is not included in the measurements of transmission losses here given. While this discrepancy is well recognized by Prof. Lockwood and his associates, it is probably not a very considerable factor in most instances, and can, therefore, be overlooked without great error. In any case the results



Curves showing the performance of the steam passenger car S, the light (gasoline engine driven) trucks T and U and the heavy "Class B" Army truck V.

here reported shed much light upon factors which are given far too little consideration by most automotive engineers and, therefore, serve a highly useful purpose, especially in the absence of more precise information on the various points in question.

The practice of making tests with loads substantially equivalent to those imposed upon the engine in level road operation is especially to be commended, for there is far too little data secured in general under these conditions which are the prevailing ones in service and therefore of great importance. Consequently, while it is readily admitted that the tests do not precisely duplicate the conditions of level road operation, they do closely approximate them and are far better than any arbitrary selection of load which may or may not be indicative of usual service conditions.

It is interesting to note from the tabulated data that the rear wheel hp. for level road operation at 20 m.p.h. is in most cases well under 3 hp., the minimum figure recorded is 2.29 and the maximum for a passenger car 4.03 hp., the latter applying to a car which weighs 5180 lb. The rear wheel hp. for level road operation increases at a higher rate than the speed due to the factor of wind resistance, which increases as the square of the speed. It is a significant fact that at 20 m.p.h. the rear wheel hp. required for level road operation is only 2½ or 25 per cent of the maximum available, while with some of the larger cars it is only 10 per cent of the maximum available. This, of course, means that the car has a very low average power factor, and, since the economy of throttling engines of the conventional type is low at low loads, the engine operates most of the time under loads at which its thermal efficiency is poor.

The maximum tractive effort which the cars tested are capable of developing when running in direct drive is of interest chiefly as indicating the reserve power which American cars have for hill climbing and rapid acceleration. The advantage of this quality is appreciated by the user insofar as it affects performance to a marked degree, but the adverse effect upon the fuel economy which is involved in the use of large gear reductions and consequent high engine speed with its accompanying excessive friction loss and average operation under low throttle conditions is seldom fully appreciated.

The maximum grade (expressed in per cent) which the car will climb in high gear at the various speeds is determined readily by dividing the net tractive effort, or the maximum tractive effort minus the tractive effort for level road operation, by the weight of the car plus whatever load it carries. In the figures here given the weight of the driver only is added to that of the car in computing maximum grade which the car will climb on direct drive. Since acceleration is equal to the force acting divided by the mass of the body whose velocity is changed, the accelerating ability of the car is easily computed by dividing the net tractive force by the weight of the car plus the load it is carrying, and multiplying by g, the acceleration of gravity. Accelerating ability varies with the speed, just as the grade which the car can climb varies, both becoming zero at the maximum level road speed which the vehicle is capable of attaining.

Brake Horsepower of the Engine

The brake horsepower which the engine is required to develop for level road operation at average driving speeds is small as compared to its maximum power at these speeds. The average at 20 m.p.h. for 17 passenger cars is about 5.4 hp. as against a maximum hp. average at the same speed of 23.8. In other words, under what may be considered a normal operating condition, the average engine develops from one-fifth to one-quarter of the power it is capable of developing at that speed. Even the heaviest of the passenger cars tested requires only 7.55 b.hp. to propel it at 20 m.p.h. on a level road while some of the lighter cars require only a little over 4 b.hp. Were facts such as these more generally appreciated, it seems almost incredible that so little attention would have been given to making engines which are more efficient at the light loads obtained in normal use.

It is instructive to note from Table II, which is condensed from Table I but contains some additional computations, the relative importance of the three losses which together exactly balance the power developed at the flywheel of the engine. These are (1) the rolling resistance of the front wheels, (2) the power losses between the engine and the driving surface of the rear tires, including the losses in these tires and (3) the wind resistance. It will be seen that (1) varies from 20.2 to 30.8 per cent of the total, the average being nearly 27 per cent. Item (2) accounts for an average of 46 per cent, varying

from 37.5 to 55.7 per cent of the total, while item (3) averages the same as (1) but varies from 19.5 to 37.8 per cent of the total. These figures apply to a speed of 20 m.p.h. on a level road, with no head wind. At other speeds and loads the factors vary, the windage in particular increasing rapidly with increase in speed.

If it is assumed that the rolling resistance of the rear tires alone is the same as that of the front tires the remaining power losses attributable to friction of mechanical parts, including the gearing in the axle and the bearings plus the losses caused by any churning action on lubricants amounts to about 20 per cent of the total brake power developed by the engine. Tire losses alone probably amount to about half of the total under the conditions in question, and these losses are minimized when a good grade of cord tire properly inflated is used. That there is a large variation both in the amount and percentage of the various losses is at once evident, but the reason for the variations are not apparent from the data in hand. It is probably fair to assume, however, that the higher figures can be bettered in most cases if a more detailed analysis of the reasons for the loss were made. In comparing the figures for different cars it should be borne in mind that rolling resistance usually increases with increase in weight, other things being equal. Evidently other things are not equal in some of the cases recorded. Probably the variation in tire equipment accounts for a considerable part of the difference in some instances.

Efficiency of Power Transmission

If we accept as correct for conditions of power transmission the power losses recorded we find that the ratio of power delivered at the periphery of the driving tires to the brake power developed by the engine, or what may be termed the efficiency of the drive is 0.89 to 1 in the average case for passenger cars running under wide-open throttle at 20 m.p.h. The variation under this condition is from 78.5 to 93.2 per cent. The reasons for believing that the power losses are somewhat greater when the transmission system is running under load rather than running idle, as it was when the power losses here given were measured, have already been stated.

There is little doubt that the tires are much the largest single source of power loss in the transmission, even though they be of the cord type. For this reason such relatively slight difference as may be caused by differences in the bevel gears are probably not of great importance in the total, although it is quite conceivable that a change in the type of gearing employed might have a marked effect. It should not be forgotten, however, that the total loss in the mechanical parts other than the tires is quite considerable, as already pointed out, so that each of these losses

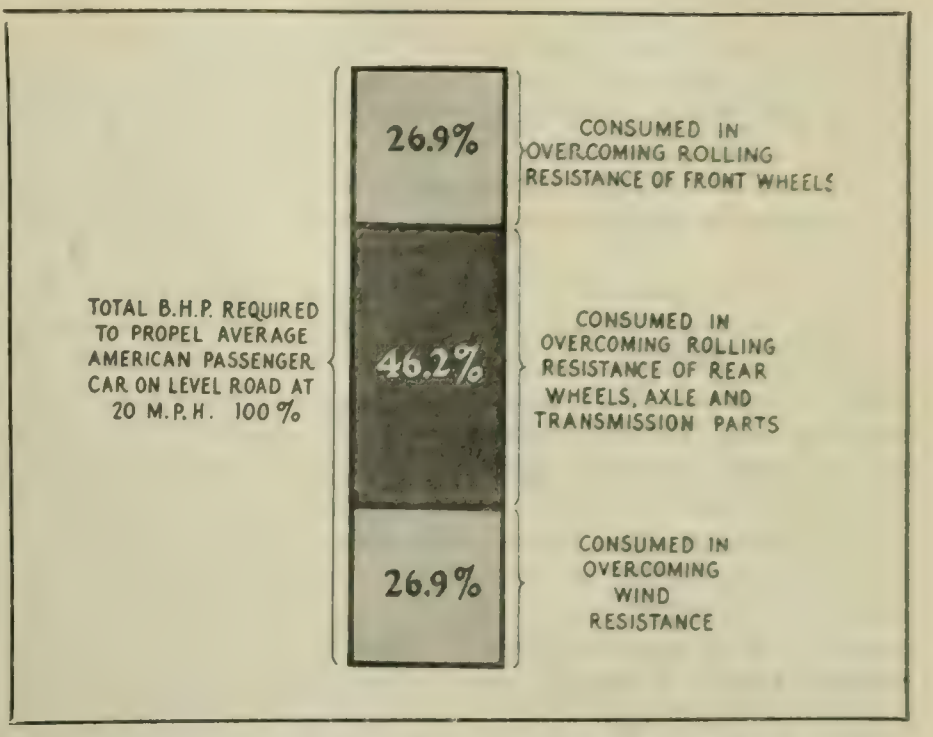


Chart showing losses which balance the power developed by the engine of the average passenger car when running at 20 m.p.h. on a hard level road.

should be minimized in the interest of high over-all efficiency.

Fuel Economy at Various Loads

Coming now to the matter of fuel consumption, we find, as anticipated, that the rate at which fuel is used per b.hp. at the light loads of average normal use is very much greater than at full load. The average consumption of 17 of the passenger cars listed is 0.80 lb. per b.hp.-hr. at wide-open throttle and a speed of 20 m.p.h., the maximum and minimum figures for the same conditions being respectively 1.04 and 0.66 lb. With the engine operating under level road conditions and at the same speed the average consumption of the same 17 cars is 1.34 lb. per b.hp.-hr., or nearly 70 per cent higher than at full load. The maximum and minimum figures under this condition are respectively 1.80 and 0.97 lb. From curves given in the accompanying charts it is apparent that in most cases the engine operates most efficiently when running under wide-open throttle at speeds corresponding to 20 or 30 m.p.h. on the road, a condition of operation which obtains, in all probability, much less than 1 per cent of the time the car is in actual operation. Under the conditions of average normal operation, on the other hand, the thermal efficiency averages little more than half that obtainable under the comparatively unusual condition of wide-open throttle. Such a condition would not be tolerated in the operation of any other class of powerplant in extensive

Table II.—Showing Brake Horsepower Required to Propel Car on Level Road at 20 M.P.H. and the Various Factors Responsible for Consumption of This Power

Car	A		C		E		G		I		K		Q		Average
	Hp.	Per Cent of Total	Hp.	Per Cent of Total	Hp.	Per Cent of Total	Hp.	Per Cent of Total	Hp.	Per Cent of Total	Hp.	Per Cent of Total	Hp.	Per Cent of Total	Per Cent
Type of Tires.....	Fabric		Cord and Fab.		Cord		Fabric		Fabric		Cord		Cord		
Hp. Consumed in Overcoming Front Wheel Rolling Resistance	1.09	20.2	1.65	35.2	0.91	22.5	1.65	30.8	1.71	30.4	1.15	24.4	1.87	24.8	26.9
Hp. Consumed in Overcoming Rolling Resistance of Rear Wheels, Axle and Transmission Parts	2.93*	54.2	1.76	37.5	1.81	44.7	2.35	43.7	2.77	49.2	1.79	37.8	4.21	55.7	46.2
Hp. Consumed in Overcoming Wind Resistance	1.39	25.6	1.28	27.3	1.33	32.8	1.37	25.5	1.15	20.4	1.79	37.8	1.47	19.5	26.9
Total = B. Hp. Required to Propel Car on Level Roads	5.41*	100.0	4.69	100.0	4.05	100.0	5.37	100.0	5.63	100.0	4.73	100.0	7.55	100.0	100.0

*Has planetary gearset which produces undue friction when rear wheels are driven with gear shift lever in neutral position.

use. Most powerplants are designed to give, so far as possible, their maximum economy under the conditions for which they are most used. Not so the motor car engine. There are many reasons for this condition, among them being a more or less general lack of understanding of the conditions of average performance and of steps which can and should be taken to increase economy under these conditions.

It will be noted that the number of miles per gallon which a car will travel decreases as a rule with increase in speed. This is due, of course, to the fact that the power required for propulsion is less at the lower loads, although the thermal efficiency at these speeds is much less. It is evident, however, that, since a certain power is necessary to propel a vehicle at any given speed, the engine which develops this power with the least expenditure of fuel per hp. is the one which will propel the car at that speed the greatest number of miles per gallon of fuel consumed. If it were feasible to design the car so that the engine, which is usually most efficient at full load, could operate at full load under normal speed and level road conditions, it would, of course, go much further per gallon than at present. Since this is not feasible, it is desirable to strive to make the engine as economical at low as at high loads. This is a difficult problem, but steps in the right direction are being made and should receive more encouragement than they are generally given at the present time.

Performance of Steam Car and Trucks

Much of the foregoing analysis applies primarily to the passenger cars A to R inclusive as listed in Table I, but most of the points brought out apply also to the light trucks T and U and many of them to the steam-driven passenger car S and the heavy Class B army truck V, although certain of the data in reference to the last two vehicles mentioned are, for obvious reasons, quite different than that covering the passenger cars of the usual type. Since in the steam car the engine is geared directly to the rear axle—that is, drives the axle without a clutch between the two—the friction of the engine is included in the rolling resistance of the rear wheels, and the power of the engine is the indicated instead of the brake power, the latter being obtainable by the usual method employed in other cases. The fuel measurements are also based on indicated power. The data covering the indicated m.e.p. of the steam engine, while not directly comparable to the brake m.e.p. given for engines in the other cars, shows immediately why steam cars do not require the use of a gear-set such as is employed in the conventional gas car and truck.

The standard Class B army truck is much the heaviest of the cars tested and the only one equipped with solid tires. It will be noted that the rolling resistance of the front wheels at 20 m.p.h. is 83 lb. or 36.7 lb. per ton as compared to 30.2 lb. per ton for the largest cord tire on the passenger cars. Corresponding figures for rolling resistance of rear wheels is 212 lb. total or 64 lb. per ton as against 52.7 lb. per ton, the figure for the passenger car having the highest rear wheel rolling resistance. The rear wheel hp. required to propel the truck at 20 m.p.h. is 7.41 or 1.33 hp. per ton as compared to 4.03 hp. or 1.56 hp. per ton for that passenger car which required the largest amount of rear wheel hp. at the same speed of all those tested. For the truck the b.hp. required for level road propulsion at 20 m.p.h. was 18.71 or 3.36 b.hp. per ton as compared to 7.55 b.hp. or 2.85 b.hp. per ton for the heaviest passenger car tested. The ratio of the power delivered at the rear wheels to brake power developed by the engine under wide throttle conditions is 34.2 to 45.5 showing that the efficiency of power transmission (rear tire losses included) is only 75 per cent, or lower than that of any of the passenger cars. The maximum miles per gallon recorded for the truck in question was 5.8, or 32.3 ton m.p.g. approximately the same as the equivalent reading for the heaviest passenger car.

Cutting Fluids

TECHNOLOGIC PAPER NO. 204 of the Bureau of Standards on the subject of cutting fluids will soon be available for distribution by the Government Printing Office.

The paper is divided into two parts, theory and practice. In the first part the difficulties attending the proper lubrication of the cutting tool in machine work are described, and the reasons why lard oil is particularly suitable for this work are set forth. It is shown that the viscosity of an oil is not the only factor to be considered in this connection. Oils for cutting purposes should have a high adhesion, and it seems possible to improve mineral oils by adding such fluids as oleic acid, pine oil and fixed oil.

An important function of cutting fluids is to cool the tool and chip, and for this purpose alone water with its high specific heat is well suited, but it rusts the machines, and for this reason where water is used such alkaline substances as soda or soap are always added. In conclusion, Part 1 suggests methods for the measurement of the adhesion of oils.

Part 2, practice, considers the correspondence which the Bureau conducted with many large machine shops throughout the country as to their experience with cutting fluids. The different kinds of oils which have been used for this purpose are listed, and attention is given to the possibility of using emulsions made up of mineral oil compounded with neutralized sulfonated oil and formed into a permanent emulsion with water.

Mineral oils compounded with alcoholic solutions of soap and a thick soap solution and mineral oil marketed as a paste, are also described. In choosing any cutting fluid it is pointed out that the character of the metal to be worked should be considered. Brittle metals, such as cast iron, are easier to lubricate than the so-called "draggy" metals, such as soft steel and wrought iron.

Porto Rican Market Opening Up

THE head of the largest automotive business in Porto Rico, who was in New York recently, declared that business is on the upgrade again in that country and that it should again be considered in the buying column. No stocks of new cars are on hand, and orders are being placed rapidly. The new sugar crop will soon be coming in, and automobiles are needed to take care of transportation needs not provided by the railroads. The railroad services in Porto Rico are poor but the highways are good. Hundreds of motor buses are already in operation and the use of trucks is growing.

A CATALOGUE of the Mechanical Engineering Collection in the United States National Museum has recently been compiled by the Smithsonian Institution in the form of Bulletin No. 19 of the Museum, and can be obtained from the Superintendent of Documents, Government Printing Office, Washington.

An Efficient Method of Transmission Production

Methods employed in the Hudson and Essex Transmission Department. Drilling of cases and machining of gear blanks accomplished by labor saving methods. Gears matched for best mesh by a special testing device.

By J. Edward Schipper

AN interesting example of what can be done in efficient production is offered by the transmission departments of the Hudson and Essex companies. Transmission units were formerly made in separate departments, and there were a number of breaks in the continuity of manufacturing progression. By bringing the two transmission jobs into one department, the cost of manufacture, as compared with that of a year ago, has been cut at least 40 per cent. The departmental overhead has been practically cut in half by a rearrangement of the machines and by better placing of the workmen; the labor cost has been reduced 25 to 30 per cent and the manufacturing operations on the two types of transmission require only little more than the floor area formerly required for one. The work in this department is handled on the group system, in accordance with the general practice in the Hudson factory.

An idea of the efficient operation of the department may be gained from the fact that 75 cases for the Hudson car, each requiring 24 operations, have been put through daily by six men during the time of curtailed production. Now that production is increasing rapidly, practically the same ratio of operators is being maintained, indicating a highly efficient arrangement of machinery and the use of types of machines, which, in a great many instances, are so nearly automatic that three and sometimes four machines can be taken care of by one operator.

The way the transmission department is at present laid out, it can take care of 150 Hudson and 150 Essex cases per day. The machining operations on the two types of case are practically identical in character, although the dimensions of the case and some of the details differ. The machining operations run along parallel lines and the work supervision is taken care of by one staff instead of two, which has been a material factor in the reduction of overhead. An outline of the methods employed in manufacturing the transmission case is of interest.

The cases are of aluminum and are checked in the receiving room on a target, to make sure that there is sufficient metal at all points for the initial cuts. Location on this target is by two V-blocks on the countershafts bearing at both ends of the case. This same method of location is employed for the first operation on the case, which is milling the top face (Fig. 1). Two cuts are taken off the top face on a Cincinnati miller, the first being a rough cut, ⅛ in. deep, and the second a finish cut in which only about 1/64 in. of metal is removed from the top face.

Using the milled face as a location with V-blocks on the two countershaft bearings, the main and countershaft bearings are rough and finish bored. Both sides of the transmission case are worked on simultaneously by means of four tools (Fig. 2). The rough and finish cuts are taken on the same machine. The first tool to enter takes the rough cut, and as soon as this is clear of the hole the finishing tool takes up the work. The work is handled on a Barnes double-head, horizontal boring mill, and 0.004 in. is left for finish reaming both bores.

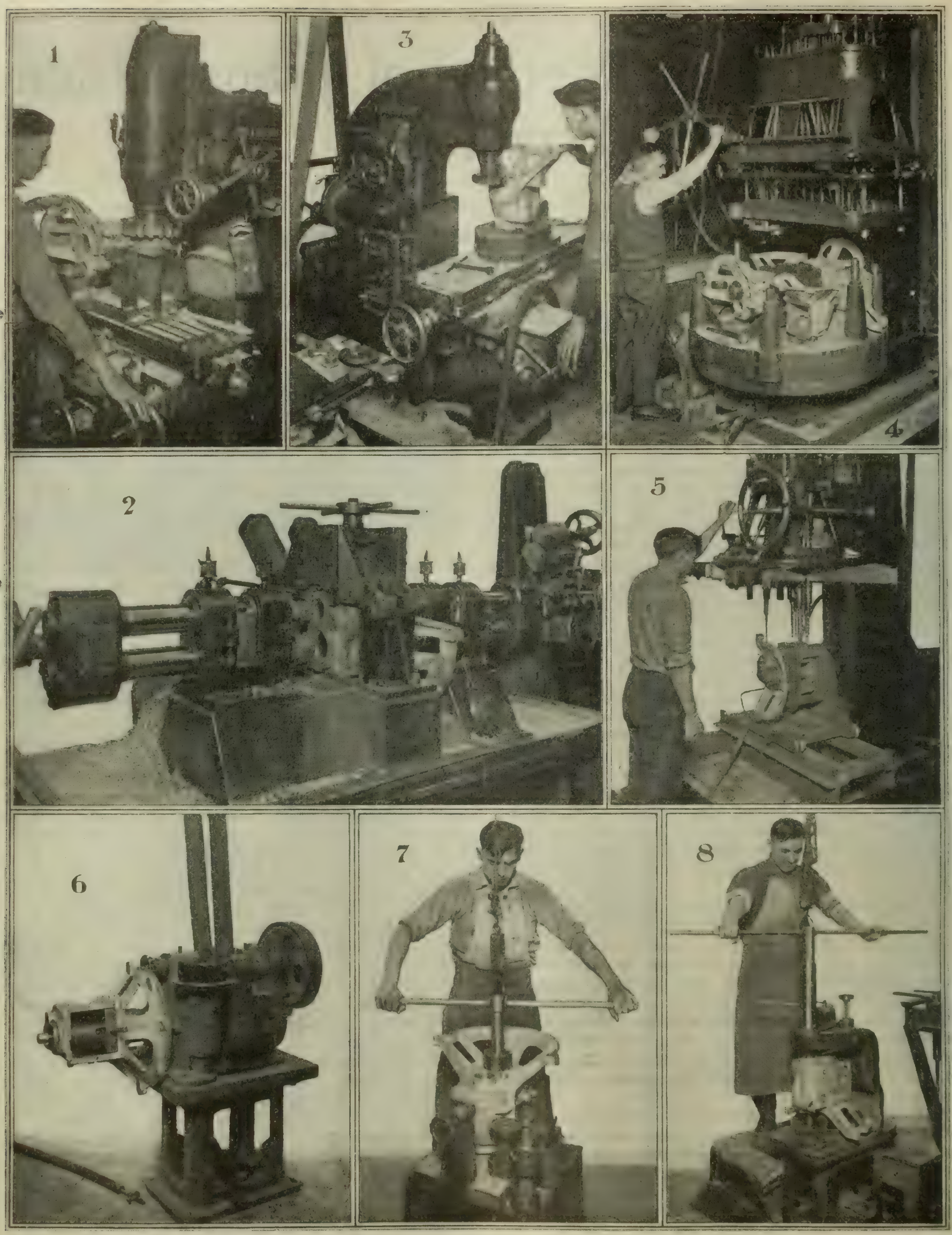
The front end of the case inside of the bell is faced off in the next operation. The work is located from the rear end face, lengthwise, and transversely by means of an arbor which passes through the main bore. This operation of facing off the front end fixes the length of the case. The work is done on a Baker mill. Following this operation, there is another milling job on the pedal bosses, this work also being located from the rear end and on the arbor through the main bore. This latter work is done on a Steptoe mill.

Nearly all the drilling on the case is done at one time on the ingenious Natco multiple spindle installation, Fig. 4. This machine works on different sides of three different cases at the same time, and, having an indexing table, permits of three others being loaded while the three are being worked upon. In this way it is possible to pass 60 cases through the machine per hour. Twenty-six holes are drilled in each case, and they are all located from the main bore. Formerly it required three machines to do this same work, and a material cut in cost has been made, as there is now only one operator. There are other drilling operations which cannot be taken care of on the Natco; one of these is handled by a Baush drill, which performs two operations on two sides of the case with an indexing fixture. The holes drilled are for the pedal bolts, brake ratchets, anchor pins and oil level indicator (Fig. 5).

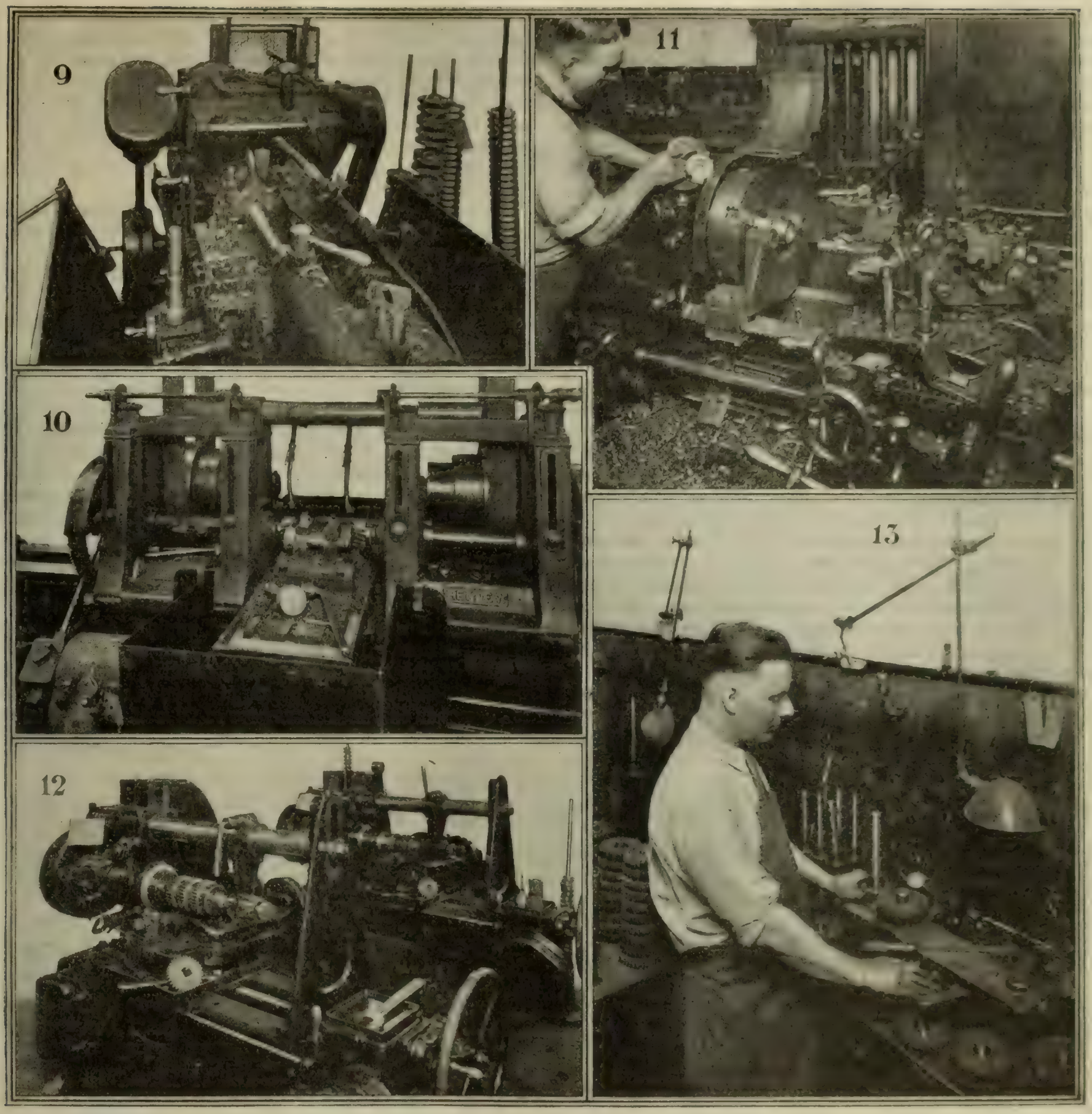
Another drilling operation is for the oil return, which is on an angle and consequently requires a separate operation. A Carlton radial is used for this work and also for spot facing the brake ratchet boss and for tapping the holes in the boss and the oil level holes. This same machine also drills, spot faces and taps the drain plug holes at the bottom of the transmission case.

Both ends are tapped on a Carlton radial with a reversing fixture, and a similar machine taps the top face flange holes and the brake pedal holes. Finish reaming of the main bore is a hand operation of line reaming.

In finish milling the bell flange (Fig. 6), the case is located on an arbor through the main bore, with the front face resting against a shoulder on the arbor. The distance from this holder fixes the length from the front



1—Initial milling operation on top face of Hudson transmission gearcase. Machine takes rough and finish cuts. 2—Rough and finish boring main and countershaft bearing bores on one machine, boring from both ends simultaneously. 3—Milling front end of gearcase on a Baker mill, fixing length of case. 4—Natco multiple spindle drill which handles different sides of three cases while three more are loaded on fixture. Capacity 1 per min. 5—Drilling Hudson transmission case for oil level hole and pedal control bracket hole. 6—Finish milling the bell flange, location secured by the arbor through the main bore. 7—Finish reaming main shaft bore. This is a hand operation for best possible finish. 8—Finish reaming the transmission countershaft bore. Note fixture, which pilots above and below the reamed hole



9—Turning two sides and face of the transmission main shaft drive gear simultaneously on an automatic lathe. 10—Straddle milling to length transmission main shaft drive gear. 11—Pratt & Whitney machine which rough and finish turns the main shaft drive gear bores for the internal bearing, turns relief and chamfers. Note steady rest on machine on each side of chuck. 12—Rough cutting six main shaft gears simultaneously on a Barber-Colman hobbing machine. Teeth are finished on Fellows shapers. 13—Rolling and matching gears for transmission gearset before sending them to final assemblies

face to the front of the bell. With the case in practically a finished condition, the bell housing is drilled and reamed for the dowel pin holes, which locates the bell housing against the dowels on the crankcase. Location for drilling these dowel holes is from the main bore and from a dowel through the center bell housing bolt hole. The location being primarily from the main bore, alignment of the transmission housing with the center line of the crankshaft is assured.

The final operations on the case are spot-facing the bosses on the bell flange, drilling, reaming and spot-facing inside and outside with a combination tool, the reverse idler shaft hole, and then finish reaming the countershaft bore. A feature of interest in connection with the reamer used for the countershaft bore is that pads are placed on the reamer acting as bearing surfaces, giving chip clearance which would not be available with a solid type of reamer. In order to secure the utmost accuracy in this final reaming operation (Fig. 8), the reamer shaft pilots above and below the reamed hole and is held to very close limits. This finishes the case, which is then washed in sal soda and passed along to the assembly line.

Manufacture of the transmission gearcases is backed up by a very efficient gear department. The forgings are bought outside, but all of the machining and forming is done in the Hudson-Essex transmission department. In the initial operation for the forming of the blanks,

each man finishes his own gear blanks; that is, he drills them, round-broaches them and key-broaches them. The drilling is done on Foote-Burt drills and the broaching both for the round-broach and the key-broach, on La Pointe broaches. In this little department for the manufacture of the blanks, five men can turn out 1700 to 1800 gears per day. These blanks are turned over to the gear department, the gears, regardless of size, going through quite similar operations. The first operation, ordinarily, on any of the gears is done on Potter & Johnson automatics. In this operation three faces are turned at once (Fig. 9). The machine turns both sides and the outside diameter. These Potter & Johnson lathes are so lined up that one man can take care of four machines. The machines turn out about 12 per hour, giving a production of 48 per hour per man on this particular job.

The Essex countershaft has an integral gear. This is straddle milled to length on a Hendey duplex mill (Fig. 10.) The countershaft is centered at both ends on a De Whiton centering machine and is then turned over to a Fay automatic which rough and finish turns the countershaft on the same machine. In this work the countershaft is located between the centers, and all four diameters on the shaft are turned in this operation. The key-way is cut in this shaft on a Cleveland machine which has been rigged up with a weight on the end of the feed lever to permit the operator to take care of two machines. Without this it is would be necessary for him to press on the feed lever to feed the saw to the proper depth. A trip is arranged in connection with the weight so that the proper depth will not be exceeded.

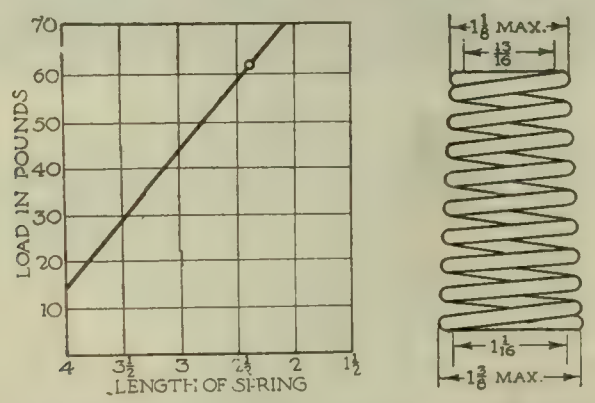
The second operation on the main drive gear is performed on the Pratt & Whitney machine, which rough and finish turns the gear, bores for the pilot bearing, turns the relief and chamfers. This machine, which is illustrated in Fig. 11, is designed for accurate production and is equipped with a steady rest, as shown, to prevent chatter of the tools. Following the automatic operation, the main shaft drive gear is ground for two bearings. It is also ground for the internal bore, location for the latter operation being from the outside ground surface. There is a bushing on the fixture which locates around the external grind.

The gear teeth are rough cut on the Barber-Colman hobbing machine. One man takes care of four of these machines and on some of the gears six can be roughed out at a time by placing them face to face (Fig. 12). One of those gears, of which six can be roughed out at once, is the countershaft constant mesh gear for the Essex. The gear teeth are finished on Fellows shapers.

Before the gears are sent to the transmission assembly department, they are matched up for the best mesh. Different gears are tried out on a special fixture with an amplifying gage and adjustable center distance, and those which match with the least "run-out" are selected to run together (Fig. 13). They are held to 0.002 in. eccentricity and are not permitted to have a "run-out" between the gears of more than 0.004 in. at any point. After this selection has been made the gears are passed along and meet the cases at the point where assembly takes place. The assembly is progressive and the line is equipped to handle either Essex or Hudson transmissions. As production is being increased rapidly at the plant, the figures here given are somewhat out of date, but give an idea of the ratio of men to assemble cases. At the time the notations were made, six men were assembling 120 cases per day, or an average of 20 transmission gear-sets to the man per day.

Specifications for Valve Springs

AN interesting point which may have come to the attention of engineers and purchasing agents is that where valve springs are specified simply by the amount of compression for 60 lb. pressure or for any other figure which may be given, considerable variation has been experienced in the bids made by the different concerns on these springs. The reason for this is that it is possible to make up the valve spring with fewer turns and with other variations so that it is perfectly possible to meet



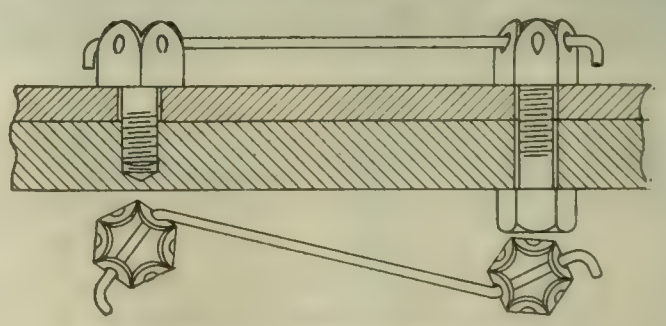
Compression charts for spring specifications

the compression specification with springs varying considerably in other respects.

A Detroit manufacturer specifies coil springs by the use of a graph of compression per pound load. The drawing for the spring, instead of merely carrying the dimensions of the spring with load specifications, also include one of these graphs or charts of compression. A sample drawing for a valve spring is illustrated herewith. It will be noted that the pressure-compression graph is plotted for the range from 15 to 70 lb., which increase in pressure causes the spring to compress from 4 to 2 in. in length.

Crown Socket Screw and Nut Lock

A VERY simple device for locking nuts and screws against unscrewing has been placed on the market by C. E. Ashley. It consists of a hexagonal socket-shaped stamping with its six sides turned up and perforated near



Crown screw and nut locking device

the top. The lock is placed under the nut or bolt head and after the latter is screwed home a wire is drawn through the holes in two of the sides of the socket. This wire, which also extends through holes on similar adjacent locking sockets, prevents the nut or screw from unscrewing. It would seem that the locking device is particularly applicable in cases where there are a number of screws or bolts close together, as in the covers of machinery cases, but can of course be used also with a single bolt, as a place to secure the wire to can practically always be found, and if not, can be provided.

Business Revival Evidenced by Specific Reports

All sections of the country appear to be sharing to a greater or lesser degree in the general revival of business. Increase partly seasonal but specific reports show an acceleration and improvement in all automotive lines which may be taken as indicating a more or less permanent condition.

FOR some time we have had indications that the automotive business is picking up; this improvement has been somewhat localized and hence not realized as being indicative of a general business revival. However, as these welcome signs have increased in number, they have lost their character of localization and have become indicative of fact rather than hopes.

Reports which come in from all over the country show that the industry has a great deal of sound business to look forward to. These reports give word of a factory taking on employees here, of heavy travel there, of an increase in orders and of definite increases in sales generally. The fact that they report hopeful signs from such a number of places and concerns changes the character of the items from one of rumor and hope to one of concrete fact.

The various news items which follow will indicate clearly the fact that business is proceeding well and that it is general throughout the country. Such items will doubtless be of more value and interest than a general statement of conditions because they do, in many cases, give specific facts which carry with them a certain amount of proof.

Middle West

Detroit.—Business conditions throughout the Middle West and Southwest are showing a decided change for the better, and this is having a strong tendency to improve the motor truck business, according to Vance H. Day, sales manager of the General Motors Truck Co., after an extensive trip through this territory. Cities visited included Chicago, St. Louis, New Orleans, Houston, Dallas, Salt Lake City, Lincoln, Denver and Kansas City.

Most of this business is coming from the industrial centers, he said, the farmers being responsible only for a small part of it. There are indications of strong business from the agricultural districts late in the summer, but this depends largely on the prices the farmer is able to command for his products.

The greater part of the business is for lighter model trucks, Day said. Buying in the heavy duty vehicles is light. The company will manufacture 1000 vehicles in April, and the May and June schedules are expected to be as heavy.

The company is making preparations for marketing its new bus which is now in production.

Minneapolis.—Dealers are making actual deliveries and one large distributor is several hundred cars behind orders at the factory. These are cars that are actually sold. While trainload delivery of cars to this territory has not been resumed, business is tending that way. One firm delivered 68 cars last week and has started in well this week. There is some trading in, but a lot is straight business.

In spots the bankers seem to be relenting and permitting dealers to get money to bring in cars, but sales to date seem to be among people who have had money but delayed buying of cars until spring.

Reports by travelers back from Montana on business trips carry the inference that there is much better feeling. With two copper mines resumed at Butte and between 6000 and 8000 men again at work, wool selling higher and a good crop planting outlook the financial feeling is better.

In general prices in the Federal banking district have risen for all grains except rye and all live stock except cows. Wool prices and sheep are strong in this advance. Wholesale trade is increasing as well as flour grinding.

Unemployment has decreased generally, crop acreage prospects are better, merchandise distribution has increased and there are fewer business failures. A survey by a St. Paul newspaper divulges the fact that less than 40 per cent of the farms in the Northwest outside Wisconsin are mortgaged. In Minnesota 60 per cent of the farms are free from debt, in North Dakota 61 per cent, in Montana 55 per cent and in South Dakota 45 per cent.

Moline, Ill.—Velie Motors Corp. will probably increase its daily output from 25 to 45 in the near future, due to the gain in demand.

"Our Cedar Rapids and Waterloo, Iowa, dealer reports that more farmers have been looking at cars in the last two months than in the ten preceding months," said H. T. Wheelock, advertising manager, in speaking of agricultural conditions. "Our Fort Dodge dealer points to banks in his city which have paid off their entire Federal Reserve indebtedness as indication of improvement in business and states that the automobile trade is reflecting this condition. Fifty per cent of the Iowa farmers are able to buy cars at the present time, and the outlook for the year is unusually bright."

Milwaukee, Wis.—The first half of April has witnessed a very satisfactory continuation of the progress made in March by manufacturers of passenger cars and makers of automotive parts and equipment of all descriptions in this center. The same is true of plants at Racine, Kenosha, Hartford and other Wisconsin cities having industries of this class. During the past week the Mitchell at Racine has increased its daily production by 25 cars and the demand from distributors and dealers is broadening steadily. Its force of 650 is being increased to 800 or 900. The H. & M. Body Corp., also located in Racine and making open and closed bodies principally for Hupmobile and Mitchell, has orders on the books to keep up capacity operations for eight months ahead and is adding a night shift. It is gen-

erally admitted that the situation of the automotive industries in this section is on the best footing it has occupied in more than eighteen months, and there has been no development in the last six to eight weeks to interrupt progress, as was experienced frequently last summer and fall. That is to say, the course of the improvement is steady and even and it is this tenor which lends so much satisfaction and encouragement.

Columbus.—With the coming of pleasant weather and a noticeable improvement in industrial conditions, demand for motor vehicles, particularly passenger cars, has shown a good increase. Dealers and distributors in Columbus and Central Ohio are much more encouraged over the outlook. There is a much better feeling among the farmers with prospects for a good wheat crop.

Cleveland.—Reports of Cleveland automobile dealers that there has been an influx of factory workers into the market for new and used cars in recent weeks is borne out by the record of employment in local industries as made public by the Chamber of Commerce.

Employment increased in six out of ten industries surveyed during March by the labor solution committee of the chamber. The record on March 31 was 2.1 per cent in excess of the figures for Feb. 28.

The iron and steel industry with an increase of 5 per cent in the number of employees made the greatest gain, while the automobile and parts makers showed an increase of 1.5 per cent. Food, textiles, lumber and smaller miscellaneous industries showed losses, occasioned by strikes and local conditions.

Cleveland.—The peak of the spring buying of automobiles in Cleveland has not been reached, say representative retail automobile dealers.

General business conditions bear out what the automobile dealers say. Banks here report that the first half of April proved the most promising period since 1920 from many standpoints. While it is true that part of the improvement is seasonal and another part is due to certain industries that have had an extra run of patronage, yet reports show that the whole economic machine is moving forward and gaining momentum rapidly.

The City Employment Bureau states that there has been a substantial reduction in unemployment. There are many other evidences of improvement such as prices of staple raw materials are advancing; production of iron and steel is on the increase; prices of stocks and bonds are higher; interest rates are falling and building construction is increasing.

In the automobile industry the evidence unmistakably shows improvement. The National Acme Co.'s Coit road plant is running to capacity. The Murray Ohio Co., maker of fenders and other parts, reports it is working ten hours a day six days a week. In other lines like the Owen Shops Co., maker of upholstered furniture, trouble is experienced in obtaining a sufficient number of qualified artisans.

A canvass of automobile dealers here disclosed that the first half of April has been better than the fifteen days of the preceding month. In fact, April has been the best month of the present year.

Los Angeles.—Throughout the Middle West and the West there is a marked improvement in business conditions, especially as affecting the automobile trade, declared Harry M. Jewett, president of the Paige-Detroit Motor Car Company, upon reaching Los Angeles.

"The farmers of the Middle West have considered themselves the hardest hit of any class in the so-called slump of last year," said Mr. Jewett. "They based their stand on the fact that they were not showing a profit on their investment, but the recent conference with Hoover at Washington sent them away with an entirely different understanding of their own situation. They had been figuring their percentages on wartime prices of land and products, and they had forgotten that the rest of us had been compelled to absorb millions in readjustment of inventory. Now they realize their mistake—and this, with the fact that snow and rains have assured them of bumper crops this season, has caused an opening up of the Middle West, such as has not been recorded since long before the war.

"The farmers really are in good shape financially and have the money to spend, but until recently they did not realize it. Now that they do, the Middle West is opening up—and the Middle West has been one of the most serious situations existent because of the widespread effect upon the rest of the country."

INDICATIONS are that the first improvement in business conditions, in so far as orders received are concerned, is coming from the industrial centers and that the farmers as yet are responsible for only a small part of it. That the farmer will appear in force as a buyer later in the year depending in volume on the prices received for his produce, appears to be the general opinion.

Decrease in unemployment, improvement in banking conditions and a general increase in the volume of orders and business actually transacted, give a favorable outlook for the automotive industry for the year.

Reports from the South

Atlanta, Ga. — Automobile sales in the Atlanta territory have improved steadily for the past thirty or forty days, and while considerably better than during the same period one year ago, there is still plenty of room for improvement. The principal demand at this time is for the low and medium priced cars, though many more sales of higher priced makes are being reported than during the early spring of 1921. Most of the dealers and distributors of Atlanta are looking forward to a fairly good business during the remainder of the spring and the coming summer.

One proof of improvement is noted in the records of the State automobile department, Secretary McLendon reporting that to date approximately 5000 more licenses have been issued than at this time in 1921. Up to April 1 of this year 94,000 passenger car licenses had been sold and 13,000 truck licenses or a total of 107,000. The 1921 total to April 1 was only 103,000.

As was the case last year most of the automotive sales are in the larger cities of the State, while business is still comparatively poor among the dealers in the smaller towns.

Truck sales are about on a par with those of a year ago and the outlook is not exceptionally bright, at least for the next few months.

Accessory and equipment sales are generally reported much better than the early part of 1921, with indications portending a fairly good volume for the next several months.

Tire sales also are much better than they have been in many months, and many of the dealers state they are experiencing almost normal business so far as tires are concerned.

Tractor and power farming equipment business continues at a low ebb, though somewhat better than it has been in the past several months. The outlook does not

promise material improvement until the next crop has been gathered at least, due to the low financial condition of the farmers in the southeastern territory.

Detroit.—Sales throughout the Southern States are increasing rapidly, reported G. H. Peasley, sales manager of the Olds Motor Co., after returning from a trip covering Chicago, Oklahoma City, Dallas, San Antonio, Houston, New Orleans and Memphis.

Louisiana and southern Texas are showing the best business, he said. Business conditions in western Texas are being greatly helped by rains, but too much rain may damage rice and other crops in eastern Texas and Louisiana. Sport models are in special demand throughout the territory, some cities being sold ahead.

To meet the demand on sport models from all sections of the country the Oldsmobile factory reports advancing May quotas to meet April demands.

Pacific Coast

Portland. — Portlanders who feel that the automobile business has turned the corner on the way to better days had their judgment vindicated to a considerable extent by the record for March, which in many instances was characterized as very good, and in practically all instances, with standard dealers, was better than March of last year. Dealers and distributors handling the standard lines all reported a good business, somewhat uneven, but still aggregating an excellent total.

One rather unexpected feature has been the increase in demand for the higher priced cars. Cars in the price class of $2,500 and above, which had not been moving to any extent, seemed to come to life again and, while figures are not available, it is estimated that this class of car was sold in better proportion in volume than for many months. One dealer in a popular make selling around $3,500 here reported that March this year was one of the best years in his history.

Eighteen sales of a popular car in the $1,000 class were reported one day this week. This is said to be the greatest number of cars of any one make aside from Ford ever reported sold here in one day.

New York State

Syracuse.—Increased activity in every branch of the automotive industry in this city is reported by factories and dealers. While few of the plants are on a normal basis, many of them have increased production within the last few weeks to such an extent that gear manufacturers and automobile makers and dealers are more optimistic than they have been in a year. The big gear plants are slowly getting back to normal, although it will be some months before all of them are on a full time basis.

Dealers report increased sales compared to the same time last year, and it is estimated that the number of automobiles in the county this year is at least 25 per cent greater than a year ago.

Franklin shipments for the week ending April 1 were greater than the entire month of February. The week was the largest of any in the last nine months.

Business in Canada

Toronto.—Automotive dealers in the province of Ontario report an excellent business which is steadily improving. March was the best month in the history of the Dominion Automobile Co., Ltd., distributor for the Essex and Hudson cars in Ontario. The same was true of the Toronto branch of the McLaughlin Motor Car Co.

The General Motors plants are working overtime with larger staffs than ever before. Ford is doing considerably better than last year and Studebaker has shown an increase every month this year, in spite of the fact that last year exceeded the peak production of 1920. The Durant jobs continue to receive much attention and patronage. Dodge Brothers is doing a very large business notwithstanding a flat refusal to accept trade-ins.

Montreal, Que.—Even the automobile dealers themselves are amazed at the big sales which they have been making in Montreal recently. Owing to the setback in general mercantile conditions, dealers were apprehensive regarding the sales they were going to be able to make this spring, and on this account made very limited reservations from factories. In face of this, one agency sold in the month of March alone fifty-eight new cars and twenty-nine used cars. In the case of the high priced models, sales for March are said to have run considerably ahead of the same month last year. If anything, however, it is stated that the French Canadian buyer is more largely represented this year than was the case a year ago.

Spanish Trans-Atlantic Air Service

A SPANISH-SOUTH AMERICAN airship service is being organized, according to the London *Times*. It is planned to have engineers trained in the works of the Zeppelin Company supervise the construction of the airships in Spain. In that country the whole of the building will be done, and the duralumin for the frameworks of the ships will be made there. Sites for aerodromes have already been taken over near Seville and Buenos Aires. Building will be begun next month.

Three revolving sheds will be put up at Seville, two large ones for the accommodation of three Zeppelin airships and a small shed to take a ship of less cubic capacity, which is to be flown to and from the Canary Islands for the instruction of Spanish airmen. The airships will be larger in volume than the R-38, and they will be driven by nine Maybach engines, each of 400 hp., four on either side of the envelope and one in the stern. The cabin will be placed forward. In it there will be quarters for the pilot and his staff, a saloon, a kitchen, and a smoke room. Much space for baggage will be provided along the keel. Forty passengers will be catered for, but it is intended to give the bulk of the available carrying space to mails. A single journey a week will be made each way between Buenos Aires and Seville and the fare will be about £200. The letter fee will be about 18d.

It is hoped to begin regular flights in approximately two years' time.

A new type of mooring mast is to be used for the new service. The main principle in its design is that the mast is built into a deep socket in the ground, in which it is sunk when not in use. For the purposes of mooring, the line dropped from the airship is attached to the coupling gear on the mast before the latter is raised from the socket. When the airship is secured the mast is raised, and by means of a door in a turret in the top of it connection is made with the forward end of the airship cabin.

Exports of Passenger Cars, Trucks, Tires, Tractors,

COUNTRIES	GASOLINE PASSENGER CARS						GASOLINE TRUCKS						PARTS	ELECTRIC PASSENGER CARS AND TRUCKS	
	Up to $800		$800 to $2000		$2000 and over		Up to 1-ton incl.		Over 1 to 2½-tons		Over 2½ tons				
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value
Europe															
Austria													$112		
Azores and Madeira Islands													827		
Belgium	357	$121,177	6	$5,518	1	$2,275	120	$34,114	1	$1,257			7,303	1	$900
Bulgaria															
Czechoslovakia	1	435											435		
Denmark	10	7,240	5	4,674									91,427		
Finland													583		
France	10	4,661	1	2,000	1	3,270	2	748					171,555		
Germany	1	400	6	6,600					10	33,875			2,000		
Gibraltar															
Greece	9	3,817	1	1,605									2,717		
Hungary	2	936					1	389					167		
Italy													2,572		
Malta, Gozo, and Cyprus Islands	4	1,568											664		
Netherlands	55	37,778	6	6,374	4	19,000	24	9,294					1,503		
Norway			11	14,265									5,523		
Portugal													993		
Roumania													1,502		
Russia in Europe			1	1,500											
Spain	4	2,468	7	6,993									27,075		
Sweden	41	27,513	21	20,608									4,371	1	1,678
Switzerland			3	6,000									1,713		
Turkey in Europe			1	2,000									2,872		
England	14	8,498	13	13,750	5	23,500			6	5,865			394,295		
Scotland													14		
Ireland													69		
Jugoslavia, Albania, etc.			1	1,000									1,008		
North and South America															
Bermuda															
British Honduras													236		
Canada	236	144,367	249	299,591	51	156,726	3	3,478	53	61,029	5	$9,638	1,467,883		
Costa Rica													76		
Guatemala													3,015		
Honduras	1	527											3,060		
Nicaragua							1	1,400					136		
Panama	2	1,200	2	2,718			4	1,698					2,470		
Salvador			2	2,839	1	3,000							35		
Mexico	345	141,143	132	158,564	7	25,689	59	23,510	23	27,622	6	12,293	56,615		
Newfoundland and Labrador			2	2,758									2,359		
Barbados	1	600	1	972					1	680			2,861		
Jamaica	19	10,333	10	10,657			4	1,698	2	5,300			7,369		
Trinidad and Tobago	4	2,721	1	850									3,029		
Other British West Indies	12	5,894	2	2,100			2	849			2	6,900	1,627		
Cuba	41	22,627	20	32,324	4	17,548			3	2,948			20,332		
Dominican Republic	4	1,741	1	1,600									6,652		
Dutch West Indies	6	2,526					1	424					719		
French West Indies	1	435											904		
Haiti	16	8,472					1	424					6,830		
Virgin Islands of U. S.	2	815											87		
Argentina	13	8,826	66	68,391									247,494		
Bolivia													127		
Brazil	13	9,480	22	20,546	1	4,881							16,812		
Chile													10,448		
Colombia	5	2,009	2	2,831			3	1,274	1	934			9,132		
Ecuador													1,500		
British Guiana													466		
Dutch Guiana													980		
French Guiana	1	435													
Peru			2	1,912	1	3,000			1	1,211			6,664		
Uruguay	10	4,347	5	6,069									8,704		
Venezuela			1	1,125	3	10,500							2,190		
Asia															
Aden													81		
Ceylon	10	5,848	3	3,026							2	8,956	1,153		
China	19	14,187	10	9,340	2	4,920							5,623	5	2,675
Chosen	1	500											547		
British India	20	14,546	68	70,248			2	2,052					24,183		
Straits Settlements	2	550											3,566		
Other British East Indies													35		
Other Dutch East Indies													4971		
Java and Madura			60	51,402					1	3,925	1	3,220	14,902		
French Indo China													456		
Hejaz, Arabia, Mesopotamia													574		
Far Eastern Republic															
Hongkong					1	2,600							594		
Japan	104	41,455	15	20,798	1	5,300	50	25,980	9	22,379	1	5,000	30,432	3	8,589
Palestine and Syria	42	18,720	13	12,501			2	1,000					2,767		
Persia													7,291		
Greece in Asia													97		
Siam													293		
Turkey in Asia															
Oceania															
Australia	311	192,353	164	175,815	20	80,000	7	8,855	17	25,450	6	10,240	51,886		
New Zealand	65	43,344	22	25,843	1	4,115			5	8,612			25,548		
Other British Oceania													432		
French Oceania													5		
Other Oceania													418		
Philippine Islands	25	12,504	21	18,841	3	6,889							5,772		
Africa															
Algeria and Tunis															
British West Africa	2	1,166							2	2,173			5,711		
British South Africa	20	13,199	113	115,190	3	6,950			6	6,944	4	8,100	36,252		
British East Africa	2	1,166											4,341		
Canary Islands	7	2,944	1	1,400									1,938		
French Africa	3	1,306											1,298		
Egypt	16	9,454	3	4,440									1,350		
Liberia													7		
Morocco															
Portuguese Africa	1	583											98		
Total	1,890	$958,814	1,096	$1,217,578	110	$380,163	286	$117,187	141	$210,204	27	$64,347	$2,840,259	10	$13,842

Motorcycles and Aircraft for February, 1922.

TIRES						FARM TRACTORS		PARTS	MOTORCYCLES		AIRPLANES AND SEA-PLANES		PARTS	COUNTRIES
Casings		Inner		Solid										
No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value	No.	Value	Value	
														Europe
														Austria
														Azores and Madeira Islands
904	$17,368	637	$1,405			16	$7,698	$200	77	$21,349				Belgium
16	164	16	39											Bulgaria
														Czechoslovakia
1,014	15,348	276	606	78	$3,553			87	2	375				Denmark
														Finland
2,565	27,968	180	301			50	19,351	1,814	32	5,227				France
164	2,615	71	277	2	113				1	350				Germany
														Gibraltar
1,803	34,913	1,540	3,053	15	522	1	421						$50	Greece
						6	2,371	520						Hungary
568	7,875	472	891					425	87	23,010				Italy
44	591	8	31			1	423	80						Malta, Gozo, and Cyprus Islands
494	7,554	245	469	3	215			425	287	78,929				Netherlands
1,756	35,559	1,346	3,219						109	28,661				Norway
529	8,688	456	1,105											Portugal
240	5,999	50	195					41						Roumania
														Russia in Europe
929	13,065	231	635	8	697	1	375	31	59	16,473				Spain
1,285	21,179	891	800			1	400							Sweden
									20	6,555				Switzerland
						5	2,299							Turkey in Europe
17,951	220,820	6,509	9,834	178	5,424	1	676	3,258	25	6,333			5,141	England
														Scotland
								92						Ireland
		1,400	2,759											Yugoslavia, Albania, etc.
														North and South America
								19					77	Bermuda
6	90	4	15											British Honduras
4,730	63,703	5,988	18,228	176	6,294	73	51,418	18,810	35	8,858			382	Canada
63	1,355	37	74											Costa Rica
108	2,584	104	282	2	70				1	148				Guatemala
26	720	22	67											Honduras
4	114							629						Nicaragua
652	8,915	881	1,525	20	667			125	1	100			150	Panama
47	1,006	14	69											Salvador
4,397	71,769	5,814	14,554	261	9,972	19	16,395	37,189	9	1,726			1,199	Mexico
4	59							91						Newfoundland and Labrador
120	1,594	61	177											Barbados
942	13,008	869	1,440	137	3,326			47						Jamaica
211	2,847	127	321											Trinidad and Tobago
50	523	47	127											Other British West Indies
7,730	91,899	4,440	8,364	345	7,930	1	2,000	2,122	1	125				Cuba
196	3,681	238	424					200						Dominican Republic
67	922	66	101											Dutch West Indies
202	2,672	30	60	4	82			26						French West Indies
79	1,674	40	111											Haiti
91	1,352	90	140					584						Virgin Islands of U. S.
5,930	65,381	3,857	6,796	4	215			5,193	10	2,860			15	Argentina
41	1,547	83	249											Bolivia
817	11,398	450	797	10	143	1	671	781					18	Brazil
763	12,141	562	1,615	10	159			2,898						Chile
275	6,475	231	574	38	1,197	1	935	1,145	1	306				Colombia
204	3,719	158	295											Ecuador
84	916	185	293											British Guiana
														Dutch Guiana
														French Guiana
420	7,610	497	970	24	1,074			354					388	Peru
1,028	15,503	126	195	10	180	20	7,292							Uruguay
1,190	19,218	900	2,022	34	224			198						Venezuela
														Asia
12	249													Aden
78	1,884	51	138			2	300		1	400				Ceylon
329	3,738	180	308	45	1,488	1	5,243	57	21	5,795				China
1,190	15,584	1,121	1,892	309	6,300			9						Chosen
														British India
								259						Straits Settlements
969	12,090			24	969			38	32	8,135				Other British East Indies
														Other Dutch East Indies
268	5,852	82	209											Java and Madura
58	1,531	58	169											French Indo China
				20	440									Hejaz, Arabia, Mesopotamia
267	4,863	75	200	176	3,172	1	1,975	688	18	4,400			1,200	Far Eastern Republic
314	3,115	208	506					103						Hongkong
														Japan
														Palestine and Syria
														Persia
30	354													Greece in Asia
														Siam
														Turkey in Asia
1,065	14,481	875	1,782	220	7,139			188	120	33,316			565	Oceania
1,111	21,591	496	1,669	70	2,407	15	8,713	1,023	11	3,140			905	Australia
8	115			12	77									New Zealand
13	175	2	4	3	109								34	Other British Oceania
														French Oceania
1,740	24,245	2,177	4,569	160	4,075			1,269					22	Other Oceania
														Philippine Islands
						2	774	522	1	390				Africa
401	10,828	814	2,617											Algeria and Tunis
4,309	62,258	426	1,296					250	4	1,115				British West Africa
417	6,389	91	250											British South Africa
83	1,347													British East Africa
														Canary Islands
146	1,676							608	4	1,271				French Africa
														Egypt
240	1,971	105	188											Liberia
								17						Morocco
														Portuguese Africa
$73,787	$1,028,467	46,941	$101,301	2,388	$68,233	218	$129,733	$82,415	969	$259,347			$10,116	Total

Fundamentals of Labor Question Ignored

Efforts toward improving industrial relations largely abandoned. Control of labor through economic conditions only postpones the final settlement. Labor study tends to find an immediate solution to a specific problem rather than to understand fundamentals to achieve a permanent solution.

By Harry Tipper

A SURVEY of the country in the automotive field indicates very thoroughly the extent to which industrial relations efforts have been abandoned. Employment managers remain and in many instances these employment managers are attempting to improve the morale, conscientiously endeavoring to provide a better spirit among workers. They are hampered by the circumstances. In the fluctuating employment little can be done to improve the situation between the workers and their supervisors while, under the prevailing impression that labor is beaten, the desire for better relations and better understanding seems to have gone into the discard almost entirely. There is a widespread belief in manufacturing circles that labor is definitely beaten for a considerable time and that it is possible for the manufacturer to place himself in a position of virtual control again. This is the idea behind the refusal of the coal operators to confer with the miners in accordance with the terms of their agreement. It is also the reason for the general abandonment of work in industrial relations within the plant, the advocacy of the open shop, and the bitterness expressed in many quarters towards the unions. This attitude is all the more interesting in view of the past history since the industrial system began. Strikes have been defeated, unemployment has occurred and labor has been beaten many times during that history only to organize more carefully a little later on.

THE greatest waste of industry to-day is human waste and the great advance in efficiency will be made by an advance in orderliness and the lack of interruption and increase in working capacity of the individual. It is disturbing to find the manufacturers giving up all study of this kind so readily and lacking an apparent appreciation of its importance from a business standpoint. Reports from various parts of the country indicate that employment managers and general executives interested in the wage and labor situation believe that this is a matter of supply and demand and apparently believe that the alternate prosperity and depression will answer all the requirements in the relation between the management of a company and the workers.

It is true, there is no actual necessity for placating the worker at this time. There is little necessity for worrying about the price to be paid, but that is not the point. As things are going to-day, the next era of more or less full employment will find the manufacturer as badly off as he was in 1920. He will learn practically nothing by his previous experience, and the general situation will not be improved in any large measure. When labor is scarce and wages high, the efforts of the manufacturer to establish decent industrial relations are viewed with suspicion. They are figured as part of the scheme to keep wages down. In other years they were suspected as a part of the deep policy of the manufacturer to undermine the labor organization. No such suspicion can attach to efforts that are made during a time like the present. There can be no element of self-defense in the study of the problem by the manufacturer, and such study is not likely to weaken the actual antagonism of the labor union as it would have done in 1920. The labor problem is not a temporary one. It is not concerned with the growth of this or that union or the payment of this or that wage scale. It is a perennial problem which has grown more acute as the industrial system has grown more complicated. It is not settled because a few strikes are beaten or because a few organizations are temporarily weakened. It can only be settled within the plant, and the operations of the plant management in this direction are still the most important operations for increased efficiency that can be made.

The factory labor on an automobile varies from 15 to over 20 per cent in the examples which we have been able to secure. A reduction in the wage rate such as has taken place between 1920 and 1922 in the skilled trades will make some difference in costs, but it will not bring the economies required by the great reduction in prices. Prices are being made all along the line without any particular record for cost at the present moment. The raw material man, the man who is selling supplies and parts, all along to the man who is selling complete cars, have been cutting prices to meet the market and the adjusting costs as best they can. It is still possible to secure more reduction of labor cost per unit of production by the proper management of industrial relations than by a reduction of the wage rate, and, in the plants where the industrial relations have been amicable and carefully considered and there is a unity in the organization, reductions have been accepted or suggested by the workers without difficulty and the efficiency has been maintained or increased. The manufacturer can get by for the present moment of depression with his problems based upon supply and demand and control all the working conditions. Getting by will not

solve his problem, neither his cost problem nor his problem of a sufficient supply of skilled labor at all times on a reasonable basis, a lessened "turnover" and a greater efficiency.

It is evident that the apparent study given to the labor question in 1919 and 1920 was very largely due to the immediate question of looking for some special way of meeting the problem and not a desire to understand the question fundamentally so that it could be met, not for a year, but for any part of the life of the business. Skilled labor has not been reduced to the same extent as the unskilled labor in many lines and the reductions have been more uneven. The highly organized trades are resisting the reductions more successfully, and there is a great activity in workers' organizations not for immediate purposes but to secure an increased strength when the present acute problem has passed mostly away.

The greatest waste of industry to-day is human waste, and the great advance in efficiency will be made by an advance in orderliness and the lack of interruption and increase in working capacity of the individual. It is disturbing to find the manufacturers giving up all study of this kind so readily and lacking an apparent appreciation of its importance from a business standpoint. Reports from various parts of the country indicate that employment managers and general executives interested in the wage and labor situation believe that this is a matter of supply and demand and apparently believe that the alternate prosperity and depression will answer all the requirements in the relation between the management of a company and the workers.

This is not the case in Europe, where the desires and aspirations of the workers have proved to be of sufficient importance to demand attention before the industrial machinery can be set to work properly and kept in proper motion. The working of this law of supply and demand for 400 years in the industrial system has increased the number of adherents to workers' organizations from a few hundred to some thirty million in the various countries, so that it is not likely that the workings of this law will reduce either the number or the strength of such organizations. Moreover, industry is not concerned with ruling the worker. Industry is concerned entirely with securing the largest amount of work for the least possible amount of money per individual piece. It still remains that a company of men working in harmony with a community of purpose and ideas and some sound trust in each other can accomplish more at less cost than men who are working because it is necessary. This is the meat of the matter and it is only in this way that the full benefits can be secured by modern industry in the handling of its labor to economic advantage.

Headlight Tests and Regulations

A GREAT deal of interest is now being shown in regulations governing the headlights used by motor vehicles. The Bureau of Standards has assisted local authorities and the manufacturers through tests of these devices, and already quite a number of the states have framed laws to govern the use of lights on automobiles. The matter is one which should receive uniform treatment, and this has been recognized by nearly all those concerned in the subject.

In order to secure a satisfactory degree of uniformity in all parts of the country it will be necessary to have (1) uniform laws, (2) uniform procedure in the enforcement of the laws, and (3) an extensive campaign of education for enforcement officers, garage men and drivers of automobiles.

The establishment of headlight adjusting stations in garages has been found to be a very desirable step, and they have already been used in a number of states and cities under more or less definite official regulation. So far uniformity of legislation has been based upon the specifications formulated by the Committee on Motor Vehicle Lighting of the American Illuminating Engineering Society. These specifications have been adopted in practically the same form by nearly a dozen states. At the time they were formulated it was believed that the specifications were as rigid as could be enforced, but recently even more rigid regulations have been adopted in some sections.

In view of this situation, the above-mentioned committee decided that a revision of its specifications should be made. In accordance with this decision, the values specified for light on the road were considerably increased, while the limiting values, which are intended to control glaring light, were left unchanged. Other changes were also made.

With the idea of securing uniformity in the adoption of regulations, an informal organization of State authorities representing the whole of New England, New York, New Jersey, Pennsylvania and Maryland has been formed. Another meeting of this organization will be held at Harrisburg in April, and it is understood that an attempt will be made to establish a board of officers which will be charged with the approval of devices in all the states represented.

A RECENT letter from a resident of Brisbane, Queensland, Australia, which was published in the British paper *Motor*, tells some facts regarding the local automobile market which should be of interest to the American manufacturer. He admits that the State is almost entirely held by the "Yankee" product, but hopes that the English manufacturer will go after the market.

The fact that the American cars are almost entirely from the low-priced, light-car group gives an idea as to the type of car best fitted for that country.

He asks two leading questions:

1. Is the British manufacturer going to maintain his enthusiasm for the small car?

2. If he exports, will he take any interest in the product after it leaves his hands?

At present Queensland has suffered financially with the rest of the world, but the writer believes that the British light car would have a chance if pushed hard. He maintains that the following things must be done to insure any measure of success:

1. A reduction in price to make real competition with the American medium-power car.

2. Actual samples on the spot, vigorous advertisement via the press, active entry for all A. C. Q. events, such as hill-climbs, reliability tests, fuel consumption, and so on.

3. Genuine spare parts, standardization and, say, a six months' guarantee.

Each American manufacturer represented in Queensland should be able to tell in a measure what he has done and what he has left undone to win and maintain the market according to the writer's idea of what actions are necessary for the British manufacturer to succeed.

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A Forward Step

A PRODUCT is manufactured at the lowest possible unit cost when the fullest powers of the various workmen as well as of the various machines are called into play. As the individual is made capable of assuming increased responsibility, the necessity for supervision and administrative expense decreases. While there has been a general tendency to disregard the production importance of these fundamentals during recent months, there are striking exceptions here and there throughout the industry.

The Oakland factory, for example, has in operation a plan which tends toward the better development of the capacity of individual workers and which operates to procure both better quality and cheaper production. The plan is explained in a bulletin issued by the company as follows:

"Every new employee is thoroughly taught the particular operation he is called upon to supervise. In addition he is taught the principles of the operation of the employee preceding him and also of the employee who performs the next operation after him. For every employee inspects the operation of the man preceding him before doing additional work and inspects his own work before sending it on to the next man. These inspections are made beside many inspections of the regular inspecting force. The thought underlying this system is not to have one employee discriminate against another, but to see that there is no let-down in quality of work done.

"The secondary result of this system is to keep on hand at all times a body of skilled mechanics. There are no green hands called upon to fill any position. All the men required for the most difficult positions are recruited from within the Oakland factories. There is ever a promotion of the older, more skilled employees to the higher positions. In like manner all the inspectors at the factories are chosen from among the men who have held several positions and who know from actual experience the kind of perfect workmanship that is required."

This is an excellent practical example of how the idea of developing the individual worker may be worked out. Such a plan does not solve the labor problem, nor was it installed for any such purpose. It does constitute a step in the direction of constructive progress. The idea behind the plan is based upon production practice and human psychology that is fundamentally sound.

Alcohol Fuel in Exported Vehicles

MANY automotive manufacturers are looking more and more to foreign markets to absorb a portion of their products and they are consequently interested in the conditions which must be met to satisfy customers in these markets. In all or nearly all countries outside the United States and Canada the cost of gasoline is so much greater than it is in this country that substitutes are frequently used and there is more incentive to consider the matter of fuel economy.

In Brazil and in the Spanish speaking countries of South and Central America, the West Indies and even in Hawaii and the Philippines alcohol is either being used or discussed as a possible future motor fuel. As might be expected, this fuel does not give entire satisfaction in vehicles designed to run on gasoline, even though it is, in some respects, a better fuel. Some of the reasons for this were set forth in an article entitled "The Use of Alcohol in Exported Vehicles," which appeared in AUTOMOTIVE INDUSTRIES for April 6. This article also gave figures showing how extensively fuel alcohol is already used.

Those who have made a study of the export market believe that cars, trucks and tractors especially fitted up to burn alcohol will find a ready sale. The changes needed in standard gasoline vehicles are not of a radical nature, but exact information as to the most economical compression ratio, the quantity of heat required for satisfactory vaporization, the most economical mixture ratio, and the best metals to resist corrosion is lacking, although some data on these points are available.

In short, the subject is in need of further study, and considerable research work is required before the best results are obtained. But the subject is not simply academic. It is of immediate practical interest and should be seriously considered by manufacturers who might well see that Congress appropriates funds to carry out research work on this and related subjects at the Bureau of Standards and in such other Government laboratories as are equipped for the work.

We shall welcome discussion of the subject in the Forum and be pleased to receive any authoritative data regarding the performance of automotive equipment using alcohol fuel. Interchange of information along this line will certainly benefit all concerned.

Will Distributor Study Markets?

MANUFACTURERS seem to be agreed that the distributor cannot be depended upon to secure comprehensive or accurate market analysis data. Consequently such essential work is being undertaken by the factories. This is necessary in view of the facts which must be faced.

Nevertheless, the factory will reduce the cost of its analysis work if efforts are continuously made to explain to the various distributors what it is all about, the practical value it has for them, and how they can use the results of such analyses in their selling effort. To do this will be extremely difficult in some cases and nearly impossible in others. It should be recognized, however, that in proportion as the distributor becomes interested and active in this work, the relative cost of carrying it on decreases from the factory standpoint. Moreover, the distributor is better able to carry on his work, sells more cars, and makes more money.

Distributors sometimes think that factory market analysis work is against them rather than with them. They have a suspicion that the factory is merely going through a lot of statistical gymnastics, purposely devised so that the distributor cannot understand them, with the idea of forcing him to take more cars than he wants—or in good times of keeping from him some cars that he does want.

From every standpoint it is worth while to continue the effort to sell the distributor on the idea of market analysis and market studies.

Two-Stroke Engines in Europe

RECENTLY there has been a notable increase of interest in two-stroke engines among European designers of passenger cars. In the British motorcycle field the two-stroke engine has always occupied a position of considerable importance, and from this field it is now forging its way into the cyclecar and light car fields.

Having had an extensive try-out in the United States and been discarded as a car engine, it is rather surprising to see the two-stroke turn up in Europe again, but if the situation is carefully analyzed the present European interest in the engine does not seem so illogical.

The two-stroke engine, in its simpler forms at least, has two shortcomings which led to its abandonment in this country. One is that it is less ecomonical of fuel than the four-stroke engine, especially if it is designed for operation at high speed and to this end provided with ports of considerable depth. The second is that it cannot be throttled as well as the four-stroke engine. Perhaps this latter disability should have been placed first, as it was undoubtedly the chief cause for its failure to satisfy car owners here. The cost of fuel was not as yet considered very seriously at the time of the two-stroke's decline as a car engine in this country.

The great advantage of the ordinary two-stroke engine is its simplicity, as a result of which it is cheap to manufacture and easy to maintain. Its inherent weaknesses, of course, are also closely bound up with this simplicity, and all attempts to overcome these weaknesses have resulted in complication, and thus at least partially eliminated the advantages over the four-stroke engine.

It is to be noted that the class of car for which European engineers are now selecting the two-stroke engine is the lightest and cheapest class which has to be built "to meet a price." The purchasers of these cars are not particularly exacting in respect to flexibility of the engine, and the simplicity of the design, with its entire absence of any valve gear, appeals to them. The lack of economy might be expected to be the greatest handicap of the engine, but the designers have concentrated their efforts on the elimination of this weakness and no doubt have succeeded to an extent. Quite a number of the engines are air-cooled, and air-cooling, in the estimation of many engineers, tends to greater fuel efficiency. All of the engines are small and therefore not great fuel consumers, and the advantages of low price and simplicity probably make a stronger appeal to the customer than a slight superiority in fuel economy would.

The Tractor Market

THERE are indications that the tractor business is picking up. Reports show a very healthy demand and a much greater interest in the possible purchase of them.

One dealer sent out a given number of letters to farmers, asking whether they were interested in the purchase of a tractor. This letter was sent out for three successive years and the replies tabulated. The results were as follows: Taking the year 1920 as a basis, in 1921 the number interested decreased 44 per cent, while in 1922 the number increased 329 per cent. This may be taken as a very good omen.

"There is many a slip 'twixt the cup and the lip" may be said in this case to mean, "There's many a slip b'twixt the interest and the sale," but if we know that the market is there and that the farmer's interest is backed up by an improved financial status then it is up to the tractor manufacturer to perfect his sales organization so that there may be as few slips as possible between the genuine interest and the bona fide sale.

Sales Keep Abreast of Factory Output

Production Still Speeding Up—No Large Surplus of Finished Vehicles Carried

By James Dalton

NEW YORK, April 18—With April more than half gone, manufacturers of motor vehicles still are speeding up production. There is every reason to believe the month will show a gain over March as was recorded by March over February. That was approximately 32 per cent and it was 65 per cent in excess of the preceding March.

Sales at retail, so far as can be determined, are keeping practically abreast of production. It is certain, at any rate, that no large surplus of finished products is being built up.

Up to this time the industry has been rather hesitant about accepting the theory that the country actually has begun the long swing back from depression and even now there is no disposition to abandon caution in commitments, but it is generally believed that any decline in sales this year will be merely seasonal.

Company after company is coming through with reports of greatly increased output for April. This applies to truck manufacturers as well as to those in the passenger car field. The largest producers of heavy duty vehicles assert that April orders will exceed any month since May, 1920. Makers of light trucks agree that business is excellent. Ford production is approaching capacity but the proportion of trucks turned out is much larger than it has been in many months.

Dealers Optimistic

Dealers everywhere are as optimistic as builders. Factory enthusiasm, in fact, is based solely on sales. Not only is there a strong demand for new vehicles, but the market for used cars is so strong that in most places they have ceased to be a sales deterrent.

Demand for motor vehicles is not peculiar to a few sections of the country but is practically universal. Even the South and the grain growing sections of the Middle West are buying in considerable volume. The farm market generally is steadily expanding, especially for commercial vehicles. The same is true of the industrial centers. Business in Canada is keeping abreast of the United States.

It is reported in a few of the larger cities that factory workers are beginning to buy used cars and inexpensive new cars. It is significant that the bulk of the passenger car buying is in the low and middle price classes. The percentage of increase in these fields is much greater than in the high price class although a few companies turning out comparatively expensive products are having the best business in their history.

Production in parts plants continues to gain rapidly and many of them are having the largest business in nearly two years. Several expect April to be the best month in their history.

Business in Brief

NEW YORK, April 18—Trade and industry generally continue their upward trend in spite of rains, bad country roads and strikes. The strike situation is no less serious and there are no indications that the mine walkout is any nearer an end than the day it was called. It has not yet affected industry, except iron and steel to a small degree.

The winter wheat crop has made a further gain notwithstanding an excess of rain. Spring seeding has been somewhat delayed by bad weather in some sections.

Export trade apparently has turned the corner. March recorded really definite gains.

Financial developments are practically all favorable. They include immense sales of bonds at steadily rising prices, sustained strength in the stock markets, more pronounced ease in money markets at home and abroad and continued strength in exchange rates.

Great improvement in buying of lumber, builders' hardware, cement, paints and other materials by the forward surge in construction activities is releasing huge sums of money and taking up the slack of unemployment.

Cotton consumption and exports are increasing in the face of the New England strike.

There is heavier buying of hides and leather.

The iron and steel industry has witnessed another buying spurt with advances in prices of many grades. Mills in the Chicago district are operating at 80 per cent of capacity.

There has been a very definite improvement in sales and credit conditions in the South.

POLAND FORBIDS CAR IMPORTS

NEW YORK, April 18—The importation of passenger cars and bodies now is forbidden in Poland.

Willys Is Optimistic on Return from Tour

Deliveries for Second Quarter Will Be Limited Only by Production Capacity

NEW YORK, April 17—The second quarter of 1922 would be the largest in the history of the Willys-Overland Co. if it could deliver all the cars for which it could get orders. It is estimated that sales of Overlands and Willys-Knights for the quarter will aggregate 37,000, but it would be possible to raise this number to 50,000 if that many cars could be turned out. This was a message brought to New York this week by John N. Willys after a seven weeks' trip in which he covered 18,000 miles, talked to 2500 dealers and all the distributors in the western territory.

While the company is in the unhappy position of not being able to take care of all the business it can get, there is no intention of departing from the conservative policy which has been in force at the Willys-Overland plant since the company began to recover from the depression. Willys would prefer a surplus of orders rather than a surplus of finished cars for which there is no market.

After his trip to the Coast by way of the northern route, then down through all the coast states and back to Toledo by the southern route, Willys was optimistic over the business outlook. In every section he visited he found a material improvement in general business conditions, resulting largely from increased prices for lumber, wool, livestock and agricultural products. The rapid return of confidence is, to him, the most encouraging feature of the situation. He believes that the relative prosperity which now is being experienced generally will continue, although he does not expect a boom.

Company's Affairs Improve

So far as Willys-Overland is concerned Willys is entirely confident. There still are a few difficulties to be ironed out, but the affairs of the company have shown an extraordinary improvement in the last few months. All possible losses have been taken, and operations are on a substantial basis, which undoubtedly will show a profit for the year.

After spending the week-end with his family here, Willys returned early in the week to Toledo, where he will spend most of his time in future. Although he has been on the road almost continuously for many weeks, conferring with distributors and dealers, this work will be continued for the next two months. The enthusiasm with which he has imbued the company's distributing organization has been reflected in the phenomenal business for the past five or six weeks. There is a strong demand for both Overland and Willys-Knight cars in all sections and Willys says they are giving entire satisfaction to purchasers.

Nash Will Direct Pierce-Lafayette

To Formulate Selling and Manufacturing Operations After Consolidation

NEW YORK, April 18—Detailed plans for the consolidation of the Pierce-Arrow Motor Car Co. and the Lafayette Motors Co. are being worked out following a conference of bankers and officers at which the plan was agreed upon in principle. C. W. Nash, president of Lafayette and of the Nash Motors Co., will become chairman of the board of the consolidated companies, while Colonel Charles Clifton, chairman of the board of Pierce-Arrow, will serve as president. Nash will have charge of all operations. He will shape the selling and manufacturing policies.

It is understood there will be no new financing in connection with the consolidation, as stockholders of both companies will exchange their stock for securities of a new company which is to be organized. No title has been selected for the new company, but it is intimated that the name of Pierce-Arrow will be retained. The banking house of J. & W. Seligman & Co. has been interested in the affairs of both Pierce-Arrow and Lafayette for some time, while Lee, Higginson & Co. have been interested in Lafayette. Both houses will be represented on the board of directors of the new company.

Better Production Facilities

It is understood one of the factors which led to the proposal to consolidate is to be found in the fact that the excessive manufacturing space of Pierce-Arrow can be utilized to turn out bodies for both Lafayette and Pierce-Arrow cars. Lafayette has been experiencing difficulty in obtaining satisfactory bodies for its chassis. Nash is quoted as having said that the Pierce-Arrow plant turns out the best passenger car bodies available.

The plans do not contemplate any immediate change either in the Pierce-Arrow or Lafayette lines. Both are in the higher class field. The Pierce-Arrow is powered with a six-cylinder engine and Lafayette with an eight cylinder. The Lafayette phaeton sells for $4,090 and the Pierce-Arrow for $6,500.

Pierce-Arrow has taken heavy losses in the last two years, but there has been a very sharp upward turn in its sales, both of passenger cars and trucks, in the past few months, and it is expected to show an operating profit this year. Lafayette also has been experiencing financial difficulties in the past few months, and some time ago asked for the cancellation of its commitments for materials. It was understood this step was taken at the demand of bankers.

Nash Motors will not be involved in the consolidation any more than it has been with the Lafayette company. Both are controlled by Nash. Until the merger is completed, Colonel Clifton will serve as chairman of the board and president of Pierce-Arrow.

Stockholders' Meeting Postponed

BUFFALO, April 19—The meeting of stockholders of the Pierce-Arrow Motor Car Co., which was to have been held at the plant yesterday afternoon, was indefinitely postponed because a majority of the stock was not represented. Nothing of a definite nature was announced regarding the merger of the company with the Lafayette Motors Co.

Myron T. Forbes, vice-president and general manager, issued a statement in which he said there was no announcement to be made at the present time concerning the merger and the plans for the future would not be discussed. He had just returned from a visit to the Lafayette plant at Indianapolis.

Amount of Truck Business Is Large Now and Capacity Volume Is Promised

By Martin L. Pulcher

Vice-President and General Manager of the Federal Motor Truck Co., and President of the National Association of Motor Truck Industries

Detroit, April 17.

IN this day of returning business in the motor truck industry it is of the utmost importance that the manufacturer take a long look into the future and make his plans accordingly.

The motor truck business is going to continue long after the day of many of the companies now in it. How long many of the present companies are to continue is largely a matter of their ability to analyze the fundamental requirements of the business and their capacity to meet them.

Most important of all considerations is the merchandising policy. Manufacturers without a strong selling organization or the ability to develop one might as well get out of business now and as quietly as possible. The best trucks in the world stored in the rear of any factory will never produce a cent of profit.

Trucks should be fathered almost in the sense that a child is and this fathering carried through until the truck has completed its mission as a business adjunct. It is not enough for the manufacturer to sell the truck to a distributor or the distributor to a user. Both manufacturer and dealer must be in position to help the owner keep it operating. Manufacturers unable to do this or manufacturers with dealers unable to do this are not operating on a basis sound in its possibilities for the future.

There is a large amount of truck business now and promise of capacity business soon. For the present, manufacturers are content to trail with this business rather than seek to control it. For this reason demand is running in excess of supply. As the trend of business becomes more definitely established the truck makers will meet the demand with spot deliveries. It is unwise to take chances on creating a surplus.

Factors making for truck business now are the rapid growth in building operations and the opening of extensive road building operations. Material prices in these fields are low. The number of idle freight cars is decreasing and some roads are placing orders for new cars. This means motor truck operations on both ends.

Practically all of the surplus war trucks have now been distributed, removing a serious sales resistance factor for the truck manufacturer. Used trucks do not exist in any quantity. War trucks shipped back from abroad in good condition have, for the most part, been sold. There is no market for the others. Steps have been taken to prevent any more coming back.

Taking all these factors into consideration, there remains only the question of continued restoration of general business. Indications are that it will continue its strides. Later on this year, with fair prices for farm produce, there will be large developments in this field.

With all these harbingers of business there should be no pessimism for motor truck manufacturers who are solidly established. Good trucks, sold right and properly maintained, will command the market.

Peerless March Business Approach High Record

CLEVELAND, April 18—Peerless Motor Car Co. shipments during the second week in March, including two entire trainloads, were exceeded only twice in the history of the company and then only by margins of eight and seventeen automobiles respectively. The total March business has been exceeded in only one previous March in the history of the company.

Monthly manufacturing schedules have been increased to keep up with the orders, and overtime is common at the factory.

When R. H. Collins came here as president and general manager of the Peerless company he set before his organization the task of producing and selling during the first six months of 1922 more than the entire total of Peerless production and sales during 1921.

$9,188,561 Is Sought from Lincoln Motors

Government Files Suit in Detroit Against Old Company on War Contracts

DETROIT, April 18—The United States government has filed suit for $9,188,561 in Federal court here against the bankrupt Lincoln Motors Co., which brought $8,000,000 when it was sold recently by the receiver to Henry Ford.

The suit was filed by Earl J. Davis, United States District Attorney, who received the papers from Washington. The government claims the amount asked in the suit was the sum which the Lincoln company was overpaid on war contracts for Liberty motors.

When the property was purchased by Henry Ford on Feb. 4, the debts of the company were estimated at $11,170,000, including a contingent liability of $1,500,000. The unsecured claims amount to $8,670,000.

Assets were carried on the books amounting to $15,061,492, but appraisal by the Detroit Trust Co. as receiver fixed them at $9,073,105 and the liabilities at $9,490,811.

The new Lincoln Motor Car Co. will not be affected in any way by the suit.

Will Press Suit

WASHINGTON, April 15—The government's claim against the old Lincoln Motor Co. will be pressed, it is asserted by Attorney General Daugherty after a conference with counsel representing creditors of the defunct company whose claims amount to approximately $9,000,000.

The creditors were represented at the hearing, over which Daugherty personally presided, by Harold H. Emmons of Detroit, acting for the Detroit Trust Co., receiver. There are approximately 900 creditors, Emmons said after the meeting, and to pay their claims there is available $5,000,000 out of the $8,000,000 paid by Henry Ford for the property. The other $3,000,000, he added, represented preferred claims, including labor, mortgages and city, state and county taxes.

The following statement was issued by Daugherty at the close of the hearing:

As was planned, a final hearing of the controversy involving the Lincoln Motors Co. has been held. It was participated in by a greater number of officials of the Department of Justice than generally participate in hearings of this character. It is customary upon request for the department to hear those against whom the government is pressing a claim as a matter of courtesy. This hearing was insisted upon by the receiver of the Lincoln Motors Co., an officer of the United States Court who represented more than 900 creditors.

The department thought it fair to grant this hearing under the special circumstances of the case. No time has been lost and no money has been lost to the government in affording an opportunity for this hearing. The hearing was concluded after a two hours' session and a decision was promptly reached that the government proceed in an orderly way to file and press the payment of this claim. It will no doubt promptly reach the Federal Court, where the whole matter of the liability of the parties will be determined.

Representatives of the War Department, the Department of Justice, the judge advocate's office, with legal and accounting counsel, participated in the hearing.

In a statement issued earlier in the week Daugherty declared that the case of the Lincoln Motors was brought out into the light through the desire of a former solicitor of the department to make trouble. The former employee referred to was H. L. Scaife, former solicitor and investigator, who had resigned because, he alleged, the government was not taking proper action to follow up evidence uncovered against the Lincoln and other concerns having contracts with the government.

(*Continued on page* 893)

Kelly Tire Eliminating All Its Own Salesrooms

NEW YORK, April 14—Consolidation of the general offices of the Kelly-Springfield Tire Co. at 250 West 57th Street, this city, was designed to organize more efficiently the executive branch of its business. A significant feature of the reorganization is that the New York branch has been moved to the company's warehouse at 553 West 57th Street, a step which is really equivalent to giving up the branch altogether since it now has no display rooms or sales counters.

The company explains its action on the ground that with the stabilization of the industry there is no need for the maintenance of these expensive establishments. With the discontinuance of all retail sales by the company, the factory branch was deemed a needless expense. This overhead burden will be eliminated in all cities as soon as practicable, and warehouses will be established in various centers of distribution where railroad facilities are best suited to give prompt service to dealers. In all these cities the branches will be supplanted by offices.

Reorganized American Bearings Buys Plant

INDIANAPOLIS, April 18 — The American Bearings Corp. has bought a factory building here from T. B. Laycock, Son & Co., manufacturer of juvenile bicycles. The negotiations are said to have been pending for some time. The bearings company has been installing machinery in the plant for two weeks.

The bearings company is a reorganization of the American Bearings & Die Casting Corp., which went into the hands of a receiver last July. Since the reorganization, it has been operating on another site in this city. The officers are Arthur Dixon, president; William Fletcher, vice-president, and Paul J. Moore, secretary and treasurer.

Frontenac Acquires Indianapolis Plant

Expects to Be Operating It Within 30 Days—To Make All Units There

INDIANAPOLIS, April 15—The Frontenac Motor Co. of America, which is to manufacture the new four cylinder motor car designed by Louis Chevrolet, has purchased the plant formerly operated by the Empire Motor Car Co. of this city. The plant was built originally and operated by the Federal Motor Co., and the purchase was made from that company.

Situated at Fifteenth Street and the Big Four tracks (Indianapolis), the plant affords more than 100,000 sq. ft. of space. The main structure is a one-story building of saw tooth construction, which will be used for machine shops and assembly. A three-story structure nearby will take care of the balance of the manufacturing plant. In addition there is a two-story office building which will house the executive staff.

Directors of the company state that work will begin at once to put the buildings in shape for production and that all necessary equipment and machinery has already been bought. Officials say they expect the plant to be in operation within thirty days. The first sample cars are expected to be ready by the latter part of May, and production in a limited way will be in process by the latter part of June.

William N. Thompson, president of the Stutz Motor Car Co., who has been prominently identified with the Frontenac company of which he is a director, says that when the Frontenac reaches full production more than 1500 men will be employed. He also says that all the units will be built in the newly acquired plant.

Guy H. Hall Will Direct Work of Tractor Bureau

CHICAGO, April 15 — The Power Farming Bureau, which was organized more than a year ago to promote publicity in behalf of tractors, has been succeeded by the National Institute of Progressive Farming. Guy H. Hall, best known to the tractor industry as secretary of the Kansas City Tractor Club and manager of the tractor shows held in Kansas City, is manager of the new organization.

The headquarters of the new organization will be in Chicago. It is supported by tractor and farm implement manufacturers and by organizations supporting progressive and diversified farming movements. The several cattle associations are for the first time joining with the manufacturers for a general advancement of the better farming idea. The plan is that the information developed and broadcasted by this organization will be constructive for farming and not in any sense the ordinary publicity type.

Packard Announces Its New Single Six

Produced in Two Wheelbase Lengths to Suit Different Body Types

DETROIT, April 20—The Packard Motor Car Co. released for publication today details of the new single six model which was announced in AUTOMOTIVE INDUSTRIES of February 9. The new model is now being produced in two wheelbase lengths to suit different types of bodies. The 5-passenger phaeton, 2-passenger runabout, 5-passenger sedan, 4-passenger coupe and 4-passenger sport models are mounted on 126 in. wheelbase chassis. The 7-passenger phaeton, 7-passenger sedan and 7-passenger limousine are mounted on 133 in. wheelbase. The prices are based on a list of $2,650 for the 5-passenger phaeton and $2,685 for the 7-passenger phaeton.

Mechanically, there is but little change as compared with the previous single six. In order to take care of the heavier bodies and to provide a standard engine for both wheelbases, one-half inch has been added to the stroke, making the dimensions for the power plant now three and three-eighths by five inches. Another slight change is the addition of one driving plate to the disk clutch, making this now a four driving plate type instead of three.

The bodies are characterized by long, low lines, accentuated by a bead strip which runs from the radiator around the entire length of the body and hood.

On the 5-passenger phaeton the tool compartment is in a space behind the front seat with curtains in left door pocket. On the 4-passenger sport, steel disk wheels are standard equipment. The tire equipment is cord 33 by 4½ in. on all except the sport model. Steel disk wheels are optional at $35 additional.

List prices of the new single six, f.o.b. Detroit, are as follows:

5-passenger Phaeton	$2,485
Runabout	2,485
Sport Model	2,650
Coupe	3,175
5-passenger Sedan	3,275
7-passenger Phaeton	2,685
7-passenger Sedan	3,525
7-passenger Sedan Limousine	3,575
"126" Chassis	2,250
"133" Chassis	2,350

These prices do not include freight or war taxes.

MANY AIRPLANES ENTER MEET

NEW YORK, April 18—More than 60 airplanes have been entered in the first of the national flying meets sanctioned by the Aero Club of America and the Aeronautical Chamber of Commerce, which will be held at Curtis Field, Garden City, Sunday, April 30.

PATENT CLAIM SETTLED

CLEVELAND, April 18—A claim of patent infringement against the General Motors Corp. has been settled by Frank A. Scott, receiver for the Standard Parts Co. By the terms of the settlement, the corporation has taken a license under patents Nos. 1,153,481 and 1,153,482, dated Sept. 14, 1915, relating to rims, and has paid approximately $25,000 for past infringement, this amount having been offset against the claim of the corporation against the estate of Standard Parts. It was contended by the Standard Parts Co. that the Jaxon Steel Products Co., a General Motors subsidiary, infringed the patents.

Monroe Incorporates with $500,000 Capital

INDIANAPOLIS, April 15—The reorganized Monroe Automobile Co. of Indianapolis has filed articles of incorporation here with capitalization placed at $500,000. The directors are William Small, J. H. O'Brien, F. A. King, J. F. Martin, and H. H. Alexander. Small is president and general manager; O'Brien, vice-president and executive manager, and Alexander is to be sales manager.

The plan is to sell direct to owners. Manufacture is to be continued at the old plant in this city, and the executive offices will remain at the same place. The company succeeds the William Small Co., which was sold at receiver's sale some time ago. Pending the reorganization the concern has been operating on the plan to be followed now.

Two Sections of S. A. E. to Hold Joint Meeting

NEW YORK, April 17—The Metropolitan and New England sections of the Society of Automotive Engineers will meet jointly at New Haven on April 21, when a paper will be presented by Prof. E. H. Lockwood of Yale University on "Power Losses from the Engine to the Road." The members of the Metropolitan section will go to the meeting in gasoline engined railway motor cars over the New York, New Haven & Hartford railroad.

On the same evening the Cleveland section of the society will discuss the matter of motor vehicle lighting, the paper of the evening being presented by H. H. Magdsick.

William F. Parish will discuss the dilution of crankcase oil at the meeting of the Detroit section on April 21, and will demonstrate a device to distill off the gasoline in the lubricating oil.

On April 27 C. T. Myers will read a paper before the Pennsylvania section, giving some notes on motor trucks.

PETERS MOVING TO NEW PLANT

BETHLEHEM, PA., April 17—The Peters Autocar Co., which has taken over the building formerly occupied by the Bethlehem Paper Co., is making rapid progress in transferring its equipment from the old plant at Trenton. The company is negotiating for the purchase of fifteen acres of land adjoining the building to provide for future expansion

Ford to Sell Truck Equipped with Body

"Three in One" Will Be Adapted to Several Uses—3-Ton Model Likely

DETROIT, April 18—The Ford Motor Co. will begin late in the summer to supply its one-ton truck, equipped with body complete, as well as the stripped chassis. The design of the body has not yet been definitely determined, but it will be a combination type practical for several uses. "Three in one" is the way one factory official described it.

It is probable Ford will enter the three-ton truck field late in the summer. This is dependent largely upon the development of business generally up to that time and the consequent probable demand for trucks. The company has mapped out definite plans to go into the heavy truck field, but they have been delayed temporarily.

Models of GMC Truck Made in Two Wheelbases

PONTIAC, MICH., April 15—The 2, 3½ and 5-ton GMC trucks are now being made in two wheelbases, the standard length models being designated as A and the longer models as B. The other chassis details remain as before, except for changes necessary to the longer construction. The prices of the models are:

Model	Wheelbase	Price	Capacity
K16	Standard	$1,495	1-ton
K41A	Standard	2,775	2-tons
K41B	Long	2,775	2-tons
K71A	Standard	3,950	3½-tons
K71B	Long	4,050	3½-tons
K101A	Standard	4,350	5-tons
K101B	Long	4,450	5-tons

KREBS-COLLIER TRUCK

BELLEVUE, OHIO, April 17—A line of trucks to be known as the Krebs-Collier will be built by the Collier Motor Truck Co. for the Krebs Motor Truck Co. The capacity and prices of the new models follow: ¾-ton, $1,260; 1-ton, $1,565; 1½-ton, $2,125; 2½-ton, $2,375; 3½-ton, $2,975.

BRINGING OUT NEW TRUCKS

CEDAR RAPIDS, IOWA, April 15—The Beck-Hawkeye Truck Works is bringing out two new models, a 2-ton C-40 to sell at $2,150 and a 2½-ton D-50 to sell at $2,850.

PRIVATE OWNERSHIP IN RUSSIA

NEW YORK, April 17—A dispatch from Moscow says the Council of Commissars has restored the right of private ownership of automobiles in Russia, and it is announced that the importation of motor vehicles and accessories will be permitted through the Foreign Trade Commissariat.

Creditors to Handle Assets of Owen Tire

During Stormy Meeting They Elect Attorney as Trustee to Supersede Receiver

CLEVELAND, April 15—Creditors of the Owen Tire & Rubber Co., at one of the stormiest meetings of claimants ever held in this city, took charge of the assets of the corporation, which came into existence here during the hectic days of the war.

The creditors elected Charles Higley, an attorney-at-law, trustee, and authorized him to take charge of the plant. M. M. Scott, who has been acting as receiver, filed his final report and was superseded by Higley.

There came into the meeting, which originally was scheduled to be held in the office of C. D. Friebolin, referee in bankruptcy, men and women to the number of 200. The meeting had to be adjourned to the old court house to accommodate the crowd. Among them were men and women whose life savings had been wiped out. They had drawn their savings from the bank and invested in stock of the company with the conviction that it would double and possibly treble, as everything was soaring in those days.

Dream of Wealth Gone

Their dream of wealth was shattered when the plant was closed down, but that shock was nothing like the one received at the meeting of creditors, to which many of these stockholders came.

This is what they learned: Men and women in Cleveland and northern Ohio had purchased approximately $2,250,000 worth of stock. To-day the assets of the company consist of the plant and its machinery, worth possibly $400,000. There are a number of suits pending in Common Pleas Court against officers and directors in which approximately $300,000 is asked to be returned to the company. These suits set forth a story of large sums paid out as dividends when the company was not earning a surplus; of architects fees paid an officer of the company; of real estate belonging to the corporation that was taken over by officers of the corporation, and of extravagances practiced during the short time the plant was in operation and stock was being sold.

Against the plant and its machinery and the amount that may be realized from the pending suits, creditors at the meeting presented claims totaling $900,000.

TORBENSEN AXLE REORGANIZED

CLEVELAND, April 17—Reorganization of the Torbensen Axle Co. has been carried through by J. O. Eaton, its former president and general manager, backed by Cleveland financial interests which acquired the interest of the Republic Motor Truck Co. in the axle corporation. Under the reorganization plan the company will have 80,000 shares of common stock of no par value, which will be exchanged for the former Torbensen preferred stock on the basis of four shares of the new common for one of the old. A block of the common has been underwritten to provide working capital.

YELLOW MAY REPLACE RED FOR TAIL LIGHT

NEW YORK, April 18—A bulletin sent out by the Society of Automotive Engineers states that serious consideration is being given to the advisability of using yellow instead of red tail lights to minimize the danger of motorists confusing with tail lights the lights placed along highways to indicate dangerous road conditions. This is held to be the cause of many accidents.

United Auto Stores Assets Ordered Sold

PHILADELPHIA, April 15—Public sales of the assets in the stores of the United Auto Stores, Inc., located in the eastern district of Pennsylvania, have been ordered by United States District Judge Thompson. Application for the sales was made several weeks ago, but the court took the matter under advisement on account of pleas of the stockholders for a postponment until they should have time to consider a proposition for reorganization.

While Judge Thompson's order applies only to the assets in this district, similar orders will be sought in the Federal courts in those districts where the other stores of the concern are located. Francis F. Burch and Samuel A. Whitaker, receivers in equity, asked for the sale on the ground that every one of the stores was losing money in operations, and that unless a public sale were ordered at once, the assets practically would be consumed by accumulations of rent.

The merchandise assets in the 58 stores the company maintained were inventoried as of Dec. 31, last, at a valuation of $221,000, while the fixtures cost the company $1,000 for each store.

NEW CHASSIS SPRING

SPOKANE, WASH., April 15—A new type of chassis spring without center bolt has been invented by F. J. Laher of the Laher Auto Spring Co. of this city. Laher welds side clips to the leaves to hold them together, this welding being done by the electric arc process. The side clips naturally prevent the leaves from shifting laterally, but it was also found that, although no center bolt is used, there is no need for humps or other substitute methods to prevent endwise shifting of the leaves.

Will Sign Barnsdall As New Fuel Licensee

Contract Involving Ramage Process to Be Entered Into with Syndicate

DETROIT, April 15—Contracts will be signed this week between the Chemical Research Syndicate, Ltd., headed by F. F. Beall, vice-president of Gray Motors Corp., and the Barnsdall Corp. of New York, by which the latter company will become the sole licensee in the United States and Mexico of the hydrogenation process perfected by Dr. A. S. Ramage, by which low grade fuel oils may be converted into motor spirit.

The Barnsdall Corp. has been testing the Ramage process for over a year to decide its commercial possibilities. Its recent annual report indicates an average yield of 70 per cent of motor spirit from the semi-waste oil products.

Under the contract to be signed, the interests of the automotive industry will be fully protected as to minimum supply of the new fuel to be produced, Beall said. Though the Barnsdall company will be sole licensee it will be empowered to license other companies, and will do so where its own facilities are inadequate.

Leading members of the Chemical Research Syndicate, Ltd., besides Beall, are J. B. Weaver, vice-president of the Pullman Co., Chicago; Benjamin Briscoe, former president of Briscoe Motor Corp.; Dr. Ramage, inventor of the process; H. H. Emmons, Detroit attorney, and Rudolph Stahl of Briscoe & Stahl, consulting engineers.

The offices of the syndicate will be continued in Detroit where research work and experimentation will be continued by Dr. Ramage in semi-waste oil products.

New Obenberger Forge Works on Organization

MILWAUKEE, April 17—The Obenberger Forge Co. of West Allis, Milwaukee County, has been incorporated with a capital stock of $250,000 by the secured creditors of the defunct John Obenberger Forge Co. of Milwaukee, who recently purchased the entire assets, appraised at $980,000, for $48,000 in cash and assumption of secured claims amounting of $188,000.

The new corporation is perfecting its organization with a view to resuming immediately the operation of the big drop forge works at West Allis. The incorporators include L. J. Klug of Klug & Smith, consulting and contracting engineers; B. A. Stenz and B. Hoffmann, Jr., head of the B. Hoffmann Manufacturing Co., all of Milwaukee.

FRENCH TO SHOW AIRCRAFT

NEW YORK, April 15—At its last meeting the French Syndicated Chamber of Aeronautical Industries decided to hold an aircraft show this year.

Casing Production Gains Over Last Year

Shipments Also Increase—Lower Inventories Carried Except of Inner Tubes

NEW YORK, April 18—Statistics of the rubber industry for the first two months of the year as compared with the same period in 1921 show a very material increase in production of pneumatic casings, inner tubes and tires.

Notwithstanding this fact, inventories for both months were considerably less except in the case of inner tubes, which show stocks on hand at the end of February larger than at the close of either January or February, 1921. Shipments were materially larger, but the gain was not so great in comparison with last year as in the production field. Tire production for the first two months of the year was running at the rate of more than 24,000,000 per annum.

Details for the two months of 1921 and 1922 follow:

PNEUMATIC CASINGS

1921—	Inventory	Production	Shipments
Jan.	5,319,605	703,430	965,417
Feb.	5,193,018	819,892	1,073,756
1922—			
Jan.	4,174,000	2,055,000	1,597,000
Feb.	4,691,000	2,084,000	1,562,000

INNER TUBES

1921—	Inventory	Production	Shipments
Jan.	5,586,163	740,824	1,042,617
Feb.	5,415,464	916,627	1,129,881
1922—			
Jan.	5,247,000	2,343,000	1,890,000
Feb.	6,142,000	2,597,000	1,703,000

SOLID TIRES

1921—	Inventory	Production	Shipments
Jan.	303,753	21,220	29,116
Feb.	304,374	23,365	29,599
1922—			
Jan.	182,000	40,000	33,000
Feb.	183,000	39,000	37,000

"Production" and "Shipments" figures cover the entire month for which each report is made. "Inventory" is reported as of the last day of each month.

"Inventory" includes tires and tubes constituting domestic work in factory and in transit to, or at warehouses, branches (if any), or in possession of dealers on consignment basis, and as a total represents all tires and tubes still owned by manufacturers as a domestic stock.

"Shipments" includes only stock forwarded to a purchaser and does not include stock forwarded to a warehouse, branch, or on a consignment basis, or abroad.

Durant and Gray Start to Add to Factory Space

DETROIT, April 15—Two large additions to existing motor car plants were put under way this week when the Durant Motor Co. broke ground for an addition to its Lansing factory which will give it a capacity of 400 cars daily for the Star car, and the Gray Motor Corp. signed contracts for the building of an assembly structure on its Detroit site with a capacity of about 200 cars a day.

Manufacture of the Star car will start at the Lansing plant in the present buildings during May. The first shipments of the Gray car have been fixed for May 15. Manufacture of engines for the Star car is now under way in the Continental Motor Corp. factory at Muskegon, and manufacture of engines for the Gray car is under way at the Gray engine plant, Detroit.

Contracts have been signed with the Auto Body Co. of Lansing for the manufacture of the open car bodies for Star cars made in the Lansing plant. In addition to its Star car capacity, the Lansing plant will have capacity for 200 Durant four-cylinder cars daily.

CALL FOR FARM HELP GREATER THAN SUPPLY

MILWAUKEE, April 17 — For the first time in nearly two years, the demand for farm help in Wisconsin is in excess of the supply, according to a statement issued by R. G. Knutson, state director of the Federal employment service in Wisconsin.

This condition strikes the manufacturers, distributors and dealers in farm operating equipment of all descriptions as probably the most encouraging they have heard about since the slump in prices of farm products generally induced a sharp depression in equipment sales.

During the latter part of 1920, all through 1921 and until a few weeks ago, farmers in Wisconsin maintained that they could get all the manual assistance they wanted without resorting to mechanical economies.

Tentative Plans Drawn for Bus Standardization

NEW YORK, April 17—The Engineering Committee of the American Electric Railway Association has drawn up tentative plans for standard motor bus construction. Proposed dimensions for the three sizes of chassis are:

No. of passengers	21	25	29
Wheelbase (inches)	156	176	196
Engine (horsepower)	30	40	50
Tread, front and rear (in.)	66	66	66
Capacity of rear (tons)	2	2½	3
Braking surface (sq. in.)	150	175	200
Approx. maximum weight (lb.)	4500	5000	5500

Other recommendations are:

(a) Low-hung type of chassis frame with a maximum frame height of 26 inches, preferably lower.
(b) Spring suspension.
(c) Engine preferably of either poppet or sleeve valve type with maximum speed not to exceed 1300 r.p.m.
(d) Gear ratio not to be less than 7 to 1 and not more than 12 to 1.
(e) Metal plate or spoke wheels.
(f) 34-inch solid or semi-solid tires; pneumatics where low floor height not desired.

TAX YIELDS $1,057,767

HARRISBURG, April 15—The State of Pennsylvania has realized $1,057,767 from gasoline taxes during the first six months of enforcement of the new tax.

To Plan Year's Work at Aviation Meeting

Development of Type of Engine Eliminating Fire Hazard Will Be Discussed

WASHINGTON, April 19—A program for aeronautical research and development for the coming year will be considered by the members of the National Advisory Committee for Aeronautics at its semi-annual meeting to be held in the Navy Building to-morrow afternoon, April 20.

The committee, which is headed by Dr. Charles D. Walcott, is composed of independent and governmental scientists and engineers. The scientific research and development undertaken during the past year in both civil and military aviation will be reviewed. Problems of airplane wing design, new developments in aeronautical engines, methods of testing airplanes, wings and parts, airship studies, lifting gases, aerial routes, the air mail service, and problems for the advancement of commercial aviation are among the subjects to be discussed.

Dr. Joseph S. Ames, chairman of the executive committee, will outline the future plans of the committee with a view to placing America "foremost" in the development of aviation, as President Harding has recommended to the Congress.

The development of a new type of aircraft engine with a view of eliminating the fire hazard by the use of heavy fuel oil in place of gasoline, will be among the subjects discussed. Special studies and tests of a new high-speed airplane wing, believed to be of great value in the interests of military scout planes, will be recounted by Dr. Ames.

Commercial Aviation Bill Is Introduced in House

WASHINGTON, April 17—Representative Steenerson has introduced in the House a bill designed to encourage commercial aviation and authorizing the Postmaster General to contract for air mail service.

It prescribes rates of transportation and postage. The postage rate, under the bill, would be not less than 6 cents per oz. or fraction thereof. The Postmaster General would be authorized to contract with any individual, firm or corporation for the transportation of air mail at a rate not exceeding two mills per lb. per mile, and to contract either for the transportation by aircraft of first class mail other than air mail at a rate not exceeding ½ mill per lb. per mile.

A similar bill offered by Representative Kelly of Pennsylvania would fix the rate of payment for transportation by air mail at 1 mill per lb. per mile. Both measures have been referred to the Committee on Post Office and Post Roads.

Seeks to Minimize Acute Unemployment

Conference at Washington Shows Work Done by Chamber of Commerce

WASHINGTON, April 14—Manufacturers, trade association executives and members of the national conference of Business Paper Editors met yesterday with Secretary of Commerce Hoover, to discuss means of collecting and disseminating information intended to prevent or minimize the periodic recurrence of depressions and acute conditions of unemployment.

The meeting was in charge of Joseph H. Defrees, president of the United States Chamber of Commerce, assisted by Dr. Wesley C. Mitchell, director of the Bureau of Economic Research of the Department of Commerce. Representatives of the N. A. C. C. and M. & A. M. A. and the Rubber Association of America were present. Dr. Mitchell's bureau is working with a special committee of the Chamber of Commerce to collect unemployment information.

Dr. Mitchell explained that it was hoped to prepare a study which would contribute to trade stabilization of production, by finding out how some manufacturers have done this and by analyzing this information and putting it before manufacturers generally in a form which they could apply to their own problems. Dr. Mitchell said that the further fact that some manufacturers had been able to avoid sharp curves in the employment situation indicated that others probably had done the same thing.

Data to Be Analyzed

It was the object of the investigation, he said, to search out all such instances possible and to assemble and analyze comparable data on the subject. Among other things he said the Russell Sage foundation had been asked to assist in getting up a better system for reporting unemployment statistics.

During the discussion it developed that some progress already had been made in obtaining information on suitable methods of some manufacturers and on learning the effect of their policies on production, sales, inventories, employment, costs, etc.

The bureau hopes by fall to present a report on its investigation, and in the meantime wants all the assistance available from trade assoications and individual manufacturers and wholesalers on means of getting the desired information and on methods of popularizing the study so that practical use can be made of it when it is complete.

EMPLOYMENT RECORD FOR YEAR

DETROIT, April 17—The Employers' Association has reported an increase of 4345 in total employment for the week and a decrease of 14,113 in the number of men working part time. The net gain is 321,464 payroll hours over last week and establishes a new high record for the year. Of the 79 members of the association, only eight shops are on a part time basis. Total employment of the organization amounts to 140,734, compared with 96,000 during the corresponding week last year and 198,000 during the same week of 1920.

Racine Factory Feeling Skilled Labor Shortage

RACINE, WIS., April 17—For the first time in about a year and a half a manufacturing industry here has experienced the sensation of being unable to enlarge its operations because of the lack of skilled workmen. The industry is the H. & M. Body Corp., owned jointly by Hupp and Mitchell. It is seeking enough men to put on a full night shift, thus bringing up its output of open and closed bodies by 65 or 75 per cent. It has orders on its books to keep the plant busy at capacity more than eight months.

Other members of the automotive industry in Racine are experiencing a growing patronage, which is forcing extension of working schedules and forces. The Mitchell Motors Co. has increased its output by 25 to 30 cars a day within the past week by adding 200 men to its payroll, now in execess of 850.

Foundries and machine shops in Racine catering to automotive and agricultural equipment manufacturers are averaging 75 to 85 per cent of normal in operations. The tractor business is slowly but steadily advancing to the point where new production on a fair scale is in sight.

Exports from Germany Show Big Drop in 1921

WASHINGTON, April 18—Automobile exports from Germany during 1921, totaling 8840 motor vehicles, show a big drop, compared with the previous year, when 17,534 automobiles were exported, according to figures received by the automotive section of the Department of Commerce.

The exports were to the following countries, in the order named: Holland, Sweden, Spain, Belgium and Denmark. The exports of the last three months of 1921 were the only ones to show an increase as a consequence of the Berlin Motor Show.

GRANT TO IMPROVE POSITION

CLEVELAND, April 18—The Grant Motor Car Corp. has sent a letter to its stockholders informing them that negotiations are well under way whereby the company's financial status will be materially improved by the sale of its interest in the H. J. Walker Co., which manufactures engines. A full report of this transaction will be sent out later. The usual statement of the company's affairs for the year has been delayed because the annual audit has not been completed.

Ireland Will Offer Big Market for Cars

Demand Estimated at 30,000, Mostly Low Priced Products, Following June Elections

DETROIT, April 17—Ireland will be in the market for 30,000 motor cars a year following the establishment of its government in the June elections, according to Harry B. Huet, one of the big distributors of that country who is in the United States on a buying trip. Huet has acquired the sole sales rights in Ireland for the Gray car and the Seiberling tire.

Most of the Irish demand will be for cars in the low price field, owing to high costs of upkeep and the inherent economy of the people, he said, with only a scattering of business in the higher price classes. Price is the biggest consideration, and with high import duties and high ocean freights only cars in the low price fields can reach the big market.

Money is plentiful in Ireland, Huet said, but is not in great circulation as yet, owing to the recent troublous period, but the markets are gradually opening. Since 1916 products have commanded high prices which latterly have diminished to a certain extent, but are still yielding a large return. This is especially true of the farm products of the South.

Poor Railroad Service

The truck market is very good because the country is poorly served by its railroads, he said. There are plenty of good roads, and a start has been made toward the construction of more highways and better ones by the appropriation of more than $1,500,000 for this work to begin at once.

Huet said he represented only one of many hundreds of dealers who will soon be in America looking for sales rights in Ireland. There is a warm feeling in Ireland for American products, he said, and where prices can be met there should be a large demand.

Tractors are in small demand, Huet declared, because the farms are for the most part too small to warrant their use, and, also, that the Irish farmer is not a mechanic and unable to keep his machine in constant use. Serious strides are being made by the Ford interests to educate the populace in the use of the tractors, but with indifferent success thus far, he said.

Huet estimated the total number of registered cars in Ireland to-day at approximately 60,000, practically all of which have come in since 1914.

CHARLES F. MOLLEY DEAD

READING, PA., April 18—The American Boron Products Co., Inc., makers of copper alloy metals, announces the death of Charles F. Molley, its vice-president and general manager.

Durant Again Asked to Buy Willys Plant

Offer Made to Pay $4,000,000 in Notes for Corporation's Elizabeth Property

TOLEDO, April 19—Frank P. Kennison, one of the receivers of the Willys Corp., said to-day that the receivers and attorneys had again been in communication with W. C. Durant in an effort to persuade him to take over the Elizabeth, N. J., plant. The proposal made was to accept in payment $4,000,000 in notes. The cost of the plant was approximately $10,000,000.

"We have been at work on plans to provide for the liquidation of the assets of the corporation over a period of time and thus avoid any forced sale," Kennison said.

It is believed this is the reason for the recent advance in the price of the first preferred stock. The New Jersey Federal court has decreed that the sale of the Elizabeth plant shall be made in 60 days. Durant is the only possible purchaser considered seriously thus far.

It has been agreed that the Federal court in Toledo shall be the center for the legal entanglement for the Willys Corp., but the bankruptcy suit filed in New York will have to be cleared away first.

There was a Willys Corp. "field day" in court here yesterday. Attorney Joseph P. Cotton appeared for the first preferred stockholders' committee, E. Bisbee for the bank creditors' committee, Col. J. M. Hatfield for the merchandise creditors' committee and D. H. Miller, Thomas Tracy and E. J. Marshall for the Ohio receivers.

All the committees, with the exception of the bank creditors, have approved the sale of the Electric Auto-Lite Division, including the Toledo and Fostoria plants, at the upset price of $4,500,000. Bisbee said he would have to have authorization from his committee before he could approve the move. The Federal tax claim against the corporation stands in the way, in his opinion, and should be determined first.

Claims Total $24,000,000

TOLEDO, April 13 — That claims against the Willys Corp. will total more than $24,000,000, but that only $12,000,000 will be admitted as valid, was stated in a motion filed by attorneys for the Ohio Savings Bank & Trust Co. here asking for the sale of the Electric Auto-Lite division to pay valid claims. The motion filed was accompanied by an inventory of the Electric Auto-Lite division signed by the three receivers, Frank P. Kennison, C. O. Miniger and F. G. Caffey.

This inventory shows that the property of the Auto-Lite Corp. is worth about $4,210,000, divided as follows:

Total factory inventory of the Toledo plant, $2,137,425.71; land, $125,793; buildings and equipment, $509,821.34; machinery and equipment, $1,200,550; furniture and fixtures, $38,663.26; Willys light division, $18,098.64.

The report says there should be deducted $564,228.43 for depreciation, leaving a total of $1,696,915.47 as the present value of the property inventory.

The value of the Fostoria plant is given as $209,817.28 and that of plant number six as $167,943.68.

Auto-Lite Business Satisfactory

"In order to pay the valid claims, it will be necessary to sell the property in the Toledo federal district," the motion says.

It is stated that the Auto-Lite has been conducted practically as a separate concern. Business is reported very satisfactory.

There are 30 acres with factories and equipment near Poughkeepsie, N. Y., which parcel of the Willys Corp. is considered an integral part of the Auto-Lite and the motion recommends that this be sold also. Consent of the New York Federal court jurisdiction would have to be obtained.

Gary Assets Bought; New Company Formed

GARY, IND., April 18—The assets of the Gary Motor Truck Co., which has been in receivership for several months, have been purchased by Frank Dawson and three associates, who will reorganize the corporation under the name Gary Motor Corp., with a capital of $1,000,000. Dawson is president and general manager of the new company. He also headed the old company.

T. H. Cooper, who was Kansas City distributor for Gary trucks, is secretary and treasurer; John Griffin is vice president, and Harry Searle is the fourth director. The property was purchased at trustee's sale for $110,000.

Dawson announced that the company would continue the same line of trucks that the old company manufactured, at reduced retail prices, and would add a light delivery truck to be sold at a popular price. Following the sale, the factory was reopened and a number of men put to work. It is planned to distribute the trucks through branches to be opened in the larger cities.

The schedule of prices is as follows:

Model	Old Price	New Price
F 1½-ton	$2,600	$1,675
I 2-ton	2,900	2,150
J 2½-ton	3,800	2,550
K 3½-ton	4,900	3,550
M 5-ton	5,900	4,000

REORGANIZING LOCOMOBILE

NEW YORK, April 19—Bank creditors of the Locomobile Co., now in receivership, are understood to be working out a plan for the reorganization of the corporation. Merchandise creditors will be permitted to come in under the plan on the same terms as the bank creditors. The demand for Locomobiles now is said to be large enough to justify reorganization.

Bid for Bethlehem Regarded Inadequate

Merchandise Creditors Will File Objection to Confirmation of Sale for $550,000

NEW YORK, April 19—Representatives of the merchandise creditors of the Bethlehem Motors Corp. will file in Federal Court at Philadelphia objection to confirmation of the sale yesterday by the receiver of the assets of that corporation on the ground that the high bid for the property was inadequate.

The high bid for the assets was made by Howard B. Hall of this city, formerly vice-president of the corporation, who offered $550,000 for all the real estate and personal property both at Allentown and Pottstown, Pa. The only other bid was that of the Creditors' Syndicate Committee which offered $540,000. Hall's bid was made in behalf of himself and other former officers, including Arthur T. Murray, who was president prior to the receivership and now is president of the American Bosch Magneto Corp.

In a recent letter sent to creditors by Murray and Hall, it was stated that they had a plan to rehabilitate the company and resume operations. The letter stated that if claims were assigned to "outsiders," the creditors would "simply afford an opportunity to junk the property and to make a profit on the claims held so long and doubtless prevent a reorganization and continuance of the business."

Kern Reported Interested

It has been reported that Martin E. Kern, who organized the company and whose purchase of the American Bosch Magneto interests from the alien property custodian is now being investigated by the Department of Justice, has been associated with Murray and Hall in their reorganization plan.

The creditors' syndicate committee represented the Chase National Bank and other banking interests which propose to take over the assets.

The upset price fixed by the court for the property was $450,000, but the assets have been appraised at $2,400,000. Merchandise creditors have contended that a bid of $600,000 should be the minimum accepted by the court. It is understood that if Hall's bid is refused there is a possibility of a reorganization under conditions which will practically guarantee creditors an immediate payment of 10 per cent in cash and a very substantial interest in a new company.

When counsel for merchandise creditors requested Judge Dickinson, the special master, to postpone the sale set for yesterday, he declined to do so on the ground that a bid of at least $600,000 would be made by certain interests connected with the old company. He consented, however, to extend the date of confirmation of the sale from April 24 to May 8.

Men of the Industry and What They Are Doing

Hohensee in Charge of Production

F. W. Hohensee, president of the Durant Motor Car Co. of New York, has been placed in general charge of production and engineering at the Long Island City, Lansing and Toronto plants of the Durant companies. Hohensee was one of the first executives to join forces with Durant and resigned as general manager of production for the Chevrolet Motor Co. to go with his former chief. He played an important part in getting the Long Island City plant into production in a remarkably short period.

Gallup Resigns from Marmon

David L. Gallup, for the last five years head of the division of research and experiment of the Nordyke & Marmon Co., has resigned, to take effect May 1. Gallup is well known in the industry and has been actively associated with the Society of Automotive Engineers, serving at one time as president of the Indiana section. Before entering the automotive industry at the Marmon plant, Gallup, for many years, was in charge of the automotive division of the Worcester, Mass., Institute of Technology.

Waterfall at Film Conference

Arthur T. Waterfall, vice-president of Dodge Brothers, has been named to represent the automotive industry at the Industrial Film Conference of the Committee on Motion Pictures, which will meet in New York on April 27. The committee will take up the work of drafting a report on the use of industrial films and their distribution, being the outgrowth of the recent industrial associations' conference with Secretary Hoover in Washington.

Rieman on Chicago Air Board

C. S. Rieman, president of the Elgin Motor Car Corp., has been appointed chairman of a committee of the Air Board of Chicago to co-operate with the Lincoln Park commissioners in laying out and developing an aircraft landing field.

Alford Elected a Councilman

Walter H. Alford, vice-president of the Nash Motors Co., has been elected a member of the Kenosha, Wis., city council for a two-year term.

Lount Is Cadillac Comptroller

H. J. Lount has been appointed comptroller of the Cadillac Motor Car Co. and has been succeeded as head of the factory accounting department by L. S. Carter. Lount has been with the company continuously since he began his association with it as a payroll auditor eighteen years ago. During the war he was associated in accounting both as to automobile and aircraft production. He was made factory accountant August 1, 1918, a position he has held up to the present time.

Sonneborn in Charge of Branches

Arthur B. Sonneborn, vice-president of the American Electric Fusion Corp., will be in charge of branch offices of that company opened in the Dime Bank Building, Detroit, and covering the Ohio, Indiana, Western Pennsylvania and Michigan territory. Sonneborn was formerly sales manager of the Detroit Electric Welder Co. and the Federal Machine & Welder Co.

Sam Miles Goes to Europe

S. A. (Sam) Miles, veteran automobile show manager, sailed from New York Wednesday on the Carmania with Mrs. Miles for his annual trip to Europe. He will spend most of his time in England, but also will visit the Continent to study prospects abroad for the sale of American motor vehicles and equipment. He expects to return some time in June.

Martin Now with Denman Tire

H. J. Martin, former advertising manager of the export department of the Firestone Tire & Rubber Co., has become promotion manager of the Denman & Myers Cord Tire Co., with headquarters at Warren, Ohio.

Dill Made Sales Director

George W. Dill, for many years associated with the Dayton Airless Tire Co., has been appointed director of sales of the Essenkay Products Co., Chicago, manufacturers of Essenkay and ammonia gas tubes. Dill was formerly in charge of the mail sales division of the Dayton company and later served as sales manager, a position he retained until his resignation to become connected with the Essenkay organization.

Davis Heads Apperson Branch

J. F. Davis, for fourteen years head of the Chicago branch of the Winton Co., has taken over the management of the branch in that city of Apperson Bros. Automobile Co., and will launch an aggressive sales campaign. Re-establishment of the Apperson sales rooms on Michigan Avenue is the first major move made by Davis.

Dodd Represents Crowley

Theodore L. Dodd, Chicago, has been appointed western sales representative of the D. J. Crowley Co. of Detroit. In this capacity he will look after the sales of the Penn Seaboard Corp. of Philadelphia, the Tacony Steel Co. of Philadelphia and the Titusville Forge Co., of Titusville, Pa.

Will Direct GTD Sales

Edward Blake, Jr., vice-president of the Greenfield Tap & Die Corp., who has been manager of the corporation's drill plant at Taunton, Mass., has been appointed vice-president in charge of sales, and will make his headquarters in Greenfield. Blake served as vice-president and general manager of the Lincoln Twist Drill Co. at Taunton until its sale to the Greenfield corporation in 1920. Ralph Barstow, former general sales manager, has resigned to associate himself with Marquis Regan as counsellors in merchandising and marketing, with offices at 21 East Fortieth Street, New York City. Barstow went to Greenfield in July 1919, after serving as director of the department of selling and advertising in the A. E. F. university at Beaune, France. For two years he has been an instructor in sales methods for the Massachusetts state university extension.

Lee Tire Names Wilkinson

Tom H. Wilkinson has been appointed Pacific Coast representative of the Lee Tire & Rubber Co. He resigned as manager of the San Francisco branch of the United States Rubber Co. recently, after serving for a period of 17 years with that corporation. Wilkinson's earliest connection with the industry was with the old Hartford Rubber Works Co., which he represented in the San Francisco territory. At that time he was an associate of Harry E. Field, now general sales manager of the Lee company. When the Hartford Works was absorbed by the United States Rubber Co., Wilkinson was retained, and since that time has held important executive positions with the latter company.

Schwab Heads Sales at Ford Branch

P. W. Schwab, connected with sales at the Ford branch in New York for a number of years, has been made head of the department under the general direction of Gaston Plantiff, branch manager. W. A. Francis, whom he succeeds, has been made branch manager at Cincinnati.

Seiberling, Jr., Distributing Cars

C. W. Seiberling, Jr., son of the president of the Seiberling Tire & Rubber Co., will distribute Wills Sainte Claire cars in New Mexico, with headquarters at Sante Fe, as a result of a co-partnership between him and F. P. Weaver.

Dolan Joins Mack

James F. Dolan, former division superintendent of the Willys-Morrow plant at Elmira, N. Y., has been appointed to an executive position with Mack Trucks, Inc., at New Brunswick, N. J.

Plants Speeding Up in All Branches of the Industry

Yellow Cab Triples Output

CHICAGO, April 18—The production of the Yellow Cab Manufacturing Co. for April will be more than three times the production for April of last year. The output at this time last year was five or six cabs a day, and it is now 15 to 20 a day. The shipments in March were 350 cabs. Several departments of the factory, including mill and machine shops, are working day and night. More of the cabs are now going to New York than to any other city. Sales are 50 days ahead of production, orders now in hand being sufficient to keep the plant busy until well into June.

Hendee Adds to Force

SPRINGFIELD, MASS., April 18—Hendee Manufacturing Co. has added 200 to its plant force, bringing the number to 1200, and is producing 100 motorcycles daily. A further increase is projected on the strength of incoming orders that assure brisk business at the plant for months ahead. All departments are working full time, and several are working overtime. Export business is showing an improvement, along with a big gain in domestic sales.

Building More Engines

PONTIAC, MICH., April 18—The Wilson Foundry & Machine Co. has been increasing production on the Willys-Knight engine for the Willys-Overland plant in Toledo rapidly since the installation of the plant here. Production during the past week has approached 100 engines daily and efforts are now being made to advance it to 150 daily. This would call for capacity production on the line with the present shifts at work.

Bosch Force Will Number 2000

SPRINGFIELD, MASS., April 17—The American Bosch Magneto Corp. is operating with a force of 1200 in its plant here, and it is said the force will be brought to 2000 soon. A largely increased business is being done with the battery ignition system for the Ford, and a similar equipment for the Chevrolet is now being placed on the market.

Reo's Question One of Production

DETROIT, April 17—Reo production has reached a point, officials declare, where it is not a question of how many cars can be sold, but how many can be built. There is every indication, the company reports, that this increase in business will be extended over the year and will not merely be a spring revival.

Westinghouse Adds to Plant

SPRINGFIELD, MASS., April 15—Owing to a heavy increase of orders, the Westinghouse Electric & Manufacturing Co. has begun the erection of an additional factory building of one story, 525 x 85 ft., here, to be completed in six weeks. This will enable the company to take on 500 additional employees.

TIRE FACTORIES ARE STEADILY MOVING FORWARD IN OUTPUT

AKRON, OHIO—Production has been increased from 22,000 tires a day to 24,000 daily by the Goodyear Tire & Rubber Co. following the employment of 1000 additional tire builders.

When Goodyear issued the call for 1000 men, it was the largest single labor call Akron had heard for many months. Goodyear started the year with an average production of 18,000 tires a day.

The Firestone Tire & Rubber Co. in the last five weeks has increased production from 18,000 to 21,000 tires daily.

SPRINGFIELD, MASS., April 18—New England Tire & Rubber Co. is establishing quantity production in its cord tire, and it is stated that carload lots are being shipped regularly to branches and dealer agencies. Sales Manager J. B. Cothran predicts that by summer the plant will be operating nearly at capacity.

White Sees General Improvement

CLEVELAND, April 17—The White Co. has received reports from all its 40 branches indicating a decided improvement in general business conditions with every prospect for increased sales. The demand for motor trucks to operate on railroads continues. A few of the railroads now operating White trucks on rails are the LaCrosse & Southeastern; Minneapolis, Verde Tunnel & Smelter; Clarksdale, Ariz., & Mt. Hood; Hood River (Oregon) and the Tennessee Midland.

Moon 50 Per Cent Better

ST. LOUIS, April 17—The Moon Motor Car Co. reports that its sales for March were 50 per cent greater than for March 1921 and 20 per cent greater than for March 1920. The production schedule has been increased, and the company says it has enough orders on hand to maintain the present schedule until July 15.

Stewart-Warner Output Doubled

CHICAGO, April 17—The Stewart-Warner Speedometer Corp. has increased its production from 4200 to 5130 units a day and vacuum tank production from 4000 to 4800 units a day. This is double the production a year ago and compares favorably with the record output of the company.

Cadillac Has Record Business

DETROIT, April 17—The Cadillac Motor Car Co. reports that the first quarter of 1922 brought the best business in its history. Its foreign shipments have increased materially since Jan. 1. The increases range from 37 per cent to 651 per cent over the same period in 1921. The largest increases have come from Argentina with 213 per cent, Cuba with 315 per cent, Australia with 420 per cent and Holland with 651 per cent. Shipments have been made since January 1921 to 28 countries.

Gardner Increases Schedule

ST. LOUIS, April 15—The Gardner Motor Co., which originally announced a production schedule of 1500 cars for April, has increased the schedule to 2000 for this month and 2500 for May. A statement issued by W. H. Yeldell, sales manager, says that the company has in hand orders for more cars than it will be able to produce up to June 1. Almost equal parts of the Gardner production for the last few months have gone to the east and to the west of the Mississippi River.

Improvement with Preston

BIRMINGHAM, ALA., April 18—J. T. Driver, vice-president of the Preston Motor Corp., manufacturer of the Premocar, reports that orders have been placed in this city alone to assure steady production for several months. The company also notes improvement in the foreign trade—having shipped three of its phaeton models to New Zealand this week.

Dort to Build 2000 Cars in May

DETROIT, April 17—The Dort Motor Car Co. will increase its schedule to 2000 cars for May to meet increased business. The inventories of the company will be brought to a low figure by early summer under the impetus of present business, being worked down from a figure approximately $2,000,000 a year ago.

Nash Reports Big Gain

KENOSHA, WIS., April 14—Nash Motors Co. reports an increase of more than 50 per cent in sales for the first quarter of 1922 as compared with the same period in 1921. There were on hand at the beginning of April delivery orders for 5025 four and six-cylinder cars as compared with 3307 at the same time last year.

Jordan Producing 40 Daily

CLEVELAND, April 14—Production at the factory of the Jordan Motor Car Co. has been increased to 40 cars a day, and it is expected the May output will be still larger.

Creditor Now Asks Kentucky Receiver

Suit Filed, Although Merger Plans Are Practically Completed

LOUISVILLE, KY., April 18—Two additional actions were filed yesterday to throw the Kentucky Wagon Manufacturing Co. into the hands of a receiver. At the same time it was learned that the committee seeking a merger with other companies in the Associated Motor Industries practically has completed all details and in a few days will announce the merger.

Both of the suits filed yesterday seek the appointment of a receiver to conduct the affairs of the company and also to consolidate the cases with two similar ones filed three weeks ago.

The Willard Storage Battery Co., plaintiff in one action, alleges that the company is indebted to it in the sum of $5,000 in notes.

The plaintiffs in the other actions are Eva F. Churchill, Willa F. Whitclock, J. M. Rogers, J. J. Shelley and Mrs. Lotta Lee Peter, executrix of the estate of R. A. Peter, all of whom are stockholders seeking to preserve their interests and the interests of others similarly situated.

The suits filed separately three weeks ago have been consolidated, and some proof has been taken in the form of depositions to be used when the motion for a receiver is heard by Judge Davis W. Edwards at a date yet to be agreed on by the attorneys. Those named party defendants to all the actions are Robert V. Board, G. E. Glazebrook, J. C. Murphy, James R. Duffin, John W. Barr, S. E. Duncan and I. T. Axton, the committee seeking the merger with several other corporations in different sections of the country.

Predicts Unlimited Credit for Dealer

WASHINGTON, April 17—Credit facilities for automobile dealers this year will be virtually unlimited to the dealer who is worthy of credit, according to a statement made here to C. A. Vane, general manager of the National Automobile Dealers Association, by Governor W. D. G. Harding of the Federal Reserve Board.

Banks have plenty of money, Governor Harding said, and are anxious to lend it where it will be productive. "But this is a period of settling business," the governor went on, " and money in all lines will be available only to the man who is worthy of credit."

The governor expressed considerable interest in the new membership requirements of the N. A. D. A., and his questions made it plain that he believed the dealers were doing a thing that would make it much easier for them to establish proper credit facilities with their bankers.

Vane left here for New York, where he expects to conclude final arrangements for fire, theft and transportation insurance for "One of a Thousand" members of the association. Present negotiations indicate that a saving of substantially 40 per cent will be effected for this contents coverage, placed in one of the biggest old line stock insurance companies in the world.

Highway Traffic Body Prepares for Meeting

NEW YORK, April 17—Among the subjects listed for discussion at the annual meeting of the National Highway Traffic Association, which will be held at the Automobile Club of America in this city, May 12, are traffic safety regulations governing speeds, weights and dimensions of motor trucks and trailers, license fees and highway franchises.

The national chairmen who have been asked to make reports on the conference are:

Elmer Thompson, secretary, Automobile Club of America, on uniform highway signs; Herschel C. Smith, assistant professor of Highway Engineering, University of Michigan, on traffic capacity and widths of highways outside of municipalities; H. Eltinge Breed, consulting engineer, New York City, on the status of the construction of highway curves and recommended practices to increase traffic safety; F. W. Fenn, secretary national motor truck committee, National Automobile Chamber of Commerce, on highway transport franchises; Tom Snyder, secretary, National Association of Commercial Haulers, on highway transport clearing houses; George H. Pride, president, Heavy Haulage Co., New York City, on regulations governing speeds, weights and dimensions of motor trucks and trailers; and Henry G. Shirley, roads and sanitary engineer, Baltimore County Roads and Sewerage Department, on license fees and motor vehicle taxation.

ZEDER FINANCING PLANS

CLEVELAND, April 20—Plans have been completed for financing the manufacture of the new Zeder car, but await the approval of certain interests in this city and New York before they are made public. A prospectus for the new company has been prepared and will be submitted in a few days to the persons interested. The new car will be made in the plant of the Cleveland Tractor Co. in this city, and the capitalization of that company will be increased to provide the necessary capital.

PACKARD EXPECTS GOOD YEAR

NEW YORK, April 20—The financial statement of the Packard Motor Car Co. for the six months ended Feb. 28 showed a loss in factory operations of $204,349 and through branch operations of $570,198. It is expected, however, that the second six months of the fiscal year "will form a distinct contrast to the first, and that the year, as a whole, will prove a profitable one." Factory sales for the six months' period were $13,687,739, and the cost of sales $12,999,613. The balance sheet showed a net profit and loss surplus of $14,631,706.

Templar Syndicate Deposits $750,000

Funds Will Pay Off Creditors' Notes and Provide Working Capital

CLEVELAND, April 18—The Templar syndicate of which M. F. Bramley, president of the Templar Motors Co.; J. C. Brooks, an attorney, and W. M. Patterson, a Cleveland business man, are managers, has deposited $750,000 in the Guardian Savings & Trust Co. to pay off the notes of all creditors and to provide working capital for the Templar company.

It is announced that all outstanding notes and claims of all kinds will be paid and the balance of the funds will be used to carry on plant operations. Notices have been sent to all creditors of the company asking them to send their notes and claims to the Guardian Savings & Trust Co., this city. The bank will pay these liabilities.

The production of Templar is now on a basis of eight cars a day. The capacity is 25 cars a day. Business on the books indicates that May will be a better month than April for the company.

Midwest Tire Makers Report Bigger Output

CHICAGO, April 17—At the monthly meeting of the Midwest Rubber Association here several manufacturers reported noticeable increase in tire business, and one manufacturer said he was gradually increasing the price of his tires. About 30 members of the association and a number of guests attended the meeting, several western and midwestern cities being represented.

One manufacturer who a year ago last January made only 500 tires in the whole month said his production is now about 750 tires a day. Several others reported 24-hour operation with production of 1000 or more a day. One maker said his distributor at Atlanta, Ga., has sent in greatly increased orders in the last few weeks, and reported a business improvement of nearly 200 per cent in the last few weeks in that section of the south.

W. W. Wochter, president of the association, who conducts a tire manufacturing business at Omaha, Neb., said the business improvement was coming from the West and spreading toward the East.

LEE WILL ADDRESS MEETINGS

WASHINGTON, April 15 — Gordon Lee, chief of the automotive division of the United States Bureau of Foreign and Domestic Commerce, will address automotive men in the far West in June and July. He will speak at the summer convention of the Automotive Equipment Association at Colorado Springs, then going on for the annual meeting of the Washington State Automotive Trade Association at Olympia, July 21 and 22.

Prices of Franklin Reach Lowest Mark

Phaeton Now Listed at $1,950—Reductions Range from $450 to $650

SYRACUSE, April 17 — Reductions ranging from $450 to $650 on its various models, effective immediately, are announced by the Franklin Automobile Co. The list follows:

	Old Price	New Price
Roadster	$2,400	$1,900
Phaeton	2,450	1,950
Demi-Coupe	2,750	2,100
Demi-Sedan	2,850	2,250
Victoria Coupe	3,200	2,750
Brougham	3,300	2,750
Sedan	3,450	2,850

This reduction brings the Franklin cars to the lowest prices in the history of the six-cylinder type extending as far back as 1906, with the single exception of a four months' period in 1916. The war price of the phaeton was $3,100 and of the sedan $4,350.

The Franklin company was the first to follow Ford in the price reductions which came when the period of deflation was well under way. The drastic cut made at that time brought a very substantial business. Increases of $100 on its more popular models went into effect Feb. 1.

NEW TRIANGLE PRICES

ST. JOHNS, MICH., April 17—New prices are announced by the Triangle Motor Truck Co. on its four models. The list follows:

	Old Price	New Price
Model AA, 1-ton	$1,385	$1,285
Model A, 1½-ton	2,350	1,985
Model C, 2-ton	2,700	2,285
Model B, 2½-ton	2,950	2,585

PARKER TRUCK REDUCED

MILWAUKEE, April 17—Substantial price reductions are announced by the Parker Motor Truck Co. The list follows:

	Old Price	New Price
Model J 20, 3½-ton	$4,400	$3,950
Model M 20, 5-ton	5,500	4,850
Model C 22, 1-ton		1,875
Model G 22, 2½-ton		3,200

Model F20, 2-ton, will be discontinued.

WARD ELECTRIC REDUCTION

MT. VERNON, April 17—The Ward Motor Vehicle Co. announces price reductions ranging from 35 per cent to 40 per cent. The WS-2 model, ½-ton capacity, is now $2,485, and the WA-2 model, ¾-ton capacity, is now $3,295.

CHANGE IN SENECA PRICE

FOSTORIA, OHIO, April 17—The Seneca Motor Car Co. has reduced the price of its model M ½-ton truck from $920 to $820.

TEXAS MOTOR PLANT SOLD

FORT WORTH, TEX., April 19—The bid of the Moco Monkey Grip Rubber Co. of Oklahoma City, boot and patch manufacturers, for the plant of the Texas Motor Car Association, has been accepted by the court which previously had named receivers for the association. Bankruptcy proceedings against the association were dismissed yesterday. The bid for the plant, which cost $3,000,000, was $295,000. The Oklahoma factory will be moved here.

General Motors Elects Directors to Vacancies

WILMINGTON, DEL., April 19—At the annual meeting of stockholders of General Motors Corp. held here to-day, the twenty-eight directors now constituting the board of directors were re-elected and the three existing vacancies were filled by the election of:

George M. Hannum, general manager of the Oakland Motor Car Co., a division of the corporation.

Alex B. C. Hardy, general manager of the Olds Motor Works, a division of the corporation.

Herbert H. Rice, general manager of the Cadillac Motor Car Co., a division of the corporation.

Organization meeting of directors for election of officers for the ensuing year will be held in New York at 3 p. m. Tuesday, April 25.

U. S. Rubber Co. Reports Substantial Gain in Sales

NEW YORK, April 19—Charles B. Seger, president of the United States Rubber Co., issued a statement following the annual meeting of stockholders yesterday in which he pointed out that the company's business generally showed a steady improvement since the close of 1921 and that the sales for the first quarter of 1922 were considered satisfactory. He said:

Tire business has shown substantial gain in unit sales over the corresponding period of last year and an increase in dollar volume of sales notwithstanding a lower level of prices compared with last year.

Trade conditions among tire dealers point to a substantial increase in demand over last year.

Newcomb Carlton, president of the Western Union Telegraph Co. was elected a director. The other directors were re-elected.

ATWATER KENT INCREASES

PHILADELPHIA, April 15—Demands of automomobile manufacturers for electrical equipment have resulted in the Atwater Kent Manufacturing Co. increasing its output from 30 to 90 per cent of capacity within the last 60 days. A year ago the plant was on 40 per cent capacity and about 25 per cent four months ago.

GRAY & DAVIS GAINS

BOSTON, April 18—Gray & Davis, Inc., is feeling the full effects of the increase in automobile sales and reports that it is receiving a big volume of releases from all of its important customers.

Maibohm Plan Rests on Getting Simplex

Latter Would Be Marketed Instead of Former—Bankers Consider Bond Issue

NEW YORK, April 19—Receiver's sale of the assets of the Maibohm Motors Co., which was scheduled for to-day at Sandusky, Ohio, was again postponed to give further opportunity for a reorganization of the company. A New York banking house is seriously considering a bond issue of $500,000 and a stock issue of at least that amount, contingent upon the acquisition of the rights to manufacture the Simplex car, now owned by the Mercer Motors Co.

The reorganization plan is being promoted by H. C. Maibohm, who organized the Maibohm Motors Co., and it is understood he has obtained an option on the Simplex assets. If the plan goes through successfully it is understood that a new Simplex car will be placed on the market at a price radically less than that for which it formerly sold. The Maibohm will be discontinued but certain features of it may be included in the new Simplex, which will be produced in standard models at the Sandusky plant.

Simplex was operating as a separate entity when its sales were taken over with those of Mercer and Locomobile upon the organization of Hare's Motors. Prior to the dissolution of the contract with Hare's Motors, all the capital stock of the Simplex Automobile Co., Inc., was acquired by the Mercer company. Manufacture of the Simplex car has been discontinued.

$9,188,561 Is Sought from Lincoln Motors

(*Continued from page* 884)

DETROIT, April 19—W. C. Leland, general manager of the Lincoln Motor Car Co., issued a statement to-day in which he said the suit of the government was wholly unexpected, as a complete settlement was regarded as having been made three years ago. Both W. C. Leland and his father, Henry M. Leland, will take the witness stand to deny charges of profiteering and to defend the rights of Lincoln creditors.

In his statement Leland said there was no justification whatever for the presentation of any claim on the part of the War Department. From the time a complete settlement was reached in the early part of 1919 until the last of February, he declared, no one had the slightest idea or intimation that the government had any intention of overturning the settlement, "which was fully and fairly made and in which the government was represented by many very able men."

He added that he and his father were very anxious to have the case heard in court as quickly as possible to prove the charges unfounded.

Graham Resolution Meets Bad Weather

Promises of Legislative Leaders Far from Fulfillment—Objections to Overcome

WASHINGTON, April 19—It appears that promises of legislative leaders to protect American manufacturers and dealers against speculators in surplus army trucks originally sold the American Expeditionary Forces, as well as the British and French governments, are far from fulfillment.

Talks with senators and representatives showed that it would be necessary to eliminate objections among the minority to the consideration of the so-called Graham resolution, which would assess high tariffs on motor trucks, passenger cars and other surplus material re-imported and intended to compete with domestic products. It was believed that the Senate Finance Committee would incorporate a provision to this effect in the tariff bill, but the bill contains no such protection.

It is reported that senators on the committee felt that it would be possible to obtain quick action by rushing the passage of the Graham resolution, knowing that the tariff bill would be indefinitely delayed in the Senate and in conference, owing to the conflict as to valuation basis. The resolution has been called up several times at this session, but each time was tabled on the objection of various senators. The measure, as approved by the finance committee last year, would allow the speculators sufficient time to handle shipments after it became effective.

However, the Senate Finance Committee retained the provision of House tariff bill which levied the same internal tax on imported articles as assessed on domestic products. When the goods were shipped abroad, no internal taxes were paid on Government property.

Western Underwriters Urge Sterner Measures

CHICAGO, April 15—A conference to discuss means of reducing the number of automobile thefts throughout the country was held in Chicago this week by managers and representatives of the various automobile insurance theft bureaus and representatives of the Western Automobile Underwriters Conference.

The meeting was suggested some time ago by the national theft committee of the National Automobile Underwriters Conference. The opinion was held among those at the conference that automobile stealing will continue to increase until thieves are more severely punished than they have been in the past. There was considerable discussion of the Dyer Law which makes it a Federal offense to transport a stolen car from one state to another.

It was suggested that automobiles should be inspected by the state before licenses are issued, and that this would result in reducing the number of thefts. It was said that in many cases automobile thieves have been released upon payment of a light fine or after serving a short sentence. In many cases it was said the reluctance of the insurance companies to push the case against the automobile thief has resulted in turning loose countless numbers of automobile thieves.

FINANCIAL NOTES

General Tire & Rubber Co. has declared the regular quarterly dividend of 2 per cent on common stock payable May 1 to a stock of record April 20. The company on April 1 paid a 1¾ per cent dividend on preferred stock. General was one of the few tire companies in the country which did not suspend dividend payments during the slump period.

American La France Fire Engine Co.'s report for the quarter ended March 31 shows net income amounting to $196,049 before Federal taxes but after interest charges. This compared with net profits of $183,950 in the corresponding period in 1921. The income account lists operating profit at $205,217 against $225,814 in the preceding year.

Grand Rapids Tire & Rubber Corp. announces the payment on April 1 of the regular 2 per cent quarterly dividend on preferred stock. The corporation has increased its distribution to a point where it is represented in every state in the country.

Franklin Automobile Co. has declared the regular quarterly dividend of 1¾ per cent on preferred stock payable May 1 to stockholders of record April 20.

WIN LOCK PATENT SUIT

LOS ANGELES, April 15—The United States District Court here has granted an injunction and damages to the Miller-Chapman Co. of Los Angeles and the Security Manufacturing Co., manufacturers of the Red Security Auto Theft-signal, against the Los Angeles distributor of the Green Lock Co. of Detroit, Mich. The court decided the patent of the latter company an infringement.

LAMP SUIT DISMISSED

BALTIMORE, April 19—Judge Rose has handed down an opinion in the United States court dismissing the suit of August R. Gross against Joseph Frank for alleged infringement of a patent for a parking lamp for automobiles. Gross conducts a business as the General Machine & Specialty Co., and Frank as the Arjo Manufacturing Co. Both are located in Baltimore.

GOODRICH DIRECTORS RE-NAMED

NEW YORK, April 20—Directors of the B. F. Goodrich Co. were re-elected at the annual meeting of stockholders. The regular dividend on the preferred stock was declared at a meeting of directors which followed.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Last week's money market showed signs of continued ease. Call loans covered a range of 4 per cent to 4½ per cent, as compared with 4½ per cent to 5 per cent in the previous week, and on April 17 the ruling rate was 3½ per cent. An easier undertone was also apparent in the rates for fixed date funds. Toward the last of the week there was a decline to 4½ per cent for all periods of from sixty days to six months, as against 4½ per cent for sixty and ninety days and four months, and 4½ per cent to 4¾ per cent for five and six months' maturities in the previous week. The price commercial rate remained unchanged at 4½ per cent to 4¾ per cent.

A significant event in last week's money market was the offering of $150,000,000 of United States Treasury Certificates at 3½ per cent. This is the lowest offering rate since September, 1917. The last previous offering on March 15, 1922, was at 4¼ per cent. This, taken in conjunction with the lowering on April 13 of the Bank of England's discount rate to 4 per cent, strengthens the belief held in some quarters that a lower official rate may obtain in New York.

The Federal Reserve Bank of Richmond reduced its rediscount rate on all classes of paper from 5 per cent to 4½ per cent, effective April 14. Only three banks, the Dallas, Kansas City and Minneapolis institutions, now retain a 5 per cent uniform rate, the others having a 4½ per cent rate.

The foreign trade figures for March show exports at $332,000,000, the highest amount since October, 1921, and imports at $258,000,000, the greatest for any month since December, 1920. The export balance of $74,000,000 compares with $35,000,000 in February and $135,000,000 in March, 1921, and is the largest favorable balance since November, 1921, when the excess of exports amounted to $83,000,000.

Wholesale price indices for March show a decline, Dun's figures registering a decline of 2 per cent and Bradstreet's 6/10 of 1 per cent.

Staring to Manage New Walker Engine

CLEVELAND, April 20—The H. J. Walker Co., manufacturer of automobile engines, expects to announce in a few days completion of a plan for refinancing the company, by which it will have $300,000 additional cash working capital. A $390,000 common stock syndicate subscription was oversubscribed by $40,000. W. H. Staring, who was formerly vice-president of the Peerless company, is to have the management of the Walker company. The syndicate taking charge of the refinancing is headed by the **Krouse, Tremaine & Kulas Co.**

Capacity of Truck Plants Seen by Fall

Production in Detroit District Is Now Running Close to 50 Per Cent

DETROIT, April 18—Truck production in the leading factories of the district is now running close to 50 per cent of capacity with increases in business accumulating which promise capacity production by early fall with a gradual stepping-up throughout the summer. The demands run from 1-ton to 3-ton sizes. Most of the business is in the lighter vehicles, but with gradually increasing business in the heavier models.

Road work is responsible for most of the 3-ton sales at this time, these vehicles being equipped with pneumatics because of the greater traction offered on weak, yielding surfaces. Although most of the Government war trucks were alloted to state highway departments, it is found that these are being used mainly for maintenance and repair work.

Contractors on new roads are in the market for trucks. Building contractors in the cities are found to be turning to lighter models because of their greater responsiveness in heavy traffic. Some manufacturers of trucks are viewing with alarm the increased activity of highway officials in limiting loading capacity, but others regard this as something which will work out favorably for the truck industry as making for longer life of vehicles.

Reduced rates on automobiles carried on Detroit & Cleveland Navigation Co. boats are effective to-day. The open car rate is reduced 15 per cent and the closed 25 per cent. The new rates are practically the same as pre-war rates.

Car Business to Continue Heavy

DETROIT, April 19—Three factory conventions held in the Detroit district the past week have given indications of continued heavy absorption of automobiles for an indefinite period. These conventions were held by the Maxwell Motor Corp., the Reo Motor Car Co. and the Detroit Electric Car Co.

As nearly as can be estimated, the ratio of replacement and first car buying is about three to one. Reports from territorial men attending these conventions showed that dealers in most parts of the country are handling their replacement business in a way which permits quick turnover of the exchanged car at a profit. The factories realize that new car business will be large only as long as used cars are kept moving at a proportionate rate.

Edsel Ford Optimistic Over Business Outlook

NEW YORK, April 20—Edsel B. Ford, president of the Ford Motor Co., in a statement here yesterday took an exceedingly optimistic view of the industrial outlook. He declared his company expects its production for the year to reach a high water mark of 1,150,000, compared with 1,038,000 cars and trucks last year. He added that the new plant at Green Island near Troy, in which all ball bearings and roller bearings will be manufactured, will be in operation late in the year. Ford stated that no further reduction in the price of Ford cars is contemplated at this time, notwithstanding prospective competition.

INDUSTRIAL NOTES

K. O. Muehlberg Co. of Manitowoc, Wis., manufacturer of a new type of automatic drill and other mechanical devices for automotive, gas engine and service shops, has acquired the Hoffman Glove Co.'s factory in that city. The Hoffman company is moving to Chicago, and will give possession about May 1. Karl O. Muehlberg began manufacturing tools several years ago and incorporated about three months ago. The industry has grown so rapidly that a number of buildings in addition to the original shop have been leased for short terms to keep production apace with demand.

Dickinson Cord Tire Corp., New York, announces the following officers: President, F. S. Dickinson; secretary, E. W. McCarty, active head of the J. C. McCarty Co., New York; treasurer, C. H. O'Connor, New York, identified with real estate and insurance interests; directors, Louis C. Block, Philadelphia, former Ford branch manager and now distributor for the Gray Motor Corp. and N. R. Bagley, president of the N. R. Bagley Co., New York.

International Harvester Co. will open bids this month for the construction of two units of the motor truck plant it will build at Fort Wayne, Ind., and expects to begin actual work May 1. Each of the buildings will be 200 x 600 feet and will cost $1,000,000. Much preliminary work has already been done at the site of the plant where the company owns several hundred acres of land.

Curtis Motor Car Co., Little Rock, Ark., has been placed in the hands of H. V. Forl as receiver upon petition of one of the stockholders, Dr. Benjamin A. Adams. The company was organized in 1919 but was not incorporated. About 25 or 30 cars were completed at the plant in Little Rock.

Studebaker Corp. has plans underway for a new power house at its plant in South Bend to cost about $750,000 and a storage and shipping building provided with crate handling and conveying machinery estimated to cost approximately $500,000.

Hinckley-Myers Co., Jackson, Mich., has opened its eastern sales and executive office in the General Motors Building, Detroit. William A. Kent is the eastern sales manager and John E. Moore, general sales manager.

Simms Magneto Co. will open a branch office and show room at 5781 Woodward Avenue, Detroit, May 1, with L. F. Acker in charge. The branch will cover the states of Ohio and Michigan.

BRITISH EXPORTS DECLINE

WASHINGTON, April 18—Automobile exports in Great Britain for February show a big decline over the previous month, there being £100,001 worth exported in February against £147,254 in January, according to reports received by the Automotive Division of the U. S. Department of Commerce.

METAL MARKETS

Actual steel consumption, always more or less of a mystery, is the unknown quantity in the present steel market. Mill output at this time has grown probably to a rate of 37,000,000 or 38,000,000 tons a month, as compared with just about one half that tonnage last December, and statistically this is looked upon as the apparent consumption. In the present condition of the steel industry and its principal consuming arteries it is, however, obvious that there must be a wide discrepancy between apparent consumption or mill production and actual consumption or the amount of steel that goes into finished products and therefore disappears definitely from reserve holdings. In the absence of figures covering actual consumption which are unobtainable, sentiment counts, and many shrewd market observers are of the opinion that a much larger tonnage of the steel now being produced is intended for reserve than was the case during the year's first quarter.

All of the tonnage that mills are now working on was sold at the prices that prevailed previous to April 1, and a large number of consumers have not only covered their wants for the second quarter at these prices but, unless their own consumption should undergo unexpected increase, they will have some reserve stocks to draw upon after the first half of the year has passed into history. Automotive plants that have covered their sheet wants until June care very little whether the market at the higher prices proclaimed April 1 is characterized as firm or not. They will not begin to worry on that score until much of the steel now due them from mills at old prices has been worked up.

There have been quite a few odd lot sales of sheet bars at $31, Pittsburgh or Youngstown, and in at least one transaction an even higher price has been mentioned. In spite of many misleading headlines in the daily newspapers there is no shortage of coal at the steel mills but as the result of the Connellsville region walkout of non-union miners there is a temporary curtailment in the coke output of bee-hive ovens that supply fuel for about one-fifth of the country's blast furnaces. Conservation of semi-finished steel for producers' own finishing mills comes as a natural precaution but there is no more justification for a panicky feeling regarding steel mills' fuel supply than there was at the outbreak of the strike.

Pig Iron.—The coal strike is being used as chief argument in support of advance of 50¢ @ $1 per ton on all grades and in all markets.

Aluminum.—The market for 98 to 99 per cent pure virgin ingots has hardened and lots below 18¢ have generally disappeared. With the Senate Finance Committee concurring in the aluminum schedule of the Ways and Means Committee of the House, importers, while still hoping against hope for a more moderate rate of duties as the result of arguments on the floor of the Senate or in the conference committee, are laying out their program resigned to the seemingly inevitable. The very large warehouse stocks of ingots make it dubious whether large holdings at the time when the tariff law goes into effect would prove profitable within a reasonable time. The situation with reference to sheets is somewhat different. Undoubtedly these will be considered a good investment with the expected rise in tariff rates.

Copper.—Although domestic sales are not large the market's tone is slightly better.

Calendar

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

October — Paris, Automobile Show.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

Nov. 3-11 — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

New Haven, April 21; Cleveland, April, 21; Detroit, April 21; Philadelphia, April 27; Indianapolis, May 8; Chicago, May 12; Detroit, May 19. The Pennsylvania section will hold an outing at Torresdale or a body meeting on May 25.

February Big Month in Canadian Exports

Shipments of Cars Gain 100 Per Cent Over January—Trucks, 39 Per Cent

WASHINGTON, April 18—Canadian automobile exports in February compared with January of this year show an increase of approximately 100 per cent in the number of passenger cars and 39 per cent increase in the number of trucks exported, according to reports received by the automotive division of the United States Department of Commerce.

The February exports of passenger cars were 2719, valued at $1,539,936, but only two came into the United States, these being valued at $2,335. January exports were 1344 passenger cars, valued at $904,667, of which 5 were imported into the United States, these having a value of $7,240.

More Trucks Exported

There were 264 trucks valued at $119,619 exported in February, compared to the exportation of 98 trucks valued at $43,962 in January. Of the February trucks exported, but one came into the United States, valued at $2,500, while none were imported into the United States in January.

Repair parts exported in February were slightly less than the January exports, there being $188.923 January repair exports against $105,913 February shipments.

Of the 2719 passenger cars exported from Canada in February, the last month for which figures are available, 1267 went to Australia; 547 to the United Kingdom; 204 to Argentina; 162 to South Africa; 107 to the Dutch East Indies and the remainder to more than 50 other countries.

Practically all of the trucks exported went to Australia during February, as did more than 50 per cent of the repair business. British India ranked second with 21 trucks received; Ceylon third with 17, and United Kingdom fourth with 16 trucks imported from Canada.

The declared exports from the United States during February were 3096 passenger cars and 454 motor trucks. Adding these to the Canadian shipments, a total of 5815 cars and 718 motor trucks are shown. No month since December, 1920, has shown a higher volume of passenger car exports.

Belgian Law Regulates Equipment on Trucks

WASHINGTON, April 14—In an effort to save the newly constructed highways of Belgium, legislation has just been passed compelling all motor trucks and trailers, weighing one ton per axle and over, to be equipped with rubber tires, according to foreign information of the U. S. Department of Commerce.

The same bill provides that all mufflers must exhaust downward against the ground. The existing laws require that all mud guards must be constructed so as to prevent all scattering. How this is to be done, however, is not stipulated in the bill, although the regulation requirements of the city of Brussels require a wide flange on the guard, which more or less prevents excessive spattering of mud.

S. M. KITCHIN DIES

RICHMOND, IND., April 18—Announcement is made of the death of S. M. Kitchin, for years connected with the Auburn Ignition Manufacturing Co., Inc., and other manufacturing and selling companies in the automobile and hardware fields. Kitchin served as sales manager, general manager, vice-president and director of the Auburn company.

State to Build Road for Motor Truck Use

30-Mile Stretch Will Parallel Boston Post Road in Connecticut

HARTFORD, CONN., April 18—State Highway Commissioner Charles J. Bennett has announced that the thirty-mile concrete state highway, which will be built exclusively for motor trucks, will extend from Bridgeport to the state line at Greenwich and will parallel the Boston Post Road. This is said to be the first time in the history of American road building that such a road has been seriously considered by reason of the expense involved.

Surveys are now being made by the highway department and the project is being closely observed by the Federal government. The highway commissioner is personally supervising the making of the surveys. In addition, the highway commissioner is to have the Boston Post Road surveyed from the air, the object being to secure a panoramic view. These views, which will be joined together, are to be taken at the busiest time of the day. It is said that traffic is heavier on the Boston Post Road than on any other road in the country.

Cost Estimated at $1,500,000

Bennett estimates the cost of the thirty-mile truck road at $1,500,000. It was deemed advisable to construct a road exclusively for trucks rather than widen the present highways to accommodate the heavy commercial vehicle travel. Statistics show that an average of 10,000 vehicles a day travel over the road, and of this number trucks are represented to the extent of 2000, most of them long distance freight haulers.

AUTOMOTIVE INDUSTRIES
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Survey Proves Highway Transport Economic Necessity

Report of Joint Commission of Agricultural Inquiry shows broad vision of future needs. Will recommend promotion of highway construction and maintenance. Urges a correlation of highway transportation with rail and water transportation.

AFTER the most comprehensive survey of the distribution and marketing problem ever undertaken in the United States the Joint Commission on Agricultural Inquiry, headed by Representative Sydney Anderson of Minnesota, has completed its report to Congress. One section of the report is devoted to highway transport. The importance of this arm of highway transportation service is given official Congressional recognition for the first time.

While the purpose of the commission, as outlined in its warrant from Congress, was primarily to make a thorough study of the problem of distribution and marketing, its recommendations to Congress, based upon a careful analysis of the enormous mass of data assembled, undoubtedly will carry great weight in framing legislation.

It is significant that the commission, after announcing that "nothing since the advent of railroads has had so marked an economic and sociological effect upon the life of the country as the motor vehicle," will recommend "that Congress promote highway construction and maintenance direct to the more effective correlation of highway transportation with rail and water transportation."

In its survey of the problem before it, which never has been adequately studied in this country, the commission worked back from the ultimate consumer as represented by the retailer, through the wholesaler and the manufacturer to the producer. It obtained specific data on every element of cost from the time agricultural products left the farm until they reached the last station in the point of distribution.

In gathering this information the commission sent out 30,000 questionnaires in which 25,000,000 questions were asked. In analyzing the data more than 50,000,000 calculations were made. This mass of material now has been digested and put together in a formal report.

One striking fact revealed in a digest prepared by Chairman Anderson of that part of the report referring to motor transport is that while motor vehicle traffic increased more than 1900 per cent in the period from 1910 to 1921, the actual expenditure for highway construction and maintenance, taking into consideration the increase in cost of materials and labor, was only slightly over 200 per cent. In his digest Anderson says:

Nothing since the advent of the railroads has had so marked an economic and sociological effect upon the production life of the country as the motor vehicle. The Commission will recommend that Congress continue to promote an adequate program of

highway construction and maintenance, directed to the more effective correlation of highway transportation with rail and water transportation.

Also that the program of highway construction and maintenance by States and counties be continued under the direction of qualified experts, with particular reference to the construction and maintenance of farm-to-market roads; that adequate funds should be appropriated for research and regulation of traffic based upon the facts so ascertained.

Also that the several States co-operate in effecting a uniform basis for taxing motor trucks and other motor vehicles, which shall fairly represent the proportion of expense of highway construction and maintenance chargeable to such vehicles.

Previous to its appearance, the economic zone of transportation was sharply defined by the haulage range of the horse and the cost of such transportation. It will be shown in the report that in 1918 the estimated cost of hauling in wagons from farms to shipping point averaged about 30 cents per ton-mile for wheat, 33 cents for corn and 48 cents for cotton. Hauling in motor truck or by tractors the averages are 15 cents for wheat and corn and 18 cents for cotton. In the same year wagon hauling averaged 9 miles from farm to shipping point and motor truck hauls 11.3 miles; the motor truck averaged 3.4 round trips per day over its longer route, while wagons made 1.2 round trips per day.

It thus appears that the major result accomplished by this new form of transportation has been to extend and broaden the markets of the farmer. Single reactions are to be found in the fact that the use of the motor vehicle has brought the farmer closer to the city and also has increased the desirability and comfort of farm life.

Figures in the report will show that while the motor vehicle traffic has increased more than 1900 per cent in the period 1910 to 1921, the actual expenditures for highway construction and maintenance, taking into consideration the increase in cost of materials and labor during the war and the readjustment period, was only slightly over 200 per cent.

In some sections the combination of inbound farm products and outbound supplies by motor truck has concentrated upon the motor truck service the majority of the traffic within 30, 40 and 50 miles, and the Commission believes that the effect upon rail carriers has been to reduce the amount of local way freight and that ultimately it will reduce the number of local freight trains operated.

"Since the growth in the use of the motor vehicle has been very markedly in advance of highway construction and maintenance," Chairman Anderson said, "and since it has brought with it a new and heavier form of highway traffic, it becomes evident that large funds will have to be expended if the 2,500,000 miles of rural highways in the United States are brought up to the standard of efficiency comparable to the extended use of the roadbeds."

Another effect of improved highways is to enable the farmer to hold his products on the farm for a longer time. Where highways are unimproved the farmer must move his produce when the roads are good, which is generally at the season when the prices are lowest. Improved highways thus make not only for a broader market but for a more stabilized one.

The Commission believes there should be regulation of the use of the highways, especially with respect to overloading and maximum loading to be based upon the facts so developed. It will also urge that since poor highways not only increase the cost of transportation of commodities from farm to market, but also affect the comfort of the farmer and prevent him and his family from a full enjoyment of communication with his neighbor, all highways wherever possible should be improved and adequately maintained.

It is already clear that there is a wide variation in principle and application of the various State and local regulations affecting intrastate motor traffic. Studies of local motor transportation should be expanded as rapidly as possible to afford a definite and comprehensive basis for uniform regulation of motor transportation in order that the inconvenience, expense and inefficiency of operation occasioned by a lack of uniformity in State and Federal legislation in the future may as far as possible be avoided.

Electric street railways, the Joint Commission has found, have suffered to some extent from the encroachment of the automobile upon their revenues. This competition, which is the first competitive activity to be felt by the street railway, has not seriously affected the revenues except in individual cases, and will not be fatal to their successful operation where these competing forms of transportation are subject to regulation and control by the proper regulatory bodies. When they are required to assume the same responsibilities as to service rendered and license fees and taxes paid they have not proved to be detrimental to existing transportation agencies.

HERE are some of the chief points brought out in the report: "Nothing since the advent of the railroads has had so marked an economic and sociological effect upon the production life of the country as the motor vehicle."

"The major result of this new form of transportation has been to extend and broaden the markets of the farmer."

"Large funds will have to be expended to bring the 2,500,000 miles of rural highways up to a standard of efficiency comparable to the extended use of roadbeds."

Viewed in a general way the recommendations reviewed above are of considerable importance to the automotive industry. Sponsored by the powerful farm interests, the recommendations of the Joint Commission of Agricultural Inquiry will shortly be presented to Congress and are likely to be embodied in future legislation.

Thus the industry will note with favor the high tribute paid to the motor vehicle as an essential part of the economic life of American agriculture.

It has long been obvious to students of the question that the motor vehicle is fulfilling a utility function in the conduct of industry and agriculture and that it is an important unit in economic progress. This contention has been justly and strongly made by the automotive industry for some time past.

It is highly useful, however, from a practical standpoint, to have this view of the essential utility value of the motor vehicle so strongly stressed in an impartial and powerful document of this kind.

The report as a whole covers the many economic phases affecting agricultural progress. Digests of the various sections are being published currently. The entire report will probably be ready for publication some time in the near future and can be read with profit by all interested in the subject.

Minor Changes in New Packard Single Six

Wheelbase has been lengthened and half inch has been added to stroke of engine. Slight change in carbureter design. Instrument board has been redesigned, and windshield mounting improved. Deeper side rails employed.

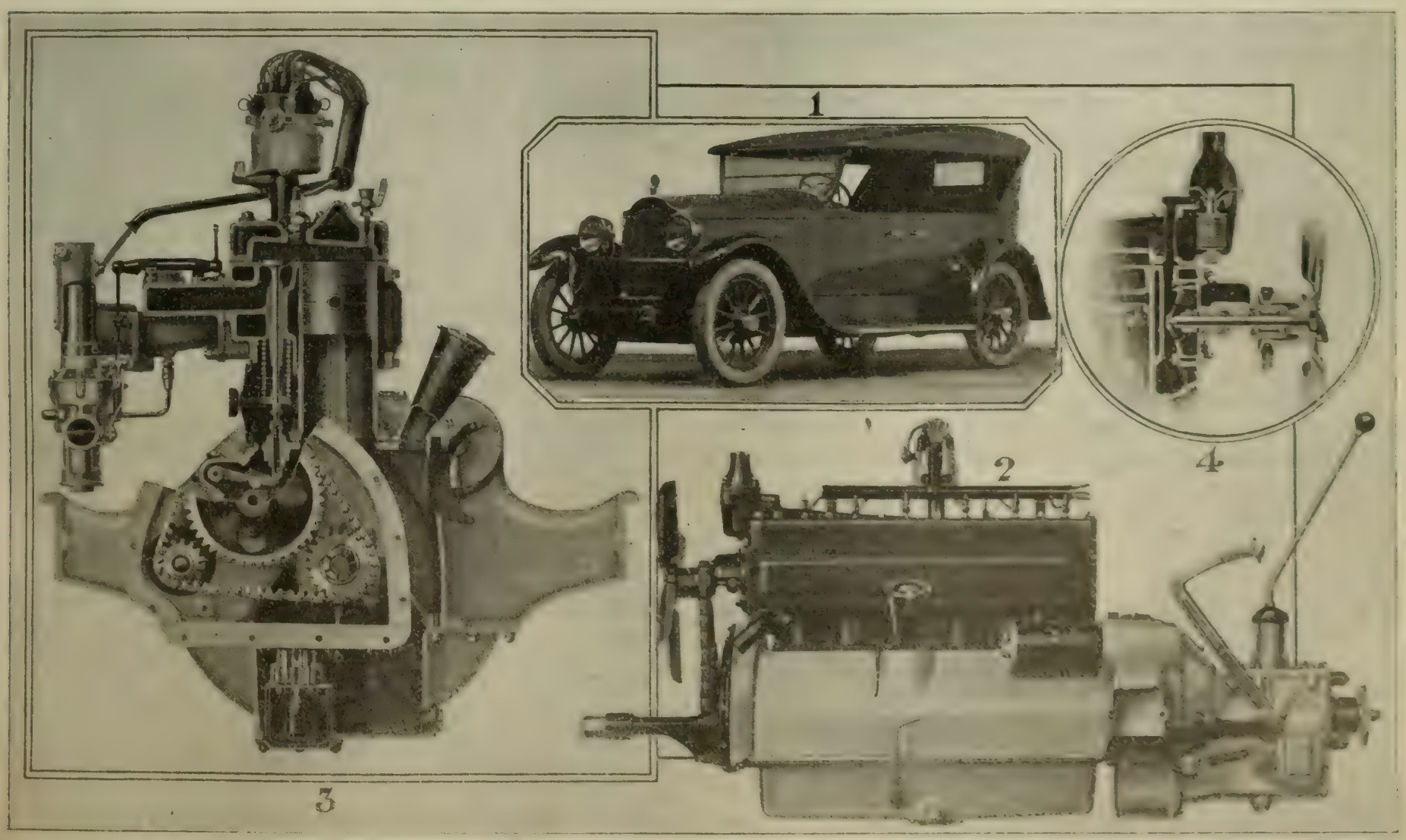
NO radical engineering changes have been made in the new Packard single six chassis, which was briefly announced in AUTOMOTIVE INDUSTRIES last week. A complete line of bodies is being supplied mounted on two wheelbase lengths of respectively 126 and 133 in. The only alterations of a design character are those intended to take care of the longer wheelbase and the larger body sizes. A half inch has been added to the stroke of the engine, making the bore and stroke now 3⅜ by 5 in. The lengthening of the stroke has been accompanied by the use of a lighter, more rigid and more servicable connecting rod. The valve spring retainer shape has been altered, the water pump relocated to add to cooling efficiency under certain operating conditions, the ignition system simplified and some detailed changes have been made in the design of the carbureter. These changes have resulted in a 10 per cent increase in engine output.

A slight change has been made in the clutch to provide for four driving plates instead of three. The gear ratios are now 4.3 to 1 in the 126-in. wheelbase chassis and 4.66 to 1 in the 133 in. Both sets of gears are carried in service stock and are interchangeable so that it is possible to use the low gear ratio in the 126-in. wheelbase and the high ratio in the 133 in., if desired.

The relocation of the water pump has made it easy to take off the cylinder head without loosening the radiator, fan, etc., and resulted in a shortening of the fan belt. The engine is now equipped with a new type of fan which gives better efficiency. The outside water pipes have been eliminated and there are only two water hose connections. All of the piping for the deflection of water when the thermostat is closed is cast into the cylinder head and the water outlet manifold is provided for in the bolted-on cover plate.

Other detail engine changes increase accessibility. The fact that the ignition distributor is now mounted directly on the top permits the cylinder head to come off more readily and the fan and front end chains are readily adjusted from the exterior. The generator mounting is also more accessible.

A chassis change of importance is the greater rigidity



1—Complete car showing improved body lines and lengthened wheelbase. 2—Engine, clutch and gearset unit. 3—Sectional end view of engine. Ignition distributor mounted on top. 4—Cross-section of fan, water pump and thermostat

of the frame side rails. These have been increased in depth to 7½ in. for the 126-in. wheelbase and 8 in. for the 133-in. There is a new front cross member designed to provide for greater rigidity in the front end of the frame and to furnish a more substantial support for the radiator while improving the front end appearance.

There are a great many detail changes for both appearance and quietness, as well as accessibility. A simplified system of conduits and junction boxes has improved the electrical installation and, concealing the cables on the inner dash surface, adds to both appearance and protection. An enameled sheet steel container makes the storage battery more accessible and secure. An improvement has been made in the exhaust system. The vibration set up by the pulsating gases in the exhaust system has been eliminated by the more rigid system of bracketing in a specially designed outlet fitting. The gasoline tank has been redesigned to locate the filler cap on the left side. When the tank is full this location prevents leakage of fuel due to the crown of the road.

A number of detail changes are apparent on the exterior of the car and are designed to improve appearance or to provide greater convenience for driver and passengers. The new type radiator has a nickel plate shell with a convex front surface which relieves the severity of the sharp corners. The radiator is mounted differently. Heretofore, it has been set on built-up pedestals which are now done away with and the front end cross member is so shaped that the radiator frame rests directly on it. This adds to the stiffness of the front end of the frame and the same time providing a more rugged mounting for the radiator.

A new feature has been added in the hood rest, both on the radiator and at the cowl. The fabric is placed some distance under the hood so that a little space is provided both at the radiator shell and the cowl. This eliminates the possibility of the hood coming in contact with metal either edgewise or flatly and thereby prevents the possibility of hood noises.

The dash is now a steel stamping, fitted with a backing of wood to deaden the sound. An improvement in the cowl ventilator is designed to make water leakage impossible. The edge is crimped up so that water, when blown up on the cowl, will not enter, but be carried around to the back and run off. The ventilator is also provided with a lever adjustment on a tight spring, with three different locations for adjustment. On the side hood panels, the louvres are cut in instead of pressed out.

A completely redesigned instrument board is now provided. This has two oval glasses, one of which is a combination speedometer and clock of Waltham manufacture and under the other is the oil pressure gage and ammeter. The switch is just to the left of these two ovals and the dash light is operated with a separate button on the top of the switch. An improvement has been made in the windshield mounting. Rubber pads have always been provided to prevent leakage around the windshield base, but on the new cars these are improved by the use of a rubber pad that runs completely under the lower half of the windshield and is entirely made in one piece. The lower portion of the windshield does not move and is also equipped with rubber fillers. The doors on all models are now made flush so that there will be no overlapping moldings to break the body line. The inside door handles on the new cars are so designed as to unlock the door by either an up or down motion. The rear end of the muffler pipe is now equipped with a nozzle which is flattened out in such a way that the exhaust will not strike the ground, sidewalk nor the spare tire. This nozzle is connected by a rod to the spare tire rack to make it solid. The irons for supporting the top when down are not visible when the top is up. They fit into sockets in the body which are hidden by the gypsy curtains when the top is up.

A complete line of open and closed bodies is provided on these two chassis. On the 126-in. chassis are mounted the five-passenger touring, two-passenger roadster, four-passenger coupe, five-passenger sedan and four-passenger sport. On the 133-in. chassis are the seven-passenger touring, seven-passenger sedan and seven-passenger sedan-limousine.

On the inside of all of the doors on the closed car models is a cloth loop which is set in the doors to use for closing it from the inside. The window regulators on the doors of the sedans and on the coupes are moved forward to be out of the way. In all sedan models the robe rail is made of tubular braided cloth. All except the right front doors are equipped with inside locks, so that it is only necessary to lock the right front door from the outside. In the 133 sedan-limousine, outside locks are provided on both right-hand doors. All closed cars are equipped with visors of metal which are covered and rolled around a rod at the front end. The windshields are vertical on the closed jobs in order that the water will not blow up and through the windshield and the double pillars at the front corners have been eliminated.

The fundamental specifications of the Packard chassis have not been altered. The engine is a six-cylinder, block cast, three-point suspension unit of 3⅜-in. bore and 5-in. stroke. The horsepower on the block is claimed by the manufacturers to be over 54. The clutch is a multiple disk, dry plate type with four driving plates. The tire equipment is 33 by 4½-in. rib tread front and non-skid rear, cords. Wood wheels are standard on all models except the sport, which use disk steel wheels. On all other models the disk wheels are optional at $35.

Welded Valve Seats Tested

IN view of the interest among automobile manufacturers concerning the use of alloy steel valves with welded seat of heat-resisting alloy, some recent tests by the Power Plant Section of the Engineering Division, Air Service, McCook Field, are worthy of study. The tests were made particularly to study the properties of a welded valve seat, the seat being a cobalt-chrome alloy. The valve is a product of the Rich Tool Co.

It was found that the bond between the body of the valve and the material is satisfactory and should withstand severe service conditions. It was also found that the welded-on seat material, which is an alloy mainly of cobalt and chromium, is resistant in a large measure to attack by 20 per cent aqueous sulphuric acid. When the valve was subjected to a highly oxidized flame at a temperature of about 1350 deg. Fahr. the chrome-tungsten steel of the valve proper scaled perceptibly, but the welded-on seat showed only slight oxidation. It was found that the alloy possessed non-staining and non-oxidizing properties in high degree.

More extended service tests are to be given this type of valve and the expectations are that it will prove out satisfactorily. Metallographic studies showed a very satisfactory structure at the weld.

Gear Makers' Convention of Much Technical Interest

Papers presented on good hob practice, use of the projection comparator in testing gear teeth, proportion of industrial gears, the grinding of gear teeth and a new system of bevel gears. Definite progress made in standardization work by the American Gear Manufacturers Association.

By P. M. Heldt

THE Sixth Annual Convention of the American Gear Manufacturers' Association, held at the Lafayette Hotel, Buffalo, April 20-22, was well attended and disposed of a well-rounded program. President Sinram in his opening address said that perhaps never before in the memory of anyone present had business been so sorely tried as during the past year. During the depression, which now fortunately seemed to be passing, old and seemingly well established firms had tottered and fallen, and fortunes had been lost. In many fields of industry a housecleaning was absolutely necessary. The gear industry presented a firm front, although it might show a dent here and there. He did not like to strike a pessimistic note, as he was naturally an optimist, but it was necessary to look facts in the face. He expected a gradual and steady improvement during the current year. No lasting prosperity could be looked for until the volume of our exports had assumed reasonable proportions. A definite start had been made on the upgrade in business, but the demands of the new era would be exacting. There had never been a time when those in the same field of industry could counsel together with as much profit as at present. Hereafter the Association should look particularly after the commercial problems confronting the gear industry. By stabilizing their industry they would help to stabilize business in general.

Mr. Sinram made reference to two group meetings to be held during the convention to consider business conditions in the industrial and automotive fields respectively. He thanked the chairman and members of the executive committee and all other committees for their efforts during the past year which, he said, had been a most trying period, and also thanked the membership for the confidence reposed in him during his five years as president of the Association.

Tariff, Public Relations and Public Policy

During the session on Thursday morning reports of numerous committees were received and several new members elected. S. L. Nicholson presented the report of the Tariff Committee, in which he gave an outline of the present situation with regard to tariff legislation. J. B. Foote reported for the Industrial Relations Committee and advocated the adoption by the membership of an apprenticeship system in order to train competent help. He said that during the war and the two years following many men had been taken on without any previous training, but most of these had now returned to the farms or to other forms of common labor, and already a dearth of skilled help was felt in several of the most important industrial districts. Mr. Foote said that they all knew of the difficulty in getting a good all-around machinist and that this was largely due to the fact that there was no regular apprenticeship system in this country. Mr. Sawtelle, who had attended the meeting of the National Metal Trades Association in New York during the early part of the week, said that much consideration had been given by that Association to the apprenticeship problem and that six different systems had been worked out and were now being investigated. It was therefore decided to co-operate with the National Metal Trades Association in this matter.

Henry E. Eberhardt reported for the Public Policy Committee. He said that some concerns still adhered to the policy of providing their machines with screws and gears of non-standard pitch, their reason being that by so doing they expected to establish a monopoly on the supply of repair parts. Mr. Eberhardt said that this policy was opposed to the interest of the user, and he suggested that all members educate their customers to calling for standard gears when ordering machines of any kind.

From the report of the secretary it developed that the Association now has 94 member companies, with 109 executive members and 53 associate members. The Automotive Gear Works at Atlanta, Ga., and the Willys-Morrow Co. of Elmira, N. Y., are new member companies admitted at the convention, and additional associate members from the Westinghouse and General Electric companies were also elected.

Good Hob Practice

During the morning session on Thursday H. E. Harris, of the H. E. Harris Engineering Co., read a paper on good hob practice. Mr. Harris' paper was based upon experiments made with lathe and similar cutting tools about ten years ago in which it was found that better results are obtained as regards the rate at which stock is removed, the accuracy of the work and the durability of the cutting edge if the tool is given a "hook" and a "rake." These principles were later applied to milling tools and to hobs for cutting gears and splines and were found to work out equally well in these lines. Heretofore the teeth of hobs have been generally made with the forward side radial, but it is found that if this face is given a slight angle with relation to the radial plane to the cutting edge, the cutting qualities are improved. Exactly what this angle should be for best results has not yet been determined. In the discussion of this paper it was brought out that in making hobs allowance must be made in the outline of the cutter for the "hook" and the "rake," as otherwise the tooth shape will not be

correct. Mr. Buckingham pointed out in this connection that it is very difficult to determine the modification required. Mr. Flanders said that the amount of the "hook" should be stamped on the hob, as otherwise the operator, when grinding the hob, had nothing to guide him and the angle would increase or decrease after repeated grindings. Mr. Harris said that the same thing applied to hobs with radial teeth.

Standardization Work

At the afternoon session Ralph E. Flanders, of the Jones & Lamson Machine Co., presented a paper on "The Use of the Projection Comparator in Testing Gear Teeth," which was accompanied by a demonstration of the device. We expect to print Mr. Flanders' paper in an early issue of AUTOMOTIVE INDUSTRIES. Following this, B. F. Waterman, chairman of the General Standardization Committee, first presented the report of the Sectional Committee on Gears of the American Engineering Standards Committee. He said that a meeting of the Sectional Committee was held October 27 last and that consideration was given to the present S. A. E. standard for starting motor pinions which reads as follows: "Flywheel starting motors shall be equipped with an 8-10 pitch, 11 tooth, 20 deg. pressure angle pinion. The clearance on the pitch line between the pinion and the flywheel shall be from 0.015 to 0.025 in." It is suggested by the Sectional Committee that "clearance on pitch line" be made backlash. It was further agreed to define backlash as follows: "Backlash is the play between the teeth of a pair of gears mounted at the specified center distance, the increased width of space to be obtained by an addition of not more than 0.025 in. in the thickness of the cutter, so that the bottom diameter will not be so small as to weaken the pinion." The secretary was instructed to write to the S. A. E. for approval of this suggested modification. The Sectional Committee in going over the A. G. M. A. standards and proposed standards made a number of other suggestions. For instance, in connection with the A. G. M. A. composition gear standard, which mentions by name several materials now used for non-metallic gears, it was suggested to delete these names, as trade names are not to be used in American standards.

Various changes were also suggested in the A. G. M. A. recommended practice for gear inspection, which has been published in a previous issue of AUTOMOTIVE INDUSTRIES. These changes are as follows:

Gear Inspection Changes

"Keyways.—Keyways, single and multiple, for straight and tapered holes, should be inspected for width by using 'go and no go' flat limit gages, gaging the width only. For alignment a plug gage with a key or keys will be used, with the diameter of the plug and width of key enough smaller than the low limits to meet the requirements of the work in hand. The key should be long enough to reach the entire length of the keyway; the height of the keyway equal to the customer's low limit. If the maximum depth is important, a similar gage should be used as a 'no-go,' having a height equal to the maximum shown in the customer's drawing. Keyways for Woodruff keys should be inspected by using a hardened gage similar in shape to the key, slightly thinner than standard, and sliding a key-seated ring gage over the key when in place in the keyway. Two keys may be put in the ring gage to agree with the depth limits on the customer's drawing. For width of keyway in the shaft, use a 'go and no-go' flat limit gage, both ends of which should agree with customer's limits.

"Shafts.—Splined shafts should be checked for width of spline, roots and outside diameters, using 'go and no-go' snap gages made to the dimensions given on the customer's drawing or a micrometer used. For accuracy of spacing use a ring gage having one portion ground to the minimum limit of the large diameter, bottom to bottom of keyways, in the mating part, and at one end a slotted portion with a diameter of hole equal to the minimum diameter of the bore of the mating part and made with slots of width equal to the maximum limit of the spline of the shaft.

"Shifter Grooves.—Shifter grooves should be inspected for diameter at the bottom of the groove by using a 'go and no-go' snap gage slightly thinner than the width of groove and made to dimensions of customer's drawings or a micrometer used. If a fillet is called for around the edge, round the snap gage enough to clear. For width of groove use a 'go and no-go' flat limit gage made to limits upon customer's drawings.

"Small Size Spur, Helical and Internal Gears.—Smaller size spur, helical and internal gears should be checked for pitch diameter, eccentricity and irregular teeth by inspecting on a hand stand, the essentials of which should be rigidity of construction, one rigid and one freely sliding head, so arranged that the movement of the sliding head will actuate a dial indicator. Hardened master gears of proven accuracy should be used. The studs on which the work and master are mounted should be at right angles with the surface on which the sliding head moves and parallel with each other within 0.002 in. in 12 in. The diameter of the work stud should equal the diameter of the 'go' gage, and the stud in the master gear should be about 0.00025 in. less than the hole."

This recommendation also included the definition of backlash which has already been given. The above recommendations of the Sectional Committee were adopted by the A. G. M. A.

At a further meeting of the Sectional Committee, held on January 19 last, a research committee on gears was appointed, consisting of Wilfred Lewis, Earle Buckingham, A. M. Greene, Jr., R. E. Flanders and Charles E. Logue. At this meeting it was voted that the S. A. E. starting motor pinion standard with the proposed changes be submitted to the sponsor bodies as a proposed tentative American standard, provided the proposed changes met with the approval of the S. A. E.

Mr. Waterman also made a brief report for the General Standardization Committee of the A. G. M. A. He said that practically all of the work of this committee had been carried on jointly with the Sectional Committee.

Bevel Gear Committee Report

Several subcommittees of the Standards Committee also reported during this session. The most important of these reports from the automotive standpoint was that by F. E. McMullen, chairman of the Bevel and Spiral Bevel Gear Committee, which follows:

Backlash.—The amount of backlash varies with the pitch of the gears and the committee suggests the following amounts for bevel gears:

D. P.	Backlash*	D. P.	Backlash*
12	.003"-.005"	4	.008"-.012"
10	.003"-.005"	3	.010"-.014"
8	.005"-.008"	2	.015"-.020"
6	.006"-.009"	1½	.021"-.027"
5	.007"-.010"	1	.031"-.040"

*Backlash specified above is to be measured when the pitch lines of the gears are together. Runout of the pitch line will affect the backlash, which should be measured at the tightest point. In the case of gears to be hardened the backlash measurements should be made before hardening.

For bevel gears above 2 D. P. the backlash can be obtained from the following rule:

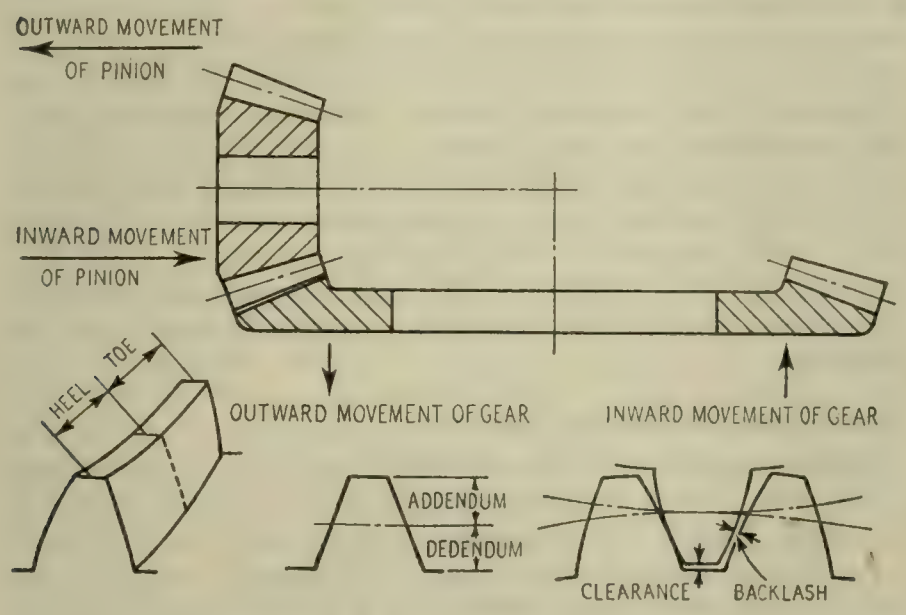
$$\text{Backlash} = 0.01 \text{ in.} \times \text{circ. pitch}$$

$$\text{or} \quad \frac{0.0314}{\text{D. P.}}$$

Adjustment of Gears at Assembly

The proper adjustment of bevel gears at assembly is a vital factor in obtaining quiet and durable gears.

There are two distinct considerations in obtaining the proper tooth contact; one is the bearing along the tooth, lengthwise bearing, the other the bearing up and down the tooth or profile bearing, and it is essential that the two be considered separately to obtain the proper results in combination.



Adjustment of bevel gears at assembly

In the above illustration are given graphic definitions of the terms used in describing the proper procedure to mount a spiral bevel gear. Gears are cut with a predetermined amount of backlash to suit the pitch and operating conditions, and this backlash should not be altered by any great amount to obtain the proper tooth contact, as the necessity of such a step indicates a fault either in the cutting or in the alignment of the supporting bearings. The usual amount of backlash is from 0.004 in. on 8 pitch gears to 0.012 in. on 3 pitch.

Gears, when mounted in a rigid testing machine, should show a bearing toward the small end of the tooth, and the amount the bearing favors the small end is determined experimentally by the stiffness of the mounting the gears are to be finally assembled in. Any spring in the mounting of the gears under load will cause the bearing to move toward the large end, and in no case should the bearing be heaviest at the large end of the tooth under the operating load. Any extra load, such as induced by suddenly applying the full load, will cause the bearing to become concentrated on the top corner of the large end of the tooth and breakage will ensue. In the figures below are shown typical tooth bearings obtained in a testing machine and when mounted in an automobile axle, also the effect of spring in the mounting on the apexes of the gear and pinion. It will be observed that the apexes do not coincide when the gear mounting has sprung under the working load. Therefore, when cutting the gears, it is necessary to make provision for this lift or spring.

Bevel gears are commonly cut to run flush at the large end of the teeth, and as a first step they should be so assembled in the mounting for an initial trial. Powdered red lead and any light machine oil should be mixed and spread over the working surfaces of the teeth with a brush to show clearly the tooth contact that is obtained.

There is no difference in the method of adjusting spiral or straight bevels, and while the following statements are particularly applicable for spiral bevels, they are also true for straight bevels.

After mounting the gears flush with the proper amount of backlash, they should be operated under load in each



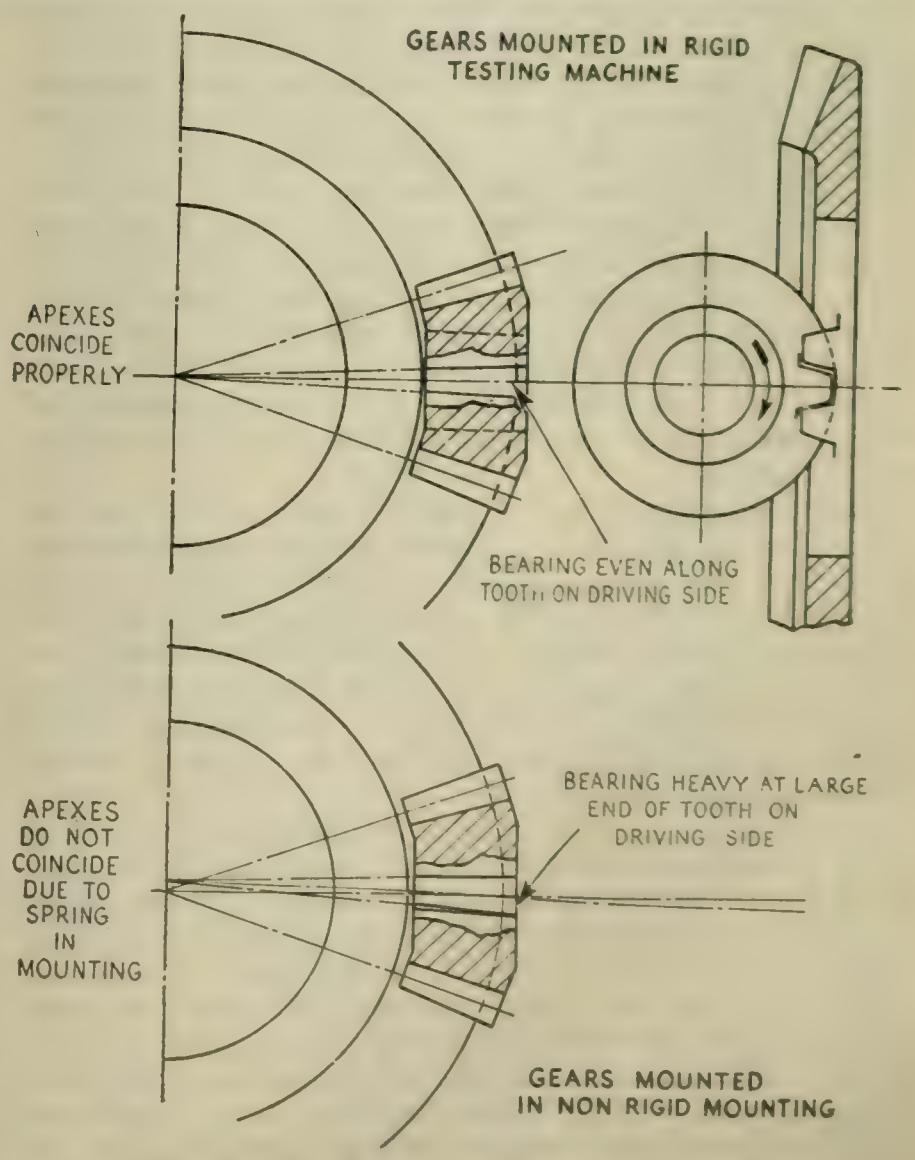
Tooth bearing—rigid and non-rigid mounting

direction for a minute. In the case of the automobile rear axle driving gears the rear axle should first be raised to have the wheels clear the floor, then start the motor and drive the wheels in both directions with the brakes applied to obtain the necessary load.

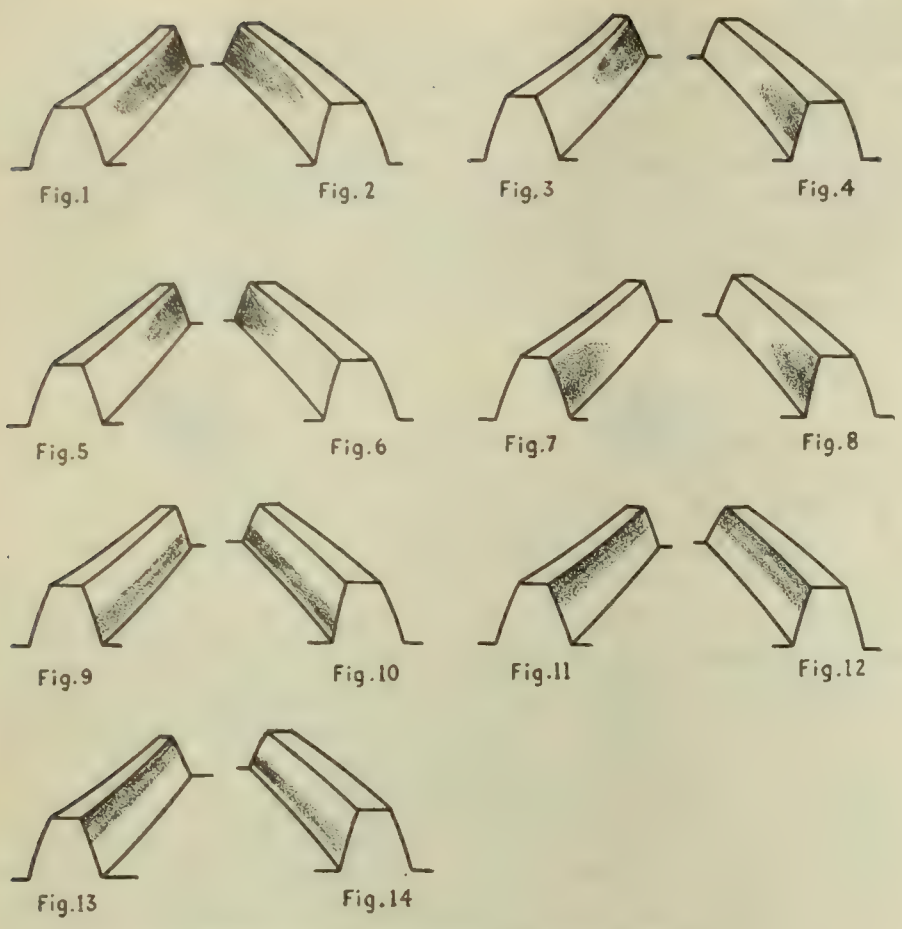
All figures show the bearing on the gear tooth. With a right-hand spiral bevel gear (mating with a left-hand spiral pinion) mounted in an automobile, the driving side is on the convex side of the tooth and the concave side of the tooth is used when in reverse.

The tooth bearing, both lengthwise and profile, should appear as shown in Figs. 1 and 2 (see next page), but a condition of tooth contact may be obtained as indicated in Figs. 3 to 14. The lengthwise bearing adjustments will first be considered.

Lengthwise Bearing Adjustments.—Figs. 3 and 4 show what is called a cross bearing and is caused by either a misalignment of the mounting or an error in the cutting. The mounting should be tested and if found faulty, should be corrected. If the drive side has a toe



Effect of spring in mounting on gear tooth bearing



Examples of bearing on gear tooth

bearing and the reverse a heel bearing, the gears are serviceable provided the bearing is about ⅝ of the tooth length, but if the heel bearing occurs on the drive side, it should not be used and the cutting conditions should be altered if the mounting is found correct.

Figs. 5 and 6 show a toe bearing on each side of the tooth, and the gear must be moved away from the pinion to increase the lengthwise bearing, which on ratios 1-1 to approximately 4-1 will change the profile bearing to some extent and an adjustment of the pinion may be required as described under "Profile Bearing." This movement of the gear will introduce more backlash and the gear cutting should be changed to properly locate the bearing if this increase in backlash becomes excessive.

Figs. 7 and 8 show a heel bearing on both sides and the gear must be adjusted toward the pinion to increase the lengthwise bearing, which on ratios 1-1 to approximately 4-1, will change the profile bearing to some extent and an adjustment of the pinion may be required as described under "Profile Bearing." This movement will decrease the backlash and the gear cutting should be changed to properly locate the bearing if there is insufficient clearance.

Profile Bearing.—Figs. 9 and 10 show a low bearing on gear tooth which may appear at any position along the tooth. The pinion should be moved away from the gear, and on ratios 1-1 to approximately 4-1, the gear should be moved towards the pinion to maintain the proper backlash. This movement of the gear will alter the lengthwise bearing and several adjustments for both lengthwise and profile bearing may be required to obtain the proper tooth bearing.

Figs. 11 and 12 show a high bearing on gear tooth which may appear at any position along the tooth. The pinion should be moved towards the gear and on ratios 1-1 to approximately 4-1, the gear should be moved away from the pinion to maintain the backlash. This movement of the gear will alter the lengthwise bearing and several adjustments for both lengthwise and profile bearing may be required to obtain the proper tooth bearing.

Figs. 13 and 14 show a lame bearing. It is possible to adjust the gears and obtain a fair driving condition as indicated in Fig. 1, but a poor coast or reverse, and the only method of completely eliminating the trouble is to properly cut the gears.

It must be borne in mind that the adjustments cited should be moderate and if great amounts of adjustments are needed, the mounting and gear cutting must be carefully checked, and the necessary steps taken to correct the trouble in the manufacture of the gears or mounting.

After a brief discussion the recommendation with respect to backlash was adopted as a standard for future design and the recommendation respecting mounting of bevel and spiral bevel gears as recommended practice.

On Friday morning a number of committee reports were received and the rest of the day was given over to a visit to Niagara Falls. A certain amount of discussion followed the report of the Committee on Uniform Cost Accounting made by J. H. Dunn. Mr. Dunn pointed out that his committee had made a report at every meeting in the last four and one-half years and yet there were 44 members who had never indicated either disapproval or approval of the recommendations made. He made the suggestion that possibly there should be district committee workers on the subject, or that the Association might consider the employment of a special accountant to give his entire time to the Association and travel from plant to plant. Mr. Hamlin suggested that Mr. Dunn meet the Executive Committee to discuss with it measures calculated to increase interest in uniform cost keeping.

Gear Strength Testing Machine

In his report on composition gears, Mr. Christensen elaborated on what he had said on the day preceding, viz., that some work was under way toward developing a machine for testing the strength of gears. In this connection a letter from Prof. Henry A. Wolsdorf, of the University of Cincinnati, was put into the records. At the present time a machine is being designed at that institution for determining the pitch line load required to break off gear teeth. When the design is completed and has been approved by several competent engineers it will be built, provided funds are available for the purpose. Tests will then be made on this machine to establish the relation between this load and the pitch, pressure angle, velocity at pitch line, length of arc of action, width of face, characteristics of material and nature of load (constant or sudden impact). Many gears will have to be broken before all these relations are accurately established. Seven years ago Wilfred Lewis built a gear testing machine for the University of Illinois, but this machine has never been used, being faulty because of excessive friction, lack of flexibility and speed. It is therefore desirable to design another machine to overcome these objections. The objects are entirely educational and results would be published for the benefit of all interested in gear problems.

All Officers Re-elected

As members of the Executive Committee J. B. Foote, Foote Bros. Gear & Machine Co., Chicago, and E. J. Frost, Frost Gear & Forge Co., Jackson, Mich., were re-elected for three years, and C. F. Goedke, William Ganschow Co., Chicago, and W. H. Phillips, R. D. Nuttall Co., Pittsburgh, were elected members for three years. They, in turn, in an organization meeting, returned as officers: President, F. W. Sinram, Van Dorn & Dutton Co., Cleveland, Ohio; First Vice-President, R. P. Johnson, Warner Gear Co., Muncie, Ind.; Second Vice-President, B. F. Waterman, Brown & Sharpe Mfg. Co., Providence; treasurer, F. D. Hamlin, Earle Gear & Machine Co., Philadelphia. Mr. Hamlin was elected secretary a year ago for a term of two years.

At the dinner Friday evening John C. Bradley, of Pratt & Letchworth Co., Buffalo, asserted that excessive taxation was throttling business, but he emphasized that, notwithstanding unfavorable legislation, "we are well on the road to recovery." "Of course," he said, "those accustomed to wartime prosperity may not be satisfied with the volume of business in the immediate future, but compared to a pre-war average, it is more than satisfactory. Sane prosperity is ahead as contrasted with wartime excesses."

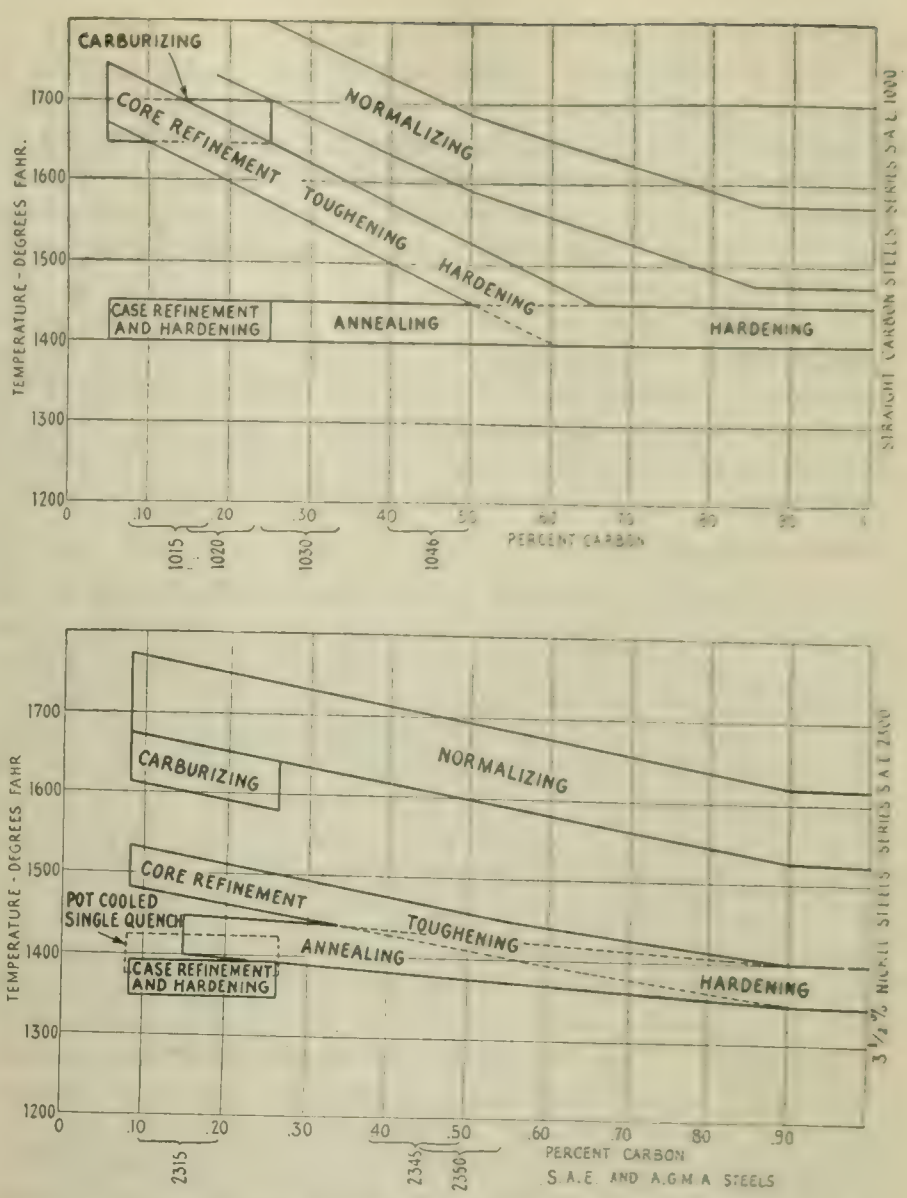
At the Saturday morning session several more reports by standardization subcommittees were presented. Lars Nilson, reporting for the Keyway Committee, said that he had only a progress report to make. A great many tables of key and keyway sizes had been published and while most of them agreed pretty closely in regard to width of key, they were not in very close agreement with respect to depth of keyway. At present, sentiment seemed to favor the use of square keys for shafts up to 3 in. diameter and of flat keys for larger shafts. The A. G. M. A. was one of the sponsor bodies, together with the A. S. M. E. and it was necessary to bring about agreement between the committees of these two bodies. The A. S. M. E. had recommended a double standard, covering both square and flat keys for all sizes of shafts. The A. G. M. A. Committee was of the opinion that there should be only one standard key for any given size of shaft and recommended square keys for shafts up to 3¼ in. diameter and flat keys for larger shafts. The committee in a table it had worked up also gave sizes of flat keys for shafts up to 3¼ in. diameter and for square keys for larger shafts, but wanted to designate these keys as a second choice and not as the standard. In the case of the flat keys, the depth of the key was taken as equal to the nearest 1/16 in. size to two-thirds of the width of the key. Tolerances for keys and keyways were also given in the table and these agreed with the tolerances adopted by the British Engineering Standards Committee and the proposed A. S. M. E. standard. The only difference between the A. G. M. A. committee recommendation and the A. S. M. A. proposed standard was that the latter called all of the sizes of keys listed, standard keys, whereas the A G. M. A.. proposal was to call square keys for up to 3¼-in. shafts and flat keys for shafts above that size, standard, and the rest of the keys listed, second choice. Upon discussion it was decided to have the report multigraphed and distributed to the members for their comment.

In the absence of Chairman C. R. Weiss, the report of the Sprocket Committee was made by S. O. White. Mr. White said that it had been found necessary to make a slight revision in the form of the standard sprocket tooth adopted at a previous meeting. It was necessary, however, to co-operate with the corresponding committees of the S. A. E. and the A. S. M. E. and the committee expected to have something definite to report at the meeting next fall.

C. B. Hamilton, Jr., reported for the Metallurgical Committee. In connection with this report a couple of charts giving the heat treatment temperature ranges for different steels, based upon the carbon contents of the steels, were presented. Mr. Hamilton said that charts for all of the A. G. M. A. steels based on the S. A. E. recommendations recently published were being prepared.

The Metallurgical Committee made the suggestion that the term "cast steel" be dropped in connection with gear steels, owing to the fact that it is much used for designating certain kinds of tool steel, and that the term "steel casting" be used instead. It was also suggested that the term "cast iron" be dropped and the more specific terms "gray iron" and "white iron" be used instead. It was further suggested that the term "semi-steel" be abandoned and that the material referred to be described as gray iron with a certain amount of scrap steel. In the discussion it was asserted that the use of the term "cast iron," which was so firmly established in the industry, could not be readily discontinued. On the other hand, there has been a great deal of objection to the use of the term "semi-steel" which has always been regarded as a misnomer. Both the S. A. E. and the A. S. M. E. were opposed to the term. There are now no established specifications for this material, but the S. A. E. is planning to draw up such specifications. Mr. Frost said that his firm commonly used such expressions as 40 per cent semi-steel, which meant gray iron with 40 per cent of scrap steel added, but he admitted that it was poor terminology as a material could not be both "40 per cent" and "semi."

The report also included a test for steel castings. It was proposed to grind and etch a section of the casting and then examine it with respect to grain structure and the requirement was to be made that the coarse structure characteristic of unrefined cast steel must be completely absent. In this connection some discussion arose on the point as to just how this test was to be carried out. Some members feared that if the gear makers were to be too strict with the steel founders it would result in an increase in price. On the other hand, the opinion prevailed that, inasmuch as gear makers were held responsible for the material in their gears by their customers, they, in turn, must hold the suppliers of this material responsible. One member mentioned that the Bethlehem Steel Co. had arranged to test every ingot in substantially the same way as suggested by the Metallurgical Committee. The test could be made by very simple



Heat treatment temperature ranges for different steels

apparatus, without the use of a microscope, and was in no way burdensome. Upon the matter being put to a vote the steel casting test specification was adopted. Mr. Hamilton also made a motion for the adoption of the nomenclature recommendation, but owing to the opposition developing withdrew it, with the understanding that the terms "cast iron" and "semi-steel" be avoided as much as possible.

As another part of the report of the Metallurgical Committee S. P. Rockwell read a paper on Recommended Practice in the Selection, Test and Use of Carburizing Materials and the Design of Carburizing Pots. We expect to print this paper in an early issue of AUTOMOTIVE INDUSTRIES.

Gear Grinding

At the closing session on Saturday afternoon R. S. Drummond, vice-president of the Gear Grinding Machine Co., read a paper on The Grinding of Gear Teeth and Its Future in the Industry. He pointed out that it was the demands of the automobile industry for gears that would run quietly at high pitch line velocities which led to the introduction of gear grinding. So far, the greatest number of gears with ground teeth had been used in automobile construction, but gear grinding was now being introduced in other lines of work. For instance, some gears are now made of high manganese steel containing approximately 13 per cent manganese. This alloy steel is so hard that it can be machined only by grinding. The driving gears of gear-driven locomotives and of multi-engine airplanes are also being ground. There are two classes of gear grinding. In some cases gears which originally were not intended to be ground, are so greatly distorted by the heat treatment that they are very noisy and may then be salvaged by grinding their teeth faces.

The second class of gear grinding is the finish-grinding of gear teeth which have been rough cut and have had sufficient stock left for grinding. This constitutes the largest volume of gear tooth grinding to-day. The gear grinding process was originally introduced about 12 years ago, but up to a year ago its chief use was for salvaging gears that had been ruined by distortion in heat treatment.

The question was asked whether the grinding entirely took the place of finish-cutting, to which the answer was in the affirmative. One of the members mentioning that he had a couple of the Gear Grinding Machine Company's machines, another member asked whether he might infer from this statement that the machines could now be bought. Mr. Drummond replied that he was not prepared to announce a definite policy on this point, but that they had, in the past, placed a small number on machines where they thought they could expect skilled and conscientious operation.

A. C. Bryan, chairman of the Transmission Committee, which was constituted at the Rochester meeting last fall, had only a progress report to make, but promised that there would be something definite at the next meeting.

Differential Gear Standards

S. O. White, chairman of the Differential Committee, which was also constituted at Rochester, said that his committee had started by working out a standard nomenclature for differential gears. They took as a basis the S. A. E. nomenclature, but made several recommendations differing therefrom. One of the new terms recommended is that of "complete differential," which covers the differential gear proper together with the rig gear and driving pinion. This part of the report was accepted as a progress report. Mr. White said that the committee was almost ready to circularize the Association with respect to two complete designs of differential gear. These are both of the four-pinion type and contain gears of the 20 to 11 and 18 to 10 sizes, both of 5-7 pitch. These are the two sizes in most common use on passenger and light commercial cars, respectively. The committee, therefore, plans to develop design of differential gears that are completely standardized, thus carrying standardization a little further than it has ever been carried before in automotive work. Later they expect to work out designs for other sizes as well.

H. J. Eberhardt made a report for the Tooth Form Committee. Special attention was given by this committee to the problem of standardizing the stub tooth and a questionnaire was sent to all members for the purpose of getting their views on the subject. The members were asked to consider a stub tooth having an addendum of 0.8/D.P, a dedendum of 1/D.P., a working depth of 1.6/D.P. and a pressure angle of 20 deg., which in these respects coincides with the A. G. M. A. standard herringbone gear tooth section in the plane of rotation. Of 13 replies received 8 favored the proposal and 5 opposed it. The reason the committee took up the stub tooth first was that they were asked by the Netherlands Committee on Tooth Form Standardization to take up this work. The Netherlands committee, in making this proposal, aptly remarked that the cost of making new cutters and of carrying two or even three sets of different cutters during the period of change-over loomed very large. The report was accepted.

Standard System of Bevel Gearing

The last item on the program was a paper on the Gleason Works system of bevel gears by F. E. McMullen and T. M. Durkan. The Gleason Works showed to the A. G. M. A. at its meeting in Rochester last fall a new system of gears which they had worked out and which they intended to offer to the A. G. M. A. as a standardized system of bevel gearing. The system then presented was worked out with a view to securing maximum rolling and minimum sliding action. It was found, however, after a number of samples had been made and tested out in practice, that they were rather more noisy than gears made to the old designs. The system was, therefore, discarded and a new system designed chiefly with a view to silent operation, and it was this system which was explained at the Buffalo meeting.

Mr. Durkan, who read the paper, pointed out that the bevel gear systems now in use were based entirely upon spur gear practice. In the design of a spur gear system, the great object in view was interchangeability of gears of all sizes from 12 teeth pinions to a rack, and in order to attain this object sacrifices in respect to other desirable qualities were made. Now, in bevel gears there is no interchangeability, as for a right angled drive a bevel pinion will mesh properly only with a gear specially designed for it, and the sacrifices made in order to insure interchangeability in the spur gear system, therefore, bring no corresponding advantage here. One of the requirements of interchangeability is a constant pressure angle for all sizes of gears. This, therefore, has been abandoned in the new system of bevel gearing, and three different angles are used, of 14½, 17½ and 20 deg. Mr. Durkan explained the complete system, using a number of diagrams illustrating it. We expect to reprint his paper in an early issue of AUTOMOTIVE INDUSTRIES. It is planned to get this system ready for presentation as a proposed A. G. M. A. standard for the next meeting.

Some Recent Developments in the Motor Bus Field

The new twenty-passenger G. M. C. bus and a new model twenty-three-passenger Duplex bus are described and the chassis compared with the truck chassis of which they are modifications. Particulars regarding a Canadian double-deck body and some bus materials and parts also given.

A NEW twenty-passenger bus has recently been brought out by the General Motors Truck Co. The bus is mounted on a chassis which has been especially adapted to this type of body, and it is carried on 36 x 6-in. cord tires all around. In designing the chassis, by combining a long wheelbase with long, flexible semi-elliptic springs, easy-riding qualities have been secured. The body overhangs the frame but slightly, and this, it is claimed, eliminates much of the side sway and whipping which have been common with buses with a wheelbase which is considerably shorter than it should be for a long body. The frame on the new chassis overhangs the rear axle by only a few inches.

The powerplant is the same as that used in the G.M.C. two-ton truck. The engine is governed to permit maximum speeds of 30 m.p.h. In test, the bus, fully loaded, was driven at 25 m.p.h. up a 4 per cent grade on high gear. The G.M.C. 4 x 5½-in. engine, which has been described in these pages, incorporates features such as removable cylinder sleeve, removable valve lifter assemblies, pressure lubrication, hot-spot vaporization, etc.

Aside from the engine, the chassis is comparable in most respects to that used in the G.M.C. one-ton truck known as model K-16, but has a much longer wheelbase, 178 in. as compared to 132. This necessitates deeper side members in the frame, these being ¼ x 5⅞ as compared to 5/32 x 4½. The front springs are 4 in. longer and are made of alloy instead of carbon steel. The use of 36 x 6-in. instead of 34 x 5-in. tires, together with the deeper frame and the different spring characteristics makes the top of the frame about 4 in. higher above the ground than that on the one-ton truck. Other differences include the use of a larger gasoline tank, larger radiator, a center bearing on the longer propeller shaft, a large steering wheel and certain additional equipment such as a vacuum tank, speedometer and Klaxon horn.

Interchangeable brake rods are employed to make it possible to use both the internal and external sets of brakes for foot operation. The bus is provided with radius rods which take the drive and hold the axle in a fixed position so that braking conditions are the same, regardless of the load in the bus. The bus chassis will be sold alone in cases where special body equipment is demanded.

The bus body is furnished with two seating arrangements, one adapted particularly to interurban bus operation and the other designed for city passenger work. The body is built of oak reinforced with metal and is finished outside in smooth-panelled surfaces. The bus has been built with a width of 47 inches and the seating arrangement has been made to correspond with this width without sacrifice to comfort or balance. The interior of the bus is finished in panelled oak, with rattan seats. The equipment includes non-rattling adjustable windows, complete buzzer signal system, front entrance door controlled from the driver's seat, rear emergency door, rear vision mirror, dome lights and an advertising card rack. The fuel tank is located outside and is filled from outside without inconvenience or fire risk.

The Duplex 23 Passenger Bus

Another model of bus has recently been announced by the Duplex Truck Co., which has furnished, among other installations, a large fleet of buses for use in Washington. The chassis used is identical in most respects with that used in the 2½-ton Duplex truck, but it has a slightly shorter wheelbase (160 in.) made necessary by the use of a different axle. The frame length is the same as that on the truck but because of the more uniform loading, a 5-in. instead of a 6-in. frame is employed, ¼-in. stock being used in both cases. The truck is equipped with a No. 4 Vulcan rear axle, 40 x 8-in. tires in rear, and 36 x 6-in. pneumatic front. The bus chassis is equipped with a model W-103 worm drive, Sheldon rear axle, the rear tires being 38 x 7-in. and the front 36 x 5-in. pneumatics.

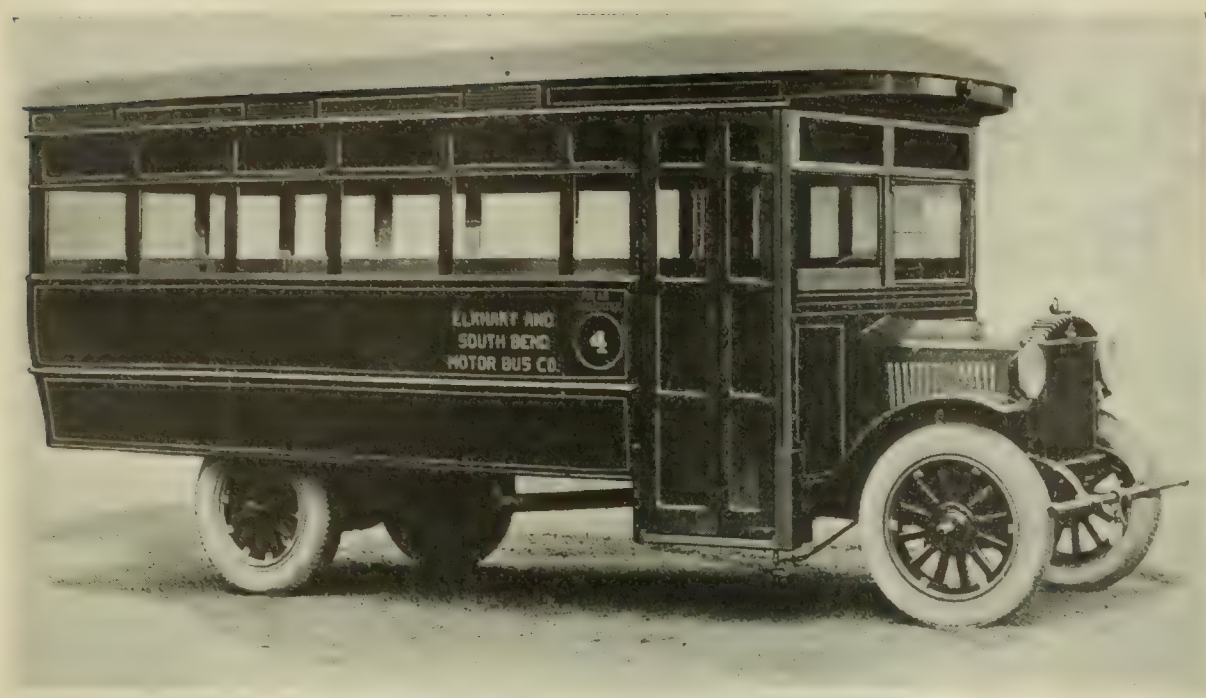
A Hinkley 4 x 5¼-in. four-cylinder engine is used in both chassis, the governor being omitted in the case of the bus engine.

The gear ratio on the bus is 6½ to 1; on the truck it is optional. The gage of the rear wheels in the case of the bus chassis is 62 in., or 2 in. greater than in the truck.

Other specifications of the bus chassis are as follows:



G. M. C. twenty-passenger bus



New twenty-three passenger Duplex bus

Wheels, artillery type; brakes, both internal expanding on 18-in. rear wheel drum; two-unit starting and lighting system and battery ignition; fuel tank of 25-gal. capacity, feed by vacuum tank; multiple dry disk clutch; four-speed gearset; worm and nut steering gear. The equipment includes: Motometer, speedometer, electric horn, Alemite lubrication, front bumper, Gabriel snubbers front and rear, and power tire pump.

The body is of hardwood, with steel reinforcements. Side panels are of steel and the roof of agasote and aluminum covered with oiled duck and painted white on the under side. The seating capacity is for 23 passengers. The operator's seat is in a vestibule separated from the passenger compartment by glassed-in partitions. The folding front door is 25 in. wide and a rear emergency exit door is provided. Headroom is 6 ft. 4 in.

Standard body equipment includes: advertising racks, ventilators, exhaust heaters, lights in domes, fare register, fare box and mechanical door opener.

Double-Deck Bus in Canada

A double-deck bus has recently been constructed in Canada for the Toronto Transportation Commission. The chassis was constructed by the Eastern Canada Motor Truck Co. and is assembled from the following units: Buda four-cylinder engine, Clark internal gear axle, 36 x 10-in. Morand demountable cushion rear wheels and special nickel steel frame, designed to give as low steps as possible. The wheelbase is given as 186½ in. and the track, center to center of rear wheels, as 74⅛ in.

The body is manufactured by the Ottawa Car Mfg. Co., Ltd., who furnish the following particulars:

This bus is similar to those adopted in Toronto, New York City and Detroit. The main idea in design was to adopt a low-hung chassis which has been specially built, giving only two steps into the body of the bus. Heights being, rear 17 in. from ground to platform, 11 in. from platform to body, front steps 13 in. from ground to first step, and 13 in. from step to body floor. There is a winding stairway leading to an upper deck, capable of seating 30 passengers. The height from the ground to the upper deck side rail, which is the highest point of the bus, is 10 ft. 9 in.

All seats in upper deck are of wood slat design, as they are exposed to the weather. Wood slats are also installed over the canvas on the roof.

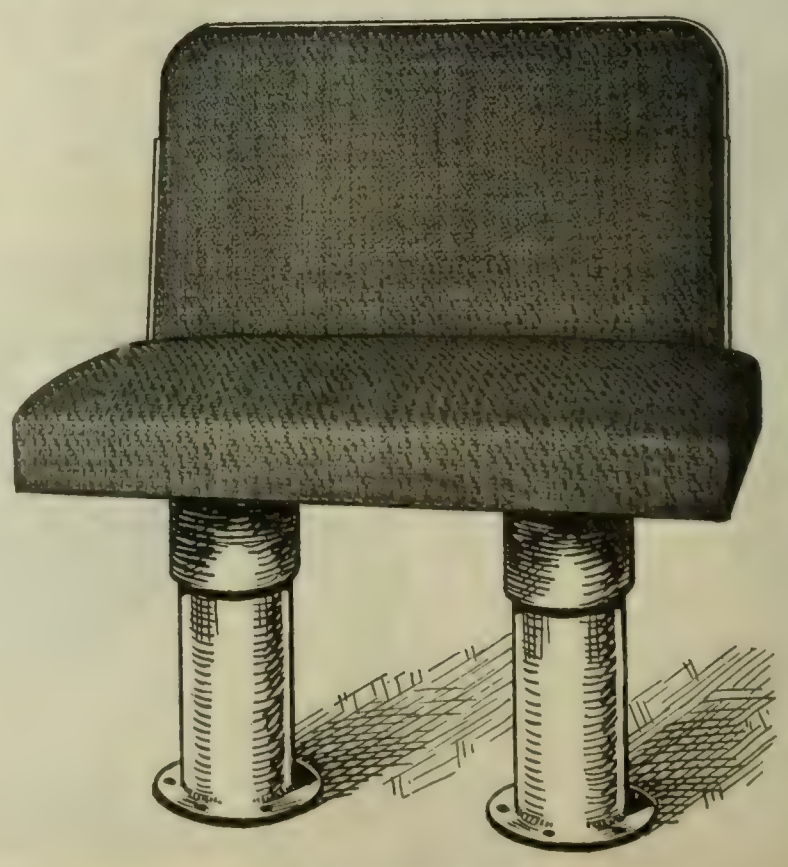
The interior rattan upholstered seats are capable of seating 21, seven cross seats, one single cross seat at the front and two longitudinal seats at rear. Cushions and backs are fitted with the Ottawa Car Mfg. Co.'s toggle spring.

The interior agasote ceiling is painted ivory, agasote waist panels painted green, woodwork mahogany stain.

Seven flush dome lights are installed in the ceiling, some of four and some of nine candlepower. Wood slats are installed on the floors and push bells are provided on each side post on the lower deck and side rail on upper deck. Communication between conductor and motorman is by a hand bell and vice versa by electric bell.

Drivers' quarters are comfortably fitted with pantasote trimming, cushion spring upholstered and stuffed back, giving ample room for operating steering apparatus and levers.

This bus, the first of its kind built in Canada, is convertible for one-man operation if required. It has a front entrance door which can be operated by the driver from his seated position by a simple arrangement of levers. All working parts of door are mounted on ball bearings making it easy to operate. A small door is installed to the left of the driver for his convenience and double automatic sash on the left hand which can be opened in warm weather. The sash in front of the driver has no top rail to obstruct his vision, when it is in a lowered position. This sash can be lowered 12 in. by automatic locks. All side sashes drop into pockets, making a comparatively open bus for summer service. Trap doors are installed to facilitate access to gearset. Four ventilators, two on each side, are installed on the upper sash for winter use. Curtains are of double-face Fabrikoid installed on all-metal rollers and have pinch handle fixtures. A conductor's seat, which is adjustable to height and swings under the stairs when not required, is installed on the rear platform. Two signs indicating route and destination are installed in front over windshield, also two in the two upper rear sash on the door side. Perfection heaters are provided under four cross seats regulated from valve installed at the driver's bulkhead. Length of rear platform is 3 ft. 5 in., height lower deck floor to ceiling, 5 ft. 10 in., width at belt rail outside, 7 ft. 4¾



Parker pneumatic bus seat

in., and length of body is 17 ft. 8 in.

Bus Roof and Panel Material

Haskelite, a waterproof plywood, which is molded to form and shipped ready to fasten to top bows is being marketed by the Haskelite Mfg. Corp. This material, which, as we understand it, requires no exterior covering other than paint or varnish, possesses considerable strength, yet its weight, given as 0.89 lb. per sq. ft., is said to be less than that of a slat roof combined with a head lining. Both interior and exterior surfaces are smooth. The interior, being enameled, is easily cleaned by washing. Due to its arched shape and light weight, it is said to withstand vibration better than some other types of roof and to reduce the tendency to swaying by lowering the center of gravity. The roof panels are three-ply and measure 5/16 in. in thickness. Several sizes ranging from 48 by 90 in. to 60 by 144 in. are carried in stock.

The same concern also furnishes "plymetl" for making bus body side panels, which is haskelite faced with thin sheet steel cemented to one or both sides. This material can be readily bent into curved panels and is said to weigh from 25 to 45 per cent less than sheet steel body panels of 20 and 18 gage. In addition, it is said to eliminate metallic drumming, give insulation against cold, increase seating space and decrease cost by eliminating the need for side lining, avoid wavy surface and consequent highlights which sometimes occur with all-metal panels and afford excellent surfaces for finishing and glueing. The panels are ¼-in. thick, rolled steel face, being sanded and galvanized. Stock sizes are 24, 30 and 36 in. wide and 96 in. long.

A new type of bus seat, the base of which has one or more pneumatic cylinders or dash pots, is being marketed by the Parker Pneumatic Bus Seat Co. The back and cushion are similar in appearance to those used in other bus seats, and are arranged to move together, but the base is formed by a pair of telescoping cylinders held apart by a heavy helical spring which is compressed by the weight of the seat and its occupants. When the vehicle passes over rough roads the cylinders are given an up-and-down motion which is damped by the dashpot action of the air in the cylinder, the air being compressed and forced out of a small hole on the down stroke, with reverse action in returning to normal position. The device is in effect a shock absorber applied direct to the seat, and is said to greatly improve riding qualities.



British folding top bus. Top open and closed

A Folding Roof Bus

A British manufacturer, Christopher Dodson, Ltd., has recently designed a folding top bus which is so constructed as to be readily transformed from an open to a closed type or vice versa. The main portion of the roof is designated to fold up so that it occupies only a narrow space along the center, while the side windows can be dropped out of sight. The fact that the roof occupies so little space when folded makes it excellent for sightseeing and for touring. Front and rear of the bus are not folding. They serve to protect occupants from undue wind and dust and also to simplify the construction.

Why Lumber Is Steamed During Kiln Drying

THERE seems to be a common impression that the purpose of steaming lumber is to "remove the sap." This is far from being the fact, for when lumber is steamed it takes on moisture, as a rule, instead of giving off anything.

The reason for steaming lumber during drying depends on when it is done, but nearly always the treatment is given for one of the following purposes: (1) To heat lumber through quickly at the start; (2) to relieve stresses which otherwise would produce checking, case-hardening and honeycombing; (3) to equalize the moisture content and condition the lumber ready for use at the end of the run; (4) to kill fungi and insects in the wood.

When lumber should be steamed, how long the treatment should last and what temperature should be maintained are points which have been determined at the Forest Products Laboratory by experiments on many species of wood. A thorough understanding of the steaming operation is essential, because the whole kiln charge can easily be ruined by too severe a treatment. One of the chief needs of many commercial kilns is proper steaming facilities, without which a high degree of success in the artificial seasoning of wood is impossible.

A NEW type of steel which is highly susceptible to the acquisition and retention of magnetic properties, has been discovered, according to *Chemical and Metallurgical Engineering*, by a Japanese. It has the composition: Carbon, 0.4 to 0.8 per cent; cobalt, 30 to 40 per cent; chromium, 1.5 to 3 per cent; tungsten, 5 to 9 per cent. It is very brittle and very hard, and great care has to be exercised in its manufacture. Its coercive range is about three times that of the best tungsten steel; the area of the hysteresis curve is also three times as great; the permanent magnetism is relatively very high; lastly, shocks and prolonged heating have a negligible effect on the magnetization. In shock tests a slight diminution in permanent magnetism was observed—6 per cent after 850 impacts by dropping from a height of 1 meter on to a cement floor.

Reconditioning Crankcase Lubricating Oil by a New Method

Fuel diluent and water automatically removed from crankcase lubricating oil by a simple refiner which also filters out sediment. Can be installed in any automotive vehicle and operates with splash or force feed systems.

A SYSTEM for automatically removing the fuel diluent and water admixture from crankcase lubricating oil and at the same time filtering out the sediment composed of carbon, sand and metal particles has been developed by a group of engineers and tried out with satisfactory results in the laboratory and also as supplied to truck and tractor engines. It is known as the Gross crankcase oil refiner and was described in a recent paper by William F. Parish read before the Midwest Section of the S. A. E., from which paper the following particulars are taken.

The new system of crankcase oil regeneration consists of four main units, (*a*) the heating element, (*b*) the filter, (*c*) the refiner proper and (*d*) the cooler. The system is light and simple and occupies about the same space as a vacuum fuel system. It does not interfere with present lubricating systems, functions equally well with splash and force feed systems and can be readily installed in most any type of passenger car, truck or tractor.

Fig. 1 gives a plan view of this system, showing the flow of the diluted oil from the crankcase to the heating element and on to the filter and refiner, whence the oil is discharged to the cooler and back to the crankcase. The force causing the circulation of oil through the system is obtained from the vacuum present in the intake manifold, which ranges from 2 to 25 in. of mercury, according to the type and condition of engine, revolutions per minute, manifold design and other conditions. A tube extends from the top of the refiner to the intake manifold, through which the vacuum or suction is transferred to the system, and through which the vaporized diluent is drawn off and burnt in the cylinders.

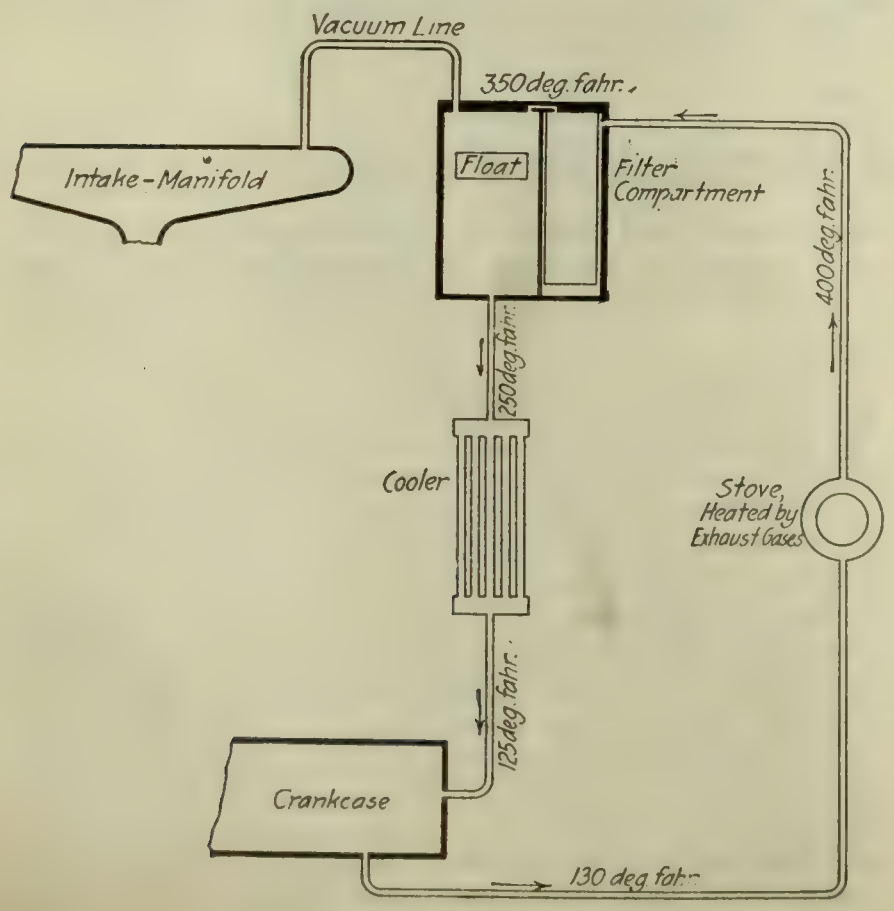


Fig. 1

The temperatures shown in the sketch are given as approximately 130 deg. Fahr. for the oil from the crankcase to the heater; 400 deg. Fahr. from the heater to the refiner and 350 deg. Fahr. in the refiner, which temperature, plus the vacuum and agitating effect, quickly removes the diluent. From the refiner at 250 deg. Fahr. the oil passes to the cooler, with a further falling in temperature in the cooler, until the oil will go to the crankcase at about 125 deg. Fahr. The diluent, in the form of a fog or gas, goes into the intake manifold at temperatures up to 200 deg. Fahr., according to the distance of the refiner from the intake manifold.

Operation of the Heater

Heat is taken from the exhaust by any one of several efficient ways. There is sufficient heat in the exhaust under practically every condition of operation to allow of the removal of most of the diluent from the oil. The heater, while in operation, is either filled with oil to the exclusion of air, or is working with oil passing through the heater under the force of a vacuum.

In this way charring of the oil is prevented. The heaters are cylindrical shells slipped over the exhaust pipes, or coils of various designs, either machined or made from tubes or piping, inserted in the exhaust pipe or manifold. Heaters of several kinds have been cut open after thousands of miles of operation and have been found free from carbon deposit.

The refiner, which acts as a distillation flask in the removal of the fuel content from the lubricating oil, is integral with the filter and settling system. The oil comes from the heater to the first filter and settling chamber, where it passes through the screen or filter, from where the cleaned oil is drawn to the still proper and deflected by a baffle to a thin film of heated oil. The combination of the heat and the great reduction in boiling point produced by the vacuum, plus the agitation from the moving vehicle, causes a very rapid vaporization of the diluent. The diluent, in the form of a heated fog, then passes along the vacuum line into the intake manifold, and then to the cylinders, where it is consumed as fuel. The bottom of the still is arranged as a second settling chamber for the collection of such sludge and dirt as pass the first settling chamber and filter. Means are provided to clean out the accumulated dirt when necessary quickly and easily. The still contains the float mechanism that actuated the air and vacuum valves. This part of the system is similar to that employed for the vacuum fuel tanks, which is an item of value in considering service. There is the one feature of interest as influencing the wear of the only moving parts in the system. With the fuel vacuum-tanks the operating mechanism is mostly dry and occasionally covered with a

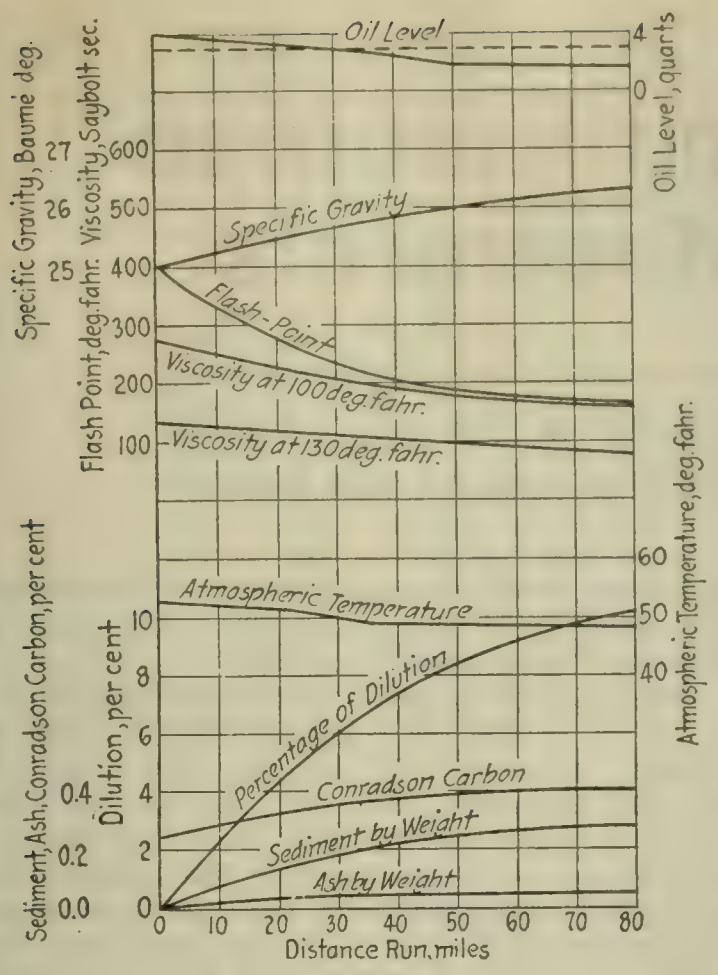


Fig. 2

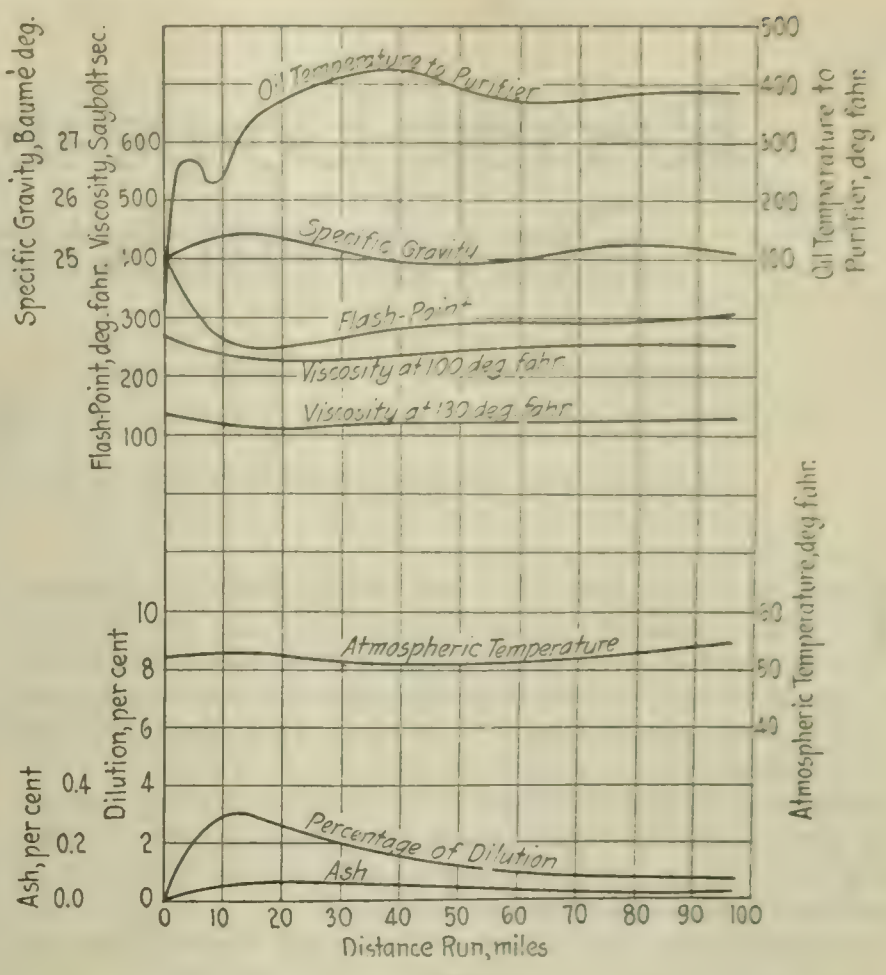


Fig. 3

sulphur powder from the gasoline fumes, while similar parts in this oil refining system are continually covered with oil. The perfectly lubricated parts should, therefore, outlast the engine to which the system is attached.

One of the most important elements in the system is the cooler. The cooler is placed where the air from the fan will dissipate the heat being thrown off from the oil. On engines where there is no fan for cooling, the cooler is placed near the flywheel.

Fig. 2, which shows the characteristics of many comparative tests, indicates the condition of the oil at various periods in the engine of a car operated in city traffic. The oil has become diluted to an extent of 10.2 per cent in 89 miles. The oil was drained and the engine filled with new oil of the same make and grade, some of the former 10.2 per cent diluted oil remaining in the engine and diluting the new oil about 3 per cent as shown in Fig. 3. After 36 miles the dilution was 1.5 per cent and at 74 miles the dilution was under 1 per cent, where it remained. The viscosity of the oil at the end of the 98-mile run was within 5 sec. viscosity at 100 deg. Fahr., of the new oil. The viscosity remained the same in this engine during subsequent runs to a total of 2180 miles. Occasionally during these runs, which were in city traffic, 1 pint of raw gasoline would be put into the crankcase. This would be taken out of the oil inside of 30 miles. One pint of raw kerosene would be taken out of the oil in about 60 miles. The sludge removed from the bottom of the reclaimer tank generally contains a characteristic sediment of 75 per cent of oil, 12 per cent of carbon and 13 per cent of an ash composed of silica and metal. The ash and the carbon will vary with nature of roads and character of service.

Properties of Steels at High Temperatures

IN Technologic Paper No. 205 of the Bureau of Standards the results are given of a number of determinations of tensile strength, proportional limit, elongation, reduction of area and strength at fracture throughout the range 20 to 500 deg. C. for four steels containing about 0.38 per cent carbon as follows: (a) Plain carbon steel; (b) 3½ per cent nickel steel; (c) 3 per cent nickel and 1 per cent chromium steel and (d) 1 per cent chromium, 0.2 per cent vanadium steel.

Brief reference is made to the types of fractures of steels tested at various temperatures, and particular attention is paid to comparison of the tensile properties of these alloys at 550 deg. C. Of the four steels tested in normalized condition, it appears that the two alloys containing chromium show greater resistance to weakening by increase in temperature to about 550 deg. C. than either the plain carbon or 3½ per cent nickel steels, and at this high temperature the chromium-vanadium steel is to be preferred from the standpoint of high tensile strength and limit of proportionality. The carbon and 3½ per cent nickel steels behaved alike with rise in temperature above that of the room, and at about 550 deg. C. the addition of 3½ per cent nickel appears to have but little effect upon the strength of the carbon steel.

A summary is being prepared of the data obtained on the various carbon and alloy steels which have been tested in the metallurgical laboratories of the Bureau, including the effects of normalizing rolled-low carbon steel, the effects of 1¼ per cent of manganese, the presence of 5 per cent cobalt, the addition of 0.4 per cent of molybdenum to carbon chromium steel, and the effect of various heat treatments on their properties.

Progress has also been made in determining the effect of time-annealing at blue heat on the properties of cold-rolled boiler plate.

THERE are about 300 farm tractors in Roumania, according to a report received by the Department of Commerce from Bucharest. It is estimated that fully one-half of these are of a popular American make.

Recent Domestic and European Standardization Movements

A collection of items with regard to movements toward standardization in various lines pertaining to the automotive industry in general. Among others are included chains, tires and rims, petroleum, varnish and lumber.

THERE is almost universal recognition of the economic value of standardization within a given plant, and there is also a certain recognition but much less conviction that standardization throughout an industry increases efficiency. It is to this end that the standardization movement tends.

Progress in standardization and the securing of the full measure of economy in manufacture as a result will be greatly aided by the interested parties keeping in touch with the latest developments.

The following items deal with recent standardization movements in the United States and in Europe.

SPECIFICATIONS for the various refined petroleum products purchased by the Federal Government are given in Technical Paper 305, just issued by the United States Bureau of Mines. The specifications cover motor gasoline, aviation gasoline, naphtha, kerosene, signal oil, fuel oils, lubricants, etc. These specifications have been officially adopted by the Federal Specifications Board. They supersede the specifications published in Bulletins 1 to 5, inclusive, of the Committee on Standardization of Petroleum Specifications.

The Interdepartmental Petroleum Specifications Committee replaced the Interdepartmental Committee on Standardization of Petroleum Specifications, which had superseded the wartime Committee on Standardization of Petroleum Specifications. The work of the several committees has been continuous, and the present set of specifications is the result of several years' experience in preparing specifications and drawing up testing methods for petroleum products.

The present set of specifications was prepared by the Technical Committee on Standardization of Petroleum Specifications and adopted by the Interdepartmental Committee on Standardization of Petroleum Specifications, which were the immediate predecessors of the present committee.

The chairman of the Interdepartmental Petroleum Specifications Committee is N. A. C. Smith, of the Bureau of Mines. W. S. James, of the Bureau of Standards, is one of the other members.

Copies of Technical Paper 305 may be obtained by applying to the Bureau of Mines, Washington, D. C.

Silent Chains

At a recent meeting of the Chain Division of the Society of Automotive Engineers Standard Committee, held jointly with the Committee on Steel Roller Chains of the American Society of Mechanical Engineers and the Committee on Sprockets of the American Gear Manufacturers Association, the subject of silent chain standardization was brought up, but it was the consensus of opinion that structural differences between makes prevent the adoption of a standard at the present time. It was thought that normal silent chain development during the next few years will make standardization possible.

It was stated that to obtain interchangeability of silent chains it will be necessary to standardize the pitch, the included angle, the method of guiding, the width, the maximum radial clearance from the joint over the back of the link, the maximum distance from the center of articulation to the point of the link, the perpendicular distance from the bearing face of the link to the center of articulation and the location of the top of the teeth with regard to the chord connecting the centers of articulation. It was emphasized that the standardization of silent chains is further complicated owing to the actual differences in construction of the chains.

British Tires and Rims

The British rubber tire manufacturers section of the Society of Motor Manufacturers and Traders for some time has been discussing standards for tires and rims and already has adopted certain standards. The subject is being steadily pursued and at a recent meeting, a letter was read from the Association of British Rubber Tire Manufacturers recommending that the British standard list should continue unaltered.

It was resolved to appoint a sub-committee to consider pneumatic tire and rim standards, and another subcommittee was appointed to consider solid rubber tire standards. Reference to the work of the Tire and Rim Association of America concerning standard rims resulted in the recommendation that the pneumatic tire subcommittee should endeavor to confer with rim and wheel manufacturers on the subject of standard rims.

Varnish

The second edition of Circular 103 of the Bureau of Standards, distributed by the Superintendent of Documents, contains a specification for water-resisting spar varnish, and was prepared under the auspices of the Bureau of Standards by the U. S. Interdepartmental Committee on Paint Specification Standardization.

The revision is largely based on criticisms of the first edition made by certain varnish manufacturers' associations. The committee's draft was submitted to numerous representatives of the varnish industry, and careful consideration was given to their suggestions. The specification gives the general requirements and detailed methods of sampling and testing as well as the basis for purchase. The general requirements are that the varnish shall be suitable for use on inside and outside surfaces of vessels, buildings, etc., and must be resistant to air, light, and water.

Circular No. 117 of the Bureau of Standards consists of specifications for interior varnish. The specification states the general requirements and gives detailed methods

of sampling and testing as well as a basis for purchase. In the requirements it is stated that it shall be suitable for general interior use, including both rubbed and unrubbed finish exclusive of floors; it must be capable of easy application of brush in the ordinary manner according to the rules of good standard products, must flow out to a good level, cut free from runs, sags, pits, or other defects, and dry with reasonable permanence to a hard semi-elastic glossy coating which can be rubbed in forty-eight hours or less.

According to Sir William Tritton, all British steam traction engines, portable engines, etc., are designed to drive at a belt speed of 2200 ft. p. min., and this is equally true of German, Austrian, American and Canadian engines. This standardization, it seems, was arrived at without any convention ever having been held for the purpose, and as a result of it any make of steam traction engine can be used to operate any make of threshing machine. In the British farm tractor trials held recently, the belt speeds, on the other hand, varied between 1830 and 3760 ft. p. min.

Lumber

A movement is now on foot looking to the ultimate formulation of lumber standards, including terminology, sizes, grades and specifications. The movement is being fostered by the American Engineering Standards Committee, the National Lumber Manufacturers' Association and the Forest Products Laboratory, among other organizations. It is expected that a conference on this subject will shortly be called by the A. E. S. C., with whom those interested should communicate, at 29 West 39th Street, New York.

Prior to the war there existed an institution known as the International Association for the Testing of Materials, with headquarters in Vienna and branches in practically every industrial country. It had as its objects the development and unification of standard methods of testing; the examination of the technically important properties of materials of construction and other materials of practical value, and also the perfecting of apparatus for this purpose. From the parent body there had sprung the American Society for Testing Materials in this country, the Deutsche Verband für Materialprüfungen der Technik in Germany and the Italian Society for the Study of Building Materials in Italy. In England there existed a branch of the International Association, and a movement to establish a national society for the testing of materials was on foot when the war intervened and put a stop to the efforts. Now, however, a new movement has been launched to organize a British association.

Following is a complete list of automobile standards issued to date by the British Engineering Standards Association: Spark plugs; screw threads, nut and bolt heads; tungsten filament lamps; pneumatic tire rims; wheel rims and tire bands for solid rubber tires; charging plug socket for electric vehicles; wrought steels; magnetos; body spaces and frame ends; ball journal bearings; rubber tires for British standard rims.

Gage Steels

An informal meeting was recently held in New York for the purpose of considering improved specifications of composition and the heat treatment of gage steels. The meeting was arranged by the Ordnance Department of the United States Army and was well attended by steel makers, gage makers and gage users. A subcommittee was appointed to arrange and carry out a comprehensive program with a view to determining, first, the physical characteristics required of gage steel, and, second, the composition and heat treatment necessary to produce these characteristics. The active cooperation of Government research agencies, standardizing bodies, gage makers and users is contemplated by the committee in the program to be undertaken.

The specifications and tolerances for liquid measuring devices adopted by the preceding conference were reviewed by the Fourteenth Annual Conference of Weights and Measures held some time ago and several changes were made, the advisability of which was indicated by the experience gained during the preceding year. New tolerances were adopted, 2 cubic inches being allowed on deliveries of ½ gallon or less, 3 cubic inches on a single gallon, and 1 cubic inch per gallon additional in case of deliveries of more than this amount.

A recent meeting of the National Screw Thread Commission, held at the Bureau of Standards, was directed chiefly to a consideration of tap drill sizes and tolerances and dimensions and tolerances for nuts, bolt heads and wrenches. Some consideration was also given to the question of wire and sheet metal gages. Matters under consideration were referred back to subcommittees for a continuation of the work, and these committees will report at the next meeting.

Welding and Cutting Blowpipes

A THOROUGH investigation of oxyacetylene welding and cutting blowpipes was recently conducted by the Bureau of Standards at the request of the War Department. Apparatus from 14 different manufacturers was submitted to test, and the character of the test was decided upon only after a thorough study had been made of the various operations in which these blowpipes are used.

The tests to which all the blowpipes were submitted were developed with the idea of minimizing the personal equation of the operator and securing data which were representative only of the blowpipe itself. In order to accomplish this result, a rather elaborate testing equipment, consisting of a weighing system, gage board equipment, welding table, cutting table and safety flashback testing apparatus was designed and used throughout the investigation.

This investigation is fully described in Technologic Paper No. 200 of the Bureau of Standards, which describes in detail the various parts of the equipment and then considers the different classes of tests which were used for the cutting and for the welding blowpipes. The conclusions arrived at as a result of this work should prove of considerable assistance in improving the design of apparatus of this kind, with the object of securing better work, greater economy and increased safety to the operator.

THE German Minister of Finance has given notice that owners of automobiles equipped with electric generators for lighting purposes are not entitled to receive duty-free light mineral oils. The notice does not specify what class of consumers are entitled to the duty-free fuel—owners of automobiles without lighting generators or owners of stationary lighting plants comprising a liquid fuel engine.

Methods Used in Specialized Production of Cast Iron Pistons

Some original processes used in the production of light weight, cast iron pistons. The foundry cores are machine made. A description of the aging process and machining and inspection methods. It is claimed that the pistons are held to a tolerance of plus or minus 0.0005 in.

By J. Edward Schipper

IN making a study of production methods in use on automotive parts, it is worth while to note those in use by some of the parts specialists. There are a number of very interesting manufacturing establishments in the automotive field which specialize on one particular part and have a production sufficiently large to enable them to sell their products to manufacturers of the complete unit at a price which is less than it would cost the manufacturer to make the part himself. Often, too, these specialists take a unit and carry it to a higher state of development than it has attained in the art generally, and in that way are enabled to sell it at a price somewhat higher than what the standard article would cost the manufacturer of the complete unit to produce.

This specialized parts business is interesting from a production standpoint, because it affords opportunity for a comparison between the methods in use in such plants and those in use in plants manufacturing the complete car unit. When the production of complete engines, for instance, is large, there is very little to choose between the two, but where the production is small it is often possible for the specialist to successfully compete on a price basis, because of the greater output. From a design standpoint the specialized parts business also affords an interesting study, because it often turns out a product which is better from a performance standpoint than products which are used as stock equipment by manufacturers of complete engines or cars.

The Foster Machine Co., manufacturers of turret lathes and screw machines, have for some time specialized on the manufacture of the Foster piston. This is an internally ribbed, light weight, cast iron piston which has been extensively sold for replacement purposes. Some interesting and original processes are used in the production of these pistons. This concern does its own foundry work and delivers the pistons in either a semi-finished or finished condition.

Core Manufacture

In manufacturing the cores for Foster pistons, a patented machine is used, which is illustrated in Figs. 1 and 2. It consists of a six-part box which is mechanically pulled out in segments, as shown. The core box is closed and filled with ordinary core sand, the box is then turned over, the segments are separated and the finished core is deposited upon a plate ready to be put in the oven. A core machine of this type is capable of making 300 cores per 8-hour day. As there are five of these machines now in operation, the capacity of the plant is 1500 cores per day. The box operates on a bell-crank lever system and deposits each core on an independent plate. Cores are baked for 2 hours in an oil oven at a temperature of 300 deg.

The castings are allowed to age for 10 days before machining operations are begun. The usual annealing process is dispensed with, it having been found that the roughing tool for the first operation peens out any internal strains. A heavy cut is taken on this tool, and after leaving it the castings are sufficiently relieved. The machine operations here described are used for all types of piston that are put through this plant. The Foster company makes 110 types of piston at the present time.

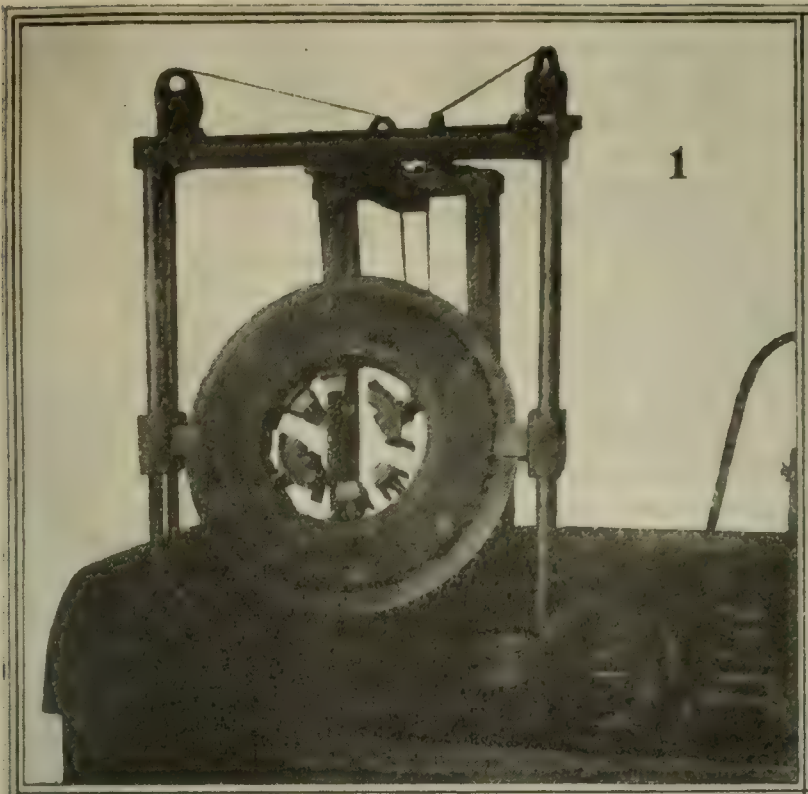
Roughing Operation

In the first roughing operation the piston is chucked at three points inside near the head and three points inside near the open end. It is driven by the piston pin boss. In this operation the piston is rough-turned, the head rough-faced and the ring grooves are roughed out. The work is done on a Foster universal turret lathe made by the same concern that manufactures the pistons. The capacity of the machine, of course, depends on the type of piston manufactured. With a piston such as that used in the Buick model D-45, the machine has a capacity of 22 per hour. This piston is 3¼ in. in diameter by 4 in. in length. The machine takes off 5/64 in. all around or 5/32 in. on the diameter. This is a very heavy cut and requires a rigid machine. The operation set up and the machine may be seen in Fig. 3. The tool is cooled with water containing soluble oil.

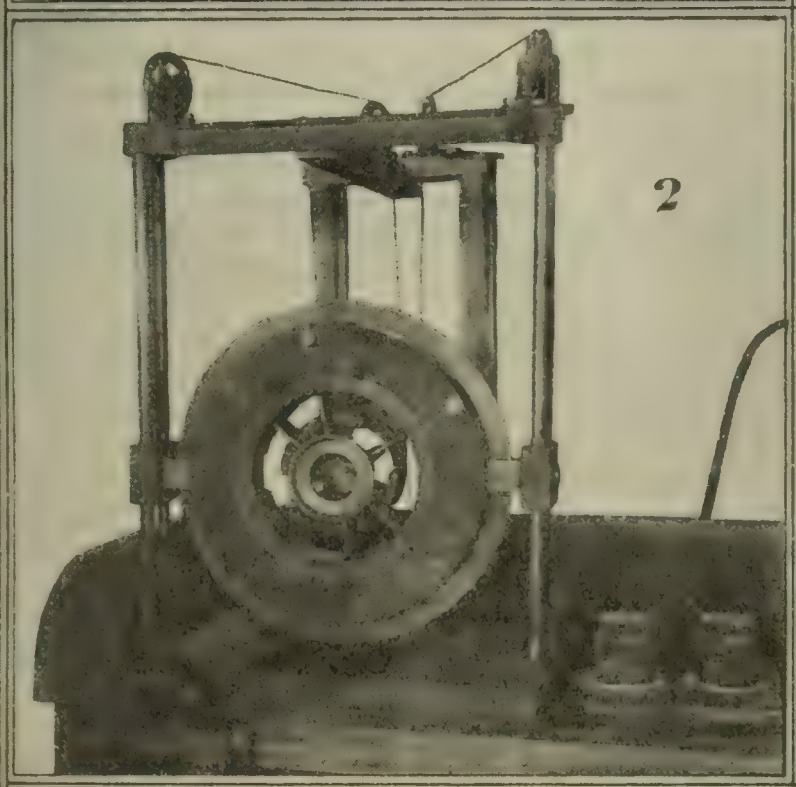
Following the roughing operation, the piston is chucked by means of a Barker wrenchless chuck on its outside diameter. The open end is first rough-faced and rough-bored and then finish-faced, bored and chamfered.

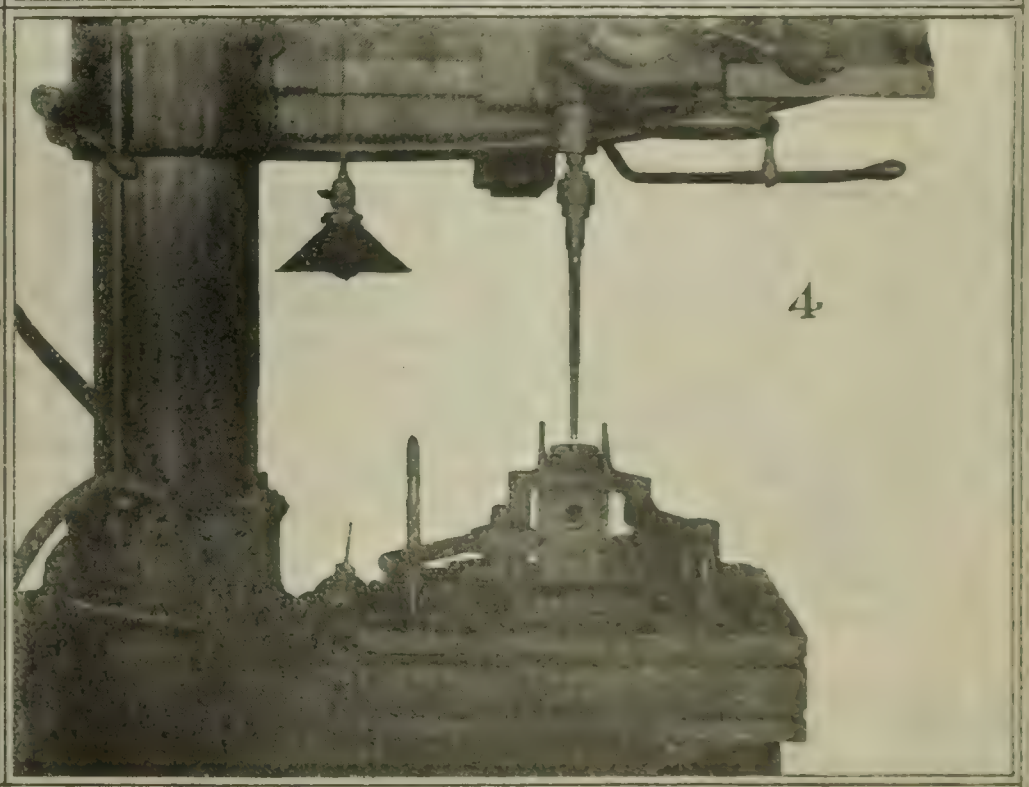
All of this work is done on Foster universal turret lathes. The average time on this work is about 1.8 min. per piston for both the rough and finish operations.

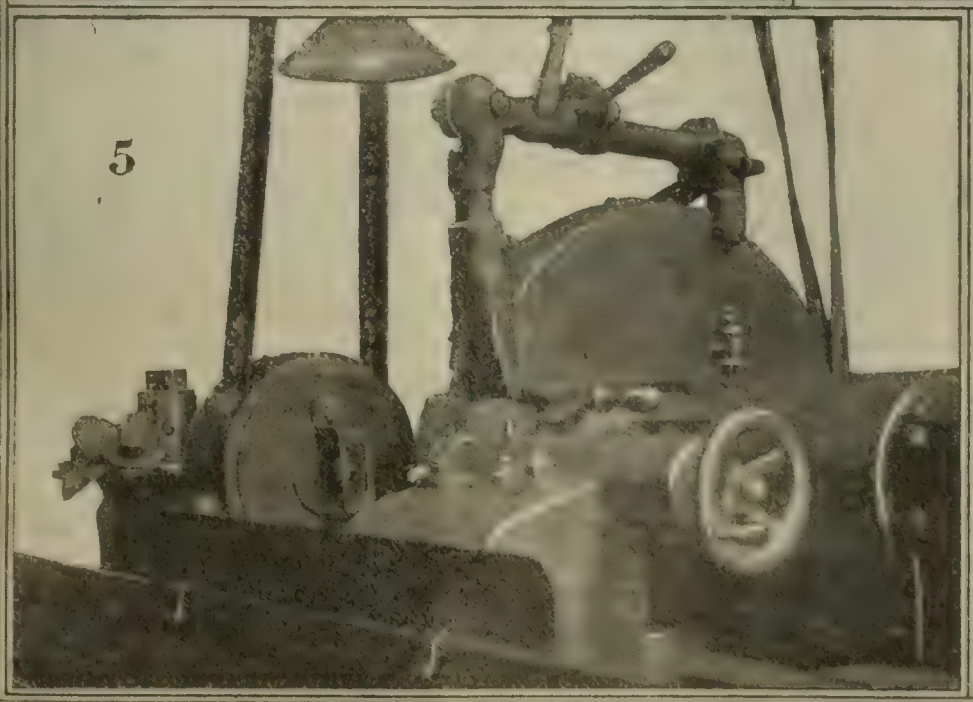
The pistons are then put into a drill jig with a clamp against the open end face and a cam against the head. The work is located by means of V-blocks which fit against the bosses. While in this jig, the piston pin hole is rough drilled, allowing 3/64 of an inch for reaming, and the holes are also reamed. The reamer is piloted above and below the piston and in shifting over for the reaming operation, the piston is located in the jig by a drill bushing through the hole, which lines it up for the reamer. A Magic chuck is used for quick shifting over to the reaming tool. The drilling and reaming operations require about 2 minutes per piston. In carrying out this work, the operator puts through both the drilling and reaming operations without taking the piston out of the jig, eliminating any danger of shifting of the piston. Consequently, the reamer is exactly concentric with the drilled hole. The jig with the reamer in position and the drill standing by its side is shown in Fig. 4.

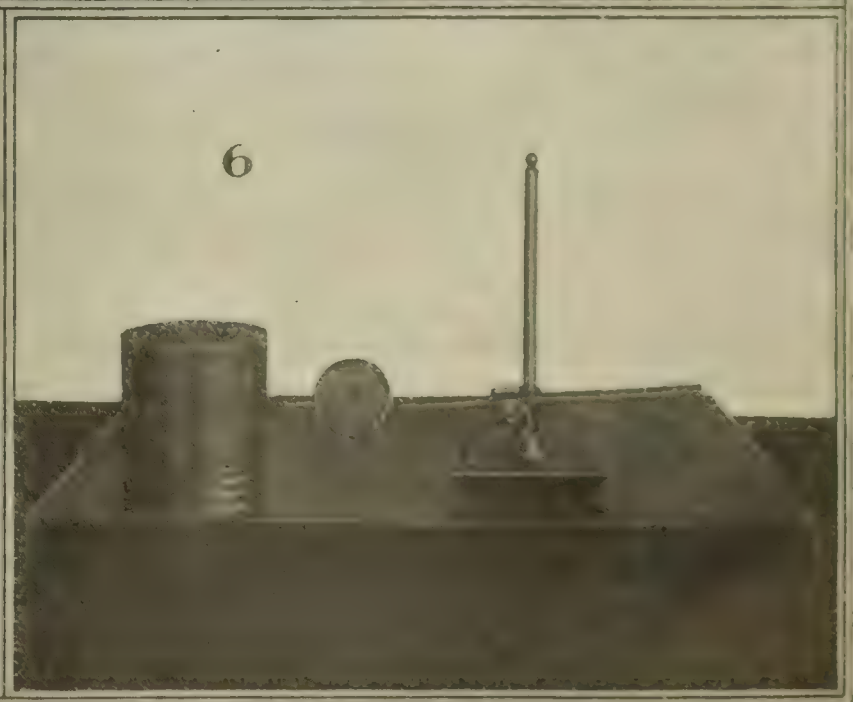












1—Machine for manufacturing foundry cores. Six-part box pulled out in segments. 2—Foundry core machine with core box closed. 3—Foster universal turret lathe set up to rough turn the piston, rough face the head and rough out the ring grooves. 4—Drill jig with reamer in position and drill standing at one side. 5—Modern grinder and piston with adapter inserted into the open end ready to be rough ground. 6—Surface plate for checking the piston pin hole for parallelism with the piston head

In finish-turning the pistons, the casting is clamped against the open end with a pin adapter through the piston pin hole which has just been reamed. In this position it is possible to finish-face the piston head, finish-turn the outside diameter and finish-turn the ring grooves, while at the same time a centering operation establishes the center of the piston in relation to the piston pin hole. This work is also done on a Foster universal lathe and requires 3 min. per piston. Stellite cutters are used for this and the previous cut.

Following the finish-turning, the oil drain holes are drilled and the pistons are then rough ground. In grinding, an adapter is inserted into the open end of the piston, with a pin as shown beside the machine in Fig. 5. This pin contacts with the piston boss and acts as a driver. The piston is placed between centers on this adapter and rough ground to 0.003 in. oversize, with a tolerance limit in manufacture of plus or minus 0.0005 in. The machine used is a Modern grinder. The finish grind is taken in the same way, requiring only one pass of the wheel back and forth. The pistons are held to a tolerance of plus or minus 0.0005 in. Norton Crystolon wheels are used for both rough and finish grinding.

The usual inspection operations follow. One of particular interest is that for checking the piston pin hole for parallelism with the piston head. The piston is placed upon its head on a surface plate, as shown in Fig. 6. The distance from the surface plate to the top of the piston pin hole is located on an amplifying gage on one side and the amplifying gage is set at zero. The piston is then turned around to the diametrically opposite side and the deviation from the zero point on the amplifying gage is noted. The tolerance at this point is plus or minus 0.002 in. The eccentricity tolerance for the final inspection is 0.0015 in.

Division of Frictional Losses in Engines

THE friction load of a gasoline engine may be determined in an easy and accurate manner by the deceleration method. The principle of this method, which may not be generally known, is as follows:

When an engine is running at its normal speed, a certain amount of energy is stored up in its rotating parts. If the power is then shut off, the speed will gradually decrease, by reason of the energy absorbed by the friction of the various parts, which gives rise to a retarding couple, or friction moment. The value of this moment may be determined if the moment of inertia of the rotating masses and the negative acceleration are known.

Let C_f be the frictional moment in lbs.-ft.

I, the moment of inertia in lbs.-ft.^{2}/sec.

ω, the difference in angular speeds, in radians per per second per second

n, the difference in revolutions per second per second

We then have

$$C_f = I\ \omega = 2\pi\ I\ n$$

The values of ω and n are measured by means of a chronograph.

In order to determine the moment of inertia, two tests are necessary, one with the resistance couple C_f alone and the other by applying to the shaft of the machine a known resistance couple C_b. In the first case, if the reduction in the number of revolutions is n_1 we have

$$C_f = 2\ \pi\ I\ n_1$$

In the second test the reduction in the number of revolutions is n_2, which is greater than n_1; and we then have

$$C_f + C_b = 2\ \pi\ I\ n_2$$

From these two equations we derive the following:

$$I = \frac{C_b}{2\ \pi\ (n_2 - n_1)}$$

In both tests the power is shut off when the engine is rotating at the same speed n. Then, in order to determine the friction of the different parts, a number of tests are made, first with the machine completely assembled, next with the piston removed, then with the distribution gear disconnected, etc. The tests should be made under normal operating conditions as regards lubrication, speed and temperature.

The engine being completely assembled, it is run at normal speed by the explosion of the gaseous mixture. After the connecting rod head is disconnected, it is run by an electric motor. However, when there are no explosions in the engine cylinder, it is necessary to take into account the fact that the piston exerts no side pressure against the cylinder wall as a result of the explosion pressure, consequently the total internal losses are not the same as those shown by an indicator diagram taken when idling. In the same way, the reactions of the explosion on the bearings is eliminated. It is necessary to assure uniform lubrication during the tests in order that the various results may be comparable among themselves.

Experiments were made in Australia some time ago by F. P. Taylor with a 6-hp. National, a 40-hp. National and a 30-hp. Crossley engine. The speed was measured by tracing a line by means of an electromagnetic stylus on a card covered with lamp black. In this way it was possible to trace a curve of speeds, and the deceleration was determined by drawing tangents to different parts of the curve.

The results obtained from tests on these engines permitted of a comparison of the individual losses in the different engines, which is made in Table I.

On the average the division of losses is as follows:

Piston friction	45 per cent
Pumping losses	35 per cent
Engine bearing friction	14 per cent
Connecting rod	4 per cent
Distribution gear	3 per cent

TABLE 1.

	National	Crossley	Victor
Crankshaft bearings	15	16	11.5
Distribution gear	2	4	1.5
Pumping loss	34	37	37
Connecting rod	4	3.5	5
Piston	45	40	25

While all three of these engines were stationary engines, the distribution of losses in automotive engines would no doubt be very much the same.

A TRADE organization for the British rubber industry has been created, known as the Institution of Rubber Industry. It plans to promote the interests of rubber growers, manufacturers and distributors, and to advance the general standards of the rubber industry. At the inaugural meeting of the new body it was brought out that the rubber industry was substantially a century old; in 1873 the world's production of rubber amounted to 15,000 tons, while in 1919 it reached nearly 400,000 tons.

Traffic Facts Shown by Highway Transportation Surveys

Overloading is prevalent in hauling all commodities. Trucks handle large percentage of manufactured products carried over route covered by surveys. 3.2 passengers per car is average determined. 2-ton trucks form 16 per cent of total. Census an example of needed transport studies.

THE practice of overloading trucks is prevalent in the carrying of all commodities, according to the results of two recent traffic surveys conducted by the Connecticut Highway Department in cooperation with the Bureau of Public Roads. Other interesting data were developed in the surveys which form the beginning of actual studies in the economics of highway transport. Information was developed concerning the percent of total vehicles comprised by trucks of a given weight, the average length of haul of the various commodities, truck weights per inch of tire width, and a comparison of truck and railroad traffic.

While this data cannot be considered as final in any sense, the method and type of the survey illustrates well how the needed information on highway transportation can be compiled and analyzed. For this reason the story of these two traffic censuses are of special value. The purposes of the censuses were to determine the economic value of the highway; the classification of vehicular traffic; the gross weight and wheel loads of motor trucks and the extent of overloading; a basis for the distribution of construction and maintenance costs; density of traffic; width of vehicles and the relation of density and width of vehicles to roadway width; the movement of freight by highway; the speed of vehicles and to serve as a basis for a formulation of traffic regulations.

The first census was taken during the last two weeks of August on the Hartford-Springfield road at the Massachusetts-Connecticut State line. The second census took place during October on the Boston Post road at the town of Greenwich, Connecticut. Each of the censuses covered a period of fourteen days. The daily survey covered ten hours, rotated so as to determine the traffic movement at the earlier and later periods of the day. Two night counts were conducted to form the basis for an estimate of night traffic. Road scales were installed on both roads to weigh the traffic as it passed over the road. At the Greenwich station a 49,000 pound automatic Fairbanks scale was used in order to delay the traffic as little as possible.

During the first census traffic bound south from Springfield, Mass., to Hartford, Connecticut, was weighed whether empty or loaded. North bound trucks were stopped, but only commodity information was obtained. The density of traffic was such that it was impossible to weigh trucks going in both directions. In the second census the east bound traffic from New York was weighed and west bound trucks were stopped only for commodity information. The personnel of the survey included eight men to handle both truck and passenger car traffic. During the second census older men were employed and the results, especially the truck information, were more accurately recorded. Traffic was only slightly delayed by the observers and drivers cooperated willingly when they understood the purpose for which the information was asked.

During the first census the information, including the weight of the truck was obtained in an average of one minute and forty-one seconds, the longest time being two minutes and fifty-five seconds and the shortest one minute. At different times during the census speed tests were made and one of the results of the survey is the indication that a more accurate index of truck speed can be obtained at a place a few miles from the traffic station where drivers will not suspect that the test is being made.

Five forms were devised for use in recording the data, copies of which are attached.

The cost of the first census was $1,693.10, of which $977.63 was for the scale, $170 for the cost of erecting it, and the balance for salaries of the observers. The cost of the second census was $3,331, of which $2,700 was for the scale and the balance for salaries of observers, etc.

The report on the censuses is divided into four parts. Part one is in the nature of an introduction. In part two are covered analyses of the best methods of obtaining such information and of the passenger traffic recorded and a study of the extent of truck overloading. Part three deals with an analysis of commodities carried, and part four has to do with a study of the relation of highway traffic observed to railroad traffic in the same section.

Passenger Traffic Analyses

28,011 passenger cars were recorded during the first census and for 14,036 of the cars observed the records were analyzed to determine the average haul, number of passengers, etc. In the second census 38,566 passenger cars were recorded and the records of 5023 were analyzed.

The number of motorcycles and horse-drawn vehicles was so small in comparison with passenger cars and truck traffic that their numbers are not reported.

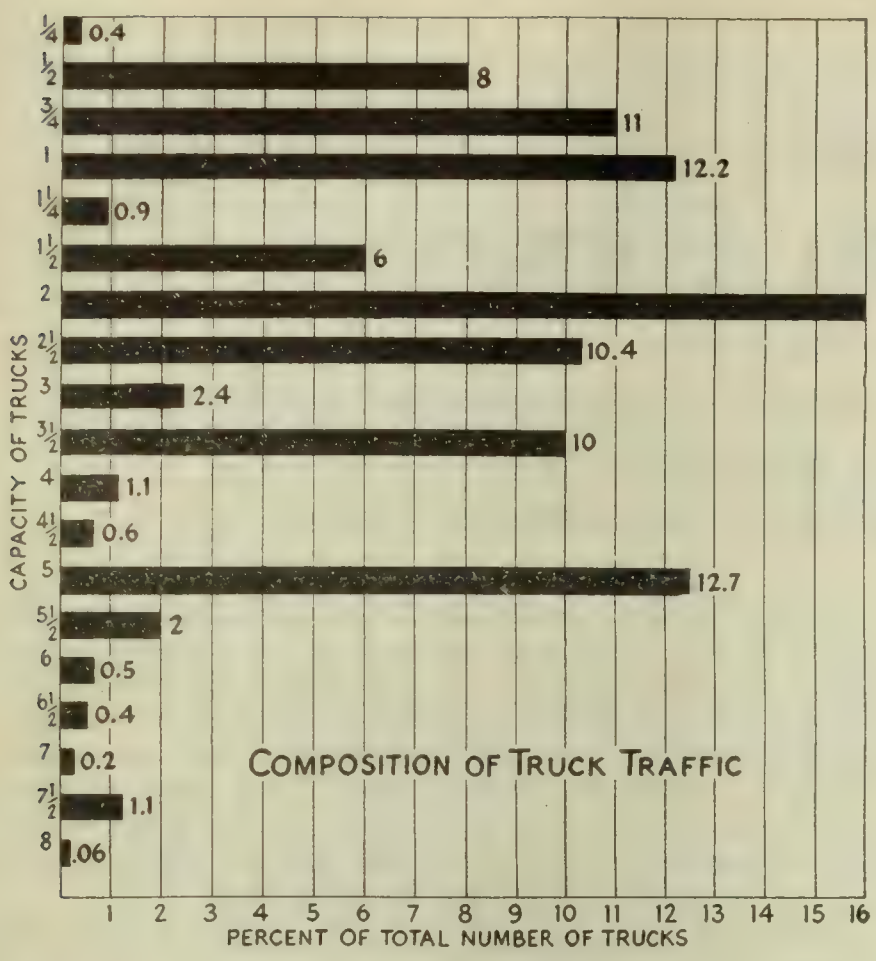
All makes of cars and all types including touring cars, roadsters, and other special types were observed during the census.

44,950 passengers were transported in the observed cars, south bound in the first census. An average of 3.2 passengers per car. During the first census of the licenses observed 50.5 per cent of the total were Massachusetts tags; 34.9 per cent were Connecticut; 7.2 per cent were New York, and 7.2 per cent were miscellaneous.

The location of the census station near the Massachusetts-Connecticut State line and the fact that this analysis relates to south bound traffic accounts for the high percentage of Massachusetts cars.

In the second census the average number of passengers per car was found to be 3.314. The analysis of license tags shows Connecticut with 53.1 per cent; New York 37.4 per cent; Massachusetts 3.2 per cent; New Jersey 3.2 per cent. A daily average of 6739 passenger cars was found for the two censuses while the daily truck average was 792.

The principal movement occurred between seven o'clock



in the morning and eight in the evening, the peak load occurring at five P. M. The hourly density of truck movement from eight P. M. to five A. M. indicates the night movement of regular truck lines. During this interval an average of thirteen trucks passed over the roads per hour.

In the first census the daily average of passenger car movement for twenty-four hours was 2907. The average mileage per car was 70.018 at 3.2 passengers per car, and figuring the value of the passenger service rendered at the railroad rate of 3.6 cents per mile the passenger service on the Hartford-Springfield road during the two weeks was valued at $327,595.50.

During the second census the daily average of passenger car movement for twenty-four hours was 3832.4. The average mileage was 52.4. Computing the value of the service as above the value for the two week interval was $355,417.04. On the two roads together the value of the service rendered for a year would be $17,238,326. This figure is merely the value of the service rendered by these two roads estimating the value at railroad rates. It is not the cost of the service rendered by the roads.

Truck Overloading

The truck weight data from both censuses were analyzed to determine the wheel and axle loads and to ascertain what percentage of the vehicles weighed in excess of the legal limitation of 25,000 pounds, and what part of the traffic consisted of vehicles with wheel loads greater than 800 pounds per inch of tire width, and what proportion of the vehicles was overloaded when gauged by the capacity rating of the manufacturers. The latter practice is referred to as overloading per capacity. The weight standard used in determining overloads for each make and capacity consists of a summation of the manufacturer's 1920 weights for the chassis, body, and rated capacity, giving the total weight when loaded to rated capacity. The percentage distribution of weight recommended by the manufacturers of trucks for front and rear axle load was used as a standard for computing overloads on the front and rear axle. To be conservative 5 per cent of the total chassis, body and capacity weight was added to the manufacturer's given weight in deriving the standard for computing overloads. One half of this 5 per cent was added to the front and rear axle weights in arriving at a standard for measuring overloads per axle.

The practice of overloading per capacity is not confined to loads of heavy material such as sand, gravel, brick etc. It is restricted to no typical group of commodities, but is almost universal.

Apples, beer, butter and eggs, drugs, fish, furniture, groceries, lumber, meat products, paper, rubber goods, sugar, vegetables, wire are typical commodities of which overloads per capacity were noted.

Of the cases of overloading per capacity observed, 75 per cent was practiced by regular trucking vehicles, 25 per cent by irregular trucks.

Commodity loads exceeding 25,000 pounds were noted in the case of such commodities as brick, butter, drugs, eggs, glass, groceries, litharge, meat, plumbing supplies, sugar, vegetables and vinegar.

Of the number of loads exceeding 25,000 pounds 87.8 per cent were overloads per capacity; 88.7 per cent were by regular trucking companies. Thirty-nine out of 41 cases were loaded from 846 to 1560 pounds per inch of tire width on the rear axle.

Only 4.2 per cent of the trucks observed were over 5-ton capacity. The percentages of other capacities noted were as follows:

Capacity in tons	Per cent of total number	Capacity in tons	Per cent of total number
¼	0.4	4	1.1
½	8.0	4½	0.6
¾	11.0	5	12.7
1	12.2	5½	2.0
1¼	0.9	6	0.5
1½	6.0	6½	0.4
2	16.0	7	0.2
2½	10.4	7½	1.1
3	2.4	8	0.06
3½	10.0	...	....

Width of Truck Bodies

The least width of truck body observed in the two censuses was 5 feet; the greatest width in either census was 9 feet, 6 inches. Only 6 per cent of all trucks observed in the first census and 5 per cent in the second census were equipped with bodies exceeding 7 feet, 6 inches in width.

Pneumatic tires were observed in use principally on the lighter trucks; solid tires on the heavier trucks and a combination of pneumatic and solid on the front and rear wheels respectively principally in the weight classification from 3000 to 14,000 gross weight in pounds. The use of pneumatic tires increases rapidly from 2000 to 5000 lb. and then decreases rapidly to 10,000 lb. The number in excess of 10,000 lb. is negligible. The greatest percentage of trucks equipped with pneumatics occurs in the 4000 to 5000 lb. class. Solid tires begin to increase rapidly at 5000 lb.

The density of movement was found to be between the 4000 and 14,000 lb. classes, 1378 out of 2183 observed trucks falling in these classes. Only 51 out of 2183 or 2.3 per cent exceeded 25,000 lb. Only 7 out of 2183 weighed more than 28,000 lb.

In the first census 29 of 2266 trucks, 12.8 per cent were found to have front axle loads in excess of 800 lb. per inch of tire width.

138 out of 359, 38.44 per cent were found to have rear axle loads in excess of 800 lb. per inch of tire.

167 of 585 or 28.55 per cent were loaded to more than 800 lb. per inch of tire width on both axles.

Overloads on the rear axle range from 800 to 1100 lb. per inch, density occurring at 900 lb.

Overloads on the front axle range from 800 to 1650 lb. per inch, density occurring at 1100 lb.

In the second census the per cent and range of overloads were as follows:

Front axle .....11.9 per cent, 800-1500 lb., density 950 lb.
Rear axle .....36.5 per cent, 800-1925 lb., density 1100 lb.
Both axles.....24.6 per cent

In both censuses the number of overloads increases as tire thickness increases to 1½ inches and decreases above that thickness.

The weighted average overload per capacity (computed on basis of standard defined on page 5) is 39 per cent. This is construed to mean that every third truck was loaded beyond the capacity of the truck and tires. A total of 37.5 per cent were overloaded on the rear axle, and 40 per cent were overloaded on the front axle.

Recommendations Based on Overloading Analysis

1. Classification of highways.
2. Seasonal restriction of loads.
3. Prohibition of overloads per capacity, and restriction of tire to 800 pounds per inch width.
4. Maximum body width of 7 ft. 6 in.
5. Maximum axle loads to be determined for each make and class of trucks and placed in conspicuous place on the vehicle.

Commodity Analysis

The 20 commodities noted in greatest bulk in the second census, with the weight and average haul of each, follow:

Commodity	Weight in pounds	Average haul in miles
Groceries	1,039,469	44.15
Furniture	553,545	71.47
Beer	421,665	72.92
Sugar	404,640	47.26
Household goods	375,495	99.81
Meat products	334,410	42.75
Rubber goods	279,020	82.96
Vegetables	176,893	37.68
Poultry	159,760	32.67
Cocoa beans	158,518	33.12
Merchandise	153,831	42.88
Wire	145,550	66.50
Grapes	141,220	48.56
Bananas	133,627	47.13
Dry goods	133,360	43.79
Feed	131,140	27.10
Silks	125,305	110.22
Lumber	119,805	35.51
Machinery	115,875	89.10
Litharge	114,370	106.25

The longest average hauls reported were those of boats and yeast, each of which was hauled an average distance of 150 miles. The volume of these commodities hauled were: Boats, 840 lb.; yeast, 10,445 lb.

The shortest haul reported was that of charcoal, 2150 lb. of which were hauled an average distance of 3.50 miles. The next shortest haul was milk, 4725 lb. of which were hauled an average of 5.80 miles.

Agricultural products make up only 14.3 per cent of the traffic in the second census; manufactures and miscellaneous 72.5 per cent, indicating, according to the report that truck movement in Connecticut is predominantly that of manufactured goods of high value and small bulk.

Because the survey was limited to one season all agricultural products are not represented in the list of commodities. The average haul of agricultural commodities is 39.5 miles; the longest, eggs, is 68.21 miles.

Extending observed weights and hauls during the period of the second census it is estimated that the annual ton-mileage of agricultural commodities is 86,649.

Estimated value of agricultural products hauled both ways over Boston Post Road at Greenwich, based on observations of the second census, $15,075,000.

Comparison of Truck and Railroad Traffic

Comparing the truck traffic observed in the second census with traffic over the New York, New Haven & Hartford and Boston & Maine Railroads, the results are as follows:

	By Truck	By N. Y., N. H. & H. (1918)	By Boston & Maine (1920)
Products of Agriculture	14.3	9.4	11.8
Product of Animals	11.2	3.3	3.2
Product of Mines	0.5	42.5	36.8
Product of Forests	1.5	6.5	13.2
Manufacturers and Miscellaneous	72.5	38.3	3.50

Total observed east-bound truck traffic, second census, 239,562 ton-miles.

Adjusted to give 24-hr. traffic for the 2-week period, 360,000 ton-miles, eastbound.

71 per cent of east-bound traffic loaded.

36 per cent of west-bound traffic loaded.

Estimated traffic both ways for 2-week period, 540,000 ton-miles.

Assuming this traffic to be average for year the annual east and west movement at Greenwich is estimated at 14,040,000 ton-miles of pay freight.

The average haul of truck movements was 47.44 miles.

A Census of the Petroleum Refineries in the United States

PETROLEUM refineries in the United States on January 1, 1922, numbered 479 completed plants, with 30 additional plants in process of construction, according to a statistical summary prepared by H. J. Lowe, petroleum economist of the Federal Bureau of Mines. The indicated daily refining capacity of these plants is 2,164,050 barrels of crude oil.

The tremendous increase in the extent of the petroleum refining industry of the country is shown by the fact that in 1914 but 176 petroleum refineries had been completed. Within eight years the number of refineries has been increased by 172 per cent.

Texas at present leads all other states in the volume of oil refining business, with 63 operating plants, with a daily capacity of 345,150 barrels; in addition, the state had on January 1, 46 refineries in shut-down condition, while 9 other plants were being built. Oklahoma is the second state in number of refineries, with 54 operating and 43 shut down; operating plants in this state had a daily capacity of 234,650 barrels. California, with 34 operating plants, was refining 314,360 barrels daily. Pennsylvania had in operation 48 plants, with a daily refining capacity of 114,930 barrels. New Jersey, with but 5 refineries, treats 224,000 barrels of oil daily.

The importance recently attained by the state of Louisiana in this industry is indicated by the fact that 14 refineries were treating 114,350 barrels daily, while 11 plants were in shut-down condition. Kansas, with 19 operating plants, was refining 57,650 barrels daily; Illinois, with 12 plants, was handling 62,050 barrels; Wyoming, with 11 plants, was refining 89,900 barrels; and Indiana, with 5 plants operating, was handling 54,300 barrels daily.

Of the 479 completed refineries in the United States, 154 were in shut-down condition at the first of the year. The daily refining capacity of these non-operative plants was 254,610 barrels, or approximately one-eighth of the entire refining capacity of the country. The 30 new plants in process of construction will, it is estimated, add 59,950 barrels to the country's daily refining capacity.

Copies of the directory of petroleum refineries in the United States may be obtained from the Bureau of Mines, Washington, D. C.

Automotive Industry Organizes for International Trade

Foreign trade will absorb from 5 to 15 per cent of American automotive production. This may mean the difference between profit and loss. The trade associations have recognized the practical help that can be given by the Automotive Division of Bureau of Foreign and Domestic Commerce. This report presents information of vital importance to manufacturers.

AUTOMOTIVE transportation is an international institution. Automobiles, motor trucks, motorcycles, motor boats and aircraft provide the transportation so necessary to modern civilization.

The introduction of the internal combustion engine is fraught with more significance than any other recent development in the great territories of North and South America, Europe, Africa, Asia and the Pacific. Just as the steamboat, the locomotive and the telegraph were the vehicles that brought about the world upbuilding of the nineteenth century, following the devastation wrought by the long Napoleonic conflicts, so will the automobile, the airplane and the motor boat guide the twentieth century and speed up the economic development that must follow the World War.

To the automotive industry of America has fallen the leadership and the direction of this world wide need for transportation. The American industry alone is prepared to supply the essential passenger cars, motor trucks and attendant equipment. Its ability to build and produce these vehicles places upon it an obligation of education and service far transcending the continental limits of the United States.

America has a duty and an opportunity. It is her commercial destiny not merely to export American-made automotive vehicles and equipment but to bring to the entire world the benefits of efficient transportation on the road, in the water and through the air.

This report has been prepared by the international trade committees of the several associations having to do with the manufacture and distribution of the various automotive products. The purpose is to explain something of the assistance that may be accorded them in building up their international sales. The belief of the committees of these associations and the sub-committee preparing this report is that our industry cannot longer delay in taking its rightful place in this world movement. Other countries naturally will find it worth while to take advantage of the production facilities which have been so highly developed in this country during the last two decades.

Each company and each firm, no matter how large or small, should investigate the possibilities for the use and sale of its products in these other countries. Many companies, it may be found, have no place in this trade, as the character of their products, the volume or production or other conditions may not warrant more than a local merchandising effort. But to numerous others a definite volume of international sales seems assured if they will but make an honest and careful campaign to obtain it. To such firms, this report is directed.

The value of this trade is two-fold. The first is that it will absorb a certain percentage of production—5, 10, 15, perhaps 20 or 30 per cent—in any event, the final proportion that may mean the difference between profit and loss. Secondly, it insures a definite volume of monthly production. Sales seasons differ throughout the world. When the curve of demand is falling in the northern countries the change in season swings the sales upward in territories south of the equator, thus assuring a more continuous production than is possible if only one territory is cultivated.

The question is not so much as to the value of international trade but as to how it may be obtained. Thus we come to the real purpose of this report, which is to explain the work and the activities of the Automotive Division of the Bureau of Foreign and Domestic Commerce, organized under the Bureau of Commerce to aid in the enlargement of the international sales of American-made automotive products.

The object of the Bureau is to collect and disseminate information on the various markets and to lend every hand in the promotion of commercial relations between this and other countries. Previously the Bureau consisted only of regional, technical and service divisions, but, in 1921, to these older divisions were added an additional twelve, each of which embraces a special commodity, such as agricultural implements, rubber (including tires), electrical equipment, fuel, foodstuffs, lumber, textiles, etc. Naturally, because of the great strides already made in the international field by the American automobile, one of the new divisions concerns itself with automotive products.

Under this division fall passenger cars, motor trucks, motorcycles, marine engines and motor boats, airplanes and aircraft, with, of course, the parts, units, accessories and service equipment that go with them. These products constitute the automotive industry and it is the development of their use for which the Automotive Division is working.

An outline of organization shows Herbert Hoover, as Secretary of Commerce, the head of the Department of Commerce. Under him is the Bureau of Foreign and Domestic Commerce, directed by Dr. Julius Klein, with the Automotive Division as one of its component parts. This division is directed by Gordon Lee with M. H. Hoepli as assistant chief.

The organic act which created the Bureau provides that its name shall embrace both foreign and domestic commerce, but that is almost a misnomer, at least so far as the present work of the Bureau and of the Automotive Division is concerned. Its activities are entirely directed to the promotion of foreign commerce, although this requires constant contact and work with manufac-

turers and distributors at home. Later, it is expected that some phases of the domestic trade will come under the bureau activities but, as now functioning, it is exclusively devoted to the upbuilding of overseas business.

The Bureau and the Automotive Division act solely in an advisory capacity, furnishing information upon which American manufacturers and distributors may obtain international outlets. To understand the extent of this information, a review of the established contacts throughout the world and at home is essential.

There are in other countries approximately 1000 official representatives of the American government, these being commercial attaches and trade commissioners in the larger centers, consuls and consular representatives. These representatives are co-operating wholeheartedly in the work of the Division. An automotive trade commissioner is now traveling in the Far East and another will leave shortly for Europe. Each of these thousand or more officials is transmitting up-to-the-minute and thoroughly reliable information back to this country for clearance to the industry through the various channels that are being provided. In addition to their reports, the Division is receiving a vast amount of material from unofficial sources, from business publications and daily newspapers published in other countries and from travelers and visitors who come in contact with the Division and its representatives, either at home or abroad.

These reports provide surveys of the trade, including past, present and potential developments. Statistical information is supplied regarding registration, importation, exportation, etc., and other reports, frequently by cablegram, are regularly received regarding current market conditions, significant developments and trade opportunities. The material is transmitted to the Automotive Division either automatically and at stated intervals or upon special occasion. When a tender is offered, for instance, for motor trucks in Brazil, Spain or Japan, or for motorized fire fighting equipment or airplanes in Bombay, Buenos Aires or Capetown, full information concerning it is sent to the Division, either by mail, or, if the time is short, by cable and is then supplied at once to manufacturers and distributors here. Dozens of such inquiries are being received each week from numerous countries covering all automotive products, ranging from aircraft to accessories and service equipment.

Questionnaires dealing with local registration distribution channels, dealer establishments and other similar topics have been or are being submitted to all overseas representatives. The registration questionnaire, as an example, provides for a careful and authoritative world census on passenger cars, motor trucks, motorcycles, airplanes and fire fighting equipment. Returns from it are being tabulated as they are received, district by district, the results being made public from time to time. This census will prove of immense value to motor equipment manufacturers in laying out and planning their sales campaigns and it will enable them to picture the markets as they exist at present or may be expected to develop in the years to come.

Monthly reports are being received, by cable, from the important territories, these reports being both general and specific in nature. The Department representatives review the economic, agricultural, financial and industrial conditions in each territory, thus drawing a conclusive showing of the possibilities of that market for immediate or future business. A recent step forward is the enlargement of cable service so that each of the monthly cable reviews will give specific information on automotive conditions. It must be remembered that the automotive industry is in the forefront of American industries having international possibilities and this special reference in the cable reports was deemed essential as a merited recognition of its importance.

The world stands in great need of American automotive equipment. The passenger car and motor truck and other equipment that has negotiated the roads of Kansas, Missouri, Oklahoma, Iowa or Nebraska, is likewise the vehicle best suited to overcome similar conditions and to give the maximum of service in Mexico, Patagonia, South Africa, India and other countries. This committee believes that nowhere else are produced the automobiles, airplanes, motor boats and motorcycles, regardless of price class, quality, durability or finish, that comprise the American output and it likewise believes that these are the products that must fill the myriad transportation needs of practically every territory. The airplane was invented in America and the automobile, the motor truck and the motor boat were brought to their present high standard of efficiency and value through the development that has taken place in this country. Nowhere else has the conception been held that the automobile is a vehicle of transportation and nowhere else has it been so perfected. Consequently the American

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THIS report outlines the opportunities available for American automotive manufacturers in international trade and shows how practical commercial assistance is being given by the Automotive Division of the Bureau of Foreign and Domestic Commerce, under the direction of Gordon Lee.

The report was prepared under the direction of the following representative committees:

National Automobile Chamber of Commerce:
J. Walter Drake (Hupp Motor Car Corp.), chairman, and George F. Bauer, secretary, Foreign Trade Committee, 366 Madison Avenue, New York City.

Motor and Accessory Manufacturers' Association:
W. O. Rutherford (B. F. Goodrich Co.), chairman, and M. Lincoln Schuster, secretary, Foreign Trade Committee, 33 West 42d Street, New York City.

Automotive Equipment Association:
S. D. Black (Black & Decker Mfg. Co.) and Graham W. Brogan (Black & Decker Mfg. Co.), Foreign Trade Committee, City Hall Square Building, Chicago.

Aeronautical Chamber of Commerce:
Luther K. Bell, 501 Fifth Avenue, New York City.

Motorcycle and Allied Trades Association:
W. G. McCann (Hendee Mfg. Co.), chairman, Foreign Trade Committee, Springfield, Mass.

National Association of Engine and Boat Manufacturers:
Ira Hand, secretary, 29 West 39th Street, New York City.

Association of Automotive Equipment Manufacturers:
Noah Van Cleef (Van Cleef Bros.), chairman Foreign Trade Committee, and W. E. Green, secretary, 3222 Washington Blvd., Chicago.

The Class Journal Co.:
George E. Quisenberry (El Automovil Americano), 239 West 39th Street, New York City.

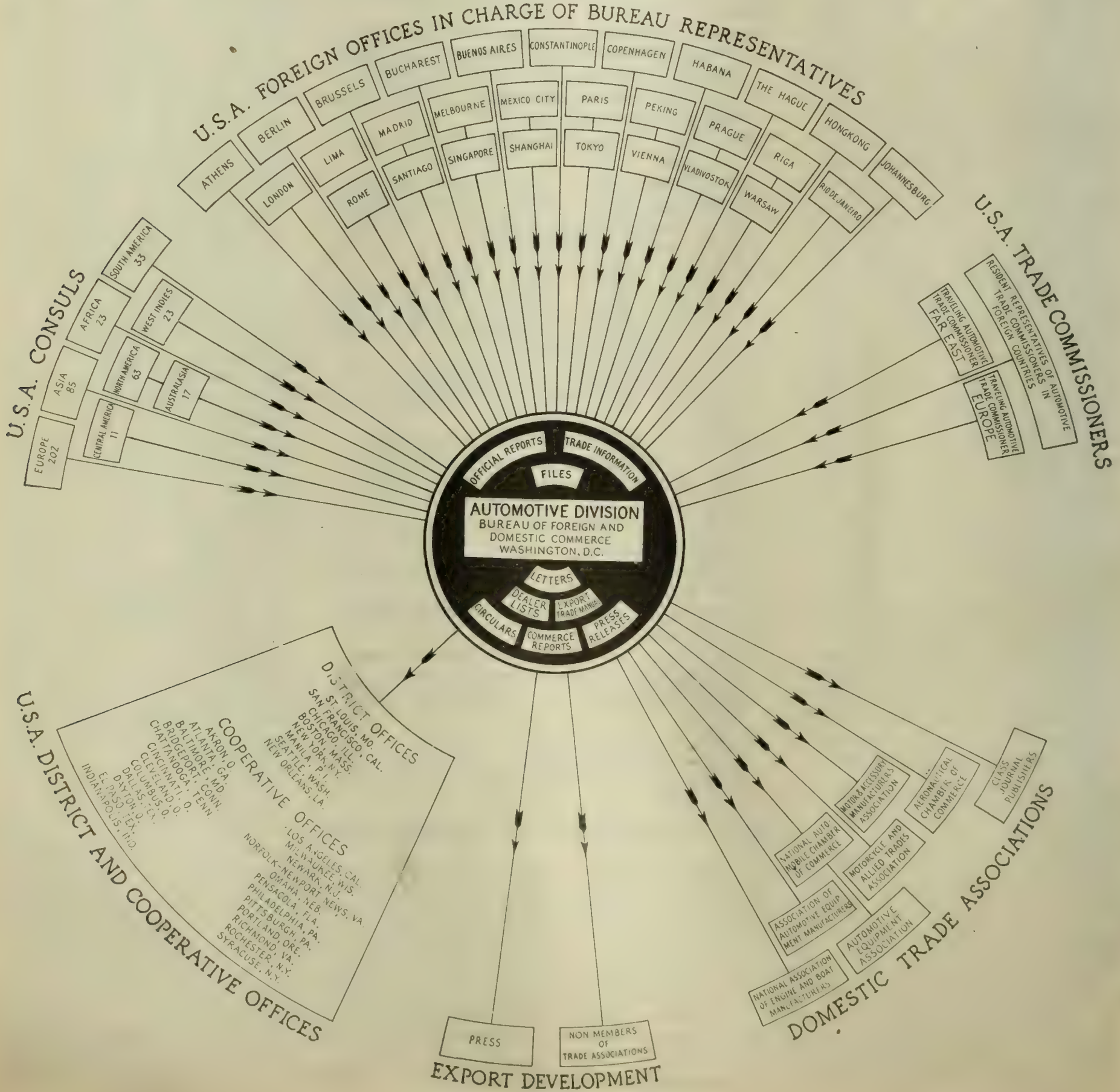
automobile stands upon the threshold of a world use so large that its possibilities can be little more than imagined. As we have built up our home demand and as we have evolved its many uses—from the Atlantic to the Pacific and from the Great Lakes to the Rio Grande—so also is the remainder of the world looking for the simplified but meritorious automotive vehicle of American design to furnish the transportation needed in city, town and rural district.

The Automotive Division is seeking to bring back the picture of these developing markets so that full advantage may be taken of the numerous opportunities for trade that are being offered. Let us go further into the manner in which the Division functions.

The information gathered from all overseas centers must be transmitted to the trade if it is to have any value. Some of the material is of no practical value and naturally is discarded. A part is not suited for publication but is valuable for reference purposes and is incorporated into permanent files. Some is confidential or semi-confidential and distribution must be guarded accordingly. Other material is released at once to the automotive business papers, the daily press or is published in other form. The large bulk of all the information finds immediate transmission to the trade.

The first contact of the Division with the industry is through "Commerce Reports," the weekly publication of the Bureau. It contains an automotive section, together with a resumé of conditions in the different centers and a list of trade opportunities or leads for immediate business. This committee recommends to all interested firms or individuals a subscription to this report.

A second contact is through the Exporters Index. To all firms properly listed on the index, confidential bulletins and lists of trade opportunities are sent from day to day as they are received. Only firms of undoubted American foundation and standing are placed in the index by the Department of Commerce. This committee



recommends that all companies avail themselves of this opportunity. Information concerning it and the proper blank forms for listing may be obtained either from the committees of the various associations or direct from the Division.

Lists of overseas dealers also are in process of formation and will be supplied upon request. Lists of this nature previously furnished have given little information upon which a manufacturer or exporter might base a sales campaign, but this fault is being corrected and those now coming from the Division contain many more facts than formerly was the case.

Reference files of the Division are also open to the trade. Of primary importance are those under such general subjects as:

Aircraft	Sales Promotion
Automotive Transportation	Miscellaneous
Statistics	Parts and Accessories
Markets	Automobiles
Service	Motor Trucks
Legislation	Customs
Motor Boats	Contingent Factors
Transportation Possibilities	Distribution
Production	Preferential Specifications

These files are subject to indefinite expansion and are so flexible as to permit the establishment of numerous sub-headings. Key indices are kept so that reference to all subjects is readily possible and the Division is building up a library containing automotive reference books and business journals. Furthermore, the Division is preparing special reports upon each territory, with distribution points outlined, potential demand, customs, preferences, tariffs, etc. Many of these reports, some specifically considering road and highway construction, have been brought out and others are in the hands of printer or are nearing completion.

Tariff laws and special regulations of each country are being studied for their import to the industry and special bulletins upon these subjects are promised within a short time. This committee believes that American manufacturers, distributors and exporters will find the files, libraries and reports of utmost importance in regard to whatever international campaigns may be under way.

The Division, if its full value is to be returned to the industry and if the industry is to profit from it according to the full opportunities presented, must be considered as being other than an academic institution. That it is not academic will be borne out amply by any contact and regardless of any preconceived notions that may be held because of its location at Washington and its organization under a government department. This committee believes in the work of the Division only after a full investigation and because of what it already has completed or has instituted.

Gordon Lee, the chief, came to the division from the industry itself, his appointment having been largely at the direction of the National Automobile Chamber of Commerce. Lee has been associated with the industry for years and was a member of the family of George B. Selden, the inventor of the automobile. Aside from extensive domestic experience in the manufacture, distribution and sale of motor cars, trucks and motor tractors, he has traveled extensively abroad as an automotive representative. Since his appointment in 1921, Lee has made various trips to the automotive centers and is thus keeping in close touch with developments in the domestic field, this naturally being necessary for a proper survey of the international markets.

Much of the organization work of the division has been in the hands of M. H. Hoepli, assistant chief of the Division. Previous to his present work, Hoepli was executive research assistant for one of the largest American automotive corporations. In addition he has had first hand experience abroad.

Much of the information collected by the Division will be distributed to the various manufacturers through the associations of which they are members and by the automotive business papers. These contacts have already been formed by the Division through the associations previously listed.

International trade bulletins already are being sent out to all members by the National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers' Association and the Aeronautical Chamber of Commerce. Arrangements for similar bulletin service are being considered by the Automotive Equipment Association, the Motorcycle and Allied Trades Association and the National Association of Engine and Boat Manufacturers.

Thus it will be seen that the American industry is advantageously situated to take its proper place in the international automotive development. This committee believes that the Automotive Division of the Bureau of Foreign and Domestic Commerce will prove of immense help in aiding and guiding the industry in matters pertaining to international sales. Subjects of practical importance at the time of writing include the following:

The fostering of wider and cheaper distribution of gasoline and kerosene.

The use of alcohol as a motor fuel in those territories where it may be produced economically.

The upbuilding of service and distribution facilities.

The promotion of local automobile shows and expositions.

The furtherance of good roads and highway improvement.

The development of motor bus, passenger and freight carrying lines.

The establishment of commercial aviation projects.

The extension of motor boat use.

To these may be added the production and exhibition of motion picture films explanatory of the American automotive idea, the packing of international shipments, the organization of automotive dealer associations in the various foreign centers and the participation by manufacturers and distributors in merchandising, servicing and financing all automotive products.

The committee believes that the international markets offer wide possibilities for the many American firms which will intelligently and honestly seek its development. The committee believes likewise that the best ideals and the highest integrity of American business should be maintained and safeguarded at all times in this international commerce.

The world's needs for transportation have been little more than touched and the coming months and years are so fraught with promise that this committee hopes every real American firm will investigate without delay and determine what position it should occupy in this great business.

ACCORDING to German patent No. 810,261, to the Badische Anilin and Sodafabrik, rust can be removed from iron parts by treating them first with a dilute acid solution and at the same time or later on with a mixture made up of an emulsion of oil or grease, as, for example, 80 parts of water, 20 parts of hydrochloric acid of 20 deg. Baume and 25 parts of a 10 per cent mineral oil emulsion. The iron parts remain in the bath until the rust disappears and they are then rinsed and dried.

Practical Progress in S. A. E. Fuel Research Program

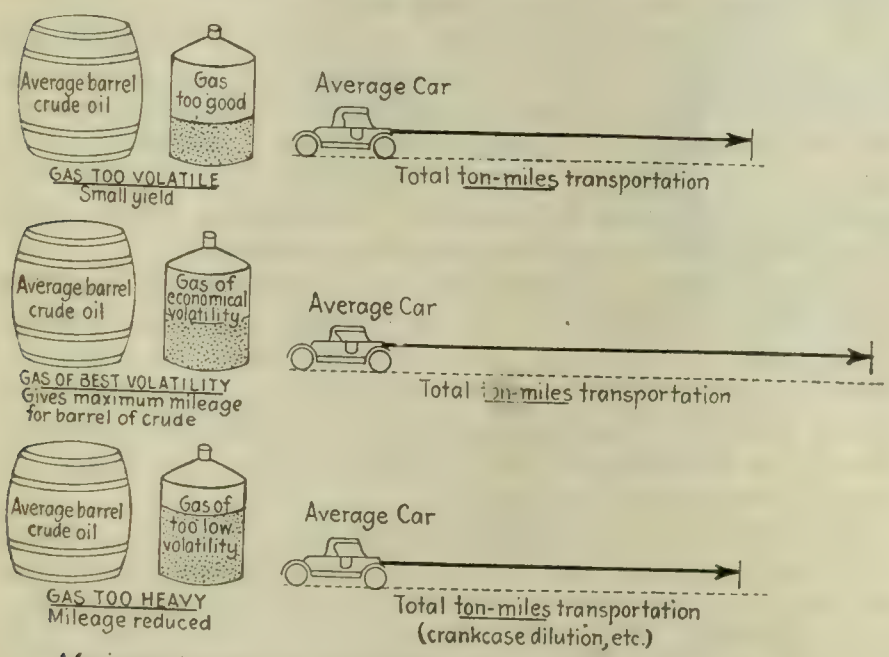
Fuel research is being carried out in four parts. Tests are under way at Bureau of Standards, and at a number of automobile plants. Purpose is to determine what sort of fuels, as regards volatility, will give the average operator most transportation miles per barrel of crude oil used.

THE automotive industry recognized some time ago the necessity for a careful study of the fuel problem. Viewed from the standpoint of the automotive executive the fuel question may properly be stated as follows:

"What sort of fuels, as regards volatility, will give the average operator the most miles of transportation per barrel of crude oil used in the production of this fuel?" Or, in more technical terms, "What are the relations between fuel volatility, fuel consumption of the average vehicle, and fuel produced per barrel of average crude?"

We know that increasing end-point increases the available number of gallons of motor fuel, supposedly decreasing the cost per gallon, and that it qualitatively increases the average consumption, thus tending to increase the total cost of fuel. Neglecting for the moment other ill effects, it is obvious that there is here involved a broad question of economic balance. When adding heavy ends increases the number of gallons consumed more than the cost per gallon, we lose.

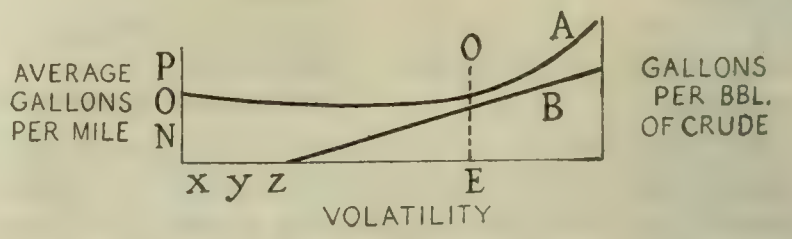
We may expect both industries to be best served when the motor gasoline produced from a barrel of crude delivers the most mileage to the average vehicle. The accompanying drawing illustrates this point.



Maximum ton-mileage depends upon the correct fuel volatility. Therefore we must find what this correct volatility is.

A barrel of crude oil will produce more or less gasoline, depending upon its volatility. If the volatility is correctly chosen, the total ton-miles of transportation per barrel of crude will be a maximum. If unnecessarily volatile, the amount of fuel will be small and the mileage less. If too poor, while the quantity of fuel will be larger, the miles per gallon will be less and the total ton-miles will be again less than the maximum.

To put the question in such a form that it will indicate the technical answer we require, we may consider two curves:



Curve A has some such form as is shown. Fuel consumption goes up at an increasing rate as volatility goes down. But we know nothing as yet about numerical values of the co-ordinates. Curve B should be more easily determined. Refining figures can show how much motor fuel of any given volatility can be produced from an average barrel of crude by any selected process. An answer to the above question requires both of the curves A and B plotted together. This shows that there will be some point, O, beyond which the increase in consumption exceeds the increase in production. At about this point the total cost of fuel will increase.

A systematic research program to accomplish the desired result **has now been started,** under the supervision of the Research Department of the Society of Automotive Engineers, which department will compile the results of the tests as well. This research program may best be described briefly in four parts:

1. Preparation of fuels.

Several of the refineries have made up batches of experimental motor fuels, the volatility of which has been decided upon after careful consideration. Four fuels are to be used, ranging in volatility from aviation gasoline to the heaviest which can be used in practical service. The U. S. Bureau of Mines is in charge of the specifications for these fuels and will make tests as to their quality, as well as control tests on fuel samples to be submitted by the various companies running the tests.

2. Road-laboratory tests of vehicles.

The United States Bureau of Standards has prepared a program of road tests to be made on each of the half dozen models of passenger cars representing the largest production. For the purpose of these tests, a most complete layout of indicating and recording instruments has been specially designed and built at the bureau by means of which accurate records of fuel consumption and all elements of car performance can be made under all conditions of normal road service. Thus the effect of the experimental fuels on both car mileage and car performance will be accurately known.

3. Service road tests of vehicles by manufacturers.

A number of makers of the cars representing the largest production are each to put through a road test program with a number of their own cars in the hands of average drivers and in average service, to supplement the above part of the program by securing average results with a large number of cars under average service conditions. The companies making these tests include Studebaker, Packard, Dodge, Chevrolet, Stromberg and International Harvester.

4. Road tests by United States Government.

A very extensive series of road tests is also being run by the Bureau of Standards, making use of fleets of Government-owned vehicles in Philadelphia and Pittsburgh. This program will require the use of about 80,000 gallons of fuel in several hundred vehicles. The three cities were selected because of their diverse road conditions, Pittsburgh being very hilly and Philadelphia almost level.

When these tests are completed, the research department of the Society of Automotive Engineers should be in a position to supply information which will make possible better economic use of the petroleum resources and longer postponement of the time when costs of fuel will retard the development of automotive transportation.

Gasoline Powered Industrial Lift Truck

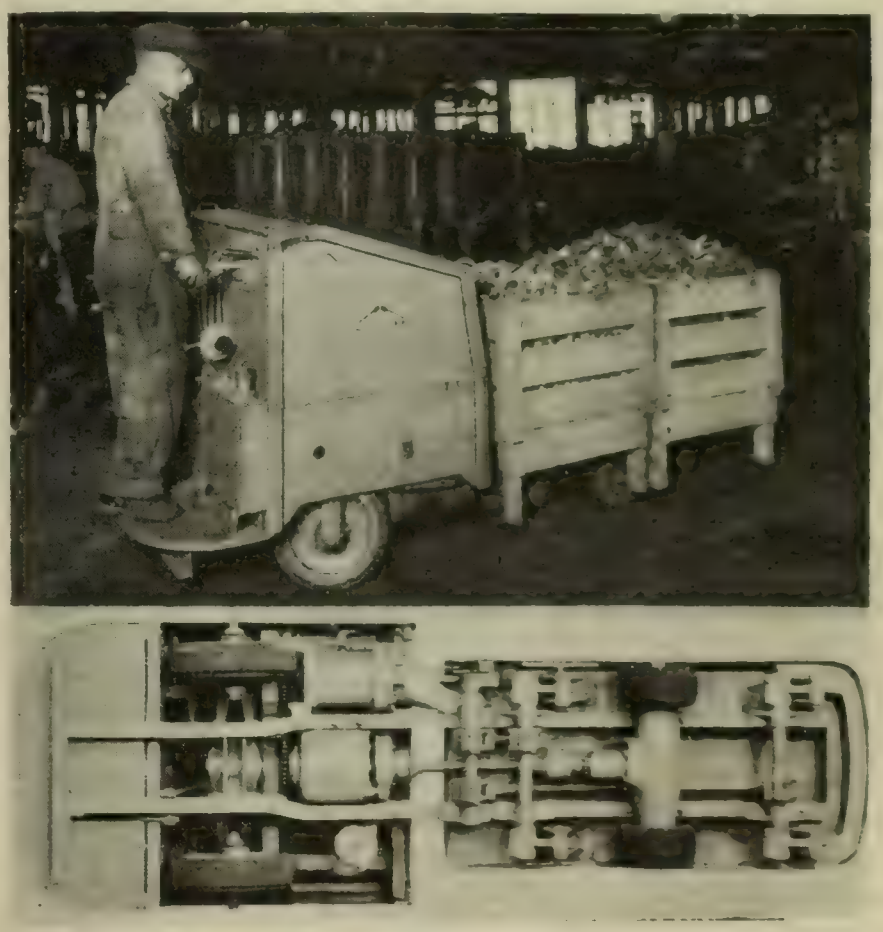
A GASOLINE powered elevating platform truck to be known as the Clark Truklift has been put in production by the Clark Tructractor Co. It conforms in appearance and uses to the electric elevating lift trucks which have been used in industrial plants for several years. Low initial cost, ease of maintenance, flexibility and continuous service are characteristics claimed for it by the builders.

The loading platform measures 26 x 54 in. and will elevate its load of 4000 lb. from a minimum of 11 to a maximum of 16 in. above the floor in eight seconds. There are automatic stops for both the up and down limits, and elevation can be stopped by the hand control lever at any point. The lifting mechanism is operated by hydraulic pressure. Power for locomotion and elevating the load is derived from a 15-hp., 4-cylinder, 3⅛ x 4½ in. tractor engine which is mounted at the rear in a closed compartment containing the transmission, the governor, the vacuum tank and the radiator.

A three-point suspension is used, the steering wheel forks being supported in a steel casting which is pivoted at the center of the frame on a chrome nickel steel pin 2 in. in diameter. The drive is through a Clark bevel gear axle fitted with ball and roller bearings. Driving wheels are cast steel with pressed-on 10½ x 5 in. rubber tires, whereas the steering wheels are of the cast-steel disk type with pressed-on 16 x 3½-in. rubber tires.

The driving and elevating controls are mounted on the rear of the engine compartment and are operated by the driver who drives standing. The brake pedal is under the driver's foot and so arranged that the Truklift stops automatically if for any reason the operator steps off while the machine is running.

The total weight of the Truklift ready for work is 2500 lb.; its over-all length is 107 in., the width 35½ in. and the height 51 in. The machine has two speeds in each direction and is claimed to be able to climb a 10 per cent grade with a 4000 lb. load.



Clark Truklift in operation and view from underneath

RECENT experiments with gasoline-driven cars and comparative costs of operation of this form of equipment and steam trains hold out the hope that passenger service now conducted at a loss on about 50,000 miles of American railroads may be turned to a profit. Including 25,000 miles of short lines and 25,000 miles of branch lines of Class 1 roads, to both of which this sort of equipment is especially adapted, about 19 per cent of the country's mileage lends itself to the change.

The first thing the motor car does is to reduce the number of the crew by half. As the wages of engineers and motormen are influenced in part by "weight on drivers," the actual pay is reduced by more than half, the motormen falling under the minimum clasification.

Pittsburgh & Shawmut has two motor cars in operation —one out of Brookville on a 98-mile run and one out of Kittanning on an 83-mile run. The wages of the crew on these runs are respectively 17½ cents and 22½ cents a train-mile. The cars average 6.8 miles a gallon of gasoline.

According to Dwight C. Morgan, vice president, in a statement to "Railway Age," total cost of operation, including wages, materials and supplies, fuel and 4 per cent depreciation, amounts to 35 cents a mile. The cost of operation of light steam equipment, based on the same method of ascertaining costs, is 71 cents a mile, or more than double.

THE Engineering Advertisers' Association of Chicago is now publishing a monthly bulletin in the interest of its members. The Bulletin gives a digest of the speeches made at the various meetings and also includes other information and facts regarding the movement of goods from industry to industry, personal notes, etc.

Two S. A. E. Sections Join in Discussion of Chassis Losses

Metropolitan and New England Section members attend joint meeting at Mason Laboratory, Yale University, to inspect chassis testing equipment and participate in discussion of paper by Prof. Lockwood outlining an investigation of the frictional losses in tires and other parts of the chassis.

NEW HAVEN, April 22.

MEMBERS of the Metropolitan and New England Sections of the Society of Automotive Engineers held a joint meeting here to-day for the purpose of hearing and discussing a paper on frictional losses in automobile chassis, by Prof. E. H. Lockwood of Sheffield Scientific School, Yale University, and of inspecting the chassis testing equipment in the Mason Laboratory. The meeting was one of the most interesting and instructive ever held by either of the two sections, and was well attended.

Most of the members of the Metropolitan Section journeyed from New York to New Haven in two rail cars built for the N. Y., N. H & H. Railroad by Mack Trucks, Inc., which were especially provided for the purpose, but others who could not be accommodated on the rail cars made the trip in buses furnished by Mack Trucks, Inc. This is believed to be the first time rail cars driven by gasoline engines have made a trip out of New York, and is certainly the first opportunity afforded any large group of engineers to make a long trip in vehicles of this description. The distance, 74 miles, was covered in 2 hr. 45 min., including stops, or at an average speed of 27 m.p.h. The buses, traveling by road a distance of 84 miles, made the trip in 3 hr. 22 min. elapsed time, or at an average speed of 25 m.p.h. Members of the New England Section met the rail cars here and were given an opportunity to make short trips in them prior to the meeting.

After a trip through a portion of the Yale campus, including in particular an inspection of the new Harkness Memorial buildings, and luncheon in the University Dining Hall, the section members were given an opportunity to examine the automobile testing equipment in the Mason Laboratory, after which a test run was made on a car to illustrate the methods followed in routine work of this character. Professor Lockwood explained in some detail the working of the apparatus and the methods followed in its use.

The engineers then assembled in the laboratory lecture hall, in which the joint meeting was held. Chairman Slauson of the Metropolitan Section presided. A brief business session followed, at which a report on the canvass of the mail ballot for Metropolitan Section officers was read. The following officers were elected: Chairman, W. E. Kemp; vice-chairman, H. W. Slauson; treasurer, W. P. Kennedy; secretary, R. E. Plimpton; members of governing board, C. B. Veal, Arthur Waterman and Joseph Bijur.

Dean Breckenridge of the Sheffield Scientific School made a brief address of welcome to the visiting engineers, and complimented Professor Lockwood upon the thoroughness and interest taken in the experimental work done under his direction.

W. L. Bean, mechanical assistant to the president of the New Haven Railroad, asked to make a few remarks regarding the rail car, stated that he believes it has a future in helping to make branch lines which are not now profitable show a profit, or at least operate with less loss than heretofore. He believes that only a start has been made in this direction and that considerable development work will be required before a wholly satisfactory rail car is developed, but has great hopes for success in this direction. With a sufficient equipment of satisfactory rail cars he believes that the New Haven road can show a saving of about $500,000 annually on branch lines now operated at a loss.

Professor Lockwood then presented his paper, portions of which will probably be printed later in these columns. He first described briefly the apparatus used, this apparatus being the same as that fully described in AUTOMOTIVE INDUSTRIES last week. The methods used are similar to those employed in power tests of cars on the rear wheel dynamometer, many of the results reported having been obtained in routine tests of cars, several of which tests were reported in the article in these columns last week. Professor Lockwood stated that it had been found possible to separate bearing and some other friction losses from tire losses by allowing the tires to rest very lightly on the driving drums and by driving them through the drums in this manner to measure approximately the bearing loss only, since, when the tire is not deformed by passing between rim and drum, the loss in the tire is practically nil.

By driving the front wheels and the rear wheels, including axle parts, propeller shaft and main shaft of gearset, with gears in neutral and measuring the tractive force required, it has been found that, for fifty passenger cars tested from 1916 to 1921, the weight varying from 2000 to 5000 lb., the rolling resistance, R, is given by the following equation:

$$R = 30 + 0.012\,L$$

where L is the weight of the vehicle in pounds.

In the case of seven 1922 passenger cars in good condition, equipped with cord tires, it has been found that

$$R = 0.019\,L$$

while for four heavy trucks, three of which are of 7½-ton capacity, equipped with solid rubber tires,

$$R = (30 \text{ to } 70) + 0.018\,L$$

Professor Lockwood believes that the well designed and constructed car of the future will have a rolling friction of about $0.016\,L$.

The rolling friction of the four tires (only) of various vehicles has been found to be about as follows:

Cord tires, $0.012\,L - 2$.
Fabric tires, $0.018\,L - 3$.
Solid rubber tires, $0.016\,L$.

It will be noted from these figures that fabric tires offer about 50 per cent more rolling resistance than the cord

type, while solid rubber tires offer about the same rolling resistance as well inflated fabric tires.

The frictional resistance of the bearings in the front and rear axles, gears and other parts driven when the rear wheels are turned with the gears in neutral (all running idle) has been found to be about 0.06 *L*. The average frictional loss in the following cars—Overland, Mercer, Buick, Franklin, Haynes, Oldsmobile and Cadillac—was found to be divided about as follows:

	Per Cent
Total tire friction	66
Bearings, axle parts driven from it (running light)	34

Speed has been found to have but little effect upon the rolling resistance of either tires or bearings, but of course the power loss increases in substantially direct proportion to the speed. Thick wall inner tubes add slightly, 5 to 10 per cent, to the total rolling friction of tires, and a rough tread adds about the same amount of frictional resistance, over the smooth tread, as does the thick wall tube, this applying, of course, to tires which are similar in all respects except as to the character of tread.

Partly worn pneumatic tires have been found to have about the same rolling resistance as when new, but partly worn solid tires have less resistance than new ones.

All sizes of pneumatic tires, Professor Lockwood said, have, in proportion to their carrying capacity, substantially the same rolling resistance, providing each size is inflated to the pressure recommended by the maker. Rolling resistance decreases with increase in inflation pressure, but the difference is more marked at the lower pressures. At high inflation pressures a given increase in pressure decreases the rolling friction more in the fabric than in the cord type of tire.

It was pointed out that the rolling resistance of a vehicle is often materially affected by changes in the temperature and consequently the viscosity of the lubricant.

Discussion

In the discussion which followed presentation of the paper, Major Ireland of the Motor Transport Division, Quartermaster Corps, U. S. A., stated that Professor Lockwood has been co-operating in the work which he, Major Ireland, has been doing on behalf of the National Research Council in studying the various factors relating to the rolling resistance of vehicles under various conditions. The results of this work, which includes in particular an effort to determine the effect of the character of road surface upon rolling resistance, are to be published as rapidly as possible.

Herbert Chase stated that he had been given an opportunity recently to study the methods followed and results obtained in vehicle tests made by Professor Lockwood and to criticise these in the light of past experience along similar lines. He commended the work already done, which he said should prove of great value to the industry as well as to individual engineers, but suggested that better methods of determining wind resistance be developed and that steps might well be taken to determine whether or not there is, as seems likely, a greater loss in tires and other power transmitting parts when these are driven under load instead of when running light, as in tests conducted by Professor Lockwood to date. Chase suggested that windage might be measured by driving the car on a level road at various speeds, noting the manifold depression and air speed (to determine the effect of head or tail winds) and that the car then be brought to the laboratory and the test repeated at the same speeds and manifold depressions, the power delivered at the rear wheels and that absorbed by the front wheels being measured. The difference between the last two quantities would then be a measure of the power lost in overcoming wind resistance. Suggestions for measuring the power lost in gears and tires under driving loads were also made, and the importance of developing engines which are efficient under the light loads of normal average running was pointed out.

In answer to a question by C. F. Scott regarding the effect of drum curvature upon tire losses, Professor Lockwood said that he had no data upon which to base a reply. He said in regard to a similar question regarding the effect of tire diameter on tire losses that he would expect the difference in power consumed for a given cross section and weight to be very small, if any existed.

Answering a question as to the reason for abandoning a device for direct measurement of drawbar pull which was formerly used, Professor Lockwood said that the resistance of the front tires to the forward motion of the car introduced a factor which seriously affected the results obtained, consequently the weighing through prony brake torque measurements had been substituted.

C. T. Myers suggested the use of an accelerometer for measurements of windage. This instrument can be used for the purpose when the amount of other resistance factors determined in the laboratory are known.

Others who entered into the discussion drew attention to the losses in springs, and the increased losses in tires which result from an irregular road surface. While the existence of such additional losses are recognized, Professor Lockwood said, he has not given consideration to their measurement.

Aluminum Investigations of U. S. Bureau of Mines

A STUDY is now being conducted by the Bureau of Mines of the causes of, and methods for the prevention of, cracks in light aluminum-alloy castings. The investigation as planned includes also the determination of the contraction in volume and of the linear contraction of a series of commercial aluminum alloys, as well as an examination of the cracking tendency of the alloys when poured into different kinds of molds. This study is being made in co-operation with the General Motors Research Corporation and a number of automotive and other foundries. The investigation is part of a general study of defects in aluminum-alloy sand castings. Data have been gathered from a number of foundries as to the causes for cracks and the best methods of prevention. A number of measurements have been made in the laboratory on the contraction in volume and piping effect of aluminum alloys and also on their linear contraction in graphite molds. The problem is in course of investigation.

ROBERT J. ANDERSON, metallurgist of the Bureau of Mines, Pittsburgh, Pa., is examining methods suggested for the deoxidation of aluminum and its light alloys. The presence of aluminum oxide in the metal or in its alloys seems to lead to defects of various kinds, and the problem is under consideration for study with a view to obtaining, if possible, a commercial deoxidizer. Preliminary experiments have been made with the use of misch metal (ferrocerium), and with boron suboxide for the deoxidation of aluminum-copper alloys. The former material appears to possess some possibilities, and further experiments are to be made.

Dealer Mortality in Automotive Field Not Exceptionally Large

Considering the rapidity of development in the automotive industry, dealer mortality is not high as compared with that of older industries. Greater stability is necessary, however, to reduce selling costs. Departmentalized establishments growing more rapidly than specialized shops.

By Harry Tipper

THE term "automotive dealer" is not thoroughly expressive of the automotive retail establishment and the work which must be done in this field, because the term is too strictly limited to an understanding of selling. In an earlier article we pointed out that the automotive business had revolutionized the work of manufacturing development in several ways because it is the first time in the history of the industry that a complicated machine has been sold in enormous numbers and used by amateurs. The whole retail field in the automotive industry is concerned with the sale and maintenance of a unit system of transportation under the control of the individual and available for his purposes with great flexibility and convenience. Consequently, the sale of the merchandise, whether it be car or truck, parts accessories or supplies, is not the end of the transaction, but the beginning of the contact.

The value of the particular article is subject to the use of the transportation system and the big job of the industry is to make the transportation system more efficient and to keep it in shape.

In the ordinary lines of retailing the service which has been added is a very subsidiary part of the proposition and the main function of the retailer is to provide a reasonable selection of commodities in a convenient store; see that the customers know about the commodities in this store; and sell and deliver the articles to them. In 90 per cent of the cases this closes the transaction and any further service is of minor importance. In the automotive field, on the other hand, value of the retailer in the sale of the goods is measured by his usefulness in keeping the car or truck running or in adding to the efficiency, convenience, or comfort of using the transportation itself. From the complete car and truck to the small accessory, every article sold in this business is measured by its value in the work of transporting passengers or freight in the most convenient, comfortable and flexible fashion.

This business in its growth was faced with opportunity so large and diversified that the big problem was to speed up the production and distribution so that the waiting public could be satisfied at the earliest date in their demands for this species of transportation. The business grew with great rapidity, revolutionizing methods and seizing upon possibilities to accelerate the speed of its own growth so that the customer could be provided with this convenience of transportation as fast as possible. With this rapidity of growth, a great many differences occurred in this field in a larger measure than they occurred in the older fields where there has been an opportunity to settle down considerably further and where the systems have been more firmly solidified.

The number of retail establishments has grown with great speed and as a consequence of this growth the number of people coming into the business of retailing in the automotive field has been very large and the mortality has been considerable. For many reasons the automotive retail field was an attractive one to the man who desired to be working independently. It was not governed by tradition. It was not slowed up by being solidified into the system. It was experimental, dynamic and offered large opportunities for the restless man who found the ordinary course of business too slow or too monotonous for him.

The men who entered this retail field came from all lines of business with all sorts of training. They entered a business with new problems, and no set methods of doing anything, so that they were obliged to experiment and find out the best way of dealing with their own difficulties. If any business man had been told that the retail distribution could be established within 15 or 20 years and grow from a small experimental possibility to the third largest industry, the thing would have been counted impossible. What has been done in this field is remarkable. It should not be remarkable that there are many differences in the retail establishments, many different tendencies running parallel to each other among which a manufacturer may be misled unless the strength of these various tendencies and their directional movement is thoroughly understood.

There is a general impression that people who go into their own business represent largely the more efficient individuals. This is not altogether so. There are many men who are restless and dissatisfied with the ordinary conditions of their employment, who will find an opportunity to escape from these conditions by entering a retail field where the capable requirements are not large and there is apparent necessity for more workers. In the years from 1910 to 1920, the automotive field offered a great visible opportunity to many of these men. Mechanics, salesmen, restless men from other lines of business, men from other retail lines—all flocked into the business of retailing, either the sales or the service required to perfect this unit system of transportation.

These conditions have brought the retailing of automotive apparatus and service to the point where the problem begins to show itself and the retail establishments must define themselves into a more orderly system in order to meet the future requirements. In other words, the work done by the retail establishments in the automotive field in the rapid growth up to 1921 has not been at the maximum requirements or concerned with

the maximum problems of the field. During such a rapid growth, many elements became involved in the field and many tendencies visible that are simply elements of growth and may pass out when the field defines itself more clearly.

The depreciation in 1921, coming as it did, after a period of unparalleled growth, has caused the manufacturer, the jobber, and the retailer to question and to analyze. This questioning analysis is resulting in the experimental development of many new alignments or realignments in the endeavor to secure a more efficient distribution or a more concentrated service value. These new alignments are not always developed along sound economic lines and some of them may only add to the confusion in the field instead of defining and simplifying. The present conditions to be observed are these:

1. The number of retail establishments in the automotive field is very small in proportion to other lines of business for the amount of money and effort involved, and it is probable that the number of retail establishments should be considerably larger in order to do all the work required for the maximum service of this unit system of transportation.

2. There are two apparently divergent tendencies to be observed in retailing:

(a) The tendency to operate specialized shops

(b) The tendency to operate departmentalized establishments

These tendencies need to be carefully weighed and considered in order that their significance may be understood. There are stores devoted entirely to supplies, accessories, etc.—sales establishments entirely. There are retail establishments devoted entirely to radiator repairs, machine repairs, electrical service, etc. There are also many retail establishments carrying an accessory department, a repair department, space for storage, and the other necessary elements for the work of keeping the automobile and the truck running.

A general examination of the situation shows that the departmentalized establishments are growing more rapidly than the specialized establishments, and they represent a very much greater proportion of the worth-while retail developments. This is a logical tendency because the bulk of the automotive transportation equipment is owned in the smaller towns and cities—where the departmentalized establishment possesses only sound and large possibilities of growth in development. The logical sound development of the business in all except a few large cities of the United States is along the lines of well organized, departmentalized retail establishments capable of providing the car owner with his new cars, his service, his supplies, his repairs and maintaining complete contact with the individual customer.

One of the elements of greatest importance in the retail field has been the mortality among retail establishments and therefore the greatest difficulty in the manufacturer's maintenance of the proper distributing outlets, both in character and in number. There is a good deal of misconception concerning this mortality. Many of the manufacturers in the automotive field appear to be under the impression that the mortality in this field is entirely out of line with the other retailing fields.

IN ordinary lines of retailing, service is a subsidiary part of the sales transaction. The main function of the retailer is to provide a reasonable selection of commodities in a convenient store; to see that customers know about the commodities; and to sell and deliver the articles to them.

In the automotive field, however, the value of the retailer is measured by his effectiveness in keeping the car or truck running or in adding to the efficiency, convenience, or comfort of using the transportation itself. It is this fact that makes a careful study of dealer problems essential to effective manufacturing development.

The mortality in the automotive field is higher than it is in the older retailing fields. It should be considerably higher on account of the rapidity of its growth and the very few years of its existence. It is not very much higher, however, and the indications are that in proportion to its age, it possesses as much stability as the older fields of retailing. In the investigations conducted just before the war the average percentage of grocery and hardware stores operating on insufficient capital reached between 30 and 35 per cent, and in the large cities the mortality in this type of store was very considerable. It is estimated that approximately 40 per cent of the retail establishments in the automotive field are insufficiently capitalized, have no credit, and are therefore of doubtful stability, while the actual mortality in the field is estimated at about 33 per cent.

While this mortality is not startling, it is a very important question to the manufacturer because it means that upward of 20,000 dealers went out of business in 1921 and as many, or more, came in. All manufacturers are interested in limiting the losses involved in this development and maintaining themselves in the retail field in accordance with the increasingly efficient and stable elements. The field of retail establishments should be analyzed, not only as to present conditions and stability, but also as to the probable future developments, so that the contact of distribution can be maintained without feeling the full effects of the mortality nor the various difficulties involved in the experimental tendencies to be observed in the automotive industry.

Room for More Cars in Peru

THE Peruvian market for automobiles has, in the past, been largely confined to Lima, the capital, and one or two other fairly large cities. This has been largely due, it was brought out in a recent issue of Commerce Reports, to the fact that highways connecting most interior points are in poor condition. This condition bids fair to be overcome, however, as the government is planning to build a series of roads in the interior connecting the more important places. Such a move should go a considerable distance toward increasing the potential car market in that country.

The best season for the sale of cars in Peru seems to be during June and July, just before the celebration of the national fiestas. Money is more plentiful from August to October, when the cotton crop is marketed. Several obstacles are to be overcome in selling cars, chief among which is the high cost of upkeep. Gasoline is expensive, and service stations, especially in outlying districts, are rare things. Nevertheless, American cars have obtained a firm foothold and there is little to fear from foreign competition. The pioneer period of the automobile has passed, but as the interior sections are developed so will the sale of automobiles and equipment develop.

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David Beecroft, Directing Editor
U. P. C. Building, 239 West 39th Street, New York City

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Automotive Engineers and Highway Development

PROPERLY constructed and properly laid out roads are essential to automotive progress. In the past the roads have been built almost entirely without the advice or assistance of the automotive engineers who are responsible for the vehicles which must run over the highways. The civil engineers who have borne the entire burden of road development have not always had in mind sufficiently the needs of the automotive vehicle for which the roads were being built.

The automotive engineer has a definite and constructive part to play in road development. His assistance is needed in solving such problems as the following:

1. Relation of the vehicle to the road. The factors in vehicle design, such as weight distribution, springing, tire equipment, can be properly treated only through the efforts and co-operation of the automotive engineer.
2. The cost of vehicle operation, including fuel, service, upkeep, etc., is important in its relation to the cost of highway construction and maintenance.
3. Highway safety and education. Insofar as safety to the public depends upon vehicle design, condition and efficiency of brakes, ease of control, etc., the subject is one to be considered by the automotive engineer responsible for design.

A number of research problems are involved in these subjects, which demand the attention and consideration of the automotive engineer. It is time for the designer of the vehicle to play a more important part in determining methods and policies in developing the roads over which his vehicles are to travel.

The Industry Watches Its Step

STOCK chasers are on the road again for motor vehicle manufacturers trying to speed up deliveries of supplies. Large quantities of the smaller units and accessories used in passenger cars are being shipped by express.

Thus, in some respects, the industry has reverted to the conditions which prevailed at the peak of production in 1919 and early 1920. Production in the passenger car plants which build the more popular lines is rapidly approaching capacity when it has not already reached that point. As a consequence desperate efforts are being made to speed the delivery of supplies.

There are important differences, however, between the conditions now and those when the industry was at the zenith of its output. They are:

Manufacturers are not bidding against each other to get much needed material.

Manufacturers have learned their lesson and they are determined not to tie up their working capital in inventories which will be unwieldy if there is a slump in sales.

When all supplies are purchased on a hand-to-mouth basis there is little danger of inventories getting out of balance.

The larger builders are piling up no reserves of completed vehicles.

Parts makers are steaming ahead. Many of the companies which supply the larger passenger car builders, have reached capacity production and a few are working night shifts. Almost every manufacturer in that field has about all the business he can handle. They are in the same position as the vehicle makers, however, for they don't propose to build up big inventories when the commitments given them do not run more than sixty days ahead at most.

The improvement in business in the past two months has been astounding. Production is approaching its peak load, but the industry as a whole is moving cautiously and it is prepared to shorten sail at the first sign of a squall.

Even the most optimistic do not expect production can go on indefinitely at the present rate. They can see no slump ahead for at least sixty days, but they believe there is little doubt there will be a seasonal falling off in sales with the coming of July.

It probably would have been better for the industry if prosperity had not returned so rapidly and so suddenly. It is running too far ahead of the industrial fabric as a whole, although the country as a whole has made amazing progress since the close of January. It will, perhaps, be just as well if there is a slowing up in the third quarter to give a breathing spell and let the rest of the country catch up.

No matter what happens, it is certain that 1922 will be a better year than 1921, which wasn't so bad. If there is a slump in the third quarter, whatever is lost undoubtedly will be recovered in the last three months of the year.

With the Minnesota branch of a truck company selling more light delivery vehicles in the first fourteen weeks of the year than any other branch in the country, there is no doubt of what the farm market for motor vehicles will be by the close of the year.

Financing Foreign Shipments

AUTOMOTIVE export trade has definitely turned the corner and is well on the upgrade. This fact is shown by every recent study of statistics and conditions. There are many problems before the American automotive exporter, however, which must be properly solved if our export trade is to be built upon the firm foundation that is desirable.

American firms in the past have borne very little of the burden of financing in their foreign business. Usually cash in New York has been demanded and obtained before the shipment was sent. Other nations exporting automotive products have usually extended more liberal terms to the foreign buyer.

This phase of exporting is particularly important at the present time. A representative of an important automobile exporter, after interviewing bankers and export houses in New York recently, voiced the opinion that it would be necessary for American automobile firms to take some risk in financing foreign shipments if they are to cash in on the big foreign market which undoubtedly is available. The advisability of such a step gets back eventually to the accuracy of the knowledge possessed by the domestic firm concerning its representatives in foreign countries and concerning the foreign markets.

A recent report fom Spain sent out by the Automotive Division of the Bureau of Foreign and Domestic Commerce after stating that "American automobiles will probably continue to enjoy preference in the Spanish market" points out advantages enjoyed by our competitors for automotive business and adds:

"The method of doing business of these competitors should be another factor of concern. They are sending the cars on a consignment basis, and in view of the fact that Spanish dealers cannot be sewed up in ironclad contracts with American houses at the present time, these competitors are at a big advantage."

The matter of financing foreign shipments is one for individual treatment, of course, but there is every general indication that the American automotive exporter in the future will have to operate more as a real merchant—as in his domestic business—and less as a mere supply house for cash purchases.

Better Starting Facilities Needed

WE are more than ever convinced that every car produced to-day should be fitted with some device beside a choke to facilitate starting. Even in temperatures such as those which prevail in most of the northern States during nine or more months of the year many if not most makes of cars require an undue amount of cranking before a start is effected. As a result several difficulties arise which might be avoided and these are of a kind which often cause the owner a maximum of dissatisfaction, not to say disgust. Every manufacturer who aims to give the ultimate consumer of his product the greatest satisfaction from its use, and only such can hope to succeed in the long run, should give this matter careful consideration.

Failure to make a quick start usually results in prolonged periods of cranking which discharge the battery and thus react unfavorably, to a greater or less extent, upon the ignition system, adding a further uncertain element to the starting conditions. When the choke is closed, as it frequently is during most of the starting period, large quantities of fuel are discharged into the cylinder, much of it ultimately reaching the crankcase, where it dilutes the oil and helps destroy its lubricating value. It is probable also that the flooding which comes from excessive use of the choke results in the formation of a mixture which is so rich that it cannot be ignited even by the best spark that can be produced. Until this over-rich mixture is expelled from the cylinders no start is possible. This leads to the suggestion that the choke operating mechanism be fitted with a spring so that it will return to its open position when released by the operator. A small dashpot might be added in some instances if the introduction of a time element proves desirable. In any case some means should be used to make the occurrence of flooding less likely.

Priming devices with and without electric heaters have been successfully employed in some instances and a few cars are provided with some special form of vaporizer or ignition device which is operative only during the starting period. Many cars start easily under most conditions without any special auxiliary apparatus, while others, sometimes of the same make, are always hard to start. It is not always apparent why this difference exists. No doubt different reasons apply in different cases. A study of these reasons should be made a part of any investigation of the subject and every instruction book should contain explicit instructions to guide the driver in making a quick start.

A discussion of the subject in the Forum by engineers who have had experience in this line will be welcomed and should prove profitable to all concerned. We know of no one improvement which seems likely to yield larger returns in helping to bring about freedom from trouble of a very annoying nature. Fuels marketed in this country have a lower percentage of volatile fractions during the summer months. Consequently the problem is one of immediate importance even though it is usually more serious in cold weather. It is not too soon to start efforts to solve it now.

Sales Boom Brings Parts Shortage

Affects Specialized Car Field Seriously

Stock Chasers on Road — Shipments by Express—Orders by Wire

By D. M. McDONALD

DETROIT, April 25—Passenger car business in the Detroit district has progressed to a point where the already slender store of parts and materials has been reduced to the vanishing point in a great many instances and in some cases has been entirely wiped out. The big battle of the moment is not to get business, but to get material.

Passenger car makers again have stock chasers on the road in an attempt to speed up deliveries and many shipments of smaller parts and accessories are being ordered by express.

Car makers in the specialized unit field are particularly hard hit for the shortages are not confined to any one unit. In other cases the body makers have fallen behind, but the serious shortage is with the specialized unit maker.

This shortage is most serious because of its origin in the basic metal and the impossibility of getting around the time required for treatment of the metal before it can be made up into the parts. A sudden shortage of malleables has been discovered in more than one plant and malleable stores cannot be replenished over night.

Need of Skilled Workers

In the body making field the serious shortage is skilled workers. Newspapers here are carrying advertisements for men specializing in the various processes of body making, but the ranks are very slow in filling. Some companies feel a shortage of space which will be overcome by the addition of new buildings, and in the meanwhile body contracts are being sub-let by manufacturers or placed elsewhere than in the crowded shops by the car maker.

The Timken Axle Co. is installing new equipment in several of its units to meet the onslaught of orders. Deliveries have fallen behind, it is admitted, but with the new equipment the company will get back to an even footing soon after May 1 and will be entirely caught up by May 15.

(*Continued on page* 940)

Business in Brief

NEW YORK, April 25—A "profound improvement" in business conditions is reported by the Department of Commerce after a compilation of the latest commercial and industrial statistics. Optimism is based upon the better fundamental conditions throughout the country.

Two outstanding features noted by the department are the marked increases in iron and steel activity and the big increase in construction.

Reports from all steel centers indicate that demand is constantly growing. Production ranges from 75 per cent to 80 per cent of capacity, and incoming orders are considerably in excess of production. The coal strike appears to have affected industry but little.

Freight car orders placed by the railroads of the country thus far this year aggregate 51,791, as compared with a total of only 28,358 for all of last year. It is expected 20,000 more will have been ordered by May 1.

Unemployment is rapidly decreasing and there is an actual shortage of skilled workers in many lines.

More life is apparent in primary markets for textiles and cotton goods.

Lumber and building supplies are leading the way, but the market for agricultural implements and vehicles is stronger than at any time since the slump in farm prices in 1920.

Crop reports are irregular, as they always are at this time of the year. They are based largely on weather conditions, and the late arrival of spring weather as well as floods in many sections. On the whole, however, they are favorable.

Stocks are somewhat irregular, but prices, in general, continue to advance. Bonds are active and firm, money easier and exchange steady.

Bank clearings for the week ending April 20 aggregated $7,035,495,000, a gain of 5 per cent over the preceding week and 15.2 per cent over the same week last year.

Total car loadings for the week ending April 20 showed a material decline because of the coal strike, but the loadings of miscellaneous freight and merchandise showed a continued gain.

Production in May Will Be Up to April

Passenger Car Factories Near Capacity—Truck Plants Reach 50 Per Cent

By JAMES DALTON

NEW YORK, April 25—With April production of motor vehicles running far ahead of March it now is certain that May will show an equally large output, although the percentage of gain over the same period in 1921 will not be as large as in the first quarter. Factory after factory is speeding up its output and preparing for still larger schedules next month.

Manufacturers of many of the more popular passenger cars are approaching capacity. Sales of some of them are limited only by output. Dealers in several lines are unable to promise deliveries in less than two or three weeks. The bulk of the business remains in the lower and middle price classes, although a few companies in the higher price field are approaching capacity operations.

A majority of the companies which produce trucks on a quantity basis are running at 50 per cent of capacity. It is confidently predicted that, if the general business revival continues until fall at the present rate, commercial vehicles will be absorbed as fast as they can be turned out. The demand for light trucks which began two months ago has increased rapidly, and sales of heavy-duty vehicles now are becoming brisk, chiefly for highway and building construction work.

Tractor Business Better

Price reductions in the tractor field have stimulated business to a surprising degree. At least three companies are operating at capacity in the production of the lighter models. Their ready sale is evidence of improved conditions in the agricultural districts.

At the beginning of April only a comparatively small number of parts plants were operating at more than 50 per cent of capacity. Since then the number in this class has increased amazingly. Several are running full blast, and probably 70 per cent of capacity would be a fair average for

(*Continued on page* 940)

Stockholders Ratify Willys-Overland Plan

No Dissenting Vote in Authorizing Bond Issue to Fund Bank Debt

TOLEDO, April 24—Preferred stockholders of the Willys-Overland Co. at a special meeting here to-day ratified without a dissenting vote the proposal made by the directors for funding of the bank debt through the issuance of $17,500,000 of 7 per cent first mortgage bonds, to mature Dec. 1, 1923. The bonds will be taken up by the banks which had extended the company's loans for several months and will have the effect of pledging the fixed assets where formerly only current assets were involved as security for the loans.

The plan was developed by the board of directors after a majority had been drawn from the ranks of Toledo business men. Plans for the liquidation of securities owned by the company and for conversion of real estate holdings into cash with which to pay off the bonds are going forward, according to plant officials.

The production of the plant here has passed the 400-a-day mark, and the total for the second quarter of the year will surpass 30,000 cars, which is more than double the production during the same period a year ago. More than 8000 men are now at work in the plant in this city, and more are being added as rapidly as materials can be secured to boost production schedules.

Secretary L. A. Miller announced that enough assents of preferred stockholders of the Willys-Overland Co. to the reorganization plan for the Moline Plow Co. are being received to insure adoption of the plan.

Tire and Valve Companies in Canada to Consolidate

OTTAWA, ONT., April 24—Within a few days it is expected that the merger of the Lion Tire & Rubber Co. and the Mead Universal Valve Co., Ltd., will be agreed to by the two lots of shareholders and the company be incorporated under Dominion charter to be known as the Lion-Mead Tire & Rubber Co., Ltd.

A site for the factory has been located in Hull, P. Q., and all plans are ready for the start when the merger is assured. The plant will manufacture tires, tubes, valves and other accessories.

Stockholders Soon to Get Plans of Pierce-Lafayette

NEW YORK, April 24—Details of the plan for the merger of the Pierce-Arrow Motor Car Co. and the Lafayette Motors Co. are being worked out as rapidly as possible and probably will be submitted to stockholders in a short time. The consolidated company, in addition to an exchange of stock, is expected to issue $10,000,000 or $12,000,000 worth of notes and bonds. The proceeds will be used to pay off bank loans of Pierce-Arrow which approximate $8,000,000, as well as the bank loans of the Lafayette company, and provide working capital in addition.

The capitalization of Pierce-Arrow consists of $10,000,000 in 8 per cent preferred stock and 250,000 shares of no par value common. It has no funded debt.

The Lafayette company has outstanding $4,000,000 7 per cent preferred and 40,000 shares of no par value common. It also has no funded debt.

Priority in Lincoln Claims Enters into Case

WASHINGTON, April 24—Attorney General Daugherty has instructed Assistant Attorney General Riter to go to Detroit immediately to take special charge of the government's case against the old Lincoln Motor Co. and to press the claim vigorously.

Exception to the receiver's allowance of the claims of the 900 creditors will be taken by the government, it was announced. Daugherty called attention to the fact that the receiver already had approved claims filed by other creditors amounting to more than $4,000,000, while nothing had been allowed to the government.

"The government's claims, instead of sharing with the others pro-rata, should have taken priority," he said. Should the government's claim for priority be allowed, it will result in the other 900 creditors losing heavily, the Department admitted.

Caution Is Still Necessary in Returning Industry to Full Strength

By B. F. EVERITT,
President of the Rickenbacker Motor Car Co.

Detroit, April 24.

THOUGH there is a tremendous buying field for automobiles to-day and the sick child is apparently again a thriving infant ready to resume its development where it left off two years ago, it is unwise for manufacturers to assume too much from appearances. There is still a great deal of nursing to be done before the infant is as well as it should be. There is no reason to think that the malady has as yet entirely disappeared.

The manufacturer must guard against the accumulation of the evils of sudden prosperity and keep his sails trimmed to meet every wind.. Rickenbacker Motors and probably every motor car manufacturer is operating to-day with a large number of orders ahead. It is our intention to keep our orders definitely ahead of output. In this way we will know where our materials are at all times. When sales fall off our manufacturing plans will always be within control.

The experience of the past two years has shown the inadvisability of stocking up dealers with cars to help the factory in unloading merchandise commitments and inventories. Factories to-day must place their organizations on a definite footing and fix the remunerations on a basis commensurate with the actual value of the services rendered. Mistakes have been made in the past under the impetus of boom periods.

Then, too, there has been a tendency to stagnate the working efficiency of organizations by adding too many assistants. Lack of personal touch has been a serious drawback to the industry in the past, particularly in the few years preceding the 1920 crash. The automobile has passed from the field of experimental products. It is now a staple, necessary in every field of human endeavor. Cars will be made better and better as time passes and there will always be a sane and steady increase in demand. By gauging manufacturing strictly by market requirements, there will be no recurrence of the glutted periods through which we have just passed.

High Freight Rates Check Western Sales

Edsel Ford Says They Must Be Lowered to Complete Business Improvement

NEW YORK, April 20—In the opinion of Edsel B. Ford, president of the Ford Motor Co., who came here to attend a demonstration of Fordson tractors in Long Island City, transportation costs are checking orders from the western agricultural states for cars, trucks and tractors. He believes freight rates must come down before business difficulties can be ironed out completely.

The Fords do not believe the fuel problem will become serious, even should there be a shortage of gasoline. Their company now is selling considerable benzol which is mixed half and half with gasoline for motor cars. It also has conducted encouraging experiments with alcohol.

Ford's European business has shown a material increase in the last month and a half, and sales abroad now are running from 11 to 12 per cent of the total business. Ultimately the Ford company will probably build plants both in Germany and Russia, but it has no intention of doing so in the near future. Ford made a significant statement that the company hopes to develop its foreign business to such a point that it will prepare practically the maximum production of parts the year round at its works in Detroit.

Last Scripps-Booth Car Leaves Factory

Plant Inventory Disposed of—G. M. C. Provides for Servicing Discontinued Line

DETROIT, April 22—The task of disposing of the inventory of Scripps-Booth Corp. has been accomplished and the last cars of this make to be manufactured have been shipped from the factory here. Although it was generally known for some months that the Scripps-Booth models would be discontinued, demand for the cars continued until the entire stock was sold.

General Motors Corp. decided to discontinue because the market for that type of car was not broad enough to sustain quantity production. Adequate provision has been made by General Motors for the service requirements of all Scripps-Booth cars now in the hands of owners.

A complete stock of all parts of the cars will be handled by the Scripps-Booth Service Division of General Motors with stockrooms in the former Northway engine plant and headquarters in the General Motors Building. Some branch service stations will be located in important cities of the country when complete servicing plans are worked out.

Dealers Handling Other Products

Many of the former Scripps-Booth dealers are now handling other General Motors products. In Detroit the Scripps-Booth branch has taken over the used car business of Oakland and is also handling Samson tractors and trucks. Places have been made in the General Motors organization for many of the former Scripps-Booth factory personnel. A. H. Sarver, president and general manager, is continuing for the present in charge of Scripps service work.

The Scripps-Booth plant is being rapidly equipped for the production of Buick closed body cars. Parts for all Buick closed cars will be shipped from the Flint plant and assembled in Detroit. This has been done to provide greater factory space for Buick and to do away with the necessity of shipping the bodies, built in Detroit, to Flint.

G. M. C. Will Complete Truck Plant at Pontiac

PONTIAC, MICH., April 22—Decision has been reached by the General Motors Corp. to complete the building expansion program at its truck plant here. The expansion was decided upon and an appropriation made in 1920 which contemplated enlarging the capacity of the plant to 25,000 trucks annually. This was carried forward to the point that the new machine shop was finished and equipped, and the new assembly line arranged.

The test house had been partly completed before the cessation of building and is now to be pushed forward. It will make possible a capacity of 100 trucks daiiy. The plant has been operating on a production of 35 machines daily recently, a number that will not be sufficient if the present run of orders continues for a few weeks longer.

Very good prospects for business on the new motor-bus model being turned out are reported by the sales department. The new bus is making an appeal because of the design, aimed to prevent sidesway and to promote comfort and ease of driving.

New Harley Financing May Prevent Receivership

SPRINGFIELD, MASS., April 24—That the affairs of the Harley Co. are in a way to be adjusted satisfactorily without the appointment of a receiver was stated to-night by an officer of the company. Arrangements are said to have been made with a New York bank to write a $1,250,000 mortgage to take up the first mortgage for $725,000 held by the Hendee Manufacturing Co., and cover a bond issue and provide some additional working capital.

The matter of a receivership, for which a petition was filed recently in the United States Court in Boston, has been postponed until May 1. It is believed that the refunding of the company's indebtedness will have been made in the meantime, and the occasion for a receivership removed. The company has just booked a substantial order for drop forgings for automobile parts to be delivered to a Cleveland manufacturer.

Oakland Will Adopt Flat Rate Generally

PONTIAC, MICH., April 24—The Oakland Motor Car Co. has decided to put into effect as quickly as possible a new plan of universal "flat rate" charges for service. The majority of its branches, distributors and dealers already have established this plan. Specialization on a piece rate basis is expected to do away with complaints from motorists that they never have any idea what a specific repair will cost until after the job is completed.

Another feature of service work by the Oakland company is the training of mechanics in a special school at the factory. These mechanics go back to the branches and distributors, and in turn open schools for the training of service men for Oakland dealers.

NO BIDS FOR ALLEN ASSETS

COLUMBUS, April 22—Although a number of possible bidders from Chicago, Detroit, Cleveland and Toledo were present when the assets of the Allen Motor Co. were offered for sale, no formal bids were made. After waiting for a time, James M. Butler, representing Receivers W. C. Willard and George A. Archer, announced that another effort to sell the property would be made June 6 at 10 a. m.

No Halt in Business of Gillette Rubber

Receivers Were Appointed to Prevent Embarrassing Moves by Hostile Creditors

EAU CLAIRE, WIS., April 24—To insure the continuation of the business without interruption and enjoin any creditors from taking steps which might interfere, the United States court has appointed C. W. Lockwood and Frank C. Herman as receivers of the Gillette Rubber Co., with authority to continue the business and requiring creditors to file their claims with the court before June 1. The receivership was made effective in the determination of litigation brought by an Illinois creditor. Counsel for the Gillette company made the following statement:

The condition of the Gillette Rubber Co. has been improving daily for the past several months. The company is solvent and its business is increasing. The receivership proceedings were friendly in character and are for the purpose of preventing hostile creditors from embarrassing the operation of the plant when the present creditors' agreement expires April 30. Plans for reorganization are developing but it will take considerable time to work them out, and to give this time the only way is to put the company's affairs in the hands of the court's receivers.

Full Faith in Receivers

C. W. Lockwood and Frank C. Herman, president of the Gillette Rubber Co., were appointed receivers, and Messrs. Aaron & Aaron of Chicago, and Roy P. Wilcox of Eau Claire were appointed by the court as attorneys for the receivers. The receivers will continue the operations of the plant under broad powers and will really be in better shape to carry on the business efficiently than the company itself could have done under existing conditions.

The character and ability of the men put in charge by the court is a guaranty that the company interests, including those of stockholders and creditors alike will be prudently and honestly administered. I think there is no doubt that within a short time the reorganization plans will be carried out in a way as to preserve this splendid industry for Eau Claire and establish it on a firmer and better basis than ever before.

Bill for Rural Post Roads Will Be Acted On Shortly

WASHINGTON, April 24—Prospects for early action on the Dunn bill, authorizing $65,000,000 for construction of rural post roads in 1923 and $75,000,000 the year following, were assured when the bill was placed on the Union Calendar of the House and will come up for action by Congress within the next week.

Recommendation that the bill be enacted was made by the Committee on Roads after hearings were held with the Secretary of Agriculture, the Director of the Bureau of Roads, the Chief of the Forest Service and others.

Optimism Features Firestone Meeting

Business Everywhere Is Showing Gains, Sales Representatives Report at Conference

AKRON, April 25—Seven hundred field men, sales representatives and branch managers of the Firestone Tire & Rubber Co., from as many cities in the United States and Canada and from the principal tire distributing centers of Cuba and Mexico, united at their annual conference here in sending broadcast a message of cheer and optimism with the declaration that business everywhere is showing substantial signs of complete recovery.

At the opening session of the three-day conference, General Sales Manager L. G. Fairbank announced that Firestone was near its peak production with a daily output at present of nearly 24,000 tires and 25,000 tubes, as compared to a peak in 1920 of 28,500 tires a day.

Firestone representatives from the Northwest reported that the lumber business is picking up rapidly. Western and Midwestern states are showing strong gains, while the improvement in farming localities brought about by the upward trend of farm produce prices is reflected in stimulated sales of automobiles, trucks and tires.

"The time for optimism is now," Fairbank said. "Our survey of the country, gleaned from the individual reports turned in to us by men at the conference, show that business is coming back rapidly and that prosperity is just ahead. We expect tire production to continue its steady gait and look for steadily increasing sales."

The field representatives, after a series of business and sales talks, were taken through a series of booths demonstrating window displays. The conference closed Wednesday night.

Paris Automobile Show Will Be Held Oct. 4-15

PARIS, April 11 (by mail)—Wednesday, Oct. 4 has been fixed as the opening day of the Paris automobile show, to be held, as usual, in the Grand Palais. The show will close on the evening of Oct. 15. This decision which puts the Paris show at the head of the European series has only been taken after considerable hesitancy on the part of manufacturers and dealers.

The Paris show will be on the same general lines as the one held last year. It will include every branch of the automobile industry, with a special building for trucks and tractors if necessary. American firms can only get space in the show after the requirements of other nations have been met. This restriction is adopted as a protest by the French industry against America's policy of a 45 per cent import duty before the war.

Automobile manufacturers who do not rent a stand in the Palais will not be allowed to exhibit cars on body makers stands. This will particularly affect Rolls-Royce and Ford. These two firms decline to exhibit at the Paris show, but large numbers of Rolls-Royce cars are always to be found on body builders' stands, and Fords with mechanical modifications or unusual types of bodies are always on view in big numbers.

A further refund has just been made on last year's Paris show rentals, making a total of 50 per cent refunded to exhibitors.

Sees Dunlop Resumption at Buffalo Coming Soon

BUFFALO, April 22—Production is soon to be begun at the $25,000,000 tire plant of the Dunlop company here, Albert L. Kinsey, president of the Buffalo Chamber of Commerce, told the members of the Equality club of the Central Y.M.C.A. to-day.

"There have been many rumors regarding disposition of this plant," Kinsey said. "Recently the Chamber of Commerce had communication with a large automobile firm which contemplates changing its location. The Dunlop interests were approached to determine if their plant is available for purchase.

"Those who approached the Dunlop company were informed that its American plant is not for sale at any price. The impression was given that commercial production of tires will be begun in the near future, probably in the early fall."

Chassis Lubricating Corp. Locates Plant at Monroe

NEW YORK, April 24—The Chassis Lubricating Corp., which has been conducting experiments for three years on a chassis lubrication system, has located its factory at Monroe, Mich., and has an assembling plant at 1926 Broadway, New York.

The company is incorporated in Delaware for $1,200,000, and the officers are Rex W. Wadman, president; Fred H. Gleason, chief-engineer, and Martin W. McCloskey, secretary and treasurer. The directors are Fred H. Gleason, Joseph Van Blerck, E. V. Rippingille, George V. Codrington and N. G. Rost. Van Blerck is the head of a factory producing marine, aerial and truck engines and Rippingille is president of the Watson Stabilizer Co. and until recently was sales manager of the Hudson Motor Car Co.

AWARDED STAR GEAR CONTRACT

SYRACUSE, April 24—The New Process Gear Co. of this city has been awarded the contract for differential gearsets for the new Star. Gears for the car have been produced at the local plant for some time. The factory is now operating nights in some departments and approximately 700 persons are employed. The company is also making gears for the Willys-Overland.

Durant May Obtain Plant at Elizabeth

Likely to Be Only Bidder When Property of Willys Corp. Is Auctioned in June

NEW YORK, April 24—Durant Motors, Inc., probably will be the only bidder for the big new Elizabeth plant of the Willys Corp. when it is put up at auction by the receivers June 9. An auction sale has been decreed by the Federal court, and private sale of the property, therefore, is not permissible. No definite information is available as to the amount which will be bid, but it is understood it will be about $500,000 less than the $4,000,000 which the receivers have asked Durant to pay. The original cost of the plant was about $10,000,000.

If Durant obtains the property, as it is expected he will, it is probable the Long Island City factory, which was equipped to turn out the Durant four, will be leased and the Elizabeth plant used to produce the Durant line, as well as the new Star. The primary purpose of the purchase, however, will be to provide space for assembling the Star in quantities.

The Elizabeth factory is said to be the largest automobile plant in the world under one roof. It covers 38½ acres, and it contains 1,200,000 sq. ft. of floor space. It was built to produce 250 six cylinder cars in an eight-hour day, or 500 if the factory was operated in two shifts. It would be possible to assemble in it at least 1000 Stars a day. It is probable that one end of the plant in which much machinery has been installed will be leased by Durant if he bids in the property.

Could Start Star in Quantities

Purchase of the Willys factory would permit quantity production of the Star almost immediately, as well as increased output for the Durant four.

A. T. Sturt, chief engineer of the Durant Motor Car Co. of New York and engineers representing the Continental Motors Corp. have been devoting their time for the past three weeks to thorough road tests of the Star. These tests have been made over rough country roads in Virginia and other Southern States. They have been designed to demonstrate the endurance of the new car and are reported to have been entirely satisfactory. It is said the little car has averaged 30 miles per gallon of gasoline in the difficult tests to which it has been subjected.

TRUCK FOR TOURISTS

SAGINAW, MICH., April 21—The Ruggles Motor Truck Co. has entered a truck for the 1922 tour "Around Lake Michigan." The truck will be of special design to carry baggage for tourists and will be mounted on a 2-ton chassis to travel at a passenger car speed. The body will have three decks for baggage, with a capacity of 110 suit cases.

General Motors Makes Special Export Line

Producing New Buicks and Chevrolets in Canada to Meet Foreign Tastes

NEW YORK, April 22—A special line of Buick and Chevrolet phaetons is being put into production for the export trade at the Oshawa, Canada, factory under the control of General Motors Export Corp. In making the announcement, officials of the export company stated that the new automobiles, which mount much extra equipment, had been added to meet an overseas demand for cars with different colors and different equipment than the standard lines.

Coincident with the New York exposition, Buick announced a special maroon roadster on the six cylinder line. The new models from Oshawa carry out the same purpose. The six-cylinder phaeton models are finished in either blue with black wheels or maroon with natural wood or maroon colored wheels. The top is of special material, with glass side windows and natural wood bows. The equipment includes electric tonneau light, nickeled foot scraper, rubber trimming on the running board, transmission lock, gasoline tank under cover, Alemite lubrication, front bumper and radiator thermometer. The seven passenger model is furnished with a power driven tire pump. The four cylinder Buick is finished in blue and is provided with much of the same equipment.

The new Chevrolet is finished in green, with gold stripe trimming and black fenders. The top is of improved waterproof material, in either black or drab. The instrument board is illuminated and cord tires are standard. Fuel feed is by vacuum system, with tank at the rear of the body, differing from the standard model. The radiator is of nickel finish and the car carries a front bumper.

S. A. E. Names Committee to Aid Road Development

NEW YORK, April 22—The Society of Automotive Engineers has appointed a highway committee to bring together the research and educational activities of the society along highway lines. Herbert Alden is chairman of the committee. The other members are: W. A. Brush, F. A. Whitten, George Green, W. E. Lay and H. C. Dickinson.

The society feels that the automotive engineer has not had enough to say in the direction of highway development, and that as a consequence the construction of highways has not been carried forward with enough consideration for the needs of the vehicle which is to use the roads. The mechanical side of the question, it feels, has naturally been neglected by the civil engineers who have done the highway work.

ASKS BOSCH INQUIRY

WASHINGTON, April 24—Investigation by a special Senate committee of the administration of the Alien Property Custodian's office, especially the sale of the Bosch Magneto Co., has been asked in a resolution introduced by Senator King of Utah which has been referred to the judiciary committee.

Government to Make Tire Survey Abroad

As Result of Conference Official Will Go to Europe to Determine Market

WASHINGTON, April 21—A survey of the European automobile tire market will be made by the Department of Commerce, it was announced to-day by the Rubber Division, following a conference of national tire builders and rubber dealers.

Dr. P. L. Palmerton, chief of the Division, will sail for Europe immediately and make an exhaustive study of that country as a market for American made automobile tires and other rubber goods products. This will be the first foreign survey ever made by the government, in an endeavor to find a foreign market for United States rubber and tire exporters.

The scope of the survey, it was announced, will comprise practically the whole of reconstructed Europe and will require, it is expected, ten months or a year to make.

Among those who attended the conference to-day and endorsed the survey of the department were: F. E. Titus, chairman, B. F. Goodrich Corp.; A. G. Lubke, vice-chairman, General Tire & Rubber Co.; A. R. Gormully, Ajax Rubber Co.; Harry Braender, Braender Rubber & Tire Co.; F. K. Espenhain, Goodyear Tire & Rubber Co.; D. D. Yard, Pennsylvania Rubber Co.; George S. George, Federal Rubber Co.; K. S. Chamberlain, of the Fisk Rubber Co.; C. E. Wagner, Miller Rubber Co., and E. H. Huxley, United States Rubber Export Co.

Representatives of Industry Discuss Export Problems



The meeting of the Contact Committee formed from the automotive industry for cooperation with the automotive division of the Bureau of Foreign and Domestic Commerce marks the first occasion upon which representatives of all phases of the industry have come together for a joint discussion of foreign trade problems.

Reading from left to right the members of the committee are: (Seated) George F. Bauer of the National Automobile Chamber of Commerce; Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce; T. F. Cullen, Automobile Trade Journal; G. W. Brogan and S. D. Black, representing the Automotive Equipment Association; M. L. Heminway, general manager of the Motor and Accessory Manufacturers Association; Luther K. Bell of the Aeronautical Chamber of Commerce; George E. Quisenberry of the Class Journal Co.; M. P. Hoepli, assistant chief of the automotive division of the bureau; W. G. McCann of the Motorcycle and Allied Trades Association; Norman G. Shidle of Automotive Industries and M. Lincoln Schuster and S. S. Meyers of the M. A. M. A.

Among those standing are Gordon Lee, chief of the automotive division who organized the committee, second from the left; J. Walter Drake, chairman of the foreign trade committee of the N. A. C. C.; W. O. Rutherford, chairman of the foreign trade committee of the M. A. M. A.; L. E. Warford of the N. A. C. C. and Ira Hands, secretary of the National Association of Engine and Boat Manufacturers

Edge Trade Body Bill Has Life Assured It

New Jersey Senator Will Push Legislation Defining Activities of Associations

WASHINGTON, April 24—Legislation presented to the Senate by Senator Edge of New Jersey, designed to define the activities of trade associations, is not to be allowed to sleep in the files of the Judiciary Committee, according to the Senator. His resolution has developed a great deal of support among trade organizations, and letters are being received by members of the Senate and House approving it. Senator Edge said:

I have no intention of permitting the important subject of defining the power of trade associations to be dropped. After two days' debates on the resolution providing for a joint Congressional committee to investigate the subject it became generally apparent that the opposition, realizing that by agreement the appropriation bill, immediately followed by a tariff bill, would necessarily displace the resolution on the calendar, and they therefore would not permit the vote.

I am reasonably positive that if there had been sufficient time and a vote could have been secured the resolution would have been passed. However, it is not important, as the main object of the resolution is covered by the bill I have introduced, which is in the Judiciary Committee.

The only difference in the present situation will be that the Judiciary Committee will hold public hearings and consider the subject rather than a special committee. So far as I am concerned, I am entirely satisfied with this procedure and have been assured by the chairman of the Judiciary Committee, Senator Nelson, that he will select a committee who will give full attention to the important schedule.

American Steam Truck Makes First Delivery

CHICAGO, April 22 — The American Steam Truck Co. this week delivered the first steam truck produced in its factory here. The truck is of four ton capacity and sells for $5,000. C. R. Howard, president of the company, said that the factory is now producing at the rate of about one a week and that he hopes to increase the capacity to 20 a month.

The company is also building steam passenger cars and expects to have the first five completed between May 1 and 15. The first cars are to be 5-passenger phaetons and priced at $1,650. It is expected to have a full line of passenger models later, Howard said, as well as to build trucks of five-ton and seven-ton capacity.

The company has made sales contracts for several states. A company composed of L. F. Gard, B. S. Edwards and C. A. Webb of Gary has contracted for the territory of Indiana and Michigan; A. H. Alexander of Webster City, for Iowa; J. F. Howard of Milwaukee for Wisconsin; H. A. Moje for Chicago and William M. Einhorn for Cook County outside of Chicago.

GENERAL MOTORS CORPORATION
224 West 57th Street
New York, N. Y.

May 1, 1922

To the Stockholders:

The automobile is the largest unit of merchandise sold for cash to the individual consumer.

In the early history of the industry, as there was no parallel to follow, motor makers could not profit by the credit merchandising experience of other manufacturers. Today the merchandising of the automobile is upon the threshold of transition from a cash to a credit basis, similar to that through which has passed the merchandising of nearly every other product.

The selling and advertising force behind the marketing of automobiles has outstripped the progress of the credit machinery available to the industry. To supplement the credits which local bankers have extended to the automotive industry, a group of specialized financing companies entered the field and they have done pioneer work in credit merchandising.

The General Motors Acceptance Corporation was organized three years ago under the banking law of the State of New York as an associated independent banking institution to provide credit accommodations exclusively for General Motors distributors and dealers and purchasers of General Motors products. The functions of the General Motors Acceptance Corporation are to supplement existing local banking facilities, which accomplishes two things: first—that General Motors distributors and dealers, with approved credit standing, are enabled to finance their purchases and sales upon a thoroughly sound banking basis; which in turn means, second—that General Motors Corporation is enabled to sell its products for cash. This necessitates the employment of much less working capital than would be needed were the Corporation itself to attempt to extend credits generally.

At this time of year the desire to buy automobiles is strongest and the demand by individuals for credit accommodations is greatest. Accommodations under the GMAC Plan are available only to those who measure up to proper credit standards. Our stockholders are all concerned in the financial success of General Motors. I am directing attention to the GMAC Plan of financing, which has been and will continue to be instrumental in augmenting sales, in order that the stockholders may fully appreciate this important part of our merchandising operations.

With a clear understanding of this, I am confident stockholders can and will cooperate in stimulating sales of our cars, trucks and other products.

Yours very truly,

President.

Facsimile of letter of Pierre S. du Pont

Selling of Automobiles Is Reverting to Credit Basis, President du Pont of G. M. C. Tells Stockholders

NEW YORK, April 25—The importance of the General Motors Acceptance Corp. in the selling system of the corporation is emphasized in a booklet, summarizing its operations, which is being sent to all stockholders. The booklet is prefaced by a letter, shown above, addressed to stockholders by Pierre S. duPont, president of General Motors and chairman of the board of the E. I. duPont de Nemours & Co., one of the largest industrial organizations in the world.

In his letter, duPont gives expression to a conclusion which the automotive industry as a whole has been slow to grasp. This is that "the automobile is the largest unit of merchandise sold for cash to the individual consumer" and that "the merchandising of the automobile is upon the threshold of transition from a cash to a credit basis." He adds a word of credit to the specialized financing companies which have done financial work in automotive merchandising to supplement credits from local banks.

The booklet gives some surprising figures regarding the General Motors Acceptance Corp., which, it says, now ranks 120th among the banking institutions of the United States from the viewpoint of capital, surplus and undivided profits. Since its inception early in 1919 to April 1, 1922, the corporation has financed under its retail plan 146,937 cars, trucks and tractors, and 102,074 under the wholesale plan. This does not include the operations of the foreign department or the financing of other General Motors products.

As of Dec. 31, 1921, the company shows total assets of $31,933,965. The total amount of financial accommodation extended since its organization has been $227,743,664, divided as follows: Foreign, $27,897,700; retail, $107,802,979; wholesale, $92,042,985. This means that it has financed General Motors cars of a retail value in excess of $300,000,000.

Plants Speeding Up in All Branches of the Industry

Western Malleables Reopens Foundry

BEAVER DAM, WIS., April 24—The increased call for malleables from the automotive industries, railroads and other extensive users has made it necessary for the Western Malleables Co. to reopen its Center Street foundry, one of four large shops operated in that city. The first shop to re-open, namely, the Elm Street plant, has been operating for nearly three months and business is beyond its capacity. The other two shops are being placed in readiness for an early resumption of operations as the volume of new business requires further extension of available capacity.

Republic Truck Sales Increase

ALMA, MICH., April 24—F. E. Smith, president of the Republic Motor Truck Co., reports that both February and March sales showed an increase of 50 per cent over the preceding month and that April sales are running at a rate of 50 per cent improvement over March. The company has closed a contract with the United Railway & Electric Co. of Baltimore for twenty-six buses. This order was placed after a five months' test and a thorough investigation of bus operation in Europe and America.

Buick Has Big Schedule

DETROIT, April 24—Production of the Buick Motor Co. for the second quarter will be 27,000 cars, or 40 per cent greater than the first three months, President H. H. Bassett says. It will be 8000 more than the second quarter of last year and within 2000 of the 1920 second quarter, which was nearly a record. There is no abatement of business coming from large cities and within the past week surprisingly large volume of business has come out of Iowa and Nebraska.

Timken Back in Deliveries

DETROIT, April 25—The Timken Detroit Axle Co. is re-equipping a number of departments in several plant units which, when completed, will give it increased capacity. The company is behind in deliveries, but is distributing its output among its many customers so that no one will be without a proportionate share, by working extra shifts. The company declares it will be in a position to make immediate deliveries within thirty days.

Ford Output 4000 Daily

DETROIT, April 25—The Ford Motor Co. made the statement to-day that the five-day week announced by President Edsel Ford some weeks ago will not become effective until late in the summer, by which time the Highland Park plant will be re-equipped. Rush of business in the past few weeks has caused the company to resume its former six-day week schedule, and it is now running about 4000 cars daily. No record production days have yet been reached, but the factory is slowly arriving at the point where new high marks for daily output may be expected.

BIG SHIPMENT LEAVES G. M. CANADIAN PLANT

OSHAWA, ONT., April 24—A train of sixty flat cars carrying cases containing 304 Chevrolets, Buicks, Oldsmobiles and Oaklands, weighing 504 tons, shipped from the plant of the General Motors of Canada, Ltd., here, is said to have been the largest single export shipment ever started from a Canadian automobile factory.

The shipment will be transferred at the Atlantic seaboard to the steamer Canadian Conqueror for shipment to foreign ports, including Constantinople, Egypt and New Zealand.

It is said that General Motors has on hand enough export orders to keep the factory going full speed for several months.

Maxwell at Capacity

DETROIT, April 25—All plants of the Maxwell Motor Corp. are now operating at capacity. April production will be in the neighborhood of 6500 cars and that of May 7000 cars, which are substantial increases over the first part of the year. In January the production was 2000, February 2200, and March 3600.

500 Rickenbackers in April

DETROIT, April 25—The Rickenbacker Motor Car Co. will build 500 cars in April and will run far ahead of this total in May. The company has contracts with its dealers assuring 8500 cars will be produced in the balance of the year, and they will endeavor to increase this total to 10,000 for its first year's work. The equipment of the factory is now about completed permitting full production.

Truck Sales Gain 375 Per Cent

NEW YORK, April 24—The New York branch of the General Motors Truck Co. reports that thus far this year its business has been 375 per cent greater than in the same period last year.

March at 65 Per Cent Capacity

NEW YORK, April 24—Mack Trucks, Inc., is operating at about 65 per cent of a capacity production of 800 trucks a month and it is expected that within the next thirty days maximum capacity will be reached.

Kissel Boosts Schedules

HARTFORD, WIS., April 24—The Kissel Motor Car Co. has recently increased its working schedules so that its operations are now the equivalent of 75 per cent of capacity, three-fourths of its normal working force being employed on a ten-hour basis, or fifty-five hours a week, with a Saturday half-holiday. During the last fourteen to eighteen months the Kissel factory was operated between 35 and 60 per cent of capacity, according to fluctuations of demand. The present increase is justified not only by the improvement in the call for passenger cars and trucks, but for the Kissel special highway contractors' truck, which has special equipment.

Hendee Foreign Trade Better

SPRINGFIELD, MASS., April 24—In the first three days of last week the Hendee Manufacturing Co. received calls for 250 machines, total orders on hand running 800 ahead of production. Improvement in foreign trade is especially noteworthy, business with Holland showing marked gains. Last fall the Holland branch had over 700 machines on hand unsold; it is fast disposing of its stocks and has ordered 300 motorcycles to be shipped not later than May 30. Inclusive of this, the company has on hand orders for between 1100 and 1200 machines.

Hupp Has Biggest Single Day

DETROIT, April 25—Hupp Motor Car Corp. shipped 215 cars on April 17, the biggest single day's delivery the company ever made. Total April shipments up to that day were 2050. Total April production sought is 4000. March, with an output of 3005 cars, was the highest single month previously. President Charles D. Hastings said the impetus of buying extends to every part of the country with the exception of the exclusively cotton growing states in the Southeast.

Night Shift for Chevrolet

DETROIT, April 25—The Chevrolet Motor Co. has started a night shift for the first time in several months, the April schedule calling for approximately 10,000 cars. About 900 axles are being turned out a day and the production of engines totals 800 daily. Shipments of the company for February were in excess of 10,000 cars.

Atwater Kent Increases Force

PHILADELPHIA, April 24—The Atwater Kent Manufacturing Co., which is now operating at 90 per cent capacity, has increased its employees 150 per cent. It now employs a large night shift. The company expects the automobile trade this year to equal the record of twelve months' period in 1919 to 1920.

Men of the Industry and What They Are Doing

Cravens Heads Climax Engineering

George W. Cravens, formerly associated with the American Motors Corp. of Plainfield, N. J., has become president of the Climax Engineering Co. of Clinton, Iowa. This company, which will manufacture internal combustion engines for all types of power driven machinery, is the successor to the old Lamb Marine Engine Co. which has devoted its efforts for several years to the manufacture of tractor engines, but which now is branching out into the industrial field generally.

Alvin Is U. S. Truck Sales Head

Forrest J. Alvin, general manager of the United States Motor Truck Co. of Cincinnati, has been appointed president and general manager of the United States Truck Sales Co. of St. Louis, to succeed J. F. Mackay. Mackay, who is vice-president of the National City Bank of St. Louis, has been elected chairman of the board of directors and of the finance committee of the St. Louis company.

Young Joins Spring Company

James W. Young, who was assistant general manager of the Oakland Motor Car Co. under Fred W. Warner for some years, and who retired after Warner's resignation, has become associated with the Spencer Spring & Axle Co. of Wilkes-Barre.

Crawford Resigns from Allen

J. M. Crawford, who has been chief engineer in charge of manufacturing for the Allen Motor Co., Columbus, has resigned, due to the postponement of the sale of the company from April 18 to June 6. Before taking up his work with the Allen company Crawford was connected with the Chalmers Motor Corp. as assistant engineer.

Frank Wolfe in Private Business

Frank B. Wolfe, assistant comptroller of the General Motors Corp. in charge of the cost division, has resigned to enter private accounting work in Detroit.

Moock Is Visiting Dealers

Harry G. Moock, assistant general sales manager of the Hudson Motor Car Co., in the course of a trip on which he is visiting dealers, spent a day with the New York organization and addressed the salesmen.

Gleason Joins Durant

C. D. Gleason has been appointed sales manager for the Dominion of Canada by M. B. Leahy, general sales manager for the New York, Lansing and Toronto plants of Durant Motors, Inc. Gleason goes to the Durant organization from the Chevrolet Motor Co., with which he has been identified for several years. He was for a long time Chevrolet distributor at Winnipeg and knows the Dominion trade thoroughly. Later he was in charge of Chevrolet sales in the Pittsburgh division and more recently was transferred to the Chevrolet staff in Detroit.

de Vignier Leaves Fibre Company

R. M. de Vignier has resigned as chief engineer of the American Vulcanized Fibre Co., Wilmington, Del. de Vignier was connected for many years with the Western Electric Co. and the duPont company as development engineer and also produced the Mercury passenger car, work on which was stopped at the opening of the war. He is considering several proposals for the future, but has not yet announced any definite plans.

Lassiter May Head Merger

C. K. Lassiter, vice-president in charge of manufacture of the American Locomotive Co., has resigned, it being reported that he will head the new merger of machine tool manufacturing companies.

McDermott Now in Sales Work

Luke B. McDermott, factory manager of the Franklin Automobile Co. of Syracuse, has become connected with the sales department of the Martlew-Bamerick Co. McDermott has been associated with the automobile industry for many years.

McLuny at Peerless Branch

A. K. McLuny has been appointed manager of the Pioneer Motor Co., the Peerless branch in San Francisco with a subbranch in Oakland. For many years McLuny was closely associated with R. H. Collins, president of the Peerless Motor Car Co., in manufacturing and sales, after which he embarked in the automobile business on his own resources.

Thurman With Equipment Makers

George Thurman, for some years connected with the Oakland Motor Car Co., has resigned to become secretary of the new United Automotive Equipment Co., which will have offices and a plant at Pontiac, Mich.

Barnett Succeeds Shaw

D. C. Barnett, who succeeded Lynn M. Shaw as secretary of the Youngstown Automobile Dealers Association, has taken Shaw's place as manager of the Indiana Automotive Trade Association. Shaw has assumed his position as assistant general manager of the National Automobile Dealers Association and has started on a trip which will cover fourteen cities in Texas, the Gulf States and the Atlantic Coast States.

Shugart an Officer of U. S. Rubber

At the recent organization meeting of the directors of the United States Rubber Co., George S. Shugart, vice-president and general sales manager of the United States Tire Co., was elected a second vice-president of the rubber company.

New Racing Officials Named

D. V. Nicholson, assistant secretary of the California Automobile Association, has been named official representative of the contest board of the American Automobile Association. He will direct the general work of the board in northern California and will officiate at the Greater San Francisco speedway races. D. J. Lafferty, Santa Rosa director of the state association, has been appointed official representative for the Santa Rosa district, and a third official is to be named to act at the Fresno speedway. E. F. Cheffins, who has represented the board at the California speedways in the past, is retiring after ten years' service.

West Has New Connection

Louis D. West, for several years connected with the Chilton Co. as Cleveland district manager, has resigned to become associated with the H. L. Rackliff Co., automotive marketing counselors of Cleveland and New York. He will have charge of the Rackliff organization's field work in Ohio, Indiana, Kentucky and western Pennsylvania.

Swinehart with Hannibal Rubber

C. A. Swinehart, after eight years' service with the Victor Rubber Co. as sales manager, has severed his connections with that company and has taken charge of sales of the Hannibal Rubber Co., Hannibal, Mo. Swinehart for seven years was associated with the Swinehart Tire & Rubber Co., directing sales.

Louis Staff in Own Business

Louis A. Staff, who recently retired from Staff Brothers Co., will continue for himself in the business of handling automotive equipment. He has opened offices in the Fisk Rubber Co. Building in New York.

Colt Goes to Distributorship

William L. Colt, for nearly five years division manager of Willys-Overland, Inc., in the Eastern district with headquarters at New York, has resigned to become the president and active head of the Overland Providence Co., Willys-Overland distributors for Rhode Island, a concern he established and financed about a year ago. Prior to his association with the Willys organization, he was for eight years president of the Colt-Stratton Co., New York.

Sales Boom Brings Shortage of Parts

Affects Specialized Car Field — Expedients Adopted to Get Supplies

(*Continued from page* 932)

Continental Motors Corp. declares it is fully equipped to meet all delivery requirements, but has been compelled to hold up shipments because of the non-delivery of other necessary parts to its customers. Shipments are being sent forward in the quantities that the makers of other units or bodies are capable of furnishing, so that inventories may be kept balanced.

Fisher Body Corp. has plans fully made to build an addition to its former airplane body plant, which has been practically idle since the war, which will give it an additional 1,000,000 feet of body manufacturing space in Detroit.

Sudden Demand for Bodies

The extent of body demand may be gaged somewhat from the fact that one independent body company has gone into production on 17 new types of bodies within 10 days. Some time will be required, the company declares, before capacity production can be reached on the new work, owing to the suddenness of the demand and the impossibility of getting skilled men quickly.

Other body companies report themselves as able to keep up to delivery requirements through employment of double shifts and overtime.

Incidental to the body situation, it may be reported that closed car demand is running 20 per cent higher than had been anticipated in most of the medium grade cars, and consequently deliveries of finished cars are running behind because of failure to authorize releases sufficient to meet the demand. Closed car commitments must be made at least 90 days in advance, a prominent maker said, to meet deliveries on schedule. Inability to gauge the extent of the spring closed car business is responsible, to a large extent, for the rush in the body plants.

No Shortage of Metal Stampings

There is no shortage of metal stampings and products of that character only because the manufacturers in those fields are working two and three shifts a day to keep even with demand. To enumerate plants working under pressure of this kind would mean to call the roll of every plant in the Detroit district.

Wheel makers, particularly those in the disk wheel field, are experiencing a heavy pull to meet which it has been necessary to enter upon overtime and double shift operation. In the frame assembly field there have been some slight delays which have been overcome.

Though it is agreed that the congestion of business could have been avoided by the spreading of orders for supplies over a longer period, it is also agreed that the present extent of the car demand could not have been estimated by anyone, parts maker included. It is also evident that, despite the rush of orders, buying on a 30 or 40 day basis will continue to be the rule for some time to come.

RAIL INTERESTS URGE DRASTIC REGULATIONS

ST. LOUIS, April 24—Members of the Traffic Club of St. Louis were advised in an address by Alexander C. Hilton, traffic vice-president of the St. Louis & San Francisco Railroad, to begin a close study of the automobile industry which, he said, is playing havoc with the receipts of the railroads. He suggested the appointment of a national committee of traffic club members to begin a campaign to have enacted more drastic regulations for automobile carriers and to see that those engaged in competition with railroads be forced to pay their share of the tax burden "now largely shouldered by the railroads."

Production in May Will Be Up to April

(*Continued from page* 932)

that branch of the industry as a whole. Tire plants are increasing their output, and tubes and casings now are being produced at the rate of more than 24,000,000 a year.

So encouraging are conditions that the Ford Motor Co. predicts a production of 1,150,000 cars and trucks in 1922. This would establish a new record for that company.

The only factor delaying full recovery for the automotive industry is lack of complete confidence in the future. Business literally seems "too good to be true." With the lesson of 1920 staring them in the face, many manufacturers cannot believe that prosperity is returning definitely. As a consequence, buying of parts and supplies still is being done on a hand-to-mouth basis, and, except in rare instances, no stocks of cars are being built up. Production is being held rigidly to an actual order basis.

A.A.A. TO MEET IN ST. LOUIS

WASHINGTON, April 24—The American Automobile Association has decided to hold its annual meeting in St. Louis, May 22 and 23. The invitation was extended by William T. King, president of the St. Louis Automobile Club, who has been appointed chairman of the arrangements committee. King also has been appointed chairman of the committee to report on ways and means of conducting a national fight against automobile thefts.

Wisconsin Factories Keep Going Forward

One Body Maker Is at 90 Per Cent Capacity—Truck Plant Increases Operations

MILWAUKEE, April 24—Tangible evidence of the improved condition of the automotive industries in all phases in Milwaukee and Wisconsin develops every day. With the motor truck trade again getting into its stride there is added significance to the betterment first discernible in passenger car trade. Progress is being made slowly, but it is substantial. What already has occurred in this direction is strikingly the feature of the current issue of *Business and Financial Comment*, monthly review of local condition, issued by the First Wisconsin National, Milwaukee's largest bank, which says in part:

Working at Full Capacity

The automotive parts and specialties group (of metal trade industries) expanded operations further during the past month. A firm manufacturing bodies is running 90 per cent of capacity, against 80 per cent a month ago. A motor manufacturing concern augmented its force by 60 men in March. Another motor products firm is operating at full capacity. A firm making switches, motor wheels and other automotive and electrical specialties, reports operations at 85 per cent, and March sales 55 per cent in excess of February sales.

A large motor truck plant increased operations from 28 per cent on March 1 to 48 per cent on April 1. A large rubber tire company had 25 per cent larger sales in March than in February.

Analyzing the agricultural situation, the review says:

First hand information received by this bank from various parts of Wisconsin indicates that the farm sections of this state entered the spring season in fair shape. Opinion is quite uniform that the outlook for the year is good, provided prices remain stable.

It is quite generally felt, however, that most of whatever the farmers make this year will go to pay off their debt. This does not argue increase of farm buying power.

No Setback with Dealers

One of the most encouraging features of the situation of dealers is that there have been no setbacks in the upward trend of demand for passenger cars, and while the sales curve is still inclined to make peaks and troughs in its day-by-day course, these are less sharp than they have been for many months. There is not a dealer who cannot claim that in the first three weeks in April he moved more cars into owners' hands than in March altogether. April probably will close as the heaviest month in any of the past twenty to twenty-two months.

A. E. A. SHOW NOV. 13-18

CHICAGO, April 24—The annual show of the Automotive Equipment Association, which will be held at the Coliseum here, Nov. 13-18, will be a closed show, for members of the association only.

Minnesota Dealers Predict Good Year

Sales of Cars Will Start as Soon as Roads Are Opened and Season Opens in Country

MINNEAPOLIS, April 24 — After June 30 what?

This question was put to a number of automotive dealers here, and their answer was: SALES.

The problem as to the automobile business after the second quarter was raised at a dinner given to the automotive dealers by Dunwoody Institute, here. The dinner was planned with a view of getting the dealers better acquainted with the educational work in the automotive mechanical course.

The question of future sales was raised in a talk made by Clyde Jennings, managing editor of *Motor Age*.

F. E. Murphy, publisher of the *Minneapolis Tribune*, a former automobile dealer, the owner of several farms and secretary of the Minneapolis Automobile Trade Association, was one of those who spoke for a full year of automobile prosperity.

Farmer Is "Good Sportsman"

"Our answer to your question," he said, "is that the Minnesota farmer will buy. He has been hard hit, it is true, but the Northwestern farmer is a good sportsman and is never down. In this connection it must be remembered that only the small grain farmer has been hit, and he is encouraged by the advancing price of grain. But in the Northwest we, also, have the dairy farmer, and in those counties where the monthly 'cream checks' are distributed, prosperity reigns and this district is constantly growing larger. There will be motor equipment of all kinds sold in Minnesota when the season comes in the county. Our good roads program is blazing the way."

The optimism as to car sales was not all at this dinner. Wherever one inquired in Minneapolis, he found the strong belief in the future. It is announced by the city Bureau of State License department that new car licenses are running more than double of a year ago. Exact comparison cannot be made because of the confusion of figures in the changing of the license system, but new car licenses since March 15 have been running from 65 to 140 daily.

This optimism is the more remarkable in the face of present conditions. Spring is very backward and the season is fully three weeks late. This fact is more apparent to the accessory and equipment dealers and jobbers than to the vehicle dealers. The vehicle dealers do not expect much business until the rush of spring work is past.

The equipment jobbers expect a rush of business as soon as the country secondary roads are clear. Last year the jobber salesmen quit the trains the last week of March and took to their motor cars. This about trebles their calls and usually brings a rush of business from the small dealers in communities where salesmen do not go during the winter.

The trade in tractors and farm implements has continued better than was expected during the winter. It is said by the men making the best reports that a large share of their sales are going to the dairy counties and the buyers are "factory farmers" who sell cream and fat stock, rather than the usual farm produce.

ARRIVAL OF MOTOR TRUCKS FOR MINNESOTA FARMS HAILED BY WHOLE COUNTRYSIDE

MINNEAPOLIS, April 24—The special light truck sales campaign of the International Harvester Co. in which about 5000 of these trucks, popularly called "red babies" have been sold since the first of the year, came to an end April 18 with the delivery that day by the St. Cloud branch of the company of 168 trucks to dealers of Northern Minnesota.

The St. Cloud branch, of which Wells Levens is manager, won first place for selling more of the trucks than any other of the 92 branches of the company. The Boston branch was second; Harrisburg, Pa., third; Denver, fourth; Kansas City, fifth, and Albany, N. Y., sixth.

The delivery of the trucks was marked by a "prosperity day" celebration under the auspices of the Chamber of Commerce.

This celebration was of such general interest to all business men of the state, including the entire automotive trade, that Governor J. A. O. Preus offered himself as one of the speakers in connection with a parade of this machinery.

It was significant in watching the parade of the new trucks that the farmer's buying power has returned.

Dan Wallace, editor of "The Farmer," brother of H. C. Wallace, secretary of agriculture, said:

"The celebration of the return of prosperity will prove of untold value to Minnesota. The eyes of the nation are turned here to-day and the hope of the nation is that the movement inaugurated here will gather momentum to sweep the world. The worst of the slump is ended."

Every farmer in St. Cloud for the celebration was the guest of the local merchants at a picnic luncheon.

This celebration was regarded as such a business stimulant that dealers and branch house managers from central and northwestern Minnesota, Canada, the Dakotas, Montana and Iowa were called in to join in it.

Committees of N. A. C. C. Will Draft Road Plan

NEW YORK, April 26—A joint meeting of the motor truck and highways committees of the National Automobile Chamber of Commerce will be held at the Detroit Athletic Club next Tuesday Members of the two committees will determine a program for presentation to the National Association of Highway Officials for discussion at its coming conference with representatives of the automotive industry.

The purpose of this conference is to map out some uniform plan for the construction of highways to carry motor transport and for the regulation of motor vehicles. Directors of the N. A. C. C. will meet at the Detroit Athletic Club next Wednesday.

GOODYEAR EXPORT COMPANY

AKRON, April 25—The Goodyear Tire & Rubber Co. has organized an export company with a capitalization of $10,000. The officers are the same as those of the parent organization. The company was formed to take advantage of the large business which is now opening in foreign fields.

Stockholders Organizing to Buy Parenti Assets

BUFFALO, April 26—Announcement was made yesterday that a stockholders' protective committee was being organized to raise sufficient capital to buy the assets of the Parenti Motor Corp. fixed at $400,000, and to obtain sufficient working capital to go on with the production of cars. Plans are expected to be completed within two weeks.

Alfred M. Saperston, attorney for the trustee, the Marine Trust Co., yesterday said all attachments, judgments, executions and suits will be held in abeyance. The attorneys also have agreed to withhold a mortgage foreclosure action on the real property and plant.

Nearly all of the 200 creditors have signed consents in approval of the plan submitted by the trustee. As soon as the bank has decided whether the assets will be liquidated or the stockholders will buy the assets, the trustee will request creditors having liens to withdraw or waive their priority rights. A decision is expected by May 15. William A. McDougal, engineer of the Marine Trust Co., now has charge of the Parenti plant.

N. A. C. C. Service Managers Will Convene at Detroit

NEW YORK, April 26—The spring convention of service managers of factories members of the N. A. C. C. will be held in Detroit May 16 and 17. The sessions will be at the Statler Hotel, and much the same style of program will be used as proved so successful at the fall meeting in New York.

Two prominent men in the industry, whose names have not been announced as yet, will be the principal speakers.

Chevrolet Perfects Plan for Flat Rates

Dealers Will Get It Next Month—Provides for Major and Minor Operations

DETROIT, April 25—The Chevrolet Motor Co. will issue soon after May 1 15,000 copies of its flat service rate to its branches, dealer organizations and independent parts depots. Details of the plan which fixes a fair price on every major operation and most minor operations on both models of Chevrolet cars have been carefully worked out, and dealers will be expected to adhere to it closely.

In issuing the plan the company will not take an arbitrary stand in its enforcement, but will leave it to the dealer's initiative to recognize it as a definite step forward in promoting the interests of the company, the dealer and Chevrolet owners. Developments in the industry have impressed themselves on factory executives as demanding a basis upon which cost of servicing may be predetermined.

All Conditions Met

There are from 15 to 18 major operations on the car which are given numbers under the plan, and a large number of minor operations which are lettered. Where major and minor operations combine, these are set forth with the average time required for the work and the cost. Prices on genuine parts which may be installed are to be added to the cost of operations, giving the final costs.

Major operations are considered as those which require the removal of a major part, and minor operations those which are readily accessible. Minor operations which can be performed only by the removal of major parts assume the costs of both. In all cases the varying conditions which may be met in performing the work have been considered in fixing the time charge.

In a prelude to the plan it is set forth that the varying times fixed take into consideration the use of tools of certain general types which dealers will be expected to have included in their shop equipment. Where dealers expect to base their charges as outlined in the plan, it will be necessary for them to have similar tools.

Building Up Parts Depots

With the promulgation of the fixed rate service plan Chevrolet is building up through its dealer organizations a system of parts depots in independent garages located in strategic points throughout the country. These parts depots will be authorized as Chevrolet parts depots and will carry supplies of parts bought through the dealers at a fixed discount.

NEW NOBLE TRUCK

KENDALLVILLE, IND., April 22—The Noble Motor Truck Corp., this city, has brought out a new 1¼-ton model that lists at $1,840 complete. This job will take an 18-passenger bus body on a standard 130-in. wheelbase.

Specifications include a Buda 3⅝ by 5⅛-in. powerplant, Eisemann ignition, Stromberg carbureter, Long radiator, Fuller clutch and gearset, Blood Brothers driveshaft, Sheldon front and rear axles and a Sharon frame. Other equipment includes indestructible steel disk wheels mounted with 34 by 5-in. Miller cord tires, Stewart-Warner vacuum fuel feed, electric starting and lighting and Alemite chassis lubrication.

April May Establish Records for Industry

NEW YORK, April 26—There is a strong possibility that April production of motor vehicles will be the largest of any single month in the history of the industry. It is certain to be the largest in respect to carload shipments. The total of carload shipments for all manufacturers in March was 27,380, and there is every indication that this record will be exceeded by 25 per cent this month. If production does not establish a new high mark this month, it will be because of the enormous number of driveaways in some of the months of 1920, when there was an acute shortage of freight cars.

New Lexington Phaeton Is $240 Lower Than Old

CONNERSVILLE, IND., April 24—The Lexington Motors Co. has a series 22, 5-passenger phaeton, priced at $1,745, which is $240 less than the lowest previous price on a Lexington fitted with Ansted engine. In this series the Ansted engine has been refined and improved in many respects.

There is a new type, two ring piston, which is specially designed to prevent oil pumping and slapping. A thermostat is used to control the cooling system. The frame has a double triangular center cross member, and the front and rear cross members have been strengthened by deepening the gusset plates. Both front and rear springs have boots laced around them to retain lubricant and keep out mud and water. The other features of the car are essentially the same as in previous models.

G. M. OFFICERS RE-ELECTED

NEW YORK, April 26—At its annual organization meeting, the board of directors of the General Motors Corp. re-elected all officers for the coming year. Membership on the finance committee was increased from 10 to 11 by the addition of Alfred P. Sloan, Jr., vice-president in charge of operation.

SIZER TO GET HAMMOND STEEL

BUFFALO, April 25—The Sizer Forge Co. of Buffalo will soon take over the management of the Hammond Steel Co. of Syracuse, which is at present being reorganized.

Car Exports Double March of Last Year

Shipments Were 4,471 Last Month Against 2,019 in 1921 and 3,096 in February of 1922

WASHINGTON, April 26—The international trade revival brought about large shipments of American automotive venicles and equipment during March. This is strikingly shown by the export totals for that month, as announced today by the Bureau of Foreign and Domestic Commerce. The shipments totalled 4471 passenger cars, valued at $3,831,432; 590 motor trucks valued at $554,292 and parts, not including engines and tires, to a total of $3,596,539. The tire shipments for the month were $2,201,349.

The large gains made over the preceding month of February and a comparison with March, 1921, are indicated as follows:

	Passenger cars	Motor Trucks	Parts
	3096	454	
February, 1922	$2,556,555	$391,738	$2,840,259
	2019	610	
March, 1921	$2,348,378	$877,781	$3,098,535

The tire shipments in February totalled $1,203,555. The upswing in export sales that began some months ago thus was continued through March at a total generally larger than any previous month since the latter part of 1920 or early 1921. The figures announced by the Commerce Department are only for shipments made from the United States and do not include the large volume now going from the Canadian factories.

G. M. Shipped 2239 Cars from Canada in March

NEW YORK, April 26—The overseas shipment of 2239 passenger cars from its Canadian factory during the month of March was announced here to-day by General Motors Export Corp., following the release from Washington of the export shipments of automobiles from the United States during that month. These Canadian totals do not show on the Washington figures. They compare with an approximate 1350 cars shipped by General Motors from Canada in February.

Of the March exports, General Motors shipped 1017 cars to its subsidiary corporation in the United Kingdom. To other parts of the world the totals were 1222. The increases over February were approximately 500 cars to the United Kingdom and approximately 400 to the rest of the world.

D. A. Laing, sales manager of the export company, says:

Our March shipments went to practically all territories. The Australasian division was first in number of cars shipped, with the Pan-American second and the European third. Australia and Argentina continued to take heavy orders and the decreased activity in Europe discloses the steady improvement being made in getting the Continent back to a more normal basis.

May Put Motor Cars On Big Four Branch

Officials Confer at Springfield—Plants in That City Increase Production

SPRINGFIELD, OHIO, April 25—Motor equipped trains may be operated on the Delaware division of the Big Four railroad within the next few months. This developed as a result of a conference between Superintendent Philip T. White of the Cincinnati-Sandusky division of the Big Four railroad, General Manager E. O. McDonnell of the Kelly-Springfield Motor Truck Co. and W. J. Foster, chief engineer for the Edwards Railway Motor Car Co. of Sanford, N. C.

The proposition was taken up a few days ago with Vice-President H. A. Worcester of the Big Four system, with headquarters in Cincinnati. It is understood that Superintendent White is favorably impressed with the proposition.

The Kelly-Springfield company is making a special drive for municipal business. During the past week it booked an order for four heavy unit Kelly trucks from the City of Milwaukee.

The Springfield works of The International Harvester Co. is keeping up its schedule of fifty light speed trucks daily. Superintendent Charles H. Smart states that orders are increasing and that foreign business is picking up.

The Westcott Motor Car Co. is rushing manufacture. The company is building all the cars it can with the limited amount of material available. The officers of the company say that April will be the best month in the past two years and that May promises to be even better. There were numerous shipments and drive-aways during the past week.

Business is improving at the plant of the Victor Rubber Co. Good sized shipments are being made, and the plant is being operated full time five days a week.

Mexico City Show Ends After Successful Week

NEW YORK, April 25—Successful sales of all classes of automotive equipment attended the annual motor show in Mexico City. Held under the auspices of the automotive division of the American Chamber of Commerce as a co-operative venture among the dealers in the Mexican capital, the exposition opened on April 16, and when the doors were closed after the week of exhibition, a total of 152 passenger cars, five trucks and ten tractors had been sold, with equipment and accessories to a total value of 800,000 pesos ($400,000).

These results were announced in a cablegram from the Chamber of Commerce at Mexico City to *El Automovil Americano*, the Spanish automotive publication of the Class Journal Co. The cable states:

American Chamber of Commerce automobile show opened without hitch despite difficulties as the three days before the opening were national holidays. The National Theater, in which the exhibition was held, was specially decorated and had a pleasing appearance. Music throughout the week was furnished by a government band. Total attendance for the week was 6,900, the best day being the closing Sunday when the visitors numbered 1350.

The total sales were 62 low-priced cars, 64 of the medium price class and 26 of the high priced class. Five trucks and ten tractors were sold. Eighteen passenger cars, two truck and four tractor lines were shown. The actual business done during the show was 800,000 pesos, with many prospects not yet closed.

Dealers say the show this year was better than that of last year and are surprised at the results. President Obregon attended on Saturday morning.

Moline Plow Reorganizes As Virginia Corporation

RICHMOND, VA., April 26—The Moline Plow Co., Inc., has been incorporated under the laws of Virginia as a reorganization of the Illinois company. It has an authorized capital of $20,000,000 in preferred and 200,000 shares of common.

The Moline Plow Co., which is controlled by the Willys-Overland company through the ownership of 82 per cent of the common stock, was incorporated in Illinois in 1870 and was gradually expanded until it became one of the largest producers of agricultural implements, wagons, trucks, tractors and sleighs. Control passed to the Willys-Overland company in September, 1918, when it acquired the Stephens interest. The company encountered financial difficulties because of the financial depression, and the reorganization plan has been worked out by committees representing all classes of creditors and stockholders. The reincorporation came almost simultaneously with the acceptance by Willys-Overland stockholders of the reorganization plan.

U. S. Chamber to Discuss Highway Transportation

NEW YORK, April 26—Tentative approval has been given by the Chamber of Commerce of the United States to a group meeting for the discussion of highway transport at its annual convention in Washington in May. A. J. Brosseau, president of Mack Trucks, Inc., has been named as chairman of the division. Prominent speakers will discuss the economic foundation of highway transport, regulation, state programs and other relevant subjects.

The national counsellors of the chamber will meet May 15, the day preceding the opening of the convention, to act upon nominations for the board of directors. Among those nominated is W. O. Rutherford, vice-president of the B. F. Goodrich Co.

The United States Chamber of Commerce has received and has approved the discussion of resolutions on taxation, highway transport and anti-dumping which have been submitted by the National Automobile Chamber of Commerce.

New York Expects Good Summer Trade

April Will Exceed March, Which Was Record Month—Deliveries Heavy

NEW YORK, April 27—There is no doubt that passenger car sales in the metropolitan district, when finally totalled for April, will exceed the March record, which was the largest since the spring of 1920. May business also is bound to be good, and the most conservative distributors look for a continuance of spring sales conditions up to the end of June. They hardly expect May to be as big a selling month as April, and they look for a logical seasonal falling off in June. Early indications are for a normal summer business, with the prospects for fall dependent upon the general trend of business.

Sales records of one or two of the most popular cars will probably fall off a little in April from what they were in March. This condition is due to inability to make immediate deliveries, particularly of closed cars. Buyers in March, in most cases, were willing to wait for April delivery, but a good many April buyers showed a decided disinclination to wait until May for their cars.

Gain in Deliveries Big

Deliveries in April have been heavy, virtually all dealers running 25 per cent ahead of March and others 40 per cent more. The new car registration report for April will show a big gain over March.

In New York City April buying has lacked the "snap" which prevailed in March. March was an exceptionally mild month, and the urge to get out in the open sent thousands of people to the salesrooms eager to obtain new cars. April weather has been cold and generally wet, and buying has been built more on sales activities of the metropolitan staffs than on the spontaneous desire of buyers. Outside New York City itself, however, March did not show any such momentum.

Wizard Automobile Co. Assets Sold for $105,500

CHARLOTTE, N. C., April 25—The final chapter in the career of the Wizard Automobile Co. was written yesterday when the entire assets of that company were sold by J. Lee Phillips to the Automatic Car Step Co. for $105,500. The Wizard company was organized for the purpose of manufacturing the Wizard Junior automobile, to sell for $395.

The sale was made subject to a higher bid within thirty days. The assets include one large building, several smaller ones and all the accessory machinery used in the manufacture of the automobiles, and 92 acres of land. All of the buildings are of the most modern type of construction.

Masetti in Mercedes Wins Sicilian Contest

Averages 39.2 Miles an Hour and Beats the Record He Made Last Year

PALERMO, SICILY, April 4 (*by mail*)—Driving a 300 cubic inch racing Mercedes of 1914 design with modern refinements, Count Masetti, an Italian amateur, won the thirteenth Targa Florio race 'round the island of Sicily. He averaged 39.2 miles an hour for the 269 miles of the race, beating his own record of a year ago, when he won this race on a Fiat, by 34 min. 15 sec.

There was unusual competition this year, for in addition to Count Masetti's German Mercedes, the Mercedes company of Stuttgart sent six other cars driven by their best professionals. Ballot put in a couple of machines with Goux and Foresti as drivers, Fiat had four cars, Austro-Daimler four, and others were Itala, Alfa-Romeo and Ceirano, making a total of 44 starters. Of these 26 finished.

Supercharger Appears in Races

Much technical interest attached to the entries, for several of them were new racers which will be seen in the European events. For the first time in Europe a supercharger was used on two six cylinder Mercedes cars of 4.1 by 5.5 ins. bore and stroke, driven by Sailer and Werner, and by two new four cylinder Mercedes cars of 2.5 by 4.4 handled by Minoia and Scheef. It was difficult to judge the value of the Mercedes supercharger in the race for the reason that, owing to the nature of the course, it was not possible to keep the charger in operation for more than a portion of the time.

All four cars with superchargers were stated to be stock models, of a high speed sporting type. The small ones are entirely new and will be used by Mercedes in the various races to be held in Europe this season. Cylinder construction is steel, with a common water jacket for the four cylinders. There are four valves per cylinder with a couple of overhead camshafts, the drive for which is by vertical shaft and bevel gearing at the rear. The compressor is at the front, driven off the crankshaft. These little racing cars have shaft drive and cantilever rear springs, the rear portion of the spring being much shorter than the forward portion. Front wheel brakes are fitted.

Fiat to Produce Racing Car

Fiat's best machine in the race was the four cylinder 91 cubic inch model, driven by Giacconi. This car is going into production on a small scale as a special high speed sporting type. The little engine of 2.5 by 4.4 ins. bore and stroke develops better than 65 hp. at 5000 revolutions and has steel cylinders with a common welded on water jacket for the group. Two valves per cylinder are employed with a couple of overhead camshafts operating the cams through a light follower. A feature of the engine is the use of roller bearings for every part except the wrist pins. Crank case is dry, all the oil being fed from a dashboard tank and returned to this tank by a scavenging pump.

Austro-Daimler competed with the smallest cars, four cylinder models of only 2.7 by 2.9 ins. bore and stroke, having a piston displacement inside 67 inches. The engines have aluminum cylinders with steel liners, a detachable head and two overhead valves per cylinder. Camshaft drive is from the front end, by a vertical shaft and bevel gearing, with the electric generator on the shaft itself. These little cars have rear cantilever springs and front wheel brakes. One of the features of the race was the use of brakes on the front wheels by practically everybody.

FINANCIAL NOTES

Stewart Warner Speedometer Corp. has declared a quarterly dividend of 75 cents a share on its stock, payable on May 15 to stockholders of record April 29, thus increasing the annual rate from $2 to $3 a share. The corporation paid 6 per cent in dividends 1917 and 1918, 9 per cent in 1919, 4 per cent in 1920 and the rate was further reduced on May 15, 1921 to 50 cents a share quarterly, at which payments were maintained until the present increase. Net profits of the corporation for the first quarter of 1922, not including income taxes, were $516,000 against $51,000 for the corresponding period last year.

Curtiss Aeroplane & Motor Corp. for 1921 reports gross profits on sales of $578,118, and net profits, after all selling expenses and subsidiary company losses, of $277,466. After allowing for interest charges, depreciation, etc., there was a net surplus for the year of $101,207. The balance sheet at the close of the year showed a profit and loss deficit of $1,158,924.

Pierce-Arrow Motor Car Co. for the first three months of 1922 shows an operating income after expenses of $290,075, against a loss of $160,193 in the same period of 1921. Deficit after taxes was $25,226, as compared with a deficit of $189,501 in the same period of 1921.

Republic Rubber Corp. showed its first net profit under C. H. Booth, the receiver, in March. After interest and all charges, the net was $27,000. Shipments for the month were $475,000. Based on gains to date, it is expected they will approximate $550,000 in April.

Lee Tire & Rubber Co. has declared a regular quarterly dividend of 50 cents a share on capital stock, payable June 1 to stock of record May 15.

FRENCH GET BRITISH LICENSE

BRISTOL, ENGLAND, April 12 (*by mail*)—The Bristol Aeroplane Co., Ltd., has granted the sole license to manufacture in France the 400 horsepower Bristol Jupiter radial air-cooled aero engine to the Gnome & LeRhone Engine Co. This is said to be the first time the manufacturing license for an airplane engine of British design ever has been acquired by a French manufacturer.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During the last week the local money market was decidedly easy. Call money practically ruled at 3½ per cent for the whole week, the range being from 3½ per cent to 4 per cent, as compared with a range of 4 per cent to 4½ per cent in the previous week. On Monday renewals were put through at 4 per cent, while a flat rate of 3½ per cent was quoted for the rest of the week. In time money the situation in general was quiet, although funds were in large supply. Toward the end of the week all periods from 60 days to 5 months were quoted at 4¼ per cent with 6 months at 4¼ per cent to 4½ per cent, as compared with 4½ per cent in the previous week for all maturities. The prime commercial rate was down to 4½ per cent, as compared with a range of 4½ per cent to 4¾ per cent in the previous week.

The Federal Reserve statement as of April 19 showed increases of $5,185,000 in gold reserves and $7,642,000 in total reserves. Bills on hand declined $27,041,000 and total earning assets showed a shrinkage of $7,866,000. Total deposits increased $49,829,000, while Federal Reserve notes in circulation decreased $19,215,000. The reserve ratio declined from 77.7 per cent to 77.3 per cent.

It appears that the coal strike now in its third week is having greater influence upon iron and steel conditions than was at first anticipated in some quarters. Although the rate of output is not greatly reduced, rising prices for pig iron and stiffening markets for steel are noted. The demand appears to be stimulated by less confidence in the adequacy of the fuel supply on hand.

According to reports filed with the Interstate Commerce Commission, the Class I railroads showed a net operating income for February of more than $47,000,000, as compared with a net operating income of over $29,000,000 in January and with an operating deficit of over $5,000,000 in February, 1921. The net operating income for February, 1922, represents earnings at an annual rate of 4.57 per cent on the tentative valuation of the roads as fixed by the Interstate Commerce Commission. The income falls short by $14,884,000 of the amount necessary to give an annual rate of return of 6 per cent.

JOHN LAUSON DIES

MILWAUKEE, April 21—John Lauson, founder and president of the John Lauson Manufacturing Co., New Holstein, Wis., a large manufacturer of gas engines and power farming equipment, died at Milwaukee Hospital following an operation. He was 54 years of age and established the nucleus of the present business when he was 19 years of age by opening a small machine shop to make gas engines and do repair work. Lauson designed the Lauson tractor.

INDUSTRIAL NOTES

Hayes Pump & Planter Co. control under the completed refinancing plans has been returned to the directors, newly elected. Officers of the company now are E. L. Yocum, president; R. W. E. Hayes, vice-president and secretary; A. L. Hayes, vice-president; F. H. Hand, treasurer and general manager. W. L. Jacoby, Chicago, president of the Mitchell Motors Co., Racine, Wis., is also member of the directorate. E. M. Kerwin has been controller of the company during the year, since creditors assumed management. The company is located at Galva, Ill.

Bingham Manufacturing Co., Columbus, has been organized with the election of H. N. Bingham, president and general manager; F. E. Kocher, vice-president and G. P. Hinkle, secretary. The company will manufacture rear transmission systems for motor trucks, assemble motor trucks and manufacture special bodies for trucks. The company recently acquired the property in this city of the Immel Co. and has come into possession of a plant at Hamilton, Ont., to manufacture for the Canadian trade, this latter company being known as the Triumph Motor Equipment Co.

Four Drive Tractors, Ltd., has bought the Four Drive Tractor Co., Big Rapids, Mich., and while it intends to continue the present size of tractor this year it plans to bring out two new sizes for 1923 trade. To take care of the new models, the plant facilities will be greatly increased. The new firm is a close concern with no outstanding stock or other obligations and is composed of A. V. Van Horn, manager; Emmet Deady, chief engineer; Henry Polaski, assistant manager; Arthur Martz, treasurer and Leon D. Williams, cashier.

Knox Tire & Rubber Co. at its reorganization meeting elected Judge F. O. Levering of Mt. Vernon, Ohio, president; Harker M. Lybarger, Mt. Vernon, first vice-president; J. O. Robson, Barton, Ohio, second vice-president and sales manager; F. D. Spencer of Mt. Vernon, secretary and George H. Jones of Mt. Vernon, treasurer. They constitute the board of directors together with C. F. Vandervert, J. P. Robson, George W. Ball, W. E. Johnson, G. L. Stephan, M. G. Spencer and Ezra Turner.

Wayne Oil Tank & Pump Co., Fort Wayne, Ind., announces the change of its name to **Wayne Tank & Pump Co.** The change was found advisable in view of the recent purchase of the Borromite Co. of America by the Wayne Oil Tank & Pump Co. The Borromite Co. formerly controlled the patent rights and sold Borromite water softening systems. These will be marketed hereafter under the name Wayne Water Softening Systems.

Six Wheel Truck Co., Fox Lake, Wis., will relocate in Waupun, Wis., local capital having assured a sufficient absorption of the stock and made provision for factory quarters so that quantity production may be started without delay. F. N. Pettegrew, president, and D. G. Strobel, sales manager, are moving their headquarters to Waupun and only a few details remain to be arranged to bring about the actual removal of the present plant.

Halliday Motors Co. has been appraised at $103,000 by J. M. Spillman, B. L. Montgomery and M. J. Reese, appraisers in the suit brought against the company by the Barber Asphalt Co. The appraisement covers property in Seneca, Muskingum and Hocking counties, mostly real estate, and personal property in Licking county. A supplementary appraisement is recommended.

Sandow Motor Truck Co. assets have been sold at auction in Chicago by the trustee. The property was purchased by various bidders, the good will and some of the machinery going to the Giant Truck Co. of Chicago Heights, Ill. The sale was for the purpose of liquidating the Sandow company and the trustee estimated that creditors would receive about 50 cent on the dollar.

Trumbull Tire & Rubber Co., plant at Newton Falls, Ohio, has been sold to the Union Savings & Trust Co. of Warren for $130,000. The sale came as the result of a suit started in 1920 by the Stambaugh Co. of Youngstown whose officials claimed they had completed the plant at a cost of $425,000 and part of this was unpaid.

Driver-Harris Co., manufacturer of Nichrome products with a plant at Harrison, N. J., announces that beginning May 1 its Chicago branch will occupy enlarged quarters at 562-574 West Randolph Street, that city. The facilities heretofore offered have been inadequate for its rapidly growing business in the Mid-West.

Canton Rim Co. has bought the property of the **F. R. Fortune Tool Co.** at Wooster, Ohio, for $25,300. Of this $13,000 was cash and the balance in preferred stock. The company will begin operations within sixty days and at the start will employ 25 to 30 men.

John E. Moore, general sales manager, and **William A. Kent,** eastern sales manager of the Hinckley-Myers Co., Jackson, manufacturers of complete garage and service equipment, have opened an eastern sales and executive office in the General Motors Building, Detroit.

Ralph Root has purchased the assets of the Worcester Abrasive Co., New York, manufacturer of "pep" water mixed valve grinding compound and has organized the Pep Manufacturing Co., with offices at 33 West Forty-second Street, New York.

International Harvester Co. shipped from Jan. 1 to April 1 a total of 1,651 carloads of trucks from its factories at Akron and Springfield, Ohio. Of the total, 892 carloads were shipped west of the Mississippi river and 759 east of the Mississippi river.

Traylor Engineering & Manufacturing Co. first mortgage 8 per cent sinking fund bonds due June 1, 1936, to the amount of $800,000 are being offered through H. D. Robbins & Co., New York, at 101 and interest.

United States Rubber Co. branch at Kansas City will become the largest of the 43 American branches of the company through the acquisition of a lease on an eight story building in that city.

New Engine for Airplane Still Under Development

WASHINGTON, April 24—The National Advisory Committee for Aeronautics, an independent bureau of the Government doing research on motor construction, has been informed of the progress made in developing the semi-Diesal airplane engine, on which the committee has been working for some time. Until the engine is fully developed and all plans have been completed, none of the specifications will be given out, Chairman Charles D. Walcott has announced.

The possibilities of an airplane engine, so constructed that it will run on a distillate, thus obviating the greater amount of danger from airplane fires, it was stated, are extremely favorable and will eventually be a reality.

METAL MARKETS

BOTH the pig iron and steel markets have responded with alacrity to the pranks and capers of frightened buyers, some of whom have apparently become so scared that they are placing orders without even mentioning the subject of prices. Thanks to the abject fear of the nervous contingent that they might be caught without sufficient supplies to satisfy their requirements the iron and steel markets have turned from the easy position they were in a few weeks ago into a strictly sellers' affair. There was a meeting of independent steel interests in New York a few days ago. Of course, no one knows what took place at this meeting, but the very fact that such a meeting was held proves the return of sunshine where a few months ago there were only great gobs of gloom.

Youngstown sheet producers let it be understood that they doubt whether consumers will be given an opportunity to cover their requirements at prevailing levels should a further advance in sheet prices be generally decided upon. This advance is already in the making. Some of the mills mention 3.30@3.40c for black and 4.30@4.40c. for galvanized as asking prices on new business. They have not yet booked any business at these prices, which imply an advance of $3@$5 a ton, but there is no telling what may come to pass in a market such as the present one.

Full-finished automobile sheets are quoted at 4.50c. It is only natural that, with the production of most sheet mills engaged up to June 30 at prices $6 a ton below what many producers believe they could obtain to-day, there is no eagerness for orders for third quarter deliveries. In spite of all the nervousness which many smaller consumers manifest, there is very little danger of runaway market conditions. In the first place, large buyers are looking upon recent developments in the iron and steel markets with considerable equanimity. They have covered their requirements for the current quarter and can afford to assume a waiting attitude. In the second place, the chief steel producing interest's policy has never been more conservative. It aims at the building up of a sound backlog of orders at present prices and a stabilization of the market. The independents can go just so far in the matter of prices and no further.

Pig Iron.—More and more furnaces are going into blast. Prices are $2 higher than they were a month ago. A further price flurry is not precluded, but with increased production and a sane attitude on the part of buyers it should be short-lived, especially if the coal strike is settled in the near future.

Steel.—Automotive consumers have placed orders (in some instances for as much as 1000 tons) for hot- and cold-rolled strip steel, with the result that many producers are reluctant to commit themselves beyond the present quarter. Cold-rolled is steady at 3.65c. and hot-rolled at 2c., Pittsburgh. Prices for nuts and bolts have been revised upwards. For sheet bars as high as $35 is asked, although in some instances business for deferred shipment has been placed at $31@$32.

Aluminum.—Market has turned stronger and it takes some combing to uncover 98 to 99 per cent pure virgin ingots at below 18c. Automotive consumers are in some instances specifying on contracts ahead of the maturing of deliveries.

Copper.—The market for ingot metal is of a lackadaisical character. The leading rolling mills interest has reduced all copper products, with the exception of wire and wire rods, 1c. per lb., and all brass and bronze products ½c. a lb.

Calendar

SHOWS

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

Nov. 3-11 — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

May 31 — Indianapolis International Sweepstakes.

CONVENTIONS

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-17—Detroit, Semi-Annual Convention, Factory Service Managers, National Automobile Chamber of Commerce, Hotel Statler.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 22-23 — St. Louis, Annual Meeting of the American Automobile Association.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-20—Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Indianapolis, May 8; Chicago, May 12; Detroit, May 19. The Pennsylvania section will hold an outing at Torresdale or a body meeting on May 25.

Reo Selects Windsor for Canadian Plant

DETROIT, April 25—The Reo Motor Car Co. has taken over the plant of the Swedish Crucible Steel Corp. in Windsor and will locate its Canadian manufacturing branch there. The work of moving equipment from the former St. Catharines plant is now under way; D. B. McCoy, former advertising manager of the company, has been appointed manager of the Canadian branch.

The plant will be used exclusively for production of Reo cars and speed-wagons for the Canadian trade, the general export business of the company to be continued from the Lansing plant. Assembling of vehicles will be under way within 90 days, and it is expected to reach a production, with facilities to be added, of 15 to 20 daily.

The St. Catharines plant of the company has not been in operation for about four years. Some time ago it was determined to move the Canadian branch to Windsor as the logical site for motor car manufacturing in that country. Plans were held up pending the acquisition of suitable buildings. The Canadian offices of the company will be located in Windsor after May 1.

Factories in Detroit Short of Skilled Labor

DETROIT, April 24—Increased production in automotive plants has absorbed practically the entire supply of skilled labor in this district. Some factories are having difficulty in obtaining common labor. An actual shortage of skilled workmen is reported in body plants. Many advertisements for wood working, machine and other skilled operatives are being carried by Detroit newspapers.

An increase of 4500 men on the payrolls of members of the Employers Association was reported last week, bringing the total to 145,234, or within 50,000 of the peak in 1920.

TRACTOR PRICES REVISED

NEW YORK, April 24—Price revisions have been announced by the different manufacturing companies on the following tractors:

	Old Price	New Price
Heider C	$900	$995
Townsend, 10-20	750	800
Fitch	...	1,850
Mohawk	785	650
T. B.	715	500
International, 15-30	1,500	1,750
Reliable, 10-20	865	390

SMALLER TRACTORS SELLING

LOS ANGELES, April 22—Tractor dealers in Los Angeles and other cities in Southern California report that there has been a satisfactory movement of the small, lower-priced lines this spring.

DIAMOND NAME PROTECTER

WASHINGTON, April 27—The Federal Trade Commission has issued an order prohibiting the Diamond Holdfast Rubber Co. of Atlanta from using the word "Diamond" in connection with the rubber business as this word has been established in the rubber trade by the Diamond Rubber Co. of Akron, Ohio, which began its use in 1898. The commission's order not only prohibits the Atlanta company from using the word "Diamond" but also from the use of the figure of the diamond or any symbol or mark likely to be confused with it.

Dominion Steel Elects Jones Head

DETROIT, April 26—Harry Ross Jones, president of the United Alloy Steel Corp., Canton, Ohio, has been elected chairman of the board of directors of the New Dominion Alloy Steel Corp. W. B. Boyd of Toronto was made president and George A. Simpson of Hamilton and B. H. McCreath of Toronto were elected vice-presidents.

A large site fronting on the St. Claire River in the south end of Sarnia has been ceded to the company by the Canadian government. Construction of a plant is expected to be started in six weeks. The first unit will probably be in operation in twelve months.

The company will specialize in production of hardened automobile steel, of which about $5,000,000 worth is imported into Canada annually. The company is to have an authorized capital stock of $15,000,000. Five million dollars will be subscribed for the commencement of operations. Arrangements are reported to have been made with bankers to underwrite the stock issue.

Kelsey Wheel to Make Bodies for New Gray

DETROIT, April 26 — The Kelsey Wheel Co., Inc., will make the bodies for the new Gray motor cars, in both open and closed models. Until within the past year, Kelsey was a big producer of Ford bodies, having a capacity for over 1000 bodies daily. This work was discontinued with the opening by the Ford company of its own body making plant.

First bodies for the Gray line are now under construction in the Kirby Avenue plant of the Kelsey company.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLVI. NEW YORK—THURSDAY, MAY 4, 1922. No. 18

Rising Prices and Low Exchange Hurt German Car Makers

Business unstable because of low value of mark. Steady price increases have created demand for small cars. Dealers are pessimistic as regards 1922. Lack of standardization hurts repair business.

By Benno R. Dierfeld

THE success of the German automobile industry depends primarily on the exchange rate of the German mark. In October, 1920, very favorable sales conditions existed, but with the gradual amelioration of the value of the mark, business slowed down so that the sweeping immunity from former governmental restrictions had, at first, no immediate result. In May, 1921, business showed marked symptoms of improvement and in August and September, 1921, when the rate of exchange of the mark dropped more, the automobile business developed with unusual intensity and record months followed.

Sales prices in general paralleled business development. In the first half of the year prices were low and business secured only moderate profits, if not direct loss on account of depreciation of stocks on hand. With the increase in demand, prices rose and good prices were received for immediately delivery of both cars and trucks; that did not, however, parallel the actual depreciation of the mark. In this manner gross profits were good, but net profits diminished considerably due to the enormous increase in expenses. The buying public did not always take kindly to price increase and a survey of the country shows that the high prices for automobiles combined with increased operating expenses caused a considerable slowing down in sales.

In the following tables and data, which are taken in part from a report given by Mr. Buschman, president of the German Automobile Dealers' Association, at the last meeting of the organization, minimum prices are quoted which apply only to the cheaper cars and trucks of each class. Higher quality cars are listed at correspondingly higher prices. These prices do not include export duty, or allow for fluctuations in exchange, but are for cars ready for shipment:

PASSENGER CAR CHASSIS VALUE (WITHOUT TIRES)

Date	Engine Brake Horsepower 15 Hp. Marks	30 Hp. Marks	45 Hp. Marks
July, 1920	43,750	70,000	89,000
November, 1920	50,000	80,000	110,000
December, 1920	46,000	77,000	92,000
September, 1921	71,000	107,000	135,000
November, 1921	90,000	142,000	180,000
March, 1922	175,000	280,000	360,000

It is easy to understand how the enormous increase in car prices has created an urgent demand for small passenger cars. Many dealers have been compelled by this pressure to complement their existing line of cars with small cars. There are serious complaints by purchasers, dealers and the trade press that the German automobile industry does not pay sufficient attention to the light, inexpensive car.

The following truck prices were compiled by the Convention of Truck Manufacturers:

Date	Load Capacity 2 Tons Marks	3 Tons Marks	4 Tons Marks
August, 1920, up to September, 1921	102,000	112,000	122,000
September, 1921	130,000	140,000	150,000
October, 1921	190,000	200,000	220,000
December, 1921	225,000	245,000	265,000
March, 1922	370,000	390,000	410,000

That the farmers and industry in general have taken an increasingly keen interest in motor trucks is worthy of note. In view of the fact that railway transportation has increased steadily this heightened interest can readily be understood. In some cases motor truck transportation is actually cheaper than railway transportation.

Motor transportation shipments are forwarded direct from the consigner to the consignee without the expense of cartage to and from the railroad freight office and the consequent loading and unloading expense. The opinion expressed by the German business press to the effect that, the future of the German automotive industry lies in the direction of the motor truck, is correct.

Light Truck in Demand

During the past year the principal demand for trucks centered on the light unit of one to two tons and the heavy unit of four to five tons.

The high level of new car and truck prices has kept interest in the used car market stimulated, and the very slow deliveries made by the factories has caused a general cleaning out of used car stocks. Immediately after the war many dealers were compelled to repair and sell used cars and trucks and recently have resumed this business, but its profitability seems to be rather doubtful. The costs of repairing and overhauling have reached such a high level in consequence of enormous wages and price of materials that the net profit is very problematical. To this is added the speculative risk of purchasing great numbers of used cars and trucks for the purpose of repairing and reselling, inasmuch as there are in some towns great stocks of used trucks.

Automotive export figures at best are incomplete and are as follows:

GERMAN EXPORTS, MAY TO DECEMBER, 1921

Number	Value
5810 cars and trucks	587,107,000 marks
1928 motorcycles	24,598,000 marks
Total 7738 automotive vehicles valued at	611,705,000 marks

It is probable that the total exports for 1921 will be lower than in 1920. The principal markets are Denmark, Norway, Sweden, Netherlands, Spain and Belgium.

Toward the end of 1920 governmental restrictions over fuel for motor vehicles were removed and sufficient quantities of fuel, principally gasoline, are now available, although the total demand for fuel for automotive purposes may be estimated at 300,000 tons for the year. The price of gasoline has been rising steadily as is shown in the following table:

AVERAGE CONSUMER PRICES FOR GASOLINE

	Per 100 Kilograms
October-November, 1920	780-790 marks
December, 1920-January, 1921	795-810 marks
February-April, 1921	770-810 marks
May-June, 1921	770-710 marks
July-August, 1921	700-880 marks
September, 1921	880-890 marks
March, 1922	1,900-2,400 marks

It is probable that these prices will rise even higher.

The quality of the gasoline is often poor. Benzol and the National Standard fuel are sold at the government supply stations, but only physicians, government cars, etc., can obtain them, and the present price (1000 to 1600 M per 100 kilograms) is rather high as well. Benzol is supplied also for agricultural purposes.

The cost of operating a small car without a driver is shown in the following table. These figures are accepted as representing an average of all costs:

OPERATING COSTS OF SMALL CARS PER KILOMETER

	November, 1921	March, 1922
15 b.h.p. passenger car without driver	6.50 marks	10.50
18 b.h.p. passenger car without driver	7.50 marks	13.50
24 b.h.p. passenger car without driver	12.50 marks	21.00

A chauffeur's wage is about 28,000 to 32,000 marks per year, excluding the cost of lodging, uniform, etc.

Automobile dealers suffer great difficulties in the buying of materials and accessories for repairing cars. Assume, for example, that a car has to be equipped with new headlights which, of course, must fit the headlight brackets. There are many factories producing headlights in Germany, but the dealer does not know which one manufactures the type which suits his specific need.

In former times a dealer or foreman of a repair shop would apply to a wholesale dealer who kept a large stock on hand and sold at factory prices. This is not possible to-day because of the continuously fluctuating prices. The wholesale dealer of to-day operates under enormous expense and could not afford to carry a more complete line. Consequently the automobile dealer applies directly to the factory if he knows which one can fill his order, and in order to determine what factory to apply to, he must have experienced employees and a card system which the average dealer cannot afford.

A Novel Syndicate

To remove these drawbacks the M. E. G. (Material-Einkaufs-Genossenschaft) Deutscher Automobilhändler, the Material Purchasing Syndicate of German Automotive Dealers, has been established in Berlin, with Mr. Leopold Steiner, a well-known accessory expert, as president. This syndicate is of great service to the individual members in that the expense of card index systems and expert employees is done away with, the syndicate doing it for him, and obtaining for him any desired article without advance payment. The syndicate is not a private company. It is registered at the law court and operates under the laws governing syndicates. Only firms registered in the syndicate's books are able to secure its services. A sample store is provided at the headquarters and members have the opportunity to examine and compare different lines of goods. A general catalog is published which contains information on all novelties and accessories, including those which are sold exclusively by individual concerns.

As regards prospects for the automotive dealer during this business year, it can be said that dealers on the whole are pessimistic. This pessimism is caused by the steadily rising prices which have not yet reached their peak. Furthermore, great difficulty is experienced due to the fact that since the fall of 1921 automobile factories will not accept orders without the clause, "Prices subject to market price at time of delivery," being written into the contract. Consequently, due to the long period between the order and the delivery, the buyer often has to pay double or triple at time of delivery.

The dealer is handicapped because it requires more capital to replenish his stock than he could secure from the sale of the old stock. The writer knows of a case where six months ago a price of 180,000 marks was agreed upon for the purchase of a car and the dealer now offers the buyer 280,000 marks to cancel the contract.

This example is characteristic of German business conditions which are so uncertain, due to dependency on the exchange rate of the mark.

Light Weight Features New Tractor Engine Design

New four-cylinder Erd engines are built in two sizes, one has 4 x 6 in. cylinder dimensions while the other has 4½ x 6 in. Their weights are 665 lbs. and 675 lbs. respectively. The kerosene burning feature retained.

TWO new four-cylinder tractor engines, one of 4 x 6 in. cylinder dimensions, designated as the "B-30," and the other with 4¼ x 6 in. cylinders, designated as the "B-35," have been announced by the Erd Motor Co. Having the stroke the same and the bores only ¼ in. apart permits of using many parts in both engines, thus simplifying the manufacturing problem. The piston displacements are 301.6 and 340.4 cu. in. respectively. Both engines are made for either three or four point support, with either open or closed flywheel and with especial reinforcing feature said to be necessary in frameless tractors.

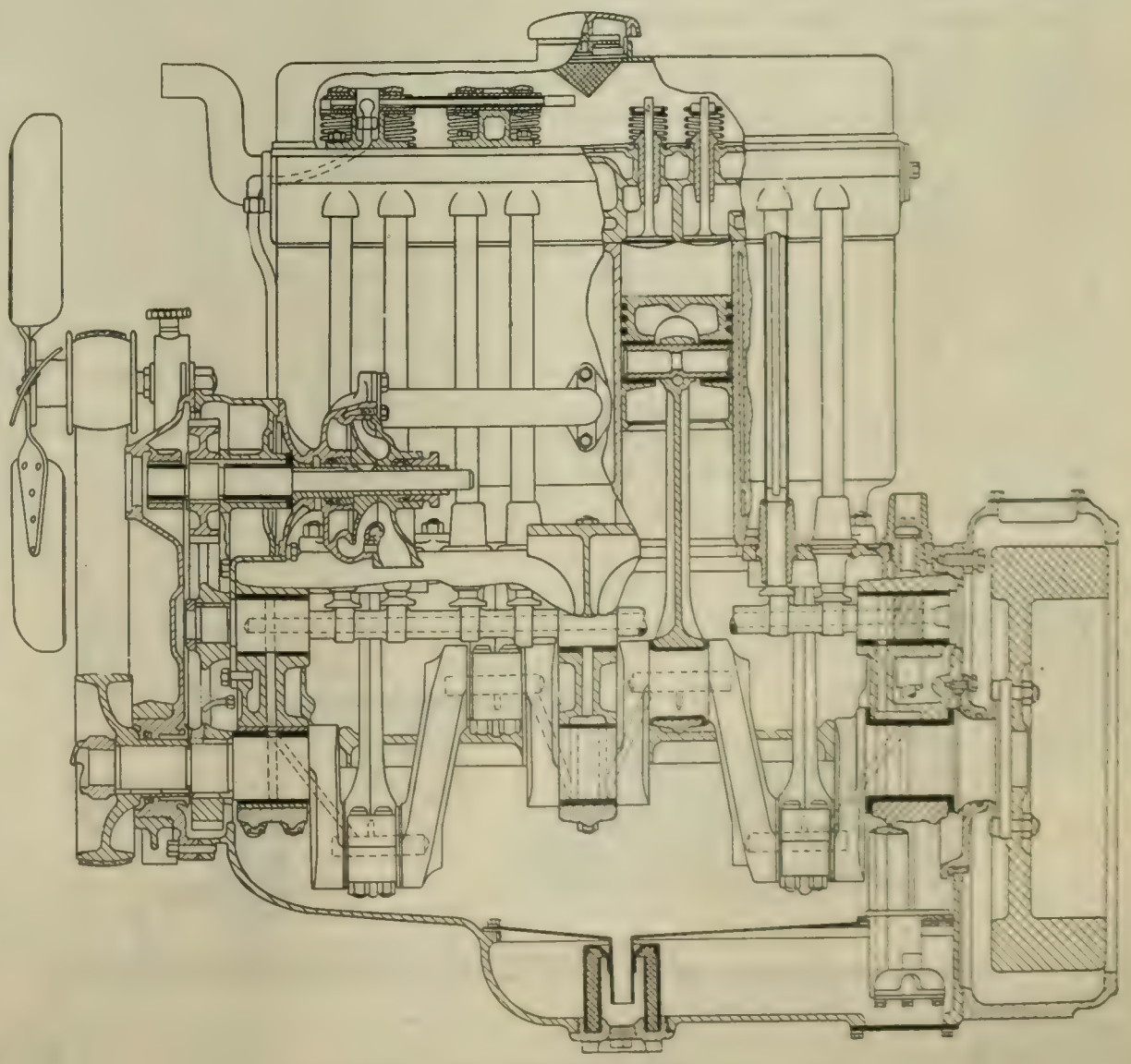
The kerosene burning feature, which is said to have been very successful on the previous Erd model, has been retained. The cylinders are cast in one block with the cylinder head detachable. A large diameter chrome-nickel steel crankshaft is used, which is claimed to obviate trouble from flat spots. The bearing diameter on this crankshaft, which is of the same size for both models, is 2½ in. The valves being located in the head, a cylindrical form of combustion chamber is obtained which adds to the efficiency of combustion. Larger water spaces are provided, especially around the valve and spark plug bosses.

The piston is provided with three rings ¼ in. wide, all located above the piston pin. The piston pin is clamped in the upper end of the connecting rod and has bearings in the piston bosses 1¼ in. in diameter. The big end of the connecting rod is of the four-bolt type, the object in using four bolts being to distribute the pressure evenly on the bearing surface. The connecting rods have a center to center length of 12 in. and the bolts holding the caps in place are 7/16 in. in diameter.

The valves are 1¾ in. in diameter and are operated through push rods extending up through tubes at the side of the engine. It is claimed that the enclosure of the valve mechanism is entirely dust and oil-tight, which in a tractor engine is, of course, of the highest importance. Oil for the crankcase is poured in through a filler in the cylinder head containing a filter, and passes down to the crankcase through a passage down the center of the cylinder block. This oil filler also serves as a breather. It is provided with a one-way valve, so that any excess pressure in the crankcase will be relieved but no extra air can enter the crankcase at this point. This tends to keep out dust.

Oil is fed from the sump by a positive, primed gear pump to the camshaft and thence to the bearings. The pump is driven by means of a helical gear on the camshaft, this same gear also driving the governor. The hollow camshaft acts as a main distributing line for the oil to the main bearings and connecting rod bearings, the crankshaft being drilled. By taking off the camshaft gear cover, the camshaft can be removed from the front end of the engine without disturbing any other part. The valve mechanism is lubricated by a positive flow of oil from the oil line to the hollow rocker arm shaft. It is claimed that by using the camshaft as an oil-distributing lead the danger of loss of pressure due to a leaky oil line is almost entirely eliminated.

Before entering the pump, the oil from the crankcase passes through a filtering screen. The construction of the screen is such as to permit the removal of a plug from the bottom of the pan to remove the sediment, without disturbing other elements, and the whole screen may also be removed and the screen cleaned by draining the oil in the



Part sectional view of Erd tractor engine

case. A standpipe within the screen automatically determines the level in the crankcase, thus assisting lubrication when operating in hilly territory. In the case of the connecting rod bearings oil enters on the cap side in direct line with the oil channels in the main bearings, at the time of the explosion and when the clearance is greatest.

Hand hole covers of ample size are provided, through which all crankcase parts can be inspected and adjusted. The hand holes are conveniently located at one side of the crankcase and give particularly good access to the connecting rod bearings. A semi-circular cork gasket at the rear end of the crankcase permits of the removal of the pan. At the forward end a felt gasket is used. A series of three oil return grooves act against an oil deflector on the crankshaft.

The water pump may be quickly removed from the shaft by disconnecting the pipe and removing the flange screws. Crane molded packing is used. Oversize bearings are provided on the pump shaft to permit a power take-off for the fan if desired. A positive, mechanically controlled oil regulator is employed, which regulates the oil pressure by throttle, in proportion to both the load on the bearings and the speed of the engine. There are two independent springs, one a screw adjustment for use while the motor is idling, at which time the tendency to flood the oil lines is greatest. Standard S. A. E. fittings are used throughout.

The rate of oil circulation at 1000 r.p.m. is 1.9 gal. per min., and the quantity of water circulated at the same speed is 13.6 gal. The weight of the engine when fitted with an open flywheel is approximately 665 lb. for the smaller and 675 lb. for the larger model, and with a bell housing, 675 lb. for the smaller and 685 for the larger model.

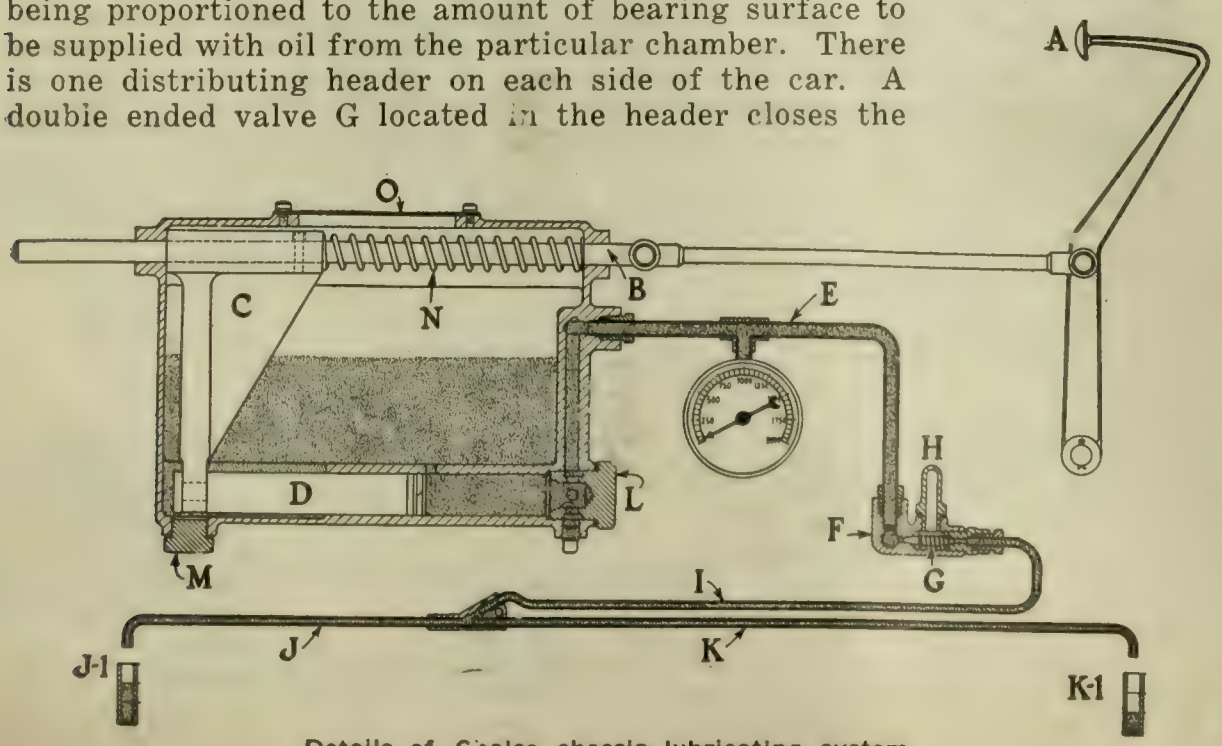
An Automatic Chassis Lubricating System

A NEW system for automatic lubrication of the chassis is being marketed. It comprises an oil reservoir located on the chassis back of the driver's seat, a plunger pump combined with this reservoir and operated by means of a pedal located convenient to the driver, a main supply line leading from the pump and carrying a pressure gage, a distributing header with air chamber thereon and connection or leads from this header to the different bearings to be lubricated. It is known as the Chalco system and supplied by the Chassis Lubricating Corp.

It is claimed for this system that it permits of feeding the right amount of oil to each bearing and does away with all oil cups and grease cups on the chassis. The illustration shows the system in diagram. At the bottom of the oil reservoir may be seen the plunger pump containing the plunger D. This is actuated through an arm C and rod B from the pedal A. A spring N on rod B returns the plunger to the beginning of the pressure stroke when the pressure is removed from the pedal. When the plunger is in this position oil enters the pump cylinder through a port on top, and during the pressure stroke of the plunger oil is forced through the supply line E to the distributor header F. On this distributing header are mounted four air chambers H. These air chambers are of different volume, the volume being proportioned to the amount of bearing surface to be supplied with oil from the particular chamber. There is one distributing header on each side of the car. A double ended valve G located in the header closes the secondary supply lines during the period pressure is exerted from the pump, and during this period the air chambers are partially filled with oil. As soon as the pump pressure ceases, the double-ended valves automatically throw over, closing the inlet from the pump and opening the outlet from the air chambers to the secondary supply lines. Thereupon the air pressure in the air chambers forces the oil trapped in the chambers through the secondary supply lines and the branch supply lines to the various bearings which are to be lubricated.

The amount of oil fed to each bearing is further controlled by the dimensions of the supply lines as regards both their diameter and length. This is illustrated in the diagram. The air chamber H is proportioned to take enough oil for the left rear spring bearings. Secondary supply line I carries oil to a T located at a given point on branch supply lines J and K. J-1 is the outlet to the rear of the rear spring, where two bearings have to be fed. K-1 is the outlet to the front of the rear spring, which has only one bearing. Therefore, line J is made only half as long as line K, which is claimed to result in twice as much oil being fed in a given time to J-1 as to K-1.

The branch distributing lines are carried in the usual way to all of the spring bolt bearings, the steering gear bearings, the brake connection bearings, etc. The reservoir will hold enough oil for 5000 miles running of the car.



Details of Chalco chassis lubricating system

Taking Census of Safety Workers

THE National Safety Council has requested that all men and women engaged in safety work send their names to the council's headquarters in Chicago. The organization wishes to complete a census of all persons engaged in safety and industrial health work in all industries of the country. One reason for this step, it is pointed out, is that the council will have a list of persons available upon whom they can call when requests for speakers or writer on safety subjects are received.

Detonation—A Consideration of Its Causes

Since the tendency of a fuel to detonate is of great importance in determining its value for use in automotive engines a better understanding of the causes of this phenomenon is desirable. The effect of explosion pressure, spark advance and other related factors are pertinently discussed.

By Stanwood W. Sparrow[1]

A DETERMINATION of the relative merits of various fuels for use in high compression engines is the object of experiments being conducted at the Bureau of Standards for the National Advisory Committee for Aeronautics. Inasmuch as the tendency of a fuel to detonate often makes it unsuitable for such use, a consideration of the general subject of detonation has formed the initial step in this investigation. The purpose of this article is not to summarize the available information on the subject, but to discuss a phase which seems to have received relatively little attention by those who have written heretofore on the subject.

In most discussions of detonation attention has been focused on the rate or the nature of the combustion. Charge temperatures and pressures before combustion have been considered from the standpoint of their influence on this rate rather than from the standpoint of their influence upon the temperatures and pressures after combustion. This does not imply that investigators have failed to appreciate this latter influence but that they have thought of it as a sort of necessary background fixed by the compression ratio, and so have turned their attention to a factor that could be altered, namely, the rate of combustion. It is believed, however, that a careful scrutiny of this background will throw considerable light on some of the results heretofore reported by other experimenters in this field.

Explosion Pressure

Fig. 1, which presents results obtained from a single-cylinder engine, forms a convenient starting point. In this figure and throughout this article, the presence or absence of detonation should be understood to mean the presence or absence of the metallic ringing sound characteristic of detonation. As indicated in the figure, detonation was only apparent at spark advances between 25 deg. and 55 deg. before center. More interesting is the fact that with this engine detonation occurred only when the explosion pressure as measured was somewhat greater than 450 lb. per sq. in. From this, one would conclude that, for a given engine, the explosion pressure must exceed a definite value if detonation is to result. Such a conclusion is a natural consequence of the common belief that the sound which serves to identify detonation arises from a deflection or vibration of the combustion chamber walls. It seems logical, therefore, to consider such changes of engine condition as are known to affect detonation and to estimate the effect of such changes upon the explosion pressures.

Compression ratio deserves first attention, as it is known to exert great influence upon the tendency of an engine to detonate. Accordingly, calculated explosion pressures for several compression ratios have been plotted in Fig. 2. These have been computed as though the entire charge were burned at top center with no heat loss. Obviously explosion pressures thus calculated should exceed those obtained in practice. Nevertheless they form a satisfactory basis for comparison provided actual rates of burning and heat dissipation are approximately the same for all the conditions compared. Moreover, ground for believing that this assumption is not far from the truth comes from the testimony of numerous investigators that they have obtained maximum power with nearly the same spark advance over a wide range of fuels[2] and compression ratios.

Relations for Calculations

In calculating the values for Fig. 2, the following familiar relations have been employed:

$$P_2 = P_1 r^n$$
$$T_2 = T_1 r^{n-1}$$
$$M = T_3 - T_2$$
$$P_3 = P_2 \left(\frac{T_2 + M}{T_2} \right) = P_2 \left(1 + \frac{M}{T_2} \right)$$

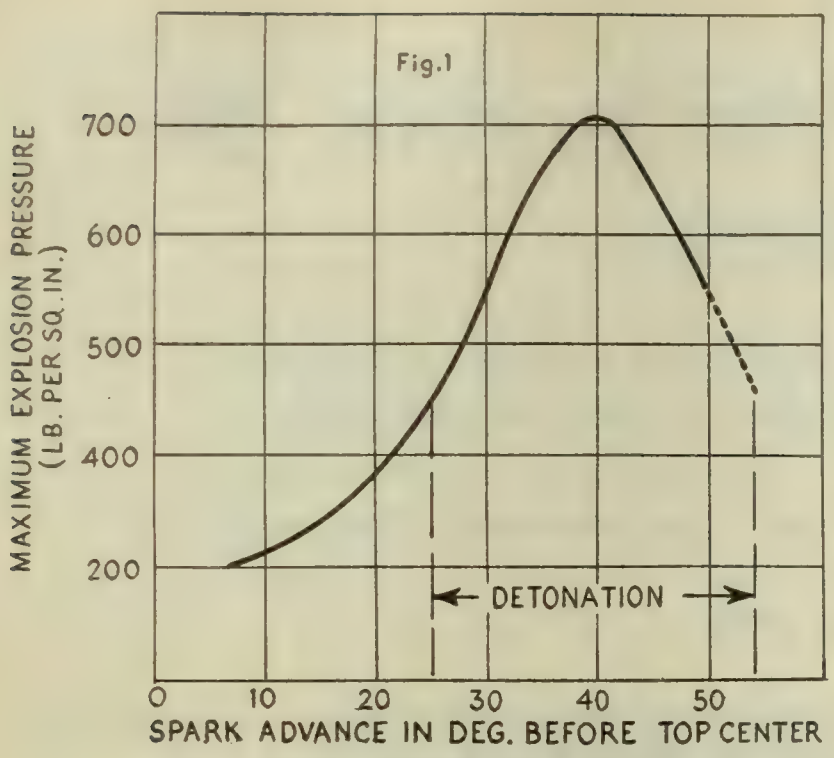
where

r = ratio of compression and expansion.
P_1 = absolute pressure at beginning of compression stroke.
T_1 = absolute temperature at beginning of compression stroke.
P_2 = absolute pressure at end of compression stroke.
T_2 = absolute temperature at end of compression stroke.
M = increase in mixture temperature due to combustion.
T_3 = absolute temperature after combustion.
P_3 = absolute pressure after combustion.
n = exponent having experimental values ranging from 1.25 to 1.35.

In preparing Fig. 2, P_1 has been taken as 14.7 lb. per sq. in, M as 4892 deg. Fahr. (2700 deg. C.) and n as 1.3. In figuring T_1, the fresh charge has been assumed equal to the piston displacement in volume when at atmospheric pressure and at an absolute temperature of 608 deg. Fahr. (320 deg. C.). In like manner the residual products of combustion have been assumed to have a volume equal to the engine's clearance space when at atmospheric pressure and at an absolute temperature of 2322 deg. Fahr. (1273

[1] Technical Note No. 93 issued by the National Advisory Committee for Aeronautics. The author is in immediate charge of investigations relating to detonation at the Bureau of Standards.

[2] All fuels give nearly the same maximum power at the same compression ratio.



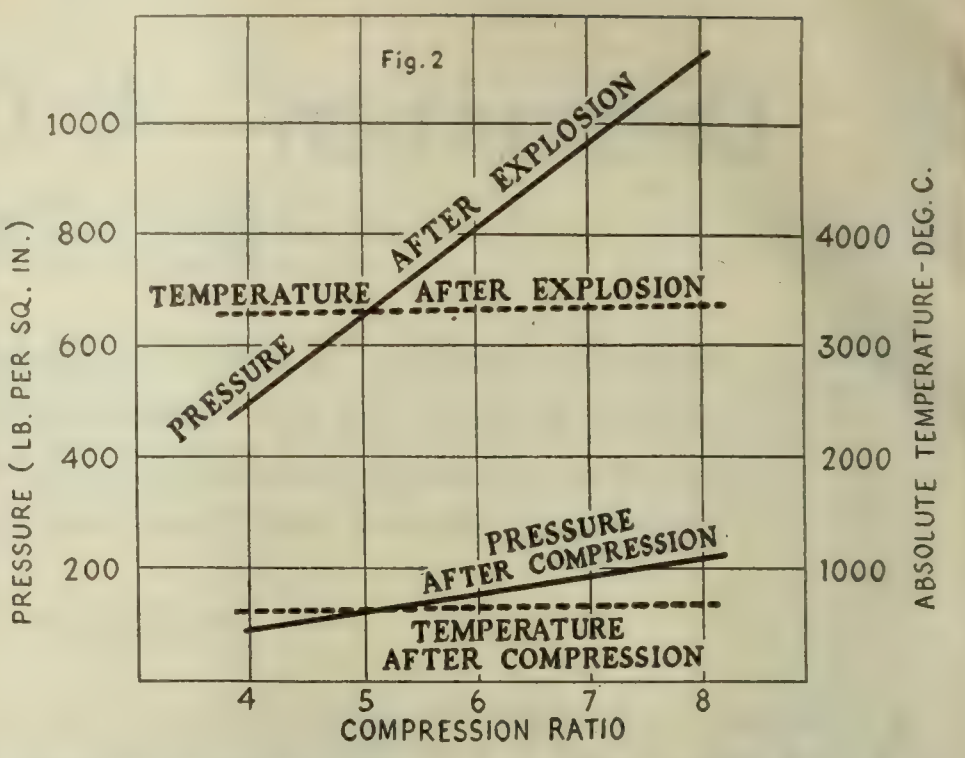


Fig. 1—Relation between spark advance and maximum pressure in a single-cylinder, 5 x 7-in. engine running at 1100 r.p.m. Fig. 2—Calculated maximum compression and explosion pressures and temperatures for different compression ratios

deg. C.). Some values thus calculated are tabulated below.[3]

r	T_1 Deg. C.	T_2 Deg. C.	P_2	P_3	T_3 Deg. C.
4	393	595	89	494	3,295
5	376	610	119	645	3,310
6	365	625	151	806	3,325
7	358	643	185	960	3,343
8	353	660	219	1,115	3,360

Attention has been directed repeatedly to the many tendencies toward an increase in combustion rate with an increase in compression ratio. A smaller volume through which the flame must spread and a smaller proportion of inert gas are two of the factors emphasized. All such tendencies would increase the differences shown in Fig. 2. The significant thing is that, neglecting all such possibilities, assuming no change in combustion rate, there would still be an increase in explosion pressure of over 125 per cent produced by changing from a ratio of 4 to one of 8. This change of ratio would only increase the absolute temperature at the end of compression by 11 per cent and the absolute temperature at the end of combustion by 2 per cent. It is not surprising, therefore, that a well known British investigator concludes charge temperature to be of minor importance from a detonation standpoint.[4]

At this point it is well to consider Fig. 3, which presents some of the most interesting information that this investigator, Mr. Ricardo, has obtained from his variable compression engine. The figure shows data obtained by throttling the engine, at compression ratios above 4.8, to the point of detonation. The dotted line shows the indicated m.e.p. obtained at full throttle with a non-detonating fuel. After operating at each ratio the compression pressure was measured with a gage while the engine was driven by a motor at the same speed and throttle opening as before. The most striking lesson from this curve is that detonation occurs at very nearly the same compression *pressure* regardless of the compression *ratio*.

Inasmuch as this discussion is concerned with the relation of explosion pressures to detonation, an estimate of the probable explosion pressures for the conditions shown in this figure is in order. One might anticipate that the expansion of the gases after passing the throttle would cause an appreciable temperature drop. Calculation and experiment both show this effect to be negligible under the circumstances under consideration.[5] Another factor which is likely to influence the temperature at the beginning of compression is the proportion of exhaust gas present. This can be estimated rather closely by assuming that the weight of fresh charge at part throttle bears the same relation to the weight of charge at full throttle as the indicated m.e.p. at part throttle bears to the indidicated m.e.p. obtained at full throttle with a non-detonating fuel. Actual experimental determinations of indicated m.e.p. are given in the figure. Except for the use of the indicated m.e.p. to estimate part throttle exhaust gas content, the method of calculation is the same as that used in obtaining Fig. 2. Although throttling an engine of fixed compression ratio tends to increase the proportion of exhaust gas to fresh charge, the calculations indicate that with the variable compression engine under the circumstances under discussion there is an accompanying decrease in clearance volume which neutralizes this effect. Thus, over the range covered by the curves, the exhaust gas expressed as a percentage of new charge varies less than 1. It follows that the temperature at the beginning of compression will remain nearly constant and values calculated on this basis are tabulated below.

r	T_1 Deg. C.	T_2 Deg. C.	T_3 Deg. C.
4.8	388	620	3,320
5.0	388	629	3,329
5.5	388	648	3,348
6.0	388	664	3,364
6.5	388	680	3,380
7.0	388	696	3,396
7.5	388	710	3,410

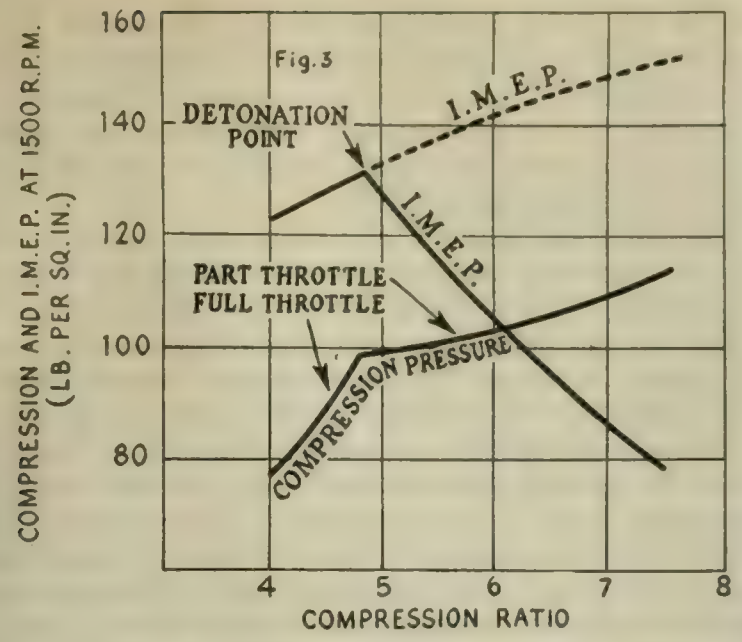
[3] It should be remembered that the aim is a comparison rather than accurate determination of temperature and pressures. This justifies the omission of steps that would otherwise be essential. For example, the temperature increase produced by combustion has been taken as 2700 deg. C. for all compression ratios, although because of the smaller clearance volume of spent gas the amount of temperature rise should increase with the ratio (since less of the energy of combustion is expended in raising the temperature of the inert gas). An opposing tendency is the increase in specific heat that results from the higher compression temperatures of the higher compression ratios. The use of the same value of exhaust gas temperature for all ratios is open to similar criticism. An increase in expansion ratio tends to lower this temperature, which effect is opposed by a decrease in heat loss due to the decrease in combustion chamber surface. These various tendencies have been considered but are not included in the calculations, as their combined influence should affect the comparative values less than 5 per cent.

[4] See article entitled "Recent Research Work on the Internal Combustion Engine," by Harry R. Ricardo in AUTOMOTIVE INDUSTRIES, Jan. 19, 1922. The conclusion quoted is expressed thus: "Our experiments appeared to show pretty clearly that detonation has very little connection with the temperature of compression, but is closely dependent upon the compression pressure."

[5] On page 109 of Bulletin No. 19 of the Engineering Experiment Station of Ohio State University Professor Norman discusses the laws governing this drop in temperature and calculates the following values:

Gas velocity in feet per second	50	100	200	300
Temperature drop in deg. C.	0.1	0.4	1.8	4.2

Tests at the Bureau of Standards showed no decrease in manifold temperature when the throttle of an aviation engine was closed while it was being motored with the fuel supply cut off.



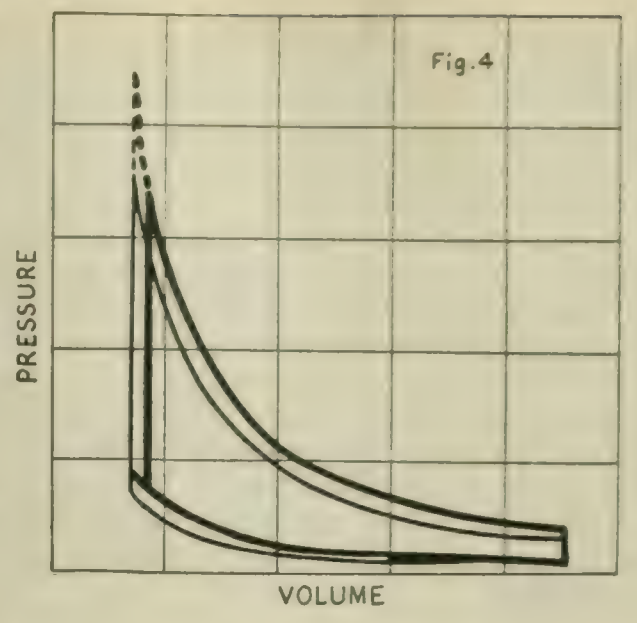


Fig. 3—Relation between compression ratio, compression pressure and indicated m.e.p. as reported in tests made by Ricardo. Fig. 4—Theoretical pressure-volume diagrams. Light line represents card for an engine throttled to give 85 per cent of its maximum power. Heavy line represents equivalent card given with throttle wide open and spark retarded

It will be recalled that the relation between explosion pressure and compression pressures is as follows: $\frac{P_3}{P_2} = 1 + \frac{M}{T_2}$. An increase in compression ratio means an increase in T_2, and hence a decrease in the value of this ratio. For this reason a higher explosion pressure will be obtained from a low compression ratio engine at full throttle than from a high compression ratio engine throttled to the full load compression pressure of the low ratio. This fact may be stated from a slightly different angle in this fashion—to maintain a constant explosion pressure the compression pressure should increase slightly with increase in compression ratio.

Explosion pressures as calculated for Fig. 3 are tabulated below.

r	P_2 (Absolute Pressure)	P_3
4.8	113.0	606
5.0	113.2	599
5.5	114.2	589
6.0	116.2	589
6.5	119.2	592
7.0	123.2	601
7.5	127.7	612

The maximum variation in explosion pressures is seen to be less than 4 per cent and the deviation from the average pressure about 2 per cent. When experiment has shown detonation to be constant under the conditions of Fig. 3, and calculations show explosion pressures to have been constant, there is reason for a deepening conviction in the close relationship of explosion pressures to detonation.[6]

Scavenging

Scavenging, that is to say, removing all or part of the spent gases from the clearance space, increases detonation. This fact has been taken as convincing proof of the great influence exerted by small proportions of exhaust gas on the rate of flame spread. Very probably this influence exists and operates as supposed. It is true, nevertheless, that the effect of scavenging on detonation can be explained partially at least by its influence on the explosion pressure. This influence is twofold. First of all, removing the hot exhaust gases from the clearance space of the engine means a lower temperature at the beginning and hence at the end of compression. Reverting again to the relation $\frac{P_3}{P_2} = 1 + \frac{M}{T_2}$ it is clear that lowering T_2 increases the ratio and thus the explosion pressure. This holds true if M, the increase in temperature resulting from combustion, does not decrease. But M should increase, since the energy of the fuel is expended in heating a smaller mass of inert gas. This, then, is the second tendency toward increased explosion pressure, and consequently detonation. Calculated explosion pressures show a probable increase of over 25 per cent for a scavenged in comparison with an unscavenged engine having a compression ratio of 4.

Effect of Spark Advance

Another influence which vitally affects detonation is the ignition timing, the spark advance. As before, it is convenient to picture the charge burned at constant volume at a point in the stroke governed by the spark advance. This does not mean picturing the combustion as occurring at the same time as the spark, but as always occurring at the same interval of time after the spark. The burning that takes place during this interval may be treated as the burning of a fuse that later fires the explosive. As shown when discussing the effect of compression ratio, the maximum explosion pressure should occur when the pressure prior to combustion is greatest. Since the charge is compressed most at top center the maximum explosion pressure should result from a spark so timed as to cause the actual combustion to take place at that part of the stroke and retarding the spark so that combustion comes later should decrease the explosion pressure. For the engine from which the pressure measurements of Fig. 1 were taken the estimated ratio of the explosion pressures obtained with combustion at various angles past top center to that which would have resulted from combustion at top center are given below.

Degrees of Crank Angle After Top Center at Which Equivalent Instantaneous Combustion Occurs	Explosion Pressure in Per Cent of the Pressure When Equivalent Instantaneous Combustion Occurs at Top Center
0	100
10	94
20	84
30	72
40	59
50	49

This demonstrates that very considerable differences in explosion pressure would be expected from a change in spark advance even if the rate of combustion remained the same. When there is superimposed the influence of a

[6] In the paper by Ricardo already referred to he says: ". . . The tendency to detonate depends in effect upon the compression pressure not, as I supposed, because the pressure has any marked influence, but rather because in any actual engine the compression pressure is in itself a measure of the proportion of inert diluent present in the cylinder."

The reader will perceive that the author's interpretation of the data is somewhat at variance with Mr. Ricardo's. It is regrettable that the scope of the paper does not permit citing the many views of Ricardo with which he is in hearty accord. The use of Fig. 3 is but one indication of his belief in the accuracy and value of Ricardo's experimental determinations.

change in rate, it is not surprising to find differences of the magnitude shown in Fig. 1. The pressure at the time of explosion should be the same whether combustion takes place at a given angle before top center or after. With combustion before center, however, barring the heat loss, the subsequent compression of the burned gases will increase the pressure to a value in excess of that resulting from burning the charge at center. In practice it often happens that with an early spark the rate of heat loss exceeds the rate at which heat is produced by the compression of the burned charge so that the maximum pressure of the cycle is lower than with a later spark. This accounts for the decreased pressures at the extreme spark advances of Fig. 1. Furthermore, it is not surprising that carbon-bisulphide, which preignites early in the stroke, does not detonate, since the effect of preignition is that of a too early spark.[7]

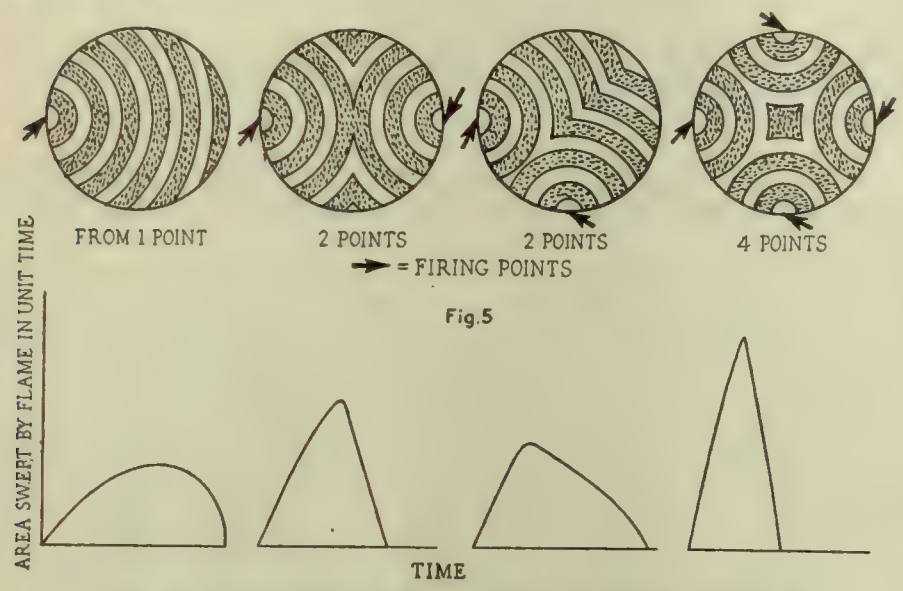


Fig. 5—Diagrammatic illustration showing effect of the number and location of spark plugs upon rate of combustion

The relative influence of spark advance and throttle opening on detonation is of considerable importance in connection with the use of high compression over-dimensioned engines. Such engines have too high a compression ratio to operate safely at sea level at full throttle with the spark advance that would give maximum power with a non-detonating fuel. Experiments at the Bureau have shown that for an emergency "take-off" in the case of such engines used in aircraft will develop more power if the spark is retarded to eliminate detonation than if the throttle is closed to produce the same effect.

Aside from its practical bearing in engine design, it is worth while to see whether the comparative influence of spark advance and throttle opening would be predicted from their influence on explosion pressures. The theoretical indicator cards of Fig. 4 will aid the comparison. In this figure the dotted line indicates the pressures at full throttle with a non-detonating fuel and a compression ratio of 6.5. The problem is to obtain from this engine the maximum power possible with a fuel which, because of detonation, cannot be used with an unthrottled engine having a compression ratio in excess of 5.5. The volumetric efficiency is assumed the same for both ratios. If explosion pressure controls detonation, the problem resolves itself into so adjusting spark advance or throttle as to restrict the explosion pressure to the value obtained with an unthrottled engine of 5.5 ratio. Since the explosion pressure with a 5.5 ratio is about 82 per cent of that with a 6.5 ratio, an engine having the latter ratio must be throttled to about 82 per cent of full load. Taking into consideration the modifying factors discussed in connection with Fig. 3, gives 85 per cent as a closer value. The light line card of the figure shows the probable pressures under this throttled condition.

The other alternative is to retard the spark so that combustion does not take place until the piston has traveled far enough on the down stroke for the pressure to have fallen to the maximum compression pressure with the 5.5 ratio. A heavy line card shows the pressures under this condition. Since the engine receives a full weignt of charge, the power should be less than that obtained with the non-detonating fuel only because the ratio of expansion after combustion is 5.5, in contrast with 6.5 with the non-detonating fuel and the optimum spark advance. The air cycle efficiency[8] for a 5.5 ratio is 94 per cent of that for a 6.5 ratio. Thus retarding the spark to avoid detonation requires a 6 per cent decrease in power against the 15 per cent sacrifice which throttling entails.

From all the evidence presented it appears that a close relationship exists between explosion pressures and detonation and that, having calculated the explosion pressures for an engine condition at which detonation occurs, for any other engine condition the probable presence or absence of detonation can be predicted from a calculation of the probable explosion pressure. It does not follow necessarily that the uniform explosion pressures as here calculated produce the sound of detonation. There is evidence that there are local pressures which exceed these average pressures, and to which should be charged both the sound and destructive effects of detonation. The evidence does indicate that if local high pressures exist they are proportional to the average pressures as calculated, inasmuch as the latter have proved an accurate index of the presence or absence of detonation.

Change in Combustion Rate

Emphasis, thus far, has been placed on conditions that influence detonations even with the rate of combustion unchanged. Better appreciated and no less important is the influence of a change in combustion rate with other conditions remaining constant. In fact, detonation research has confined itself largely to attempts to influence this rate. The goal is a slowing down of the final stages of combustion. It may be neither necessary nor desirable to decrease the average combustion rate. An illustration will show how the disastrous peak pressure can be avoided by a slight change in the combustion rate. For the first condition assume that the piston is at top center, that all the charge has been burned and that the charge temperature is 6062 deg. Fahr. (3350 deg. C.). Assume also that a temperature drop of 482 deg. Fahr. (250 deg. C.) results from the heat dissipation during the next 10 deg. of crank motion. For the second condition let it be assumed that when the piston reaches top center sufficient charge has been burned to have produced a temperature of (3350 — 250) deg. C., and that the remainder is burned during the next 10 deg. of crank motion at such a rate that the heat input shall just offset the heat dissipation and the pressure and temperature at 10 deg. past top center be approximately the same as in the first case. Ratio of pressure in the latter case to that in the former is (3350 — 250) ÷ 3350 or 93 per cent. The only difference in power that should result is that due to a loss in efficiency chargeable to the decreased expansion ratio of the portion of the charge burned in the 10 deg. after center. Calculation shows the net loss to be less than two-tenths of 1 per cent. In short, a decrease of 7 per cent in maximum pressure is obtained at the expense of a decrease of two-tenths of 1 per cent in power.

[7] In the Journal of the Society of Automotive Engineers, September, 1920, C. F. Kettering says: "Using carbon-bisulphide as a fuel, we get a genuine preignition. This fuel ignites very early and the pressure rises rapidly but it will not knock. Preignition will not necessarily cause a knock, because it may be that the pressures will not rise higher than normal."

[8] Air cycle efficiency $= 1 - \left(\frac{1}{r}\right)^{n-1}$ where $n = 1.4$ and $r =$ expansion ratio.

Fig. 5 indicates in a general way why differences in spark plug position and combustion chamber shape change the rate at which the charge is consumed. By means of the alternate light and dark areas the amount of surface swept by the flame from each spark plug in equal time intervals can be determined. The lower plots show total areas swept by flame in unit time plotted against time. In these figures the area under the curve at the left of any ordinate represents the total area swept by the flame up to that time. The upper flame spread diagrams are drawn as though the flame moved radially at a uniform linear rate. This assumption is admittedly false for the flame, at least in its initial stages, spreads at an accelerated rate. Moreover, in the engine it is not areas with which one is concerned but volumes, and the problem is further complicated by the movement of one wall of the combustion chamber, namely, the piston head. Obviously, then, there is no point in analyzing the figures to show which spark plug arrangement gives minimum detonation. Their sole aim is to show why a change in spark plug arrangement should make a difference in detonation.

A discussion of the influence of changes in fuel characteristics upon detonation lies outside the province of this paper. Possibly the most hope of relief from detonation troubles lies in the ability to alter these characteristics, and much excellent work has been done in this field.

Except in the case of the automobile engine the noise of detonation in itself is of small consequence. Detonation's seriousness lies in its high pressures and in the excessive heat loss which prevents the attainment of the power that would otherwise be possible. Most investigators have been made acquainted with this excessive heat dissipation by an increased loss to the jacket water whenever detonation has been present. In a preceding paragraph a comparison was made between the effect of burning all the charge at top center with a resultant temperature of 3350 deg. C. and slightly retarding the rate of burning so that the maximum temperature did not exceed 3100 deg. C. Radiation varies approximately as the fourth power of the absolute temperature and would at top center be 35 per cent greater with the higher temperature. It seems clear that much of the power loss that accompanies detonation can be attributed to excessive heat dissipation arising from a condition approximating the one just mentioned.

Preignition and detonation are now generally conceded to be entirely independent phenomena. Preignition is unusual, caused by a hot spark plug electrode, by an exhaust valve or by a piston head and depends upon the ignition temperature of the fuel. Changes in the design of these members will do much to prevent this trouble. The important fact is that such changes will be necessary with an increase in compression ratio unless the fuel has been prepared to eliminate preignition as well as detonation.

It may be mentioned in passing that overheating troubles are a more likely result of preignition than of detonation. This can be illustrated best by assuming an extreme case of preignition with the charge ignited as it enters the cylinder and all burned by the beginning of the compression stroke. It is conceivable that the rate of heat dissipation during this stroke might be such that at top center the same pressure and temperature would result as when, under normal operation, the bulk of the charge is burned at top center. Pressures and temperatures during expansion would be the same for both cases. For the compression stroke, however, the average temperature would have been in the neighborhood of 3000 deg. C. in contrast with 500 deg. C. under normal operation.

Calite—A New Heat Resisting Alloy

WHEN freshly cut, aluminum will show a bright lustrous surface, but after it has been exposed to the atmosphere for a short time it becomes dull. Continued exposure produces little change in this strongly adherent coating. Aluminum when alloyed with other metals retains this property of oxidizing rapidly and imparts it to the alloy.

Advantage was taken of this property when the process of calorizing was developed a few years ago. This consists in coating metals with aluminum at high temperatures, actually forming a surface coating which strongly resists oxidation, as well as various kinds of corrosion. Calorizing is not suited for work that is exposed to temperatures above 1832 deg. Fahr. as the aluminum rapidly diffuses and the surface layer then becomes so thin that it no longer forms a protective coating but breaks down under oxidizing influences.

A homogeneous alloy made by melting aluminum with iron will show no diffusion on subsequent heating, and, provided the aluminum content is sufficiently high, will resist oxidation nearly up to its melting point. Unfortunately, on repeated heating and rapid cooling, or uneven heating, the alloy will crack badly, and no small addition of any third metal will remedy this defect. When the least amount of moisture is splashed onto the hot metal it acts like glass and flies to pieces.

The low expansion of nickel steels and the fact that aluminum and nickel form high melting point alloys led the General Electric Co. to investigate ternary alloys of aluminum, nickel and iron. Keeping aluminum at a minimum and substituting nickel for iron in increasing percentages, a series of alloys was obtained which showed increasingly good properties from the heat resisting standpoint. Manganese and silicon above 0.75 per cent both tend to decrease resistance to oxidation, but with care in melting no trouble is experienced. Carbon increases brittleness and should be kept as low as possible. The melting must be done in a basic furnace and the ladle must have a basic lining.

The alloy thus developed is known as calite and is marketed for use in heat treating and annealing boxes and for similar purposes. Its properties were described in a paper read recently by G. R. Brophy before the American Society for Steel Treating. Calite resists oxidation up to 3772 deg. Fahr., but 2200 deg. Fahr. is recommended for indefinite service. The protective oxide formed is strongly adherent and does not snap off even on quenching from high temperatures.

Calite is practically non-corrosive. Samples have been polished and run in a spray of saturated salt water solution at 100 deg. Fahr. for 200 hours and at the end of this time still retained a perfect polish. So-called stainless steel will last only a few hours under this test. For fittings exposed to salt atmospheres calite should be excellent. In general, the physical properties are:

Melting point, degrees Fahr.	2,777
Softening temperature, degrees Fahr.	2,500
Working temperature, degrees Fahr.	2,200–2,370
Specific gravity	7.03
Weight per cubic inch, pounds	0.25
Brinell hardness, annealed	286
Sclerescope hardness, annealed	40
Thermal conductivity, per cent of iron	25
Transverse stress, 1 inch square bar, pounds per square inch	4,250
Tensile stress, pounds per square inch	36,800

Calite cannot be machined in the cast condition nor cut with oxyacetylene. Any change of dimension or finish must be done by grinding.

How to Select, Test and Use Carburizers

Many men handling carburized work consider only depth of penetration as a basis upon which to judge efficiency. The percentage of carbon in the case and rate at which it decreases toward the core, is far more important. This article gives practical help on carburizing material and methods.

By S. P. Rockwell*

THE average purveyor of carburizing materials argues fast penetration, and many consumers consider it a mark of merit. Eighty to 90 per cent of the practical men who handle carburized work consider only the depth of penetration and base their judgment on this alone. They overlook what is more important—the percentage of carbon in the case and the rate at which it decreases toward the core. These things are excusable, as few plants have the equipment necessary for analysis. Often examination of a carburized product will show carbon as high as 1.60 per cent for an appreciable depth, but people would never think of using a carbon steel with any such amount of carbon.

Fast penetration is, of course, desirable from a cost standpoint, but it is generally accompanied by high carbon and its product, free cementite. The saving made by cutting down the time of the carburizing operation is usually lost by the regenerative heating required to put the free cementite into solution, and there is therefore no gain.

It has never been stated in publications that steel of a specific analysis absorbs carbon at a certain specific rate. Many observations have led the writer to form the belief that this is so. For instance, a No. 1020 steel will form an eutectic case of a certain depth in a certain length of time, and if the steel is subjected to the carburizing influence for a longer time the case becomes hypereutectic.

With the commercial carburizer now on the market, there is little tendency for carburized cases to vary too abruptly from hypereutectic, eutectic and hypoeutectic. With certain forms of gas carburizing these conditions exist, but they are of more interest to the laboratory than to the shop. In all pot cooled work the carbon naturally tends to form into zones. The breaking up of these zones is a heat-treating problem and as such will not be discussed here, except to say that excessively slow pot cooling, such as is attained in pots of 2 to 3 ft. diameter, is apt to make the heat-treating more difficult.

It is rather difficult to say with any degree of surety what the correct amount of surface carbon should be in a case-hardened gear. For ball bearing work an eutectic case is desired. The bearing after carburizing is considered to have 1.10 per cent carbon in the outer case. The grinding, however, is calculated to remove this. Owing to warpage and the resulting uneven grinding, it is a question whether the results desired are always attained.

For camshaft work quite high carbon is permissible, provided the resulting cementite is in solution and not in the free state. When properly heat treated a mosaic surface effect is produced. Finely divided particles of extremely hard cementite are embedded in a softer matrix of eutectic steel. This condition is excellent for retaining the film of lubricant. The condition is somewhat analogous to that of cast iron, which makes an excellent wearing surface where the load per unit surface is low.

The gear, in a way, has to meet the requirements made of both the ball bearing and the camshaft. The pressure per unit of contact area is less than in the bearing and more than in the camshaft. Furthermore, the gear must resist sliding and rolling contact. It is surmised that the carbon content of the surface layer should be between 1.00 and 1.10 per cent. It is difficult to devise means of inspection that will insure that this carbon range is maintained, unless the carburizing material is standardized by the user for his own particular requirements.

Material vs. Specification Standardization

The question of standardization of the materials and the specifications of the same are two different things. It is probable that if more users of carburizing materials would test them out for results the makers would be forced to supply according to specifications.

One concern buying carburizing material selects at random one bag from ten and carburizes a 1-in. bar, 6 in. long, in a 5 x 10-in. pot at 1650 deg. Fahr. for 24 hours and pot cools. The bar is of 1020 steel and all elements are within the specification range. The bar is centered and the surface removed before the carburizing operation. After carburizing and polishing with emery to remove adhering carburizer, 0.010 in. of the surface is removed in the lathe and a carbon combustion is run on the chips. The result, together with a microexamination of the case, decides the question of rejection or acceptance of the shipment. In the operation of such a method of standardization, conditions should permit of exact duplication. In this respect uniformity of furnaces and calibration of pyrometers are of great importance.

In *Machinery* for January, 1920, a writer compared three types of carbureters with respect to cost, case depth, surface case toughness and hardness. The idea was to give a method which could be used to rate a material for any class of work. To summarize the conditions in order of importance, quality being first, we would have

	Rating
1—Material with the greatest zone of eutectic	25
2—Material showing best joining of the different carbon zones	25
3—Material least destroying the core strength	15
4—Material giving greatest hardness with freedom from soft spots on single quench	15

*Metallurgist, Whitney Mfg. Co., Hartford, Conn. Article slightly condensed from a paper read before the American Gear Manufacturers' Convention, Buffalo, April 22, 1922.

5—Material giving the greatest case depth	10
6—Material giving the best surface	5
7—Material giving the greatest economy	5
Total	100

There are, strictly speaking, but four different types of carburizers; they are classed according to their physical form as follows: (1) Powdered materials, in which the generator and the energizer are in powdered form, and are thus mixed together to form a mechanical mixture. Such materials are "Hydro-carbonated Bone Black," "Ajax," etc. (2) Pill materials, in which the generator and the energizer are in powder form, but are held together by a binder, which in itself may be a generator or an energizer. Such a material is "Carbo." (3) Pellet materials, in which the generator is a granule of solid carbonaceous material coated with an energizer by the help of a binder. Such a material is "Quick Light A." (4) Pellet and powder materials, in which the generator is a granule of solid carbonaceous materials and the energizer is in the form of a powder. A certain per cent of the powder may also be a generator. Such materials in the most common use are "Bohmite," "Carbonite," "Pearlite," etc. Three other media are in use for carburizing, namely bone, leather and gas. Bone is classed as a pellet material, with this exception, that the energizer is contained within the bone. Leather is classed as a powder material; its energizer is a nitrogeneous compound. Gas stands by itself and is the essence of the carburizing property of all carburizers. Charcoal, coal and coke cannot be classed as carburizers, due to their difficulty of control. Strictly speaking, they are generators and are sometimes used as fillers.

CARBURIZING is an important operation in many phases of automotive production. Both quality and cost of product may be affected materially by the way in which it is handled. It is essential that the proper type of carburizer be used for the particular work involved.

To decide on any one type of carburizer, one must first know the conditions of carburizing and the results desired. Twelve definite suggestions are given here to guide the executive in the selection of carburizers.

To decide on any one type of carburizer one must first know the conditions of carburizing and the results desired.

Rules for Selection of Carburizer

The writer offers the following as a guide for selection:

1. For low cost, and to secure a uniform case with 0.10 to 0.20 per cent less carbon than is usually secured with the pot packed process, use the American gas furnace method with gas or with a solid carburizer. In this case heavy work will be marred, and the method is not recommended for threaded work. With solid carburizer 3 lb. of material will carburize 50 lb. of work to 0.045 in. depth at 1650 deg. F. Use any type.

2. For fast heating use a coarse mesh carburizer, such as Types 2 and 3. The air spaces allow room for the heat-generated gases to circulate and offer unrestricted passage for heat-transference to the center of the pot.

3. For non-shrinkage, use fine mesh carburizers, preferably a coke type generator or carburizer with a lot of inert filler. These last usually contain 40 to 60 per cent of petroleum coke.

4. For low carbon case, use charcoal generator with oil hydro-carbon energizers. Such materials are H, C, B, B, bone and charcoal.

5. For high carbon case, use chemically energized materials. Such energizers contain cyanides, barium, ammonium salts and carbonates. Carburizers containing forms of leather are also used.

6. For great depth, use coke and charcoal generators with oil hydro-carbon energizers combined with fine mesh and considerable inert material.

7. For very clean surface work, use charcoal and bone carburizers where the energizer is naturally contained in the bone.

8. For work which must be carburized at low heats, use raw bone or carburizers containing a large percentage of raw bone.

9. For work which must be carburized at low heats to secure mottled effects and clean surfaces, use charcoal, charred bone, charred leather or combinations of these. Avoid chemicals.

10. For copper plated work, use charred bone, charcoal and oil hydro-carbon energized materials, together or alone. Avoid chemicals.

11. For extreme case-hardness, use nitrogen carrying compounds, which would be cyanogen energized compounds and leather mixtures.

12. For local carburizing, where the compound is forced by pressure about the zone which is to have a higher carbon content, use fine mesh materials combined with a semi-liquid binder, such as molasses, tar or resin.

After a decision has been made on the type of carburizer for the particular class of work it is to be used with, the user will find that he is in no way restricted as to the dealers from whom he may purchase. Most all of the standard carburizing material dealers make all types, but they do not always exploit all of them. They are apt to confine their advertisements to one or two of the more popular types. It will further be found that each type can be purchased in different variations of mesh and grain size.

First, buy from a respectable house.

Second, study what type, mesh, generator and energizer is best fitted for your work.

Consider as first cost the cost per cu. ft. rather than the cost per pound.

Test the material under conditions as nearly like regular practice as possible. This refers to depth, representative work shape, temperature and pot size.

Examine the pot-cooled sample for case structure by the microscope, and by carbon combustion. The microscope will be found invaluable for this purpose. Once one becomes familiar with estimating the carbon by the microscope, the combustion method can be dispensed with except as a means of check.

Maintain your standard for future shipment of material.

Soft Spots Due to Many Causes

If soft spots develop on the hardened work do not blame the carburizer. Soft spots are due to rust on work prior to carburizing, phosphorous banding, delayed quenching, copper or sulphate spots, slag, faulty grinding, cold rolled surfaces, scale formation, excessive oxygen in hardening fires, faulty quenching medium, too low hardening heats. These faults can not be laid to the carburizer. The carburizer rarely makes soft spots if it contains no excessive amounts of inert filler, or burned out material, such as ash dust. These conditions, of course, should be guarded against. If hardened work has soft spots, and these areas are carefully marked and the piece is carefully rehardened, two results can be obtained:

(1) Original soft areas become hard. In this case trouble is not due to carburizing.

(2) Original soft areas stay soft. In this case the trouble may be due to rust, copper, decarburized in hardening or carburizer.

With the aid of the microscope, polishing wheels and cloth and dilute nitric acid, any of those conditions may be accurately established.

Selection of Pots

As regards the selection of pots, the special alloy heat-resisting pots are by far the best investment when compared to cast iron, malleable iron and cast steel. The round pot will be found to give a greater life than the square pot, due to the equalization of expansion and contraction stresses. The cored or chimney pot is only efficient, considering its added cost, where the chimney is 5 in. in diameter or over. Too large pots should be avoided for small work.

The round pot will be found most satisfactory for pinion and ring gear work. It offers the advantages of even heating, and prevents the tendency to overcrowd the carburizing hearth space. Square or rectangular pots are best for long shaft work, but the work must be packed with due regard for the transference of heat. The size of the pot should not be greater than the work demands. This is imperative from the standpoint of handling, slowness of heating and the subsequent unevenness of carbon penetration from the center of the pot to the outside. It is also imperative that the pot should not be greater than is required by the work, on account of the slowness of cooling where work is pot-cooled, with subsequent separation of the carbon zones.

Dependence on Furnace

The dimensions of the pot depend largely on the furnace. Too high pots are as bad as those too large in diameter. The average furnace varies greatly in temperature from top to bottom, and this variation increases with the arch height. A well-proportioned pot never exceeds in height the greatest width or the diameter. The height is best made between 5/8 and 7/8 of the greatest width or diameter. All pots should be cast with legs to allow circulation of heating gases. For this same reason the floor of the furnace should be held out after each heat. Great care should be used in sealing the pots. The tighter the seal the more uniform the results. No pot should be used that is cracked, as this is the cause of blistered work. The pot becomes a veritable blast furnace, containing its own fuel.

American Automobiles in Belgium

"AN analysis of the passenger car situation in Belgium shows that the Belgian motor car industry has not been able to supply the home demand since the armistice, and that American cars in the Belgian market satisfy a need as to price that is not filled by the local producers." Such is the recent information from the Bureau of Foreign and Domestic Commerce.

"The total number of passenger cars and chassis imported into Belgium since the armistice, with the share of the United States in that total, is shown in the following table:

Year	Total import	From United States	Per cent of total
1919	3,908	1,628	42
1920	4,468	2,362	53
1921	4,815	846	18
Total	13,191	4,836	37

"At present all Belgium combined and working at full capacity cannot turn out more than 5000 cars a year; before 1921 their output was greatly restricted, so that the 1921 production rate could hardly have been sustained. It is thus obvious that during these years, even if the Belgian manufacturers had been able to turn out the car most desired at a popular price, their mere shortage of output would have compelled importation of cars from other countries to meet the local demand.

"Detailed figures show that Belgian buyers give preference to cars selling as much under 20,000 francs as possible. The fact that sales of all American cars slowed down with the rising dollar exchange indicates on the whole that price was the initial argument in their favor.

"On the whole, the quality of American cars is recognized. While some criticism is levied against the carriage work on the lower-priced cars (which may justly be met by the reminder that the American manufacturer gives good value for the price asked), the chassis and driving units enjoy a good reputation. In general, American lubrication, transmission and radiators are considered exemplary. American rear axle construction is generally considered superior to the European type, the latter often having the foot brake working on the drive shaft so that the motor has to be cut out on down grades.

"Thus, with passenger cars that fill a fundamental need, sell at favorable prices and command a good general reputation, American manufacturers should find a remunerative market in Belgium."

Conference on Colors for Traffic Signals

A CONFERENCE has been called by the American Engineering Standards Committee in accordance with requests received from the Illuminating Engineering Society and from the International Traffic Officers' Association to determine the desirability of standardizing the colors used for traffic signals. These organizations have called attention to the fact that there are being placed on the market and in use semaphore control apparatus having numerous colored lights at variance with each other and at variance with colored lights used for other purposes along the highways, thus leading to confusion and to numerous accidents. In their opinion there is need of a thorough study of colors for traffic signals in order that there may be national uniformity in the use of colored lights for such purposes. The meeting will be held in room No. 2, fifth floor, Engineering Societies Building, 29 West Thirty-ninth Street, New York, Tueday, May 23, at 10:30 a. m.

Singapore Bars Left Hand Driving

SINGAPORE has officially placed the ban on cars having the driver's seat on the left-hand side. An order recently received in Los Angeles from the government of the colony declares that only cars so equipped that are registered prior to Dec. 31, 1921, will be permitted in the Straits Settlement. Such cars must be fitted with a mechanical device for the purpose of indicating the intention of the driver to turn to the right.

Making a Profit Under Light Production Load Conditions

This story tells how the careful selection and placing of machinery is enabling a new company to produce 25 cars per day with profit, although capacity of works is nearly 100. Cylinder block production described in detail, while other interesting production features are shown.

By J. Edward Schipper

PRODUCTION methods and machinery must be turned to the factory output. Just as much care has to be exercised in the purchase of a machine for a 25 car per day plant as for a 200 or 500 car per day plant. The opinion generally is that it does not pay to use a power-driven assembly chain until after a production of 50 cars per day. Nevertheless, it is just as advantageous to have a true progressive system of manufacture in a 10 to 15 car per day plant as it is in a plant producing a large number. A minimum of motion and consequently a maximum convenience in the placing of stock and machinery is a necessity if money is to be saved in manufacture.

The Rickenbacker Motor Co., which has been in production for only a few months, is now turning out on an average of 25 cars per day and offers an excellent example of a factory which is equipped with thoroughly up-to-date machinery, but which is so balanced that it is not necessary to keep expensive machines shut down for any appreciable length of time. The plant has a production capacity of at least 75 to 100 cars per day. The buildings, including the administration building and two large manufacturing buildings, have a total area of 197,500 sq. ft. The two main manufacturing buildings are of monitor and saw-tooth construction and are single-story structures.

To obtain an idea of the methods used in this plant it will be interesting to follow the cylinder block through its manufacturing stages. This unit has been selected as an example, owing to the necessity for many kinds of machining operations and because of the employment of some novel machinery.

Operations on Cylinder

The cylinder block is received by the Rickenbacker company after having been tumbled and sand blasted at the foundry. This six-cylinder block casting is rough and finish-milled on a large 18-ft. bed planer type of Ingersoll milling machine, Fig. 1. This machine is equipped with cutter heads located on either side of the rail, having ten cutters in all. Six cutters in one group perform the roughing operation and four cutters on the opposite side of the rail perform the finishing operations. These cutters take care of the top, two side faces and four bottom surfaces of the cylinder block in one setting. The table is capable of holding six milling fixtures and of producing more than 75 cylinder blocks per day. Location on the milling fixtures is from four points, two points being at the ends and two on the side of the casting.

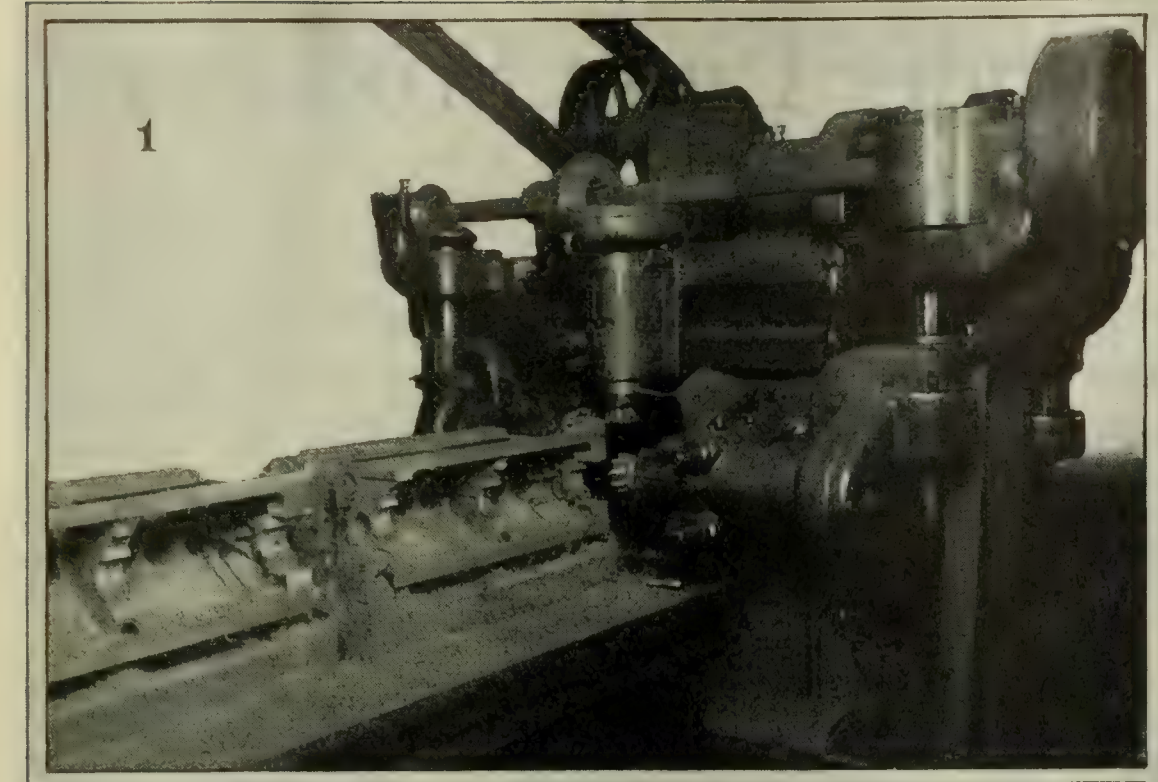
Following the initial milling operation, two locating dowel holes are drilled and reamed in the bottom flange of the cylinder block. These holes are taken care of on a radial drill. The cylinder block is then placed on an Ingersoll duplex head milling machine, Fig. 2, which mills the two ends of the cylinder block at the same setting. This insures these surfaces being square with the crankshaft center line. Location for this work is from the milled bottom flange and the dowel holes.

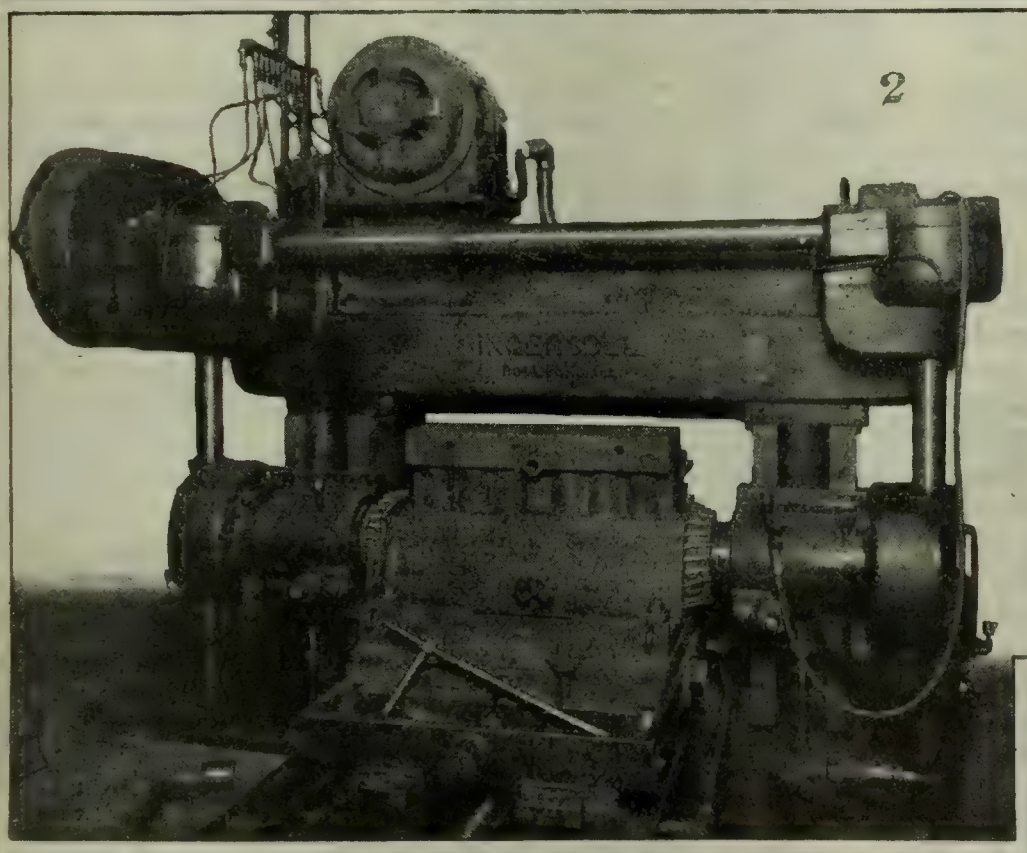
The rough boring operation on the cylinder is performed upon a specially constructed machine which was designed and built in the Rickenbacker shop, Fig. 3. The machine is equipped with six boring bars which are piloted at each end of the cylinder barrels. This is somewhat of an innovation as it is customary to support the boring bar at one end only. By piloting it at both ends, alignment of the cylinder barrels in relation to the crankshaft is secured, according to the manufacturers. By ascertaining this alignment and following up this boring operation with a size reaming operation, Fig. 4, which allows only .004 to .005 in. for grinding, it is possible to secure an accurate, smooth surface very economically. The boring and reaming operations considered together are somewhat novel. The boring tool employed is a double point fly cutter, giving a rough and finish bore, and this followed by the sizing reamer which allows only .004 to .005 in. for grinding, does away with the rough grinding operation and permits of a high-grade finish to be secured in one grind.

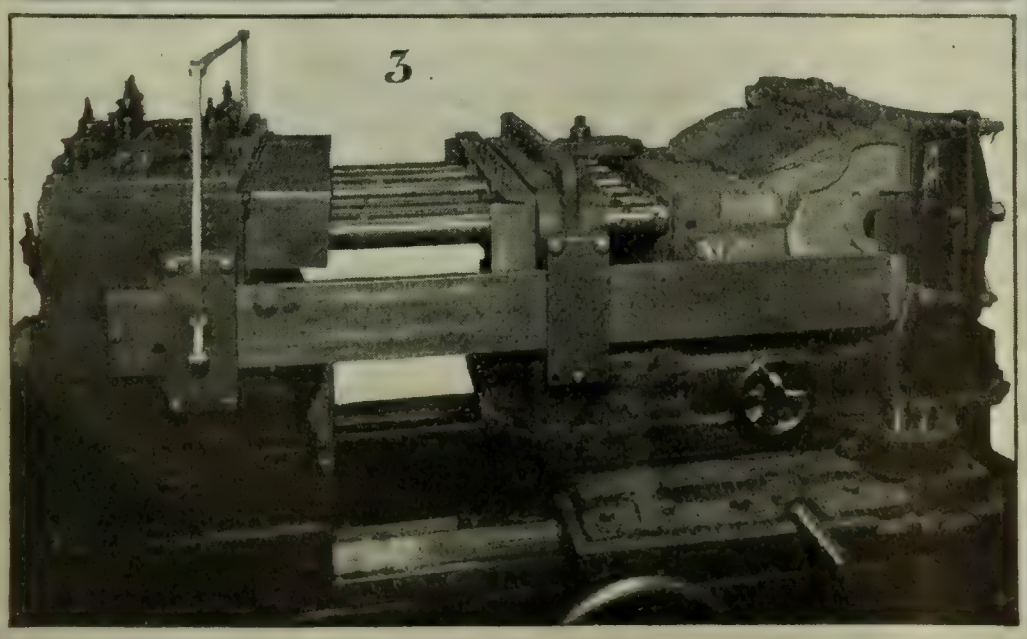
Drilling Operations

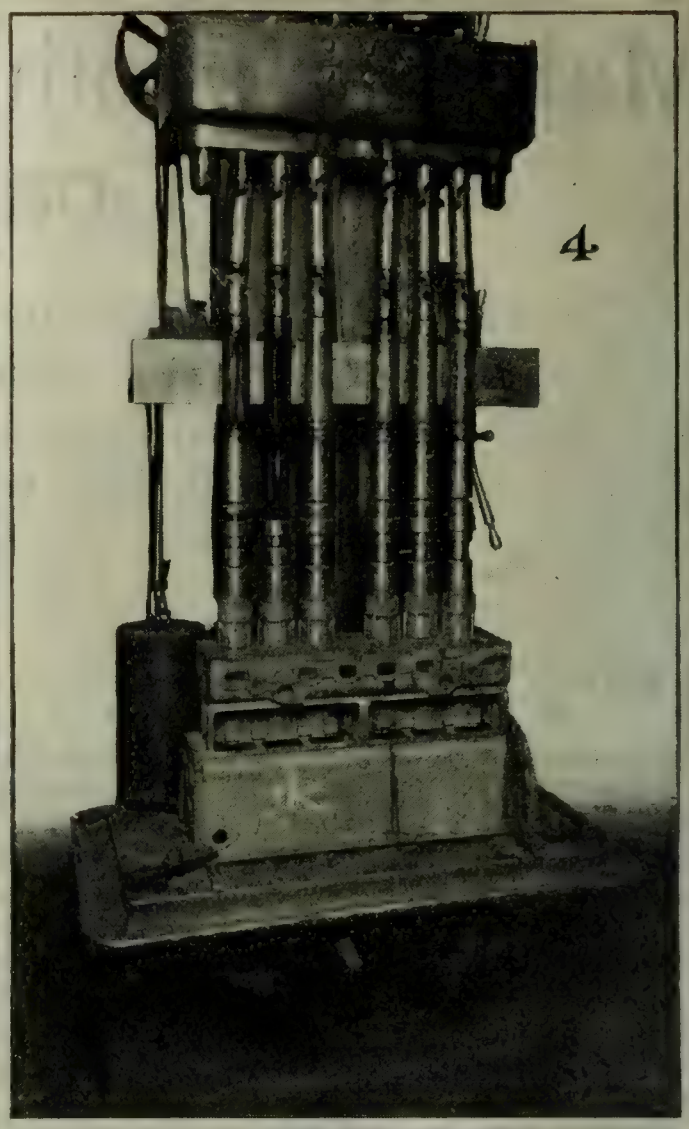
Following the boring and reaming operations, the cylinder block passes along to a number of minor drilling operations which are usual with any make of cylinder block. After the block has been prepared to receive the water jacket core plugs and after these are inserted, the block is given a hydraulic test in order to detect any porosity that might exist in the water jackets, cylinder bores or gas passages. After passing this hydraulic test, the block goes through the multiple spindle drilling operations, these being a battery of five large Natco drills which take care of all of the holes in the cylinder top, bottom flange, manifold pads and front and rear flanges. The multiple spindle drilling machine which drills the holes in the bottom flange is equipped with thirty drill spindles, Fig. 5. This is a Natco machine which performs this operation in less than 1 min. per block. The drills are guided by permanently attached drill templates for accuracy. During these operations the blocks are conveyed from one machine to another on gravity roller conveyors so that there is no undue amount of manual handling necessary.

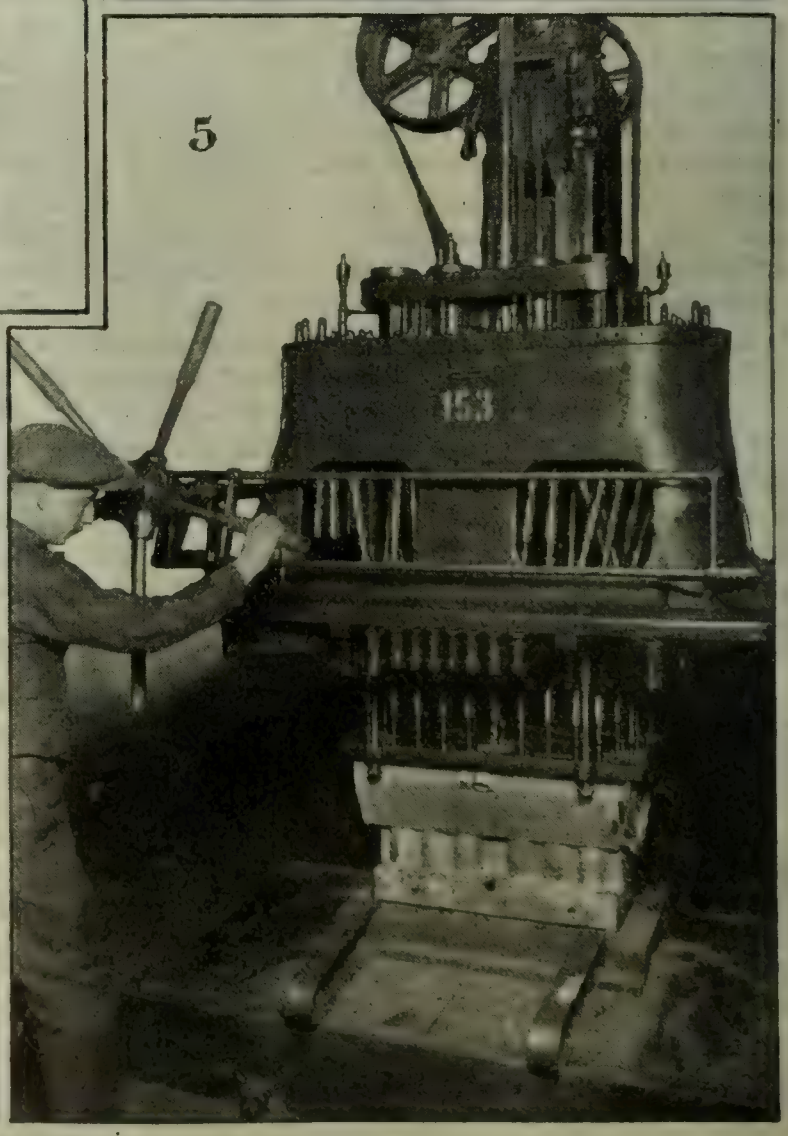
Following the drilling operation, the necessary tapping work is handled on a radial tapping machine, after which the crankshaft bearing caps are fitted into their respective doweling grooves and bolted to their seats. The blocks are then placed upon a special machine which is another



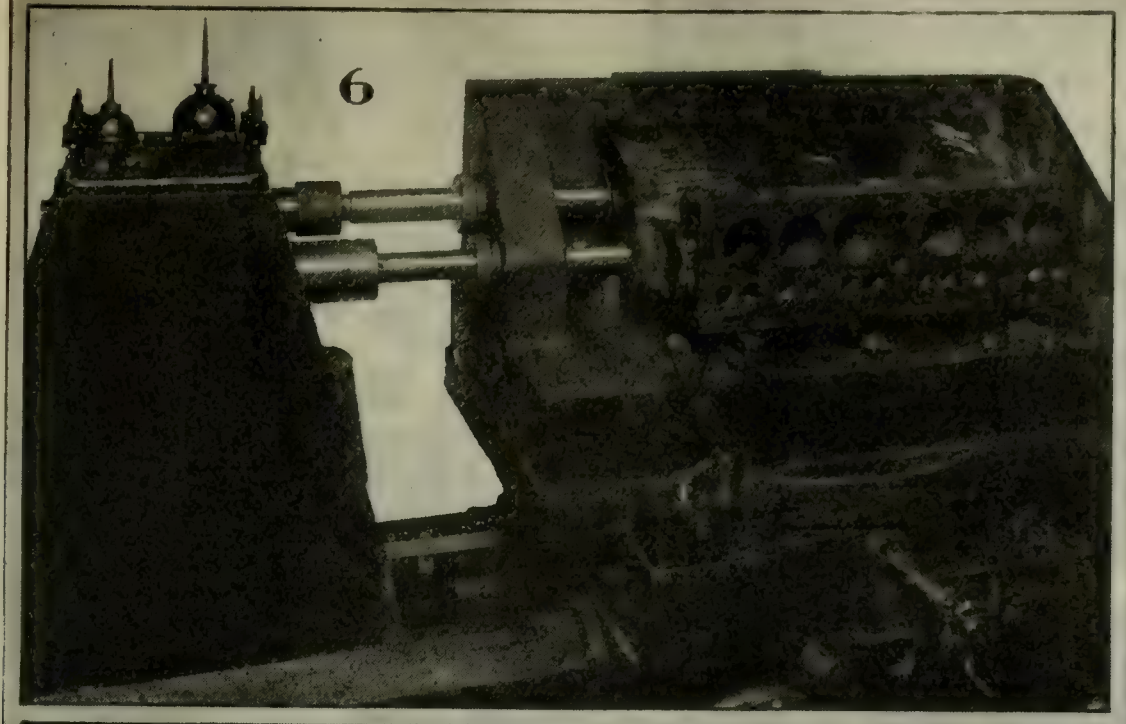


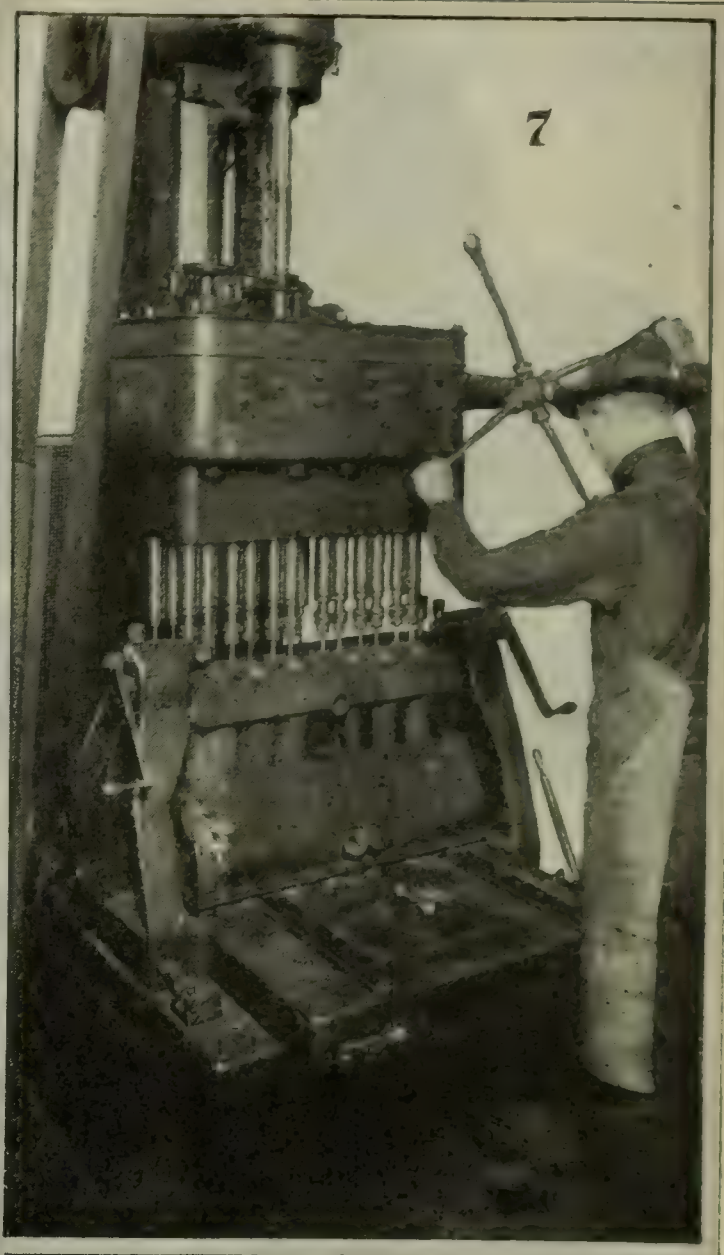


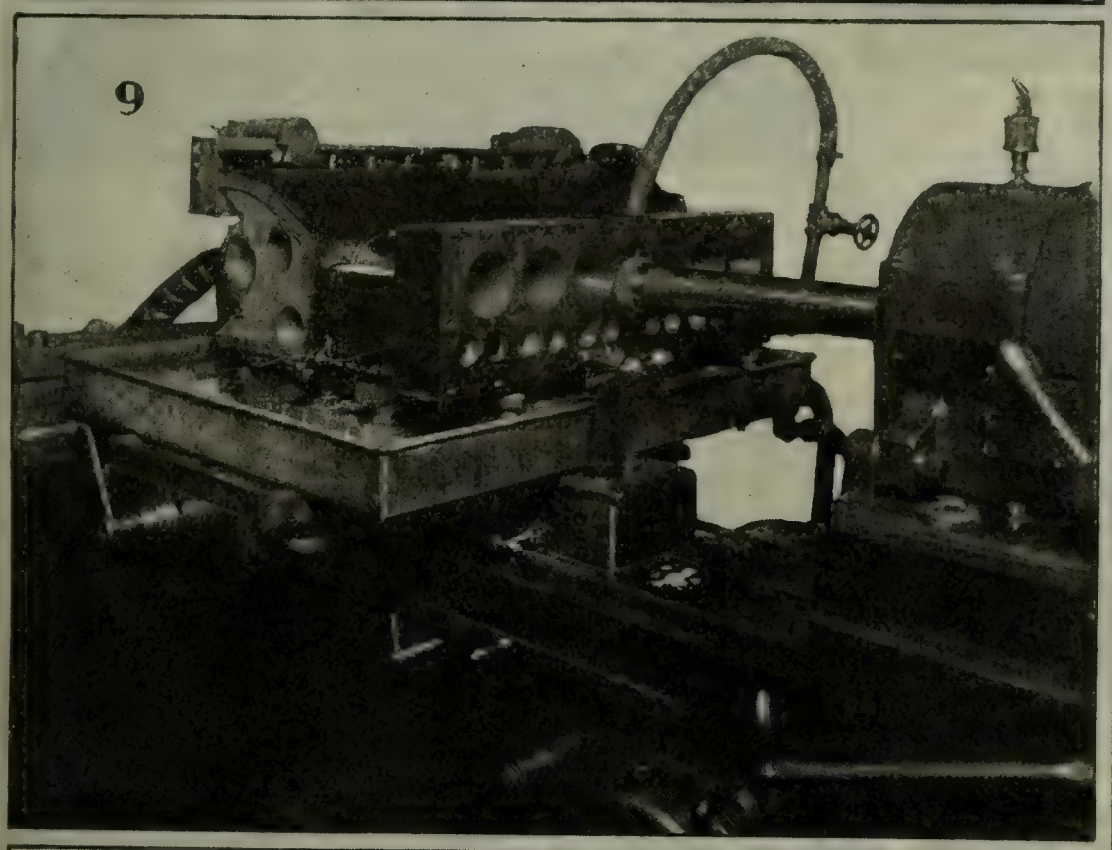


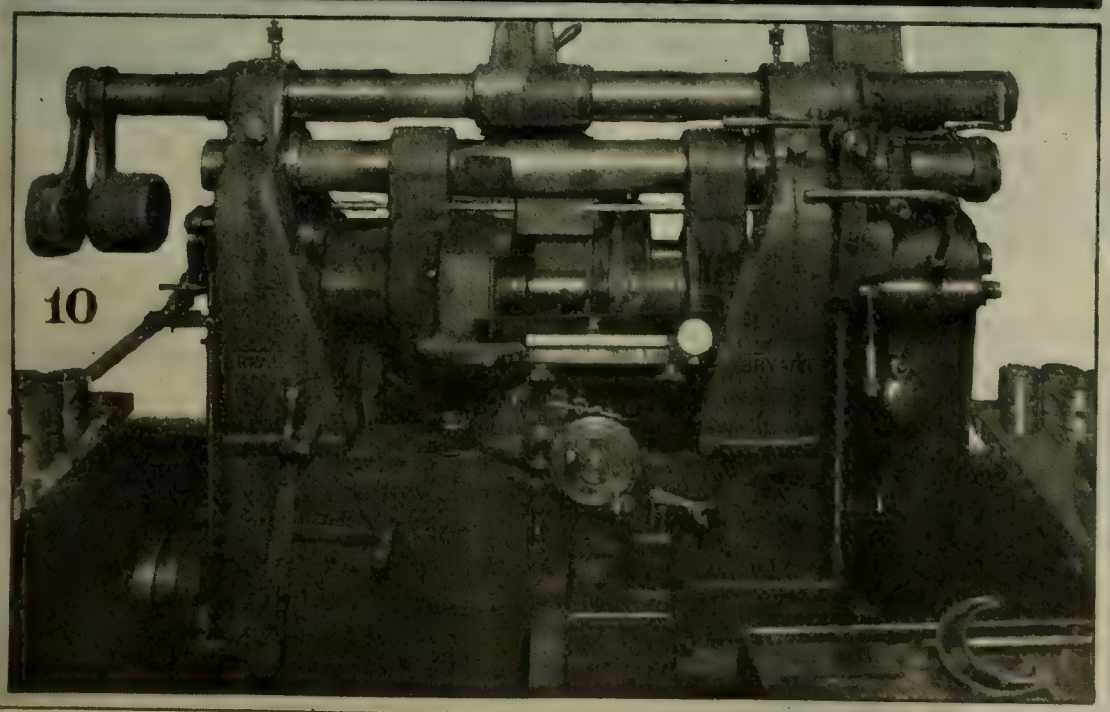


1—Ingersoll planer type milling machine with 18-ft. bed forming initial milling operation on Rickenbacker cylinder block. 2—Ingersoll duplex head milling machine straddle milling both ends of the Rickenbacker cylinder block simultaneously. 3—Rough boring Rickenbacker cylinders on a special machine built in this concern's own tool room. 4—Reaming Rickenbacker cylinder block to size, leaving .004 to .005 in. for grinding. 5—Natco multiple spindle drill which drills the thirty holes in the cylinder block bottom flange simultaneously



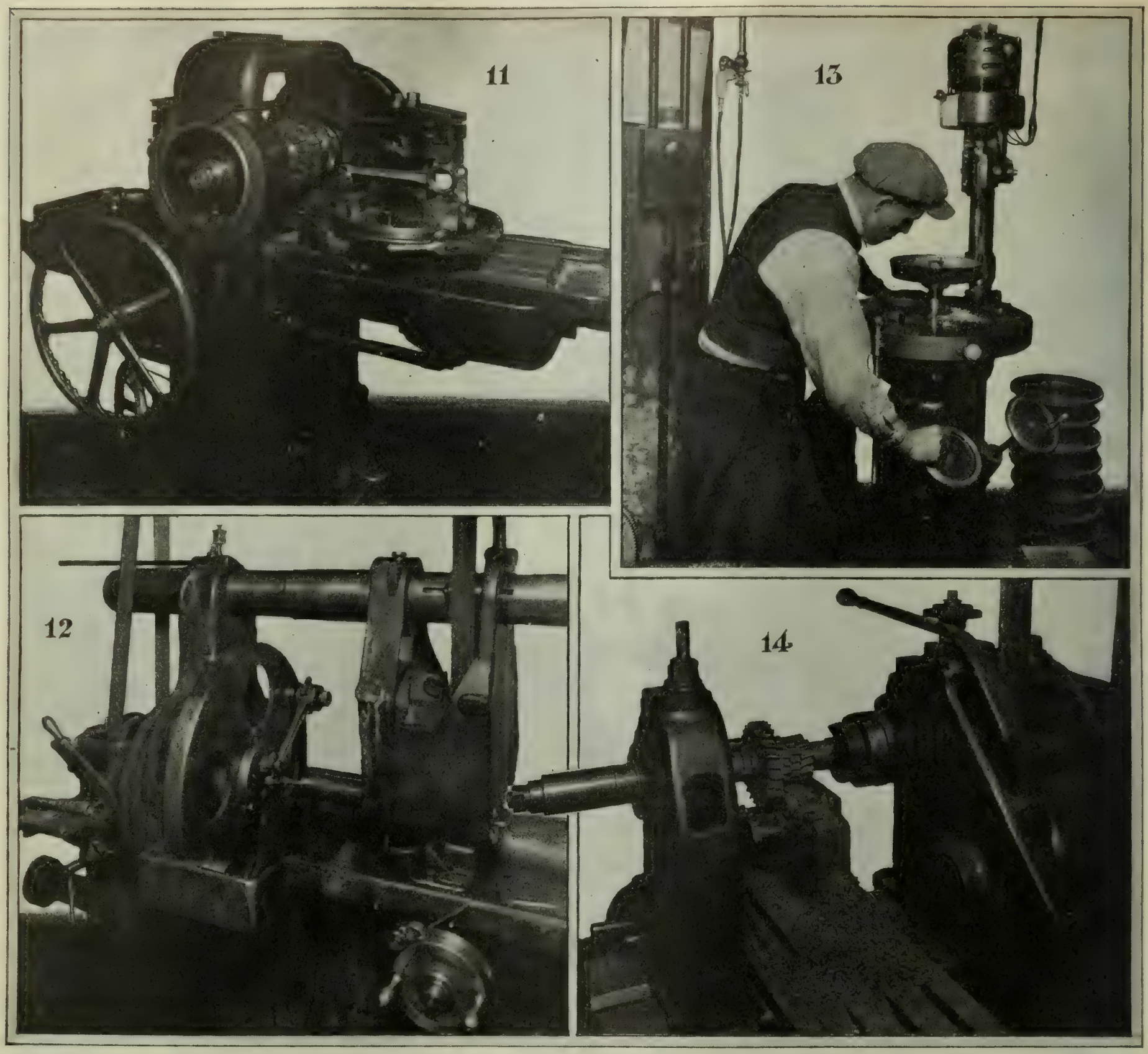








6—Boring crankshaft and camshaft bearing holes in the cylinder block. Note in this operation the support of the boring bars for rigidity. 7—Valve chambering machine which cuts the valve seat and also drills for the valve stem guide. 8—Milling of the tongue seat for the push rod guide assembly in the cylinder block. In order to establish alignment between the push rod guide assembly and the camshaft surface, this operation is located from the camshaft bearing opening. 9—Final grinding operation on Rickenbacker cylinder bore, the grind being located from the crankshaft bearing holes. This is a Baxter D Whitney type of grinder. 10—Grinding Rickenbacker pistons on the Bryant piston grinder equipped with wheel truing diamond for variable clearances



11—Milling Rickenbacker connecting rod on Briggs straddle miller. 12—Grinding piston pin hole located from big end opening to insure parallelism between wrist pin and crank pin. 13—Crawford balancing machine used to put in dynamic balance the flywheel, clutch cone and spider. Machine is shown performing the operation on the clutch cone. 14—Cincinnati automatic miller milling tongue on push rod guide assembly. This fits in the groove in the cylinder block and establishes alignment between tappet guides and the camshaft surfaces

product of the Rickenbacker tool department, upon which the crankshaft and camshaft bearing holes are bored and reamed in the cylinder block. In this work the boring bars are rigidly supported on either side in order to assure alignment of these bars. This machine, which is illustrated in Fig. 6, has been designed for rigidity, as will be noted from the piloting arrangements made for the cutters.

Following some other miscellaneous drilling and tapping operations, the block is placed upon a special valve chambering machine. This machine has two set-ups, the block first going on the machine and having one operation performed, then passing to some other milling machines and returning for finishing. The chambering machine is shown in Fig. 7. The valve stem guide hole is first drilled, all twelve holes being drilled simultaneously. The valve stem guides are pressed in and the $\frac{3}{8}$-in. hole in the valve stem guide is reamed, after which the fixture is slid into second position on the valve chambering machine and with the cutters piloted in the valve stem guide, the valve chamber is cut in.

The push rod guide assembly fits with a tongue and groove arrangement on the block and the next operation is the milling of the tongue seat for this push rod guide assembly, Fig. 8. It is essential that the push rod guide assembly, when assembled in the block, be at right angles with the camshaft surfaces to assure uniformity and smoothness of operation. For this reason, the operation on this milling machine is located from the camshaft opening.

Following this operation, the cylinder block is washed in a hot Oakite solution, then in hot water and allowed to dry. Black japan is sprayed on the cylinder block on the exterior and the interior of the crank chamber is sprayed with a special red crankcase sealer to insure that no minute formed particles may be emitted from the pores of the

iron. These exterior and interior coats are baked in an automatically controlled electric oven. The ovens are the product of the Gehnrith company and automatically hold the temperature to 420 deg. Fahr. After this operation, the cylinder block is sprayed for a second time with baking japan and again baked in an electric oven. This baking japan finish insures a pleasing and lasting finish of the engine assembly, as the cylinder head, chain case cover and other detachable parts of the assembly are likewise black japanned in this same department. They pass through the same oven with the same temperature.

The final grinding operation is taken after the blocks have had an opportunity to cool off. The grinding machine is the Baxter D. Whitney of the latest type, Fig. 9. The cylinder bores are ground at right angles with the crankshaft bearing holes, and are located from them, the tolerance being .0015 in. on alignment. The cylinder bores are held within the total tolerance of .001 in. for diameter, roundness and parallelism. By leaving the grinding operation to the last, no opportunity for distortion is afforded. Following the grind, the cylinder blocks are given a 100 per cent inspection, after which they are ready for the assembly department.

Space does not permit the following through of the various operations on the other units of the Rickenbacker engine. There are, however, some very interesting side operations which may be cited as good examples of manufacture in a plant of this size. The grinding of the pistons is a particular point which may be touched upon. They are ground upon a specially constructed Bryant piston grinder which is equipped with a very broad wheel, Fig. 10, the face of which operates upon the entire length of the piston, and by means of a cam which guides the diamond holder with which the wheel is dressed, three distinct steps are formed upon the face of the wheel. The first step represents the diameter of the top ring land, the second represents the second ring land and the third represents the skirt diameter. The grinder handles about 60 pistons per hour, and about once an hour the dressing tool is utilized to properly check up the clearances as determined by the grinding wheel.

Another interesting point may be mentioned in connection with the manufacture of the connecting-rods. The babbitt metal in these rods is cast into place and reamed and broached, the finish on this broaching process being claimed to be within .00025 in. on diameter and parallelism of the hole. The broaching operation gives a burnish and tends to densify the metal. The rod is then held in a fixture on a specially constructed grinding machine which locates from the finished hole in the large end of the rod. From this, the piston pin hole is ground in the small end to insure the alignment of these two holes, Fig. 12. This eliminates the usual methods of bending the connecting-rod shank, which is the practice ordinarily employed. This is a rather unusual operation in the production of a car in this price class.

The flywheel for the Rickenbacker engine is made of ship steel plate. The flywheel, as well as the clutch cone and spider, are balanced in a dynamic balancing machine which indicates the point from which metal must be taken in order to put these cars in dynamic balance, and also indicates the amount of metal to be removed, Fig. 13. The machine used is the Crawford balancing machine. The reciprocating parts, together with the crankshaft, are balanced on Norton crankshaft balancing machines, this combination being designed to produce an exceptionally smooth-running engine.

This rather brief summary of some of the manufacturing operations at the plant are of interest because of the newness of the plant and because they show the possibility of using advanced type of machinery in a plant which is not running at maximum capacity or on a large output basis. It is an interesting fact that the books of the Rickenbacker company show that the concern made a profit during the month of March, although this was only the second month in production. The ability to accomplish this feat is largely due to the well-considered choice of machinery with which this plant is equipped.

Standardization in the Petroleum Industry

IN his presidential address to the Institution of Petroleum Technologists (England) Prof. J. S. S. Brame gave an outline of the efforts at unification and standardization in the petroleum industry to date.

He stated that at the early international conferences of petroleum industrials and scientists meeting in connection with Paris exhibitions, little was achieved. The Bucharest Conference of 1907 appointed seventeen experts to deal with analytical and testing problems, but that number was too small. The proposal for national sections came from Berlin in 1908, and the International Chemical Congress, held in London in 1909, had for the first time a special Petroleum Section. An International Commission under the presidency of Prof. Carl Engler was established at Karlsruhe, to the Technical High School of which petroleum technologists congregated from all parts of the world. The International Petroleum Congress of Vienna, in 1912, was attended by almost all interested countries, including the United States, Russia alone not being officially represented. It was agreed that the nomenclature should have a scientific basis with due regard, however, to commercial uses. Various problems were assigned to various committees; storage, transport and fire insurance were also discussed, but France and the United States did not approve of dealing with these questions, and the Government representatives were on the whole reluctant to bind themselves. The next conference, originally projected for 1913, was to meet in London in spring, 1914, but Rumania interposed an invitation to Bucharest, and the preparations were so much delayed thereby that the London conference was again postponed. Then war intervened. Meanwhile an International Petroleum Institute, to deal also with statistics and literature, had been suggested, the initiation coming from Germany, though not for Germany and not from Karlsruhe; Rumania again proposed Bucharest as the seat of that Institute. After the war the Société Industrielle de Chimie proposed to resuscitate the International Commission, at Strassburg. Professor Brame personally did not see the advantages of Strassburg. Though himself a chemist, he would not tie petroleum technology to chemistry, and he would rather support the educational development by endowments and scholarships. The United States, moreover, had achieved so much for petroleum generally by the work of the Geological Survey, the Bureau of Mines and the American Society for Testing Materials—created in 1902 as the American Branch of the Internationale Verband für Materialprüfung at Vienna—that Professor Brame advocated co-operation of the two English-speaking races, the greatest oil-producing nation and the nation most extensively interested in oil all over the world. American methods had been so well developed and so largely adopted that America would probably not be inclined to wait for international approval.

Welding Duralumin—Some Experimental Work and Its Results

An account of experimental work done at the Naval Aircraft Factory and of results attained from this work and from welds made by a private firm. Details of tensile and corrosion tests made on different types of welds.

By Horace C. Knerr*

THE welding of duralumin has heretofore been considered impracticable. This conclusion was natural, in view of the fact that overheating in heat treatment is very injurious to the metal, reducing its tensile strength and causing brittleness. Moreover, the properties of cast duralumin are supposed to be inferior —at any rate, the alloy is not used for castings—and a weld is essentially a casting. The only method of joining duralumin parts therefore has been by riveting or other mechanical means.

Duralumin may be soldered with aluminum solders, but these will not stand the temperature of heat treatment of duralumin, and if applied after heat treatment

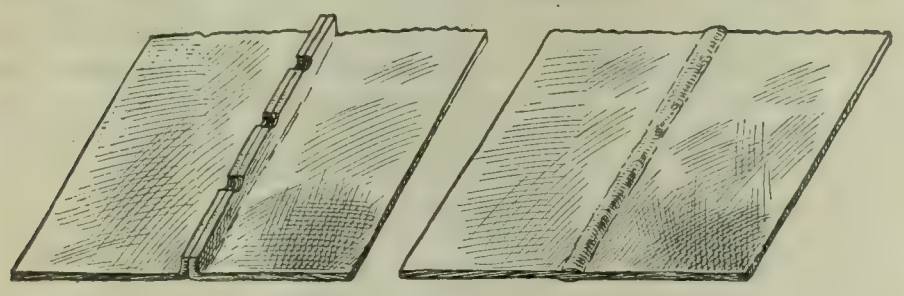


Fig. 1—Types of weld

the duralumin is likely to be at least partially annealed. The chief objection to soldering duralumin is the fact that all aluminum solders are subject to rapid electrolytic corrosion in the presence of moisture, causing the joint to lose its strength in a comparatively short time.

In aircraft construction and elsewhere there are many instances where a welded joint would be desirable, even at some sacrifice in the strength of the material, notably in the construction of fuel tanks, floats and pontoons, as well as in divers structural members.

Successful Welds Made at N. A. F.

Experiments were undertaken at the Naval Aircraft Factory to determine whether sheet duralumin could be welded in the same way as aluminum, and if so, what mechanical properties would result.

Sheet of two representative thicknesses, 0.065 in. (No. 16 B.W.G.) and 0.035 in. (No. 20 B.W.G.) were used in the experiments, from stock furnished by two manufacturers. This duralumin had been heat treated by the manufacturers after rolling, and its specified physical properties were:

Yield Point (minimum) .....25,000 lb. per sq. in.
Ult. Tensile Strength (minimum).....55,000 lb. per sq. in.
Elongation in 2 inches (minimum).....17 per cent

All welding was done by one operator, skilled in the welding of sheet aluminum. Narrow strips sheared from the edges of the sheets were used as welding rods. Sheets and welding rod were pickled in hot caustic solution to clean them. A momentary immersion in nitric acid, followed by rinsing in hot water, removed the dark deposit left by the alkaline bath and rendered the metal clean and bright. Just before welding, the edges were further polished by means of steel wool. The same flux as used in welding aluminum was used in welding the duralumin specimens. This was dissolved to a thin paste in water and applied liberally with a brush to the welding rod and the edges to be welded. The oxyacetylene welding flame was used, with a small torch such as is employed in lead burning. The welds were 6 to 12 in. long.

Butt Welds

Some plain butt welds were made in the following manner:

The sheets were placed edge to edge, "tacked" together at intervals of about one inch by melting the edges together at those points and adding a little metal from the welding rod. Fresh flux was then applied and the weld made continuously by melting the edges together and building up the joint with metal from the welding rod. Butt welds were more successful with the thicker sheet (No. 16 gage) than with the lighter sheet (No. 20 gage), as the latter melted through easily.

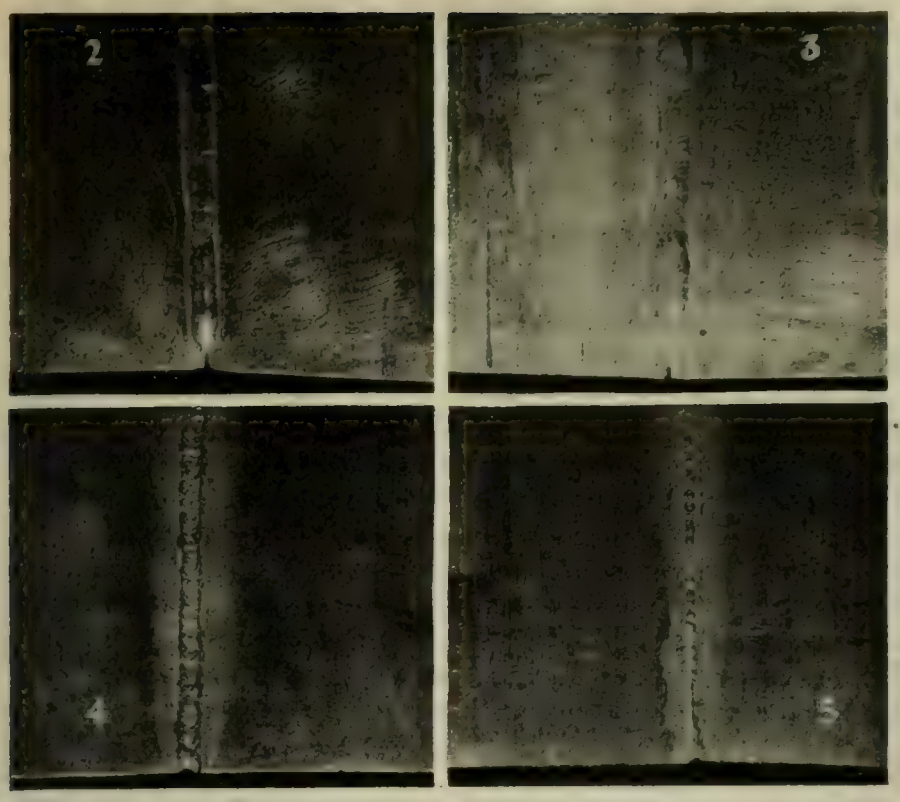
An attempt to prevent melting through of the butt weld by backing up the joint with a piece of smooth sheet steel was unsuccessful. The weld was made more easily and with a more workmanlike appearance than without the backing, but the rapid cooling caused by the backing resulted in a continuous crack along the weld. Further experiments might yield more satisfactory results, but the method is limited in its application.

Flange Welds

The remaining welds were made by flanging and melting down the edges, as is customary with aluminum. The edges of the sheets to be joined were bent up at right angles a distance of about three times the thickness of the sheet. These flanged edges were clamped together with small "C" clamps and tack-welded about every half inch, as shown in Fig. 1. Flux was reapplied to both sides of the joint after tacking. The weld was then completed by melting down the flanges and adding a little material from the welding rod where necessary. This method was found more satisfactory than plain butt welding, and left a good fillet on the lower as well as the upper surface of the joint.

Where the bends in flanging ran parallel to the grain, the sheet was annealed before bending by heating to 350-400 deg. C. (660-750 deg. Fahr.) to avoid cracking.

*Metallurgist, Naval Aircraft Factory, Philadelphia.



Figs. 2 and 3—Welds made by Naval Aircraft Factory process
Figs. 4 and 5—Welds made by Welding Company

The behavior of the metal in making either butt or flange welds was similar to that of aluminum in that it was necessary to progress continuously at an even speed along the weld. It was difficult to make a new start in a weld which had been allowed to cool or which had burned through.

The appearance of the finished welds was, in general, very satisfactory. Photographs of welds made by the flange method are shown in Figs. 2 and 3.

Samples Prepared by Welding Company

At about the time the above experiments were undertaken at the N. A. F. a commercial welding company stated they had been successful in welding duralumin, and offered to prepare samples for test. Sheet of 0.065 in. thickness was sent to this concern, from which they made some straight welds and also two small cylindrical tanks. The acetylene flame was used, with welding rod sheared from the sheet, but further details of their process were not disclosed. From the appearance of the welds, this company, hereafter referred to as the Welding Company, employed the butt method of welding. Their welds showed excellent strength, but lacked the fillet on the underside, which is a desirable feature of the flange method of welding. Photographs of welds made by the Welding Company are shown in Figs. 4 and 5.

Tensile Tests

Tensile specimens were prepared from welds made by the Welding Company and by the N. A. F. These specimens were ¾ in. wide at the reduced portion, with a 4 in. gage length.

Some of these specimens were dressed by filing the weld down smooth to the thickness of the metal, but the majority were left as welded, as welds are seldom "dressed" in practice. The specimens were further divided into groups, heat treated and not heat treated, and some of each group were subjected to the action of the salt water spray corrosion test for thirty days. All were then tested in tension. Results are given in Tables 1, 2 and 3.

Effect of Corrosion

In the salt water spray corrosion test the specimens are suspended in a wooden box with a glass cover and are kept constantly moist with a solution of common salt in water (20 per cent by weight), atomized by means of a compressed air jet. A galvanized steel fitting is required to stand this test for 100 hours without signs of rust.

Specimens which had not been heat treated after welding were severely attacked by corrosion along a line about one inch away from the weld, as illustrated in Fig. 6, some specimens being eaten entirely through.

This localized corrosion, which was plainly electrolytic, was doubtless due to a physical difference between the metal which had been annealed by the heat of welding and the remaining metal which was in the heat treated state. The weld itself was in no case attacked. Similar specimens, heat treated after welding and subjected to the same corrosion test, are shown in Fig. 7. They were only slightly corroded, having some scattered surface pitting, but none locally along the weld.

Gasoline and Benzol

Some welded samples were placed in gasoline and benzol, each containing a considerable amount of sulphur in solution, but no appreciable corrosion took place.

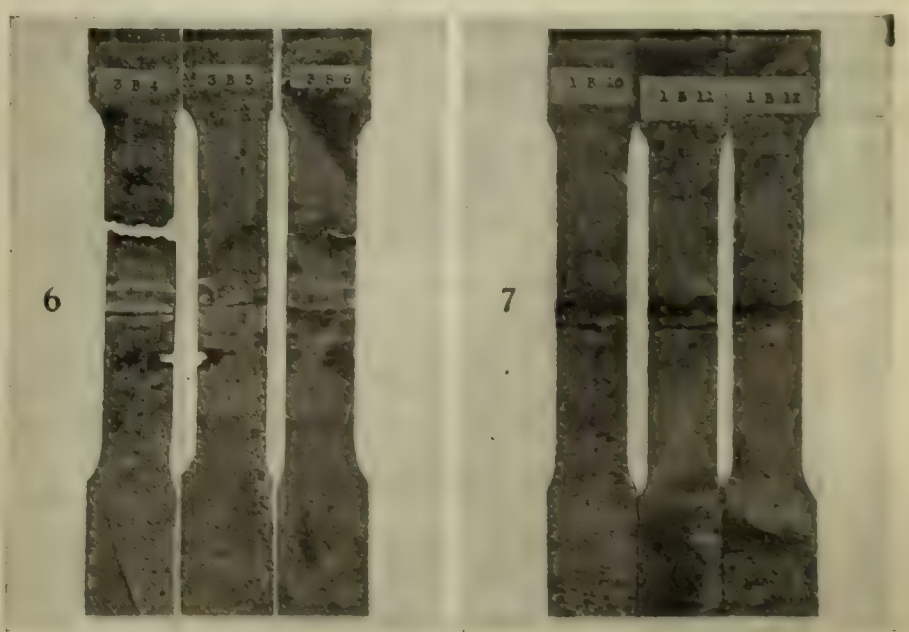
Bend Tests, Effect of Corrosion

Specimens were subjected to a bend test to determine whether the exposure to salt spray had induced brittleness in the sheet. This was done ten days after removing from spray. The specimens which had not been subjected to the corrosion test withstood a 180 deg. bend on a diameter equal to about four times their thickness, whereas the corroded specimens withstood only about 135 to 150 deg. bend before cracking. Bend tests on welded joints were made with the results given in Table 4, indicating that corrosion had no marked effect on the bending qualities of heat treated welds.

Welded Duralumin Tanks

One of the small duralumin tanks (6½ in. dia. x 13½ in. high), made up by the Welding Company, is shown in Fig. 8. Heat treated duralumin sheet (No. 16 gage) was used, but the tank was not heat treated after welding. It withstood a hydraulic pressure test of 68 pounds. Failure occurred by blowing out the lower head along the line of the weld. Had the weld been well filleted inside, as it is when the flange method of welding is used, greater pressure would probably have been withstood.

The effect of corrosion on the other sample tank (8½ in. dia. x 9¼ in. high) is illustrated in Fig. 9. The photo



Figs. 6 and 7—Test specimens of welded duralumin



Fig. 8 (on right) — Welded duralumin tank

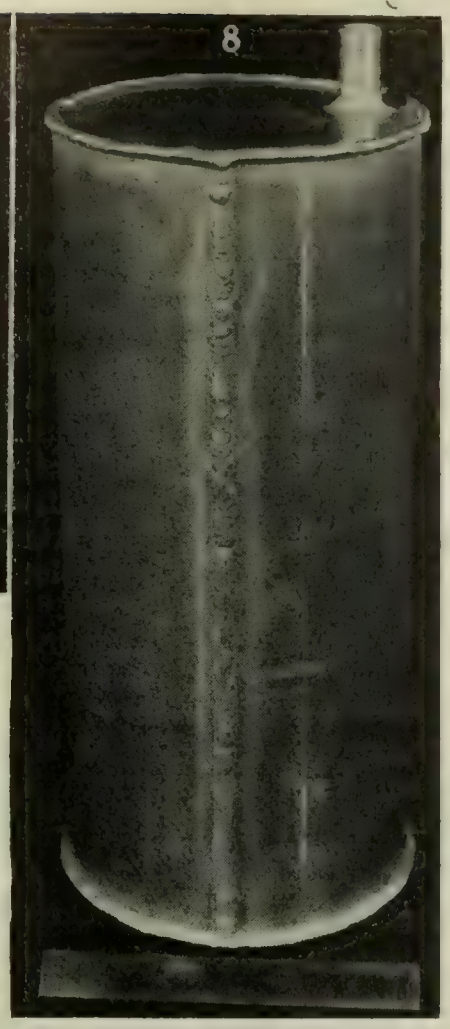


Fig. 9 (above)—Effect of salt spray test on duralumin tank

shows the tank after five days in the salt spray test, without cleaning off the foamy deposit which forms. The salt water spray had access to the interior of the tank through the inlet tube, but caused only slight pitting uniformly distributed over the inside surface, not localized near the welds.

Removal of Welding Flux

Unless all traces of welding flux are carefully removed from duralumin and aluminum after welding, severe corrosion will occur. This is especially important on the inside of tanks. Flux may be removed by submerging the parts in a 10 per cent solution of sulphuric acid for about one hour, followed by thorough rinsing in running water. The acid solution must be frequently renewed to prevent accumulation of flux. The container for the acid bath should be made of wood, as the presence of metals other than duralumin or aluminum will cause pitting. The part being cleaned must be entirely submerged and (if a tank) completely filled with the solution, as contact with air will cause local pitting.

Heat Treatment

Heat treatment of duralumin ordinarily consists in heating to 480-500 deg. C. (896-932 deg. F.) in a salt bath or electric muffle furnace, holding for 15 minutes or longer, quenching in boiling water, and allowing to age at room temperature for at least 4 days.

The quenching of tanks, floats or other large members in a water bath would present serious problems on account of the softness of the material while hot, the

TABLE 1.
DURALUMIN WELDED AT N. A. F.
(Manufacturer "B")
WELD NOT DRESSED
As Welded—No Heat Treatment

Specm. No.	Thickness No. 16 Ga. (.065 In.) Yield Stress	Ult. Stress	Elon. % 2 In.	Thickness No. 20 Ga. (.035 In.) Yield Stress	Ult. Stress	Elon. % 2 In.	Butt Weld No. 20 Ga. Yield Stress	Ult. Stress	Elon. % 2 In.
B 1	24,400	30,900	1.0	26,400	33,900	2.0	22,400	24,800	1.0
2	16,600	19,300	1.0	25,100	37,500	2.0	22,500	29,400	2.0
3	22,100	25,500	1.0	25,400	37,100	2.5	.....	21,400	.....
Aver....	21,030	25,230	1.0	25,630	36,130	2.2	22,450	25,200	1.0
Same (Not Heat Treated) after 30 days Corrosion Test									
4	.....	12,700	1.0	.....	12,100	.....	Broke in handling due to excessive corrosion.		
5	.....	20,500	1.9	.....	10,400	1.0			
6	.....	18,600	1.0	.....	11,300	0.5			
Aver....	.....	17,300	1.3	.....	11,300	0.5			
Heat Treated (Water Quenched)									
7	25,800	43,200	3.5	29,700	37,500	2.0	23,600	27,200	1.0
8	27,300	45,000	4.0	32,300	40,400	2.0	25,500	30,100	1.0
9	30,800	43,000	3.5	30,700	53,600	8.0	25,900	29,900	1.0
Aver....	27,960	43,730	3.6	30,900	43,800	4.0	25,000	29,060	1.0
Same (Heat Treated) after 30 days Corrosion Test									
10	29,800	30,400	1.0	33,500	44,900	4.5	23,700	26,700	1.0
11	28,900	46,200	5.0	32,400	43,300	3.5	16,900	19,700	1.5
12	31,800	41,500	3.0	32,000	42,600	3.5	.....	.....	.....
Aver....	30,200	39,360	3.0	32,960	43,300	3.8	20,300	23,200	1.3
Weld Dressed Smooth to Thickness of Sheet As Welded—Not Heat Treated									
13	20,200	21,600	1.0	24,900	29,800	1.0	.....	.....	.....
14	24,400	35,300	2.5	25,400	35,000	2.0	.....	.....	.....
15	23,400	31,600	2.5	25,100	30,100	1.5	.....	.....	.....
Aver....	22,700	29,500	2.0	25,200	31,600	1.5			
Same, Heat Treated (Water Quenched)									
16	27,800	34,700	1.5	29,100	42,100	3.0	.....	.....	.....
17	19,500	21,100	1.0	30,400	43,700	3.5	.....	.....	.....
18	29,300	39,100	2.5	20,800	24,400	1.0	.....	.....	.....
Aver....	25,530	31,600	1.6	26,800	36,700	2.5			

TABLE 2.
DURALUMIN WELDED AT N. A. F.
(Manufacturer "A")
WELD NOT DRESSED
As Welded—No Heat Treatment

Specm. No.	Thickness No. 16 Ga. (0.65 In.) Yield Stress	Ultim. Stress	Elon. % 2 In.	Location of Break	Thickness No 20 Ga. (.035 In.) Yield Stress	Ultim. Stress	Elon. % 2 In.	Location of Break
A-1	22,500	25,600	1.0	Edge	14,800	16,700	1.0	Edge
2	23,700	26,700	0.5	Edge	16,100	25,400	3.0	Edge
Aver.....	23,100	26,200	0.7		15,450	21,100	2.0	
Same after 30 days Corrosion Test								
3	.....	16,300	0.5	Outside	.....	8,300	1.0	Outside
4	.....	10,500	0.5	Outside	.....	18,700	1.0	Outside
Aver.....	.....	13,400	0.5		.....	13,500	1.0	
Heat Treated (Water Quenched)								
5	21,500	23,500	0.5	Edge	21,100	32,200	6.0	Edge
6	23,000	26,500	0.5	Edge	20,200	29,800	4.0	Edge
Aver.....	22,250	25,000	0.5		20,650	31,000	5.0	
Same (Heat Treated) after 30 days Corrosion Test								
7	.....	27,900	0.5	Edge	29,400	49,500	5.0	Outside
8	21,500	22,900	0.5	Edge	31,400	41,500	3.0	Edge
Aver.....	21,500	25,400	0.5		30,400	45,500	4.0	
Weld Dressed Smooth to Thickness of Sheet—Not Heat Treated								
9	.....	11,300	0.7	Edge	.....	25,800	0.5	Edge
10	12,600	15,000	1.0	Edge	.....	21,800	.....	Edge
Aver.....	12,600	13,150	0.8		.....	23,800	0.3	
Same (Dressed) Heat Treated								
11	.....	20,100	1.0	Edge	29,000	31,700	1.0	Edge
12	.....	13,400	0.5	Edge	.....	.....	.....	Edge
Aver.....	.....	16,700	0.7		29,000	31,700	1.0	

pressure of the bath on the immersed shell and the contraction of the air inside of the tank or pontoon, all tending to cause deformation. The rapid attack of corrosion on the unheat-treated welded parts, however, makes some form of heat treatment necessary. The effect of heat treatment is presumably to put all the metal in the same physical state, avoiding electrolysis.

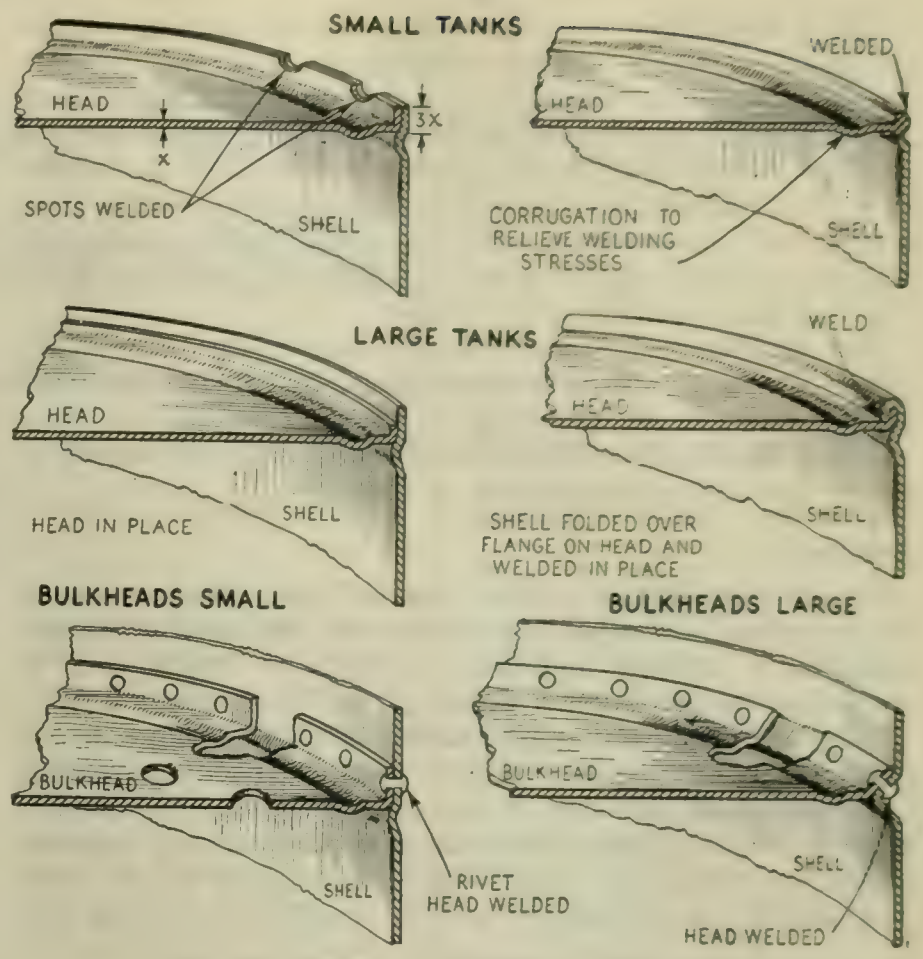


Fig. 10—Details of aluminum welded tanks

Experiments were undertaken to determine the effect of "air quenching" duralumin, that is, allowing it to cool in air after heating to the quenching temperature. It was found that the strength and ductility were very nearly, if not entirely, as good as by quenching in water or oil. Air-cooled specimens of 1/16 and 1/8-in. sheet duralumin (not welded) showed the following minimum physical properties:

	Test	Required
Yield Stress	31,750 lbs. per sq. in.	25,000 lbs. per sq. in.
Ultimate Stress	57,600 lbs. per sq. in.	55,000 lbs. per sq. in.
Elong. in 2 inches	17.5 per cent	17 per cent

A comparison of air quenched and water quenched welded specimens was less satisfactory, as shown in Table 5, although the properties were much better than without heat treatment.

TABLE 3.
DURALUMIN WELDED BY WELDING CO.
BUTT TYPE OF WELD
Thickness of Sheet No. 16 Gage (.065 In.)
As Welded—No Heat Treatment

Specimen No.	Yield Stress	Ultim. Stress	Elon. % 2 In.	Location of Break	Remarks
14	22,900	36,400	2.5	Center	
15	.....	24,300	1.5	Center	
16	23,900	30,200	1.5	Center	
Average.....	23,400	30,300	1.8		
Same (Not Heat Treated) after 30 days Corrosion Test					
11	23,900	29,100	2.0	Outside	All badly corroded in a line about 1 in. away from weld, both sides. All broke there.
12	21,300	26,700	1.5	Outside	
13	17,400	18,600	1.0	Outside	
Average.....	20,850	24,800	1.5		
Heat Treated (Oil Quenched)					
4	30,200	53,200	9.0	Edge	
5	33,200	52,000	7.5	Center	
Average.....	31,700	52,600	8.2		
Same (Oil Quenched) after 30 days Corrosion Test					
1	21,200	23,000	1.0	Edge	No localized corrosion in these specimens. Light surface corrosion all over.
2	27,800	31,500	1.5	Center	
3	30,400	41,600	.....	Outside	
Average.....	26,500	32,000	1.3		
Heat Treated by Air Quenching					
9	32,300	55,500	10.5	Edge	
10	29,200	42,300	4.0	Center	
Average.....	30,750	48,900	7.3		
Same (Air Quenched) after 30 days Corrosion Test					
6	15,200	17,900	1.0	Outside	Corrosion caused deep blistering and sealing all over, except at weld. Metal appears "rotten" at fracture.
7	12,600	14,800	1.0	Outside	
8	.....	6,300	1.0	Outside	
Average.....	13,900	13,000	1.0		

NOTE:—"Location of Break" refers to center of weld, edge of weld, and outside, away from weld.
All welds left in natural condition, not dressed. All welds sound and fine grained at fracture. Stresses figured on basis of thickness of *sheet*.

TABLE 4.
BEND TESTS.
Welds Heat Treated—Not Dressed

Specimen No.	Manufacturer "A"		Manufacturer "B"	
	Thickness of Sheet		Thickness of Sheet	
	No 16 Ga.	No. 20 Ga.	No. 16 Ga.	No. 20 Ga.
1	30 Deg.	135 Deg.	30 Deg.	45 Deg.
2	80 "	90 "	90 "	90 "
3	30 "	180 "	45 "	180 "
Average.....	47 Deg.	135 Deg.	58 Deg.	105 Deg.
Same, after 30 days Corrosion Test.				
4	30 Deg.	135 Deg.	30 Deg.	180 Deg.
5	30 "	160 "	45 "	135 "
6	80 "	135 "	45 "	90 "
Average.....	47 Deg.	145 Deg.	40 Deg.	135 Deg.

NOTE:—Radius of bend about twice thickness of sheet. Angle at which crack started given. Failures occurred at edge of weld.

NOT WELDED

Bends made in specimens of sheet, not welded, heat treated, and not heat treated, withstood about 180 Deg. before corrosion test and 135 Deg. to 150 Deg. after 30 days corrosion test.

TABLE 5.
DURALUMIN WELDED BY WELDING CO.
COMPARISON OF WATER QUENCHED vs. AIR QUENCHED WELDS
Water Quenched

Specimen No.	Yield Stress	Ultim. Stress	Elong. % 2 In.	Location of Break
23	32,100	56,400	16.3	Outside
25	32,000	56,500	12.5	Edge
27	32,900	54,300	12.0	Edge
29	32,000	54,600	10.5	Center
31	30,700	43,500	4.5	Center
33	31,400	55,700	12.5	Center
35	27,400	54,400	10.0	Edge
37	32,100	53,500	9.0	Edge
Average.....	31,325	55,500	10.9	
Air Quenched				
22	27,600	41,600	3.5	Edge
24	29,900	54,100	12.0	Center
26	31,800	41,200	3.5	Center
28	28,100	40,100	3.5	Edge
30	28,800	44,100	4.5	Center
32	31,700	48,900	7.0	Center
34	29,100	52,100	9.5	Edge
36	28,900	48,100	7.5	Edge
Average.....	29,500	46,300	6.4	

Remarks:—All welds sound and fine grained at fracture.
Stresses figured on basis of thickness of sheet.
Air and water quenched specimens taken alternately along continuous weld.

When subjected to corrosion test, the air quenched specimens did not corrode locally, as with the unheat-treated specimens, but severe corrosion or scaling took place over the whole specimen, greatly reducing its strength. See Table 3, Specimens 6, 7 and 8. It should be borne in mind that the salt spray corrosion test is very severe. Air quenching, with the use of some protective coating, such as spar varnish, might be quite satisfactory for many practical purposes.

The problems of heat treating large duralumin structures to obtain satisfactory physical properties and avoid corrosion is receiving further attention.

Some details of welding aluminum tanks, also applicable to duralumin, are shown in Fig. 10.

Summary

Duralumin may be welded in practically the same way as aluminum, although more care and skill are required. There is a greater tendency to melt or "burn" and to crack and buckle during welding than with aluminum.

The efficiency of welded joints, heat treated but not dressed, is fairly high, varying in the present test from about 50 to 100 per cent of the specified strength (55,000 lb. p. sq. in.) of the material. The efficiency of dressed joints, heat treated, varied from about 25 to 80 per cent.

Welds of high strength may be obtained either by the butt method or the flange method of welding. The flange method is considered preferable, as it produces a fillet on the under side of the weld.

Heat treatment should follow welding. When not heat treated, rapid and severe corrosion sets in, along a line parallel to and about an inch away from the welded joint, in the presence of moisture. Heat treatment prevents this.

Heat treatment greatly increases the strength of welds. Heat treatment may be either by oil or water quenching and possibly by air quenching or other means. The greater convenience of air quenching for large parts, such as tanks, etc., would warrant its use in certain cases, even at some sacrifice of properties.

Neither gasoline nor benzol has any noticeable corrosive effect on duralumin, welded or otherwise, even with considerable sulphur in solution.

Welding flux must be thoroughly removed.

It seems practicable to apply welding in the fabrication of duralumin provided:

(a) Care is taken in design to facilitate welding, to avoid difficult and complicated joints, and to take care of expansion strains.

(b) Provision is made for heat treating the entire part after welding, or for protecting it from exposure to moisture.

Standardization of Bearing Alloys

THE American Engineering Standards Committee has before it for approval as "Tentative American Standard," A. S. T. H. Standard Methods for Chemical Analysis of Lead, Tin, Antimony and Copper.

These methods as first recommended to the A. S. T. M. in 1917 were based on methods of analysis in use by manufacturers, analytical chemists and large users of the alloys. In 1920 partial revision of the methods was made following suggestions of the United States Bureau of Standards, and as a result of co-operative analytical work with the use of the methods carried out by members of the committee and by other co-operating chemists. The methods were adopted as standard by the A. S. T. M. in 1921.

Submission for approval to the A. E. S. C. is in accordance with the special procedure of the committee, under which important standards in existence prior to 1920 may be approved without going through the regular process followed in new work.

The A. E. S. C. would be very glad to learn from those interested of the extent to which they make use of these methods and to receive any other information regarding the methods in meeting the needs of the industry.

These methods are contained in the 1921 volume of A. S. T. M. Standards. Copies may also be obtained from the American Engineering Standards Committee, 29 West Thirty-ninth Street, New York City. Price, 25 cents.

The Tractor Drags 'Em Out. Bull!

THE American tractor is playing a prominent part in bull fights at Chihuahua, Mexico, according to the Agricultural Implement Division of the Bureau of Foreign and Domestic Commerce.

Instead of having a team of horses or mules drag the carcass of the dead bull out of the arena, as has been the custom from time immemorial, an American made tractor was employed. Although the clearance afforded by the gate through which the tractor had to pass was only two inches, the entries and exits were made with ease and time was saved in clearing the ring for the entry of the next bull.



Front and reverse side of Grand Prix medal won by Duesenberg

Grand Prix Won by Duesenberg Last Year Arrives in United States

THIS is the Grand Prix won by Jimmy Murphy in a Duesenberg at Le Mans, France, last July. The medal has just been received in the United States. The distance of 321.78 miles was covered in 4 hr., 7 min. 11 sec., or an average speed of 78.12 m.p.h. Incidentally two other Duesenbergs finished in this race, one being fourth and the other sixth. Nine cars finished. This is the first time that an American car has won the Grand Prix, and was the first big European race in which an American team was entered.

A Spring Suspension Which Secures Greater Flexibility

In this spring suspension system practically the entire sprung weight is supported on two equalizing bars, one at each end of the chassis. It is claimed that all rolling is eliminated and after-bounding is damped out.

FOR some years past a number of inventors have been endeavoring to devise a vehicle spring suspension which should distribute any shock received by one road wheel between either the two springs on opposite sides of the chassis or even between all four springs. If the shock is taken up entirely on one spring it is evident that the spring is strongly compressed and will rebound correspondingly, whereas if the shock is distributed between a number of springs the rebound is materially reduced. Greater flexibility is also claimed for this arrangement of springs.

A spring construction of the type referred to has been invented by Chauncey Coleman, a Canadian engineer, who has recently been demonstrating a car equipped with these springs in this country.

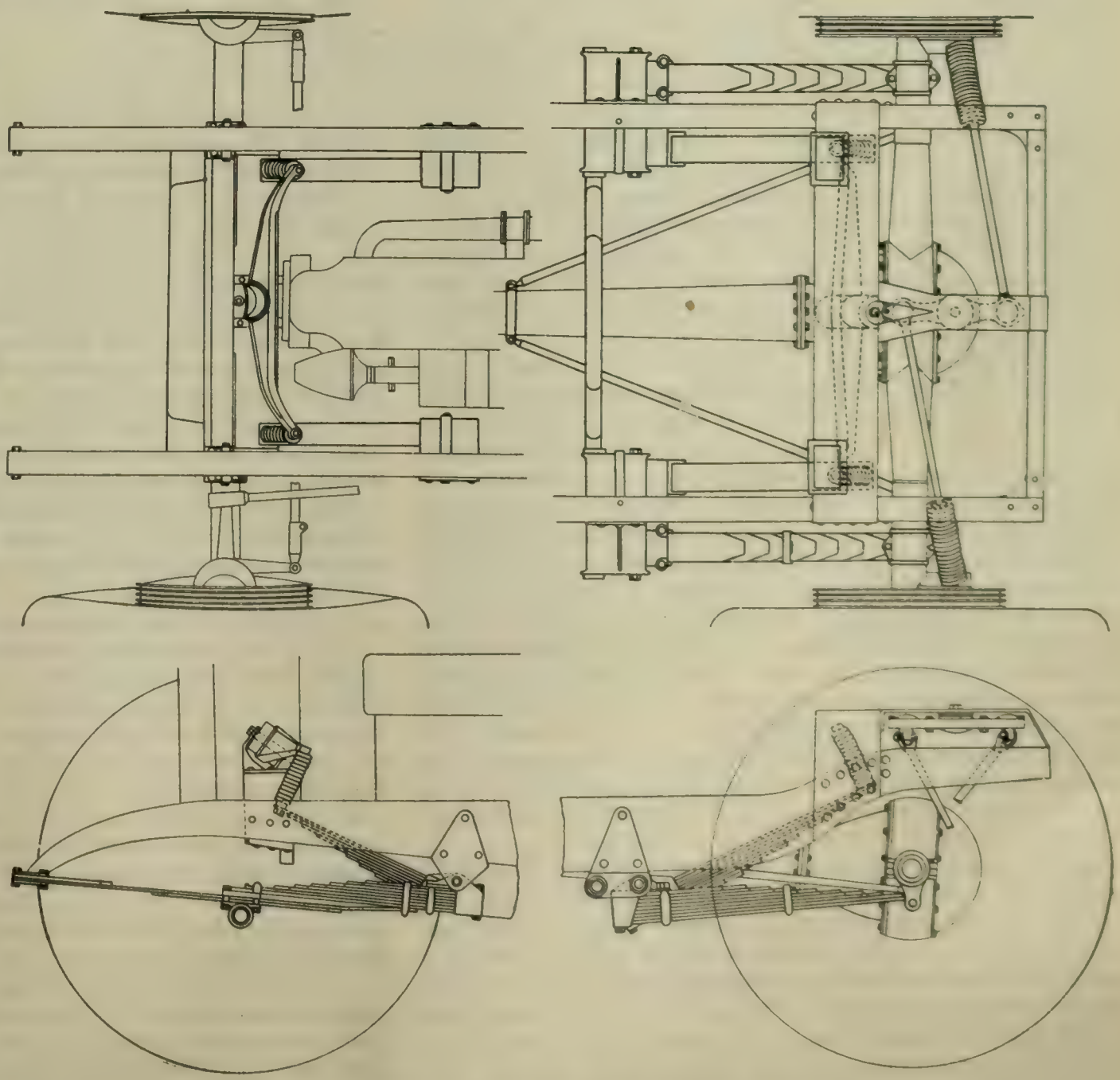
With the Coleman suspension practically the entire sprung weight is supported on two equalizing bars, one at each end of the chassis, pivoted at their center to cross frame members and connected to the axle by V shaped springs, which are pivoted at their butts to the side frame members. This construction places the springs on the opposite sides of the chassis in series with each other and gives twice the flexibility that would be obtained with one spring only. In action, the axle and equalizing bar are said to move in unison without disturbing the body.

The V spring is flexibly connected to the equalizing bar by a closed coil spring. At the front a two-leaf, semi-elliptic is used in conjunction with the V spring to increase lateral stability and flexibility by obviating the fixing of the V spring to the axle.

Rolling is eliminated, it is claimed, because the two weight carrying pivots are the centers of rotation, and if rolling took place the butts of the V springs would have to swing in a lateral direction, which is impossible.

At the rear a stabilizer is used to prevent side sway. It consists of two struts connected to a short equalizing bar pivoted centrally on the chassis. The lower ends of the struts are fastened to a plug in the end of a closed coil spring. Each of these springs is fastened to one end of the axle. If the body sideways it is countered by instant and heavy resistance, one spring being stretched 2 in. for every inch the body moves laterally.

After-bounding is damped out, it is claimed, because a very large percentage of road shocks strike one wheel before the other, thus setting the equalizing bar in motion,



Detail views of Coleman spring suspension system

Analysis of Netherlands East Indies as an Automotive Market

A detailed report on the present status of American automotive products and the potential market in that country. The writer tells about dealer organizations, credits and advertising and gives specific facts as to how American manufacturers can hold their place and secure market expansion.

By John A. Fowler*

UNTIL the war shut out imports from Europe the people of Java knew little about American automobiles. There was much of the sort of misinformation that has attended the introduction of American automobiles in other countries, where they came in close competition with European makes, and, while they had begun to make a small place for themselves, they were not appreciated in the popular mind. European-made cars (such as the Italian F.I.A.T.; the French Lorraine-Dietrich, Berliet and Brasier; the Belgian Minerva; the Dutch Spijker; the German Opel and Protos; and the English Siddeley-Wolseley, Napier, Austin and Sunbeam) were all well known and were looked upon as the last word in mechanical efficiency and finish.

The European automobiles brought high prices and the European manufacturers were eager to meet the special requirements of this, which was important to them. Special body designs were provided, copper radiators (supposed to be suited to the climatic conditions of the tropics) were furnished on order, and the engines were finished with copper and brass trimmings; but such American innovations as self-starters, storage batteries and electric lights were looked upon askance.

The war brought about a revolution in the trade. European cars could not be bought and the dealers tried to get American cars without electrical equipment, insisted on having magnetos, and tried to induce American manufacturers to change their models and equipment to suit the habits of their trade. The American automobile, through its mechanical efficiency, structural strength and high power proportionate to weight, has won a firm place in the market. During the time American manufacturers have had an opportunity to make their position in the trade almost impregnable and through their manufacturing ability they have gone far to accomplishing that end, so far as passenger cars are concerned, but as continental Europe becomes able to compete for the trade they will find that greater care in cultivating the market and extending to the users the service that American owners have at their command will give them that additional strength necessary to maintain their position.

In the motor truck trade, which has developed rapidly during the last three years, America's position is not strong. Continental European manufacturers have been able to offer a truck of equivalent capacity and power at a very much lower price than was being asked for American trucks, and German trucks were increasingly in evidence on the roads during 1921.

Notwithstanding the proven efficiency of the American machines there is still a very definite prejudice in favor of European cars in the minds of many people and, other things being equal, the European cars would get the preference.

Commercial Divisions and Roads

The grand commercial divisions in the Netherlands East Indies, from the point of view of the automotive vehicle trade, are six in number, based on the established trade organizations and the island and road groupings. There are several sub-divisions to which the business is handed through sub-agents.

1. *The west-Java division* is based on Batavia, with an important sub-division based on Bandoeng, the mountain capital. It includes the Lompongs districts in Southern Sumatra and the Preangor Regencies and the residencies of Bantam, Batavia, and Cheribon, in Java. In the Lompongs districts there are a few light grades on less than 100 miles of good roads, but there are many miles of plantation roads of dirt construction with varying grades. In western Java there is a large mileage of roadway of good construction for light motor traffic, but the fine metalling is usually washed off by the heavy rains soon after the completion of repairs. This part of the island is level on the north coast, with undulating stretches between the plains and the massed mountain regions, where the grades are long and steep, with very few level stretches except in the immediate vicinity of Bandoeng. Many of the plantation roads, of which there is a large aggregate mileage, are well built, but in the course of their duties the managers often tax their cars to the limit on the poorly constructed auxiliary dirt roads.

All of the more important automobile companies of the colony have their head offices in Batavia, with the exception of one, which is located at Bandoeng. There is an adequate service organization in Batavia and Bandoeng and spare parts can usually be obtained for all the cars properly represented.

2. *The central-Java division* is based on Semarang and includes the residencies of Semarang, Soerakarta, Djokjakarta, Kedoe, Banjoemas and Pekalongan. This part of Java is made up of a coastal plain on the north and southwest with high volcanic mountains rising singly or in groups of two or three with low saddles between. There is a well-developed road system, but the standard of upkeep is lower than in west or east Java. The plantation roads are not so good as in the Preangor Regencies or in east Java and the grades on both Government and plantation roads are heavy. Soerakarta and Djokjakarta are the centers of two sub-divisions. At these points heavy re-

*American Trade Commissioner. This article is printed through the co-operation of the Automotive Division of the Bureau of Foreign and Domestic Commerce.



Map showing commercial divisions in the Netherlands East Indies based on established trade organizations and the island and road groupings

pairs can be made as well as at Semarang, where full stocks of parts are carried. Some of the Batavia automobile companies have branches at Semarang and there are several local companies, not equipped for general distribution, who can give good local representation.

3. *The east-Java district* is based on Soerabaya and includes the residencies of Soerabaya, Rambang, Madioen, Kediri, Pasaroean and Besoeki, in Java; the islands lying to the east, including Madoera, Bali and Lombok, the island of Celebes, all the islands to the east, and the southern and eastern residencies of Borneo.

That part of this district lying on the island of Java has a very extensive road system, including several fine highways. These radiate across the lowlands to Semarang, Soerakarta, the southeast residencies; and into the several mountain groups where there are considerable plantation areas and many resorts. In the lower lands the Government roads cut the plantations and such plantation roads as are necessary are of fairly good construction. In the mountain districts the Government roads have heavy grades and there are the same difficulties with metalling as in other parts of the island. The plantation roads of the highlands are poor with heavy grades.

The principal Batavia automobile companies have branches in Soerabaya and several local companies have good organizations for local distribution. There are ample service facilities at this city. Malang is the principal sub-center.

The Island of Bali, lying east of the residency of Besoeki, Java, has a fairly well-built road system, skirting the north coast and crossing the high mountains to the east and south coasts. This island is dependent on Soerabaya for distribution and all but the lightest repairs. The island of Lombok has a few miles of fairly good roadway. Like Bali, it is dependent on Soerabaya for distribution and heavy repairs.

Out of Bandjermasin, in southern Borneo, there are a few miles of roadway running north.

In the southwestern part of the island of Celebes, radiating from Macassar, there is a very extensive road system. There are only a few plantations, most of the roads having been built for strategic purposes primarily. There are two repair shops at Macassar, where thorough overhauling is done, and they represent the Soerabaya dealers as subagents.

There are a few miles of standard roads out of Menado in the northern part of Celebes. This sub-district is tributary to Soerabaya.

Sumatra is divided into three commercial units, not including the Lompongs districts of southern Sumatra which, as noted above, are tributary to Batavia.

4. *The Sumatra east-coast district* is based on Medan, Sumatra, and includes the residencies of Sumatra east coast and Atjeh. It has an excellent road system which reaches from the northernmost point of the island to Si Pare Pare on the south and joins the road from Sibolga on the west coast at the summit of the mountain range. Some of the grades in the mountain districts are heavy, but for the most part they are not especially so. The large bulk of the roadways are level and are kept in fairly good condition. Plantation roads, on which automobiles are used, are fairly good.

Some of the Batavia automobile companies have branches in Medan and there are some companies of local importance only. Major repairs can be made and parts are carried for most of the makes represented.

5. *The Sumatra west-coast district* is based on Padang and includes the residencies of Sumatra, West Coast and Tapanoeli. While there is a fine highway between Medan and Sibolga, the mountain range lying between is an effective barrier to commerce. Padang is the general trade center of the area west of the mountains and the produce

is moved on coastwise steamers calling at the numerous ports.

A very good roadway extends from Sibolga south to Padang and beyond. In the highlands of Padang it branches out into an elaborate system through a highly developed agricultural country. There is considerable individual wealth in the district, not only in the hands of Europeans, but of the Menangkabou Malays as well. There is one Dutch company in Padang doing a general import and export business that represents several American manufacturers of automobiles and maintains an efficient service plant, capable of complete overhauling.

6. *The Palembang-Benkoelen district* is based on the town of Palembang and includes the residencies of Palembang and Benkoelen, the western residency of Borneo, and the islands lying between. A road is under construction between Padang and Benkoelen and is far toward completion except for bridges. When it is completed Benkoelen will probably be logically allied with Padang in the automobile trade, but at present, on account of road connections with Padang, it is within Palembang's sphere of influence.

A good road connects Palembang, which lies fifty miles inland from the east coast, with Benkoelen on the west coast and crosses a high mountain range.

There is considerable wealth in the country but not in large units. The people are fairly prosperous, especially in the pepper districts. Except for the few plantations near Palembang, the market would soon be for cheap American cars, the buyers being Europeans, Chinese and Arabs.

An automobile dealer in Medan has opened up a service station at Palembang and there are many native or Chinese owned shops at various centers in the district for minor repairs.

On the islands of Banka and Billiton there are some good roads. Such purchases as might be made for the private population of these islands would naturally be made in Palembang were stocks kept there. The western residency of Borneo has a few miles of roadway.

There is no representation of American automobiles in this district and purchases must be made at Batavia or Medan. There are but two local concerns in a position to develop this trade, one of which is the largest importing and exporting house in the colony outside of Java and the other is an engineering company.

Number of Motor Vehicles in Use

The following estimate of the number of motor vehicles in the Netherlands East Indies at the end of 1918 was based on a privately compiled register of automobiles licensed in the Netherlands Indies, published early in 1919:

West-Java Division:

Batavia	2,000
Bantam	65
Preanger	1,227
Lompongs District	95
Cheribon	498
Total	3,883

Central-Java Division:

Pekalongan	556
Samarang	1,679
Banjoemas	255
Kedoe	27
Djokjakarta	605
Soerakarta	510
Total	3,632

East-Java Division:

Soerabaya	2,669
Rambang	287
Madioen	326
Kediri	(a)
Pasaroean	1,018
Besoeki	485
Madoera	87
Bali and Lombok	115
Celebes	(a)
Menado	(a)
South and East Borneo	(a)
Total	5,017

Sumatra East Coast District:

Sumatra East Coast	1,275
Atjeh	157
Total	1,432

Sumatra West Coast District:

Sumatra West Coast	264
Tapanoeli	126
Total	390

Palembang-Benkoelen District:

Palembang	(a)
Benkoelen	111
Banka and Billiton	338
West Borneo	63
Total	512
Grand Total	14,866

(a)—Statistics lacking.

While several residencies having roads (principally the Celebes) are not included in this enumeration, it is sufficiently accurate to serve as a basis for a rough estimate of 15,000 cars as the colony's equipment at the end of 1918. Of these, 10,923 were imported since 1913 as follows: 1328 from the Netherlands, 8126 from the United States, 293 from England, 245 from France, 252 from Italy, 186 from Germany, 313 from Singapore and 180 from all other countries.

Importation of Motor Vehicles

Since 1918 there have been 10,877 passenger cars and 3678 trucks imported, 252 and 256, respectively, from the Netherlands; 8082 and 2446 from the United States; 127 and 37 from England; 40 and 4 from France; 144 and 6 from Italy; 89 and 207 from Germany; 198 and 7 from Singapore; 1807 and 597 from Canada, and 158 and 118 from all other countries. The following table shows the number of motor vehicles imported into the Netherlands East Indies since 1913:

Countries of Shipment	1913	1914	1915	1916	1917	1918	1919	1920	1921*	Total
Netherlands:										
Passenger cars	576	477	144	117	14	..	14	71	167	
Trac. & trucks	..	..	..	..	..	..	..	130	126—	1,836
United States										
Passenger cars	251	240	357	2,384	2,998	1,701	2,654	3,489	1,939	
Trac. & trucks	..	..	..	..	..	195	629	1,066	751—	18,654
Canada:										
Passenger cars	..	..	..	..	..	..	65	679	1,063	
Trac. & trucks	..	..	..	..	..	..	21	99	477—	2,404
England:										
Passenger cars	95	111	65	17	5	..	3	76	48	
Tractors	..	..	..	..	..	..	4	33	†—	457
France:										
Passenger cars	114	87	42	2	..	..	..	3	37	
Trac. & trucks	..	..	..	..	..	..	..	4	†—	289
Italy:										
Passenger cars	25	60	98	63	4	2	6	41	97	
Trac. & trucks	..	..	..	..	..	..	..	6	†—	402
Germany:										
Passenger cars	106	80	..	..	..	..	..	41	49	
Trac. & trucks	..	..	..	..	..	..	..	55	152—	482
Singapore:										
Passenger cars	88	71	50	22	31	51	84	13	101	
Trac. & trucks	..	..	..	..	..	..	7	..	†—	518
All Other Countries:										
Passenger cars	75	54	21	3	16	9	31	30	77	
Trac. & trucks	..	..	..	..	..	2	8	8	102—	436
Total:										
Passenger cars	1330	1180	777	2608	3068	1763	2857	4443	3577	
Trac. & trucks	..	..	..	..	..	197	669	1401	1608—	25,478

*First 10 months. †Included in "all other countries."

Prior to 1918 the customs returns showed the imports of motor trucks, tractors and passenger cars under one classification; but in 1918 trucks and tractors were put into a separate class and passenger cars were listed as "Automobiles not otherwise specified." In the table, therefore, the figures for passenger cars in the years 1913

to 1917, inclusive, also include motor trucks and tractors.

The preceding table shows the phenomenal development of the trade since 1913 and the part taken by the United States. A considerable increase in the imports from Canada is shown. The manufacturers of Canada began to export to this colony in 1919, and in 1921 shipped 1063 passenger cars and 477 trucks and tractors against 1939 and 751, respectively, from the United States.

The larger number of cars shipped from the United States and Canada in the early months of 1921 were on contracts made early in 1920 and arrived on a heavily over-stocked market. By May these contracts were filled, or cancelled when possible, and the succeeding months until August show a shrinkage of imports. A slight increase in September and October showed the arrivals of passenger cars on new orders, mostly of popular priced cars from the United States, Canada and European countries. The import of trucks and tractors from the United States and Canada decreased throughout the period, but European makes showed the slight revival of demand after July.

The Dealer Organization

There are several sales organizations doing business in Java. Two of these have sales rooms and service equipment in Medan, Sumatra; several have sales organizations in Batavia, Semarang and Soerabaya, and others are well equipped to handle sales in more limited fields. Salesmanship, as this term is understood in the United States, is unknown in the colony, as the demand exceeded the supply up to the middle of 1920. Since that time there has been a serious financial depression with large overstocks and greater effort has been made to effect sales, but there is a lack of trained salesmen. There are small dealers in the minor cities and towns who act as sub-agents, some of whom are ambitious and are a potentially powerful means for a more intensive cultivation of the available markets, but they lack capital and training in salesmanship.

Motorcycles

The following table shows the imports of motorcycles for 1915 to 1919 for the whole colony and for 1920 for Java and Madoera only by countries:

Countries of Shipment	1915	1916	1917	1928	1919	1920[a]
Netherlands	81	61	52	4	15	50
Great Britain	54	49	21	50	14	62
France	3	3	..	4	..	..
Italy	19	10	2	..	..	..
Switzerland	18	..	..	..	..	..
United States	68	339	842	497	658	949
Singapore	36	24	'20	4	7	8
Hongkong	3	..	..	..	..	..
Philippines	..	8	7	..	..	..
All other countries	5	6	5	2	24	15
Java and Madoera	205	466	903	559	680	1,084
Outer Possessions	82	34	46	2	38	..
Total	287	500	949	561	718	

[a]Java and Madoera only.

Before 1915 motorcycles and bicycles were classified in the returns under the same heading.

Since 1916 the United States has supplied most of the motorcycles imported for private use. In 1919 and 1920 the government equipped its field police with American motorcycles and side cars, said to have been taken over from war supplies, but these do not appear in the returns as government imports.

Two American motorcycle manufacturers have the bulk of the business, although others are represented and are doing some business. American motorcycles are recognized by users to be in the lead in mechanical efficiency, and the prospect for the further development of the trade seems to be good.

There is a large mileage of good roads and many of the estates employing European assistants need cheap and rapid transportation. In the cities the distances between the residential sections and the business sections are long and many of the younger men use motorcycles. The young Chinese have taken to this method of travel to some extent, partly for transportation and partly for sport, and among this class is a large field for growth in the trade.

Some of the automobile importers have agencies for motorcycles, but the larger part of the sales are made by concerns specializing in these lighter vehicles and they are equipped to give quick and efficient service.

Credits

There are but few dealers who are financially worthy of credit accommodations and this has led to the organization of one company, located at Sabdoeng, Java, to finance imports for an organization of many of the small dealers and some of the larger ones.

The Dutch banks have been unwilling to finance automobile imports, and this reluctance has been accentuated by the experience of the past two years. The demand for cars up to the middle of 1920 led to keen competition between the dealers for the more popular agencies, and in order to retain them they contracted for more cars than they could expect to sell, thinking that the manufacturers would not be able to fill the orders. Deliveries had been very slow and so great was the user demand that the back orders and new orders were covered by credits, as required by the manufacturers. When the manufacturers filled all these orders within a few months, at the same time lowering prices from time to time, it overstocked the market and the dealers suffered heavy losses. In order to realize on their stocks in the falling market, they lowered prices and gave long credit terms to buyers. The banks that opened the credits had to stand behind the dealers to protect themselves, but it is the dealers who will eventually absorb the losses.

A considerable amount of reorganization has taken place during 1921 and a complete statement of its development up to Sept. 1 is on file in the Bureau of Foreign and Domestic Commerce. There is no way of knowing the exact financial position of these new groupings.

Market Recovery

In August, 1921, a few orders were placed for the more popular of the cheaper makes, but there were still large overstocks of other makes, and with a prevalent depression in the markets for native products, no prophecies could be made as to when the stocks would be cleaned up. While these markets are in far from a healthy condition it was thought by the bankers, in the middle of August, that the lowest point in the depression had been definitely passed and they expressed the hope that the recovery would be gradual. Outward movements of minor products had been far below normal before that time, but by July 1 there was a demand from Europe and the United States that relieved the situation materially.

Reports dated Nov. 30, 1921, indicate a cleaning up of stocks of imports in many lines and a resumption of exports on a much lower level than prior to July, 1920.

While there is no apparent prospect of an early revival of the automobile market to the level of 1919 and 1920, the trade to-day is taking a greater number of cars than before 1913.

The newspapers of the colony circulate among the European population that are buyers of automobiles, but they have refused to run large displays and generally take

a very arbitrary attitude with regard to proofs of publication, payment in advance, and proof reading. Could they be induced to co-operate in making the advertisements effective, their publications would be good mediums. Lists of publications and further information are on file in the Bureau of Foreign and Domestic Commerce. There are a few weekly publications that are good mediums for automobile advertising. The printing of these papers is more carefully done. They circulate among the wealthier classes and they are more willing to meet the requirements of the advertisers.

Advertising by Posters

Poster advertising is effective, but has greater limitations in this colony than in the United States. There are no poster companies, and while some space on sides of buildings can be bought from property owners, most of the posters are displayed in small units. Frequent heavy rains minimize their usefulness.

The Address Book for Netherlands Indies Industries, printed in Dutch, contains a list of all the industries, with an indication of the size of the industry. Practically every European and Chinese factory either owns an automobile now or is a prospect for a sale. The list of 187 sugar estates on file in the Bureau of Foreign and Domestic Commerce contains information about these mills. Each mill has an automobile and is a prospect for a new one. A copy of this publication is on file in the Bureau. The list of some 700 rubber and coffee estates, also on file in the Bureau, is a valuable mailing list. Each one of these estates has a manager and most of them have two or more assistant managers, all of whom are possible purchasers of cars.

Direct Advertising

Direct advertising, if it is connected up with the local distributor, should be effective if printed in the language the receiver can read. For the European trade Dutch is the best language to use, but the Chinese can best be reached through the Malay language Romanized.

Newspaper and weekly publications can most effectively be used through the local representatives. Poster advertising can only be done by local dealers. Direct advertising can be done best through the local dealer if his active cooperation can be enlisted.

Correct translations are essential. Dutch translations made in the Netherlands are liable to be unsuited for colonial use. Translations into Malay for the Chinese trade can only be made in the colony, as many of the words of this language are different from the Malay of the Straits Settlements.

One American manufacturer maintains an organization in Singapore to take care of the dealer trade of the Netherlands Indies and British Malay, and other manufacturers send men into the field occasionally to make new contracts. The favorable position that American cars hold in the colony is due, as stated before, to their structural and mechanical efficiency. The trade has not been cultivated but has been forced to make contracts beyond its ability to sell. The dealers made these contracts in fear of the agencies being taken away and with the expectation (and in some cases the verbal understanding) that they would not be required to fulfill them. The sudden influx of cars in 1920 and 1921 is greatly to be deplored, as it weakened the dealers financially.

Service the Most Important Factor

Financially strong dealers are necessary to effective sales development and any policy that tends to weaken the dealers will weaken their ability to give service to owners. With over 25,000 automobiles in the colony, most of which are of American make, the most important factor for American manufacturers to consider is owner service. If the users are satisfied with American cars the dealers will have to stock them. Service to the user is very inadequate at present. Repair stations equipped to make quick and satisfactory repairs, including reboring and rebabbitting, running in and burning in, carbon removing, and complete electric-ignition service, are still to be installed, and it is for the American manufacturers to take the initiative that will put the service on a satisfactory basis. Price regulation, especially of parts, is another phase of service that will have to be considered. This development will be through the dealer and in the long run he will profit by it, but it will mean an initial outlay on his part and the loss of some immediate profits. He is entitled to the same protection as the dealer in the United States and he should not be required to contract for more cars than his market will absorb. At the same time he should be supplied with cars as fast as he can sell them and he should be required to develop a sales organization that will give the maximum turnover.

German Air Traffic in 1921

THE official data for German air traffic comprise the flying period from April 1 to Oct. 31, 1921. In this time 6820 passengers have been carried on the different lines. These are distributed over this period as follows:

April	400	August	1,730
May	650	September	1,240
June	730	October	620
July	1,390		

For the most popular month, August, the number of passengers carried by the different air traffic companies is as follows:

German Air-Merchant Service	893
Lloyd Air-Service Sablatnig Type	436
Rumpler Air-Service	138
Bavarian Air-Lloyd	50
German Air-Lloyd	95
Lloyd Eastern Flying Service	57
Paul Strahle	56

The types of airplanes used were Fokker, Junkers, Rumpler and Sablatnig air limousines and also former military airplanes redesigned for air traffic, with permission of the Entente committee.

Generally, the flying was performed with great regularity. The average regularity per month was:

April	85.9%	August	94.4%
May	91.0%	September	92.9%
June	91.3%	October	88.4%
July	92.0%		

A total distance of 1,654,000 kilometers was covered. The lines most frequented were the Danzig-Koenigsberg, Bremen-Wangerooge, Hamburg-Westerland, Berlin-Dresden, Munich-Augsburg and Stuttgart-Constance line.

The weight of mail (letters and parcels) and luggage carried totaled 30,700 kilograms, of which 10,400 kilograms was carried in August. The price of passenger transportation from Berlin to Dresden was 350 marks in July; corresponding prices for the other lines have been fixed.

During the railway strike from Feb. 2 to 9, 1922, the German air traffic alone performed the forwarding of mail and passengers. In that short time 3601 kilograms of letters, 216 kilograms of newspapers, 80 kilograms of parcels and 36 passengers were transported.

The Farmer Wants More Motor Transportation

Complete report of the Commission of Agricultural Inquiry shows that motor transport has enlarged the farmer's market and makes six recommendations on highway construction. Traffic survey shows truck cheaper than railroad for some commodities and for distances of less than 75 miles.

WHEAT and corn can be hauled to market by motor truck at half the cost of transport by wagon, according to figures quoted in the final report of the Commission of Agricultural Inquiry. Despite the fact that highway construction and maintenance has not kept pace with the increased use of motor vehicles, the farmer is getting more efficient use from his trucks each year and that the motor truck has greatly extended and broadened the farmer's market. These facts indicate a desire on the part of the farmer for more trucks and better conditions under which to operate them.

Six recommendations are made concerning motor transportation. These recommendations approve the continuance of Federal aid for roadbuilding, and ask for more adequate maintenance, support the movements for highway research, and recommend the adoption by all the states of some uniform method of taxing motor vehicles. That part of the Commission's report which deals with motor transportation follows in slightly condensed form.

Highway transport is the first link in the chain which binds the producer to the consumer. Practically all the products from the farm travel first over the highway, and it follows that the final price of the commodity is affected in some degree by the relative efficiency of the roadbed and the vehicle using it.

Perhaps no single development since the railroads were first constructed has had so marked an economic and sociological effect upon productive life as the motor vehicle. Previous to its appearance, the economic zone of transportation was sharply defined by the haulage range of the horse and the cost of such transportation. Motor freight transportation has only become a factor within the last four years, but already has had an appreciable and growing influence on our whole transportation problem.

Studies of the Bureau of Crop Estimates of the Department of Agriculture in 1918 show that the estimated cost for hauling in wagons from farms to shipping points averaged in 1918 about 30 cents per ton-mile for wheat, 33 cents for corn, and 48 cents for cotton; for hauling in motor trucks or by tractors the averages are 15 cents for wheat and corn and 18 cents per ton-mile for cotton. While most of the hauling from farms is done by the farmers themselves, these estimated costs are based largely upon the usual charge in the various counties for hiring team and wagon or for motor truck by the day.

Motor-truck hauling of these commodities in 1918 from farm to railroad shipping point averaged 11.3 miles, while wagon hauls averaged 9 miles; and a motor truck made 3.4 round trips per day over its longer route, while wagons made 1.2 round trips per day.

Studies just completed by the Bureau of Public Roads in the State of Connecticut show an average loaded haul of 47.7 miles for the motor truck.

Similar studies made in other localities indicate that the first result of motor-truck operation and use has been to extend the range of economic haulage from and to the railroad.

It thus appears that the major result accomplished by this new form of transportation has been to extend and broaden the markets of the farmer.

Signal reactions are to be found in the fact that the use of the motor vehicle has brought the farmer closer to the city and also has increased the desirability and comfort of farm life.

A survey conducted in the corn-belt region by the Department of Agriculture also shows that 215 out of 831 farmers answering questions raised have changed their markets since purchasing trucks. For the 215, the average distance to the old market is 6.9 miles, and the average distance to the new market 17.6 miles. Practically all of these men stated that they had changed markets because the new market is better than the old.

In examining the extent and influence which the motor vehicle has had upon economic and social life in this country, it is only necessary to go back a period of ten years, when figures from the Bureau of Public Roads show the total motor vehicle registrations in the United States was 501,000, of which 14,000 were trucks. The vehicle estimates for 1921 show 10,300,000 motor vehicles registered, of which 1,390,000 are trucks. The total investment in motor vehicles based on an estimated average of $750 for passenger cars and $1,500 for motor trucks in 1921 was $8,767,500,000, or 46 per cent of the Interstate Commerce Commission valuation of railroads, namely, $18,900,000,000. The total special taxes paid by motor-vehicle users in 1921 is $262,500,000.

Going back over the same period, the total highway program for 1910 involved an expenditure of $120,000,000, of which $95,000,000 was for construction. In 1921 the total estimated expenditure was $600,000,000, of which $420,000,000 was for construction. The Federal appropriation for this year was $75,000,000. The total highway expenditures for the period from 1910 to 1921 was $2,526,000,000, and the total replacement cost is estimated at $1,779,000,000.

It is thus evident that while the motor-vehicle traffic has increased more than 1900 per cent in the period 1910 to 1921 the actual expenditures for highway construction and maintenance (taking into consideration the increase in cost of materials and labor during the war and the readjustment period) is only slightly over 200 per cent.

Estimates prepared by the Bureau of Public Roads show that the total number of passengers carried 1 mile by automobile in 1921 was 70,820,000,000. This is upon the average of 2½ passengers per automobile and an annual average mileage per automobile of 3500 miles.

In an actual census taken by the United States Bureau of Public Roads in California, during 1920, the average number of passengers per automobile was found to be 2.2. In the Connecticut census of 1921 the average was 3.25. These counts, taken in conjunction with the records of counts taken by the several State highway departments indicate the estimate above of 2.5 passengers per automobile to be conservative.

The total ton-mileage of motor-truck operations in 1921 was 6,479,200,000. This estimate is upon the basis of an average load of 2 tons and an average yearly mileage of 2800. (Bureau of Public Roads.)

The United States Department of Agriculture estimates that 134,400,000 tons of farm products were hauled over the highways of the country in 1921.

The Bureau of Public Roads has correlated information obtained by it from the California, Connecticut, Maryland and Tennessee surveys, which show in detail the commodities hauled and the quantities and lengths of haul for trucks of different capacities, as well as passenger travel by automobiles and other vehicles.

Leading Commodities Distributed

Among the leading commodities distributed under private operation of motor trucks are the following: Farmers' products and supplies, building construction supplies and materials, roofing and paving materials, grocery products, hardware, paper, lumber, oil, machinery, packing-house products, ores, coal, ice and livestock.

In the delivery of milk to available markets there seems to be a decided advantage in the use of the motor truck, and the collection and delivery of milk and other dairy products generally resolves itself into the development of roadside platforms for milk collection in front of farms producing small quantities of milk, such as one to a dozen cans. At intersections of the main roads and crossroads other platforms are located which are used by the farmers along the side roads. Cans hauled to these platforms are picked up by trucks operated by farmers engaged in the milk-hauling business and by co-operative milk organizations and by creamery-owned trucks.

The transportation problem of the dairy farm producing milk on a large scale is somewhat different from the above, in that such a farm usually sells to one creamery, which takes care of the hauling. Most of the creameries send their own trucks to the various country milk depots, the milk being hauled to these depots by the farmers and then brought to the creamery in the creamery's trucks.

Centrally located stock markets are now transporting live stock, especially hogs, by motor truck, which was formerly handled short distances by rail or was driven on foot.

This seems to be a natural development of the motor truck, and by relieving the rail carriers of stock traffic that was formerly expensive to handle, and by affording a ready market to the farmer at his option, would seem to benefit all concerned, while on the other hand the long-haul live-stock traffic of the rail carriers is probably increased.

In some sections it is found that the combination of inbound farm products and outbound supplies by motor truck has concentrated upon the motor-truck service the majority of the traffic within 30, 40 and 50 miles.

The effect upon the rail carriers is to reduce the amount of local way freight, and will ultimately reduce the number of local freight trains operated.

There is a type of service that the motor truck is rendering the farmer which, in many cases, may be found feasible. This is known as the co-operative farm truck. These trucks, like the rural motor express, are designed to serve small farmers. Perhaps it would be better to relate the experiences of a co-operative farm-truck association in order to explain the workings of such an organization. The company in question is known as the Farmers' Co-operative Co. of Harford County (Md.) Incorporated.

A County Co-operative Association

In this county the association was incorporated with a capitalization of $5,000. Two hundred shares of stock were sold at a par value of $25 per share. Each member was required to buy at least one share of stock, but was limited in his stock purchase to 20 shares. A 4-ton truck, which was operated between Bel Air and Churchville, Md., carried milk, cream and other farm produce to the city and foodstuffs, feeds, salts, machinery and supplies in general on the return trip. The association pays its members for all goods lost or destroyed. Where the shipper desires insurance against loss, the charge for hauling cream is 4 cents a gallon, while if the farmer is willing to assume the risk, the same charge is made for hauling cream as for milk. The members who live along the route have constructed loading platforms at the same height as the floor of the trucks at their front gates. This facilitates the transfer of freight from the farm platform to the motor vehicle.

This co-operative club is of further assistance to its members in both the purchase and sale of produce and supplies. Members notify the secretary of their needs, and as soon as a sufficient number of orders are on hand he buys at wholesale in large amounts in Baltimore. He thereby reduces the cost of the article to the farmer. (Farmers' Bulletin 1032 of the Department of Agriculture.)

Certain sections of the country are particularly favorable to the establishment of long-distance motor routes through the fact that there is only a limited steam-railroad development.

In the matter of claims for damage to or loss of shipments, the information is necessarily incomplete. The organized trucking companies in some cases require the owner of the property to insure his own goods, and in some instances give no bill of lading other than a simple receipt. Some operators give no receipt at all, but in the development of trucking service it is coming to be recognized that the responsibility must be assumed through

Table H-8—Summary comparison of rail and truck rates (old rates).

[Excess of truck rates over rail rates indicated by +.]

	Mileage.	Multiples of first class.	First class.	Second class.	Third class.	Fourth class.
Greenwich, Conn.	30	—35	— 2	+ 4½	+ 12½	+16
Cos Cob, Conn.	32	—46	— 2	.....	+ 9½	.....
Stamford, Conn.	35	—27	— 2	+ 3	+ 9½	+15
Norwalk, Conn.	44	—25	+ 4½	+10	+ 17	+23
Westport, Conn.	47	—25	+ 6	+12	+ 19	.....
Bridgeport, Conn.	58	—22	+ 12	+18	+ 25	+32
Danbury, Conn.	66	— 4	+ 17	+23½	+ 31	.....
Derby, Conn.	72	—16	+ 12½	.....	+ 26½	+33½
New Haven, Conn.	75	— 8	+ 24½	+31	+ 38	+46
Waterbury, Conn.	90	+ 6	+ 28½	+35½	+ 43	+50½
New Britain, Conn.	106	.....	+ 30	+37½	+ 43	+51
Hartford, Conn.	112	+15½	+ 38	+45½	+ 51	.....
Springfield, Conn.	139	+22	+ 56	+63½	+ 69	.....
Providence, R. I.	203	+59	+ 97	.....	+110½	.....
Boston, Mass.	243	+89	+126	.....	.....	.....

——Heavy line indicates the limit of economical truck shipment on the basis of rate comparison for each class of freight.

Table H-9—Summary comparison of rail and truck rates (new rates).

[Excess of truck rate over rail rate indicated by +.]

	Mileage.	Multiples of first class.	First class.	Second class.	Third class.	Fourth class.
Greenwich, Conn.	30	—56	— 15	— 6½	+ 1½	+ 9½
Cos Cob, Conn.	32	—62	— 16	.....	0	.....
Stamford, Conn.	35	—47	— 16	— 8½	0	+ 8
Norwalk, Conn.	41	—44	— 10	— 2½	+ 7	+15½
Westport, Conn.	47	—47	— 9½	— 1½	+ 8½	.....
Bridgeport, Conn.	58	—49	— 4	+ 4½	+14½	+24
Danbury, Conn.	66	—29½	0	+ 9	+19½	.....
Derby, Conn.	72	—41	— 4½	.....	+15	+25
New Haven, Conn.	75	—33	+ 7½	+16½	+27	+35
Waterbury, Conn.	90	—21	+ 10½	+20½	+31	+41½
New Britain, Conn.	106	.....	+ 12	+22½	+30½	+41½
Hartford, Conn.	112	—11½	+ 20	+30½	+38	.....
Springfield, Conn.	139	— 4	+ 38	+48½	+56	.....
Providence, R. I.	203	+28	+ 76	.....	+94½	.....
Boston, Mass.	243	+58	+105	.....	.....	.....

——Heavy line indicates the limit of economical truck shipment on the basis of rate comparison for each class of freight.

the issuance of a proper form of bill of lading and by satisfactory insurance policies.

Rural Schools

Consolidated rural schools have been made possible in many communities through the use of the motor bus, which is now carrying the farmers' children to 12,000 schools of this type, operated on regular schedules, picking up the children and taking them to the school and subsequently distributing them from the school to the houses.

No data exists upon which conclusions as to the sphere of motor transport in our national system of transportation can be predicated. Moreover, very little data exists as to the relative cost of motor and rail freight transport. A study, however, has been made by Prof. J. Gordon McKay, highway economist of the Bureau of Public Roads, based upon the Connecticut motor-traffic census made by the bureau in co-operation with the Connecticut highway department in the fall of 1921. A summary of the conclusions reached is as follows:

From these studies it will be found that in the main the trend of operation of the motor truck on highways may be divided into six parts:

1. The haulage of commodities from the farm to the railroad or water shipping point.
2. The use of the motor truck in relieving congested terminal conditions.
3. The use of the motor truck in radial operations from large cities in the delivery of less-than-carload lots of merchandise and raw materials.
4. In the haulage of perishable farm and dairy products, such as milk, fruit and vegetables.
5. In the operation in short hauls between centers of population, where the truck offers a special degree of service in the carriage of commodities from the consignor to the store door or home of the consignee, where time is an important factor.
6. In longer hauls, where there are no rail facilities, such as those found in parts of Maryland and in sections South and West, where rail development has not been sufficiently extensive.

Any examination of the costs of operation of these different movements must necessarily be somewhat limited at this time. Thus the condition and seasonal use of highways is different as between communities not more than 10 or 15 miles apart. The varying kinds of commodities to be hauled, the question of rail and water facilities and the type and tonnage capacity of the motor vehicle used in connection with the type and grade of highway traveled upon, all prevent anything more than specific local studies at this time. Additional detailed information must be accumulated before we can hope to arrive at anything more than conclusions covering specific operations.

This situation is further complicated by the fact that the road engineer has been unable to design rational systems of highways because of incomplete knowledge of the probable trend of traffic over a proposed highway, with the added factors of diversion of traffic to and detour over newly constructed hard-surface roads. Investigation of motor operation is further complicated by the complex and varying rules, regulations and methods of taxation imposed by the several States.

Table H7 gives a summary of the laws governing the control of motor vehicle common carriers in the several States. While there appears to be some uniformity in the powers granted the State agencies exercising control, the regulations fixed by such agencies are not uniform and the taxes and license fees levied are in no way comparable.

In view of the rapid growth of this form of transportation and the use of motor vehicles in interstate as well as intrastate commerce this commission recommends that the several States adopt uniform laws and regulations governing their operation as common carriers.

Since the growth in the use of the motor vehicle has not only been very markedly in advance of highway construction and maintenance, but more, since it has brought with it a new and heavier form of highway traffic, it becomes evident that large funds will have to be expended if the 2,500,000 miles of rural highways in the United States are brought up to the standard of efficiency comparable to the extended use of the roadbeds.

In all these situations during the transition period when the short-haul traffic to and from the farming centers is being transferred from the local freight trains of the railroads to the motor trucks the cost to the railroads is excessive, because they are not able to reduce materially the expense of operating the freight stations and the local freight trains.

Railroads Operate Trucks

To meet the situation some railroads are operating gasoline motor vehicles on the tracks of branch lines where traffic is insufficient to support the use of steam locomotives.

An analysis of the motor trucks now operating to, from and within Indianapolis in the distribution, cartage, transfer and transport service follows:

Trucks used in distribution of milk, groceries, laundries, merchandise, etc.	500
Trucks used in delivery of coal and ice	250
Trucks used in freight transfer, baggage and express	550
Trucks used in delivery of sand, gravel and building material	250
Trucks used in manufacturing and building industry	175
Trucks used in cartage delivery and distribution of vegetables and fruit products	85
Trucks used in transfer of household goods	112
Trucks used in intercity and rural motor express	160
Trucks operating in and out of city in transporting live stock	250
Total	2,282

There is a type of service that the motor truck is rendering the farmer which, in many cases, may be found feasible. This is known as the co-operative farm truck. These trucks, like the rural motor express, are designed to serve small farmers. Perhaps it would be better to relate the experiences of a co-operative farm-truck asso-

ciation in order to explain the workings of such an organization. The company in question is known as the Farmers' Co-operative Co. of Harford County (Md.) Incorporated.

In this county the association was incorporated with a capitalization of $5,000. Two hundred shares of stock were sold at a par value of $25 per share. Each member was required to buy at least one share of stock, but was limited in his stock purchase to 20 shares. A 4-ton truck, which was operated between Bel Air and Churchville, Md., carried milk, cream and other farm produce to the city, and foodstuffs, feeds, salts, machinery and supplies in general on the return trip. The association pays its members for all goods lost or destroyed. Where the shipper desires insurance against loss, the charge for hauling cream is 4 cents a gallon, while, if the farmer is willing to assume the risk, the same charge is made for hauling cream as for milk. The members who live along the route have constructed loading platforms at the same height as the floor of the trucks at their front gates. This facilitates the transfer of freight from the farm platform to the motor vehicle.

Assisting Sales

This co-operative club is of further assistance to its members in both the purchase and sale of produce and supplies. Members notify the secretary of their needs, and as soon as a sufficient number of orders are on hand he buys at wholesale in large amounts in Baltimore. He thereby reduces the cost of the article to the farmer. (Farmers' Bulletin 1032, Department of Agriculture.)

Certain sections of the country are particularly favorable to the establishment of long-distance motor routes through the fact that there is only a limited steam-railroad development.

In the matter of claims for damage to or loss of shipments, the information is necessarily incomplete. The organized trucking companies in some cases require the owner of the property to insure his own goods, and in some instances give no bill of lading other than a simple receipt. Some operators give no receipt at all, but in the development of trucking service it is coming to be recognized that the responsibility must be assumed through the issuance of a proper form of bill of lading and by satisfactory insurance policies.

Consolidated rural schools have been made possible in many communities through the use of the motor bus, which is now carrying the farmers' children to 12,000 schools of this type, operated on regular schedules, picking up the children and taking them to the school and subsequently distributing them from the school to the houses.

Another influence which follows in the wake of improved highways is the ability of the farmer to hold his products on the farm for a longer time. Where highways are unimproved the farmer must move his produce when the roads are good, which is generally at the season when prices are lowest. Improved highways thus make not only for a broader market but for a more stabilized one

The uneconomic method of highway improvement, until recently in vogue, is being superseded. On November 9, 1921, the President approved an appropriation made by Congress for Federal aid defined system, consisting of not to exceed 7 per cent of the total to roads which limits expenditure on Federal-aided roads to a well-existing road mileage. This will constitute a framework upon which to build a much greater system, eventuating in the improvement of our whole mileage. (Federal aid act, 1916, as amended 1919 and 1921.)

Surveys made by railroads in eastern territory indicate that the use of the motor truck thrives in proportion to the extent of good roads. Motor trucks can not be successfully operated over rough or muddy highways.

It would not be out of place to say that the farmer is as much interested in the location and direction of the roads for which he is paying as he is in the type of road.

First and foremost the road should bring into connection with the railroad as much territory as possible, and this can only be done economically when the situation is carefully studied in advance.

If the highway is to be built primarily for passenger vehicles a route which traverses the most beautiful sections and connects the communities most directly will find most favor with the tourists and the dwellers in the cities and towns; but the farmers who want to market their products in bad weather as well as good, who produce a surplus beyond the demand of their own families and immediate neighborhood, will ask that the highways be laid out so as to give them access to all markets, and this should not be done by paralleling the main railroads but by building and maintaining the feeder roads from the main roads and from the railroad.

Another factor has been the lack of adequate maintenance for the highways already in use. The enormous spread of our highway traffic in a few years, coupled with abnormal conditions during the war, has prevented our highway authorities from adopting and carrying adequate maintenance.

Six Recommendations

The rapid evolution of highway transportation has brought with it new problems. From a study of the above conditions, as supported by the detailed facts and figures accompanying this report, the following recommendations are made in order that agriculture may be provided with a complete rational system of highways at the earliest possible moment and may receive the benefit of the reduction in highway transportation costs as soon as possible. It is recommended:

(a) That the program of Federal aid and supervision be continued.

(b) That the program of highway construction and maintenance by States and counties be continued under the direction of qualified experts with particular reference to the construction and maintenance of farm-to-market roads.

(c) That the program of appropriations for research into methods of road construction and maintenance, density, character and effect of traffic be continued, and regulation of traffic and highway construction based upon the facts ascertained by such research.

(d) Since poor highways not only increase the cost of transportation of commodities from farm to market, but also affect the comfort of the farmer and prevent him and his family from a full enjoyment of communication with his neighbors, all highways wherever possible should be improved and adequately maintained.

(e) Highway design, construction and maintenance is a science and should be in the hands of trained engineers and investigators.

(f) That the several States co-operate in effecting a uniform basis for taxing motor trucks and other motor vehicles which will fairly represent the reasonable proportion of the cost of highway construction and maintenance chargeable to such vehicles.

(g) The question of relationship between railways, waterways and highways should be subject to a rigid analysis in order to determine the economic value of each, and all three should be tied together in as close coördination as possible.

Employee Stock Ownership Has Limited Value in Securing Labor Interest

Stock ownership does not carry with it a sense of responsibility as great as that which comes with works councils, since the visibility of participation is greater in the second case. Common ownership, moreover, does not necessarily bring with it agreement in ideas and in common purposes.

By Harry Tipper

ONE of the methods adopted for the purpose of securing interest in the organization on the part of the employees has been participation in the stock of the company by means of plans for financing and other plans, in some cases involving the payment of part of the money value of the stock; in other cases, a gift of a certain amount of stock. The object of these plans, in general, is to make it easy for the employees to become stockholders; to encourage the ownership of stock by the individual; to provide a reasonable security for the installments paid upon the stock, and by spreading the ownership of the business among the employees to increase the solidity of the organization.

There are in the United States, at the present time, approximately one hundred corporations who have arranged for stock participation among the employees by carefully worked out plans in this direction. These concerns vary in size from the U. S. Steel Corporation to small organizations. The value of the plans cannot be thoroughly determined at the present. There is no visible connection between such plans *per se* and the satisfaction of the labor unrest that is constantly developing. For the individual employee, these plans of stock participation are of value, provided they are so arranged that the capital savings of the employee are reasonably legal and the installments are safeguarded until the completion of the payments. In the organization they are of value in reducing to some extent the turnover, and in encouraging that percentage of the workers who are naturally inclined to steady development in the organization so that a nucleus, or skeleton, may be preserved under all conditions for its effect upon the whole group.

However, the ownership of stock in a concern does not carry with it a large sense of responsibility unless the group is sufficiently small to enforce that sense of responsibility by virtue of the necessities of ownership. Where the participation represents a small amount, which is a very slight fraction in the actual total responsibility of ownership belonging to that concern, this ownership has very little weight in comparison with the occupational solidity, and the more immediate common interests naturally evolved between members of the same occupation in the same locality or between people who live in the same social strata or under the same social conditions.

It is to be noted that these stock participation plans have not grown in accordance with the growth of Works Committee, Conference, and House and Senate plans for unifying the individual factory organization, and it is not likely that they would grow to the same degree because of their smaller immediate effect upon the situation. In comparison with the ownership of stock in a concern, an actual participation in the discussion of conditions surrounding the work, the character of wage demands, wage rates, hours of labor, and other matters, are of more visible importance. From the standpoint of stability, ownership of homes and other community obligations of a definite stabilized character are of more importance than the ownership of stock in a concern.

This does not mean that stock participation plans are of no importance. They have a very definite value in common with their importance in introducing a greater degree of organization stability and encouraging the conservative workers to a greater and a firmer interest in maintaining his future with the individual concern. By themselves they will not effectuate organization stability and the ownership of stock will not be capable of eliminating the unrest within any occupational group without other organization elements entering into the plan.

Common ownership does not bring, by any means, agreement in ideas and understanding of common purposes, nor a sense of obligation or responsibility for the common development. Ordinarily, our sense of personal responsibility does not extend very far. It is confined to the few visible interests of life and these are the most immediate to our surroundings.

For instance, the sense of common responsibility among taxpayers within a community is not as strong as the sense of common interest among the property owners of a single street, or the demands of a single class in that community. Similarly, in industrial organizations, the sense of responsibility in the average worker is confined to his occupational group, his immediate department, or his immediate work. This is not particularly enlarged by the fact that he gets a share or two of the stock of the concern. All other things being equal, the ownership of the stock has stabilized his operations and prevents him from leaving so readily, but, in the face of any actual grievance or any actual necessity of his occupational group, the ownership of stock will be of little value in affecting his opinions or considerations. It is the visible participation in the interests of the concern, as they affect the worker, which is of most importance to him, and which is most likely to build up a sense of responsibility, a loyalty and an agreement within the organization. As these things are effectuated, the common ownership arising out of participation among all sections of the company's employees will strengthen the agreement, increase the loyalty, and enlarge the sense of participation in the company's affairs.

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David Beecroft, Directing Editor
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Torque Characteristics

DURING the past few years we have heard a good deal about engines with flat torque curves, and the impression has been formed by many that constant torque irrespective of speed is the ideal performance for a vehicle motor. The point which it is perhaps intended to bring out when claims of this nature are made is that the torque is maintained at high engine speed, and that, consequently, the engine affords the advantages due to high speed of operation. Evidently, however, the torque curve of a high speed engine need no more be flat than that of a low-speed engine. Flatness of a characteristic curve, moreover, is not a very good criterion of the qualities of an engine, as the scales of the two quantities plotted—in this case the torque and the speed—are not fixed, and the form of the curve can be changed a great deal by changing the scales used for the two quantities.

From another point of view a flat torque curve is a rather undesirable quality, as it shows that the engine has very little inherent self-regulation. Suppose the engine to be operating at a certain speed under a certain load, and that for any reason the load then increases. An ordinary engine with the usual humped torque curve, which is operating at a speed beyond that of maximum torque, will drop to a slightly lower speed, at which the torque developed is sufficiently greater to equal the increased load. Now, if the torque curve were absolutely flat, a drop in speed would not result in any increase in torque, and the least increase in load would stop the engine—unless the throttle was immediately opened further. It might be objected that the torque curve to which reference is made when using the description "flat" is the full-throttle torque curve; but it is obvious that the torque curves obtained with the throttle nearly fully open must be of substantially the same form as the full-throttle torque curve, and that, in consequence, but little increase in torque could be gained from a decrease in speed. Therefore, with such an engine, if the load was subject to fluctuations, it would be necessary to constantly manipulate the throttle in order to prevent stalling the engine.

Quotas and Cars

THERE is a belief, among dealers at least, that manufacturers have forced cars on dealers during the last twelve months. As in most controversies, this one has two sides, but it is doubtless true that this condition did hold in many instances.

In considering the various methods used to establish quota, it is interesting to discuss along with it the extent to which dealers are forced to abide by the quota set. Some factories have a clause in their contract which provides that the dealer may cancel his next month's quota on or before the 15th of the month preceding. Strangely enough the companies which have this liberal provision in their contract are those which use the most scientific and accurate means of establishing quota in the first place. In other words, the quota established is a rather accurate measure of what the dealer's territory may reasonably be expected to absorb during the given period under the given conditions.

Research Means Progress

RESEARCH points the way to progress. It determines what the standard practice of to-morrow shall be. It is an attempt to transport certain data from the unknown to the known. It is an investment for future prosperity.

The automotive manufacturers have many problems confronting them, many of which call for research activity. Much has already been done along various lines. The Research Number of AUTOMOTIVE INDUSTRIES, to be published June 8, will summarize the research activities being carried on throughout the industry. The complete success of this new undertaking is already assured by the hearty and extensive cooperation which is being given by general executives, engineers and sales managers of the various automotive concerns, as well as by government and other laboratories.

Looking Ahead

BETTER business is here to stay. This is the inevitable conclusion of a survey of current economic conditions as they affect the automotive industry. Looking forward to the next sixty days, certain qualifications of the definition of "better" need to be made, but these will not alter the fundamental trend indicated in the preceding statement.

There has been a general increase in employment throughout industry during the past three months. This has been coupled with a decrease in the cost of living as compiled by the Bureau of Labor Statistics ranging from 2.3 per cent in Los Angeles and New Orleans to 5.8 per cent in Cleveland. Wages in general have decreased 17 per cent below the war-time peak.

The marked increase in iron and steel production continued through April, although "the situation in steel has changed so rapidly in favor of sellers," according to *The Iron Age*, "that in view of possible effects of the coal strike and the large volume of March sales some manufacturers are more cautious about looking head." Steel production is only about 10 per cent below normal, while pig iron production is about 30 per cent below.

Building activity is marked in all sections and has resulted in a distinct advance in lumber activity. Textiles do not appear favorably and constitute the only major industry that is not showing some evidences of real upward progress. Cotton consumption by textile mills, however, was 80,000 bales larger in March, 1922, than in March, 1921.

There was a steady rise in prices in the chief commodity markets during April until the last week, when there was a very slight falling off in coffee, corn and wheat. In every case a rise in price, however, was recorded for the month.

Conditions in the leather trade are not favorable, while tobacco production has continued to decline since August, 1921.

The chief feature of the foreign situation is the stability exhibited by most of the exchanges despite the unsettling influences of the Genoa conference. Sterling exchange advanced steadily during the month of April, as did marks, and francs. South American exchanges generally showed very slight fluctuations, advances being more common than decreases.

The increasing stability of foreign exchanges is reflected in the automotive export figures for March which show a 50 per cent increase in passenger car exports over February. Trucks were about 20 per cent better than February, while tires jumped 90 per cent. In each case these figures were considerably better than those of March, 1921, with the exception of truck exports, which fell off slightly as compared with a year ago.

A geographical survey of buying conditions shows an irregular, but improving trend throughout the country. Buying progress exhibits the same general characteristics, however, as are reflected in a study of industrial activities. The basic trend is upward but there are numerous specific exceptions.

The automotive industry has taken a sharp and continued upward rise since the beginning of the year.

American industry as a whole shows a definite turn for the better during the last four months, but has not jumped ahead with the rapidity that has characterized the automotive industry.

Industrial activity as a whole will eventually have to catch up with the rise of the automotive curve. Consequently, a slowing up in automotive production is likely to be necessary within 45 or 60 days. This slowing up will not be in the nature of a depression. It will probably mean operations for two or three months averaging about the same as operations during the month of March—which was a good month for the industry.

April was one of the largest production months in the history of the industry. There is every indication that May will at least equal the April activities.

Correlating the trend in automotive activity, however, with that of other industries, the necessity for a slight slowing up becomes apparent, that industry as a whole may catch up.

The present return to better business, however, is based upon a solid economic foundation. There is no slump coming. Profitable business for automotive manufacturers is here to stay.

April Production Close to Record

Carload Shipments Largest in History

Industry Operating Near Capacity —Slowed Up by Parts Shortage

By JAMES DALTON

NEW YORK, May 2—Production of motor vehicles in April closely approached a record if it did not actually establish one. It may be found when the figures are compiled, that more passenger cars and trucks were produced than in any single month in the history of the industry. It is certain that the record for carload shipments was broken. The highest carload shipment figure ever recorded in one month was 29,236. The revised total for March was 27,380 and April is estimated at 30,200. Whether a new mark is set will depend upon the number of cars made by factories not reporting.

The only possible deduction from these production figures is that the automotive industry is running at capacity. For that reason any material increase in production will be impossible this month. It can be stated definitely, however, that May will be as good as April. Predictions beyond that point would be hazardous but it would be surprising if there were not a seasonal decline in the third quarter. Nothing like a slump is probable and it is not likely that production or sales will fall below the level of March, which was an exceedingly good month.

Manufacturers Conservative

Although the industry has been restored to normal and even to capacity, manufacturers are not plunging. They are holding their output closely to an actual order basis and none of them are placing commitments for more than sixty days in advance and few of them for more than thirty days. The inevitable result, with operations at their present level, is that there is a temporary shortage of certain essential parts, particularly for assembled cars.

As a consequence most manufacturers have stock chasers on the road trying to speed up shipments, many small units are being shipped by express and orders are being placed by telegraph.

The shortage of bodies and axles is particularly acute. Difficulty in obtaining bodies is making it necessary for dealers representing some companies to defer deliveries of closed cars.

The recovery in the parts branch of the industry has been almost as rapid as in the passenger car field. Sales of parts and accessory manufacturers for March were the largest in more than 18 months and ran about 30 per cent ahead of February. April will show a further substantial gain.

Truck plants are booming ahead and one of the most encouraging signs of continued good demand is found in

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APRIL OUTPUT IS ESTIMATED AT 213,000; FINAL FIGURES MAY ESTABLISH HIGH MARK

NEW YORK, May 3—Production of passenger cars and trucks in April by all manufacturers is estimated at 213,000. This closely approaches a record for the automotive industry and when the final figures are compiled it may be found that last month set a new mark. It is certain that it has been exceeded only once or twice. Carload shipments last month, which are estimated at 30,200, established a new level. The closest approach to it was in March, 1920, when the figures were 29,236. April production ran 35 per cent ahead of April, 1921, and 24 per cent above March of this year, when the total was 173,342, of which 19,422 were trucks. The record production was 220,000 cars and trucks in March, 1920. The factory shipment figures for the first four months of 1920, 1921 and 1922 follow:

	Carloads			Driveaways			Boat		
	1920	1921	1922	1920	1921	1922	1920	1921	1922
January..	20,057	6,485	15,241	29,283	3,185	7,397	....	93	154
February.	25,505	9,986	19,600	43,719	7,507	9,950	....	99	169
March....	29,236	16,287	27,380	57,273	9,939	15,800	....	75	264
April.....	17,147	20,187	30,200	64,634	14,197	22,500	....	1,619	3,200

Factory shipments for the other months of 1920 and 1921 follow:

	Carloads		Driveaways		Boat	
	1920	1921	1920	1921	1920	1921
May	21,977	18,608	74,286	15,193	....	2,381
June	22,516	20,269	60,746	18,834	8,350	3,947
July	23,082	19,470	52,342	15,320	8,702	3,725
August	23,386	20,350	34,060	14,290	7,095	3,565
September	20,804	20,150	24,431	13,550	5,469	3,580
October	17,209	17,323	14,127	11,257	2,519	2,300
November	13,253	14,061	9,497	10,509	659	1,385
December	11,802	12,100	6,469	7,500	89	134

G. M. Common Stockholders Totaled 50,591 on April 7

NEW YORK, May 2—Notwithstanding the suspension of dividends on the common stock of the General Motors Corp., the number of common stockholders of record on April 7 was 50,591 as compared with 48,348 at the close of the first quarter of 1922 and 44,640 at the close of the last quarter of 1921.

Strangely enough there was a slight shrinkage in the number of holders in other classes upon which no dividends have been passed. The total of stockholders at the close of the second quarter was 72,665 against 70,504 at the close of the first quarter.

New Process Gear Co. Earns Monthly Profit

SYRACUSE, May 3—According to the report of the receivers for the New Process Gear Co., a subsidiary of the Willys Corp., the plant has earned a net profit of $20,000 a month for four months. The payroll was reduced 50 per cent without apparent effect on sales or production, according to the report, which covers the period from Nov. 30 to April 1.

The local plant is in the hands of a receiver as a result of action against the parent company.

January Best Month

The report shows that January was the best month at the local plant, which is now working some departments on night shifts in order to meet the production schedule of gears and parts for the new Star car. Sales during the period of receivership aggregated $600,000. During January the sale of differentials was 13 per cent of the total sales. Several months previous to this there had been no profits on these parts.

Merchandise inventory has been reduced, the report says. The total assets of the corporation for March are fixed at $3,944,096; which includes $203,513, cash in banks; $400,869, accounts receivable; inventories, $706,153; fixed assets, land buildings, equipment, etc., $2,388,184.

A reduction in the sales costs is also reported by the receivers.

May Likely to Reach Higher Level

Factories Striving to Meet Demands

Schedules Will Be Increased — Parts Being Received in Greater Volume

DETROIT, May 1—May will be the biggest production month the Detroit district has ever known, according to the present outlook. Orders now on hand in most plants far exceed the possible output for the month, and new orders are coming in every day. Extra shifts will be resorted to in all plants to keep production to its highest possible point. In the meanwhile shipments will be apportioned throughout the sales territory.

In an effort to bring the April shipments as high as possible and to cut down the number of orders that would have to be carried over into May, many of the plants worked Sunday. Although night work and overtime has been general in the past 30 days, this was the first taste of Sunday work.

Skilled help is very scarce, a situation that is now extending to unskilled labor. Many striking miners, however, are coming into the territory and being given places in the automotive factories.

April shipments without the handicap of material shortages would have reached record proportions in most factories. Despite handicaps, however, many factories have realized the highest April production ever known. Contracts on hand for cars assure heavy production throughout the year. Material shortages rapidly are being overcome and should not seriously affect the May output.

Shortage of Materials in April

DETROIT, May 2—Two causes kept April from being the biggest month the factories in the Detroit district have ever known. The first and most important of these was the shortage of material, and the second was the thirty-day month. May, with its extra day and an improved situation in the supply markets, promises to set a new mark. Factories held up in April are already getting parts in increased volume, and improvement in this direction promises to hold up steadily from this time on. Shortages have not been confined to any particular part, although the body situation and castings presented the most serious obstacles. Aside from these, every factory seemed to run short on something different, such small fittings as bolts and nuts even having a part.

To aggravate the body situation for the moment, the Fisher Body Corp. ran into its inventory period at the end of April and was down over the week end, including Monday. Several car factories dependent on Fisher for their body supply were compelled to close their final assembly departments, although work in other departments was kept up. This delay at the start of the month will require overtime work at once to catch up with ordinary schedules.

The Ford Motor Co. will fulfill its schedule of 101,164 cars for April and will build 120,000 in May. Tractor production will continue at 400 daily. Dodge Brothers continues on a schedule of 650 cars daily. Maxwell, with a production of 250 to 300 daily in April, is aiming at the latter figure as the desired production mark for May.

In the medium priced field, Studebaker, operating at 440 cars a day in April, will continue this rate, which represents forced capacity during May. Hudson and Essex, with a production figure of approximately 250 daily in April, will increase this in May.

Hupp production, approximating 160 cars daily in April, will be increased in

(*Continued on page* 989)

Good Business for Rest of Year Assured Because of Better Feeling Existing

By PERCY OWEN,
President of the Liberty Motor Car Co.

Detroit, May 2.

THERE is a happy medium between hand-to-mouth buying and the manner of buying that was in vogue in the automotive industry two years ago.

In that medium rests the future prosperity and successful growth of the industry.

Buying has come back with a rush after a long continued void. We must recognize that buying to-day is the buying following an almost total cessation over a period of months and for that reason is not normal.

Good business is going to extend over the balance of the year, principally for the reason that people are feeling better, but it is unlikely that the tremendous spurt now on will be long continued.

With the experience of two years ago manufacturers will keep their factory stocks and commitments in such form as to be readily adjustable to meet changing conditions. Sixty to ninety day commitments should permit parts makers to make ample provision for the needs of their customers. If it would not sound socialistic I would brand speculation in materials as criminal as speculation in food-stuffs.

Increases in the potential value of securities in the past six months have had an important part in creating better feeling among the buying public. In Liberty Bonds alone there has been a potential increase of a billion and a half. With this improvement in the value of holdings, even though not transformed into cash, there has been a decided increase in the buying tendency.

Increased activity in the building trade has also had an important part in restoring general business. Many people think of building as something involving only lumber, but building, unlike any other activity, makes for increased business in almost every line.

Beginning in July the farm harvests will start to come in, bringing just that much more newly created wealth into the market. The farmer has been working hard making up for his losses and he will be in position to show large profits on his new crops. Land depreciation hit the farmer hard last year, and this together with crop losses kept him entirely out of the market. This fall, with his crops assured, the farmer should again take an important place in the buying market.

Furthermore, the whole country is getting back to work, and work is the only way out of a depression period. By keeping steadily at our tasks and maintaining a conservative attitude in our expansion the industry soon will be in stronger position than ever before.

High Taxes Disastrous Abroad, Bulletin Shows

NEW YORK, May 1—The National Automobile Chamber of Commerce has sent out a bulletin recounting the disastrous effect of high and discriminatory taxes on motor vehicles in certain foreign countries. Nearly 25 per cent of the motor vehicles in Japan ceased to operate when the motor tax was raised by 50 per cent to 80 per cent throughout the Empire.

It is asserted that the demoralization of the automotive industry in France is due directly to high taxes, notwithstanding the unusual advantage enjoyed by French manufacturers because of a 45 per cent import duty. The situation in England is similar to that in France.

In contrast to the situation in England, the policy of Canada is cited. Taxes derived from motor vehicles in the Dominion are used to maintain roads, and Canadian registration is now almost as large as that of England.

One Company Formed Of Hudson and Essex

Sale of Common Stock Allows Participation of Public in Its Affairs

DETROIT, April 29—Hudson Motor Car Co. and Essex Motors will be consolidated in the new Hudson Motor Car Co. by the terms of the amended articles of incorporation filed with the Michigan Securities Commission this week, under which the company is incorporated on a basis of 1,200,000 shares of no par value common stock.

Of this 1,200,000 total, 400,000 shares is being offered for public sale, this being the first time that persons outside the original Hudson organization have had an opportunity to acquire an interest in the company. Subscriptions of this stock were taken at $20 a share, making the nominal capitalization of the company $24,000,000.

No Changes in Product

President Roy D. Chapin said the sole intention in placing the company on its new basis was to permit the public to participate in its affairs. There will be no changes in product or organization, nor is it planned to extend or alter the present facilities of the company. The company is firmly intrenched in its present quarters with ample capacity for all requirements, he said.

According to the application, the 1,200,000 shares of no par stock were to be exchanged for the former stock of the Hudson Motor Car Co. and Essex Motors. Former authorized stock of the Hudson company consisted of 250,000 shares of common stock of $10 par value. Of this 200,100 shares are outstanding. The basis of exchange is 200,000 shares of Hudson Motor stock for 1,000,000 shares of the no par value stock. The remaining 200,000 shares of no par value stock are to be exchanged for all the capital stock of the Essex company.

The application states that present stockholders of the company have sold to a syndicate, headed by the Bankers Trust Co. of New York, 80,000 shares of the present stock of the company for $7,000,000. This stock, according to a contract made between the trust company and officials of the company, is to be exchanged for 400,000 shares of no par value stock, which will be placed on the market by the trust company at an initial price of $20 a share.

Assets Are $20,891,658

The financial statement of the company attached to the application shows total assets of the Hudson Motor Car Co. as $20,891,658. Included in this is cash of $4,102,330; land, $658,036; buildings, $4,400,883, and machinery valued at $3,776,586. The outstanding stocks include 10,000 shares of $10 par value stock sold outright and 188,608 shares paid in stock dividends.

The company has no funded debt of any kind and has ample working capital. It estimates its net earnings, during the coming year, will amount to $5,000,000, the equivalent of more than $4 a share on the new no par value stock.

Shortage of Cars

DETROIT, April 28—Hudson-Essex production for the first quarter of 1922 was 182 per cent greater than for the same period last year, a factory statement declares. In spite of this heavy production there is a shortage of cars of both these makes throughout the country, and demands of almost everyone of the company's sixty-four distributors have been curtailed.

Difficulty in obtaining bodies and inability to manufacture engines in the quantities required were the only factors which kept that month from setting up the greatest shipment figure in Hudson-Essex history. The company manufactures its own engines. Its bodies are obtained from two of the largest body makers in the business. Both of these companies are working in extra shifts to meet the demand from Hudson-Essex and other Detroit companies.

The company declares that the slogan that 1922 will be a record output year is almost certain to be justified. Before June 15 the entire total output for 1921 will have been exceeded, and orders already received mean that capacity production will be continued throughout the year.

Export orders are declared to be coming in in greater volume than at any time this year. By the early part of May, the Hudson-Essex 1921 export business will have been doubled. So great was the export demand when April closed that 20 per cent of the April orders had to be carried over to May. Shipments are being made to 50 different export points.

"Flat as a Pancake," Ford Plan for Branch Layouts

DETROIT, May 2—F. H. Low, superintendent of branches of the Ford Motor Co., speaking at a convention of the Society of Industrial Engineers here, said that the company was working on an ideal layout for future branches, and that while present branches were from one to 12 stories high, all future branches would be flat as a pancake.

By adoption of a conveyor a mile and a quarter long, the Ford company, he said, had shortened the number of labor hours for assembling engines from six in 1913 to two hours and 10 minutes. A conveyor installed last year has allowed the company to do away with 150 trucks previously used to move castings and forgings.

Other speakers at the convention connected with companies in the automotive industry were Fred M. Sawin of the Federal Rubber Co., Cudahy, Wis.; Anthony Fritz of the Penberthy Injector Co., L. Moorehouse of the Detroit Pressed Steel Co. and Norval A. Hawkins of the General Motors Corp. advisory staff.

Studebaker Enjoyed Profitable Quarter

Netted $4,069,848 Against $2,110,577 in Same Period Last Year—Sales Gain Big

NEW YORK, May 1—The Studebaker Corp. for the first quarter of the year reports net profits of $4,069,848, compared to $2,110,577 in the corresponding quarter of last year. After payment of $171,500 on its preferred stock and $1,050.000 on its common, a surplus remained of $2,848,348 for the quarter, in contrast to $889,077 in 1921. The directors have declared the regular quarterly dividend of 1¾ per cent on common and preferred stock, payable June 1 to stock on record May 10.

In his report A. R. Erskine, president of the corporation, states that production for the quarter was 26,665 cars, an increase of 143 per cent over the corresponding period of 1921, and that net sales were 22,801 cars, an increase of 96 per cent.

Plant Additions Planned

Reporting on conditions, Erskine says: Inventories March 31, amounting to $23,392,698, include over $7,000,000 surplus production of cars in the first quarter for spring business. These cars, plus 30,000 scheduled for the second quarter production will make the current quarter a record breaker. We are unable to supply the demand despite the fact that our plants are in record production of better than 10,000 cars a month. Firmly believing in the permanency of our growth, the directors have authorized the expenditure of about $3,000,000 for machinery, a new closed body plant, car storage and shipping building and a new electric power plant at South Bend.

These additional facilities when completed will permit, by Jan. 1, 1923, increased production of light sixes from 200 to 300 cars a day.

The consolidated balance sheet for the quarter shows net receivables, less reserves, of $4,093,216, against $4,035,221 on Dec. 31, 1921; inventories of $23,392,698, against $22,209,885, and quick assets of $42,079,513 compared to $38,974,732.

Current accounts payable were $5,358,659 contrasted to $3,492,414 on Dec. 31, 1921, and reserves, dealers' discounts and deposits, $705,762 against $1,306,446.

Factory of Kelley Tire to Be Sold for $275,000

NEW HAVEN, CONN., April 29—The plant and business of the Kelley Tire & Rubber Co. at West Haven is to be sold to the Armstrong Tire Co. of Garfield, N. J., under orders of Judge J. W. Banks in superior court here yesterday.

The financial consideration involved is $225,000 in cash and $50,000 in preferred stock of new corporation to be organized for operation of the West Haven factory. The court acted on the recommendation of the receivers for the Kelley Tire & Rubber Co.

Lincoln Motors Suit Based on 13 Counts

In Memorandum, Government Charges 700 Per Cent Profit Made on War Contracts

WASHINGTON, April 29—The Government's claim for $9,188,581 against the Lincoln Motor Co. will be based on thirteen counts, according to a memorandum prepared by the War Department and turned over to the Department of Justice.

It is charged in the memorandum that the company netted a total profit of $5,265,000 after being reimbursed for its entire plant and that it made 700 per cent profit on its war contracts.

Certain members of Congress have been furnished a copy of the memorandum, it is understood, and a copy of it was in the hands of Congressman Woodruff at the time he demanded action against the Lincoln company by the Department of Justice, threatening impeachment proceedings against Attorney General Daugherty if the suit was not started at once.

Says Net Profit Was $5,265,000

Following are the thirteen charges:

That the company collected a total of $45,065,693.19 for its work, which was sufficient to reimburse it for the entire cost of its plant and leave a net profit of $5,265,000.

That the profits of the company on its war contracts amounted to 700 per cent of the money invested by the company.

That in 1918 Henry and Wilfred Leland each received salaries of $100,000; William T. Nash, secretary and treasurer, was paid $27,000, and that Leroy T. Williams received an annual salary of $27,000.

That this was an increase of $50,000 for each of the two Lelands and $15,000 for Nash and Williams.

That the company was unlawfully paid an unearned profit of $1,000,000 when its contract was cancelled, although the Government had retained the right to cancel the contracts under certain conditions.

That the company erected the finest automobile factory in the United States at Government expense, without the Government being consulted or advised with in any manner as to the character or cost of the buildings. The buildings which the Government paid for included a $500,000 office building and a $170,000 restaurant.

That between January, 1920, and November, 1921, the company lost assets worth $20,000,000 and was placed in the hands of a receiver.

Claims Paid Without Audit

That the Government reimbursed the company for plant and production costs without an audit being made to establish the accuracy of the claim.

That although the original contract provided that the company was to be amortized at the rate of 40 per cent upon the actual cost of its plant, the contract was later modified to provide that the amortization should be at the rate of 55 per cent.

That the Government paid amortization amounting to $363,534.60 on 52 acres of land bought by the company at a total cost of $680,972, in spite of the fact that the land was worth approximately $1,000,000. Of the 52 acres only 18 were actually used by the company for manufacturing purposes.

That amortization amounting to $257,000 was paid on a separate plant located on Holden Avenue in Detroit, which was owned by the Lelands before they began work for the Government.

That as the Government had completed and paid a handsome profit on all but 28 per cent of the work the Government had contracted for, the company was only entitled to amortization upon 28 per cent of the cost of its plant, instead upon the total cost of $8,700,000.

That the contracts with the Government which provided for a profit of $625 on each completed Liberty motor were unlawfully charged so that the company received a flat price of $4,000 per motor, or a net profit of $1,276 each.

Racine Tire Creditors Agree on Reorganization

RACINE, WIS., May 1—The defunct Racine Auto Tire Co. has been granted a period of redemption until Oct. 1 in which to pay $90,000 due on a land contract for $225,000 with the J. I. Case T. M. Co., covering the real estate and buildings comprising its plant. The extension was ordered by the fourth after Harold Smith, trustee of the tire company, stated that creditors have practically agreed on a plan of reorganization by contributing toward working capital and accepting gold notes in payment of claims.

The Case company instituted foreclosure proceedings on the land contract and asked forfeiture of all payments, but accepted the court order for an extension. The tire company invested more than $100,000 in improving the building and erecting additions, making the plant worth at present about $328,000, including real estate. It has paid the Case company in installments a total of $135,000 in cash plus interest, leaving a balance of $90,000 principal and $7,243 interest due, which is now made payable Oct 1. By that time it is expected the industry will be rehabilitated and able to meet the obligation in full.

Bethlehem Creditors Will Not Oppose Sale

NEW YORK, May 2—Merchandise creditors of the Bethlehem Motors Corp. have virtually decided not to interpose any opposition to the sale of the plant to a syndicate represented by Arthur T. Murray, the former president, and Howard B. Hall, former vice-president. Their bid was $550,000.

It is understood that Murray and Hall will be backed in a reorganization of the company by banking interests which stood behind the original corporation. They assert positively that Martin Kern, the original organizer, will have no connection whatever with the corporation in future. Production of trucks will be resumed as soon as the sale is confirmed early this month.

ROLLS- ROYCE REPORTS PROFIT

LONDON, April 26 (*by mail*)—Rolls-Royce made a profit of £107,326 last year, and a dividend of 8 per cent will be paid.

National Creditors Get Plan for Merger

Asked to Accept Stock in Associated Motor Industries in Part Payment

INDIANAPOLIS, May 1—The National Motor Car & Vehicle Corp. has sent telegrams to its creditors asking their consent to a plan for the absorption of its assets by the Associated Motor Industries, Inc. Creditors are asked to accept 10 per cent in cash, 25 per cent in one-year notes, 15 per cent in bonds and 50 per cent in preferred stock of Associated Motor Industries.

The telegram states that Associated Motor Industries has ample working capital with $15,000,000 in current assets and only $1,500,000 in current liabilities. Its fixed assets are estimated at $10,000,000, which have been used as security for $6,000,000 in ten-year bonds. The National company states that banks representing three-fifths of the unsecured credit claims have assented to this plan.

It is understood that Will I. Ohmer, president of the Recording & Computing Machines Co. of Dayton, Ohio, will be chairman of the board of Associated Motors and that he is in active charge of all the negotiations now in progress. Present plans are to locate the general offices at Dayton. Eleven companies are now included in the consolidation plans, but it is expected others may come in.

Ford Making Batteries on Limited Scale Only

DETROIT, April 28—Ford Motor Co. has started the manufacture of batteries on a scale which will permit it to equip a certain proportion of its cars and trucks with batteries of its own construction. Officials declare that the manufacture of batteries is in the nature of a test and that it is not the intention, at least for the present, to manufacturing all batteries for the company's requirements.

Location of the battery division is in the Highland Park plant, which also houses other experimental divisions, notably a section which is now producing glass for windshields for Ford cars. The battery is said to follow customary practices and to be of about the same general character as the batteries which have been used as standard equipment on Ford cars.

WILL ADDRESS SERVICE HEADS

NEW YORK, May 1—Edward S. Jordan, president of the Jordan Motor Co., and O. E. Hunt, chief engineer of the Chevrolet Motor Co., will be the speakers at the convention of factory service managers, to be held in Detroit May 16 and 17. The subjects to be covered in the addresses and the topics for discussion have not yet been announced by the N. A. C. C., which is conducting the convention.

Seeks U. S. Chamber Aid in Legislation

N. A. C. C. Drafts Resolutions for Support on Graham Bill, Tax and Road Questions

WASHINGTON, April 29—An appeal will be made by the National Automobile Chamber of Commerce for the support of the Chamber of Commerce of the United States at the tenth annual meeting of this body here May 16 in obtaining action on the so-called Graham resolution and for relief from unjust excise taxes. The N. A. C. C. has prepared several resolutions on which action will be requested, in order that all business organizations belonging to the United States Chamber of Commerce may support these measures.

Support of plans for development of highways will also be asked of the convention. The following resolution will be submitted with the request for its adoption:

Urge Highway Transport Study

Highway transport has become an integral part of the transportation system of the United States. Its full development is essential to supplement and to extend the facilities afforded by rail and water communication. Artificial restrictions imposed without proper understanding of the economic facts underlying highway transport are unwise and can only tend to decrease the efficiency of the carrier and so impair its service to the public. Improperly constructed or maintained highways are equally injurious.

Resolved, therefore, That supplementing the position already assumed by the Chamber of Commerce of the United States, we urge the continuance of research and economic studies into highway transport, as well as the continuance of adequate highway building and maintenance programs by the several counties, states and the nation. And we further recommend that regulation of vehicles using the highways shall be undertaken after a full consideration of the economic relations between highways and the vehicles traveling over them.

As to the reimportation of surplus mofor trucks and other articles originally sold to American Expeditionary Forces, the N. A. C. C. has submitted this resolution:

Resolution on Reimportations

Vast quantities of manufactured articles sent to Europe for the use of the American Expeditionary Force were sold at low cost to foreign governments after the armistice. Speculators have since purchased these materials at a tithe of their former cost and are reimporting them to this country for sale in competition with American and foreign manufacturers without even the necessity of paying any tax upon them. Unfair competition is thus created and the good will of the manufacturer is endangered since these goods, while unused, have frequently been exposed to the elements and otherwise impaired in value.

The imposition of an ad valorem duty is recommended on such reimportations.

The proposed resolution relating to taxes suggested for action of the convention reads as follows:

No industry is non-essential to those engaged and employed therein and no industry of any consequence can suffer without adversity affecting the prosperity of all other industries, and so impairing the general welfare. Discriminatory and unjust special taxation levied for the purpose of restricting production and consumption during the war is one of the chief barriers to a return of full employment and prosperity and such taxation should not be tolerated.

We recommend, therefore, the repeal of all excise taxes levied during the war.

Exports, Imports and Reimports of Automotive Products for March, 1922, and for Nine Months That Preceded

	Month of March				Nine Months Ending March			
	1921		1922		1921		1922	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobiles, including chassis	2,629	$3,226,159	5,102	$4,443,608	93,627	$123,199,094	27,994	$24,949,837
Electric trucks and passenger cars	....	....	41	57,884	....	....	b77	112,851
Motor trucks and buses, except electric	610	877,781	....	....	16,109	27,374,181	a2,727	2,851,223
Up to 1 ton	....	....	366	184,797	....	....	b874	416,051
Over 1 and up to 2½ ton	....	....	173	248,865	....	....	b534	746,600
Over 2½ ton	....	....	51	120,630	....	....	100	244,572
Total motor trucks and buses except electric	610	877,781	590	554,292	16,109	27,374,181	4,235	4,258,446
PASSENGER CARS								
Passenger cars, except electric	2,019	$2,348,378	....	....	77,518	$95,824,913	13,708	$12,164,579
Value up to $800	....	....	2,573	1,426,837	....	....	b5,793	3,076,716
Value over $800 and up to $2,000	....	....	1,732	1,902,007	....	....	b3,822	4,175,464
Value over $2,000	....	....	166	502,588	....	....	b359	1,161,781
Total passenger cars, except electric	2,019	2,348,378	4,471	3,831,432	77,518	95,824,913	23,682	20,578,540
PARTS, ETC.								
Parts, except engines and tires	....	3,098,535	*13,589,527	3,596,539	....	58,797,621	....	22,737,964
Accessories parts of	....	....	....	....	605,758	217,726	1,545,902	604,732
Station and Warehouse motor trucks	22	24,690	19	30,651	453	272,976	94	118,537
Trailers	....	....	125	51,455	....	....	b184	91,688
Airplanes	1	15,000	23	19,850	54	401,955	42	146,015
Parts of airplanes, except engines and tires	....	10,921	*3,395	3,230	....	143,444	....	71,334
BICYCLES, ETC.								
Bicycles and tricycles	....	122,921	613	8,970	....	3,229,682	....	438,472
Motorcycles	859	291,599	1,573	402,039	22,729	7,154,087	6,596	1,788,801
Parts except tires	....	....	*272,938	161,539	....	....	*b112,777	402,187
Gas Engines	100	37,773	972	114,747	2,730	537,889	1,993	298,548
Traction engines (steam) except agricultural	3	4,438	2	9,696	257	451,293	14	41,741
Automobile engines	1,433	270,559	3,847	526,177	11,321	2,064,863	12,028	1,734,725
Aircraft engines	....	....	23	6,517	....	....	627	11,992
Complete tractors, except agricultural	1,041	935,866	3	11,612	19,930	19,598,865	144	249,531
Other internal combustion engines	856	157,787	302	43,944	12,579	2,020,379	3,339	443,597
IMPORTS								
Automobiles	50	92,244	31	77,286	969	1,073,518	370	607,289
Parts, except tires	....	60,877	....	69,677	....	1,002,667	....	474,951
All other	....	24,313	....	8,515	....	416,436	....	203,145
REIMPORTS								
Automobiles (free of duty)	47	85,428	92	170,274	2,202	3,337,036	2,381	3,642,633

*Pounds.
a—July 1 to Dec. 31, 1921.
b—Jan. 1 to March 31, 1922.

BRITISH GET DAIMLER WORKS

LONDON, April 26 (*by mail*)—It is reported from Vienna that a British syndicate has practically concluded negotiations for the acquisition of a controlling interest in the Daimler Motor Works.

NOT ALL APEX PLANT LEASED

YPSILANTI, MICH., May 1—The Apex Motor Corp., manufacturer of the Ace car, has not leased its entire plant to the Saxon Motor Car Corp., but has rented the largest building of its group to the Detroit company. The remainder of the plant capacity, which has been retained by the Apex corporation, will enable it to continue its present production and increase it considerably.

TEST ALL-METAL AIRPLANE

DETROIT, April 28—The first all-metal airplane to be built in the United States was successfully demonstrated before Admiral Moffett, U.S.N., at Selfridge Field this week.

State Bans Fixing of Used Car Prices

Dealer Associations Formed for That Purpose Outlawed by Wisconsin Attorney General

MADISON, WIS., April 28—Associations of dealers for the purpose of fixing a standard of prices to be paid or allowed for used cars have been outlawed by Attorney General William J. Morgan in the state of Wisconsin.

The state officer in an official opinion declared such an association or combination a clear violation of the anti-trust laws of the state. In his message he declares that court action will ensue unless dealers dissolve their associations.

The particular association attacked by the attorney general was recently incorporated as a non-stock corporation. It is composed of 38 dealers. There are nine other such organizations in Wisconsin. The action by the state followed a considerable investigation under the direction of G. F. Clifford, Green Bay attorney.

The state, according to Morgan, found that the purpose of the association was to "collect reliable trade information and disseminate it among the members." Members might be discharged or expelled for violation of their corporation rules. Each member is given a book containing estimates by dealers of the "Reasonable value" of models for five years back in exchange on a new car.

Figures Merely Estimates

Morgan says these figures do not represent the collection of any statistics but are rather certain dealers' estimates of what should reasonably be allowed for a car. This price list, according to Morgan, shows "clearly that it is at least used or contemplated being used as a price fixing medium and to a considerable extent to determine the allowance on used cars of the particular models."

The condemnation of the practice by the state's attorney is contained in the following paragraphs:

> From the testimony of several dealers it is admitted that the natural effect of such a combination would be to eliminate competition as to the allowance on used cars and that it would ultimately result in arriving at a more or less definite allowance for used cars.
>
> While we appreciate that the automobile dealer at present has a problem to solve with reference to used cars, especially in view of his effort to keep the manufacturer going and to satisfy a certain class of customers who have been educated up to the idea of purchasing a new car whether they need it or not, yet this problem in fairness to the public must be solved consistently with existing principles of law and existing statutes applicable to combination in restraint of trade.

A conference with dealers in Wisconsin has been held by the attorney general.

COSTS LESS TO SHIP WHEELS

MEMPHIS, TENN., April 30—The Southern Pacific Railroad and its connecting lines have authorized a reduction in the rates on automobile wheels and spokes, on request of Memphis wheel manufacturers. The reductions apply to rates on these items to Pacific coast points. On automobile wheels, spokes, spiders without hubs or rims, etc., the rate will be $2.25½ from Memphis to California per 100 pounds. On the same commodities to Northern Pacific coast points the rate will be $2.33½ per 100 pounds.

DEALERS' DISCOUNTS INCREASED BY FORD

DETROIT, May 3—The Ford Motor Co. has increased its dealers' discounts, applicable to all Ford dealers, on cars, trucks and tractors.

The discount on cars and trucks has been increased from 17½ per cent to 20 per cent.

The discount on tractors is now 25 per cent instead of the former discounts of 17½ and 5 per cent.

Fatigue of Metals Paper Presented to Societies

BRISTOL, CONN., April 29—A joint meeting of the New England members of the American Society for Steel Treating and of the Hartford Section of the American Society of Mechanical Engineers was held here to-day at the plant of the New Departure Manufacturing Co.

During the forenoon an inspection trip was made through the New Departure plant, where special attention was given to heat treatment features, while in the afternoon a meeting was held in the clubhouse of the plant, attended by nearly 300.

Vice-President F. C. Hughes of the New Departure company in welcoming the attendants sketched the development of the company and its present activities. W. H. Eisenman, secretary of the American Society of Steel Treating, gave an address on the subject of heat treating, which was of the character usually described as "in a lighter vein," while Prof. H. F. Moore of the University of Illinois presented an interesting and highly appreciated paper on fatigue of metals which was illustrated with lantern projections and moving pictures.

STEEL PLANT AT HAMMOND

HAMMOND, IND., May 3—Negotiations for the purchase of the 1000 acre site for the location of the new $20,000,000 Jones & Laughlin steel plant for this city have been concluded with the receipt of deeds from the Secretary of War. By these the government conveys the west branch of the ship canal to the East Chicago company which had given the land to the Government. This is said to mean that the steel company will be enabled to fill in the canal which has been unused.

Edge Trade Body Bill May Not Be Reported

Opposition to Its Passage Develops Among Majority Members of Committee

WASHINGTON, May 1—Favorable action on the Edge bill, S. 3385, providing for the regulation of associations by the Federal Trade Commission, is declared in legislative circles to be remote. Present indications are that the bill will never be reported out of the sub-committee of the Senate Judiciary Committee, due to the opposition to a majority number of the members of that committee.

On close study of the Edge bill, it is the opinion of the majority that the measure, if passed, would encompass the Clayton anti-trust act and make it void.

Under one section of the bill it is provided that trade associations may secure an opinion from the Federal Trade Commission as to the legality of their undertaking, and opposition to the bill is voiced by the majority members of the committee, that this is not a proper function of the commission and contrary to the provisions of the anti-trust act.

In expressing his opinion, Senator Nelson, the chairman of the sub-committee, has declared that the commission in passing on the activities of an association is doing something that the courts themselves will not do, that of adjudicating a case before there has been an actual violation.

In the opinion of Senator Nelson there is no likelihood of the bill being passed by this Congress.

Reliance Motor Truck Co. in Voluntary Bankruptcy

MILWAUKEE, May 1—The Reliance Motor Truck Co. of Appleton, Wis., manufacturing the Reliance truck and truck axles, has gone into voluntary bankruptcy with liabilities scheduled at $261,977 and assets of $187,988. Secured claims amount to $128,973.

Nine Appleton business men hold a first mortgage on the company's property for $70,000, which is the largest item. Charles L. Marston of Appleton holds a trust deed as security for $50,000 loaned to the concern. Principal items of assets are: Machinery, $37,554; merchandise or stock in trade, $72,431; real estate, $50,000; securities, $29,388; bank deposits, $13.27; cash on hand, none.

A. G. Brusewitz, president, signed the petition. The factory will be kept in operation on a small scale to provide Reliance owners with service.

W. A. PHARES ARRESTED

DECATUR, ILL., May 2—W. A. Phares, treasurer of the Pan-American Motors Corp., accused of the embezzlement of $40,000 of the funds of that company, has been arrested at Columbus and brought back to this city.

Truck Output Grows As Trade Increases

Car and Parts Makers in Milwaukee District Also Report Bigger Production

MILWAUKEE, May 1—Automotive parts industries here have just concluded one of the best months in their respective existences in volume of products manufactured and delivered. April was so far ahead of the same month last year that there is hardly any basis of comparison. Compared with April in 1920, gains ranging anywhere from 25 to 100 per cent are reported, with some concerns as much as 250 per cent ahead. In only a few instances, however, has the record of the corresponding month in 1919 been surpassed. Prospects for May are said to be even better, for the sharp revival in the demand for passenger cars in the last 60 to 90 days is being felt as well in motor trucks, and the tractor trade is believed to be at the end of its hibernating period.

Shortage of All Labor

For the first time in more than two years Milwaukee foundries are advertising for help. This refers to skilled labor, common workmen being plentiful. It is true, of course, that there are a good many skilled men who are not inclined to take jobs because they are dissatisfied with the wage scale offered by employers, and this may account in part for the apparent shortage which makes it necessary to advertise for help. Malleable shops are ahead of steel and gray iron foundries in respect to degree of renewed activity, but the latter are coming forward steadily under the stimulus of demand for automotive parts.

The four-cylinder division of Nash Motors Co. at Milwaukee, which has been operating six 10-hour days a week for a month or two past, is now putting in three hours overtime three days a week, or 69 hours a week. It is understood that straight time is paid for overtime, instead of the time-and-a-half rate once in effect.

Stoughton Had Biggest April

The Stoughton Wagon Co., Stoughton, Wis., which is now devoting practically its entire effort to building motor trucks, experienced the largest April business in its sixty-four years of existence, and the past month probably ranks higher than any other single month in that time, due to the marked revival in truck sales. Motor bus sales are mounting into relatively enormous figures.

The Oneida Motor Truck Co. at Green Bay, Wis., has resumed the operation of its large factory, and the Winther Motors, Inc., Kenosha, is greatly enlarging its production, especially due to a $2,000,000 contract for 1000 taxicabs for Chicago.

Mitchell at Racine; Kissel at Hartford; Case at Racine, and numerous other passenger car factories in Wisconsin have made further increases in daily output in the last fifteen days, supplementing gains in working hours and number of workers effected during the last 60 days. Nash at Kenosha and Milwaukee as well is on the heaviest schedule in a year or longer.

Manufacturers of automotive equipment, both for car and truck builders as well as for the jobbing and retail trade, are becoming crowded with orders, heavy pressure having been felt especially in the last two weeks. Delivery specifications for May so far received indicate even heavier pressure.

Retail Demand Surprises

The fast pace which retail demand for passenger cars set during April became more and more surprising as the month ended, and prospects for May are actually regarded as portending the best month in any past year, with the possible exception of 1919.

Business in Brief

NEW YORK, May 2—Generally speaking the industrial situation is the best in two years. The only serious retarding factors are the coal strike, the textile strike and the effect of frosts and heavy rains on fruits and crops.

The favorable factors are the activity in the iron and steel, building and automotive industries. The lumber market is firm, and orders far exceed the output. Iron prices are stronger. The jobbing trade is better and mail-order houses are moving more goods. Collections are steadily improving.

The bond market has been very active with an unprecedented absorption of securities, but the stock market has been irregular. The commodity market has been strong with the prices of 29 products advancing in the past week and only six moving lower.

Southern cotton mills and Western shoe factories are reported busy. Wool buying has broadened and prices are higher. The demand of the world markets for cotton continues to increase, and consumption is reaching the pre-war level.

Another advance in the price of corn has helped the corn belt. The same is true of hogs.

A continued steady increase in employment is reported from all sections.

Improvement in conditions in the Northwest is indicated by the fact that the International Harvester Co. has delivered 500 trucks in Minnesota in the last 30 days.

Bank clearings for the week ending April 27 were $6,520,686, a loss of 7.3 per cent from the previous week, but a gain of 17.6 per cent over the same week last year.

Draw on Inventories to Meet Tire Demand

Akron Manufacturers Experience Biggest Trade Spurt Since Early in 1920

AKRON, May 3—The rubber tire industry in Akron has reached the point where it is practically impossible for manufacturers to meet the current demand for tires without drawing upon their finished goods inventories.

The biggest single spurt the tire industry has taken since the beginning of the depression period, early in 1920, has caused a call to be issued by Akron manufacturers for 1000 experienced tire builders. These men now are being taken on by various tire companies, in addition to 1500 men employed by the Goodyear Tire & Rubber Co., since April 13, and a thousand more absorbed by Firestone, Goodrich, Miller, General and the smaller tire factories.

Were Conservative in Orders

Manufacturers here attribute the sudden and unexpected spurt in tire sales to the fact that both automobile manufacturers and tire dealers have been too cautious and conservative in ordering supplies for the spring trade. The manner in which orders are piling into Akron indicates that there are not enough tires on dealers' shelves to meet the current consumer demand, and indicates also that motor car manufacturers have exhausted their supplies of original equipment tires, having plainly underestimated the demand for motor cars this spring in America.

Tire manufacturers who had built up a finished goods inventory of about a sixty-day supply of tires admit that they will find it necessary to tap these reserve supplies until such time as enough men can be employed to build up production commensurate with current demand. They fully expect the present spurt to continue without abatement until at least August 1.

Demand Far Exceeds Expectations

Officials of the big companies frankly admit that the current tire demand is far in excess of even the most reckless expectations. Dealers everywhere have sent in S.O.S. calls for rush shipments as have automobile manufacturers as well.

With the 1000 men being taken on this week, and with the 2500 or more than were added between April 15 and May 1, tire production in Akron has jumped up to more than 80,000 a day, which is more than 80 per cent of the peak production obtained in the first five months of 1920, when every local company strained to the limit to increase output.

Goodyear is leading in the race to restore peak production and now has a production ticket calling for over 25,000 tires a day. Firestone is running a close second with an output of 24,000 casings.

Fisher Body Plant Has New Addition

Brings Completed Works in Detroit to Size of Large Cleveland Factory

DETROIT, May 1—The completion of an immense addition to the west end plant of the Fisher Body Corp., on which building operations are now about finished, will mean an increase of about 4500 people in the company's employ, giving a total enrollment for the west side factory of from 7500 to 10,000 persons.

The addition itself is 1000 ft. in length and six stories high, with a floor space of 650,000 sq. ft. This area combined with that of the present west end unit amounts to 1,262,000 sq. ft. or 30 acres of floor space. This is equal to that of the General Motors office building here, the largest structure of its kind in the world. The west end buildings cover approximately 20 acres of land.

The completed west end unit is a self-contained plant. Every process of body building will take place within its walls, from the time the raw materials enter it until the finished bodies leave, ready for the chassis.

Costs More Than $2,000,000

The new addition alone will cost, including equipment, more than $2,000,000 and will bring the completed plant up to the size of the corporation's Cleveland factory, which is said to be the largest automobile body building plant in the world.

The rounding out of the Fisher Body Corp.'s building projects makes the concern the second largest employer of labor in the city, with a total of at least 20,000 people on its payrolls for the various factories. Fred J. Fisher, president of the organization, refers to the company's building expansion as being typical of the industrial development which Detroit may expect with the gradual return of brisk business conditions.

"The new building," he said, "simply marks the completion of plant expansion which we prepared for some time ago. Its construction has been hastened, however, by the tremendously growing demand for Fisher products this spring, which has taxed our existing factories to the limit of their capacities."

The west end plant is devoted to the production of Buick and Chevrolet bodies, and, like the several Fisher Body Corp. factories in Detroit, Cleveland and Walkerville, is working at full capacity. The same rushed conditions apply also to the Fisher-owned plants of the National Plate Glass Co.

WINTHER BOOKS TAXI ORDERS

KENOSHA, WIS., May 1—The new factory and auxiliary buildings erected within the last 18 months by the Winther Motors, Inc., will be occupied immediately as the result of new and satisfactory developments in the commercial car field. Among other large orders the Winther company has booked one valued at $2,000,000, calling for 1000 taxicabs for the Universal Motor Owners of Chicago, to be delivered in lots of 100, the initial delivery to be made before June 1.

It is understood that the Winther company has purchased for $125,000 the entire equipment of the LaCrosse Taxi Manufacturing Co., which is being installed in its new plant, and is supplementing this equipment with much new machinery and tools. Operations will be brought forward steadily so that by June 15 or July 1 the new works will be producing at full capacity.

M. A. M. A. MEMBERS REPORT MARCH SALES REACHED HIGH TOTAL OF $28.670.000

NEW YORK, May 2—Sales by members of the Motor and Accessory Manufacturers Association in March were larger than for any month since collection of statistics began at the close of 1920, reaching a total of $28,670,000. Every month this year has shown a material gain in business. Even more striking than the increase in sales for March was the decrease in the total of past due accounts, which was nearly 29 per cent, and in the total of notes outstanding, which was approximately 24 per cent. The figures by months for all of 1921 and for 1922 up to April follow:

Month 1921	Total Sales	Per Cent Change	Total Past Due	Per Cent Change	Total Notes Outstanding	Per Cent Change
January	$6 264,587	.....	$8,099,727	.....	$4,359,871	.....
February	10,408,962	66.15 Inc.	6,717,165	17.07 Dec.	6,063,118	39.08 Inc.
March	20,120,386	93.30 Inc.	5,603,992	16.57 Dec.	5,069,877	16.38 Dec
April	26,746,580	32.93 Inc.	5,352,271	4.49 Dec.	5,371,086	5.94 Inc.
May	26,781,350	.13 Inc.	4,505,176	15.64 Dec.	4,460,355	16.77 Dec.
June	22,703,414	15.19 Dec.	4,720,973	4.79 Inc.	4,012,670	10.37 Dec.
July	23 096.214	1.68 Inc.	5,242,046	10.79 Inc.	3,690,154	7.90 Dec.
August	23,397,640	1.31 Inc.	4,348,790	17.06 Dec.	3,494,510	5.30 Dec.
September	23,141 891	1.09 Inc.	4,358,545	.22 Inc.	3,677 500	5.24 Inc.
October	22,053,327	4.70 Dec.	4,512,680	3.54 Inc.	3,463,500	5.82 Dec
November	18,998,490	13.85 Dec.	4,352,000	3.56 Dec.	3,661,900	5.73 Inc.
December	14,349,750	24.47 Dec.	4,220,450	3.02 Dec.	3,384 250	7.58 Dec.
1922						
January	$17,320,000	20.61 Inc.	$4,450,000	5.45 Inc.	$3,146,000	7.02 Dec.
February	22,720,000	31.17 Inc.	4,070,000	8.57 Dec.	3,483,000	10.74 Inc.
March	28,670,000	26.14 Inc.	2,890,000	28.86 Dec.	2,657,000	23.69 Dec.

Carload Shipments Largest in History

(*Continued from page* 982)

the fact that a sales contest for the first three months of the year, conducted by one of the large manufacturers of light trucks, was won by its branch in St. Cloud, Minn., rather than by one in any industrial center.

Dealers in motor vehicles are having as good a business as the manufacturers. It is possible this month may bring a slight slowing up in sales in the larger cities, such as New York, where spring buying begins early in March but this loss will be more than offset by the business in sections where spring comes a little later and where the roads are unsuited for driving earlier than May.

It now can be said definitely that business in the automotive industry is more than good, although the profit on each unit sold is smaller than it has been at some periods in the past and competition is keen.

Factories Striving to Meet Demands

(*Continued from page* 983)

May. Oldsmobile production reached approximately 120 cars daily in April and will be increased in May. Oakland continues its production of over 100 cars daily. Paige and Jewett shipments approximated 2700 in April, 1100 being Jewetts. May schedules call for 3800 production, evenly divided.

Reo speed wagon output approximated 65 daily with a car production close to the 100 mark. Columbia will build 1000 light sixes in May and about 500 of the larger model. Earl will build 60 a day in May, an increase from 40 in April. Rickenbacker completed the April schedule of about 500 and will increase this to about 800 in May. Durant has scheduled 80 daily in May, increasing from 60 in April. Liberty April production approximated 25 daily and will be increased in May.

The Gray Motor Corp. will build about 200 cars in May. Distribution of these will provide a number for each of its distributors. Heavy production will start in June.

In the higher priced field, the new Packard single six shows a wide popularity, an output of 1500 being scheduled for May with increases to 2000 as rapidly as they can be made. Twin six production will approximate 500 and trucks a similar number.

Cadillac production is now running higher than 100 daily. Lincoln, with delays in its body shipments owing to the custom nature of the work, had an output of about 500 in April, which will be increased to about 800 for May. Wills Ste. Claire is doubling its factory force and will build about 60 cars daily in May.

Men of the Industry and What They Are Doing

Webster Colburn in New Work

Webster Colburn, since January, 1918, vice-president and general manager of the Dorris Motor Car Co., has resigned both positions, effective immediately, to become secretary and treasurer of the fiscal agency of the American Union Housing Trust with offices in St. Louis. Colburn has been identified with the industry for many years, his earliest association being in 1903, when he joined the forces of the St. Louis Motor Carriage Co., organized by George P. Dorris to build motor cars. In August, two years later, he helped in the organization of the Dorris Motor Car Co., manufacturer of the Dorris Car. Colburn was secretary of the company until 1918, when he was made vice-president and general manager. He will continue as a director of the company. Taking an active part in St. Louis automobile trade circles, Colburn served as vice-president of the dealer association of that city last year and is now active as a director. He has also been at the head of the drivers' school of the St. Louis Safety Council.

Culver Made Dorris Manager

J. F. Culver has been elected general manager of the Dorris Motor Car Co. to succeed Webster Colburn, who resigned to devote himself to other business interests. Culver will continue as secretary-treasurer of the company. He was born in Connellsville, Pa., moving at an early age to Louisiana, Mo. His first position was addressing envelopes for the Stark Brothers Nurseries & Orchards Co. Later he became office manager of that concern and was elected to the directorate. In 1917 he went to St. Louis and entered the Dorris company in a minor position. He was made auditor subsequently and, in less than a year's time, was elected secretary and treasurer.

Bonham Changes Companies

F. A. Bonham has resigned as manager of parts and service for the Chevrolet Motor Co. with headquarters at Detroit and has accepted a similar position with Durant Motors, Inc. His headquarters will be at the Long Island City Durant plant.

J. M. Hibbard Again Active President

J. M. Hibbard has returned to the Automobile Crankshaft Co., Detroit, as active president, taking the place of A. R. Demory who becomes chairman of the board of directors.

Hawk Joins Durant

J. W. Hawk has been appointed sales manager for Durant Motor Co. of Michigan by M. B. Leahy, general sales manager for the New York, Lansing and Toronto plants of Durant Motors, Inc. He succeeds Leon R. German, who tendered his resignation recently and who plans to enter business for himself. Hawk has been identified with the motor car industry since 1909. Originally with Overland, he later joined the Chalmers sales staff and since 1915 has been connected with the sales department of Chevrolet Motor Co. as zone sales manager in Texas and other sections of the country. More recently he has served as special representative of the sales department of Chevrolet, with headquarters in Detroit, a position which he leaves to join the Durant staff.

Directs Hudson Advertising

William A. James has been appointed advertising manager of the Hudson Motor Car Co., succeeding George W. Cushing, who resigned recently to enter the advertising agency business in Buffalo. James has been connected with Hudson-Essex for a number of years, being first in the sales and technical service departments. He entered the advertising department a year ago. Previous to his factory connection he served as an automobile salesman in the retail field for a number of years.

Jacobson Resigns as J. & D. Head

Edward J. Jacobson has resigned as president of the J. & D. Manufacturing Co. and has been succeeded by George Southard, who has been treasurer for the past six years. Before coming to Pittsfield, Southard was vice-president of the Franklin Trust Co. and in charge of its New York branch. He has been general manager of the J. & D. Manufacturing Co. since joining the organization, and under his direction it has made material progress. The company is the outgrowth of the Pittsfield Spark Coil Co.

Partridge Represents Marmon

E. S. Partridge, one of New York's pioneer motor car dealers, has been appointed special representative of the Marmon Automobile Co. of New York for the metropolitan district. He is specializing in sales analysis.

Maxon Resigns from Durant

L. D. Maxon has resigned as purchasing agent of the Durant Motor Co. of Michigan. The resignation is due to the fact that purchasing for all Durant enterprises will be concentrated in New York and Maxon preferred to maintain his home in Lansing.

Wallace Succeeds Figgie

W. H. Wallace has been appointed sales manager of the Perfection Spring Co., Cleveland, by Dan C. Swander, general manager, to succeed H. E. Figgie, who is leaving the organization. Wallace has been with the Perfection company for some years in the capacity of sales engineer.

Melcher Managing Oneida Truck

L. W. Melcher, formerly factory manager of the La Crosse Tractor Co. and later with the Oshkosh Tractor Co., who has been connected with the tractor department of the Allis-Chalmers Manufacturing Co., Milwaukee, for several months, has joined the Oneida Motor Truck Co. of Green Bay, Wis., as general manager. Lafayette Markle, who served as vice-president and general manager for about two years, recently returned to Chicago and is again engaged in business as a distributor and dealer. The Oneida company, which has been virtually idle for some time, has experienced a renewal of demand and is getting back to production on a fairly satisfactory scale.

John L. Hibbard with Car Makers

John L. Hibbard has been elected president and general manager of the Maxwell and Chalmers subsidiary companies in Windsor, Ont., where the Canadian products of the companies are manufactured. He will assume complete charge of all operations at once. Hibbard was formerly associated with the Studebaker Corp. of America, with which he served for a number of years as export manager. Later he was associated with the Cleveland Tractor Co., first in the sales department and later as president and managing director of the Canadian branch of that company.

J. D. Isaacs in New Connection

J. D. Isaacs, service manager of the Ford Motor Co. of Canada, Ltd., has resigned to become president and general manager of Middlesex Motors, Ltd., of London, Ont. He was one of the early employees of the Ford Canadian company, joining that organization 16 years ago.

Smith with Better Tires Co.

George O. Smith, for six years identified with the advertising of Sears, Roebuck & Co., has resigned to join the advertising department of the Better Tires Co., Chicago mail order jobbers of tires and accessories.

Joe Boyer Joins Distributor

Joe Boyer, who has driven himself to racing fame in many of the greatest speed contests of recent years, has become associated with the distributing organization of the Liberty Motor Car Co., as a firm member of the Miller-Judd Co. of Detroit.

Gorman with Dunbar Forge

S. T. Gorman, 1013 Dime Bank Building, Detroit, has been appointed district sales manager for the Detroit territory for the Dunbar Drop Forge Co., Chicago.

Plants Speeding Up in All Branches of the Industry

Springfield, Ohio, Plants Active

SPRINGFIELD, OHIO, May 2—Last week was the largest week in shipments that the Westcott Motor Car Co. has enjoyed for several years. Fifty-five cars were shipped and a number of others were driven away. These went to Cleveland, Columbus, Cincinnati, Pittsburgh, Chicago and Indianapolis. The production schedule is increasing steadily, and the force is being augmented, especially in the paint and finishing departments.

There is a steady improvement in demand for tires, H. H. Durr, treasurer of the Victor Rubber Co., said in speaking of the business of this company.

Production is being increased at the plant of The Kelly-Springfield Motor Truck Co. to meet the demands of the trade.

Rolls-Royce Takes on More Men

SPRINGFIELD, MASS., May 1—Orders are being received at such a gratifying rate at the Rolls-Royce works that it is planned to make another addition of 200 men to the plant force May 15, bringing the factory to practically normal production. The feature of the selling situation is the continued large demand for closed cars.

Springfield Coach Works has doubled its force employed in making automobile bodies, and is turning out many custom bodies for the Rolls-Royce and other makes. With its associate concern, the Springfield Harness Works, it is rushing production of Hendee sidecars.

Dort Sets Body Schedule

KALAMAZOO, MICH., May 1—The Dort Motor Car Co.'s body plant in this city started work in its painting department to-day and plans to go on full production at the earliest possible date. Robert Gladfelter, general superintendent of the body department, has been directed to maintain a schedule of 25 closed car bodies and at least 60 open car bodies through May and June. The company is advertising for men. Rumors that the company planned to sell its Kalamazoo plant and concentrate its production at Flint are denied.

Auburn Demand Big

AUBURN, IND., May 1—The Auburn Automobile Co. reports that factory production is not able to meet the demand for its new sport model and that the output is being increased as rapidly as possible.

Ford in Canada at Capacity

DETROIT, May 2—"The Ford Motor Co. of Canada is operating at capacity and indications are that it will continue to do so throughout the year," said W. R. Campbell, vice-president and general manager. "It looks as though the year's business will be especially good. We have been operating at capacity, and all indications are that the black period is over. The company now is employing close to 4000 men and turning out 200 cars a day."

EMPLOYMENT INCREASES

DETROIT, May 1—A further gain of 5766 in the number on the payrolls of members of the Employers Association, making a new high total of 151,000 men for 1922, was reported at the end of last week. The change represents a net gain of 273,033 payroll hours.

Diamond T Increasing Output

CHICAGO, May 1—The Diamond T Motor Car Co. is now producing trucks at about 60 per cent of normal capacity. The output is gradually increasing to keep pace with sales, which are showing considerable improvement. Officials of the company expect this year's business to be about as good as 1919. One of the large sales made recently was a fleet of fifty 1½-ton trucks to a large baggage transportation company in Chicago.

Packard to Add to Force

DETROIT, May 3—Directors of the Packard Motor Car Co. announce that the schedule of production in the principal departments will be increased 50 per cent and that 1000 workers will be added to its forces here. The company is now employing 5500 men, which is an increase of 1500 since Jan. 1.

Closes Dump Truck Contract

KALAMAZOO, MICH., May 1—The Kalamazoo Motors Corp. has closed a contract with the Highway Contracting & Equipment Co., Chicago, calling for more than $500,000 of Kalamazoo dump trucks with 1½ yard bodies, to be delivered in regular monthly allotments. Shipments are to be started May 10.

Ninigret Adds Night Shift

WESTERLY, R. I., April 29—The Ninigret Mill, which manufactures tire fabrics for the Fisk Rubber Co. has been obliged to add a night shift in order to take care of a rush of orders. This addition practically doubles the output of the plant.

Oakes Operating at Capacity

INDIANAPOLIS, May 1—The Oakes Co., manufacturer of automobile parts and metal stampings, is operating its factory to capacity, running both a night and day shift. It reports that it is manufacturing more goods than at any time in its history.

C. G. Spring Adds Plating Plant

KALAMAZOO, MICH., May 1—The C. G. Spring Co. is taking steps to increase production as fast as possible in order to take care of its growing business. Christian Girl, president of the company, announces the addition of a plating plant to the equipment, with similar plants in Detroit and Chicago.

The company has sales branches and service stations in Detroit, Cleveland, Chicago, Milwaukee and New York City. The first four named are on a substantial paying basis. Orders for the company's heat treated steel bumpers largely exceeding $350,000 have been received during the past two weeks.

It is likely the next change in production plans will be to announce operation of the plant for the full 24 hours daily, with enough shifts of men to take care of the extended schedule.

Spring and Axle Shipments Gain

WILKES-BARRE, PA., May 2—F. L. Martin, sales manager of the Sheldon Axle & Spring Co., Wilkes-Barre, has just returned from a business trip through Texas and the Northwest and reports a noticeable improvement in conditions. There is greater activity in the oil section of Texas, and renewed interest is evident in Minneapolis and St. Paul as well as other parts of the Northwest in motor buses. Contractors and manufacturers of heavy merchandise are buying trucks in Chicago. The Sheldon factory in running a night shift in some departments. April figures will show that the shipments of springs for motor cars were more than 100 per cent greater than in March and springs for motor trucks nearly 100 per cent greater. The output of axles for motor trucks will be almost double the shipments made during March.

Increase Planned by Fuller & Sons

KALAMAZOO, MICH., May 1—Fuller & Sons Manufacturing Co., maker of truck transmissions, is planning to increase its production to take care of the orders that are coming in, according to Frank D. Fuller, president of the company. The force of men in the factory has been increased over 100 in the past sixty days, and it is planned to add another 100 during May.

Moon Looks for 50 Daily

ST. LOUIS, May 3—The Moon Motor Car Co. is building from 42 to 45 cars a day and hopes to increase this number to 50 a day by May 15. The company has enough unfilled orders on hand to keep the plant running at capacity until July 1. The business is not spotty, but sales are being made in every section of the country. Several important dealer connections have been made in the past two weeks.

Cletrac Makers Form Allyne-Zeder Motors

Cleveland Tractor Co. Will Be Subsidiary of Company Manufacturing Car

NEW YORK, May 3—The Cleveland Tractor Co. will be reorganized as the Allyne-Zeder Motors Co. to manufacture and market the new six-cylinder car which is being designed by F. M. Zeder, formerly chief engineer of the Willys Corp. and the Studebaker Corp. The reorganization will be brought about by adding approximately $5,000,000 of new capital to the present assets of the Cleveland Tractor Co., resulting in a corporation with a capital of $10,000,000 of preferred stock and 200,000 shares of no par common stock. It is not expected that there will be a public offering of the new stock as the entire issue will be taken by private subscription.

New Plan Is Ready

A new corporation subsidiary of the Allyne-Zeder Motors Co. will be organized under the name of the Cleveland Tractor Co. and will continue the marketing of Cletracs as well as a new one-ton truck embodying advanced details in design, engineered by Rollin H. White. The reorganization plan is practically ready for submission to the stockholders of the Cleveland Tractor Co., and the co-operation of several of the larger stockholders practically assures its adoption. E. E. Allyne, second largest stockholder in the tractor company, whose name is included in that of the new company, is a director of the Aluminum Manufactures, Inc.

The Allyne-Zeder company will bring back to the automotive industry two members of the Studebaker family who have been the prime movers in the reorganization. They are Clement Studebaker, Jr., and his brother, Col. George M. Studebaker. Both formerly were directors of the Studebaker Corp. and they are the controlling factors in the Citizens National Bank of South Bend. Both have other large financial interests. Clement Studebaker will be chairman of the board and his brother vice-president. Rollin H. White, president of the Cleveland Tractor Co. and a director of the Aluminum Manufactures, Inc., will be president of the new corporation.

Hodgkins to Direct Sales

The other officers will be R. T. Hodgkins, general sales manager of the Cleveland Tractor Co., vice-president; A. F. Knobloch, works manager of the Cleveland Tractor Co., vice-president and works manager; F. M. Zeder, vice-president and chief engineer; C. D. Fleming, president of the Cleveland Tractor Co., treasurer; E. B. Wilson, formerly sales manager of the Willys Corp., general sales manager; O. R. Skelton, formerly in the engineering departments of the Willys and Studebaker corporations and the Packard company, assistant chief engineer; Carl Breer, formerly in the engineering departments of the Willys and Studebaker corporations, assistant chief engineer. J. O. Hahn, formerly branch manager in several cities for the Studebaker Corp., also will be associated with the company.

The Cleveland Tractor Co. is an Ohio corporation with a capital of $6,000,000. It owns a large plant in Cleveland where Cletracs have been turned out for more than five years. The balance sheet of the reorganized company, based upon appraisals made this year, shows total net assets of approximately $10,325,000, of which about half will be available for plant extensions and for working capital. The other half will be in permanent assets. The present plant facilities and shop organization will make it possible to proceed with the manufacture of the new Zeder with a comparatively small expenditure. The productive capacity of the factory will be 50 automobiles and 50 tractors a day. To provide for this increased space, an expenditure of about $1,250,000 will be necessary.

Promoters of the reorganization expect that a production of 12,000 automobiles and 12,000 tractors will be reached in 1923.

Aluminum Manufactures Completes Six New Cars

CLEVELAND, May 3—Although executives and engineers of the Aluminum Manufactures, Inc., which has four plants in this city, have carefully guarded developments, it has been learned that the corporation has completed six automobiles of a new design and for some weeks has been subjecting them to the most rigid tests. Aluminum has been largely used in the engines.

Officers and engineers of the company decline to discuss the subject, and it is stated that several hundred thousand dollars have been expended in the exhaustive experiments that have been made in order to produce the first six cars.

New Engine Built

The company's engineering department has built a new engine, and while no data can be obtained about it, persons who have seen it assert that in it economy, power and simplicity have been highly developed.

L. H. Pomeroy, one of the foremost engineers of England, came to Cleveland several months ago and started engineering experiments. The six cars that have been built are founded on his developments. The engine has four cylinders, but that design may not be permanent.

Aluminum is to be used largely in the manufacture of the engine and the body. It is claimed this material will give lightness and strength. No statement as to when production would be commenced could be obtained at the plant of the company.

E. E. Allyne and R. H. White, directors of Aluminum Manufactures, Inc., have been prominent in promoting the reorganization of the Cleveland Tractor Co., which will build the new Zeder car.

Preliminary Highway Conference Is Held

Manufacturers Discuss Questions to Be Taken Up Later with Road Officials

DETROIT, May 2—Broad questions of highway financing, construction, maintenance and operation were discussed yesterday at a joint meeting of the highway and motor truck committees of the National Automobile Chamber of Commerce and the motor vehicle conference committees at the Detroit Athletic Club.

The meeting was called as a preliminary to a conference which is to be held in Washington next month, when repretatives of the automotive industry will discuss the same subjects with a committee representing the American Association of State Highway Officials.

White in Charge of Meeting

The meeting here was presided over by Windsor T. White, chairman of the motor truck committee, who said:

The rapid development of highway transport in the past few years has brought us to a point where we are beginning to find that modifications are necessary in existing statutes to meet the changing conditions. Continued research into highway transportation and use has given us a new conception of what this new form of transportation means to the nation as well as realization of the need of a more uniform treatment of this subject, if the motor is to be used to the best interest of the public.

Our meeting today was concerned with a discussion of the program at Washington. We decided to recommend that the meeting take up the whole question of highway development and motor vehicle restrictions in the hope that in the interchange of information we can arrive immediately at the fullest possible cooperation between those who make the highways and those who furnish the motor vehicles.

Those who participated in yesterday's discussions were: Windsor T. White, The White Co.; Roy D. Chapin, Hudson Motor Car Co.; E. S. Jordan, Jordan Motor Car Co.; Geo. M. Graham, Chandler Motor Car Co.; A. J. Brosseau, Mack Trucks, Inc.; William E. Metzger, Columbia Motor Car Co.; M. L. Pulcher, Federal Motor Truck Co.; Frank E. Smith, Republic Motor Truck Co.; David Ludlum, Autocar Co.; A. S. More, Denby Motor Truck Co.; F. H. McKinney, Packard Motor Car Co.; David Fenner, Mack Trucks, Inc.; R. H. Salmons, Selden Motor Truck Co.; Robert Patton, Pierce-Arrow Motor Car Co.; T. R. Dahl, The White Co.; Alfred Reeves, Harry Meixell, F. W. Fenn and Pyke Johnson of the National Automobile Chamber of Commerce; B. B. Bachman, president of the Society of Automotive Engineers, and George Diehl, president of the American Automobile Association.

IOWA EMPLOYS MORE MEN

DAVENPORT, IOWA, May 3—Employment in Iowa increased 4.8 per cent in March, as compared with February in 321 identical firms.

Another Price Cut Is Made by Marmon

Phaeton Is Now Quoted at $3,185, Being Second Reduction Announced This Year

INDIANAPOLIS, May 1—Reductions ranging from $515 to $765 have been made by the Nordyke & Marmon Co. on the Marmon car. This is the second cut in prices the company has made this year, the first being effective Jan. 3. The new schedule is as follows:

	Old Price	New Price
4-passenger Roadster ...	$3,700	$3,185
4-passenger Phaeton ...	3,700	3,185
7-passenger Phaeton ...	3,700	3,185
7-passenger Sedan	5,150	4,385
4-passenger Coupe	4,700	3,985

All prices are f.o.b. this city, subject to war tax. Wire wheels, shock absorbers and motometer are $190 additional.

For some time prior to May 2, 1921, the price of the 7-passenger phaeton was $5,000, a reduction being made on that date to $3,985. This price continued until Jan. 3, this year, when it was reduced to $3,700. On May 2, 1921, the price of the 7-passenger sedan was lowered to $5,275 from $6,600, which prevailed before that date, and on Jan. 3 a further cut was made to $5,150.

Three Car Manufacturers Make Changes in Lists

NEW YORK, May 4—The following price revisions have been announced by the Paige-Detroit, Chalmers and Brewster companies:

	Old Price	New Price
Paige, 6-66		
4-Passenger	$2,245	$2,495
3-Passenger	2,495	2,245
Chalmers (117 WB)		
Coupe	2,095	1,995
Sedan	2,395	2,295
Brewster		
4-Passenger	6,000	5,000
7-Passenger	6,000	5,000
Sedan	9,200	7,000

Goodyear Will Continue Its Old Price Schedule

AKRON, May 3—In the face of persistent rumors that tire prices would be increased May 1, the Goodyear Tire & Rubber Co. of Akron, at sales conferences of branch and district managers and field representatives, held simultaneously Monday of this week throughout the United States, announced a continuation of its old price schedules on practically all lines of tires.

In addition the Goodyear Co. announces introduction of a new line of cross-rib tires to be known as the Wingfoot tires. These tires will sell slightly below the standard cord tire lists.

PORTAGE TIRES REDUCED

AKRON, OHIO, April 28—The Seiberling Rubber Co. has announced a reduction approximating 10 per cent straight through the line on Portage fabric tires. It also has made slight alterations in the prices of Seiberling straight side cords, which brings the net price on this line into conformity with standard lists.

INDIANAPOLIS RACE NOW HAS 19 ENTRIES

INDIANAPOLIS, April 27—Following are the entrants thus far for the Indianapolis sweepstakes which will be run on the speedway here Tuesday, May 30, together with the drivers so far as they have been determined:

Car:	Driver:
Duesenberg	De Palma
Duesenberg	Hartz
Duesenberg	W. Reid
Duesenberg	Fetterman
Frontenac	Mulford
Frontenac	Wanderlisp
Frontenac	———
Frontenac	Kortner
Frontenac	Kline
Frontenac	Failes
Frontenac	De Paolo
Frontenac	Baker
Disteel-Duesenberg	Hearne
Ballot	Goux
Ballot	———
Leach	Elliott
Peugeot	Wilcox
De Wehr	Davidson
Fronte-Ford	Howard
Probable Entrants	
Monroe	———
Monroe	———
Monroe	———

G. M. TRUCK REDUCED

PONTIAC, MICH., May 2—Another price reduction, effective May 1, has been made by the General Motors Truck Co. The prices follow:

	Old Price	New Price
1-ton	$1,495	$1,295
2-ton	2,775	2,375
3½-ton	3,950	3,600
5-ton	4,350	3,950

WATSON TRUCK HIGHER

CANASTOTA, N. Y., May 3—Watson Products Corp. announces an increase in the prices of its two models as follows:

	Old Price	New Price
1-ton	$1,685	$1,865
3½-ton	3,825	4,250

TRACTOR PRICES CHANGED

NEW YORK, May 3—Price revisions have been announced by the manufacturers on the following tractors:

	Old Price	New Price
Automotive	$1,785	$1,250
Wallis	995	1,195

ORDERS A KISSEL FLEET

HARTFORD, WIS., May 3—A fleet of thirty special highway construction trucks built by the Kissel Motor Car Co. of Hartford, Wis., has been purchased by the George M. Gross Construction Co.

New Price Cut Made on Fordson in Peru

Is Listed at Around $875—Country Considering Alcohol as Automotive Fuel

LIMA, PERU, April 9 (*by mail*)—During March the price of Fordson was again reduced. Successive reductions have brought down the Fordson from LJ 350 to LJ 250. (LJ, Peruvian pound, par value $4.84; present value, $3.35 to $3.50 in round numbers.)

Not a little interest is being taken in Peru in the use of alcohol as automotive fuel. Peru can produce fuel alcohol at a cost that will enable it to be sold very cheaply. Its adoption for automotive power would benefit two industries: It would lend to establishment in Peru of a new national industry, the manufacture of fuel alcohol; it would make the use of automotive transportation in Peru, somewhat held back by the high price of gasoline, more general. The possible use of alcohol in Peru for automotive power in the near future should be borne in mind by American manufacturers of automobiles and trucks and acted upon.

British Bentley Reported Indianapolis Race Entry

PARIS, April 22 (*by mail*)—A British Bentley car, to be driven by W. Douglas Hawkes, will be one of the contestants in the forthcoming Indianapolis 500 mile race. This is the first appearance of this car and driver in America. The Bentley car is a regular production sporting type, with a four cylinder engine of 80 by 149 mm. bore and stroke, giving a piston displacement just inside the 3-litre limit.

Fresh from his campaign in Sicily, where he won second place on a 2-litre Ballot in the Targa Florio race, Jules Goux is preparing to sail for America aboard La France on April 29. The French driver, who will be accompanied by Mrs. Goux, is bringing with him a couple of Ballot 8-cylinder in line racing cars, which have been very carefully prepared for this contest in the Ballot shops in Paris and on French roads. Goux, who knows Indianapolis conditions better than any other European, is confident of placing his car among the leaders. The driver of the second Ballot car has not yet been announced.

AUTOCAR CO. SUES ON NAME

PHILADELPHIA, May 3—The Autocar Co., Ardmore, Pa., to-day filed a bill in United States District Court, seeking an injunction against the Peters Autocar Co., of Bethlehem, Pa., and De Veillier & Co., enjoining them from making use of the name Autocar. The bill of complaint sets forth the original name was registered as a trademark in the Patent Office in 1903 and asks that damages be assessed.

Plan Five Sessions for S. A. E. Meeting

Technical Program for Gathering at White Sulphur Springs Practically Completed

NEW YORK, May 3—The technical program for the summer meeting of the Society of Automotive Engineers at White Sulphur Springs, June 20, has been practically completed. Five sessions have been decided upon to be devoted to research, fuel and engines, passenger cars, aeronautics and motor buses. An unusually large attendance is indicated by the fact that 432 reservations already have been made.

Fuel Tests to Be Described

A report from the research department of the society will be presented by Dr. H. C. Dickinson. This report will treat principally the motor-fuel-volatility and highway-research projects in which the society has been participating. Fuel tests, which are being conducted as outlined by the research department, the Bureau of Standards and the Bureau of Mines with the full support of the National Automobile Chamber of Commerce and the American Petroleum Institute, will be described. W. S. James of the Bureau of Standards will present a paper describing tests now under way as a part of the S. A. E. fuel research program. He will describe a device perfected by the bureau which records graphically the fuel consumption of a passenger car while it is being operated under ordinary driving conditions. An analysis of records kept over a long period discloses some rather unusual facts which command the attention of all who covet an increased number of miles per gallon.

Several papers will be presented in the fuel and engine session. Thomas Midgley, Jr., will submit some data on the characteristics of blended fuels. Two papers will be contributed on the pumping of oil in engine cylinders, a current problem demanding special study. One of these will be presented by an engine designer, A. A. Bull, and the other by a lubrication engineer, G. A. Round. A paper on the present status of the hot-spot method of handling fuels of low volatility will complete the group of papers in this session. This will be presented by F. C. Mock.

To Discuss Spring Suspension

In the passenger car session, H. M. Crane will present a rather novel design of spring suspension for discussion. The wider adoption abroad of overhead camshaft passenger-car engines may indicate the tendency of future engine design in this country, and a paper on the subject will be presented by P. M. Heldt. J. B. Bray will present some constructive criticisms of the engineer's present attitude toward service and maintenance work.

The aeronautic session will include papers on several phases of aircraft progress. Only two of these can be definitely announced at the present time, these being offered by Capt. G. E. A. Hallett of the air service engineering staff at McCook Field, and Prof. E. P. Warner. Capt. Hallett will describe the methods followed by the air service in the design, experimental construction and testing of its new engine types. The paper by Professor Warner will deal with a method of estimating airplane performance. The meetings committee hopes to secure additional papers for this session.

Two papers have been scheduled for the special motor bus session. G. A. Green will treat of the important factors that influence bus design and construction. R. E. Plimpton will submit data showing the unusual growth of bus transportation and compare the many types of bus chassis now produced, indicating the particular service to which each is suited.

FINANCIAL NOTES

Perfection Tire & Rubber Co. common stockholders of record Dec. 1, 1921, have been offered the privilege of subscribing at par for new 8 per cent convertible bonds in the following ratios: Holders of $100 par value or less may subscribe for $100 bond; holders of $100 to $1,000 par value of stock may subscribe for 100 per cent of par value of their stock; holders of $1,000 to $3,000 par value of stock may subscribe to the extent of 75 per cent of their holdings, and holders of $3,000 or more par value of stock may subscribe to 50 per cent of their holdings.

American-La France Fire Engine Co., Inc., has listed on the New York Stock Exchange $2,540,600 7 per cent cumulative preferred stock. The company reports that the amount of work on Jan. 1, 1921, was $1,432,000; that $5,845,000 sales were made or orders taken during the year; that shipments totaled $6,156,000, and the amount of work on hand Dec. 31, 1921, was $1,121,000. The present year's output is expected to reach $6,000,000.

Republic Motor Truck Co. holders of first mortgage and collateral trust 7 per cent serial gold notes have been informed by President Frank E. Smith that negotiations looking toward the payment of coupons maturing May 1 and any coupons matured Nov. 1, 1921, as yet unpaid, are progressing and that the company expects to pay such coupons within ten days.

Simms Magneto Co. comparative balance sheet as of Dec. 31 shows cash on that date, 1921, of $178,409, against $154,836 in 1920; notes and accounts payable, $560,658, compared to $1,221,908. The gross revenue for 1921 was $541,624 and deductions, etc., brought the year to a close with a deficit of $278,721.

WHEEL MAKERS REORGANIZE

DETROIT, May 3—The Automotive Wood Wheel Manufacturers Association has been reorganized. It dissolved as an independent association when it became affiliated as a group with the Motor and Accessory Manufacturers Association. When that organization abandoned its group activities, the wheel manufacturers decided to become associated as they were before entering the M. A. M. A. The work which was carried on prior to that time will be resumed.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

The decided ease which has characterized the local money market recently continued throughout last week, although the market in general was quiet. Call loans covered a range of 3½ per cent to 5 per cent, as compared with 3½ per cent to 4 per cent in the previous week. Increased ease was noted for fixed date maturities, 4¼ per cent being the ruling rate for all periods from 60 days to six months, as compared with a range of 4¼ per cent to 4½ per cent in the previous week. The prime commercial rate remained unchanged at 4½.

The bond market last week was characterized by an unusually large amount of offerings of new securities, the total amount being greater than for any previous week of the year. The largest single issue was the offering of $100,000,000 of 5 per cent gold bonds of the Dominion of Canada. The City of New York sold $45,000,000 of 4¼ per cent bonds on a 4.12 per cent basis, as compared with 4.33 per cent for the issue of 4½ per cent bonds offered last December and 4.46 per cent for the issue of July, 1917.

The U. S. Steel Corp.'s report for the first quarter of 1922 showed net earnings of $19,340,000, as compared with $19,612,000 for the preceding quarter and $32,287,000 for the first quarter of 1921. With the exception of the 3 months' period ending Sept. 30, 1921, net earnings for the past quarter were less than in any similar period since the first quarter of 1915. Although January earnings were the smallest reported for any month since February, 1915, there was a substantial increase during February, and the net earnings for March, $8,505,000, were almost double those of January.

The number of business failures reported for last week was 543, as compared with 485 in the previous week and 330 in the corresponding week of 1921. The Pacific Coast section alone shows a decrease, 41 failures having been reported last week as against 48 in the previous week. Of the total number of business failures 57.6 per cent involved liabilities of $5,000 or more. This compares with 59.5 per cent in the previous week and 52.4 per cent in the corresponding week of 1921.

MAY REORGANIZE CROW-ELKHART

ELKHART, IND., May 3—Efforts are being made to reorganize the Crow-Elkhart Motor Corp. which was thrown into receivership several weeks ago. It is proposed to have the assets taken over by a new corporation which would be known as the Century Motors Co. Noteholders of the Crow-Elkhart company are being asked to accept first preferred stock in a new company, and merchandise creditors second preferred stock. It is understood that interests not heretofore connected with the company have undertaken the reorganization.

INDUSTRIAL NOTES

S. F. Bowser & Co., Inc., manufacturer of oil tanks and pumps at Fort Wayne, Ind., re-elected the following officers at its annual meeting: President, S. B. Bechtel; vice-presidents, A. A. Bowser, H. M. Bowser, D. A. Corey, W. G. Zhart and J. William Peterson; secretary-treasurer, H. J. Grosvenor. They constitute the board of directors, together with S. F. Bowser, chairman of the board, D. G. Milligan, director of foreign sales; L. C. Steger, director of purchases and stores, and W. A. Bersch, controller. In addressing the stockholders on the business outlook both Bowser and Bechtel expressed a great degree of optimism with regard to the future of the company.

Cyclemotor Corp., manufacturer of the Evans Power Cycle, has been reorganized and additional capital that has been secured will permit the acquisition of better and larger plant facilities as well as the general promotion of international sales. The proposed new plant will have a capacity of 30,000 machines, a material increase over the maximum capacity of 5000 at the old plant. Under the reorganization the general manager is D. G. Anderson; factory manager, L. R. Evans; sales manager, A. C. Rice; engineers, B. L. Madden and J. F. Merkel.

Automotive Accessories, Inc., Kokomo, Ind., announces the change of its name to the **Kokomo Automotive Manufacturing Co.** and the removal to its new factory, which will permit its output to be increased 500 per cent. There is no change in the personnel of the organization, the new name and trade mark, which bears the word Kokomo, being adopted to identify the company's goods more distinctively.

Jorgenson Manufacturing Co., Waupaca, Wis., manufacturer of priming devices and other gas engine and automotive specialties, brass castings, etc., has filed a voluntary petition in bankruptcy. Schedules list liabilities at $44,802 and assets at $120,215. The petition sets forth that lack of working capital has made it impossible to operate the plant satisfactorily for about two months, making a receivership advisable.

Master Self-Locking Differential & Manufacturing Co. of Green Bay, Wis., is negotiating with the Sheboygan (Wis.) Business Men's Association looking toward relocating in Sheboygan and establishing a permanent plant and offices. It has been in production on a relative small scale for about three years, specializing in the manufacture of a patented master locking device for passenger and commercial cars.

Dort Motor Car Co. sales and service departments in New York have been transferred to the Fisk Building, 260 West 57th Street. The executive offices and wholesale sales department as well as the parts depot and service station will be in the Sidney Bowman Building at Broadway and 132d Street. Frank C. Mattern has been appointed manager of the New York branch.

Clucker & Hixson Co., 47 Murray Street, New York City, representing a number of manufacturers, has added ten men to its selling force, and as a result is in a position to add one or two lines to those it now represents. The company believes that the automotive industry is just at the beginning of a great wave of business enlargement.

Goodyear Tire & Rubber Export Co. officers are as follows: President, E. G. Wilmer; vice-president, G. M. Stadelman, P. W. Litchfield and F. K. Espenhain; assistant to president, H. H. Springford; treasurer, P. H. Hart; secretary, C. A. Stillman. Immediate direction of the company will rest with Espenhain.

Sharon Pressed Steel Co. announces the removal of its office from 66 Broadway, New York City, to its new warehouse in the Dodge Building, 47 West Broadway, where it will carry for demonstration a complete line of trucks, trailers, skids and other pressed steel products.

Gorey Automotive Parts Co., 354 West 50th Street, New York City, with branches at Brooklyn and Newark, has been appointed service representative for the distribution of genuine Torbensen repair parts. The company will stock a complete line for all models of Torbensen axles.

Nash Motors Co. has purchased for immemediate installation a third electrically heated furnace of the rotary type and of 150 kw. capacity, manufactured by the George J. Hagan Co., Pittsburgh.

Stover Signal Engineering Co. has moved into its new location at Racine, Wis., and will devote its plant facilities entirely to the manufacture of high quality and distinctive automobile signals.

E. D. Clapp Manufacturing Co., Auburn, N. Y., manufacturer of drop forgings, has opened offices in the General Motors Building, Detroit, under the management of Nathan H. Jewett.

Friend Files Bankruptcy Petition as Individual

MILWAUKEE, May 1 — Otis C. Friend, Racine, Wis., widely known in the automotive industries, has filed a voluntary petition in bankruptcy as an individual, in the Federal court at Milwaukee. He gives his liabilities as $288,-364 and his assets at $50,000.

Friend formerly was president of the Mitchell Motor Car Co. and later became head of the United Motors Accessories Corp., more recently taking over the Olympian Motors Co. of Pontiac, Mich., which became the Friend Motors Corp.

Of the liabilities $238,597 is secured. The largest debt is a conditional one of $150,000. Friend states he endorsed a note in that sum given to the Gotham National Bank of New York. The name of the payor is not given in the petition. The debt is secured by bonds of the Olympian Corp. The assets of $50,000 consist of a loan made to the Friend Motors Corp. of Pontiac.

Friend Motor Plant Sold

PONTIAC, MICH., May 3—The property of the Friend Motor Car Co. was bid in for $150,000 by the Gotham National Bank, New York, at a mortgage foreclosure sale here yesterday. The bank was the only bidder at the sale, which was ordered by Federal Judge Tuttle. The property recently was appraised at $450,000. The building formerly was occupied by the Olympian Motors Co. and prior to that time was used to manufacture the Carter Car.

DIRECTOR OF NATIONAL DIES

INDIANAPOLIS, April 27—James B. Curtis of New York, director and general counsel of the National Motor Car & Vehicle Corp., died here to-day from heart disease.

METAL MARKETS

BUYERS are once more making prices in the sheet market. Their influence upon values, however, is of quite a different sort from that which they exerted earlier in the year, when sellers, hungry for orders to keep the wheels of their mills turning, could ill afford to turn their backs upon proffers of business, even though the prices stipulated by buyers were sorely disappointing. To-day buyers who are short of sheets tempt sellers with higher prices than those quoted by the latter themselves so as to make up the shortage in their supply. The sheet market's future depends to a large extent upon just how far these buyers will go in the matter of offering inducements.

Automotive consumers who placed sheet orders for second quarter on too conservative a scale, and who sought unsuccessfully to have deliveries maturing in June shipped in May, are striving hard to induce this or that mill to accept an extra order for rush delivery. Producers sit tight and assert that their operating capacity is fully engaged over the next two months. This is more or less true, but when producers declare themselves out of the market it is in many cases an invitation to consumers to bid against one another for preferred deliveries. Provided inducements are offered most operating schedules are sufficiently elastic to permit of a filling-in tonnage being squeezed in here and there. Already the word has gone forth that price is no object with automotive consumers who underestimated their sheet requirements earlier in the year and who are now being forced to remedy this error of judgment.

One Mahoning valley rolling mill has advanced its price for 22 gauge, full finished sheets to 4.75c. Another refuses to book additional business at 4.50c. Non-integrated mills are suffering from a decided shortage in the supply of sheet bars, and broad hints have been thrown out that at $35, Pittsburgh or Youngstown, or at $6 above the recent $29 level, one or two obliging sellers might be found. In all probability some of the rolling mills sold more sheets than the bar supply they had contracted for would yield.

Pig Iron.—No. 2 foundry is being quoted at $21 in in the Chicago and at $22 in the Cleveland market, and there is talk of another $1 per ton advance in the near future. Automotive foundries generally are buying for late May and June deliveries.

Steel.—A better demand for automotive alloy steels is noted. Nickel steels are generally quoted lower, the 3½ per cent (SAE series 2300) is held at 5¼c. for bars and the low nickel steel (SAE series 3100) is quoted at 4¼c. for bars. Billets of the latter grade are quoted at $75 for the large and $85 for the small size. The 3½ per cent billets are quoted at $95 for the large and $105 for the small. Chrome steel (SAE series 5100) is quoted higher at 4c. for bars and $70 for the large and $80 for the small billets. Pittsburgh base. Cold-drawn steel bars are firmer at 2c., base Pittsburgh. Both hot- and cold-rolled strip steel are strong at previously named levels.

Aluminum.—Sellers of foreign aluminum are fighting shy of committing themselves on import orders pending passage of the new tariff bill. The market is steady with automotive consumers active buyers. The domestice producers are more energetic in meeting foreign competition.

Copper.—The outlook is for gradual improvement of prices.

Calendar

SHOWS

Nov. 13-18 — Chicago. Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil. Automobile exhibits in connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

Nov. 3-11 — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

May 30 — Indianapolis International Sweepstakes.

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-17—Detroit, Semi-Annual Convention, Factory Service Managers, National Automobile Chamber of Commerce, Hotel Statler.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 19-20 — St. Louis, Annual Meeting of the American Automobile Association.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-20—Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Indianapolis, May 8; Chicago, May 12; Detroit, May 19. The Pennsylvania section will hold an outing at Torresdale or a body meeting on May 25.

Hartford Parts Sold to Creditors' Agent

HARTFORD, CONN., May 3—Robert C. Morris of Morris, Plante & Saxe, New York lawyers representing the creditors' committee, to-day bought the property and business of the Hartford Automotive Parts Co. for $250,000 when it was offered at a receiver's sale. The sale was featured by spirited bidding on the part of possible purchasers. It is understood that the creditors will continue the business.

The sale was decided upon when it was learned definitely that no plan acceptable to the creditors' committee for the taking over of the business had been offered by the stockholders' committee, and negotiations with that committee were discontinued.

The creditors' committee consists of A. E. Brion, chairman; LeRoy W. Campbell, vice-president of the City Bank and Trust Co.; E. L. Streeter, Jr., New London; B. P. Greene of New Haven and R. L. Dedham of the Irving National Banl of New York.

Essenkay Products Files Petition in Bankruptcy

CHICAGO, May 2 — The Essenkay Products Co., manufacturer of synthetic rubber composition fillers for automobile tires, has filed a voluntary bankruptcy petition in Federal court here. The liabilities are listed in the petition as $152,143 and the assets at $65,439. The company is capitalized at $500,000. The largest creditor is F. D. Mayer, president of the company, whose claim is $60,000.

The Essenkay company was organized ten years ago and was the first to produce a patented tire filler on a large scale. It had factory branches in St. Louis, Detroit, Cleveland and New York, and factory representatives in seven foreign countries. Mayer said that the company would be reorganized and business continued. He added that the company suffered severely in the slump two years ago, and that although its business recently had been good, it has never been able to recover from the depression.

Hupp Profits, $383,656 for First Quarter, 1922

DETROIT, May 2—The Hupp Motor Car Corp. reports for the first quarter of 1922 net profits of $383,656 before Federal taxes, but which after payment of its preferred stock dividends are equal to 75 cents a share on its 519,210 $10 par common shares outstanding, or three times its quarterly common dividend requirements of 25 cents a share.

C. D. Hastings, president of the company, says:

Our dealers have never before enjoyed the retail business in the early months of the year that they have in 1922. They are constantly oversold and crowding us for larger allotments. During the first quarter 6399 cars were sold, against 2348 for the corresponding period for 1921, an increase of 173 per cent. Our production schedule for the present quarter is 11,000 cars and for the year 30,000 cars.

House Passes Road Bill Appropriating Big Sum

WASHINGTON, May 2—Federal appropriations amounting to $140,000,000 for road building were authorized to-day when the House passed the so-called Dunn bill. The measure provides for $65,000,000 during the next fiscal year and $75,000,000 for the following fiscal year. It contains a penalty clause to insure continuous highway development.

Coast Sales of Star In Charge of Mulch

SAN FRANCISCO, May 3—Organization of the Star Motor Co. of California, formed to distribute the Star, is virtually complete, according to Norman DeVaux, formerly with the Chevrolet interests on the coast and now president of the Star company. Cliff Durant is to be vice-president, and R. H. Mulch, who has been sales chief of the Chevrolet plant since the withdrawal of the Durant interests, will head the sales division for the Star.

Mulch's coming to the coast and his severing of his connection with General Motors was the surprise of the month. When DeVaux quit the Chevrolet company a short time ago, preparatory to rejoining the Durant interests, Mulch was put at the head of the entire coast organization for Chevrolet, and it was believed he was anchored hard and fast. Mulch is here now, however, and is hard at work on sales plans for the Star.

The Star is to be manufactured in the newly constructed Durant factory in Oakland, Cal.

Master Motors Completes Its First Bus Chassis

CHICAGO, May 2—Master Motors, Inc., has completed its first motor bus chassis. The lower center of gravity, secured by underslinging the springs and a decided kick-up of the frame over the rear axle, is one of the features.

The frame is fitted with out-riggers for mounting the body, which has an overhang at the rear of only 1 in. The forward end of the chassis resembles a passenger car, in that it is completely fitted as to fenders, lamps, nickel-plated bumper, etc.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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$2000-$3000 Car Production Probably Less in 1922

3.6 per cent of car production since 1912 has consisted of cars in this price class. 2.5 per cent of 1922 sales will probably be in this group. Price cuts last year caused drop. Good business for remaining makers.

By Norman G. Shidle
Charts and Statistics by Raymond B. Prescott

IN 1922 there are 17 members of the N. A. C. C. producing cars in the $2,000-$3,000 class. These 17 makers constitute 20 per cent of the total N. A. C. C. membership. Calculations made on the basis described in previous articles in AUTOMOTIVE INDUSTRIES show that about 2.5 per cent of the total production in 1922 will consist of cars in this price class. In other words, there is 21 per cent of the manufacturers competing for 2.5 per cent of the total business—total business, in this case, being considered on a production basis.

The production capacity of the firms now making cars of this class is something like 70,000. The calculated production of the group for 1922 is 42,500. This indicates an excess production capacity for the group as a whole of something like 40 per cent.

Viewing the figures over a period of years, it appears that of 11,162,000 cars made and sold since 1912 about 403,000 have sold for prices between $2,000 and $3,000. That is, 3.6 per cent of the total car production since 1912 has consisted of cars in this group.

Based on past records there is every indication that the number of cars produced and sold in this price class will diminish during 1922. The percentage of cars in this group as related to total car production will also diminish. These are the chief facts concerning the present status of the $2,000-$3,000 group.

Fig. 1 shows the production of cars in this price class as compared with the actual and normal total car production since 1912. The group as a whole has not followed very closely the general trend of the industry. The growth of production in this $2,000-$3,000 group, for example, failed to keep pace with that of the whole industry during period of 1915 to 1917, which may be considered, in a sense, as the normal years in which the industry was growing into its period of stability.

When normal growth was interrupted by the war, however, this group grew more rapidly during the boom years than did the entire industry. The fact that this accelerated growth was due largely to the war boom, however, is indicated by the fact that the deflation of this group has been more pronounced than that of the whole industry.

Analysis of the curves shown in Fig. 1 indicates that the $2,000-$3,000 group is rapidly returning to a period in which its progress will be normal in relation to the trend indicated for it during the pre-war normal period. In other words, the ratio of cars in this price class to total cars produced will probably tend to remain stationary and is very likely to decrease.

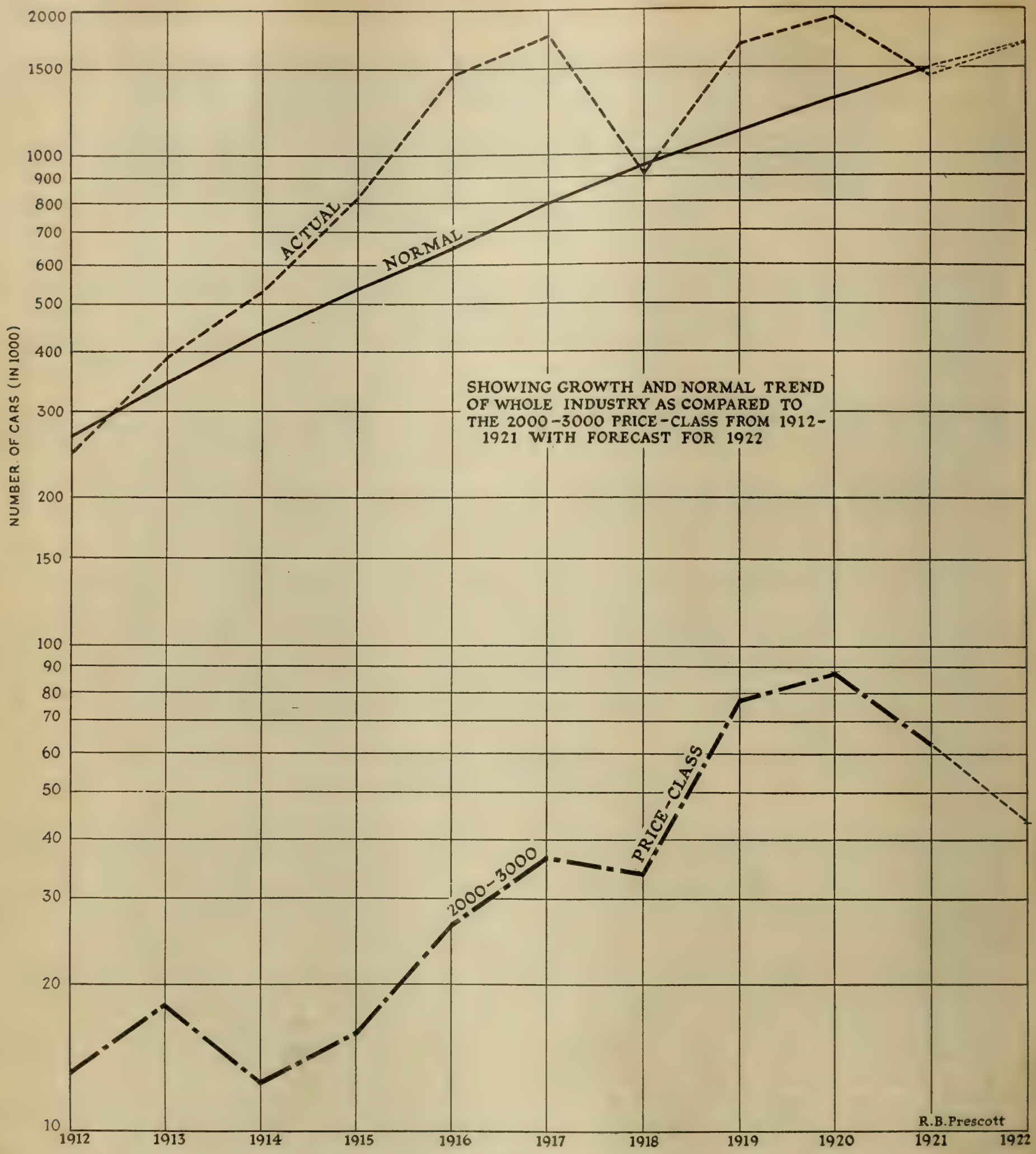


Fig. 1

As in the $1,000-$2,000 class discussed in a previous article, there is no apparent connection between the number of manufacturers entering this $2,000-$3,000 group and the proportion of total production that could reasonably be expected by the group for a given year.

Fig. 2 brings out this point clearly. The only significant feature that appears is the definite increase in the number of manufacturers entering this group in 1922 and the definite decrease in percentage of total production that the group may expect to sell.

Production is not the only basis of gaging success, of course, since a company or a price group may be sound and stable without having kept pace with the actual production of its competitors. Consequently, too much emphasis should not be laid solely upon production trends. The gross business available in a given price group, for example, is equally as important as the production possibilities.

The following table gives in a general way the gross sales value of the number of cars which it is calculated will be produced in the various price classes during 1922, together with the percentage of the total gross

business. In arriving at these figures for gross business, the number of cars calculated to be produced in the given price class have been multiplied by the average selling price of a car in that price class. Obviously, the results will not be exact, but they are close enough for purposes of comparison and discussion.

Price Class	Gross Business	Per Cent of Total
Under $1,000	$663,000,000	49
$1,000- 2,000	459,000,000	34
$2,000- 3,000	106,250,000	7
$3,000- 4,000	59,500,000	4
Over 4,000	42,500,000	3

This shows that the manufacturers in the $2,000-$3,000 class, comprising 20 per cent of the total number of car makers, are competing for 7 per cent of the total gross business, viewed from a financial standpoint, and, as noted previously, this 20 per cent of makers are competing for 2.5 per cent of the total sales, viewed from a production standpoint.

Considering sales competition in the light of the probable gross sales figures for 1922, it would appear that competition in this $2,000-$3,000 group is even keener than in the $1,000-$2,000 group discussed in our article of March 23. That article showed that 46 per cent of the manufacturers comprise the $1,000-$2,000 group and that they are competing for 18 per cent of the total business, viewed from a production standpoint; and for 34 per cent of the business, viewed from the financial standpoint.

Few cars have remained in this $2,000-$3,000 price group over a period of years. Only one car has remained within this price class from 1912 to 1922. New cars put on the market have frequently started in this price class, although no new cars entered it during 1921. Of the 19 cars entering this price group since 1912, 11 are still in existence. Four firms went out of business while members of this price group. The following table shows the movement of companies in and out of this price group since 1912.

The individual manufacturer can make use of these data for aiding in the solution of his special marketing

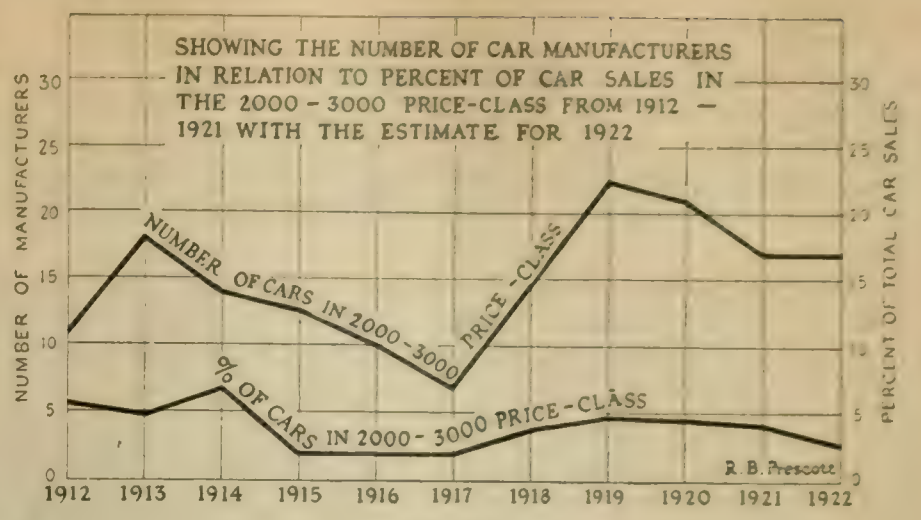


Fig. 2

	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
Total in group...	11	18	14	13	10	7	15	22	21	17	17
New cars		6	2	0	0	3	1	3	2	0	2
From lower price group		0	0	1	2	0	8	7	2	2	0
From higher price group		4	2	2	3	0	0	0	1	2	7
Out of business..		1	1	1	3	0	0	0	0	2	0
To lower price group		0	5	3	5	1	0	0	0	3	9
To higher price group		2	2	0	0	5	1	3	6	3	0

problems in the same way as was outlined in the discussion of the $1,000-$2,000 group. A particular company is concerned with determining as nearly as possible the number of cars which it may reasonably expect to sell throughout the year. A very close approximation of this number can be obtained by a proper correlation and analysis of this statistical data. First, it is necessary to consider the limitations and probabilities of the price group in which the particular car sells. Then, the relation of the past progress of the individual car in relation to the progress of the price group must be analyzed.

Increased business for any given car maker can come only by taking away some of the business previously held by others or by the retirement from business of some companies, thus leaving more business for the remaining firms.

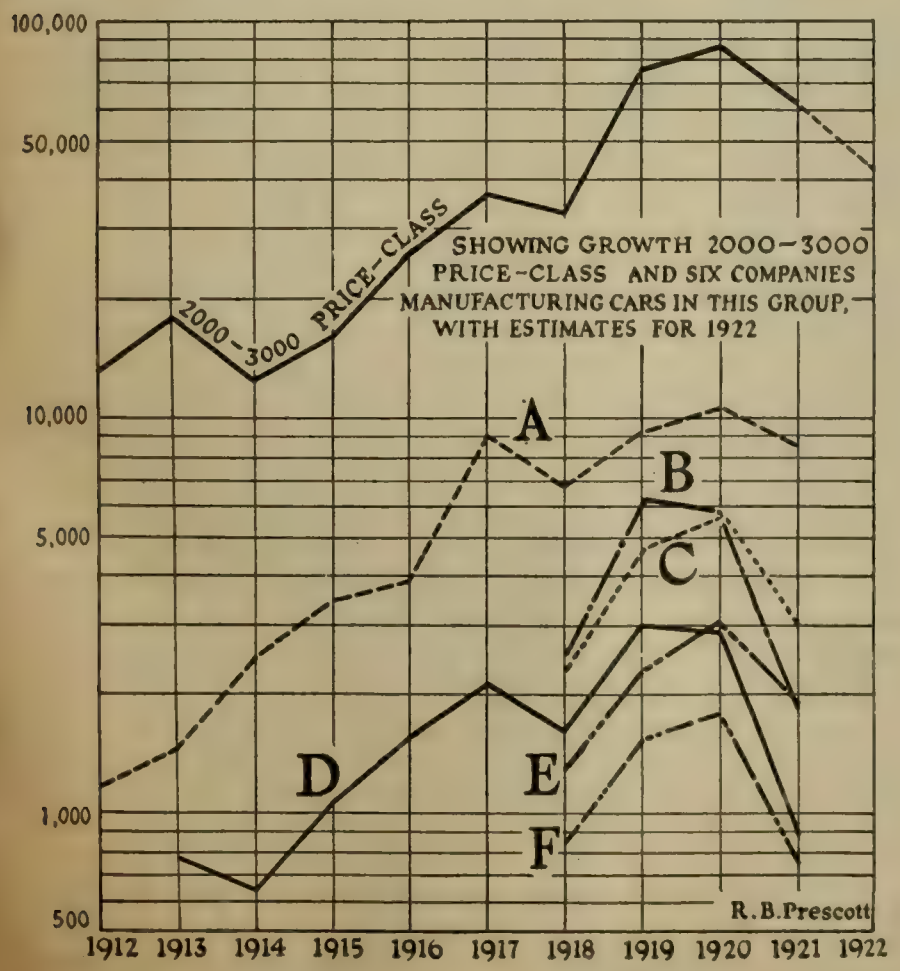


Fig. 3

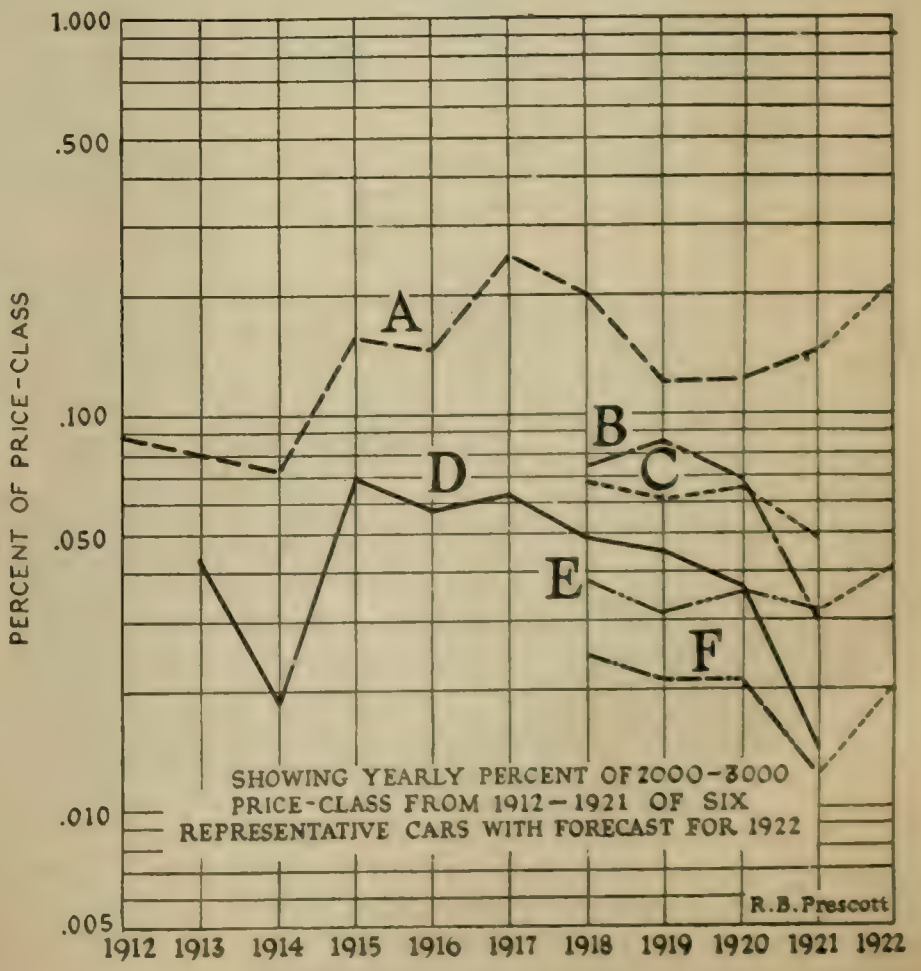


Fig. 3a

In trying to determine the market for a particular car, the principles upon which this statistical data is built must be considered as well as the figures themselves. Then the figures must be analyzed in connection with certain human and economic conditions affecting the particular make of car and the organization which is selling it.

A radical change cannot be expected by any company within a year. Human nature is such that habit and inertia play a large part in determining buying characteristics and also in molding organization methods and ideas. For this reason, it is logical to base sales and production plans for a brief period in advance upon a study of past trends.

Fig. 3 shows the production progress of six typical cars in the $2,000-$3,000 price group. All of these cars have followed rather closely the ups and downs of the price group.

Company A, which stayed in this same price group throughout the period under discussion, shows a steady progress, somewhat more rapid than the group as a whole in the early part of the period. It suffered less decline in the depression period of 1921. On the basis of past performance it is reasonable to suppose that this company will continue to produce about the same percentage of the total price class production as in recent years. Its curve indicates, moreover, that its production capacity is not much in excess of the number of cars which it may reasonably expect to produce during 1922.

Company B, on the other hand, showed a decline in production during 1920, a year in which the group as a whole made material progress. This action is reflected in the 1921 curve of Company B, which shows a sharp deflation.

The production curve of Company C took a much more decided drop in 1921 than would have been expected on the basis of past performance. This does not indicate that the past figures are not a good basis for prediction, but simply illustrates the necessity for taking into consideration such factors of internal financial condition or changes, management readjustments, etc., which cannot, under any circumstances, be predicted on the basis of past statistical data.

The progress of Company D is very similar to that of Company A and to that of the price group as a whole. Companies E and F follow the total group trend very closely, except for 1921 when they took a more decided drop than the group as a whole.

Taken as a whole, there is comparatively little variation in the development trend of the various companies represented on this chart. The differences are nothing like so marked as were those of the companies in the $1,000-$2,000 price class discussed in the March 23 article. The present curves may be interpreted as indicating that companies in the $2,000-$3,000 price class are more closely dependent upon economic factors affecting the group as a whole than upon the individual characteristics and possibilities of the various firms. The individual companies seem to be more closely dependent upon the progress of the entire group than is the case in the next lower price class. Consequently, manufacturers in this group can probably estimate their production possibilities rather accurately by studying carefully the limitations and trends of their price group as a whole.

There will be less cars produced in the $2,000-$3,000 price class in 1922 than there were in 1921. This is due chiefly to the fact that a large number of cars in this price class last year have dropped to a lower price class. Thus, although fewer cars will be made in the $2,000-$3,000 price class, there is likely to be an increased business for those older companies left in this particular group.

THIS is the third of a series of articles dealing with the production possibilities of the price class groups in the passenger car field.

The previous articles dealt with the:

Industry as a whole—November 17, 1921.
$1,000-$2,000 price group—March 23, 1922.

The articles to appear in the near future are: the price groups:

Under $1,000
$3,000-$4,000
Over $4,000

To executives and those who have the responsibility of setting production schedules and making business plans this series of articles is of vital interest. The material has been secured from original, accurate research and presents data from a hitherto unexplored angle.

A MARKED expansion of the foreign trade activities of the Department of Commerce will be possible during the coming fiscal year, beginning July 1, as a result of favorable action by Congress in providing an increase of approximately 30 per cent in this part of the Department's appropriation. In conformity with the principle developed during the present fiscal year by the newly organized Bureau of the Budget, the details of the coming expansion of the Bureau of Foreign and Domestic Commerce are being outlined in the form of a comprehensive budget for the coming year, which it is hoped will result in greater economy as well as more efficient administration.

The activities of the Bureau of Foreign and Domestic Commerce have been further intensified by the rapidly increasing number of incoming reports from the consular service, whose co-operation with the Department of Commerce in the field of trade promotion has proven to be more and more effective. The daily number of such reports received by the Bureau has grown from about 70 to 120 in the course of the past ten months.

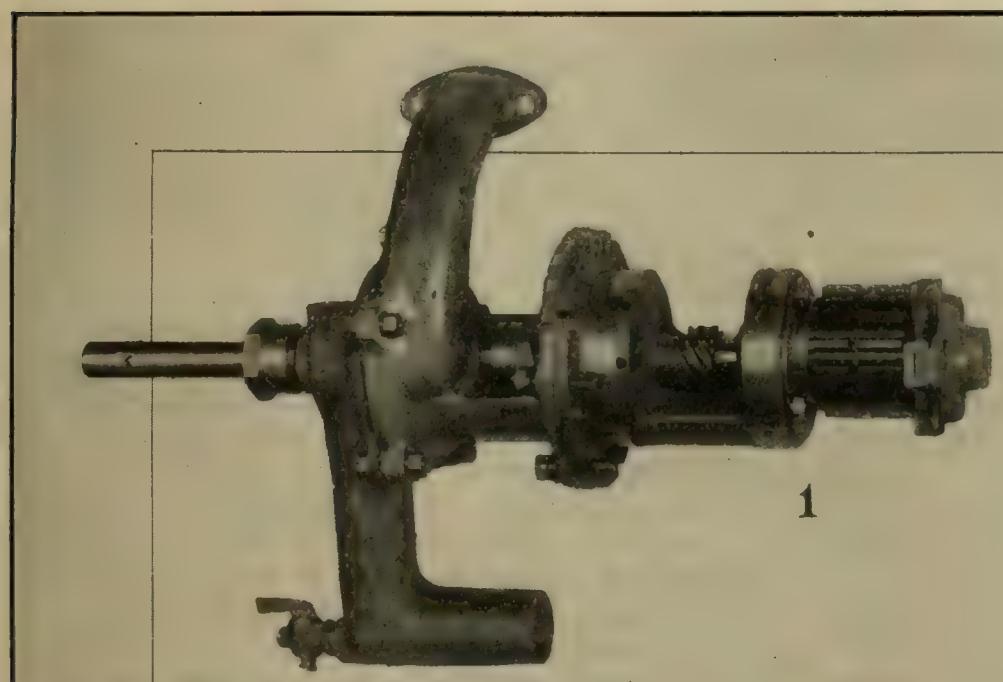
In general it may be said that the program for the coming year will be devoted very largely to the strengthening of the existing organization rather than to the addition of any considerable number of new phases or administrative units. This will apply to the over-sea staff of the Department as well as to the chain of district offices throughout the United States and the headquarters in Washington. It is not probable that any considerable number of traveling special agents will be sent abroad to study market possibilities for specific commodities, as has been the custom in years past. Aside from a few brief investigations by commodity chiefs in such lines as rubber, textiles, electrical goods, and lumber, there will be no extensive field trips by agents of the Department. The funds ordinarily used for such travels will be devoted to the strengthening of commodity intelligence in resident offices abroad and at home.

ACCORDING to a law recently promulgated by the "Grand Assembly" of Turkey, motor lorries for public purposes will be admitted into Turkey free of Customs duty. Oil and petrol will also be admitted duty free.

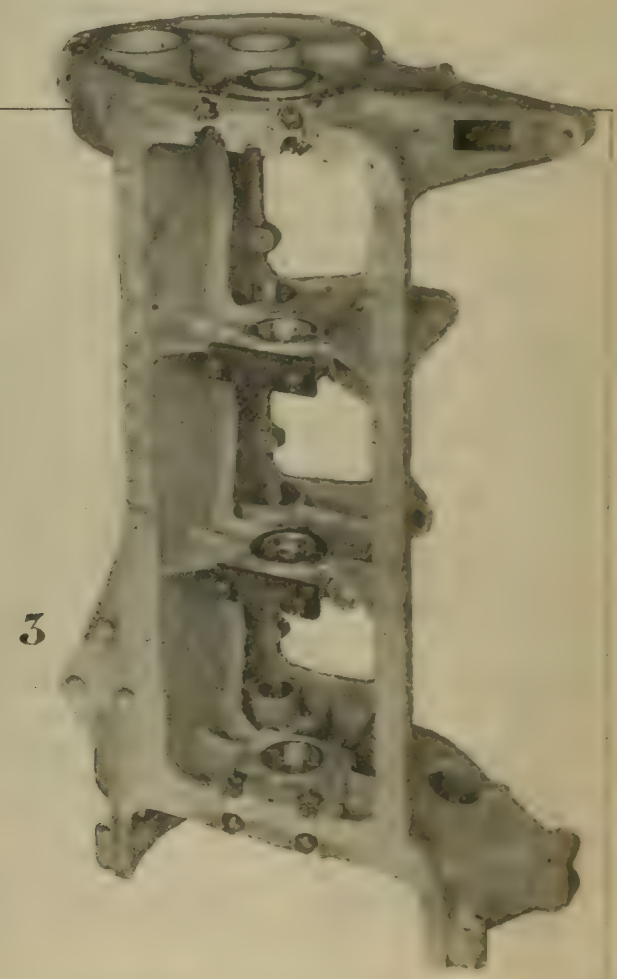
Hudson Adopts Aluminum Piston

New Hudson model carries piston similar to Essex design. Morse chain replaces gears in front end drive. Roller tappets used instead of mushroom.

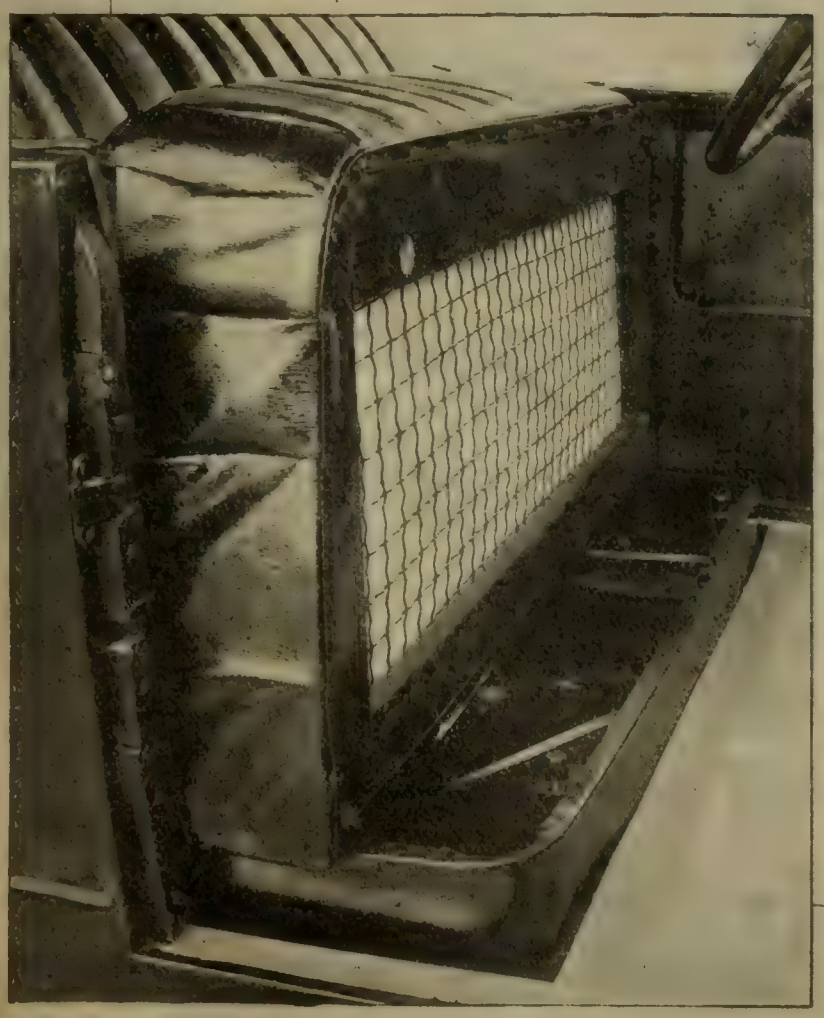
REFINEMENTS and changes in the motor of the Hudson super-six have resulted in considerably improved performance and quietness. Probably the most significant change made is the adoption of aluminum pistons similar to those successfully used in the Essex engine. The manufacturers feel that in this type of constant clearance piston, previous objections to aluminum pistons have been overcome. A change has been made from the Essex piston design in respect to guiding the oil to the piston pin. The pin is now a full floating type. The iron piston weighed from 32 to 40 oz., the latter being the weight of the heaviest oversize,



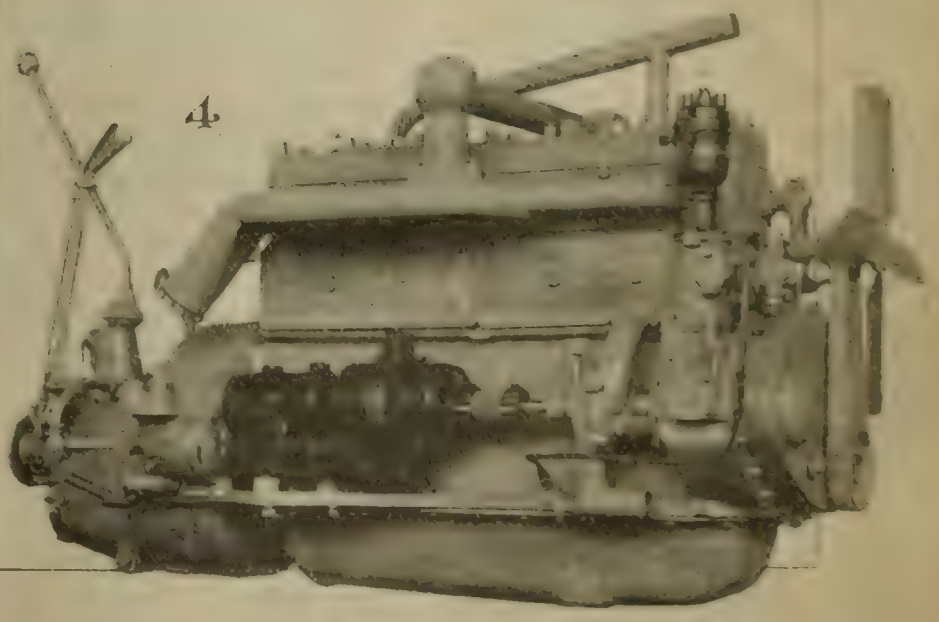
1



3



2



4

1—Water pump driveshaft assembly. 2—On the new Hudson bodies, the seats are doweled into place. 3—Crankcase more heavily ribbed. 4—Hudson super-six engine which has been revised in detail

but the aluminum piston weighs only 16 to 16¾ oz. The weights of the piston are held within limits of ¼ oz. and the weights of the rods within the same limits. The piston pin is locked against end travel by means of rings in the piston boss, and is made ⅜ of an inch shorter, so as to make room for these rings.

The front end drive has been changed from a gear drive to one by Morse chain. In this installation the water pump sprocket rotates as an idler on a bronze adjusting eccentric which is drilled off center. The drilled opening takes the water pump driveshaft. The floating bronze member is driven off a driving flange on the sprocket and there is a floating member flanged to take the fixed portion of the coupling. This is drilled and keyed to connect with the water pump shaft, which is also pinned to the fixed coupling member. To adjust the center distance between the sprocket centers on the chain, the adjusting flange is rotated. The use of this modified type of Oldham coupling allows the fixed portion of the drive to have a relative sliding action across the driving face on the floating member, due to the throw of the eccentric. This sliding portion is lapped to give a perfect sliding fit.

Roller Tappets Adopted

Quietness has been gained by adopting the roller tappet system in place of the mushroom tappets. No pains have been spared to give an accurate assembly for the roller tappets. For instance, there are three grinding operations on the roller pin held to a limit of .0005 in.

In spite of the fact that the flywheel is somewhat lighter, no noticeable vibrations can be detected in the new engine. A correspondent of this paper witnessed a demonstration in the final block test during which a nickel stood on edge on top of the cylinder block on an engine running at 2000 r.p.m. The vibration was not sufficient to upset the nickel at this speed. To compensate for the reduction in flywheel weight the crankcase has been materially stiffened by a system of internal ribbing and by making some of the walls heavier. Furthermore, the crankshafts are now put in running balance on an Olsen type of machine which accurately measures the unbalanced moment, indicates the point from which metal must be removed and gives the weight of the material that must be removed to put the shaft in both static and dynamic balance.

Camshafts are now machined on the Melling automatic cam lathe made by the Walcott Lathe Co., which turns 25 camshafts per hour. This has taken the place of three other machines with a capacity of only 9 per hour. The new lathe turns all cams at once, whereas the former machine only turned six, after which the camshaft had to be shifted for the turning of the other six cams.

Another interesting manufacturing operation in connection with the engine is the turning of the pistons. With this new machine, one of the aluminum pistons is rough turned in 14 sec., which is believed to be a record for this type of piston. This operation is performed on an automatic machine, which practically finish-forms the piston in one operation from the blank.

Changes in Body Construction

Refinements have also been made in body details. In a number of places woodwork in the framing of the body has been replaced by metal stampings. This is particularly true of the sills upon which the seat cushions rest. Instead of a trim strip for holding the seat in place, dowel pins are now employed. The seating has been rearranged, the contour of the upholstery improved to give more comfort, and the battery, instead of being hung in the body, is now hung in the chassis under the seat. A change in external appearance has been brought about by the elimination of the bevel edge on all bodies except the Essex. Even the four-passenger Hudson, which has been known for its characteristic bevel edge, now has a straight edge body. The bodies are somewhat lower in appearance, due to a lower top and windshield. The body hardware has been improved and the front compartment is now provided with a rubber mat. The robe rails are a new type and the instruments are mounted on a contoured dash cut-away for increased leg room.

British Empire Best Market for Italian Cars

THE principal market for Italian cars since the war has been in the various parts of the British Empire, with Spain second, Switzerland third, and Belgium fourth, according to information submitted to the Automotive Division of the Department of Commerce by Vice-Consul Keene, Rome. The Italian market is far too small to give the industry sufficient work in normal times, and the imposition of the circulation tax on automobiles in 1920 reduced the consumption of cars to a minimum.

The automobile industry of Italy, although the youngest of all the mechanical industries of that country, has reached the highest stage of development, and the export trade has attained high importance. Unfavorable symptoms began to be noted in this foreign trade, however. in the years preceding the war. and while exportation reached its maximum in 1921, importations increased steadily. The industry found itself in a losing fight with certain types of foreign cars, mainly American. The exportations were of the heavier type, while the cars imported were mainly of the lighter models.

During the war the industry found plenty of work executing Government war orders, and for some time after the war period manufacturers were busy supplying the demands of the large number of persons made wealthy by the war. In the foreign fields, Italian trade was made almost prohibitive by the protectionists' tariff policy, which sought to preserve in time of peace the belligerent isolation of war times. In spite of these obstacles and difficulties, the automobile industry still found important markets abroad, until in 1919 and 1920 the export trade equalled and even surpassed that of pre-war years.

The situation for the industry is unfavorable at present on account of the lack of raw materials, due to the protective tariff in force in Italy. The manufacturers are generally of the opinion that the policy of shutting out all the foreign goods possible, by the imposition of drastic customs duties, must be modified by the Government so as to permit the entry of the raw materials necessary to the industry.

The cost of production of Italian motor cars is so high, as a result of the tariff barrier, that in certain instances it allows American cars to compete with them, according to a recent communication to the effect that certain American-made small six-cylinder cars are being sold in Italy. The representative of the American firm that sold the cars thinks that an active agent should be able to do a good business in spite of the adverse exchange and high tariff.

New Designs Added to Growing List of Special Bus Chassis

Garford and Fageol produce special chassis for bus and stage service. Underslung springs and worm permit use of lower body platforms, while kickup in frame gives necessary axle clearance. Wider tread gives more body space and greater stability. Unit powerplant used in Fageol stage.

AMONG the recent developments in passenger carrying vehicles is the production of a special bus chassis by the Garford Motor Truck Co. While this chassis, which is known as Model 51, naturally incorporates certain units which are identical with those used in truck chassis of the same make, it is designed especially for passenger carrying purposes. To facilitate ease of entrance and egress the frame has been so designed that it is only 25½ in. from the ground when loaded, and this, of course, helps to lower the center of gravity and decrease side sway. The frame is made to accommodate bodies with seats for 25 to 29 passengers, the length being varied accordingly. The body space measures 247 in. in length in the case of bodies accommodating 27 to 29 passengers and is 30 in. shorter when bodies with 23 to 25 seats are provided. The wheelbase in the two cases is 192 and 186 in. respectively. The frame width is 36 in. front and 52 in. rear. The frame is made from ¼-in. pressed steel having a channel section 6 in. deep with 4-in. flanges, and has seven cross members which are hot-riveted in place. The side members are given a kickup of about 7 in. over the rear axle in order to provide the requisite axle clearance, and the springs are underslung.

The chassis is powered with a four-cylinder 4¼ x 5½-in. Buda engine which is said to have been developed especially for bus applications. It is equipped with magneto ignition, and a six-volt electric starting and lighting system, including a 100-amp. hour battery. The cooling system includes a centrifugal pump, four-blade fan driven by 2-in. flat belt and a radiator with cast aluminum upper and lower tanks and tubular core. The clutch is of the multiple dry disk type.

The four-speed gearset is mounted amidship in a three-point support between two cross members and is provided with a 4 x 10-in. foot operated brake.

The universal joints, of which there are four, are all of the metal-to-metal type. The rear axle is a Timken product and is fitted with an underslung worm and arranged for Hotchkiss drive. The road clearance is only 5½ in. when standard 36 x 8-in. solid tires are employed. Wheels are of center cushion type, with metal spokes, and are mounted on roller bearings.

The hand operated brakes act upon rear wheel drums, which measure 21 x 3¾ in.

The front axle is of the reverse Elliot type with 3 x 2½-in. drop forged center, arranged to accommodate the low hung frame. The screw and nut type of steering gear is fitted with a 20-in. wheel and is mounted outside the frame at the left side. This brings the operator well to the left and gives ample entrance room.

All springs are of the semi-elliptic type, their dimensions being as follows: Front, 42 x 3 in.; rear, 60 x 3½ in.

The tread or gage is 74 in. rear and 68 in. front.

Among the items of equipment not already mentioned are a 25-gal. gasoline tank of lead-coated steel with welded



New Garford bus has chassis especially designed for passenger carrying service



The new Fageol inter-city stage measures only 6 ft. 3 in. from ground to roof

joints, vacuum tank, head lamps, tail and instrument board lamps and electric horn.

The chassis is sold with or without body. When the body is furnished it can be had with various seating arrangements.

The Garford Co. is also marketing another new bus known as Type I, mounted on a standard Model 15 chassis. The body is suitable for depot to hotel and similar service. It seats eleven passengers, the seats being arranged along the sides with a wide aisle and space at the right of the driver for hand baggage, the door being in the center of the right side of the body.

Another recent development in motor vehicles for carrying a considerable number of passengers takes the form of an inter-city stage designed and built by the Fageol Motors Co. especially for long-distance motor travel, which is popular in California and other parts of the country. The new vehicle is neither a truck chassis with a stage body, nor a converted touring car chassis, but is especially designed to travel long distances with comfort and safety even at high speed. As will be seen from the cuts, the coachwork and general appearance resemble that of a large closed car with running boards and individual doors giving access to each of the several seating compartments. By building a frame with front and rear kickups it has been possible to maintain a low center of gravity, with a single step for entrance and an overall height of only 6 ft. 3 in.—less than that of many closed passenger cars.

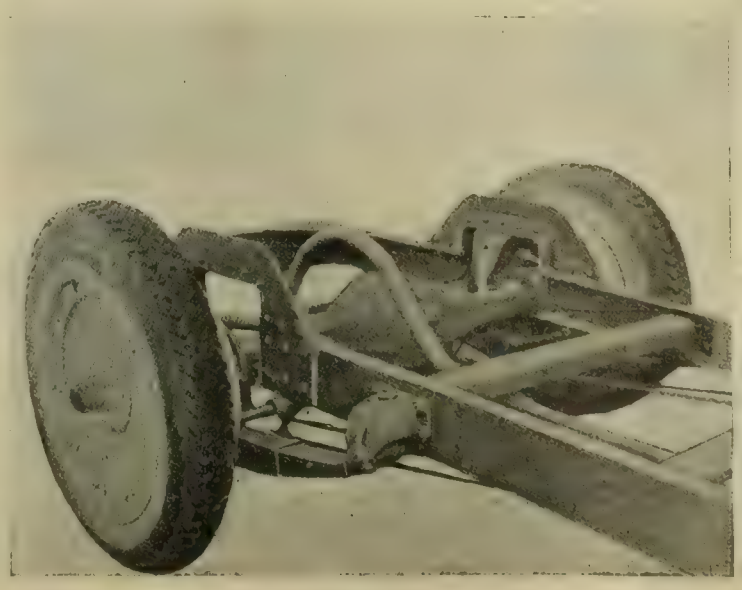
The engine used is a four-cylinder Hall-Scott, 4¼ x 5½, said to be capable of developing 62 hp. at 1800 r.p.m., the maximum governed speed. The engine has overhead valves and camshaft, pressure lubrication through hollow crankshaft and chain-driven fan through friction clutch. Delco ignition, starting and lighting system is employed.

The unit powerplant includes a radiator carried on a bracket attached to the front of the engine, and a Brown-Lipe clutch and gearset. The latter has four speeds but drives direct on third speed, being overgeared on fourth. The gear ratios are as follows: Low, 1 to 3.29; second, 1 to 1.61; fourth, 1 to 0.78. The maximum speed on the various gears is given as follows: 11.5, 23.6, 38 and 49 m.p.h. The powerplant has a three-point suspension and rests on Thermoid pads presumably intended to insulate the engine from the frame and thereby minimize the effect of vibration.

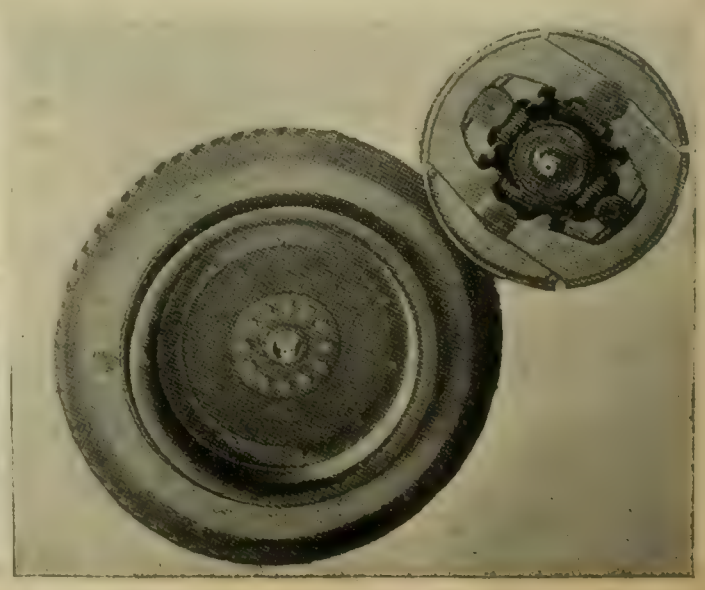
The frame, which is built up from 6-in. structural steel channel weighing 8 lb. per ft., has several cross members hot riveted in place. The propeller shaft is made in three pieces and has two bearings in center cross members. These annular ball bearings are housed in metal casings which are bolted to Thermoid fabric disks and the latter are bolted to the cross member. The fact that there is no metal-to-metal contact between bearing and cross member is said to minimize noise which would otherwise occur. The bridgework which forms the kickup over the rear axle is seen in one of the accompanying cuts. It is said to be stronger than other portions of the frame. The rear axle is a semi-floating Timken, both the worm and the springs, which are semi-elliptics, taking both torque and drive, are underslung.

The wheels, which are of the laminated wood disk type, are fitted with 21 x 4-in. drums upon which both sets of brakes bear. The brake shoes are of the Timken type but are cast from aluminum and lined with ¼-in. asbestos-wire lining. The gear ratio is 5.2 to 1. Special provisions have been made to keep the axle oil tight.

The front axle is a drop-forged I-beam type, fitted with heavy steering knuckles. Both front and rear axles have 70-in. tread, and the tires are 36 x 6-in. pneumatics. The wide tread and low center of gravity help to increase



Rear end of Fageol stage chassis showing bridge construction of frame over rear axle



Rear wood disk wheel showing large type drum and internal shoes which are cast from aluminum

stability, and consequently the safety which has been kept in mind continually in the design of the stage. The vehicle is said to hold the road exceptionally well in rounding curves at high speed. The steering gear is a worm-and-nut type and has a 20-in. wheel.

The springs are quite flat and are made from chrome vanadium steel. Those in front have 11 leaves and measure 41 x 2½ in., while the rear springs have 10 leaves and measure 56 x 3 in. The spring brackets have oil reservoirs with wick feed and are said to require filling with oil but once a month.

Fuel is fed by Stewart vacuum system from a 30-gal. tank located between seats and over the rear axle. A six-volt storage battery is carried on the running board. Other equipment includes an extra tire and carrier and a motor-driven tire pump.

The standard wheelbase is 218 in. for a bus carrying 24 passengers, but variation in wheelbase to accommodate a body seating fewer passengers can be had if desired. The weight of chassis is given as 5700 lb., and with body complete 7300 lb.

As will be seen from accompanying cuts, the body incorporates many unusual features. The doors, which are 27 x 53 in., extend down to the running board, which is 16 in. from the ground and forms the only step. The roof and body extend out over the running board. The windows, which are of plate glass or celluloid, as desired, are arranged to completely disappear in the doors. The body framing is of white oak covered with aluminum sheet and the top is of the soft slat-type construction. There are two adjustable ventilators at the floor line and three in the roof. The interior finish is wood veneer and the seats are upholstered in genuine leather, overstuffed on special springs comparable to those used in touring cars.

Bureau of Foreign and Domestic Commerce Giving Specific Automotive Reports

AMERICAN automotive firms can now obtain detailed and practical trade information concerning dealers handling automotive products in foreign countries. They can get authoritative information and contact. This has been made possible by the form of the confidential trade reports developed by Gordon Lee, Chief of the Automotive Division of the Bureau of Foreign and Domestic Commerce. This new form will contain specific and practical information such as name, address, and size of the foreign dealer; nationality; names of motor vehicles or tires handled; selling organization; storage facilities; service facilities; vulcanizing facilities; side-lines handled.

This information will not be published but can be obtained by American firms through the Automotive Division. The manufacturer will expedite his own work very greatly by making requests for all foreign trade information direct to the Automotive Division of the Bureau of Foreign and Domestic Commerce, rather than by addressing the various consuls involved.

All consular letters go through the Automotive Division and, consequently, the department is very likely to be able to answer in three days an inquiry that could be obtained from a consul only after several weeks or months.

Following is a sample form:

DEPARTMENT OF COMMERCE
BUREAU OF FOREIGN AND DOMESTIC COMMERCE
Washington

So far as possible the consular officers and the representatives of the Department of Commerce include in trade lists from foreign countries only firms of good repute, but no responsibility can be assumed in connection with any transaction had with the persons whose addresses are furnished. This list is NOT FOR PUBLICATION.

AUTOMOTIVE PRODUCTS—IMPORTERS AND DEALERS—SWITZERLAND (Compiled by the Commercial Intelligence Division, April, 1922)

NOTE.—Reference marks indicate relative size of firm: * small; † medium; ‡ large; no stars, no information as to size.

Name, Address and Size	Nationality	Motor Vehicles or Tires Handled	Selling Organization	Storage Facilities	Service Facilities	Vulcanizing Facilities	Side Lines
BASEL							
‡A. Schlotterbeck.....	Swiss	Martini, Saurer trucks. Peugeot, Benz, Ford, Cole, Maxwell cars. Indian motorcycles.	Very good; 25 sub-dealers covering N. W. Switzerland. Exhibiting room for 10 cars.	Good; storage facilities for 20 cars.	Good; repair facilities for 5 cars; employs 7 mechanics.	None.	Various accessory lines; sells also bicycles.
†Auto Centrale, 42-44 Petersgraben.....	Swiss-German	Federal trucks. Cole, Overland, Daimler cars. Dunlop tires.	Good. 10 subagents; 2 show windows.	Good; for 10 cars.	Excellent repair facilities. Employs 4 mechanics.	Yes.	Accessories and tractors.
*Alfred Lacher, 86 Alban Vorstadt.....	Swiss	Dodge cars. Harley-Davidson motorcycles. Goodyear tires.	Good. No subagents; 1 display room.	Good; 2 floors. 40 cars.	Fair; 3 mechanics.	Vulcanizing outfit. Retread tires.	Accessories and garage.
GENEVA							
†J. D. Achard, 17 Rue du Rhone.....	Swiss	Buick, Dodge, Berliet, Fiat cars. Goodrich, Zee-Zee tires.	Very good; 17 subdealers covering S. W. Switzerland. Showroom for 10 cars.	Good; 3-story house can store approximately 50 cars.	Fair; can give quick service and repair 4 cars at one time; employs 15 mechanics.	Vulcanizing outfit.	Various accessory lines; engaged to some extent in real estate business.
*A. Bouvet, 2 Boulevard Helvetique..	French	Peugeot, Pic-pic, Ford cars.	Fair; no subdealers. 1 show window.	Fair; 1 floor with space for 8 cars.	Not good; repair facilities for only 1 car: employ 1 mechanic.	None.	None.

AT the close of 1920, operating reports showed the existence of 128 aircraft terminals of all classes, of which five were in Canada, and three others devoted to airship experiment, leaving a net of 120 in the United States. Of this number probably 20 could be classified as seaplane bases.

At the close of 1921, the operating reports showed a total of 146 air terminals, both land and water, within the United States. All were for heavier-than-air craft. This is an increase of 26 over the preceding year. Of the total number, 30 were classified as seaplane bases. Sixteen of the 146 were publicly owned or controlled.

The 146 terminals reported available to commercial aircraft in the United States represent the facilities for 600 machines without regard to geographical or business requirements.

British Cubitt Car Designed to Compete with American Products

New British model designed for quantity production to compete with low-priced American cars in the home market. Has four cylinder 3⅛ x 5½ in. engine, four speeds, worm drive and cantilever springs.

By M. W. Bourdon

AMONG British productions the 20-hp. Cubitt chassis is of more than ordinary interest to the American industry, for it represents practically the only serious endeavor by British manufacturers to compete on a price basis in England with low-priced imported cars of the five passenger type.

Although the original Cubitt was introduced in 1919, the usual difficulties connected with the production of an entirely new model were experienced. Comparatively few cars were made during 1920, and it is safe to say that the output in 1921 did not exceed 40 chassis per week.

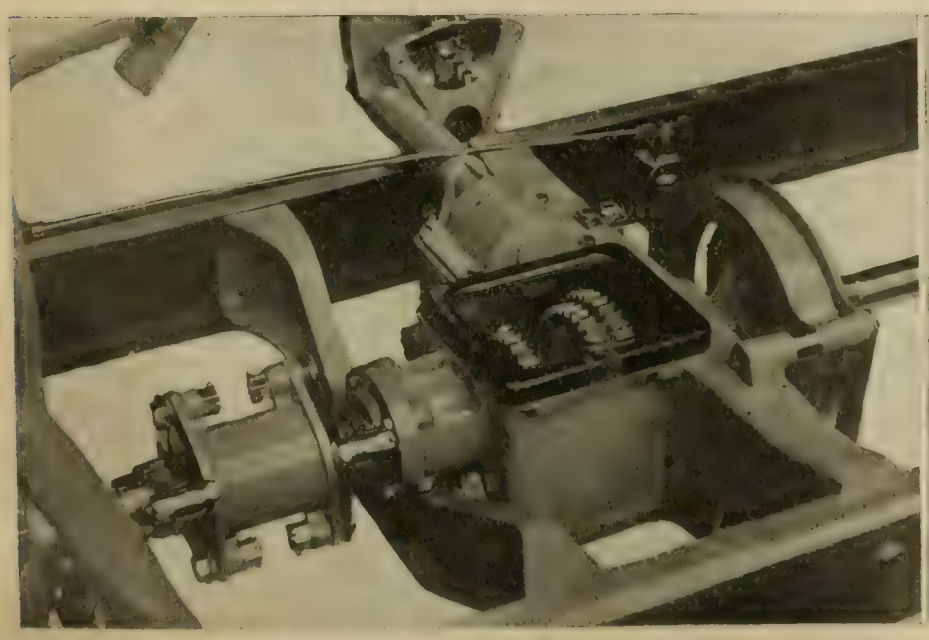
Late last year the chassis design was considerably modified. In size and passenger accommodation this car is to be ranged alongside such American products as the Buick Four, the Essex, Dodge and Hupmobile; in fact, with its 126 in. wheelbase it is rather more pretentious than any of these. In England its price is on a par with the above cars with the import duty added, for it sells at £467.

Turning to the engineering features, the frame consists of two pressed steel side members, straight and parallel in plan but slightly upturned over the rear axle; cross members comprise a cast malleable latticed member under the radiator, a tubular member on the extensions of which the rear cantilever springs are pivoted, and a pressed steel unit at the rear. The arms of the separate gearset also serve as a crossmember, and to stiffen the front horns of the side members a 1½ in. cross tube is fitted.

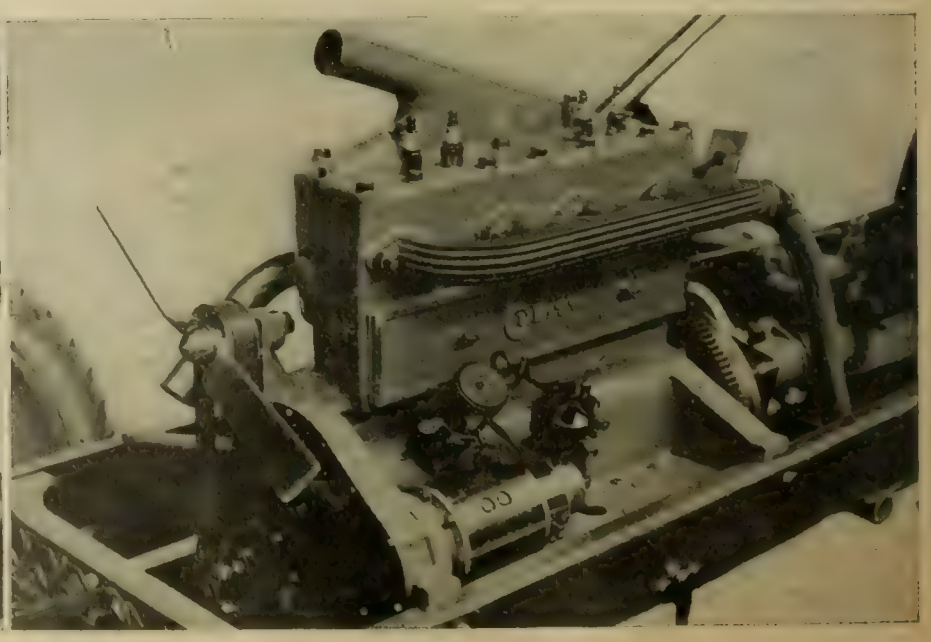
The engine which is supported on the main frame at four points has 3⅛ x 5½ in. cylinders and therefore a displacement of 170 cu. in. The L-head cylinder block is formed as a unit in cast-iron with the top half of the crankcase, having integral arms and web extensions to obviate an underpan; the bottom half of the crankcase is also an iron casting. The detachable head, secured by 17 7/16 in. studs has the water header cast with it. Water circulation is by thermosyphon, with a cellular radiator having a nickel plated sheet brass casing and a small rear extension tank.

On the left of the engine and enclosed by a full length cover plate, the valves are operated by solid followers of ⅝ in. diameter with mushroom ends and hexagon headed studs and lock-nuts for clearance adjustment. Nickel steel is used for all valves, which have a head diameter of 1⅞ in., stems of ⅜ in. diameter and a lift of ¼ in. The valves and followers operate directly in the unbushed cast-iron, but the three-bearing camshaft has separate bushings in the crankcase with journals of 1⅝ in. diameter. The camshaft is driven through helical gearing, end thrust being taken by a flange abutting the rearmost bearing housing.

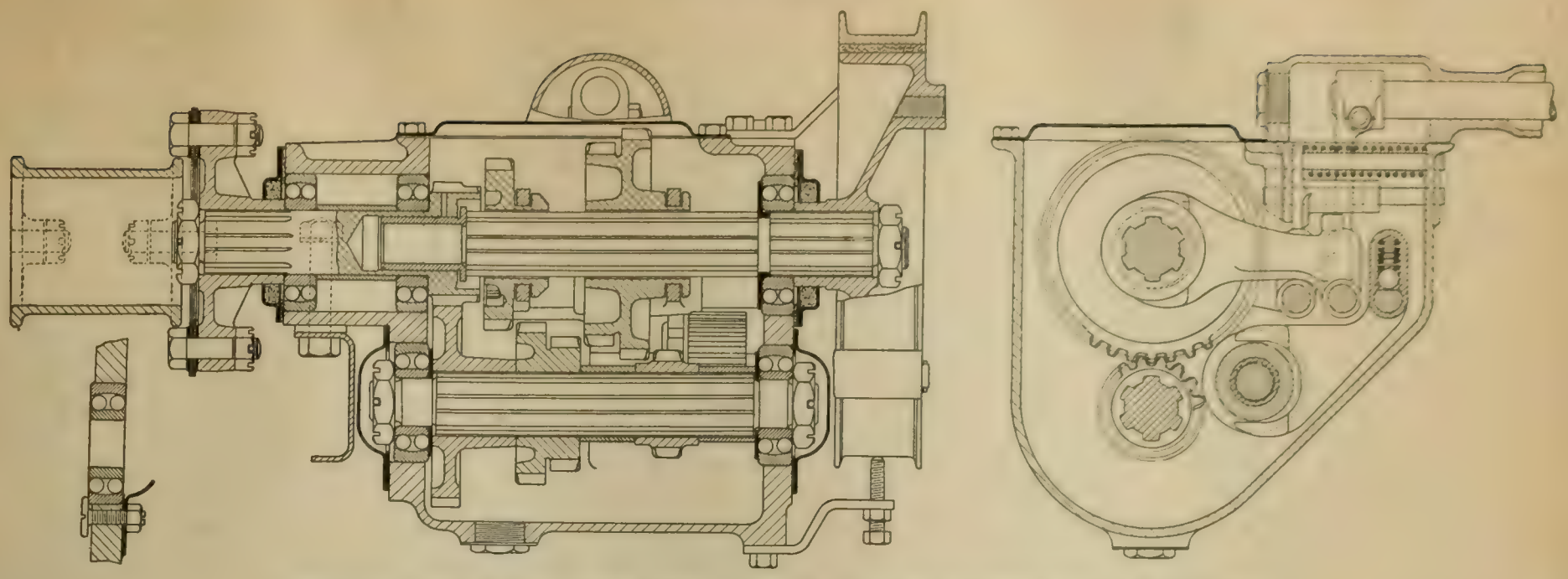
The crankshaft, machined and ground on the pins and journals only, has three die-cast white-metal bearings; both pins and journals are of 1¾ in. diameter, the front and middle journals being 2¼ in. long and the rear one 3 in. The I section connecting rods have 12 in. centers, with bronze bushes in the small-ends; the piston pin floats in piston bosses and small-end, a bronze plug at each end preventing cylinder grooving. The cast-iron pistons have two rings in the crown and a scraper in the skirt, and are comparatively short (3½ in.). The generator is driven by helical gearing in the distribution casing and has the ignition unit mounted on it, while the coil is mounted nearby on the crankcase. The front cover of the distribution casing is of sheet aluminum. In front of it is located the pulley



Four-speed gearset of Cubitt chassis. Note double flexible coupling at rear end of clutch shaft



Cubitt engine left side, showing latticed cast front cross member of frame, generator, etc.



Sectional views of four speed gearset. Gear shift lever operates in a gate on the right

for the flat belt driving the two-bladed aluminum fan. On the right of the crankcase is a combined oil-filling spout and breather, also the starting motor with Bendix drive to the light cast-iron flywheel of 15 inch diameter with integral teeth.

Lubrication is on the hollow crankshaft system. The oil pump is of unusual design; it is of the plunger type and is operated by a short eccentric strap from the camshaft. There is only one spring-loaded ball valve, on the delivery side, a suction valve being eliminated by causing the plunger to uncover inlet ports just before completing its outward stroke, when the vacuum in the pump cylinder draws up oil from the crankcase sump through an external pipe leading from a flanged fitting supporting the cylindrical filter in the sump. It is claimed that by eliminating the usual ball valve on the inlet side the most frequent cause of trouble with the plunger type of pump is removed, the high pressure on the delivery side permitting a stiffer spring to be used, so that the ball is far less liable to stick off its seat.

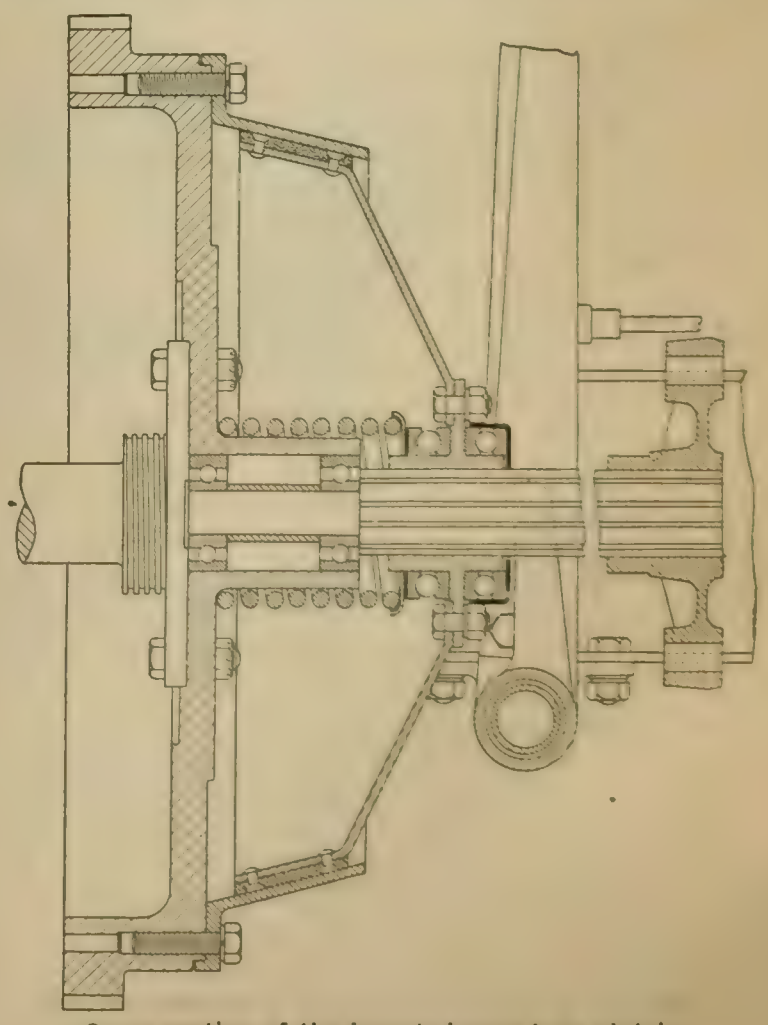
The clutch is of the inverted cone pattern with an aluminum male cone faced with fabric; the castiron female member is bolted to the rear face of the flywheel, the rear end of the clutch shaft carries the front two-armed spider of a double universal joint; the latter is of the type wherein four sets of flexible steel plates, instead of a fabric disk, connect the arms of driving and driven spiders.

Gearset Construction

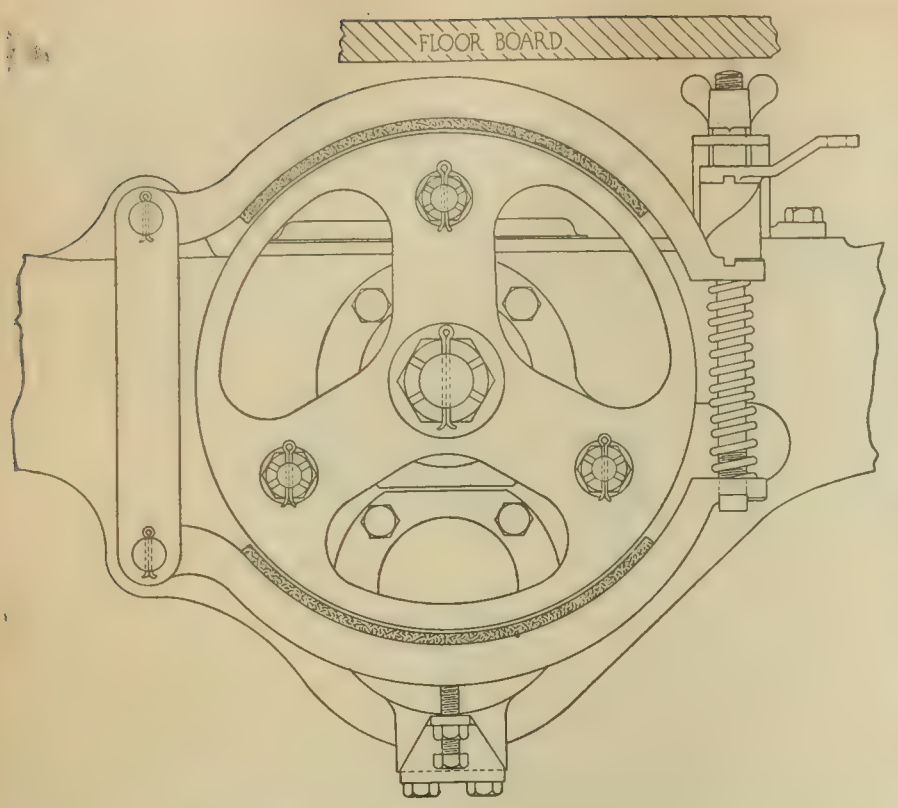
The gearset, as already mentioned, provides four speeds forward; the gear shift lever operates in a gate on the right, being supported by a tubular extension of the cover of the selector mechanism. The casing is of aluminum with two integral arms of deep inverted channel section extending from the rear end to the side members of the main frame. Excepting for the pilot, which has a plain bush, double-row self-aligning ball bearings are used throughout the gearset, the primary shaft with integral constant-mesh pinion having two such bearings separated by a distance piece 1¾ in. long. Both mainshaft and layshaft are splined, the gear sleeves on the latter being free to float axially but for distance pieces and the presence of the end bearings when the component is assembled. The mainshaft splining is continued through the rear bearing to carry the combined transmission brake drum and spider for the front universal joint of the propeller shaft; to form an abutment for the drum, a groove is turned in the splining of the shaft for a split collar between which and the drum boss the inner race of the ball bearing is pinched by the tightening of the nut on the shaft end. To locate and secure the outer ball races of the layshaft in the straight-through machined holes of the aluminum casing, 5/16 in. bolts with extra large round heads pass through holes drilled in the casing so that the heads within overlap the outer race, while the nuts hold steel plate washers overlapping the race on the outside; these nuts also secure the pressed steel end caps. Although this arrangement eliminates shouldered bores, it appears to open up possibilities for abuse by allowing over-tightening of the nuts to give rise to end thrust on the bearings, for the outer races project slightly within the casing.

The transmission brake back of the gearset is of the contracting type, with the fabric lined shoes actuated by a pair of helical cams on a vertical lever shaft.

Behind the gearset the transmission and suspension layout is unusual, for, in combination with an open propeller shaft having a disk universal joint at each end, are cantilever springs and tubular radius rods parallel with them



Cross section of the inverted cone type clutch



Contracting type transmission brake located back of the gearset

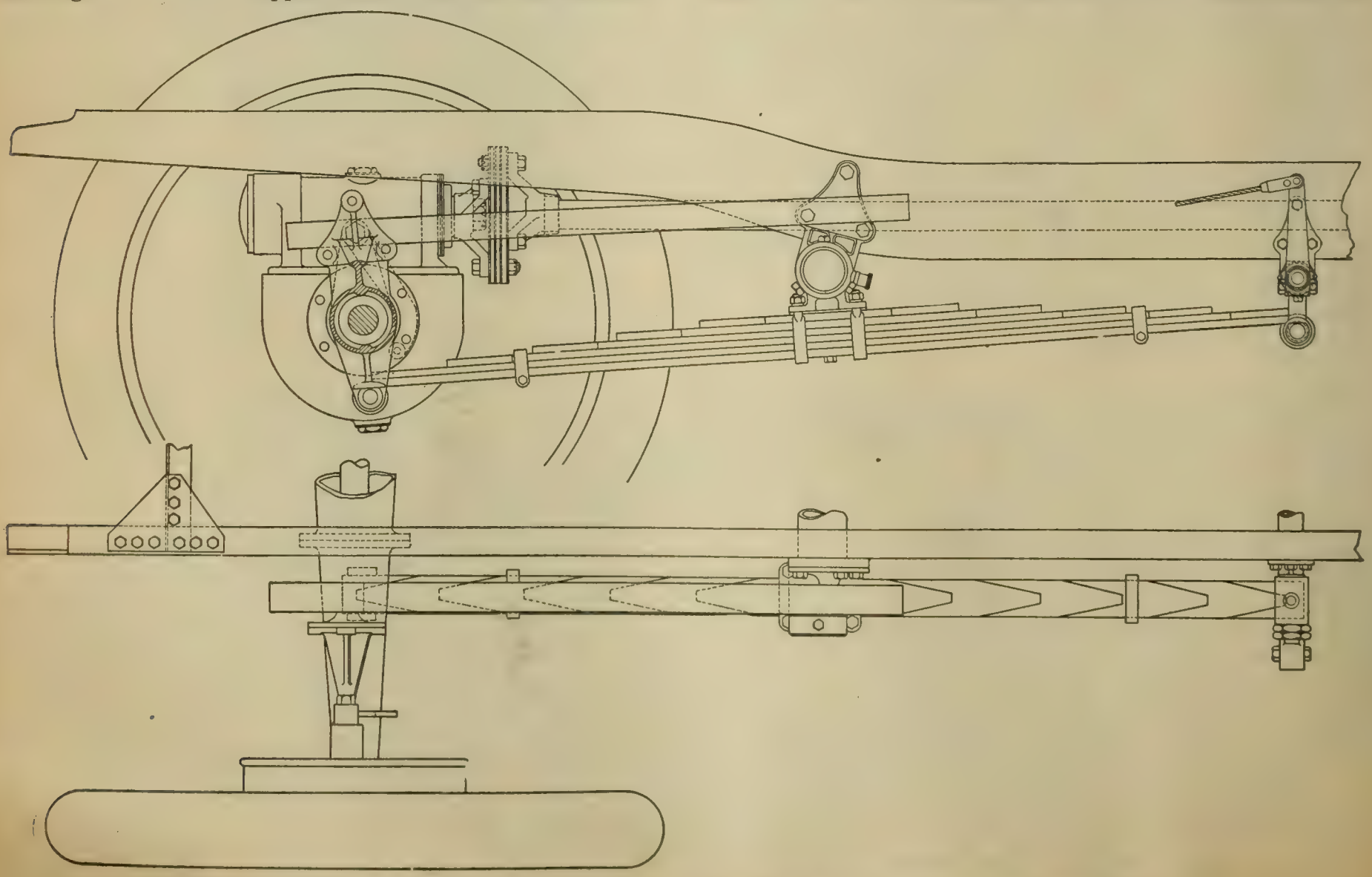
over their rear halves. The rear extremities of the springs have eyes located by pins passing through brackets under the axle casing, while the radius rods have ball joints at each end. The spring trunnion is a tubular cross member of 2½ in. diameter. At their front ends the springs are shackled to the brackets of the brake cross tube. Ignoring variations in spring centers due to deflection—the springs are approximately flat when loaded—this arrangement provides a parallel motion gear for the rear axle; it eliminates a torque tube and thus reduces unsprung weight; and, although not so neat in appearance as the conventional alternatives, appears to have features of advantage from a manufacturing standpoint. The rear springs are 48 inches long, have six leaves 2 in. wide and ⅜ in. thick.

Top worm gearing forms the final drive with a ratio of 4.125 to 1. The worm integral with its shaft is carried on ball journals with a double thrust race at the rear end. The method of locating the latter is unusual, for the central ring of the thrust unit is held against an internal flange of the housing by the threaded end-cap and a locking nut.

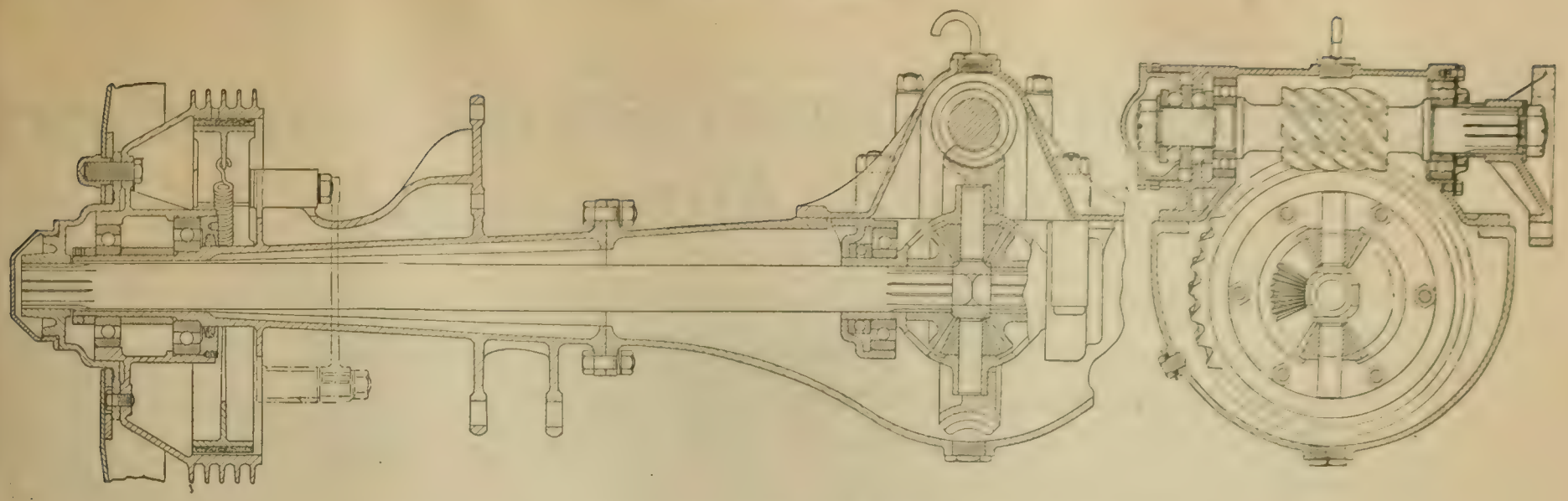
The rear axle housing is built up of three main castings with the central portion inclosed by a cover which supports the complete worm gear and differential unit so that the latter can be removed by first drawing out the driving shafts a few inches. Neither the top cover nor the flanges of the tapered extensions of the casing are pilotted, fitted bolts being depended upon to secure precise location. The axle is of the full floating type. The hubs which run on two ball bearings, separated by a distance piece 1 11/16 in. long, are cast integral with the ribbed brake drums. Transmitting the drive from the splined axle shaft on each side is a peculiar unit which has an 8½ in. flange located normally between the hub flange and the disk wheel; hexagon headed bolts pass through tapped holes in the hub flange and through clearance holes in the other two parts, the outer nuts being capped and their removal permitting the disk wheel to be quickly detached. To prevent the driving unit coming away with the wheel, set screws hold it to the hub flange.

The wheel brakes are of the internal expanding pattern, cam operated with cable connections in place of rods. These brakes measure 11 by 2 in.

The steering gear is of the worm and full worm wheel pattern with a ball thrust race above and below the worm, and an adjusting sleeve and lock-nut for taking up axial play of the column. But no adjustment is provided for the worm wheel and its integral shaft, this unit being mounted



Cantilever springs with tubular radius rods parallel with them and placed over their rear halves



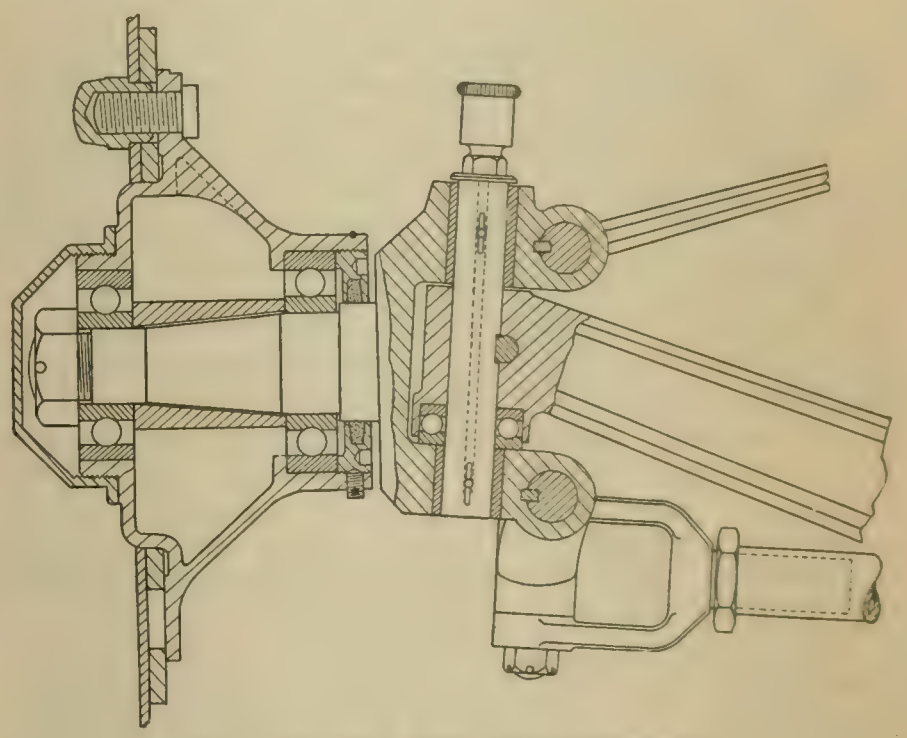
Sectional views of worm drive. Top worm gearing forms the final drive

in bearings without bushings in the steering gear casing.

The drop arm is secured to the squared end of the worm shaft by means of a pinch-bolt passing through its split boss and engaging with a groove across each corner of the square to prevent end movement. Ball joints are used for the drag link, the latter having spring loaded ends interchangeable with those of the radius rods of the rear axle.

The front axle is of the usual H section with the swivel pins secured in the ends and jawed and bushed swivel axles. Ball bearings are used for the front hubs, each of the latter being a unit casting with an outer flange for the detachable disk wheel. The steering wheel is of 17 in. diameter, the spokes, boss and rim being unit cast in aluminum, the rim coated with black xylonite. For the throttle only pedal control is provided.

The standard body is a roomy five-passenger, with leatherette upholstery, single panel screen, mahogany instrument board, and the usual folding top with side curtains. The wheelbase is 126 in., track 54 in., minimum ground clearance 10½ in., tire size 815 x 105 mm. beaded edge, and weight of complete car 2600 lb.



Front axle and swivel pin construction

Difficulties in the Production of Alcohol from Sawdust

COMMERCIAL utilization of sawdust is made difficult by the small size of the sawdust particles and by the limited quantities available without transportation. These factors are standing in the way of chemical utilization as well as restricting the mechanical uses.

The manufacture of methyl or wood alcohol from sawdust will probably never be done on a large commercial scale. The minuteness of the wood particles causes considerable trouble in any ordinary destructive distillation process, because the stirring of the charge, which is necessary to heat the sawdust mass, results in a fine charcoal dust which clogs the condenser tubes. Then, too, the charcoal by-product, usually a considerable source of revenue in destructive distillation, is not very salable in its powdered condition. A combination of distillation and the manufacture of producer gas from sawdust avoids mechanical difficulties, and charcoal is not one of the by-products. This process might be quite successful if there were a demand for power in a locality where there is an abundance of hardwood waste. The greatest trouble with any sawdust distillation process. however, is that hardwood sawdust is not obtainable in quantities large enough to run a commercial plant without much expensive transportation, and the process, therefore, must be economical enough to permit purchasing and grinding up large pieces of wood to use along with the sawdust.

Ethyl or grain alcohol can be produced commercially from sawdust, As yet, however, the process is practical only where there is a very large daily supply (at least 250 tons) of wood waste available.

AN investigation of the commercial methods of manufacture, together with the properties and uses of light aluminum alloys, has been undertaken by the Bureau of Mines for the purpose of making available a compendium of the existing information. The compiled data are to be published in the form of a Bureau of Mines bulletin. The report covers the commercial production of aluminum-alloy sand castings, die castings, and permanent mold castings, and worked manufactures, foundry practice, the properties and uses of aluminum alloys, and a discussion of the principal aluminum-alloy systems, e. g. aluminum-copper, aluminum-iron, aluminum-magnesium, aluminum-manganese, and aluminum-zinc systems, as well as the principal ternary systems. Patented alloys are dealt with at some length, and the preparation of various alloys taken up.

Suggestions for Improvement in Electric Wiring for Automobiles

Types of cables and methods of installation used for ignition, starting and lighting circuits may be standardized within certain limits. The writer urges that there be further efforts in that direction thereby adding to the usefulness of the existing S. A. E. standard for insulated cable.

By William S. Haggott*

AUTOMOBILE wiring falls naturally into three main divisions: High-tension ignition, lighting (including low-tension ignition) and starting.

In high-tension ignition present practice is about evenly divided between the use of plain rubber-covered and braided rubber-covered, high-tension cable. However, I believe the tendency is strongly toward braided cable provided the braid is thoroughly filled with a durable, flexible, insulating varnish. The principal objection to braided cable is that the braid retains moisture, thereby creating a possibility of erratic firing, but this objection can be overcome and considerable progress is being made in this direction. Braided cable, properly constructed, affords protection from oil, heat and ozone, all of which seriously damage a plain rubber-covered cable. Ozone is the worst of the three, as it causes the rubber to crack, resulting in misfiring or irregular firing.

If the high-tension wires are short and can be kept free from injury, it is preferable to run them open and not close together. This method gives positive protection against inductive disturbances and leakage between wires and will prevent "cross-firing." I believe that in a good many cases the spark-plug wires can be run open to good advantage, but there are instances, especially in connection with six, eight and twelve-cylinder engines, some of which have two spark-plugs per cylinder, where it is practically necessary to run the wires in tubes.

Metal tubes are usually used for this purpose on account of cost. A fiber tube would be better, as it prevents leakage to the ground in case the cable insulation fails. In order to nullify the condenser action when a fiber tube is used, it is only necessary to run a bare wire through the tube and ground this wire to the engine. Where a metal tube is used it must be well grounded to the engine so as to carry any static or condenser effect to the ground. The openings in a metal tube must be properly rounded or bushed to prevent cutting the cable insulation.

If possible, the coil of battery-ignition systems should be located close to the distributor, thereby keeping the wire from the coil to the distributor short. Where a tube is used for the spark-plug wires, it is best to keep the wire from the coil to the distributor out of the tube.

Lighting and Low-Tension Ignition

There is a strong tendency toward the use of armored cable on lighting circuits. This is particularly true where wires are exposed and subject to chafing. Armored cable, if properly constructed and installed, will give no trouble. The most important factor in the use of armored cable is to be sure the armor is stripped back sufficiently from the terminals, and then soldered down so that a ground cannot occur at these points. Rubber covered and braided or varnished cambric and braided cable protected by flexible metallic conduit is sometimes preferred. There is also some use of non-metallic conduit to carry these types of wire. The use of metallic conduit perhaps gives a more substantial appearance on head and tail-lamp wires, but is more expensive than armored cable from the standpoint of first cost as well as that of installation.

It is, of course, unnecessary to have metallic protection for wiring around the instrument board. As a matter of fact, I have several installations in mind where rubber covered and braided cables have been used for years on all circuits, including head and tail-lamps, without the use of additional protection, but I believe the use of armored cable is good insurance against lighting-circuit failures.

Spliced or Separate Head-Lamp Wires

The question came up recently as to the advisability of running separate head-lamp feed wires from each head-lamp clear back to the lighting switch, instead of making a splice at a point near the front end of the car and having only one wire from the switch to the point of making the splice. This latter method has practically become standard, and I think should be so considered. The splice can be properly made and supported, and when so constructed will give no trouble.

It is better not to wire instrument-lamps in series with tail-lamps as is sometimes done. The only advantage in the series arrangement is to indicate when the tail-lamp is burned out, and this fact can be checked up easily by looking back for the reflection of the tail-lamp. With tail and instrument-lamps in series, it is necessary to use 3-volt bulbs, which are rather special and sometimes hard to obtain. The series arrangement also requires continuous burning of the instrument-lamp, which is fatiguing to the driver's eyes. With separately controlled lamps, the instrument-lamp can be turned out when the car is parked, and can be substituted for the tail-lamp if it should burn out.

Where fuses are used each circuit should be protected, even though this is slightly more expensive than to have one fuse control several circuits. With each circuit fused separately it is easier to locate trouble, and, when circumstances require, it is possible to operate the car with one circuit out of commission. Considerable attention is being given to the use of a single-circuit breaker placed in the main battery feed circuit. This method of protection has the advantage that when the cause of trouble is removed the circuit-breaker can be closed and the car

*Cable sales manager, Packard Electric Co. Paper presented before the S.A.E. Buffalo Section Meeting, condensed.

can proceed without resorting to the installation of makeshift fuses, which is always dangerous.

It is good practice to consolidate lighting and low-tension wires wherever possible and braid them together or run several wires through one piece of conduit. This method is economical, convenient, and tends toward rugged and safe installations. If proper wire is used and the individual wires are assembled together in a workmanlike manner, installations of this sort give little or no trouble from a repair shop standpoint. This use of assemblies or wiring harnesses, as they are often called, is admirable from a car assembly standpoint. The wiring harnesses are formed up on a bench, which permits uniformity and careful workmanship and a more satisfactory wiring job.

Right here I would like to suggest that some effort be made to adopt a standard color scheme for various circuits on all cars. For example, every car has a wire running from the battery or starting switch to the ammeter. Is there any reason why a certain definite color cannot be assigned to this and other wires which are common to all cars, and have as nearly as possible a standard wiring color scheme among all car manufacturers? It seems that this would be of great value to the car driver and repair man and provide a uniformity which would be helpful to the industry in many ways.

Starting

The most general practice is to use rubber-covered and braided cable. On 6-volt systems No. 1 A. W. G. wire is the prevailing size, although there is quite a little No. 0 and some No. 2. The gage size is important in order that proper starting torque may be delivered by the starting motor in cold weather. Starting-motor cables should in all cases be as short as possible, thereby keeping the voltage drop to a minimum.

If the starting-motor cables are short and well supported, they will in many cases need no additional protection such as conduit or armor. Non-metallic conduit affords excellent protection if chafing or mechanical injury must be guarded against. If metallic conduit is used, great care must be taken to prevent the conduit from coming in contact with the terminals. This same precaution must be observed if an armored starting-motor cable is installed. A most important point in connection with starting-motor cables is to see that the battery is well grounded. I believe a good standard method would be to use a two-hole lug which can be firmly bolted to the frame.

Terminals

It is impossible to use too much care in attaching and soldering terminals. Wherever spade-type terminals are used, they should have two sets of wings, one pair to grip the insulation and the other pair to grip the copper core. I am greatly in favor of soldering terminals wherever possible, thus insuring a proper electrical connection. There are some types of terminals and lamp connectors which cannot be soldered, but I am strongly inclined toward soldered terminals, and would like to see the solderless types used only in cases where soldered terminals are not at all feasible.

I believe it is possible to so arrange the electric wiring and the various parts of the gasoline supply equipment that no gasoline can leak on any part of the electrical equipment that is liable to emit sparks. If this is done, one of the greatest fire risks is eliminated.

Electric Furnace vs. Open Hearth Silico-Manganese Spring Steels

IT is more or less generally recognized that steels of the same composition in so far as the elements used are concerned require variations in heat treatment to produce similar properties. This applies to comparisons between heats made by the same type of process and steels produced by different processes. A series of tests was completed at the Bureau of Standards the past month on samples of electric and open-hearth heats of silico manganese spring steels carrying equal proportions of C. Mn, P, S, and Si. The tests included microscopic examination, tensile test, and determination of proportions of certain gases present, particularly nitrogen and hydrogen. In general, the microstructure of the electric steel was somewhat different from that observed in the open-hearth when both steels were subjected to the same heat treatment.

Under certain thermal treatments, distinct differences in tensile properties were observed, but these were largely obliterated by a preliminary normalizing quench from a high temperature. It was found that the proportion of oxygen present in these steels was practically the same, about 0.028 per cent, and independent of the heat treatment applied. The nitrogen in the original rolled samples of electric steel was approximately twice that of the open-hearth and independent of the heat treatment. However, in the case of the electric steel, the proportions of nitrogen were dependent upon the heat treatment.

A New Spring Retainer

A SIMPLE type of valve spring retainer which is designed to replace the cup and spring type, has been brought out by the Master Primer Co. This is a one-piece unit which locks itself in place when the spring is compressed. It is claimed that the new type of retainer gives a 100 per cent bearing around the valve stem and, consequently, holds the valve squarely on its seat, and does not allow the valve spring to cock to one side or the other.



Master Valve Spring Retainer

In assembling, the pressure on the retainer opens the self-locking wings because the valve stem is of larger diameter than the hole through the wings. When the spring is fully compressed, the wings are caught in the groove of the stem and release of the spring compression snaps the wings into a locked position on the stem, forcing the cup and wings of the retainer together.

To disassemble, with the spring fully compressed, the locking wing is spread sufficiently to enable them to slip out of the groove. Release of pressure on the spring then pushes the retainer off of the valve stem. It is claimed that the cost of the retainer is less than the articles replaced. It is also claimed that a saving is effected by speed of assembly.

Federal Government Revises Petroleum Specifications

Color test only change of importance in respect to motor gasoline. Points on distillation curve unchanged. Viscosity limits on lubricating oils are altered and some minor changes are made in other items. Tests show that most gasolines now marketed are well under Federal limits as to volatility.

CHANGES made recently in the Federal Government specifications for motor gasoline and lubricating oils do not materially alter the specifications formerly employed, but since these specifications are widely used by many large purchasers of petroleum products they are important to the automotive industry. The changes in respect to motor gasoline do not affect the distillation temperature limits, but make the color test more specific. Surveys by the Bureau of Mines show that the average gasoline marketed to-day are well within the Federal specifications, although some California gasolines have a darker color than is stipulated in the latest requirement under this head.

The specifications cover a wide variety of products, including aviation gasolines, motor gasoline, naphthas, kerosene, fuel oils of various grades,* lubricating oils and greases of numerous different grades, etc. We give below only the specifications for motor gasoline and for Class D lubricating oils intended for use in all internal combustion engines except aircraft, air-cooled and Diesel type engines.

The new specifications, which are similar in character to those adopted during the war by the Committee on Standardization of Petroleum Specifications, have been adopted by the Federal Specification Board and have been published as Technical Paper No. 305 of the Bureau of Mines. These specifications are widely used, not only by the Federal and many State and local Governments, but by other large purchasers of petroleum products. Because of this fact they have a considerable effect upon refinery practice, although a large proportion of refinery products are not in strict agreement with them. They serve, however, as an excellent guide to purchasers who heretofore have often been more or less at the mercy of the oil companies for lack of knowledge as to what constituted a good specification.

Specifications for Motor Gasoline

1. This specification covers the grade of gasoline used by the United States Government and its agencies as a fuel for automobile, motor boat and similar engines.

2. **Color.**—Method 10.1. The color shall not be darker than No. 16 Saybolt.

3. **Corrosion test.**—Method 530.2. A clean copper strip shall not be discolored when submerged in the gasoline for 3 hours at 122 deg. Fahr.

4. **Distillation range.**—Method 100.1. When the first drop has been recovered in the graduated receiver, the thermometer shall not read more than 60 deg. C. (140 deg. Fahr.).

When 20 per cent has been recovered in the receiver, the thermometer shall not read more than 105 deg. C. (221 deg. Fahr.).

When 50 per cent has been recovered in the receiver, the thermometer shall not read more than 140 deg. C. (284 deg. Fahr.).

When 90 per cent has been recovered in the receiver, the thermometer shall not read more than 190 deg. C. (374 deg. Fahr.).

The end point shall not be higher than 225 deg. C. (437 deg. Fahr.).

At least 95 per cent shall be recovered as distillate in the receiver from the distillation.

5. All tests shall be made according to the methods for testing petroleum products adopted by the Interdepartmental Petroleum Specifications Committee. (See Technical Paper 298, Bureau of Mines.)

The foregoing specification is substantially identical with that formerly used except that the color is more specifically defined.

The following specification for lubricating oils, designated as Class D is similar in most respects to the specifications for oils formerly known as Class C. However, the following among other slight differences are worthy of note:

Reference to the inclusion of fatty oils and other compounds not derived from crude petroleum is omitted.

The viscosity limits on all five grades have been slightly altered.

The color specification now provides for mixing the oil with an equal volume of water white kerosene before color comparison is made.

The corrosion and emulsifying specifications are slightly altered.

Specifications for Engine Lubricating Oil

1. This specification covers the grades of petroleum oil used by the United States Government and its agencies for lubrication of internal-combustion engines, except aircraft, air-cooled and Diesel engines.

2. These oils shall be supplied in five grades, known as extra light, light, medium, heavy and extra heavy.

3. **Flash and fire points.**—Method 110.3. The flash and fire points of the five grades shall not be lower than the following:

Grade	Flash point, deg. Fahr.	Fire point, deg. Fahr.
Extra light	315	355
Light	325	365
Medium	335	380
Heavy	345	390
Extra heavy	355	400

4. **Viscosity.**—Method 30.1. The viscosity of the five

*For complete specifications of all products see Technical Paper No. 305 of the Bureau of Mines, procurable from the Bureau or the Superintendent of Documents, Government Printing Office, Washington.

grades at 100 deg. Fahr. shall be within the following limits:

	Seconds
Extra light	135-165
Light	180-220
Medium	270-330
Heavy	360-440
Extra heavy	450-550

5. **Color.**—The color of the extra heavy grade, when mixed with an equal volume of water-white kerosene, shall not be darker than No. 6 National Petroleum Association standard, or its equivalent. The color of the other grades, when mixed with an equal volume of water-white kerosene, shall not be darker than No. 5 National Petroleum Association standard, or its equivalent.

6. **Pour point.**—Method 20.1. The pour point shall not be above the following temperatures:

	Deg. Fahr.
Extra Light	35
Light	35
Medium	40
Heavy	45
Extra heavy	50

7. **Acidity.**—Method 510.3. Not more than 0.30 mg. of potassium hydroxide shall be required to neutralize 1 gram of the oil.

8. **Corrosion.**—Method 530.3. A clean copper strip shall not be discolored when submerged in the oil for 3 hours at 212 deg. Fahr.

9. **Carbon residue.**—Method 500.1. The carbon residue shall not exceed the following:

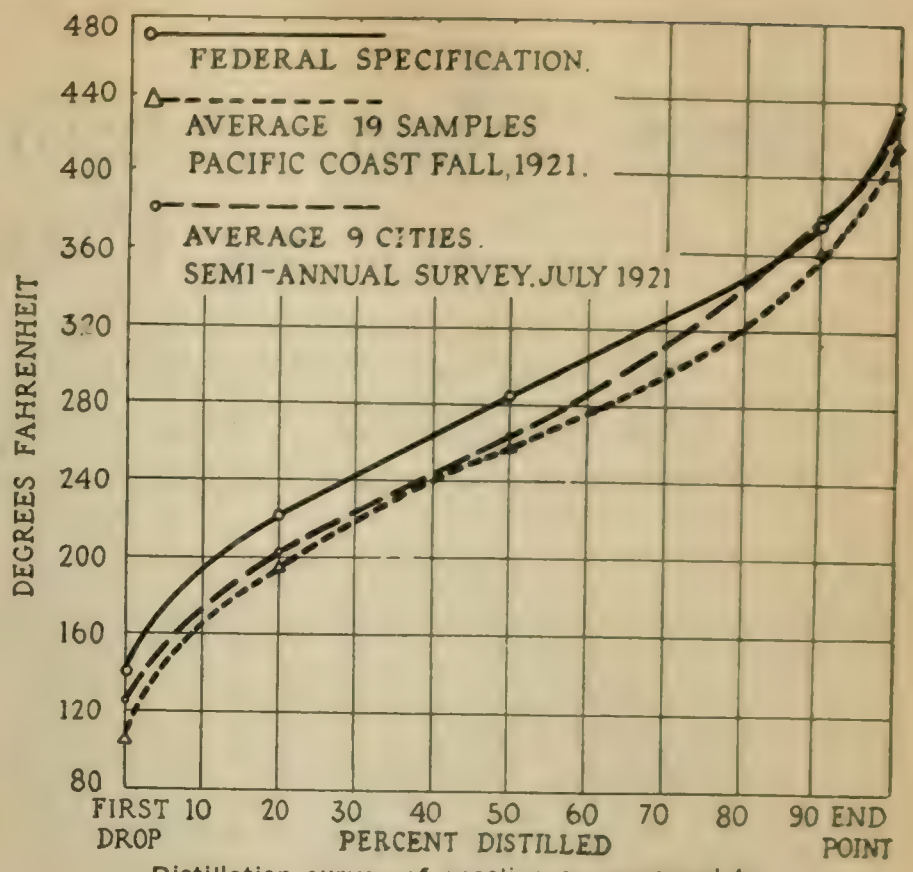
	Per cent
Extra light	0.10
Light	.20
Medium	.30
Heavy	.40
Extra heavy	.60

10. If especially required by the department purchasing the oils, the demulsibility (grades extra light, light and medium—method 320.3, grades heavy and extra heavy—method 320.4) shall not be less than 300, and the upper layer at the end of thirty minutes shall not contain more than 5.0 per cent of water.—Method 300.4.

11. All tests shall be made according to the methods for testing petroleum products adopted by the Interdepartmental Petroleum Specifications Committee. (See Technical Paper 298, Bureau of Mines.)

California Gasolines

The Bureau of Mines is making a survey of petroleum products manufactured on the Pacific Coast from California crude oils. California crude petroleum is known to differ in some characteristics from the crude oil produced in other parts of the United States, and the claim has been made that the present Federal specifications are unduly severe when applied to the products made from California crudes. The main purpose of the present survey is to determine whether these claims are justified.



Distillation curves of gasoline as compared to government specifications

This report deals only with California gasolines. Other products, such as burning oil, fuel and lubricating oils, will be taken up later.

The samples of gasoline reported upon were furnished in most cases by the four large refining companies located on the Pacific Coast, although a number of samples of motor gasoline were purchased in the open market.

The methods of analysis are, in general, those which were adopted by the Committee on Standardization of Petroleum Specifications and printed in Bulletin No. 5 of this Committee. Bulletin 5 has been revised recently.

The results of the survey indicate that the samples of California motor gasoline met the specifications in respect to volatility, as shown by the distillation curves in the accompanying cut, as well as in other respects, except that several samples were off in color, as now specifically defined.

Recent Developments in the Work of the Advisory Board on Highway Research

THE main activities in the Advisory Board since last July have been in the contacts made with potential research agencies, such as the State highway commissions and the Bureau of Public Roads, in the writing of papers, in giving addresses to quicken the will to research of those who are interested in highway development, in tying together the committees of the organizations (that are milling around) in this field.

Additional constituent organizations have been added to the Advisory Board as follows:

Bureau of Standards, Western Society of Engineers, Eno Foundation for Highway Traffic Regulation, Associated General Contractors of America, Rubber Association of America.

A comprehensive program of highway research has been drawn up, and the highway research census is being taken, and the data from the researches collected. All of this material will be filed under the code numbers attached to the program. The list of research workers will be transferred to the personnel files of the Research Information Service of the National Research Council.

New committees of the Advisory Board authorized are:

Highway Finance, Highway Traffic Analysis, Maintenance, Highway Bridges.

The personnel of the existing committees has been reviewed with the purpose of vitalizing the work of these committees, and the membership of new committees is under discussion. An administrative assistant has been supplied to Mr. H. S. Mattimore, chairman of the Committee on Character and Use of Road Materials.

New Shop Appliances Save Time in Production

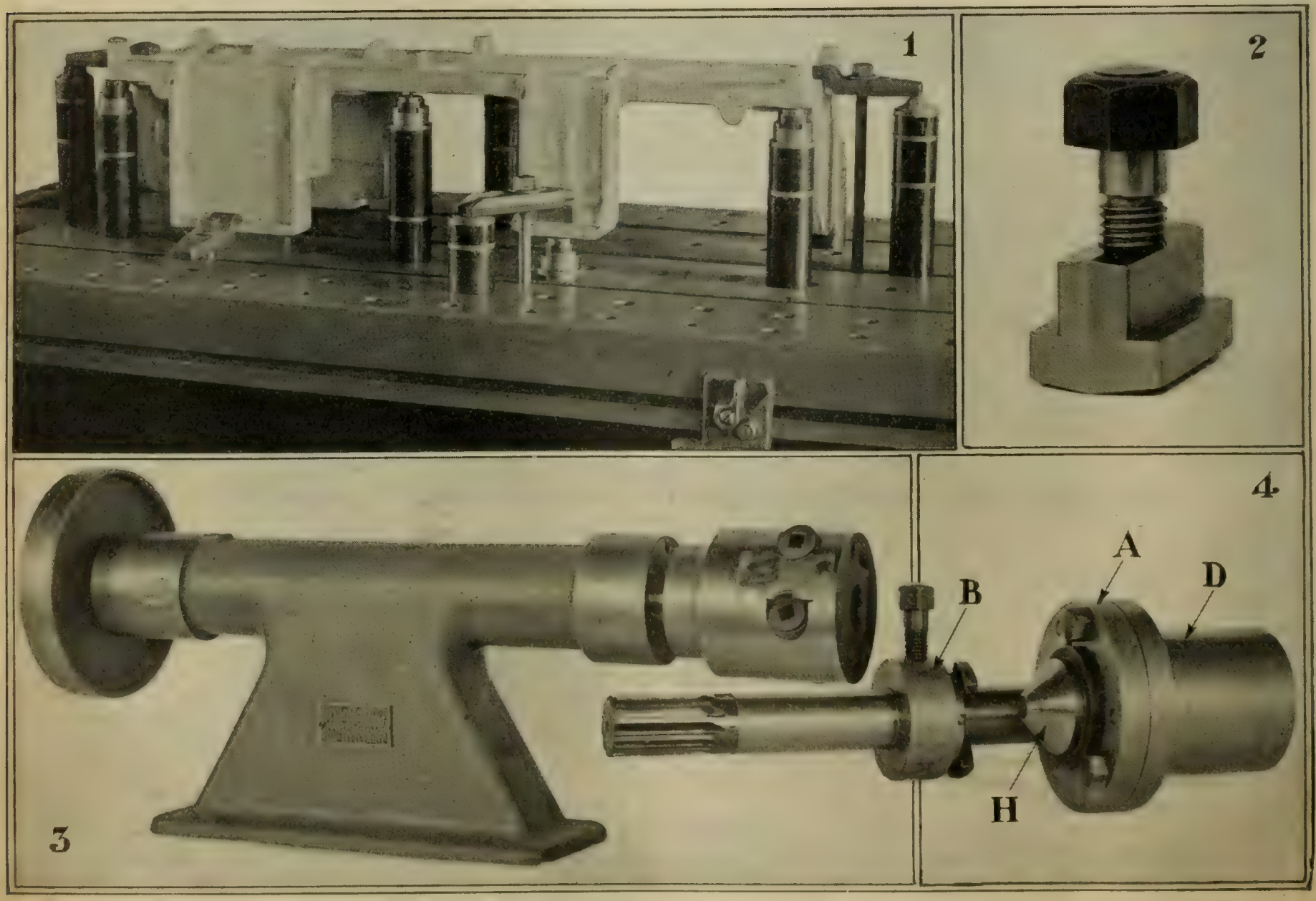
One, consisting of T slot nuts, jacks and blocks, is designed for reducing time spent in setting up work in machine tools. Another is a reamer holder which operates in a manner contrary to that of the floating type reamer.

THE T slot nuts, jacks and blocks herewith illustrated are designed for use in setting up work in machine tools. Besides saving time, the T slot nuts offer the advantage that additional bolts may be put in after the work is set up. Often the work to be machined is of such shape that if old style T slot bolts are used they must be located in the table before the work is placed on it, otherwise it would be impossible to slide them through the slots and get them past portions of the work which extend over slots.

The Casler T slot nut is claimed to present ample wearing surface, and not to injure T slots, and while it must be inserted from the end of the slot it does not necessitate disturbing the work in order to add one or more extra bolts at any time during the machining operation. The studs used in connection with this nut are easily made. The nuts are made in a large range of sizes.

The jack and blocks furnish a ready means of leveling up the work, and the blocks are claimed to save many trips to the wood shop after wood blocking. The outfit consists of three elements, a jack, block and pipe extensions. The jack screw is made with a point and a flat surface at opposite ends. The screw can be reversed to bring either end in contact with the work. The jack body is also reversible and is provided with a flange which permits it to be used with tubular extensions. The flange is so located and the tubular extensions are of such length that when combined any height between the maximum and minimum may be reached with the jack. Without tubular extensions the jack has a minimum height of 1¾ in. when using the point for supporting the work and 1½ in. when using a flat surface for the purpose.

The screw has an extension of ⅝ in. and is of such pitch and diameter that it will not run down when a



1—Application of T slot nuts, jacks and blocks. 2—Casler T slot nut. 3—The Casler lapping and filing lathe. 4—The complete Casler reamer holder fitted to adapter for use in Jones & Lamson turret lathe

chattering cut is taken on the machine. When two or more tubular extensions are used with the jack, these are held in position by one or more of the blocks.

The Casler reamer holder was designed on the theory that in order to ream a straight, true hole it is necessary to hold the rear end of the reamer concentric with the spindle and with the hole to be reamed. The illustration shows the reamer holder complete and fitted to a sleeve or adapter *D* for use in a Jones & Lamson turret lathe. *A* is a face plate of machine steel, pack hardened and ground; *B* is the reamer holding collar of machine steel pack hardened and ground; *D* is a bushing or adapter of cast iron which fits the tool holder on the turret; *H* is a cone-shaped centering plug of machine steel, pack hardened and ground.

The theory on which the design of this reamer holder is based is contrary to that of the floating reamer, and it is claimed by the manufacturers of the device, the Marvin & Casler Co., that floating reamers are being abandoned by manufacturers.

One of the accompanying illustrations shows the Casler lapping and filing lathe. The tool is equipped with ball bearings at each end of the spindle and was designed for use in lapping small holes, thereby taking the work from a more expensive lathe. It may be equipped either with the twin screw drill chuck or the three jaw chuck.

Special Tariff in Effect for Czecho-Slovakian Automobile Factories

A NEW regulation of the additional duties has been announced for Czecho-Slovakia in effect from Jan. 1, 1922. The customs tariff itself has not been changed, but the coefficients for the single tariff positions have been increased very much and the highest coefficient at present used is 30. The duty to be paid is calculated in such a manner that the original or fundamental duty is multiplied by the corresponding coefficient. The exchange value of the Czecho-Slovakian krone is oscillating like the German mark and the custom tariff with such fixed coefficients cannot be an ideal one. In every case it will be a protection against the competition of the countries with low exchange value like Germany and Austria, for the average addition of duties is 70 to 200 per cent and more. In the following table the original duty and the old and new coefficients are represented for comparison. As evident from reference to the single tariff numbers, the Czecho-Slovakian automobile factories have a special tariff.

Tariff number	Designation of ware	Original duty in kronen for 100 kilograms	Coefficient New	Coefficient Old
320 e2	Casings and air tubes for automobiles and motor cycles.....	150	20	16
445	Sheet ware:			
	(a) Raw sheet iron.....	18	16	10
	(b) Sheet iron, coarsely painted	23	16	10
	Remark to No. 445: Pressed or stamped sheet ware, like frames, running boards, wheels, rims, tires for *automobile factories* with special allowance under special conditions	..	5	..
471	Springs:			
	(b) Other springs, also for automobiles	21	16	7
	Remark to No. 471: Automobile springs for *automobile factories* with special allowance, etc.	21	5	7
483	Wrought iron ware, also in connection with cast iron and wood:			
	(a) Raw or scrubbed or coarsely painted, with a piece weight:			
	(1) Of more than 25 kilograms	10	16	7
	(2) Of more than 3 to 25 kilograms ..	12	16	7
	(3) Of more than 0.5 to 3 kilograms..	14	16	7
	(4) Of 0.5 kilogram or less	16	16	7
	Remark to No. 483a 1-4: Fittings for *automobile factories* with special allowance, etc...	..	9	7
483 c.	Ball bearings, except to those for cycles, well machined, with a piece weight:			
	(1) Of more than 25 kilograms	30	3	7
	(2) Of more than 3 to 25 kilograms	32	3	7
	(3) Of more than 0.5 to 3 kilograms	36	3	7
	(4) Of 0.5 kilograms and less	40	3	7
539	Dynamos and electromotors also in inseparable connection with mechanical devices and apparatus, with a piece weight:			
	(1) Of 25 kilograms or less..	72	30	7
	(2) Of more than 25 to 500 kilograms	50	30	13
	(3) Of more than 500 to 3000 kilograms	43	30	13
	(4) Of more than 3000 to 8000 kilograms	36	30	13
	(5) Over 8000 kilograms....	24	30	13
	Remark No. 539: For starting, ignition and lighting devices for automobiles	..	3	..
553	Automobiles, motor cycles, chassis with or without engine, with or without body, and bodies, imported apart without considering the weight...	65% ad valorem	..	..
554	Engines for motor vehicles, at separate transport:			
	(a) Airplane engines	15,000	1	..
	(b) Other engines:			
	(1) Up to 50 kilograms.	6,000	1	..
	(2) From 50 up to 250 kilograms	5,500	1	..
	(3) From 250 up to 500 kilograms	5,000	1	..
	(4) More than 500 kilograms	4,500	1	..
	Remark to No. 554: Single parts of these engines, all over machined and imported apart, have to pay the same duty like the whole engine, if the importer proves the fact, that this part belongs to an engine of corresponding species and corresponding weight. If the importer cannot prove that, then the parts have to pay the duty for Number 554 a resp. b. l.			

Tractor Service Has Been Neglected —It Must Be Improved

Research is necessary to determine service costs. Operators and oils are "trouble twins" of tractor service. Education in tractor operation needed to reduce maintenance difficulties. Tractor maker must approximate service practice of automobile manufacturers. The views of a tractor man.

By G. M. Gillette*

IN my opinion the matter of field service on threshers and tractors has not received the attention from manufacturers which it demands. Manufacturers spend thousands in engineering to effect savings in design and other thousands for special machines to accomplish a saving of a few cents each in the cost of manufacture of a part of a machine, while service in the field, which in many cases represents nearly as much as the total cost of direct labor employed in the manufacture of machines, is given little attention.

By service, as here discussed, I mean the labor, material and attention which is given to machines after passing into the hands of the purchaser.

If I should now ask the various manufacturers present as to the average cost of such service in the year 1921, based on the number of machines sold in 1921, I doubt if many could answer, and I also doubt whether you could give the ratio or percentage of service cost to the manufacturing cost of your machine. Nor do I believe there is a uniformity of practice in apportioning the cost of service. Some may add this cost of service to the manufacturing cost, others may include it as a part of sales expense, while still others would attempt to subtract it from the residue of profits which now do not exist.

Field Service Division

Field service should probably be considered under two heads:

(a) Service which should be gratuitous.
(b) Service which should be paid for.

Many abuses have grown up under the customs of the trade. Competition has increased gratuitous service, especially on tractors, to an unwarranted degree. The farmer has been encouraged to make unreasonable demands. The causes of this are in part that manufacturers have put out machines that are not entirely perfected. Salesmen have over-sold their goods and made unwarranted promises. Varying conditions, soil, moisture, etc., have created unexpected troubles.

Some of the demands for service are being lessened. Ignition troubles are less frequent than a few years ago. Gear troubles are disappearing with the adoption of better materials, better workmanship and heat treatment. Carburetion troubles are not over on machines burning gasoline only by reason of the lowering of the quality of the fuel, and in the burning of the lower grades of fuels perfection has not yet been attained.

I would consider oiling systems, and the varying quality of the oils used in lubrication, to be one of the principal sources of tractor troubles to-day, not attributable to the manufacturer, but largely to the user and to the oil situation, and to the false economy used in attempting to get away with poor oil.

Other reasons for demands for excess service arise not from the warranties, but from demands beyond the terms of warranty and lack of adherence to a uniform well-established sales and business policy, but in my judgment the greatest cause of demands for excess service arise from the fact that there are too many incompetent operators driving tractors. I am inclined to believe that the two O's, operators and oils, are the "trouble twins" of service.

In view of the known present excess cost of service, is it not fitting that we should attempt to find a remedy? Let us consider:

First, shall the present method of handling service be continued by the manufacturers themselves?

Second, is it possible to devise a means by which service may be delegated to independent service organizations?

Duties of the Service Department

If the present service system is still to be maintained by the manufacturer, what should be the duties of such a service department?

1. It should participate with the Engineering Department in the testing of any new models. I believe the experience of all manufacturers will sustain the contention that the Service Department should participate in the actual tests and operations of new models as its criticism will be of value and effect ultimate economies.
2. It should conduct demonstrations in co-operation with the Engineering Department. I say this, for in my opinion the operators should be under one control.
3. It should advise the Sales Department of new uses to which tractors may be put.
4. It should service the user, the owner and the operator, as well as the machine.
5. It should have a part in the production of instruction books to users.
6. I am in doubt whether the Service Department should be under the jurisdiction of the Sales Department or not. There are arguments on both sides.
7. Service cannot be divorced from sales, and frequently service men are of the greatest value to salesmen.

I am a strong believer that a service man should possess the germs of salesmanship, and that he should also be inoculated with the virus of the Collection Depart-

*Paper read before Tractor and Thresher Department of the National Association of Farm Equipment Manufacturers.

ment. At times it is not less important that he should have the diplomacy of an adjuster. Not infrequently upon the service man's report, or on his opinion, must rest the determination whether service should be paid for by the user or furnished gratis; or whether a free replacement should be made, or whether it should be paid for.

The service department should thoroughly educate its operators. It should also instruct the dealers and when a manufacturer's service man makes a delivery he should thoroughly instruct the buyer and operator.

The development of the tractor and thresher has not as yet reached such a state of perfection, either in design or shop workmanship, that gratuitous field service is absolutely unnecessary, and that occasions do not arise where errors should be charged back to the engineering or operating department, and gratuitous service must be furnished the buyer.

I wish I had statistical information which I might furnish you, showing how much greater is the demand for free service and gratuitous replacements on machines sold on time than on machines sold for cash, but the experience of our competitors is different from our own if they have not found that the most unreasonable demands come from those who have only made a small payment on their machine, rather than from those who own and have actually paid for their machine.

I also believe that the service department, in conjunction with the engineering department, should direct and operate schools of instruction for operators and users. Some of you do this, I believe, with excellent results.

I believe most of us have outgrown the old idea and the old sales talk that anyone can operate a tractor. The sooner we learn and the sooner the users learn that any machine requires intelligent use and good care and careful watching, the sooner will we see a decline in the demand for unnecessary service and the sooner will we see a more profitable use of the machine by the buyer. Every move made to educate the buyer and the user to give a machine better care and more intelligent use will result in an increased demand.

All the above things, in my judgment, must be accomplished by the service department if it fulfills its functions, if the manufacturer is to continue to perform the field service as in the past, and many of these things must be done by the manufacturer whether he continues field service in the present manner or not.

Let us now turn to the second phase and consider whether it is practical for the manufacturer, either through his branch houses and his own operatives, or through the dealer, to abandon field service and to turn its functions over to independent service organizations. I am not yet thoroughly convinced that such a plan is widely practicable. I am convinced that in many territories it is entirely practicable. Such a plan, however, can be successful only if it has the hearty support and co-operation of all manufacturers and most of the dealers in the territory where it is tried.

There is an enormous waste in the present system, not only from the abuses which have been heretofore indicated, arising from unreasonable demands and lack of intelligent operation, but in territories where various manufacturers have just begun to operate and have as yet but very few machines. There are many territories in the country where a large number of organizations maintain service departments which are not kept busy, but which, nevertheless, they are obliged to maintain to give necessary service and to meet the conditions which their competitors impose.

Difficulties surround the attempt to entrust service to independent service organizations.

1. There is a lack of confidence among the manufacturers in each other. They fear that service would not be impartial, or else they fear that it would be.
2. The difficulty of finding garages or service stations familiar with various makes of tractors and their peculiarities and competent to perform the service.
3. The impossibility of getting an independent service man to service the user and operator as well as the machine.
4. The difficulty of properly working out detailed arrangements for supplying spare parts.
5. The difficulty of securing the co-operation of dealers in a given locality as some dealers would have service facilities and desire to use them, while other dealers would not.
6. The difficulty of entrusting to an independent dealer the question of adjustments and the determination of whether replacements should be gratis or paid for.
7. Finally, whether the dealer would give proper instructions to owners and operators which would leave them as well satisfied as with the manufacturer's own service department. On the other hand, if in certain territories service could be thus entrusted, it is my judgment the industry would find it a great economy.

When we get back home let each one of us investigate this matter of service. Let each one determine and find out, if he can, how much his service cost him in 1921 and how much his service cost him per machine sold in 1921.

Let each one carefully go into the question of gratis repairs and replacements and determine whether his past policy has been a sane and sound one, and whether it should be continued; and each one determine how far the gratuitous service given is in excess of just demands.

Let each one determine whether in fixing his sales price he has based his manufacturing cost on manufacturing cost plus service, or his selling cost on selling cost plus service, and if not, whether he has any profits against which to deduct it from under present conditions.

Let us consider whether the furnishers of accessories and parts are performing their full duties to the manufacturer and the user, or whether they are unloading to the manufacturer their burdens under the present system. Let us consider whether the dealer, agreeing under his existing contract and for the commission received to give proper service, is doing what he has agreed to do, or is throwing the service back on the manufacturer.

Let us freely compare our views, and so arrive, not by agreement, but by reason and a comparison of views, at a sound basis on which service should be furnished.

Let us get after our various sales departments and determine whether under competitive conditions they are promising and giving unjustified free service and robbing the manufacturer of his profits, or rather increasing his losses.

The buyer is entitled to service. He cannot afford to have the machine lie idle either at seed time or harvest. The manufacturer should readily and willingly and quickly remedy his own defects, and he must provide stocks of spare parts at accessible points, but it is time for the thresher and tractor manufacturer to approximate the methods and practices of the automobile men.

THE increase of motor traffic in the Blackwall Tunnel in London has necessitated an improvement in its ventilation. Whereas in past years the occasional presence of fog in the tunnel was not associated with any real inconvenience, it was found during a recent period that the association of petrol fumes and other gases with fog made conditions in the tunnel so bad that workmen and others were overcome.

Making Salesmen Out of Automotive Factory Workers

Man is not a machine, hence the measure of his efficiency is not the ratio between energy expended and useful work done. All men in an organization should be salesmen of service. If the workmen in a plant are considered, and consider themselves, as salesmen, marketing is made easy.

DECLARING that men cannot be regarded as mere automatons and that the human element is the great unknown quantity in industrial activity, Norval A. Hawkins, addressing the Society of Industrial Engineers, in session at Detroit, Friday, April 28, made a striking plea for salesmanship as a factor in scientific management.

"The work of the industrial engineer has to do with increasing efficiency," said Mr. Hawkins. "If I were to ask just what you mean by efficiency you would with one accord define it as being 'the ratio between energy expended and useful work done,' and that's where I think you're wrong!

"Applied to locomotives, engines and drill presses—yes! But to man, with his hopes, his ideals, his heart and his soul—never! Efficiency is a human problem, for without man, with his wants and his aspirations, all our machines of wealth and power fall into heaps of rust and ruin. Efficiency as an element in human progress is always measurable in the spirit and power of ideals. Human efficiency is the ratio between what I am and what I can and ought to be—between what I do and what I can and ought to do.

"Man is the 'unknown quantity' in the equation of industrial management. He, after all, is the 'XYZ' of industry because he has within himself the power of changing.

"You can't compare man with the inanimate.

"Parts made of steel, iron, brass, nickel, wood and leather can be assembled by a man into an automobile. The combination always stays an automobile until it is changed from without. The automobile cannot make itself into a typewriter or a machine gun.

Basic Difference Between Men and Machines

"Things are that way. They have no inherent capability for altering themselves in even the slightest degree. Hence, they are easily handled. Once placed anywhere, they 'stay put.' The automatic machine continues to turn out bolts; there is no possibility that it may change its mind and produce nuts instead.

"But man—how different!

"He has the power of continual and unlimited change. Told to do one thing, he may do any of fifty other things instead. He cannot be depended upon until he has been proven thoroughly, and even then he is apt to make mistakes.

"No matter how completely a man has been instructed, or how ably he is directed, his efficiency depends upon a variable factor—his initiative power for change. The man can ignore his instructions and disobey or alter his directions.

"You can pick up a slide-rule any time you want it without giving it a smile, and it will do its little job for you quickly, unquestioningly and without a grumble. Then you can throw it down and pay no more attention to it. You need show no special interest in its performance. You do not need to help it with encouragement or advice; and when its work does not bring the result you wanted, you can show it all the temper you please. Above all, you never need to tell your slide-rule the reason why. It will work just as well for a bully or a grouch or a snob as for a real man—but men won't.

"A slide-rule will do its best for you whether it knows your purpose and is interested in your efforts or not. Men won't.

"I'm not attempting to say whether human nature is right or whether it is wrong—I am merely stating the conditions.

"As a salesman I attempt to meet these conditions as I find them.

"I think you need sales managers to help you work out some of the problems of selling the ideas of industrial engineering more effectively.

"Not only do you need sales managers but you need salesmen. Every man connected with our respective organizations should be a salesman.

We Are All Salesmen

"Since joining the General Motors Corporation I have been emphasizing to everybody with whom I have contact that they all are salesmen. Mr. Pierre duPont is our salesman president. Mr. C. S. Mott is our salesman chief of staff. Mr. C. F. Kettering is our salesman chief engineer, and so on down the line even to the porter who cleans the halls of the General Motors Building.

"I am talking salesmanship in its broadest sense—I am talking the salesmanship of service.

"Sales and service are so closely linked that the first cannot succeed without the second. I say to all our salesmen, 'You must be service men, every minute that you are selling.' And I say to our service men, 'You have an opportunity to be the very best salesmen in our entire organization.'

"The true salesman is the man who injects real human interest into his job of serving his fellow men. I believe the best salesman we have is the workman who takes pride in his task and who builds that pride into our products. The salesmen who meet the public and get the orders are not nearly so important to the success of our business as the salesmen in overalls who really love their work. As a sales manager, give me 100 per cent salesmanship in the factory, and my job in the field will be easy, for the best sales manager in the world cannot make a permanent

success of marketing a product indifferently manufactured by employees who have no pride in their work.

"When you tackle a job of industrial engineering, you should think of the workmen in the plant as your salesmen, and use sales management ideas to get them to pull with you in teamwork. Open their eyes and make them see beyond their machines, outside the factory to the customers who will use what they make. Get them interested in the people who will buy the product. It is human nature to do a better job when the man you are doing it for is standing at your elbow. You should make the workman feel the presence of the buyer right in the shop when the goods are being made. There is no better cure for inefficiency and indifference than arousing real heart interest in the work.

Workman Must See Through Salesman's Eyes

"Extend the workman's interest and broaden his perspective so that he will visualize the product in use and make him feel that his work is a part of the actual service to the user. Teach him to think of the customer as 'his boss'—the man who actually meets the payroll. Personalize the things that are being made. Inject a touch of human interest by telling the workman that he is the company's best salesman. Change his viewpoint by getting him to see things through a salesman's eyes. If you succeed in accomplishing this, the rest of your problem will be easy.

"The ordinary workman is antagonistic to industrial engineering simply because he thinks you are making him work harder and thus earn more profits for his employer. As long as the workman regards you in that light, he will oppose your efforts to improve his efficiency. You can compel him to obey, but unless he is sold on the idea, your plan will not prove permanently efficient.

"Show him the direct relation between the sales of the company and his steady job. Point out that his only competitor is a similar employee in a competing shop. Point out to him how he can help himself by helping to sell the product through the care with which he makes it. Then and then only will he be inspired by the enthusiasm of the true salesman. There isn't any employee who works so hard for his employer as the true salesman. He does not watch the clock. He is tireless and he will fight for his concern as whole-heartedly as he would battle for himself.

"The ordinary workman is not like that. It isn't a matter of the money the two employees make. Plenty of workmen get as big pay checks as the salesmen of the house. The difference is in the viewpoint.

Teach Workmen to Say "We"

"The salesman says, 'WE,' when he refers to the company. The ordinary workman says 'They.' As industrial engineers, it is your duty to change the defiant 'They' into a co-operative 'WE.'

"Similarly you need to change the language the employer uses. He must get the habit of thinking and saying 'We' instead of 'They.' It will take a lot of sales management to get that idea across to the boss nowadays. You must train both labor and capital in salesmanship principles if your engineering job is to be of lasting benefit.

"Sales management is the answer.

"I do not suggest sales management as a substitute for industrial engineering, but as a supplemental and necessary team work. Such a combination will enable you to do your work most effectively and permanently.

"Sales management will help to broaden your outlook. Professional men are not apt to get into ruts. The salesman who succeeds is never narrow. Generally speaking, the more broad minded a salesman is the more successful he is. As industrial engineers, your efficiency and progress will be largely determined by the breadth of your vision.

"There are no problems of life involving relations between man and man that salesmanship cannot aid in solving and salesmanship is made more effective by sales management. So I emphasize your need of knowing how to sell, and the correlated need for sales management in all your work.

"Your motto then is 'Service to Industry.' Salesmanship and sales management are both dedicated to service. You and I are brothers in purpose. We should not be merely distant relatives and longer, but should cultivate a feeling of sympathy, and get together in understanding and pull together for the common good of all the world."

British Motor Truck Transport Alarms Railways

MOTOR truck transport in Great Britain has grown during the past five years to an investment of $550,000,000 in 3000 lines, which, in 1921, carried 6,000,000 tons as auxiliary to the railways, as reported by the Department of Commerce based on statements by R. P. Skinner, United States Consul General at London, and by other agents of the department in Britain. The rate of growth of this character of transport is shown by the fact that in 1916 there were only 600 trucking lines.

Inasmuch as freight rates there are inclusive of truck haulage costs for collecting and delivering, the railway companies make an allowance of reduction from regular rates if the shipper or receiver maintains his own truck haulage system. The truck rates are based on an average of 14 cents per ton per mile for twelve miles, longer hauls yielding less per mile per ton and shorter hauls more.

Most of the truck lines are owned and operated by private companies or by individuals, although several railway companies maintain such service for haulage away from their lines. The reports say that increasing numbers of heavy shippers are establishing their own motor truck lines even for long distances, sometimes all the way across the Isles.

"Railway companies in Great Britain," Mr. Skinner writes, "are being offered serious competition by motor highway transport, which is making great headway and is viewed with considerable alarm by railway officials.

"However, in some quarters its importance is thought to be overestimated, because motor traffic will ultimately be compelled to bear its proportion of taxes for maintenance of the highways; furthermore, doubts exist as to whether motor transport companies are setting aside proper sums for repair and renewal of vehicles."

THE possibilities of foreign trade with the Union of South Africa are well set forth in a booklet recently issued by the National Foreign Trade Council. The Union is adequately described from an industrial and agricultural point of view and the resources of the territory are set forth in an interesting manner. Although the booklet is general in character, one section is devoted to the automobile market.

Japanese Will Buy Few Cars and Trucks in 1922

Among the factors contributing to this are: numbers of unsold cars on hand at war prices and high taxes based on horse power which throws American cars in luxury class. Trucks holding their own due to low price and reputation for superiority. Import business will be light this year.

By William I. Irvine*

THE present market for automotive vehicles in Japan is poor and in all probability will continue to be so for the balance of the year. This is practically the unanimous opinion of the majority of dealers in Tokyo and other large cities, representing more than 50 per cent of the motor vehicles in use and fully 90 per cent of those imported.

The above paragraph gives the sum and substance of an automotive survey of Japan, outlining the possibilities of automobile export business in that country which has just been completed by Automotive Trade Commissioner William I. Irvine for the Automotive Division of the Department of Commerce. Several months were spent in making this survey which gives a comprehensive outlook of the passenger car and truck business which American exporters may expect in the Far East. The report goes on to say that:

"The greatest contributing factor to the poor automotive sales outlook is the business depression which Japan is now experiencing, which has not only seriously curtailed the sale of new vehicles but has caused owners of passenger cars to put their machines up. The use of passenger cars has been discontinued because of the high cost of operation. The absence of a sufficient volume of freight and the lack of demand for quick delivery does not warrant the use of trucks.

"The situation is further complicated, from an automotive viewpoint, by the large number of unsold vehicles. A careful survey among the dealers reveals that there are at least 750 passenger cars and 250 trucks unsold. Nearly all of these were purchased prior to the price reductions made during the past 12 months in the United States. Dealers tried to maintain prices for more than a year but market conditions did not warrant such action. The vehicles have remained in government warehouses in most cases in order to defer paying the duty charges ranging from 25 to 35 per cent ad valorem.

"Dealers are now cutting their prices in order to meet the demands of the banks which financed imports, and both passenger cars and trucks are being offered at prices below cost without much success. The accumulated charges from insurance, storage charges and interest, averaging about 9 per cent on capital invested in the unsold cars, results in a high selling price, about 100 per cent above American prices. With but few exceptions Japanese dealers claim to be running business at a loss or to be just breaking even. These claims seem reasonable, especially with large dealers, on account of the large overhead represented principally in the large work shops built during the boom period for service and body building.

"A number of the more responsible dealers have raised the question of price protection. They maintain that at the present time they are holding motor cars bought at prices which to-day are higher than the present retail prices in the United States, and that the large stocks of these, even when sold at a loss, must be offered at prices higher than the price of cars of later design recently imported.

"Generally the men taking this stand are the strongest financially and consequently were in a position to finance large shipments during the boom period, with the result that they have large stocks to-day. They are now called upon to compete against smaller dealers who were not in a financial position to import in quantity, and, consequently, were not caught with many cars when the market broke and are now able to import at prices which permit them to undersell the larger dealers and make a profit. This has resulted in the sale of cars heretofore almost unknown to the detriment of the products of those manufacturers who support their equipment by financially sound dealers who are in accord with the maker's principle of service for every car sold. The smaller dealers, of course, do not maintain either service stations or repair shops, and, generally speaking, do not carry adequate supplies of spare parts. This jeopardizes the service reputation of American vehicles, which, while not perfect when considered by the standard established in the United States, is far above that of European manufacturers who, in this market at least, are not insisting that their representatives carry stocks and maintain service stations.

"Another factor operating to the disadvantage of American cars is the high tax rate in Tokyo, the center of the automotive trade in Japan. The taxes there are the highest in the world at the present time and are levied on the unsound and impractical theory of horsepower based on the cylinder bore. As American cars generally have wider cylinders than those of European make they fall in the highest tax classes. The formula used for determining the horsepower by the taxing authorities is: square the bore, multiply by the number of cylinders and divide by three. This places the cheapest American car in the same class as the highest priced European make.

"The European manufacturers have taken advantage of this opportunity to re-enter the market, and the result may be seen in the fact that the share of the United States in Japan's imports of automotive products fell from 95 per cent in number and 93 per cent in value

*Report to Automotive Division of Bureau of Foreign and Domestic Commerce.

in 1920 to 77 per cent in number and 66 per cent in value in 1921.

"Japanese dealers who represent American manufacturers have succeeded in having a reduction made in the tax rate, through continual agitation since the high taxes went into effect on April 1, 1921.

"The combination of reduced incomes and taxes created an opportunity for the importation of light cars of known economy in fuel consumption and low power rating. These vehicles, mostly imported from Europe, have been gaining in sales during the past year and present indications are that they will increase in the coming year, although dealers believe that the action of the authorities in cutting the taxes to a greater degree on higher powered cars than on those of lesser power will have a tendency to check sales.

"However, the consensus of dealers' opinions, including those handling light cars, is that the popularity of the light car will be short lived, especially among those people who have used the heavier American cars. Light cars on the bad roads of the country and unpaved streets of Tokyo subject their riders to great discomfort, while American cars, built to meet the most varied road conditions, ride easier and afford their riders a greater degree of comfort. Rear axle trouble and broken springs are common faults with the light types of motor cars.

"The Italian Fiat which sells for 7,000 yen, has been the most successful of the light cars from a viewpoint of sales. Next in popularity is the open French Renault, which sells for 7,500 yen. This is followed by the British Bean, a light car of less than 10 horsepower, the touring model of which sells for 6,000 yen. There are several other French cars, the Citroen and Mathis, which are fairly popular. In addition several freak German cars have made their appearance in the market, but they are very small and lightly built and are not deemed suitable for the conditions of the market.

"European quality cars are, on the whole, selling better than cars of similar class of American make. Sales are reported of the British Crossley, Armstrong-Siddeley, Daimler and Sunbeam cars; the Austrian Daimler; the French Renault; the Italian Lancia, and the German Opel and Protus. The prices of the above cars range from 15,000 yen to 20,000 yen, with the exception of the German makes, which have no fixed price, but vary from 6,000 yen to 12,000 yen. These last figures on German cars cannot be relied upon because each new car has a new price, the manufacturers still being unable to set a definite selling price.

"The principal buyer of quality cars is the Imperial Household Department, which normally takes about one-third of all quality cars imported. Generally the European quality cars fall in the 15-20 horsepower class and are very economical in fuel consumption, averaging above 20 miles to a gallon of gasoline.

"The prices given above are asking prices; final prices are a matter of negotiation through the series of intermediaries who collect commissions between the buyer and seller. However, the figures will not vary more than 10 per cent.

"American trucks continue to hold the market in Japan, the best of them being cheaper than European makes. In addition they enjoy the advantage of a general belief that they are superior to European trucks. None of the latter is being sold at the present time and there is little likelihood of their getting a start this year, is the opinion of various dealers. The principal sales of American trucks are being made to the Government and municipality.

"There is no large stock of motorcycles on hand, and so far they are lightly taxed. About 75 per cent of the machines in use are of American make and it is reasonable to assume that their position will not be seriously threatened by the European machines now being imported. American cycles are cheaper and stronger and although they are well entrenched in the public favor, sales are apt to be small but steady during the balance of the year.

"Imports of both passenger cars and trucks will be light this year because of the number of cars remaining unsold, which is about 10 per cent of all motor vehicles in the country. In all probability the market for trucks will be better than for passenger cars, as the number of former remaining unsold includes quite a few models and types unsuited to operating conditions and present understanding of automotive transportation."

HERE is the first published report sent back by Automotive Trade Commissioner William I. Irvine, who has been sent to the Far East to get practical merchandising information for automotive manufacturers. Irvine left the United States at the beginning of 1922 and has spent the last four months investigating conditions in Japan.

He makes some frank statements in this interesting article about the condition of the automotive market in Japan. He is quite specific in regard to the foreign companies which are giving American manufacturers the hardest competition in this market. He says that American passenger cars are losing ground and gives the reasons for this condition. He tells why American trucks continue to hold the market.

You will want to read carefully this brief, practical business report if you are interested in marketing your product in Japan.

More Commercial Flying in America Than Great Britain

A BRITISH contemporary makes a comparison of the amount of flying done in Great Britain and the United States the past year which is greatly to the credit of American flying. According to a White paper on the present state of flying recently issued in England on the London-Paris route, which is the only one in which Great Britain has any real share, while the arrivals and departures total 2394, the British share is only 671, which is 28 per cent of the total. The total of 17,000 flights which is given in the White Paper includes a good deal of flying which has nothing to do with air services in the ordinary sense of that expression. A report recently issued by the Postmaster-General for one month—October last—the distance covered by the U. S. air mails on three principal routes was nearly 160,000 miles, equaling nearly 2,000,000 miles a year on mail services alone. The American statistics also show that the air services have been operated at an average cost of $0.77 per mile, this figure including repairs and all running costs. In Great Britain people interested in air development have come to recognize the necessity of building up a productive organization for air services.

Business Books are an Aid to Executive Efficiency

Recent publications deal with automotive industry, banking, foreign trade, and personnel. "Life of George Westinghouse" is an inspiring business biography. Other new books are of practical value to the busy executive.

WHILE the average business man may not feel that he can take time to read all the latest works on industrial subjects which appear, he will find many times that new books serve as very complete sources of information for reference and will be of more value to him in that respect.

Present-day industry is so complex that one can hardly hope to master all the matter related to various divisions within an industry. One can know fundamentals and a specific line and from then on supplement information as the need appears, by using authoritative books. As to the books to be used for this purpose, the increasing complexity of the divisions of industry necessitate a constant replacement or addition of new books.

To those who have, or are establishing, a company library, information regarding new books should be welcome. The value of such a library is hard to estimate, but the fact remains that there is value. There are always some in an organization who will make use of such a library. It will encourage the rest in the reading of books which are a valuable source of information, too often unattainable elsewhere. Individual betterment will result to a greater or less degree to those who make use of this opportunity.

Much is being done in the study of labor, marketing, foreign trade and banking, and the works which appear on the subject are continually increasing to our store of information. Some of these new works are reviewed in the following pages.

We have heard from so many sources and so constantly that our business men do not go after foreign trade as scientifically as the other large industrial nations that it may have become tiresome. The fact remains that if the business of the United States is to have a large market for its surplus goods it must go after it in the manner which brings results whether it means following the methods of other countries or not. If other countries are successful then competition must be met by going them one better.

"Foreign Trade, Markets and Methods," by Clayton S. Cooper, published by D. Appleton and Company of New York, deals with the method of carrying on foreign trade and shows where the various markets exist. The volume is divided into two parts; the first deals with the principles to be followed and the necessary facts which must be known before the trade can be carried on. The second part gives a careful analysis of all the world markets and the necessary methods to be employed in each case.

The author contributes valuable information in describing the various methods of carrying on business in the different countries in order that the trader may deal with the foreign business man and consumer in the manner in which they are accustomed. Emphasis is laid on the psychology of the people of the different countries. This is contribution of a vital kind because it remains a fact that trade between countries is the aggregate of individual connections. The success of foreign trade as a whole depends on the success of the component relations which in turn depends on a knowledge of the people with whom dealings are carried on.

Some improvements have been made in the "Engineering Index for 1921," which make it an even more convenient source of reference to use than the two previous volumes. This index, which has recently been published by the American Society of Mechanical Engineers, is composed of items selected from scientific and engineering publications received from all over the world, thus making it very complete.

To avoid confusion and lost time in seeking articles bearing on a subject, the items are arranged under main and sub-heads alphabetically, also cross-references have been worked out with great care.

"The old idea of thinking of men as so many kilograms of muscular energy to be bought, exploited, and scrapped when occasion demands, is reaping the harvest it richly deserves.

"Burst, likewise, is the bubble of paternalism which sought to determine for labor what was good for it and feed it accordingly.

"Executives are now coming to realize that their workers are not a bulky mass but a group of individuals."

It is with this idea in mind that Walter Dill Scott and M. H. S. Hayes, the authors of "Science and Common Sense in Working with Men," recently published by the Ronald Press, have written concerning the problem of dealing with men in industry.

The various mental, physical and technical ability tests are dealt with and the less easily handled problems of judging character and ascertaining desires, and other material of real practical value.

It may be said that a vast number of people do not know that George Westinghouse made safe, high speed transportation possible. Even those who do know about him cannot fail to be impressed, on reading his biography, with the great number of things that he turned his hand to with success.

The American Society of Mechanical Engineers in bringing out the lives of its noted members, has chosen "The Life of George Westinghouse" as the second of the series. Charles Scribner's Sons, New York, are the publishers.

Westinghouse carried on a great number of projects at the same time and for this reason, to avoid confusion, the biography is segregated according to topics rather than being written chronologically. This arrangement permits reading the book with the idea of determining just what part Westinghouse played in any particular enterprise or invention.

The biography should be interesting reading for engineers, but also to laymen without engineering knowledge,

for the character of the man stands out through all his varied activities. To those who are making a study of transportation, there should be a distinct appeal for a thorough knowledge of the evolution of transportation is impossible without an understanding of Westinghouse's contribution.

"To give a comprehensive exposition of the theory and practice of commercial banking in the United States" is given as the aim of the book "Banking, Principles and Practice" by R. B. Desterfield, Ph.D., Assistant Professor of Political Economy, Yale University. The book has recently been published in five volumes by the Ronald Press.

That the entire range of banking is covered is shown by the subject matter. Beginning with the elements of money, credit and banking and description of the system it passes through the internal operations and organization of domestic banking to operations of the foreign division.

This work should prove of value as a book of reference to the business man as well as to those in the banking business proper.

To those who desire information, general or detailed, regarding the New York Stock Exchange, J. Edward Meeker's "The Work of the Stock Exchange" should prove valuable. The Ronald Press Co., New York, are the publishers.

This work shows the growth of the Exchange from its early days to modern times. Beside giving the operations of the Exchange in detail, it describes its economic function in relation to the business of the Nation, and this latter should bring about a greater understanding of the Nation's financial system to the reader.

Foreign Trade

American business men have much to learn from their European brothers in the way of efficiency and many other things, in the opinion of Dwight T. Farnham, consulting industrial engineer, whose book, "America vs. Europe in Industry," has just been published by the Ronald Press.

This book, which contains many things in its opening chapters that will probably cause the American "cold-blooded business man" to laugh and say, "It's bunk," is one that is full of facts and well worth studying. For the things that Farnham sets forth are important things to the European, even if they are not to the American. As he says:

"America is now a world power and owns a mercantile marine. We must do business abroad increasingly as the years pass. To do this we must understand the foreign business man and his methods. The art of negotiation is not a game for amateurs. Provincialism must give way to finesse. We can't afford to hate foreigners because they don't understand us."

Farnham has recently completed a tour of the principal industrial plants of England, France, Germany and Italy and he gives in his book a clear picture of what is being done there. Furthermore, he shows why it is being done and he has discovered the real troubles of these European countries. Practically every phase of industrial management and operation is considered in this work, which is presented in such form as to make it interesting even to a layman. Certainly it will prove interesting and helpful to the man in industry. In the words of the publishers, it is a "graphic comparison of present European and American manufacturing methods, showing how Europe is preparing to give us a stiff fight for the world's trade."

One of the pioneers in the use of crude oil as an industrial fuel, having been engaged in the development of crude oil burners and the design of burner installations since 1887, has recently written a book under the title of "Burning Liquid Fuel" which has been published by the U. P. C. Book Co. William Newton Best, the author, has succeeded in writing a book of a thoroughly practical character and gives examples of the application of oil-burning equipment in many industries. After an introductory chapter, the origin, production and analysis of liquid fuel are taken up, and this is followed by chapters on atomization, oil systems (means for supplying the liquid fuel to the burners), and refractory materials. From this point on the application of oil-burning equipment in different lines of industry and in transportation is taken up. Of particular interest to the automotive industry is undoubtedly the chapter on Heat-Treating Furnace Practice, which covers 23 pages and gives illustrated descriptions of numerous different types of furnace. The subject of oil-burning furnaces in iron and brass foundries is also covered.

Electric Arc Welding

Two electrical engineers, E. Wanamaker and H. R. Pennington, connected with the Chicago, Rock Island and Pacific Railroad, have written "Electric Arc Welding," published by the Simmons-Boardman Publishing Co. This book embodies their experience in the application of arc welding to railroad equipment and is confined almost entirely to a consideration of the autogenous electric arc welding process.

The material presented is systematically arranged for convenient reference. The evolution of welding processes from the ordinary hand-welding process of the blacksmith, through the electric resistance welding, thermit and acetylene welding processes to the various arc welding systems are briefly sketched. Next the equipment required in the arc process is described, and, following this, installations and accessories. The remainder of the book is devoted to such practical problems as the instruction of operators, carbon arc welding and cutting, electrode materials, preparation of work, welding of iron, steel and non-ferrous metals, railroad and structural applications.

The Automobile Repairman's Helper was originally brought out about two years ago. Since then a new edition has become necessary, and as in the meantime a great deal of new and interesting material on the subject of automobile repairs had accumulated it was found expedient to divide it between two volumes. The book was written by S. T. Williams and J. Howard Pile and published by the U. P. C. Book Co. In the second volume there are dealt with a certain number of repair jobs that are applicable to all makes of cars, and others that pertain to particular makes only. The general portion of the book covers inspection and lubrication, engine operations, cylinder, piston and crankshaft work, simple electrical testing, storage battery care and repair, pneumatic tire repairing, top work on open cars, simplified directions for welding, hand and machine tool practice, miscellaneous shop methods and systematic trouble shooting. In that portion dealing with particular makes of cars, repairs to twenty of the most popular cars and to a number of widely used components are described. The book should prove of great help to the practical repairman.

The thirty-fifth edition of "The Mechanical World Year Book 1922," an annual for the benefit of mechanical engineers, draftsmen and designers, has just been published. It contains mathematical tables and formulæ and a great deal of useful data on steam engineering, gas engines, Diesel engines, power transmission and machine shop practice. The volume is of pocket size and contains about 350 pages of text with 100 illustrations. It is published by Emmott & Co., Manchester, England.

The American Automobile Holds Dominant Place in Argentine Republic

The writer believes the American car will hold its position because it more nearly meets the requirements of the country. Service has been primary factor in securing this dominant position while low price unquestionably has been important and will remain so. Last year's stocks liquidated.

"THERE is no room for difference of opinion concerning the position of the American automobile in this country. The American automobile dominates here and it will continue to hold that position."

This is the opinion of Willard T. Clark of Henry W. Peabody & Co., importers of Buick cars, Goodrich tires, etc. Mr. Clark, in an article in Comments on Argentine Trade, the organ of the Chamber of Commerce of the U. S. A. in the Argentine Republic, says:

"The great war undoubtedly influenced this, but only in the way of hastening to bring it about. The fact that European competition was eliminated temporarily helped to establish the American automobile in its present position, but the same result would have been accomplished, although probably not quite so soon, had there been no war. Why is this statement made so confidently? Because the American car more nearly meets the requirements of this country, due no doubt in part to the fact that conditions here are more nearly like those existing in the United States than those existing in Europe. Comparing American cars with European, we have, for instance, lighter weight for a given horse power and more road clearance. These are important features, particularly when it is borne in mind that the bulk of the automobile business is in the country where the roads are for the most part very poor.

"The flexibility of the American car in high speed, making for easy driving, has done much toward increasing the number of owner drivers."

Prestige Gained Through Service

There is one respect in which the American car has established itself, and that is in the question of service. Mr. Clark says:

"That service in connection with automobiles was never understood as it is in the United States until American cars were well introduced here. Service is uppermost in the minds of automobile buyers here to-day, and in this the American cars are far in the lead. The American agricultural machinery houses which have been established in this market for some years have undoubtedly done much toward teaching the farmer and cattle raiser the value of service. The best equipped and the best organized service stations are those run by agents of American cars, and there are service stations here which compare favorably with the best in the United States. The fact that American spare parts are made to standard and do not require much fitting and are, generally speaking, lower in price that the European, is an advantage. While on the subject, it is proper to point out that the automobile service station in this country is called upon to perform the duties of several service stations in the States. For instance, there are no agents of American speedometers, batteries or electric systems who are prepared to give service, and the car owner would not be willing to go to them if there were. They look for service to the dealer from whom the car was purchased. In the United States, at least in the larger cities, the agents of these different accessories are obliged by the different manufacturers to maintain service stations, and the car owner is accustomed to apply to them and not to the automobile dealers for service."

American Cars Have Price Advantage

There is one other respect in which the American car should retain its position of leadership in Argentina and that is on the question of price. Mr. Clark says:

"Price is unquestionably a very important factor and an advantage which seems likely the American manufacturer will be able to maintain. American cars, light in weight, high in power, easy driving and economical, and at low prices, have within the past few years taken the automobile out of the luxury class and greatly increased its use. As the bulk of the business is not in the large cities, but in the country where the roads are generally poor, the demand is largely for the lower and medium priced car, those which are listed at present in the United States at $1,500 and less. In some sections of the country it is practically impossible to sell any other than the lower priced cars which come in the $600 and under class in the United States.

"The buying public here is, in the main, an intelligent one, and the disposition is to purchase the best for the purpose that the pocket will afford. It is an exacting public that appreciates quality and looks well into all details when buying a car. Especially in the matter of body work is it well informed and looks for the best, having for its standard the fine coach work which was turned out in Europe prior to the war. This is especially true concerning closed body jobs for city use. This has encouraged the building of bodies here to meet individual taste, and it is probably safe to say that there is as fine coach work done in Buenos Aires as in Europe or the United States."

Market Potentialities Underestimated

Regarding the future possibilities of the Argentine as a market, Mr. Clark says:

"It is very probably true that this market as a potential buyer of American goods has in boom times been overestimated in the minds of many of our people at home. But it is probably equally as true that the future possibilities of the country are not fully understood and are underestimated. The Argentine with a territory of almost three million square kilometers, rich in resources, has only about eight million inhabitants. It is producing to-day but a small percentage of its capacity. Development is sure to come and come rapidly with work

and the investment of capital. Those American firms who are prepared to supply these two elements, coupled with a knowledge of the country and a reasonable amount of patience, can reap a rich reward by establishing here and helping in the development of the country.

"The Argentines, who are natural lovers of sport, are enthusiastic automobilists, as witnessed by the number of races which take place every year in various parts of the country in the face of very adverse road conditions. They are very rapidly learning the commercial value of the automobile in business both in the city and country. They will be enthusiastic tourists and will use the automobile much more extensively commercially when we have better roads. At present, and excepting a few isolated places such as Cordoba, automobiling in this country is not a pleasure. But good roads, along with the development of the country, will come, and it is permissible to be hopeful that much progress will be made in the near future. The first National Good Roads Congress, under the auspices of the Touring Club Argentino, will be held in Buenos Aires on May 1 of this year, and this movement is creating a great deal of interest as well as receiving the support of commercial bodies and firms.

"Conditions are still far from normal. All of last year's cars have not been liquidated, and they are being offered at prices and on payment terms which keep the market unsettled to some extent. There has been a gratifying improvement in the exchange and a marked improvement in exports, more particularly of cereals, and the agricultural districts are for the most part in better condition than they have been. The crops in the South are poor in some parts, with total losses in others, and with rather small meat exports for many months, the cattle raising districts are in bad shape. In consequence the automobile business is good in some places and bad in others. Taken as a whole, it is much below normal, but in infinitely better condition than a year ago, and the future much less clouded.

"Opinions concerning trade conditions are influenced by personal experience, and opinions consequently will differ.

Automobile Show Sets Record

"Those distributors who have had the courage and the means to maintain their organization and keep up their efforts in spite of difficulties are breathing easier to-day and looking to the future with greater confidence than ever. Right along that line mention should be made of the Automobile Show held in Buenos Aires last October. In spite of unfavorable trade conditions, and the discouraging time the distributors were going through, the Automobile Show was the best ever held in this country and a credit to the trade."

The readjustment in the automobile industry with the importers, due to very heavy importations of automobiles purchased at peak prices during the first six months of 1921, has almost been completed. Some of the weaker importers and dealers were forced to discontinue their agencies and several went out of business. Some of the American manufacturers stood ably behind their dealers in connection with automobile commitments made during this period. Referring to this subject, Mr. Clark says:

"By far the largest percentage of these cars were consigned to the established agents here who paid for them in full, and have since liquidated most, if not all, of these old stocks, and 1922 models of some of the best known cars were in use in this country before the first of the year.

"The local distributors of some American cars were not properly organized financially or otherwise to do the business, excepting under war conditions when it was not particularly difficult to finance business and less difficult to sell cars, and it was to be expected that these houses would be unable to carry on in face of the difficulties which beset them, and it naturally followed that these houses liquidated. Of the cars which were in this way thrown back on the hands of the American exporters and the banks there are still a few unsold. It is gratifying to note that the agencies previously held by some of these houses have since been taken up by more experienced and better organized firms who, in spite of the depression which still exists, are doing more toward firmly establishing these American cars in this market than the old agents did in good times.

The Trade Slow to Feel Depression

"Much has been written concerning the causes of the depressed and chaotic trade conditions which were first felt toward the latter part of 1920, and to detail them here would be a needless repetition. This country itself was in excellent condition, but suffered the reflection of conditions abroad, and more particularly in Europe, which precluded the Argentine from exporting her products. Strange as it may seem, the effects which followed were not felt acutely by the automobile trade as early as they were by some other lines, and this may be responsible in some measure for the large quantity of automobiles which were imported in the face of such unfavorable conditions. All of the cars arriving here the first half of 1921, when most of the cars imported in that year did arrive, were bought at peak prices, and the great majority, if not all of them, had to be paid for at a loss in exchange which could not be recovered in the selling prices. The situation precluded advancing prices in sympathy with the rising exchange, and, generally speaking, there were no advances in automobile prices in this country after Jan. 1, 1921. In May or June of last year reductions began to take place in the States, and these were followed by further reductions later on. May it be said here to the credit of some of our American automobile manufacturers that they protected their foreign distributors upon each reduction in prices by crediting the difference in price on all cars still unsold in the distributor's hands at the time. And these same manufacturers accepted willingly the cancellation of orders, and did not increase the distributors' burdens by insisting upon their taking all the cars they had contracted for. But the reductions in prices did not offset the losses in exchange, and were consequently not reflected in a reduction in selling prices here until some months later.

Pessimism Gives Way to Brighter Outlook

"Yes, the automobile importers, along with importers of all other lines, have been going through a difficult and discouraging situation during the last eighteen months, and are not entirely out of the woods yet by any means. But to-day they look back upon the reports and prophecies of a year ago in the knowledge that they were in the main exaggerated and over-pessimistic. At that time there were large quantities of cars piled up in the custom house. But there was not a two or three years' supply, as some reports indicated; nor were all the cars left in the custom house for the account of American exporters or the banks because the importer could not, or would not, pay for them."

AMERICAN car manufacturers will play a dominant part in the Barcelona automobile show, which will be held from May 24 to June 5. Latest reports show that more than twenty American makes will be displayed.



The Bureau of Civil Aeronautics

Editor, AUTOMOTIVE INDUSTRIES:

With the passing of the Wadsworth-Hicks bills, in the near future, an important step in the development of the aeronautical industry will have been taken. These bills are the ones introduced in the Senate and House, respectively, to create a Bureau of Civil Aeronautics in the Department of Commerce. It appears to be generally conceded that they will eventually be passed, either in their present or in a modified form.

With the need of Government regulation of flying becoming more necessary daily, a few comments upon the scope and organization of this proposed bureau should be of general interest to the aeronautical industry. Strictly speaking, the proposed bureau has no exact parallel in other fields. Existing Government supervision of the railroads offers practically no comparison. In some ways present Government contact with the shipping industry offers comparisons. This contact, however, is divided between several departments, while in the case of aeronautics the new bureau would present a compact organization. Its very unity, in itself, promises close co-operation between the various subdivisions, to the great advantage of both the Government and the industry.

Contact with Shipping a Distant Parallel

The interest of the Federal Government in the shipping business is distributed mainly under the following departments and divisions: Department of Commerce, Bureau of Foreign and Domestic Commerce, Bureau of Navigation, Steamboat Inspection Service, Bureau of Lighthouses, Coast and Geodetic Survey, Department of Agriculture, Weather Bureau, Department of Labor, Bureau of Immigration, Navy Department, Coast Guard Life Saving Service, Hydrographic Office. Also, reporting direct to the President, the U. S. Shipping Board and the Emergency Fleet Corporation. If any parallel with aeronautics can be really said to exist, the new Bureau of Civil Aeronautics would operate the aeronautic services comparable with those rendered to shipping by the Bureau of Navigation, Steamboat Inspection Service, Bureau of Lighthouses, Coast and Geodetic Survey and the Hydrographic Office, with the probable addition of some lesser services peculiar to the aeronautical field. Several services, such as those of the Bureau of Foreign and Domestic Commerce, Weather, Immigration, etc., would function for aerial transport as for shipping.

Possible Form of Organization

Taking the activities of the proposed bureau as outlined in the bills, these may be divided into the four general heads of (1) examination, (2) regulation, (3) operation, and (4) investigation and research. Each of these four divisions calls for a certain amount of subdivision, even at the start, and further subdivision will become necessary from time to time as the work of the bureau grows in volume and variety. The accompanying diagram presents the writer's interpretation of a working organization resulting from a study of the bills. It is suggested to the industry as a basis for discussion of the subject.

Examination

Take first the work of examination. The intimate and finely specialized knowledge necessary to handle this end of the bureau's work appears to immediately call for subdivision into the branches heavier-than-air equipment, lighter-than-air equipment, landing fields, pilots' examinations. Each calls for the services of men specialized in their particular branch. Great difficulty would be encountered in obtaining men properly qualified were an attempt made to, for example, include the examination of airships and airplanes under one head. Likewise the landing field specialists could not be expected to possess the qualifications necessary to examine pilots. As the work of the bureau expanded it would undoubtedly become necessary to further specialize the work by separating design examination from construction examination. The subdivision controlling examination of operating condition will probably also become necessary. This would permit one group of inspectors to go from field to field, making periodic inspections of equipment in service. Another group would make periodic visits to factories where equipment is under construction. The suggestion of checking manufacture may call forth some comments, but it appears important to give the inspection service some control over the actual construction. With the low factors of safety used in aircraft design, it is not practicable to depend entirely upon inspection of completed machines when passing upon their safety. Too much can be covered up during the progress of the work of construction.

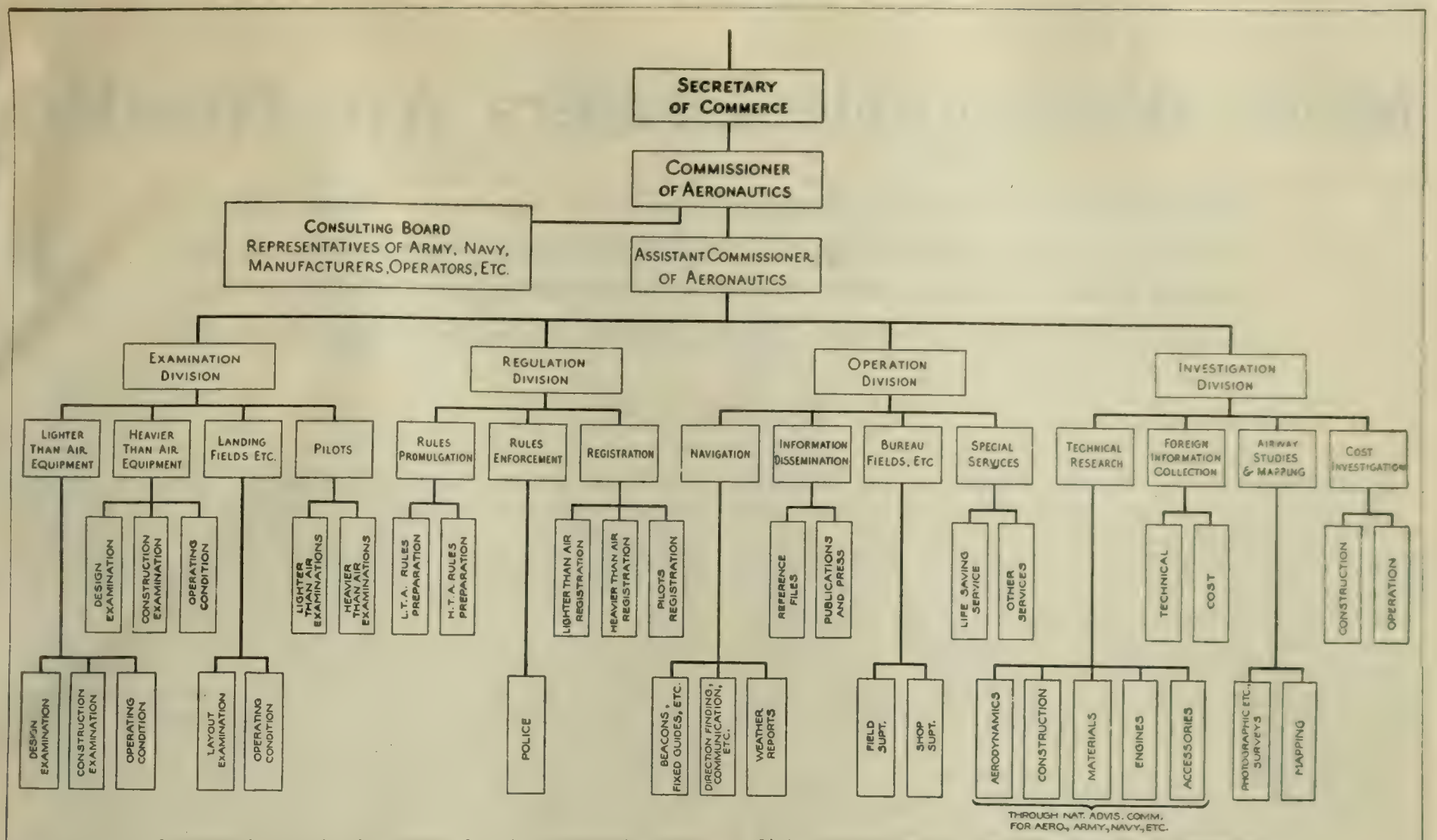
Pilots' Examinations

The question of whether or not examination of pilots should be under the same control as design, construction and operating condition examination is a debatable one. It will be influenced largely by the qualifications of the man at the head of the division. Only an experienced pilot is qualified to directly control examination of pilots. Only an engineer is qualified to direct the inspection work. If the head of the inspection division possessed both qualifications, it would be very logical to give him charge of both branches. Otherwise the examination of pilots might be placed under the regulation division in order to bring it under control of a pilot.

Regulation and Operation

The second division would bring all regulation under one head. Promulgation and enforcement of rules for navigating the air are suggested as separate subdivisions. One calls for the services of a pilot with some legal training. The other, although also calling for the services of a pilot, is practically police work. Registration is suggested as another subdivision, handling only the clerical work of keeping up-to-date records of machines and pilots licensed by other branches of the organization.

The third division would bring together under one head all operation of the bureau's equipment and appa-



Suggested organization chart for the proposed Bureau of Civil Aeronautics in the Department of Commerce

ratus. Navigation is suggested as one and probably the most important subdivision, bringing together all of the services concerned directly with navigating the air. Weather reports will no doubt be handled in close cooperation with the present Weather Bureau. Any flying fields or shops operated by the Bureau of Aeronautics would be most logically placed under one head as a subdivision of operation. Special services would probably separate themselves inherently as they developed. A life-saving service for accidents suggests itself as one possible development. Information dissemination might be placed either under the operation or investigation divisions, the former being suggested, as the latter would be more of a research organization than otherwise.

Investigation

The last of the proposed divisions would control all of the work in the nature of research or investigation. I might suggest that duplication of government work would be avoided if the actual research is carried on by existing bodies such as the National Advisory Committee for Aeronautics, Bureau of Standards, Air Service, Navy, etc. The foreign information service mentioned in the bills is very desirable. It might be suggested that some of the information could be obtained through existing channels of the Bureau of Foreign and Domestic Commerce. This could be supplemented by periodic visits of aeronautical men, from the Bureau of Aeronautics, to foreign countries. Airway studies and mapping will become increasingly important as aerial transport grows and will probably call for a separate subdivision. A subdivision on cost investigation, charged with the work of obtaining data on American and foreign manufacturing and operating costs is suggested as a valuable addition. This information could be held on file for reference and furnished as required to American manufacturers and operators. A service of this kind would greatly assist in the development of the industry and of air lines and help to place both on a stable basis.

The foregoing outline of the work and organization of the proposed bureau is given as a basis for discussion. The work of this bureau would be radically different from that of any other Government body. The problems which it would have to meet are so original that some interchange of ideas on the subject, before its actual organization, should be of value to the industry. No doubt the completed bureau organization will vary greatly from the ideas suggested. At the same time this should not prevent their being worthy of discussion.

ARCHIBALD BLACK, Consulting Engineer.

The Action of Cutting Fluids

IN a paper on "Cutting Fluids," Eugene C. Bingham explains the necessity for a lubricant in machining operations as follows: It appears that whenever two clean surfaces of metal are brought together they tend to seize. Many examples prove that a quite invisible layer of impurity will prevent seizure. The clean metal of the chip moving over the face of the tool under great pressure affords a peculiarly difficult problem in lubrication. Lard oil has a much higher adhesion for metal than have the pure mineral oils. It is drawn in between the chip and the tool and forms a strong film which prevents the chip from adhering to the tool and forming a "bead." Other oils containing fatty acids, or groups of atoms with "residual affinities," such as sperm oil, castor oil, rape oil, etc., have in large measure the advantage of lard oil. It seems readily possible to improve mineral oils as cutting fluids and as lubricants by adding liquids of high adhesion such as oleic acid, pine oil and fixed oils.

More Automobile Dealers Are Needed

The number of automobile dealers is going to increase. More will be necessary to meet changing type of buying demands. Car buying has become a habit. Consequently, buyers expect convenience similar to that in purchasing other products. More dealers mean more conveniences.

By Harry Tipper

ALL plans looking into the future for the establishment of permanent marketing policies must take into account the reactions of the buyer and his habits of buying. The methods of distribution, specialization, the character and extent of the service requirements, will be built up permanently because of the desire of the buyer rather than because of the necessity of the manufacturer. Many difficulties are in the way of the proper estimation of these effects upon the field. These difficulties are more evident in the automotive field because of its rapid growth.

The problem of distribution and service in the automotive field is different from the ordinary retailing problems. It involves a good many interests not involved in the work of other retailers. This entire distribution field, in its wholesale and retail aspects, has come within a decade and has involved many problems for which there were no precedents. Under such circumstances, it is natural that the whole field of marketing from the manufacturer to the user should be confused to some extent and present a great many conflicting tendencies.

PEOPLE no longer buy automobiles because of novelty or pure pleasure. They buy them for the convenience obtained. This demand for greater ease in purchasing and operating calls for more dealers and better service. Mr. Tipper shows that the automobile has established itself as a flexible means of individual transportation and emphasizes the fact that the importance of the various factors influencing buying is constantly changing.

There are no precedents within the field itself from which to measure the strength of these various tendencies, and the history of other fields is not entirely applicable, although an understanding of their development would be very useful in estimating the possibilities. To judge the problem, therefore, it is necessary to consider carefully the habits of the general buyer and the tendency to be observed in the sale of products to him in all the usual developments.

Up to the year 1920, the automobile was establishing itself as a flexible means of individual transportation. The main object and necessity was to secure its use, and the industry responded by providing a large number of units in the shortest possible time, so that this convenience could be put to work as rapidly as possible. The great object in the mind of the general buyer was to secure this means of transportation, and out of this reaction the statement has grown that every individual desires to own an automobile. The very character of the product emphasizes its usefulness. No other product in modern times has so continually emphasized its own value and its own desirability. Every automobile in motion suggests the value of ownership. Every automobile in use suggests the convenience of this means of transportation.

Economists have wondered many times at the propensity of the general buyer to indulge in luxuries or to buy things which do not appear to be necessary, at the first opportunity, even when some of the apparent necessities are being overlooked. The buying of the general public, however, is governed not by the necessity of the article so much as by the relative intensity of desire for the particular article. Unless the necessity is very great, therefore, the average buyer will reserve some of his earnings for the buying of things that are not usually considered necessary because his desire to own these things is more intense than the desire for the necessities. In all sections of the population, some conveniences will be left out in order that more desirable conveniences may be secured.

Relative desire is very largely a matter of emphasis, and the emphasis is not in proportion to either the necessity or the need of service. An illustration of this difference is afforded by the rapid growth in the use of radio apparatus during the months of 1921 when many of the lines included in the so-called necessities were still halting along with a subnormal business.

We have stated that the convenience of the automobile is emphasized perhaps more than any other item in the public mind and this emphasis is reflected in the publicity given to the automobile business and the place which it takes in conversation in ordinary circles. As the automobile grows into its regular place in the social fabric, this emphasis will be lost to some extent by familiarity, and the buying in connection with the automobile will be done more and more as the buying of other necessities. In all other lines of business dealing with necessities, the system of distribution has extended itself continually so that the convenience of buying could be more definitely established in all the separate communities. When articles become so purely a part of the routine life that they are virtually necessities, the buying is conducted more regularly and at shorter intervals because it does not receive the consideration that was formerly given to it. It is likely that the distribution system in the automotive field will extend itself so that the convenience of buying all commodities connected with the use of the automobile will keep pace with the growth and the absorption of the machine into the social fabric. As it stands to-day, the number of dealers in the automotive field, in proportion to the amount of business done, is very much less than in the hardware, the textile, and other retail lines. People were willing to go to considerable trouble in order to buy an automobile,

and they are willing to go to considerable inconvenience in order to secure the supplies and commodities necessary to keep it running. As a consequence, the number of retail establishments is comparatively small in proportion to the total amount of the business to be done and the widespread distribution of the automobiles themselves. The whole field has grown with such rapidity that the maximum demand upon the retail outlets has not yet been reached. As the number of cars in use grows each year, the amount of time and effort involved in keeping those cars supplied with their required equipment and service will be increased and, as a consequence, the number of retail outlets will necessarily be enlarged to meet these increased requirements.

The habit of the user in demanding convenient places in which to buy will contribute to the enlargement of the number of outlets, and to the character of those outlets. At present, the whole automotive business is in a period of readjustment not merely from the depression but from the absorption area into the stable area of development in accordance with the growth of the social fabric, in point of numbers and wealth. In other words, the past ten years have been spent in providing a sufficient number of machines to supply the needs of the population, the present period being spent in adjusting the business to the requirements of the population and, in the not very distant future, business will be shaped to the growth of the population and wealth. In this particular period, when the automobile is being adjusted to the requirements of the population, the desires of the buyer are going through some definite changes in his reaction toward his automotive buying. New elements of valuation are entering into the purchase, and these elements arise out of a previous experience with the automobile itself—its usefulness and possibilities. These elements will be considered in detail in another article. For the moment it is sufficient to suggest their presence and their effect upon the buying habits as they react upon this industry.

The buoyancy of the automotive field in its return from a condition of extreme depression has been surprising to many business men. This buoyancy is due very largely to the emphasis which is attached to the automobile and the effect of that emphasis upon the desire of the purchaser. The readjustment of values in the buying is to be discovered in the character of the buying and the way it has flowed in response to readjustment in price or service by the manufacturer or the local retailer. The various tendencies observable in the retailing field are induced by the attempts on the part of the manufacturer and the retailer to adjust the methods of distribution to the changed attitude of the buyer.

It is the experience of industry that buyers from the general public demand a greater convenience in their buying as the product falls more and more into the routine of regular necessity and gets away from the novelty or the emphasis of occasional or new demands.

Similarly, as the product is measured by constant use, the elements of valuation in the product change and the sales approach of the manufacturer or the retailer must be altered to agree with those elements of changed valuation. The various tendencies to be observed in the retail field of the automotive business are due to the readjustment which is going on, and their value cannot be completely determined at the present time.

The Cost Accountant's Opportunity to Do Analytical Work for the Executive

THE opportunity that the cost accountant has to do analytical work and to make his position an invaluable one to the executives and the concern as a whole, is stated in the following paragraphs by Robert E. Belt, secretary of the American Malleable Castings Association, Cleveland. The nature of the work is brought out as well as the real purpose of such work, which is often forgotten.

"The work of the cost accountant, primarily, is that of ascertaining actual costs of production and distribution covering past periods, so that a reasonably accurate forecast can be made of future costs, upon which current selling prices can be safely based.

"The cost accountant, therefore, has an intimate knowledge of the manufacturing, selling and administrative departments of the business. For his advancement and success it only remains for him to make the most of his knowledge and of his opportunities.

"His work is not merely the recording of facts or the determination of costs, but in a larger and more valuable measure that of analyzing costs, of studying them to determine the whys and wherefores, of forecasting future costs and of picturing or presenting both past costs and probable future costs, so that the executive can read them and get their significance.

"Most executives have neither the time nor the inclination to analyze costs in order to determine the conditions which resulted in an unusually high or an abnormally low cost.

"This is the work of the accountant for the assistance and enlightenment of the executive and it is not the work of the executive. It is this phase of cost accounting—the real object and purpose—in which the accountant is so often deficient.

"Unfortunately, there are many executives who manifest but little interest in cost results, and when the accountant is of the same trend of mind it is not at all surprising to find a feeling which is adverse to cost work. This latent faculty of the executive, however, is easily and quickly exercised when the accountant presents the results of his work in a manner which means something to the executive. When the executive sees that accurate and complete cost information results in the reduction of expenses or in an increase in selling prices, he is going to realize the importance of the work of the accountant and give him full credit for his initiative and endeavor.

"The ascertainment of costs means the determination of the true costs of production and distribution of the whole or any part of the product in sufficient detail to determine wherein they are exceptionally high or abnormally low, and the causes which resulted therein. The accountant, in possession of full information, is then in a position to present his facts, but bare facts should rarely if ever be presented without an explanation of circumstances and conditions which have produced the results. It is in the analysis and in the presentment of costs where the accountant can exercise the greatest initiative and can be of the most value to his employer.

"The department of the business for which the analysis is made will largely determine the nature and character of the report. Generally, an analysis and report should be made for the operating or manufacturing executives, for the sales executive, and for the general administrative executive."

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A. B. Swetland, General Manager
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How to Measure Noise

THERE has long been a rather urgent need for some method of measuring or comparing noises. About thirty years ago when trolley cars were first introduced, there was a great deal of complaint about noise from residents along the streets in which the tracks were laid, and electrical engineers gave serious thought to the problems. They believed that if they could show that a passing trolley made less noise than —for instance—a street corner Salvation Army meeting, they had a good case in court. But they failed to produce a recognized method and apparatus.

Recently controversies about noise have been frequent between automobile manufacturers and gear makers. Purchasers of cars demand silent operation. One of the operating parts most difficult to keep silent is the transmission gear, owing to the high pitch line velocity of some of its gears. Of course, no method of measuring noise can render gears any more quiet, but if there were some dependable and recognized method of determining the amount of noise emitted it would help avoiding disputes.

By means of a permanent magnet, coil and diaphragm the energy of sound waves can be converted into electric energy, which can be readily measured. One difficulty here seems to be that so much depends upon the relative location of the diaphragm and the source of noise, but the same thing applies in case the noise falls upon the human ear. The amount of noise from a particular apparatus falling upon the ear often varies considerably with the position of the listener. It might be necessary, as in the case of measuring the light emitted from an unsymmetrical source, to determine the mean spherical intensity.

That the problem is a difficult one will be readily admitted, for if it were not it would long since have been solved in a satisfactory way. We understand that research work along this line is contemplated by a Western institution if the necessary funds can be raised.

Used Car Valuation

IN a recent survey by the National Automobile Chamber of Commerce, one of the plans definitely favored by dealers and manufacturers was that the latter in advertising new cars should also advertise the market price of older models, based on cars in good condition.

It was claimed that the advantages in publishing used car values would be that:

First: The car owner would not expect an overallowance in trade.

Second: The dealer would not give an overallowance unknowingly.

Granted that these reasons are correct as far as they go, there are also some disadvantages which should be considered and as far as possible removed.

The fact of giving only one valuation figure will in many cases cause a sales resistance, for it is a common weakness for an owner to think that his particular car is in good condition whether facts warrant it or not. It will tend to make all allowances gravitate toward that one figure.

There are three possible valuation figures:

First: That determined on cars in good condition.

Second: Valuation set on cars in poor condition.

Third: An average valuation.

The first will tend to make wornout cars bring more than their legitimate value. The second will work an injustice to the man who takes care of his car. The third and last will tend to permit unlimited overallowances which defeats the very ends to be striven for. To do away with these disadvantages public announcements of used car market prices might give maximum and minimum figures for each model based on valuation of cars in good and poor condition respectively.

Much of the difficulty experienced in used car allowances is due to an owner's preconceived notion as to a car's actual resale value. If any plan is adopted great care should be taken to prevent this so that an owner will have an open, unbiased mind at the time of the car's appraisal.

Can Airship Builders Walk Before They Creep?

FOR many months the Navy Department has been engaged in the design and construction of a giant airship known as the ZR-1. This ship is understood to resemble in many ways the ZR-2, which, it will be recalled, crashed during test flights in England, with the loss of many lives, less than a year ago. It has recently been announced that Rear-Admiral Wm. A. Moffett, Chief of the Naval Bureau of Aeronautics, has requested the National Advisory Committee for Aeronautics to appoint a special committee of engineers to make a complete and detailed study of the plans and specifications for the ZR-1, with a view, it is understood, to securing a check upon the stresses involved. While the Navy is said to be confident that its own plans for the airship are correct, it desires the opinion of an independent committee in order to avoid the possibility of future adverse criticism. This is a wise and open-minded procedure on the part of Admiral Moffett, especially in view of the recent catastrophies with lighter-than-air craft and the fact that many misgivings as to the likelihood of a similar occurrence when the ZR-1 takes the air are being expressed by many well-wishers for the future of aeronautics.

In the absence of specific information regarding the design and type of construction to be employed in the new ship, it is too soon to draw conclusions as to the correctness, from an engineering standpoint, of plans already completed and being followed in manufacture of parts. It may not be amiss, however, to ask some rather pointed questions which might well be made the subject of another investigation as to the wisdom of continuing with the construction of so large a ship at such great expense as is involved, even though the investigation now requested shows that the design is based upon proper stress calculations and appears to be "safe," so far as present engineering knowledge of the subject goes.

The British, at one time enthusiastic over the possibilities of the rigid type of lighter-than-air craft, are reported to have entirely abandoned their civil and military program of development along this line and to have offered for sale all ships of this type. What reason is there for doubting that a similar course would not be expedient upon the part of our own Government?

The Germans, who have admittedly obtained the greatest degree of success in the construction and operation of airships of the rigid type, are reported to have declared that construction of the largest Zeppelins was justified only as a war measure—that the experience in the construction of smaller ships did not warrant going to such large designs and that such designs would not have been thought of in time of peace. Yet the ZR-1 is understood to be as large or larger than any other airship ever built. Is there sufficient justification for such a prodigious undertaking?

The successful operation of lighter-than-air craft is generally conceded to depend upon careful training and experience, which is usually gained first in handling small ships. How is such experience and training to be gained by Navy personnel when the Navy possesses no small, lighter-than-air ships of the rigid type? Would it not be more practicable to start with a much smaller ship, or even a number of them, modeled, if need be, after some of the highly successful Zeppelins, and thus build up an experienced personnel which could expect to handle a larger ship with minimum chance of disaster?

In short, does it not involve unnecessary risk to attempt building an "Old Ironsides" before a successful smaller ship of similar type has been constructed and flown?

In asking these questions, AUTOMOTIVE INDUSTRIES has at heart nothing but the best wishes for the Navy and for aeronautics, which we confidently hope will develop sanely and as rapidly as a healthy growth will permit. Another disaster such as that which occurred to the ZR-2 in England and the Roma at Hampton Roads may do irreparable damage. Huge sums have already been spent upon the ZR-1, but these may well be sacrificed rather than face the result of a possible disaster which might for many years completely check progress in one important field of aeronautics.

Production Figures Convince Skeptics

Prove Industry Practically at Capacity—Plants Seek Larger Output

By JAMES DALTON

NEW YORK, May 9—Skeptics who have thought reports of the tremendous business being done by the automotive industry were exaggerations have been routed by the preliminary production figures for April, which show that approximately 213,000 cars and trucks were turned out in that month. When the final figures are compiled they are quite likely to shatter the record of 220,000 established in March, 1920. The biggest month in 1921 was August, with 180,781.

Not only was April one of the two biggest months in the history of the industry, but production for the first quarter was the largest on record for the first three months of any year except 1920. It marked a gain of more than 100 per cent over the same period last year.

May is certain to be as large as April, and factories in the Detroit district will exert themselves to produce even more heavily. Capacity output will be necessary to fill orders now on hand and those which still are running into the plants in a flood which shows no sign of abating.

Good Outlook for June

June also promises well, although it does not seem possible that business can continue into the third quarter at the present levels. It is probable there will be the usual midsummer decline in sales, but nothing like a slump. In fact, it now seems certain that production for the first half of the year will be so heavy that the total for 1922 will be materially larger than for 1921, even if there is a sharp falling off in the sales in the last half, which now seems unlikely.

While expansion of truck sales has not been as sensational as in the passenger car field, the market is expanding month by month, and the output for the year will be much larger than in 1921. There has been a steady gain each month this year, and the percentage of increase over the same period last year has been large. The output for April was almost as large as for the entire first quarter. It is significant of the improvement in the farm market that half the commercial vehicles turned out in the first three months of the year were made by three companies producing popular light trucks fitted for farm use.

Parts plants have speeded up production to such an extent that the shortage in some lines, which slowed up operations last month in a considerable number of factories assembling vehicles, will be considerably alleviated in May.

Akron reports a boom in tire sales commensurate with that in the passenger car and truck field. Reserve stocks are being depleted to meet demands and production has been expanded.

Business in Brief

NEW YORK, May 9—Continued gains have been made in the past week by business and industry generally. Retail trade has improved slightly, crop conditions are somewhat better, the commodity markets are still stronger and industry has taken another long stride forward. The coal strike has failed as yet to exercise a serious adverse influence on the situation.

Car loadings are increasing, except in the case of coal. Railroad earnings showed another increase in March.

Railroads, at the end of April, had placed orders for 59,023 freight cars, or double the total for all of 1921.

Unemployment is steadily decreasing in the West as well as in the East. Building operations are delayed by inability to get enough workmen, and the same is true of skilled factory operatives in some lines, especially automotive.

Grain traffic in the Northwest is picking up rapidly. Wheat prices have made slight gains and the outlook for the new crop is very favorable.

Large mail order houses in the Chicago territory find May starting better than April and expect a larger month because farmer buying is steadily increasing.

Operations in the metal mining districts continue uninterruptedly, despite the coal strike.

Bank clearings for the week ending May 4 were $7,690,931,000, a gain of 20.2 per cent over the corresponding week of 1921.

Money continues easy, the security markets are in trading position and foreign exchange is somewhat irregular with sterling stronger.

Since last September the securities of American holders have advanced in value by 33 1/3 per cent, adding $5,000,000,000 to the purchasing power of the security holders, but the advance in stock averages has come to a halt, for the present at least.

Body Shortage Still Is Serious Factor

Situation Is Aggravated by Labor Unrest—Parts Coming Through Faster

By D. M. McDONALD

DETROIT, May 6—The body situation continues to be the most serious factor in the general production program of automobile factories in the Detroit district. Though the situation is apparently eased, it is only because it is too early in the month to begin straining for certain production figures. Many factories are still somewhat fagged from the April effort.

Aggravating the body situation is a condition of labor unrest which is largely due to the shortage of skilled body help and which has resulted already in a strike in the finishing department of one of the leading body makers of the city. With prices of cars at existing low marks, there is a little possibility of increases in wages. If wages go up, car prices are certain to follow.

Try to Meet Labor Problem

Manufacturers who have been intending to locate their own body plants in the Detroit district will probably find it necessary to bring in entirely new corps of skilled workers. Every effort is being made to develop workers from the present unskilled ranks, and many men are being brought in from other cities, but there is need still, under existing rush conditions, for hundreds of men.

Manufacturers of cars using custom made bodies have been unable to get bodies in anything like the quantity required. Lincoln has been sadly handicapped in this respect, a condition which is almost certain to result in the establishment by that company of a body plant which will be ample for all its requirements. Cadillac, making its own bodies, has had no difficulty, nor has Packard, which practically controls the output of its two body makers.

The demand for closed body cars is a distinctive feature of the 1922 buying. There is undoubtedly a definite desire on the part of the car owning public, especially that part which is not buying for the first time and which can afford to own only one car, to have that one car a closed vehicle. Price reduction and the development of the coach type vehicle have brought the closed car within the price range of many owners for the first time this year, and this is regarded as largely responsible for the increased business.

Closed Car Demand Varies

Demand for the closed car varies largely according to the line. In some factories it is running higher than 50 per cent of production and in others it is much lower. It is noteworthy, however, that those factories which have striven to develop distinctiveness in their closed

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New G. M. Car Moves Toward Production

"Copper Cooled" Automobile Will Be Turned Over to Chevrolet for Manufacture

NEW YORK, May 9—The General Motors Corp., which is now doing an exceedingly gratifying business in all its passenger car lines, expects sales for the third quarter of 1922 will exceed those of the second quarter. This belief is based on careful investigations and analyses which have been made. These reports point to a very large demand during the mid-summer months for Cadillacs, Buicks and Chevrolets, its three leading passenger car lines.

Not only is the domestic business of General Motors Corp. running at a high level, but there has been a very gratifying increase in export demand. The schedules of the London branch have been materially increased in the past week.

The new copper cooled car, which has been developed by C. F. Kettering in the research laboratories at Dayton and which has been subjected to a long series of the most severe tests, will be turned over in a short time to the Chevrolet Motor Co. for practical experiments along manufacturing lines. Manufacture of experimental models will be under the direction of W. S. Knudsen, and such practical modifications as are necessary will be made.

Thorough tests will be made of the models turned out by the Chevrolet company, and it is expected that manufacture of the new line in small quantities will begin early in September. At the beginning only 15 or 20 a day of the copper cooled line will be turned out. It is expected that the new line will sell for about $150 more than the Chevrolet "490."

It can be stated positively that the new copper cooled line, which is purely experimental up to this time, will have no effect whatever on the "490" line, which will be continued as heretofore.

De Berg Succeeds Parker as Kelly Truck Director

SPRINGFIELD, OHIO, May 8—Stockholders of the Kelly-Springfield Motor Truck Co. at their annual meeting Monday re-elected all of the old directors with one exception. Walter De Berg, assistant cashier of Emerson McMillin & Co., New York City, was elected in place of H. S. Parker. The report submitted shows that the company's business is steadily increasing and that prospects are bright for the future. The directors elected were: James L. Geddes, E. O. McDonnell, E. S. Kelly, J. E. Bowman, Paul C. Martin, Grayson Lathrop, B. J. Westcott and P. H. Diehl of Springfield; Charles Willard Young, A. P. Lathrop, Marion McMillin, C. N. Jellisse, James Lawrence and Walter De Berg of New York City; A. G. Hare of Philadelphia.

The directors organized re-elected these officers: Chairman of the board, James L. Geddes; president, Charles Willard Young; vice-president and general manager, E. O. McDonnell; vice-president, James McCarthy of Quebec, Ont.; vice-president, A. P. Lathrop; vice-president, Marion McMillin; vice-president, James Lawrence; secretary and treasurer, P. H. Diehl.

TO DISCUSS TRAFFIC MATTERS

NEW YORK, May 9—Means of solving some of the truck traffic problems, such as overloading and overspeeding, will be considered at a conference late this month of the motor vehicle commissioners of all the New England States, New York, New Jersey, Pennsylvania and Maryland with a special committee of the National Automobile Chamber of Commerce composed of R. H. Salmons of the Selden Motor Truck Co., R. O. Patton of the Pierce-Arrow Motor Car Co., D. C. Fenner of Mack Trucks, Inc., F. W. Fenn, secretary of the motor truck committee, and Harry Meixell, secretary of the motor vehicle conference committee.

Little Reason for Existence of Used Car Problem with Dealers Throughout Country

By H. M. Jewett,

President of the Paige-Detroit Motor Car Co. and Jewett Motors

Detroit, May 8.

FROM an automobile manufacturer's point of view, there should be no more a used car problem than a new car problem. We never hear of dealers coming to us asking how to sell their new cars. Why should there be any question as to how to sell the used cars?

The same principles of merchandising that are involved in selling the new cars apply to selling the others. When there is a market for the new cars there is a market for the used cars, and inversely, when there is no market for the new ones there is no market for the old ones. Dealers should be quick to size up market conditions and know when to shut down on taking in the old cars.

So far as my study of the automobile business has gone, I have been impressed with the fact that there will always be a market for its products, new cars and used alike. In the West there are quite a number of companies which make a business of junking automobiles and they are making money. Cars which have outlived their usefulness go off the market in the form of junk. When more junk-yards are necessary to handle used cars we will have them. That phase of the business will be taken care of.

Dealers should exercise good judgment in taking in cars in exchange for new ones. Where the price allowance is right the sale of the old one should be as ready as the new one. If a stock of used cars is accumulated dealers must cut down on accepting trade-ins.

Our experience with the new Jewett car shows that there are hundreds of sales which can be made by dealers without accepting trade-ins. In introducing the new car we instructed our dealers to look for buyers who had no cars and this policy has proved very effective. Some cars are being taken in, but only that the dealer may sell them for the buyer. On our Jewett business the trade-in allowance will be discountenanced for a considerable time to come.

Business throughout the year should continue on a very even keel. Farmers are coming into the market now in the West and the Central West, and their buying is having its effect not only on our business, but on all business. Farm-product markets are improving all the time as are markets for fruits and lumber. The lumber producers are now far behind on orders. Credits which in some districts have been frozen for eighteen months or more are again liquid.

Taking everything into consideration, there is no reason why the automotive industry should not enjoy a record year. April was the largest month our factory has ever known and May will exceed it.

Paul duPont Identified Actively with Daniels

NEW YORK, May 9—Announcement is made by Gillespie, Meeds & Co., who are forming a syndicate to underwrite the sale of $1,000,000 of 8 per cent preferred stock of the Daniels Motor Co. of Reading, Pa., that Paul duPont of Wilmington, Del., president of duPont Motors, Inc., and his associates have become actively identified with the Daniels company. It is stated that duPont has taken a substantial financial interest in the company.

There have been reports recently that George E. Daniels had decided to resign as president of the company, but he emphatically denies that there is any truth in the statement, which he characterizes as "ridiculous."

At the annual meeting of the directors the following officers were elected to serve for the ensuing year: George E. Daniels, president; N. E. Parish, vice-president and chairman of the board; L. L. Gillespie and H. W. Mansfield, vice-presidents; W. L. Davis, secretary and treasurer; J. K. Rhinelander, assistant secretary, and R. A. Wetherhold, assistant treasurer.

Must Ask for Space at Paris by May 24

No Requests to Exhibit at Show Will Be Received After That Date

PARIS, April 28 (*By Mail*)—Requests for space in the Paris automobile show, to be held in the Grand Palais from October 4 to 14, inclusive, will not be received later than May 24. The French show is closed to ex-enemy nations. Allied manufacturers are placed on an equality with French firms with the exception of American makers, who are only admitted after other requirements have been met.

One of the new rules stipulates that traders and body builders will not be allowed to exhibit chassis or complete cars by manufacturers who do not have their own stand in the makers' section. This will cause several firms, among them Rolls-Royce and Ford, to come into the show as car manufacturers, contrary to their general practice, or will shut them out altogether. Firms in the hands of an official receiver will not be allowed to exhibit, thus bringing the Paris practice in line with that of London in this respect. A special section has been formed for automobiles of less than 61 cubic inch piston displacement, the organizing committee having recognized the growing importance of this class of popular automobile.

Space Prices Same as in Past

Henri Cezanne, who continues in the capacity of show manager, announces that the Paris exhibition will be organized on economical commercial lines. The system of refunds to exhibitors will be maintained. For the last show about 50 per cent of the stand rentals was returned to exhibitors. Gate admission will be increased from 3 to 5 francs on ordinary days, and from 10 to 15 francs on the opening day and Fridays. Stand rentals remain unchanged so far as the ground floor is concerned. Beginning at 500 francs a square metre, the price drops to 120 francs a metre. Exhibitors at Paris have to sign a guarantee not to take part in any exhibition, fair or race unless it is approved by the National Automobile Federation. The Paris show will be the first of the European series.

Bethlehem Reorganized with Murray Board Head

NEW YORK, May 8—The Bethlehem Motors Corp., which recently was purchased at receiver's sale by A. T. Murray and Howard B. Hall, former officers, has been reorganized by the election of Murray as chairman of the board; Hall as president; E. H. Leland as vice-president and treasurer; W. H. Rogers, secretary and assistant treasurer.

A statement issued after the reorganization declared "there are no other interests either directly or indirectly associated with Mr. Hall," except Murray and the First National Bank of Boston. This would seem to dispose of reports that Martin L. Kern, who organized the original Bethlehem Motors Corp., was interested in the purchase of the assets.

The board of directors is composed of the officers and Clifton H. Dwinell of Boston, Richard Bennett, Jr., and Peter J. Brennan of New York. It is stated that the company intends to enter the truck manufacturing field in a substantial way as soon as possible.

Indiana Section of S. A. E. Holds Its Annual Meeting

INDIANAPOLIS, May 9—Following the May meeting of the Society of Automotive Engineers council here yesterday, the Indiana section last evening held its annual meeting, election of officers and dinner with council members as guests.

The new officers of the section are as follows: O. C. Berry, Wheeler-Schebler Carbureter Co., chairman; Ion R. Smith, Midwest engine Co., vice-chairman; B. F. Kelly, Weideley Motors Co., secretary; Mark A. Smith, Midwest Engine Co., treasurer.

In short talks, council members told of the summer meeting and gave brief reviews of the council work and progress of the society. Council members present at the meeting and dinner included B. B. Bachman, president; O. W. Young, David Beecroft, C. F. Clarkson, H. M. Crane and F. J. Scott.

The Indiana section will send a large delegation to White Sulphur with Mark A. Smith as the delegate and W. Guy Wall as alternate.

Cleveland Suggests Meals for A. A. A. Presidency

CLEVELAND, May 8—Cleveland this year is putting forth a candidate for president of the American Automobile Association in Judge Walter D. Meals, president of the Cleveland Automobile Club and former president of the Ohio State Automobile Association, and for many years an active worker in the interests of better highways and better laws for the encouragement of motoring. Former presidents of the A. A. A. have all come from east of the Alleghanies.

Judge Meals's name will be formerly presented to the association at the annual meeting in St. Louis, May 19-20. Judge Meals is judge of the Court of Claims of the United States Shipping Board at Washington.

Meeting Dates Changed

WASHINGTON, May 8—The annual meeting of the board of directors of the American Automobile Association will be held at St. Louis Friday and Saturday, May 19 and 20, instead of May 22 and 23, as previously announced. The change of date is made necessary by the fact that the American Medical Association has reserved the entire hotel accommodations of St. Louis for the week of May 22.

Order Cancellation Halts Walker Plan

Refinancing of Company Had Been Provided with Overwriting of $390,000

CLEVELAND, May 9—The plan that had been worked out for the refinancing of the H. J. Walker Co., manufacturer of automobile engines, has been abandoned for the present, according to a statement made by one of the heads of the financing syndicate.

The refinancing called for the raising of $300,000 of additional capital for the company. E. J. Kulas of Crouse, Tremaine & Kulas, investment bankers of this city, which handled the matter for the syndicate of automobile men and bankers, had obtained subscriptions for $690,000, or an overwriting of $390,000.

Creditors holding a majority of the claims had subscribed to their part of the financing plan, which was that they should take preferred stock in the corporation.

A part of the proposal called for a certain showing of orders for engines, and one of the big automobile companies had been lined up for a substantial order of the company's motors, but it was learned the order has been cancelled. This represented approximately 50 per cent of the new orders that had been relied upon.

Merger Discussed

Lately there have been conferences on the part of business men, bankers and capitalists for the purpose of discussing the plan of bringing under one management for credit purposes several well-known corporations in this city that are engaged in the automotive business.

The Grant Motor Co., the Parish & Bingham Co., the H. J. Walker Co., and the Standard Equipment Co., have figured in this talk. Men holding stock in all four companies and others holding claims against them have figured in the negotiations.

Work on this transaction has been suspended for the time being, although there is talk of it being revived.

Germany Will Have Show and Also "Grand Prix"

BERLIN, April 25 (*By Mail*) — The German automobile show will be held in Berlin at the Kaiserdamm hall from Sept. 25 to Oct. 3, under the auspices of the German Automobile Manufacturers Association.

A race, "The Grand Prix of Germany," will be held Sept. 24 on the Avus track between Berlin and Grunewald by the show management in association with the Automobile Club von Deutschland. The race is open to foreign cars, 2 litre models of 650 kilograms minimum weight and 3 litre cars of 800 kilograms minimum weight being eligible. The race is 25 laps, which is equal to about 500 kilometers.

Miniger Likely Buyer of Auto-Lite, May 29

Court Fixes $4,700,000 As Upset Price—Sale Will Include Three Plants

TOLEDO, May 9—A court order signed by Judge John M. Killits in Federal court here has set the sale of the Electric Auto-Lite division of the Willys Corp. for May 29, at 11 o'clock, at the county court house in Toledo.

Frank P. Kennison and Francis G. Caffey, receivers for the Willys Corp., have been appointed special masters to make the sale.

The upset price stipulated in the advertisement of sale is $4,700,000. It is understood here that C. O. Miniger, at the present time operating head of the Electric Auto-Lite and one of the receivers, will be probably the only bidder for the plant.

The sale includes the two plants in Toledo and one at Fostoria. Included in the assets also are 100 shares of stock in the Burt Foundry Co., Toledo, and 1000 shares, the total stock, of Electric Auto-Lite Corp., a Delaware sales unit.

The $89,556.40 claim for state taxes in Ohio now in litigation will be taken care of out of proceeds of the sale by the receivers, should any judgment be granted to the state. Federal taxes accruing during the receivership shall be paid by the purchaser of the property.

Provision is also made whereby the Willys-Overland Co. shall release the Willys Corp. for claims arising out of a contract for furnishing of farm lighting equipment.

The sale is to be made as of Feb. 28, 1922. The special masters are granted the power to postpone the sale without notice.

Industry Represented on U. S. Chamber Ballot

NEW YORK, May 9—Two representatives of the automotive industry have been nominated for directors of the Chamber of Commerce of the United States. They are W. O. Rutherford, vice-president of the B. F. Goodrich Co., who is a candidate from the domestic distribution group, and C. F. Kettering, president of the General Motors Research Corp., who was nominated to represent the sixth district composed of Ohio, Indiana, Illinois, Michigan and Wisconsin. The directors will be elected by the National Councillors who will meet in the Washington Hotel at Washington, Monday, May 15. Persons in the automotive industry have been asked to request the councillors who will represent their local Chamber of Commerce or Board of Trade to vote for Rutherford and Kettering.

An effort is being made to insure a large attendance of councillors at the highway transport section meeting of the Chamber of Commerce, which will be held Tuesday afternoon, May 16, in the new Masonic Temple at Thirteenth Street and New York Avenue. The speakers will be T. H. MacDonald, chief of the Bureau of Public Roads, and E. J. Mehren, editor of the *Engineering News Record*. A. J. Brosseau, who represents the National Automobile Chamber of Commerce on the directorate of the National Chamber, will preside at this meeting.

Peugeot Goes 95.5 Miles On One Gallon of Gasoline

PARIS, May 1 (*by mail*)—A distance of 123.2 miles was covered by a 45 cubic inch two-seater Peugeot light car on a can of gasoline containing 1.29 gallons. This is equivalent to 95½ miles per American gallon. The performance was made in open competition at Le Mans over ordinary roads, each of the competitors being given a can of gasoline and the winner being the one covering the greatest distance.

The winning Peugeot, driven by Gremillon, was followed by Henry Petit on a similar Peugeot who covered a distance of 115 miles before coming to a stop. The third car home, also a Peugeot, was driven by Madame Lavie, and covered 95 miles. The first three cars were fitted with Zenith carbureters.

Durant Output Estimated at 14,000 This Quarter

NEW YORK, May 9—Durant Motors, Inc., hopes to improve in the second quarter the remarkable showing it made in the first three months of the year, when it ranked eighth among the automobile producers of the country, including Ford. With production being expanded as rapidly as possible, Durant hopes to pass one of its competitors by the close of the first half year.

Production of the Durant line for the second quarter is conservatively estimated at 14,000. The output at Long Island City will be at least 6000, at Lansing 5000, at Toronto 1500, and at Muncie 1500. This does not include 1000 of the new Stars, which will be turned out in June at Long Island City and Lansing. One hundred samples of the Star line will be made this month.

The sales policy for the Star has not been worked out in detail, but it is expected to include some rather unusual ideas when it is announced. It is understood to be the plan of the company to sell the cars to its distributors at cost and take a certain proportion of the profit.

SALES MADE AT ELECTRIC SHOW

NEWARK, N. J., May 9—An electric automobile show held here had 23 exhibitors and resulted in the direct sale of considerable equipment and an added interest in electric automobiles. The Public Service Electric Co. provided exhibition space and assisted in staging the show.

Viggo V. Torbensen Forms Axle Company

Formerly Head of Corporation Bearing His Name—Plant in Cleveland

CLEVELAND, May 8—Viggo V. Torbensen has formed the Vig Tor Axle Co. for the manufacture in Cleveland of passenger and commercial car axles. For a number of years Torbensen served as president of the Torbensen Axle Co. and has been active in the industry for the last twenty-six years. The axle the new company will make has been designed by Torbensen.

A group of men well known in the axle industry have become associated with Torbensen. A. L. Kroesen, who will be vice-president and general manager, was for a number of years connected with the Detroit-Timken Axle Co. of Detroit. Kroesen came to this city to become director of production for the Eaton Axle Co.

W. N. Jackson, treasurer of the new company, has been associated with Torbensen for several years. Carl R. Harrison, secretary, is vice-president of the City and Suburban Realty Co. of this city. B. A. Fleming, assistant secretary, is a graduate of the University of Kansas Engineering School and has been making a study of production methods in the axle business for some years. Directors are Torbensen, Jackson, Harrison, and Joseph Lyons, president of the Lyons Machine Co. of this city.

Shipments from Canada Totaled 14,724 in Year

OTTAWA, ONT., May 8—The exports of Canadian motor vehicles for the fiscal year ending March 31, 1922, numbered 14,724, valued at $8,032,804, while automobile parts were valued at $1,151,453.

This compares with a total of 15,620 passenger cars, valued at $11,376,278, and 4286 motor trucks, valued at $2,499,103, shipped during the twelve months from March 31, 1920, to March 31, 1921. The value of the parts shipments during the same period were $4,262,325.

KILLS BILL INCREASING TAXES

BOSTON, May 6—Motor organizations in Massachusetts fighting legislation here won a sweeping victory when the lower branch of the legislature killed the proposed one cent a gallon tax on gasoline and 100 per cent increase on truck fees.

BIG SUM SPENT FOR GASOLINE

HARTFORD, CONN., May 8—In the past six months Connecticut motorists spent $7,500,000 for gasoline, according to the department of motor vehicles, and inasmuch as the state tax is one cent a gallon the officials are sure of the figures.

Indiana Plants Need Skilled Workmen

Companies Are Seeking to Build Up Factory Forces—Schedules Increased

INDIANAPOLIS, May 9—Nordyke & Marmon Co.'s recent price reduction has brought increased business to the factory in the past few days. Shipments of approximately 500 cars are expected to be made this month, this being more than for any month of 1921 with the exception of June, 1921, just subsequent to the large cut announced then.

The plant is now employing 2650 men and additions to the force are being made steadily. Not more than 600 of this force are said to be engaged in the manufacture of milling machinery, although this force as well as that of the automobile division is to be increased.

Other local and near-by Indiana factories are using the classified columns of local newspapers in the endeavor to build up working forces. The Maxwell plant of Newcastle as well as Studebaker of South Bend are advertising for skilled workmen in local papers daily. While there is no shortage of local labor, it is far from as plentiful as it was two months ago. The drain from state manufacturers and from those of Michigan and Ohio, started about a month ago, has greatly decreased the surplus of skilled automotive labor that existed here until very recently.

Stutz Motor Car Co. is also increasing its factory force, and finding it increasingly difficulty to pick up skilled workmen. The business at the plant has steadily increased during the last forty days, and by May 15 an enlarged production schedule is going into effect. Retail sales and orders from the country at large have gained.

H. C. S. Motor Car Co. has also added to its force somewhat and has a larger output than at this time last month. Sales and orders are gaining and meeting the expectations of factory officials.

Scarcity Felt in Toledo

TOLEDO, May 9—Automotive plants made a large gain in employment during the month of April, according to statistics secured for the United States Department of Labor here.

The Electric Auto-Lite Corp. put on 300 more employees; the Willys-Overland Co. added about 400, and the Toledo Chevrolet plant placed 100 more men at work.

Other allied plants made small additions to their forces, while several of the malleable castings plants greatly increased production due to orders from automobile manufacturers.

Delay in getting steel and other materials and shortage in the supply of skilled labor is retarding production in several of the large plants.

The Willys-Overland Co. reports sales holding up at the high level established in March. Recently a whole trainload of 25 cars was shipped from here to Charlotte, N. C., billed to the Dail-Overland Co. The shipment was disposed of to dealers in less than 24 hours after its arrival.

SEES MOTOR VEHICLE AS RAIL AUXILIARY

NEW YORK, May 8—The relationship between the motor vehicle and the railroads is beginning to define itself with a fair degree of clearness, in the opinion of Elisha Lee, vice-president of the Pennsylvania Railway System.

In an address before the Transportation Club, Lee asserted that the motor vehicle is destined to play an important part in short distance transportation service, both for passenger and freight. He believes the time may come when the motor car, motor bus and motor truck will be looked upon not so much as competitors of the railroads but as helpful auxiliaries. He does not think, however, that motor vehicles ever will compete seriously with the railroads for long haul business.

Lee does not see any immediate commercial possibilities for the airplane as a carrier.

Group Meetings Replace G. M. Truck Convention

PONTIAC, MICH., May 9—A series of meetings of branch and agency managers and salesmen for the General Motors Truck Co. was instituted here May 4 and 5, when 22 men attended a sales gathering at the plant. They came from Chicago, St. Louis, Indianapolis, Pittsburgh and Detroit agencies and spent the time in the study of manufacturing processes as they relate to sales, the discussion of mutual problems in truck selling and to hearing lectures from the general sales force and executives of the company.

The meeting marks the substitution of the group conference for the convention idea in the plant's program. It will be the first of a series to be held at intervals of about two weeks until the entire country has been covered.

Consensus of reports from the salesmen and managers here was that business is greatly improved in their territories.

INTERNATIONAL REPAYS LOAN

WASHINGTON, May 8—The War Finance Corp. announces that the International Harvester Co. has repaid the advance of $4,000,000 made to the company in the spring of 1920 to finance the exportation of agricultural machinery and implements. The loan was not due until 1923.

White Co. Reports Big Gain in April

Improvement Was 50 Per Cent Over Year Ago—Plant Output Increasing

CLEVELAND, May 9—Business of the White Co. increased 50 per cent in April of this year over the corresponding month last year.

During last month the company received 987 orders, as compared to 640 in the same month of 1921. The announcement of the figures was made by Walter C. White, president, at the annual meeting of the corporation.

During the month just closed the company delivered 855 trucks, or 20 per cent more than were delivered in April of 1921. Factory production is increasing and since April 750 additional men have been employed. This brings the number on the factory pay roll to more than 3000.

The company would, at the present rate of business, sell approximately 9000 trucks in the present year, upon which substantial earnings would be made.

White reported that the cash position of the company continues to improve. The notes payable amount to $2,800,000 and no customers' notes have been discounted. There is cash of $2,500,000 and accounts of notes receivable of $6,000,000.

The following directors were re-elected: Windsor T. White, Walter C. White, Thomas H. White, Homer H. Johnson, Otto Miller, Warren S. Hayden, J. R. Nutt and William G. Mather of Cleveland; Walter C. Teagle and E. R. Tinker, of New York City, and Philemon Dickinson of Philadelphia. R. W. Woodruff, of this city, was elected to fill the vacancy caused by the death of A. R. Warner.

These officers were re-elected: Windsor T. White, chairman; Walter C. White, president; Thomas H. White, vice-president; George H. Kelley, treasurer, and T. R. Dahl, secretary.

DOBLE LOCATES FACTORY

SAN FRANCISCO, May 9—Doble Steam Motors is now located in a factory at 714 Harrison Street, where production on Doble steam cars will start Aug. 1. Production for 1922 will not exceed 30 cars, and 1923 production will be on the basis of 300. Abner Doble, long a figure in the steam field, is president, and W. A. Doble, Jr., general manager.

RUBBER ASSOCIATION TO MOVE

NEW YORK, May 8—The Rubber Association of America has leased the Broadway frontage on the 10th story of the Fisk building at 57th Street, this city. The space measures 2000 feet, including a large conference room where the association directors will meet. The Rubber Association has been located in recent years at 52 Vanderbilt Avenue.

Federal Tests Seek Better Tire Mileage

Carcass Holds Key to Sustained Power, Bureau of Standards Finds

WASHINGTON, May 5—Tests to enable the automobilist to get better and more mileage out of his tires are now being made by the Bureau of Standards, it was announced to-day when the bureau gave its first preliminary report on the work already done.

The proper design and the correct inflation pressure of tires are of major importance if the motorist is to get the greatest mileage, the report states. Tests made show that various parts of the tire contribute to the absorption of power, of varying degrees. From 80 to 85 per cent of the loss in power, it was found, is due to the carcass of the tire, 10 to 15 per cent to the tread, and about 5 per cent to the tube.

These results are based upon tests which were made on a special type dynamometer in the rubber laboratory of the bureau. The dynamometer consists essentially of a motor for driving a standard automobile wheel and tire, a pulley which bears against the latter, and a generator driven by the pulley. By suitable weighing arrangements the difference between power input and output may be easily measured. The difference represents the loss in the tire.

It is possible to test upon this machine any make of tire under varying conditions of speed, inflation pressure, etc. The present announcement of the tests, it was stated, is only a preliminary statement. A brochure is now being prepared and will be ready for the automotive industry in six or eight weeks.

Expansion of Factory Begun by Studebaker

SOUTH BEND, IND., May 8—The Studebaker Corp. already has begun the expansion of its plant for which the directors have authorized the expenditure of $3,000,000. The new structures will include a closed body building plant and car storage and shipping buildings. They will permit an increase in the production of light sixes from 200 to 300 a day. The building program, which has been mapped out will require the eventual expenditure of $15,000,000 and will cover five years.

The first of the buildings to be erected will be the storage plant, paralleling the administration building. One of these will be 624 x 76 feet, four stories high, built of reinforced concrete. The other will be a one-story structure, 624 x 77 feet.

The closed body plants, which will be built upon the present site of the old harness factory of the original Studebaker enterprise, will be four stories high. One of them will be 145 x 170 feet and the other 370 x 145 feet. These buildings will be completed by October if possible and will be ready for operation not later than Jan. 1. The company also will build a large new power plant. It is expected that 2500 more men will be added to the payroll by Jan. 1.

12 TOPICS SELECTED FOR SERVICE MEET

NEW YORK, May 9—Twelve discussion topics have been tentatively selected for the N. A. C. C. factory service managers' convention at Detroit on May 16 and 17. The topics are:

Progress of the flat rate system.

Parts and labor practice in connection with warranty.

Parts adjustments.

Interchange of gratis service among dealers.

The retail end of the service problem.

Methods of educating the dealer.

Ideal co-operation between car sales and service departments.

Servicing cars in outlying districts.

Practicability of 24-hour service.

Pirate parts.

Advantages of a fixed service policy.

Reasonable guarantee limit as to time and mileage.

Edward S. Jordan and O. E. Hunt will address the convention. The headquarters will be at the Hotel Statler.

Body Shortage Still Is a Serious Factor

(*Continued from page* 1032)

vehicles are the ones that are getting this business. The increase in the closed car business has had a somewhat retarding effect on the compilation of new production records because of the greater care required in the building.

Overtime work continues unabated in most of the parts and equipment plants, and deliveries of materials have reached a volume in keeping with the production requirements of the makers. Foundries, by employment of constant shifts, have brought the castings situation well within bounds, and deliveries are now coming through on most of the small parts and fittings which for a time threatened holdups.

HOWARD J. DIETZ DIES

NEW YORK, May 8—The death is announced of Howard J. Dietz, son of the late Robert E. Dietz, founder of the R. E. Dietz Manufacturing Co., which manufactured the first lamps for automobiles. He was 55 years old, and his death was caused by heart disease. Dietz was active in the aviation and automobile fields. He was the first man in Hempstead, Long Island, to own an automobile and was the inventor of an airplane which bore his name.

Lang Body Co. Gets New Lincoln Order

First Award Since Ford Became Identified With Car Company

CLEVELAND, May 9—The most striking increase in factory pay rolls since the first of the year has come about in the automobile and automobile parts and accessories factories of the city, according to the statement of the Labor Relations Committee of the Chamber of Commerce.

The number of employees in the automobile factories surveyed has increased 79 per cent in the last four months.

For the first time this year the report shows that the number of employees in the 100 corporations, including automobile factories and those in other industries, is greater than it was at any time in the year 1920.

In the automobile industry the number of employees in the factories surveyed, and there are eighteen of them, was 9972 persons on April 29 as compared to 5568 last December and to 10,310, the largest number in the year 1921.

For the first time in many months the Lang Body Co. is operating at practically capacity. Orders have been received in increased numbers each month since the first of the year.

A contract has been obtained by this company to build closed body types for the Lincoln Motor Car Co. The firm has been making Peerless closed bodies for some months and will get into production as soon as possible on the Lincoln contract. Shipments are to start Sept. 1. The new order will run indefinitely. The Lang company built bodies for the Lelands, but this is the first order obtained since Henry Ford became identified with the Lincoln organization.

Standard Parts on Upgrade

The Standard Parts Co. has found business on the upgrade, and orders have been coming in at an excellent rate. There has been talk in the financial circles lately that the time is not far distant when the receiver will be able to turn the property back to the stockholders for management.

COPP CORP. FORMED

NEW YORK, May 8—The merger is announced of the George W. Copp Co., Inc., the Copp Body Co. and the New York Auto Equipment Co., Inc., as the Copp Corp. with a plant in Long Island City. The consolidation provides advantages in the manufacture and distribution of the slide sedan top, taxicab bodies, closed bodies and tops made by the corporation. The company now is in a position to deliver, for example, an order up to 50 taxicab bodies mounted and painted, within one week. A fully equipped reconditioning and repair department also has been established.

Demand for Trucks Is Large in Mexico

Mining Companies Are Making Purchases for Transporting Ores and Supplies

MONTEREY, MEXICO, April 20—(*By Mail*)—Although Mexico imported automobiles and motor trucks to the value of $15,000,000 United States money in 1921 there promises to be more than $20,000,000 of these vehicles sold here during the present year. Some dealers estimate that the sales may run as high as $25,000,000.

The demand for motor trucks is spreading all over the country, it is stated. Many of the larger mining companies are buying trucks for the transportation of ores and supplies. The jump of the automobile and motor truck trade from approximately $2,000,000 for the year 1920 to $15,000,000 for 1921 was due to the improvement of industrial and business conditions generally, it is explained.

In 1915, Mexico imported from the United States 70 automobiles to a value of $66,830. In 1920, Mexico imported 4089 automobiles to a value of $3,525,210, while the truck importations increased from $14,492 in 1919 to $1,973,994 in 1920.

In view of the almost virgin field for profitable motor vehicle trade in Mexico the matter of establishing a plant here for the manufacture of automobiles and motor trucks has been under consideration recently by American interests. It is pointed out that all of the raw materials, such as iron, rubber, fibers and woods, are to be had here in abundance, while labor is cheap.

Fleet Ordered

MEXICO CITY, April 20—(*By Mail*)—The American Smelting & Refining Co. has received permission to establish a fleet of thirty-seven motor trucks and to construct roads for the operation of this fleet between its mines and the town of Santa Rosita, in the State of Coahuila, according to announcement by the Department of Commerce, Industry and Labor here.

French to Make Engine with Burt Single Sleeve

INDIANAPOLIS, May 6—According to the American representatives of Wallace Glasgow, Limited, agents for the Burt single sleeve engine, the Societe des Moteurs Gnome et Rhone, Paris, has taken out a license to build 20-hp. passenger car engines. This will probably be of the four cylinder type.

This announcement of the French aviation concern to manufacture automobile engines operating on the Burt or Argyll single sleeve cycle has caused considerable comment among automobile engineers on the continent and in this country. It is known that a number of large concerns in this country have been quietly investigating this engine for some months. A significant feature of the announcement is that it is possible that air-cooling may be used successfully with the Argyll or Burt sleeve action. A number of Burt air-cooled farm lighting systems with air-cooled cylinders are in operation in England at the present time.

New Buick Sport Phaeton, Model 55, Priced at $1785

DETROIT, May 9—Buick is now putting out a sport phaeton on the six-cylinder chassis. This will be Model 55 and is in addition to the 6-54 special roadster which will be continued. The car is specially equipped throughout with a four-passenger body of practically five-passenger size.

The equipment includes an adjustable sunshade attached to the windshield, rear vision mirror, threshold plates of aluminum, runningboard step plates of nickel trimmed rubber, khaki top, combination clock and speedometer, cigar lighter, carpets in front and rear compartments, and walnut steering wheel. Tuarc steel wheels are optional equipment at $50 additional if installed at the factory. The car is provided with a touring trunk and double tire carrier. The price is $1,785 f.o.b. Flint.

SHULER MAKES BUS AXLES

LOUISVILLE, KY., May 10—The Shuler Axle Co., Inc., has started production on a line of front axles intended exclusively for motor buses. The company for several years has been making front axles for trucks, trailers and tractors, and these will be continued. The new design is strong and heavy, and the spring pad is 7 in. lower than usual. There is a large factor of safety and the journal surfaces are quite large. Material specifications and essentials of design are identical with the regular line.

SCHWARTZ OLD LINE REPLACED

READING, PA., May 8—The Schwartz Motor Truck Corp. has designed a new line of trucks to supersede the models previously made. The capacities and prices follow:—1-ton, $1,685; 2-ton, $3,000; 3-ton, $3,600, and 5-ton, $4,900. The prices have not been changed on the 1 and 5-ton models, but the 1½ and 2½-ton models have been discontinued.

SAYS AVALON IS BANKRUPT

AKRON, May 6—Harry L. Snyder, Akron referee in bankruptcy, has recommended to Judge C. D. Westenhaver of the United States District Court at Cleveland that the Avalon Rubber Co. be adjudicated in bankruptcy and that trustees be appointed. Since last November affairs of the company have been in the hands of Ray Hamlin as receiver. J. F. Hower of Akron is president of the company, which has been in production for two years. Snyder reports assets of $25,000 with total liabilities of $35,000.

New Lines of Tires Bring Lower Prices

Will Reduce Cords Below Market Lists of Regular Standard Makes

AKRON, May 8—Tire prices, instead of taking their expected and long rumored increase the first of May, have come down. Prices on regular standard make tires have not been reduced, but action tantamount to reductions has been taken by several companies in introducing entirely new lines of cords to sell at from 20 to 25 per cent below the present standard cord tire market lists.

In addition the new Seiberling company at Barberton has made a revision downward of prices on Seiberling cords and Portage fabric tires, bringing both down to the standard market levels. Heretofore they had sold at above the standard list prices.

Goodyear Tire Ready in June

Goodyear is one of the first to announce a new line of lower priced cord tires. The new Goodyear Cross-Rib cords, ready for delivery in June, will sell at about 25 per cent below the present standard cord tire prices and below the prices of Goodyear All-Weather tread cords. Goodyear officials say the new tires are not being developed to compete with standard cord makes, but to compete with jobbers now giving long discounts on standard tires. The new tire will not be a two-cure process casing, but a one-cure instead. It will, however, according to Goodyear, give as many miles per dollar as higher priced cords.

The American Tire & Rubber Co. has introduced a similar tire to sell on the same price lists as the new Goodyear cross-rib cords. This new American-Akron cord will be put into the field in direct competition with all other tire companies marketing a cheaper line of cord casings.

Seiberling's Adjustments

Seiberling's price adjustments bring the cost of the 32 x 4 cords down from $32.90 to $32.40; the 34 x 4½ from $44.50 to $43.90; and the 35 x 5 from $55.40 to $54.75. On the Seiberling line of Portage fabric tires, the price reductions are from $10.90 to $9.50 on the 30 x 3 clincher; $12 to $10.50 on the 30 x 3½ clincher; $25.45 to $22.90 on the 32 x 4 straightside; and from $27.25 to $24.60 on the 34 x 4 straightside.

The Mohawk Rubber Co., whose tires have been selling above the standard lists, announces a new Little Chief fabric tire to sell at the standard market prices.

SANFORD ADDS A TRUCK

SYRACUSE, May 9—The Sanford Motor Truck Co. has added a new 1½-ton truck to its line. This will sell for $2,150, which is the chassis price. The engine has a bore of 3¾ in. and stroke of 5 in., and the tires are 36 x 3½ front, 36 x 5 rear.

Shortage of Parts Hampered Overland

Prevented Maximum Output—President Willys Optimistic at Annual Meeting

TOLEDO, May 10—Gratifying reports of the outlook for the Willys-Overland Co. were made to the stockholders at their annual meeting here yesterday by President John N. Willys. He said the delay in obtaining materials in sufficiently large quantities was all that prevented maximum production and that the company is oversold on several thousand orders.

Dealers all over the country are clamoring for cars, and the company is allotting them only portions of their orders, Willys said. The officers of the company believe that supplies of material will be large enough to permit maximum production in July. April was one of the biggest months in the history of the company, with sales and orders far in excess of the output. More Overland and Willys-Knight cars were sold at retail the first week in May than in any previous week, with one exception, Willys declared.

No reports of earnings for the first quarter were submitted, but it was stated that such a report would be made later to cover operations for the first six months.

Two new directors were elected. Frank G. Allen of Moline, Ill., will take the place of J. R. Harbeck of New York, and C. M. Keys was added to the board. Allen will represent the Moline Plow Co. on the board. Keys is at the head of the Curtiss Aeroplane & Motor Corp.

Stephens Salient Six Prices Again Lowered

MOLINE, ILL., May 8—Following the refinancing and reorganization of the Moline Plow Co., announcement is made by the Stephens Motor Works of another price reduction on its various models. The prices follow:

	Old Price	New Price
Roadster	$1,675	$1,575
4-passenger Phaeton	1,745	1,595
6-passenger Phaeton	1,745	1,625
Coupe	2,650	2,450
Sedan	2,650	2,550

In addition to the price concessions a considerable number of refinements have been added to the different models.

KING REDUCES PRICES

DETROIT, May 8—The King Motor Car Co. has made price cuts ranging from $330 to $725. The prices follow:

	Old Price	New Price
Roadster	$2,140	$1,795
Phaeton	2,125	1,795
Coupe	3,125	2,400
Sedan	3,235	2,550

KISSEL LOWERS LISTS

HARTFORD, WIS., May 5—Reduced prices are announced by the Kissel Motor Car Co. The list follows:

	Old Price	New Price
2, 4 and 7-passenger Phaeton	$2,675	$2,385
Coupe	3,125	2,975
Sedan	3,235	3,075

The company has brought out a new 5 passenger phaeton, which sells at $1,885 as compared with $2,675 for the old model.

HOLMES PRICES DROP

CANTON, OHIO, May 5—The Holmes Automobile Co. has reduced the prices of its various models. The list follows:

	Old Price	New Price
7-passenger Phaeton	$2,950	$2,500
4-passenger Phaeton	2,950	2,500
4-passenger Coupe	3,850	3,300
7-passenger Sedan	4,150	3,600

HAYNES ROADSTER REDUCED

KOKOMO, IND., May 9—The Haynes Automobile Co. has reduced the price of its model "75" two-passenger roadster from $2,595 to $2,395.

NEW JUMBO LISTS

SAGINAW, MICH., May 9—The Nelson Motor Truck Co. has reduced the prices on its entire line of Jumbo trucks. The list follows:

	Old Price	New Price
Jumbo 15	$2,425	$2,295
Jumbo 20	2.675	2,520
Jumbo 25	3,090	2,660
Jumbo 30	3,590	3,060
Jumbo 35	4,080	3,900
Jumbo 40	4,730	4,400

LAUSON TRACTOR LOWER

NEW HOLSTEIN, WIS., May 9—The John W. Lauson Mfg. Co. announces the following reductions in price on three of its models:

	Old Price	New Price
Lauson 15-25	$1,685	$1,495
Lauson 15-30	1,985	1,875
Lauson Road, 15-30	2,225	2,100

Murphy in Duesenberg Sets New World Record

SANTA ROSA, CAL., May 8—Jimmy Murphy in a Duesenberg Special won the 100-mile Cotati speedway event there yesterday in what is unofficially stated to be the world's record, two minutes under the former mark, when he came home ahead of a fast field in 52 min. 10.23 sec. Frank Elliott in a Leach Special was second and Harry Hartz in a Duesenberg third.

The 50-mile heat was won by Pietro Bordino in a Fiat Special in 26 min. 13.36 sec., with Hartz second and Murphy third.

DELCO SALES ENGINEER DIES

DAYTON, OHIO, May 5—Frank W. Edwards, sales engineer of the Dayton Engineering Laboratories Co., died at his residence here from an acute case of pneumonia. Edwards was well known in the automotive field. He had been associated with the Delco company for more than a decade, and in that time had made many friends in the industry.

No Indications Seen of Decline in Sales

Much of Retail Business on Time Basis—Truck Trade Improving Rapidly

NEW YORK, May 10—Directors of the National Automobile Chamber of Commerce at their meeting in Detroit last week were unable to detect any signs of a slowing-up in the flood of orders for motor vehicles. Dealers in all sections of the country, except in a few agricultural districts, report that there were no indications of a falling off in sales. There has been a great improvement in the used car market, and dealers now are trading cautiously, turning their stocks over quickly. The truck business is improving very rapidly. Sales of heavy duty vehicles are best in Chicago, where a large number are being used in building operations.

One extraordinary feature of the present sales situation is that from 35 per cent to as high as 80 per cent of the retail business is on a time basis. This is construed to indicate that by no means all of the sales now being made are the result of increased purchasing power resulting from high security prices.

Good Future for Utility Car

It was the opinion of many of the manufacturers that the utility top car, or low priced closed car, will have a very heavy sale after July 1 and that this will tend to keep the plants making models of this character running at capacity.

The directors decided to appoint a committee which will be headed by Roy D. Chapin to confer at Washington, May 24, with representatives of the Bureau of Roads and the National Association of State Highway Officials in reference to a general road program. While the subjects to be considered have not been worked out in detail, one of those taken up will be the financing of highways. The decision of the automotive industry is that all property and all residents along improved roads benefit from them, and for that reason motor vehicles should not be taxed for their construction. It is admitted, however, that inasmuch as motor vehicles are the chief users of the highways the taxes imposed upon them should pay the maintenance costs.

NATIONAL CONSIDERS MERGER

INDIANAPOLIS, May 11 — The National Motor Car & Vehicle Corp. has sent a financial statement and letter to stockholders announcing that the company has been invited to become a part of the Associated Motor Industries. A decision on the question will be reached at the annual meeting of the corporation in New York. Stockholders at that time will accept or reject a substitute proposal to sell all the corporation's properties and assets. The banking interests are said to favor the consolidation.

Men of the Industry and What They Are Doing

Newmark Now With Durant

J. H. (Jake) Newmark, who was advertising manager of the Chevrolet Motor Co. for several years prior to his transfer to Detroit where he has been attached to the advisory staff of the General Motors Corp., has resigned to become associated with the sales department of Durant Motors, Inc. He will be in charge of advertising for the New York, Lansing and Toronto plants under the direction of M. B. Leahy, general sales manager. Newmark will join the Durant organization this month and his headquarters will be at Long Island City. Newmark is considered an expert on sales, and Leahy believes his services will be highly valuable in building up the Durant organization. Before going with Chevrolet, Newmark was with the Apperson Bros. Automobile Co.

Tegder Directs Hanson Sales

J. C. Tegder has been appointed director of sales and advertising of the Hanson Motor Co., Atlanta. He has been an automobile distributor for a number of years, and in 1910 served as sales manager of the Staver factory in Chicago.

Herwig Sales Manager for Ogren

R. S. Wiltrout has been made treasurer and general manager of the Ogren Motor Car Co. through changes in the organization, and C. A. Herwig has been appointed vice-president and sales manager.

Flum is C. G. Factory Manager

R. A. Flum of Cleveland has been appointed general factory manager of the C. G. Spring Co., Kalamazoo. He held a similar position years ago with the Perfection Spring Co. of Cleveland, and goes to Kalamazoo to be associated again with his old chief, Christian Girl.

Perrine Leaves Auto Parts

W. E. Perrine has resigned as president of the American Auto Parts Co., and J. C. Parsons has been appointed acting president.

Long Again Heads Wheel Makers

Hargrave A. Long has again become general manager of the recently reorganized Wood Wheel Manufacturers Association with headquarters in Chicago. Long became manager of the industrial group department of the Motor and Accessory Manufacturers Association when the Wood Wheel Manufacturers were taken in as a group, but retired when the M. A. M. A. decided to abandon its group activities.

Hutz with Fedders in Canada

H. L. Heitzman, secretary of Fedders Manufacturing Co. of Buffalo, has completed a tour and survey of Canada which has resulted in the locating of a branch factory at Bridgeport, Ont., for the production of Fedders radiators and parts. This plant will also be equipped to do a limited amount of sheet metal work in connection with radiator parts.

L. C. Hutz, for several years purchasing agent for the Pierce-Arrow Motor Car Co., has become sales manager of the Canadian plant for the Fedders company.

Coleman Manages Mitchell Branch

T. L. Coleman has taken over the management of wholesale business of the New York Mitchell Motor Co., New York City. His association with this company comes after many years experience in the industry. Among other engagements, Coleman was general sales manager for the Chevrolet Co. of Canada, controlling the entire Dominion, in charge of sales, service and manufacturing; general sales manager also for the Packard Motor Co. of Pittsburgh and district manager for Hare's Motors, traveling through the East and South.

L. H. Bennett Joins Jobbers

L. H. Bennett, formerly a Ford dealer, later with Studebaker and General Motors and more recently a merchandising worker for the Pacific Coast group of Automotive Equipment Jobbers, has joined the Chanslor & Lyon Co. of San Francisco as merchandising director. This is a new office which will bring Bennett in close contact with dealers, enabling him to assist them in analyzing their interests and problems.

Sheets Joins Lomar

W. M. Sheets, formerly of the Miami Cycle Works, has been made sales manager of the Lomar Manufacturing Co., Middletown, Ohio. Sheets has been identified with the motorcycle and bicycle business for a number of years, and through this work has built up a wide acquaintance from coast to coast.

Singer Is Advance Sales Manager

Walter O. Singer has been appointed general sales manager of the Advance Rubber Co., Brooklyn. Until receiving this appointment Singer served as district manager for the Globe Rubber Tire Manufacturing Co. of Trenton, in charge of a good portion of the Eastern territory and the New York branch.

Meixell Investigates Tire Bill

Harry Meixell, secretary of the Motor Vehicle Conference Committee, has gone to Atlanta at the request of the Rubber Association of America to investigate a tire branding bill which will be introduced in the Georgia Legislature at the coming session.

Hawkins Criticizes Present Advertising

Marred by Exaggerated Statements, He Says—Transport Idea Should Be First

DETROIT, May 10—Exaggerated emphasis has been placed on quality of product in automotive advertising, in the opinion of Norval A. Hawkins of the advistory staff of the General Motors Corp. In an address before the Michigan Automotive Trade Association here to-day he vigorously criticized the present trend of most automotive advertising and declared that it either confuses or disgusts the public.

The prospect knows, Hawkins said, that all the vehicles advertised cannot be the best, so the almost unanimous claims of superiority have little effect. He blamed superficial thinking about distribution for the conditions existing.

Effective advertising of the future, he declared, will talk about motor travel and transportation as desirable and leave in the background or to the inference of the reader the fact that with a certain product it can be accomplished comfortably and economically. He states further:

Only Facts Should Be Set Forth

The advertisement should state nothing about the product but indisputable facts, such as price, wheelbase, equipment, etc. There should be no extravagant statements of quality of product and the product should be mentioned only as incidental to motor travel and transport. This idea of motor travel and transport never has been sold, with the product completely subordinated. The product always has been pushed to the front with some claim of peculiar excellence.

In my opinion the advertising of the future will be dominated by the organization which first establishes and which maintains the unique standard of ideas of motor travel and transport to the fore and facts of quality implied, but seldom stated, far to the rear.

Hawkins quoted anonymously from a collection of more than 200 of what he termed catch phrases culled from the advertisements of forty-six manufacturers, showing that while wording was different the thought expressed was similar in all cases. He declared that such advertising at most sells only familiarity with a name.

Doody with Earl Motors

W. A. Doody, for the last three years connected with the Jackson Steel Products Co. of Jackson, has been appointed district sales supervisor for Earl Motors, Inc., with permanent headquarters at Rochester. Previous to his association with the Jackson company, Doody was a member of the firm of Ryan & Doody, dealing in stocks and bonds in Rochester.

Plants Speeding Up in All Branches of the Industry

Releases on Engine Contracts

INDIANAPOLIS, May 9 — Midwest Engine Co. views the releases that are being placed on contracts for its products by customers as one of the noteworthy indications that business is now reaching its real pace. These releases have made it difficult, for the time being at least, for production to keep up witn deliveries, although production is now swinging closer to delivery promises. In the last ten days the company has closed additional contracts with three truck and one tractor manufacturers for their 1922 requirements.

Big Gain in Quarter by Maxwell

DETROIT, May 6—Production of the Maxwell Motor Corp. for the first quarter of 1922 was 340 per cent more than for the first quarter of last year, according to a statement by President William Robert Wilson. During April demand for Maxwells so far exceeded increased production that the factory is six weeks behind on orders for May delivery. About 2500 men have been added to the payroll since the first of the year. Many departments are working day and night and much new machinery has been added to stimulate production.

Oakland Best Since September, 1920

PONTIAC, MICH., May 9—Sales made by the Oakland Motor Car Co. during the month of April were greater than for any month since September, 1920, according to George H. Hannum, general manager of the company. Hannum declared business was holding up during the first few days of May at the same or a higher level, but that production for the present would be kept on an even plane. The plant is turning out about 100 cars daily, a pace struck several weeks ago. No difficulty is now being experienced in getting materials, Hannum said.

Michigan Firms Expand

PONTIAC, MICH., May 9—Both the Bradt Wheel Co. and the Rochester Metal Products Co. of Rochester, Mich., near this city, have experienced an increase of business in the past two months that has necessitated increased operating space. They occupy a building owned by the village and the town council has ordered the expansion to meet their needs. The Bradt company makes metal disk wheels and the Rochester Metal company, machine screws, for automo tive plants.

Yellow Cab Adding to Plant

CHICAGO, May 8—The Yellow Cab Manufacturing Co., manufacturers of Yellow taxicabs, this week began the construction of an additional story to its two-story office building adjoining its factory, and within the next two weeks it is planned to start work on a factory addition. It has not yet been decided whether the factory addition will be one or two units.

The growth of the company's sales in the last few months makes expansion necessary. Officials state that orders now in hand provide for capacity operation into the month of August. The output is now sixteen cabs a day and an effort is being made in increase this to twenty-five. The sales force is being increased, five road salesmen having been added recently. It is planned to divide the United States into ten sales districts.

G. M. Truck to Increase Output

PONTIAC, MICH., May 8—The General Motors Truck Co. will increase its production just as soon as material difficulties are straightened out, according to W. L. Day, general manager. Day declared that increase of business as reflected in orders coming to the plant had been considerable during the past few weeks and warrants an increase of production. Delay in getting materials has recently been holding up the plant somewhat.

April Biggest Month with Nash

KENOSHA, May 10—Nash Motors Co. reports that April was the biggest month in its history, 18 per cent more cars being shipped than in April, 1921. Even the previous record month, August, 1920, was eclipsed in point of shipments. The first quarter of 1922 shows an increase of nearly 52 per cent over the similar period a year ago, according to C. B. Voorhis, vice-president and director of sales.

Night and Day Shift at Wills

MARYSVILLE, MICH., May 8—An addition of nearly 33 1/3 per cent to the working force was made this week by C. H. Wills & Co. in their Wills Sainte Claire plant here. A full night shift and a full day shift are now working. Every effort is being made to double April production.

R. & V. Shipments Good in April

EAST MOLINE, ILL., May 9—Shipments of the R. & V. Motor Co. in the last month exceeded those of any other month in a long period, according to officials of the company. An executive officer just returned from an Eastern tour says the trade outlook is promising and conditions show every sign of improvement.

Ships 10,000 Magnetos Monthly

SPRINGFIELD, MASS., May 8—During the past five months the American Bosch Magneto Corp. has shipped 82,000 sets of starting and lighting systems. Shipments are now running at the rate of 10,000 a month.

Republic Rubber on Two Shifts

YOUNGSTOWN, May 9—Republic Rubber Corp. has increased truck tire operations from a one-shift to a two-shift basis, and in the inner tube department from two to three shifts. Under the new schedule the company is producing 20,000 tubes and 10,000 casings weekly. Officials estimate April gross sales approximated $525,000, compared with $470,000 in March. Further gains in volume are expected in May. The increased output is going directly to dealers and consumers, and the company is accumulating no finished inventory.

Hendee Making 1800 Monthly

SPRINGFIELD, MASS., May 8—The Hendee Manufacturing Co. will maintain its present rate of production through May, which will mean an output for the month of 1800 motorcycles. It is stated that the new credit system, enabling the dealer to make instalment payments after the custom introduced by automobile companies, is proving of value in stimulating selling. The export trade in motorcycles is reported as improved, among the latest foreign orders being one for 300 from Denmark.

Chevrolet Branch Increasing Force

OAKLAND, CAL., May 8—The Chevrolet Motor Co.'s factory here is increasing its working force to reach a production of 1000 cars a week, according to announcement by W. C. Williams, superintendent of the plant. Production for March was 2800 cars, with 600 men employed. For April, it will run above 3000 cars, and an effort is being made to pass the 4000 mark in May. About 850 men will be required to meet this increase in production, according to Williams. Increased demand is given as the cause for the increase in production.

Moves Into Larger Quarters

INDIANAPOLIS, May 8—The Electric Machine Corp. of this city has moved into larger quarters, increasing its floor space four times, and is expanding both its out-put of electric testing machines and of wireless equipment. For some time this concern has manufactured rotary spark gaps for wireless sending apparatus. Recently it has entered the radiophone receiving set manufacture, though not yet in production in this line.

Added Equipment for Hupp

DETROIT, May 10 — Increased Hupp production has made it necessary, the factory declares, for the company to install an extension heat treating plant in its branch factory at Jackson, Mich. The additional equipment will be used for heat treating steering knuckles, steering arms and levers, and several small forgings, such as handbrake levers, clutch and release levers.

Receivers to Handle Stevens-Duryea, Inc.

Appointed on Petition of Fisk Tire—Assets Nearly Triple Liabilities

SPRINGFIELD, MASS., May 9 — Harry G. Fisk of this city and Frank H. Shaw of Chicago were appointed receivers for Stevens Duryea, Inc., of Chicopee, Mass., in Superior court here to-day. This action was on petition of the Fisk Tire Co., Inc., by recommendation of the creditors committee. The petition was uncontested. Sureties of $25,000 are required of each of the receivers, the bonds to be filed within 10 days.

The receivers are empowered to take over all the assets. Indebtedness is said to total $1,100,000. Net assets are approximately $4,000,000, of which $350,000 are notes receivable, finished and partly finished cars. About $2,000,000 is in real estate and equipment and most of the remainder is in the form of material and cars.

The petition set forth that on account of the business situation the company was cramped for funds and this hampered its efforts to manufacture and deliver cars to fill orders, of which it had a large number.

It was stated that unless the petition was granted the plant would be obliged to close with serious loss to all concerned. The petition stated that $4,800,000 of preferred stock is outstanding, together with $30,000 class A and $70,000 class B common stock.

Relied on Banks for Help

President Ray S. Deering gave out a statement in which he said the company had relied on New York and Chicago banks for credit, and the closing of one bank last January had cut off one of its principal avenues. As a first expedient the company sought to get authority from the stockholders to provide additional capital and refund its obligations by placing a mortgage on its plant, which is clear of encumbrance. This it was unable to do readily, owing to wide distribution of the shares. It then asked creditors for an extension of six months. This plan was acceded to by most of them, but the action of certain ones in filing attachments created a situation that made a receivership seem advisable.

He added that the creditors had found the company to be solvent, and that it is contemplated the receivership will be temporary. Sales have been increasing, he said, and orders are sufficient to keep the plant operating for two months.

INTERNATIONALIZING BEARINGS

NEW YORK, May 8—The American Sectional Committee on Ball Bearings has decided to recommend the adoption of certain proposals tentatively agreed to by the German and Swedish ball bearing committees for international standardization of bearings. These proposals will necessitate certain changes in the standards of the Society of Automotive Engineers, but only in sizes which are used to a very limited extent. It is believed, therefore, that an agreement will be reached soon as to international standards. The purpose of the plan is to have bearings manufactured in other countries which will be suitable for use in American made cars.

Soft Top "Utility Coupe" Brought Out by Chevrolet

DETROIT, May 9—The Chevrolet Motor Co. has just brought out a new closed car designated as a "utility coupe" which will sell for $720, f.o.b. Flint, as compared with the $875 price of the regular coupe model in the 490 line. It is of two-passenger type and is designed especially as a vehicle for all year use by business and professional men.

This is the first of the General Motors units to bring out a model in the new soft top glass inclosed vehicles. The mechanical features of the car are identical with the Chevrolet 490 line. The lines of the top are square and give the car a low built effect. Doors are exceptionally wide, allowing a 28 in. opening and are provided with double latches and anti-rattling devices.

A feature of the new car is the unusually large rear compartment affording a space of about 15 cu. ft. to accommodate samples, advertising matter, instruments, etc. The size of the compartment is concealed by the body lines.

Business in the new type of closed car is reported by factories which had models at the New York show as running high. Hupp and Dort have been in production for several months, and Dodge is about to enter production on its model. Hudson-Essex, whose coach was the progenitor of the line, finds it a leader in the closed car field.

Electrical Parts Service Abroad Being Developed

NEW YORK, May 8—The development of electrical service and parts distribution to cover the Delco, Remy and Auto-Lite starting, lighting and ignition equipment in the important trade centers of the world has been taken over by the Overseas Motor Service Corp. of this city. Parts distributors are being appointed who will carry stocks and offer electrical service to car dealers and owners, each distributor being given a defined territory in which to operate. Each dealer in the territory then will call upon the distributor for whatever service may be required.

The Overseas Motor Service Corp. is one of the General Motors subsidiaries, specializing in the foreign sales of accessories and equipment. The arrangements with Delco, Remy and Auto-Lite were worked out by S. W. Dorman, general manager of the company, and several distributors already have been appointed in such centers as Havana, for the island of Cuba; Ancon, for the Republic of Panama and the Canal Zone.

500 Ford Cars Sent to Belgium in April

Shipped from New York in Semi-Knockdown Condition—Market Greatly Improved

DETROIT, May 10—The Ford Motor Co. shipped approximately 500 cars from New York into Belgium in April in semi-knockdown condition. The market for Ford cars is said to be showing considerable improvement in that country, and there are now about 2300 in service. The price there, without starter or demountable rims, is $692.18. Since the armistice 37 per cent of all cars imported into Belgium have been of American make, according to the Ford statement. Prices for American cars are declared lower than the Belgian-made product. General conditions there are reported as opening up an extensive field for American cars.

Foreign plants of the Ford Motor Co., exclusive of the Ford Motor Co. of Canada, produced approximately 14,000 cars in the first three months of 1922. This compares with 3779 in the first three months of 1921. The company declares this showing to indicate much better trade conditions in foreign countries. The Manchester, England, plant in the first quarter of 1922 made 7223 cars and trucks, as compared with 2377 in the same period last year. Buenos Aires production ran 3000 ahead of the same quarter last year. In March the output was the largest in the history of the plant. Copenhagen turned out 800 cars and trucks in March, comparing with 200 a year ago. Output in the plants at Bordeaux, Cadiz, Copenhagen and Sao Paulo ran about three times as large as for the 1921 quarter.

Making House-to-House Canvass

The Ford Motor Co. of Canada has initiated a simultaneous canvass of all Dominion residents, from coast to coast, by which the 685 dealers are said to be literally combing for live prospects. In two months there should not be a home in Canada which has not heard the Ford message. A report on the canvass says a similar canvass for closed car buyers in September resulted in an increase of 40 per cent in closed car sales over the previous winter.

COLUMBIA MAKES 40 CARS DAILY

DETROIT, May 9—Columbia Motors Co. is now working on a schedule of 20 light sixes and 20 of its heavier model daily and is aiming to increase its output by June 1. The company was delayed in getting into heavy production on the new light car in April owing to material tie-ups, but is now rapidly approaching capacity.

The company has been considering leasing the recently vacated Saxon plant which adjoins the main Columbia factory. This would give an increased capacity of 125 daily. Orders now on hand are declared to insure 100 per cent production for several months.

Reeves Gives Views on Trade Body Work

Tells Manufacturers Association Sherman Law Exemption Not Desired

NEW YORK, May 10—Service which is of direct benefit to the public supplies the best proof of the increasing need for properly conducted trade associations, according to Alfred Reeves, president of the Trade Organization Executives of New York, who addressed the convention of the National Association of Manufacturers at the Waldorf-Astoria today on "Relations of Trade Associations to the Public."

Reeves, who is also general manager of the National Automobile Chamber of Commerce, asked that so-called "open price bureaus" be not put in the class of trade associations, with their score of activities that have no relation to prices or production.

Activities of Public Value

Trade association activities of value to the public, he said, include research work which makes for more scientific use of products, activities relating to more prompt delivery of goods, better service, more uniform standards of design and material as a basis for comparison, protection against untrue or exaggerated forms of advertising, the elimination of unnecessary styles, the reformation of unfair trade practices that tend to deceive and the thing which is of very definite value to the consumer—lower prices for the things he buys.

Reeves declared trade associations do not want exemptions from the terms of the Sherman law, but want the fundamentals of that law maintained. He questioned the need of any more legislation and asked for a vigorous enforcement of present laws in the belief that present governmental departments had ample powers to investigate those trade association activities which Herbert Hoover says are in the "twilight zone."

"Price Competition" Class Small

Reeves said further:

Some trade associations and open price bureaus which have to do with the so-called "open price competition" are under fire, but they are only a small percentage of the 500 or more trade associations that have become such an important factor in the upbuilding of American trade in this country and also to meet the competition in our struggle for the world's markets.

Trade associations are a natural result of the concentration of effort toward lower prices for better goods, to the ultimate broader purchasing power by the public.

The trade association is a voluntary organization to which all of standing in the same line of business are admitted to membership. It is not autocratic. It undoubtedly supplies the greatest benefits to the small manufacturer or dealer. In a vast number of cases it does not include some of the biggest manufacturers, which disposes of the suggestion that trade associations make for monopoly. Most of them aim to cut out duplication of work, to simplify manufacture and to make products better and to reduce the required capital on the part of manufacturers and merchants.

Price is something which most trade associations studiously avoid, but as associations in such activities are well known, an investigation by the proper governmental department should prove quickly whether or not they are operating in violation of law.

Lincoln Receivers Deny Claims of $4,250,000

DETROIT, May 10—Claims aggregating $4,250,000 against the Lincoln Motor Car Co., preferred by seven individuals, were denied to-day by the Detroit Trust Co., receivers. The claimants were indorsers of notes issued by the motor car company, and the trust company to-day demanded they pay these notes.

The notes are held by the Peoples State Bank, the First National Bank, the Wayne County and Home Savings Bank, William H. Murphy and Joseph Boyer, all of Detroit, the Union Trust Co. of Pittsburgh, and the Continental & Commercial Bank of Chicago. The indorsers are Henry M. Leland, Wilfred C. Leland, William T. Nash, Joseph Boyer, William H. Murphy, John H. Emmet and John Trix.

Denial of the claims means, according to Elmer W. Voorheis, clerk of the Federal court here, that the $4,250,000 if collected can be added to the $5,000,000 now held in trust by the court for the company's creditors. The claims are said to total approximately $5,000,000, independent of that of the Government for about $9,000,000, which, it contends, represents overpayments on wartime contracts.

The Government claim, it is understood, has precedence over all others.

PLANS 81,000 SETS OF WHEELS

DETROIT, May 10—The Kelsey Wheel Co. has a schedule of 81,000 sets, four wheels and five rims, for May, which will make the month the largest from the point of production in the history of the company. Of these, about 30,000 sets are Fords and the remainder is divided among Studebaker, Hupp, Cadillac, Dodge Brothers and others. Ford business comprises about 37 per cent of the total.

LINCOLN AT HIGHEST POINT

DETROIT, May 10—Production and sales of Lincoln cars continue at the highest rate in the history of the company, with enough orders on hand to keep the plant at capacity for three months. Body makers are unable to keep up with orders which are coming in three times as fast as the output capacity.

TWO SHIFTS AT LIBERTY

DETROIT, May 10—Liberty Motor Car Co. predicts that May will exceed April in point of sales and production. April surpassed March which had established a new production record. Night and day shifts are employed.

Colorado Railroads Win in Truck Fight

Utilities Body Says Vehicles as Taxed Now Are Not Entitled to Use of Highways

DENVER, May 10—The railroads of Colorado have won an important victory in their campaign against the operators of motor trucks who have taken away from the carriers a large share of the short haul freight traffic. This anti-motor truck campaign has resulted in a decision by the Public Utilities Commission of Colorado that the truck operator is not entitled to the use of state highways until the taxing laws are so amended that he "shall contribute his due proportion to the cost of construction and maintenance of the highways."

The commission asserts that an investigation it made of the transportation conditions in Eagle and Garfield counties showed that, although there were 68 motor trucks operating as public carriers, they paid into the state treasury only $819 a year, while the Denver & Rio Grande Western Railroad, which these buses parallel, paid during the same period, $38,023 for the public roads which they do not use at all, and additional taxes bringing the total paid by the railroad company up to $153,896.

The section of the decision defining "public convenience and necessity" follows:

Public convenience and necessity, by which must be understood the convenience and necessity of the people at large as contra-distinguished from the convenience and necessity of a very small number of persons who seek to derive a profit from the farmers' and home owners' investment in roads, never contemplated that the truck driver should destroy that, to the cost of construction of which he contributed little or nothing, or that he should reap where he has not sown.

Wheel Companies Add to Plant and Products

DETROIT, May 11—The Motor Wheel Corp., Lansing, is building additions to its disk wheel and wood wheel factories to meet the steadily increasing demand in the wheel department of the automotive business. Contracts require that the new buildings be rushed to construction.

The demand for disk wheels, both from car manufacturers and from replacement sources, are reaching new heights. Orders placed by car makers in several instances will keep factories at forced capacity for several months, and in one instance the equipment business has been so heavy as to cause the manufacturer to cease indefinitely all shipments for replacement purposes.

Hayes Wheel Co. will get into production this month with a complete line of disk wheels, thereby giving the company representation in all types of wheels. The disk type will be demountable at the rim and will use Hayes standard felloes, hubs and other wheel fittings.

U. S. Registration Bill Has Opposition

Car Makers and Owners Testifying at Washington Urge Measure Be Killed

WASHINGTON, May 11—Nation-wide opposition to the Mills compulsory registration bill was voiced to-day by representatives of manufacturers and automobile owners associations who appeared before the House Ways and Means Committee urging that the bill be killed.

The opposition to the measure, which provides for a $2 registration fee through which it is expected to destroy the market for stolen cars, is based on the ground that the automotive industry now is bearing all the taxes that the traffic will bear, and that if a fee of $2 is charged now it will be the entering wedge for further taxation by the Federal government.

Say Sales Would Be Curtailed

From a manufacturer's viewpoint, the view was expressed that the resale of automobiles would be greatly curtailed through the almost endless confusion of giving titles. Under the provisions of the bill a buyer must protect himself by having his title, before purchase, looked up in the same manner as is now done in the transfer of real estate.

The cost, it is admitted, would be materially offset by the saving in insurance. It is figured that the cost to motorists would aggregate $30,000,000 a year, including the $2 tax, notary fees and filing cost, in addition to the time lost in recording the papers.

In an effort to submit to the committee considering the measure, a telegram was sent to the state directors of the American Automobile Association, asking for their opinion on the Mills bill. But three states indorsed the measure, the others voicing strong disapproval of it.

A. A. A. Files Protest

As a result of the protest made by the 340 active clubs of the A. A. A., representing 500,000 members, the following report was filed with the committee opposing the measure:

Motor cars are to-day taxed directly from six to eight different times, and now comes the proposition of a Federal tax, which will necessitate miscellaneous charges for registering and re-registering, which in all would substantially make it a tax of over $30,000,000 a year.

It is impractical from the standpoint of affixing a "permanent" number to the parts of an automobile.

Should such a number be affixed once, the constant necessities of the motor car industry are such that in the repair of cars, it would place on the industry an unwarranted burden.

The Federal Government should not set up the principle of making abstracts of title for automobiles any more than they should for realty.

The benefits to be derived are not in keeping with the expense of the undertaking.

An opinion was expressed to the committee by Dr. H. M. Rowe, former president of the A. A. A., that the measure, if passed, would be illegal. "I seriously doubt the constitutionality of such a bill as the Mills' measure," he said, "as it certainly is a usurpation of the authority of the states and is not an inherent right of the Federal government."

A letter from M. L. Heminway, general manager of the Motor and Accessories Manufacturers Association, opposing the measure, was read to the committee. In substance Heminway expressed the view that the bill, if passed, would offer an excuse for further Federal taxation, which, he said, "is now excessive."

FINANCIAL NOTES

Republic Rubber Corp. up to April 12 sold $800,000 of the $1,000,000 authorized certificates of indebtedness. The net loss for the first quarter was $39,102. In a statement to stockholders of the corporation on March earnings and gross business for the quarter, Receiver C. H. Booth says, "Gradual reduction of losses and the profit finally shown in March seem to indicate that this industry is fundamental and that the company when ultimately reorganized on a reduced capitalization and placed on a proper financial basis should regain its former position as one of the substantial industries of the district."

Ajax Rubber Co., Inc., reports that since Jan. 1 it has been operated at a profit which in the first quarter was more than twice the amount required to satisfy bond interest in that period. This is in contrast to the heavy losses sustained in 1921, due to inventory adjustment and abnormal market conditions. It is stated that the business on order and in prospect should create net earnings applicable to the bonds of at least $1,700,000, or more than seven times the annual interest charge, and more than four times the year's interest and sinking fund requirements.

Yellow Cab Manufacturing Co.'s directors have voted to double the company's outstanding B stock, an increase of 100,000 shares. The new stock will be offered to the stockholders at $30 a share. Recently the company declared a 100 per cent stock dividend. At present quotations the stock outstanding has an equivalent value of about $500 for the old stock. The company's net earnings for the first four months of 1922 are reported to be more than $800,000.

Goodyear Tire & Rubber Co. of Canada shows a net profit of $251,294 for the six months ended March 31. This was reached after reserve of $204,328 had been set aside for depreciation of plant and before valuation of inventories on the basis of the latest market prices. Current assets amount to $6,340,597 against current liabilities of $736,919. Cash on hand and in banks on March 31 amounted to $579,737.

Dort Motor Car Co. reports that since Oct. 31, 1921, its liabilities have been reduced by $600,000, and its cash in bank increased $100,000. At the present time the company has unfilled orders which will keep its plant running at capacity for several months. The company's production, which for March averaged 40 cars a day, has risen to over 100 cars daily.

Hayes Wheel Co. stockholders will vote on a proposal to increase capital to full authorization to 200,000 shares by declaration of a 22 per cent stock dividend. It is also proposed to change the present $10 par value shares to no-par value shares.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Last week call money ranged between 3½ per cent and 5 per cent as in the previous week. There was no essential change in the time money situation. Funds were in fair supply and were still available at 4¼ per cent for all maturities from 60 days to 6 months. Trading was reported dull, with no important loans recorded. The prime commercial rate was 4¼ per cent, as compared with 4½ per cent in the previous week.

The Federal Reserve statement as of May 3 showed a decrease of $6,022,000 in total reserves and a decrease of $426,000 in gold reserves. Total bills on hand increased $34,039,000 and total earning assets $76,023,000. Total deposits showed an increase of $59,102,000, and Federal Reserve notes in circulation increased $15,868,000. The reserve ratio decreased from 78.3 per cent to 76.7 per cent.

On May 5 demand sterling was quoted at $4.44¾, the highest point it has reached since July 14, 1919, when sterling was "unpegged" by the British Government.

According to reports filed with the Interstate Commerce Commission, the net operating income for March of the Class I railroads was more than $83,000,000, as compared with over $47,000,000 in February and more than $30,000,000 in March, 1921. The net operating income for March, 1922, represents earnings at the annual rate of 5.83 per cent on the tentative valuation as fixed by the Interstate Commerce Commission. This compares with 4.57 per cent for February and 2.15 per cent for March of last year.

The total number of commercial failures reported for April was 1948, a decrease of more than 15 per cent from March and four times larger than the total for April, 1919, a record low year. The liabilities involved for April, 1922, amounted to $72,553,740, an increase of 20 per cent over March and of 42 per cent over April, 1921, but a decrease of 31 per cent from the total for January. The Southern section reported 29 per cent of the total failures for April.

NEW STUDEBAKER BODY MODEL

SOUTH BEND, IND., May 10—The Studebaker Corp. has added a new body model to its line. This is a four-passenger type and is to be known as the Big-Six Speedster. The rear seat is provided with an unholstered dividing arm and considerable extra equipment is included in the price, which is $1,985.

Among the items of equipment are disk wheels, including two extra wheels with tires, front and rear bumpers, traveling trunk and trunk rack and courtesy light. To provide room for the trunk rack at the rear, the spare wheels are mounted one on each running board just forward of the front doors. The body is painted a dark blue with gold striping on the hood louvres.

INDUSTRIAL NOTES

U. & J. Sales Co., manufacturer of the U. & J. carburetor, whose factory in Chicago was destroyed by fire recently, has purchased a three-story factory building at Twenty-ninth and Halstead streets that city, and expects to be in full production by June 1. The new factory has 45,000 square feet of floor space and the company expects to add another story. The company intends to manufacture several new devices pertaining to ignition, lubrication and transmission, according to C. A. Kemper, sales manager. Orders received in the last 15 days exceed those of the previous 30 days, Kemper said, and he expects this year's business of the company to equal or exceed that of the previous best year.

Martin-Wasp Corp., Bennington, Vt., has developed a body stock sawing department within the last year. Contracts are now being carried out for production body builders for sawn stock to be used in the construction of closed jobs for Packard, Cadillac and Lincoln. The firm has developed the Martin system of pattern sawn body stock and its plant is equipped for the production of all wood pieces entering body construction, sawn and ready for final machining and assembly. Karl H. Martin is president of the company.

International Steel Products Co., Hartford, Wis., has been reorganized into a new corporation under the name of the International Stamping Co. Refinancing has been provided by some of the members of the old corporation, which will give the company ample funds to take care of its business. The company will continue to manufacture mufflers and automobile specialties as well as some electrical wireless devices. A. F. Schauer is president of the corporation.

Ludington Tire Co. is shipping its plant equipment from Ludington, Mich., to a new location at Pontiac. Necessity to get larger space has caused the change in location. For the present the equipment will be set up in a local shop while efforts are made to get a permanent location. Negotiations are pending for a factory building and five acres of land formerly used by a die-castings company. The concern makes an armored puncture-proof tire.

Pennsylvania Rubber Co. of America, Inc., has moved its New York branch from 1889 Broadway to 2006-2008 Broadway. The new location triples the space previously occupied. The export division of the company, which was formerly located in the Woolworth Building, will be housed in the new quarters. The branch is in charge of G. C. McCullough. Export business is in charge of D. Dudley F. Yard.

Rockford Motor Co. has been appointed general distributor for Mitchell cars in the Chicago territory. The arrangement involves the establishment of community sales and service stations in all parts of the city which will provide Mitchell patrons with sales and service accommodations in their neighborhood.

Center Fed Spring Insert Sales Co., Wilkes-Barre, has opened an additional office in Cleveland, at 1268 Hanna Building, in charge of N. H. Eckman. L. E. Hulet, consulting engineer of the company, will also make his headquarters at the new Cleveland address.

CADILLAC SEES BIGGEST YEAR

DETROIT, May 10—H. H. Rice, president of the Cadillac Motor Car Co., commenting upon current business of Cadillac, says in part as follows:

Cadillac sales for the current year up to the first of May were two and one-half times the corresponding period of last year. The sales in March and April were two of the largest months Cadillac has ever experienced. Only three other months ever equalled and only one other month was larger than the sales in March. The sales by months since the new type 61 was announced have steadily increased.

The new plant in Detroit which made available much larger capacity than Cadillac heretofore enjoyed, is approaching capacity. The company feels that the Model 61 is the most successful in its history, both from the standpoint of style and design as well as mechanical excellence.

The forecast of sales for the current year indicates that this year will exceed any year in the company's history.

Need of Good Roads Felt in Argentina

BUENOS AIRES, ARGENTINA, April 11 (*By Mail*)—The necessity for immediate action in starting a national campaign for improved highways throughout Argentina is being recognized through the calling of the National Congress on Good Roads, which will convene here during the last fortnight of May. This national necessity is being backed not only by national, provincial and municipal authorities, but also by the public at large.

The object of the Congress is to reach the most practical solution of the problem of national highways. All sessions will be public and the delegates in attendance will represent the national, provincial and municipal governments, trade organizations, engineering societies, and corporations and firms interested in road transportation and promotion.

Like all conventions, this one will have its popular features to attract public attention. The principal one in this case will consist of a parade in which every mode of road transportation used in each period of Argentine history will be shown.

SERVICE ORDERS ENGINES

WABASH, IND., May 9—The Railroad Division of the Service Motor Truck Co. has released a large quantity of Midwest 4¾ x 6 in. engines, made by the Midwest Engine Co., Indianapolis, for its gasoline propelled railway coach. This engine is a comparative newcomer in the Midwest line, having been developed for the heavier-duty class requiring high speeds. It develops 59 hp. at 1200 r.p.m. and 70 hp. at 15000 r.p.m. The torque peak is increased 50 per cent over that of the 4½ x 6 in. Midwest engine.

DEMAND FOR TRANSMISSIONS

KALAMAZOO, MICH., May 10—Fuller & Sons Manufacturing Co., manufacturers of truck transmissions, has orders in excess of $1,000,000 booked, and in an effort to keep up with the production schedule has issued a call for former employees to return to work.

METAL MARKETS

AMONG representative steel producing interests the impression prevails that a policy of skimming the fat off the market as it appears to-day is fraught with considerable danger for its future. This attitude marks a return to the before-the-war attitude of the industry when true sales generalship did not consist so much of thinking of the problems of to-day as of those of the morrow. It was only natural that the hand-to-mouth buying of consumers, which up to six weeks ago was considered as the embodiment of good management, should find its reflex in lessening the sharp look-out which producers had formerly maintained so as to detect squalls in the offing and to avoid them.

Old time longsightedness, however, appears now to have returned. Conditions in the last few weeks were such that it would have been a very easy matter to bring about a runaway market, shortlived as it probably would have turned out to be. The restraint shown by representative steel sellers and the tight hand which they kept on the market denotes gratifying recognition of the menace that lurks in inflation. Even those whose sales policy it is to take advantage of every up in the demand, trusting to luck that they can avoid the dips, are now beginning to wonder what will happen to steel prices with the collapse of the coal strike.

The large factors are assuming a waiting attitude, confident that their outstanding commitments are safe at booked prices, and as for third quarter business they are willing to sit back and let prices shape themselves in a natural way. If the coal strike fizzles out in the next few weeks, it will not have added any appreciable expense to steel making costs, but certain it is that consumers will expect an easing off in values.

Pig Iron.—With reports of foundry iron being held at as high as $24@$25, valley base, the present movement seems to have spent its strength. Pig iron interests fully recognize that prevailing prices are largely temporary, and with additional blast furnaces resuming almost every week there is likely to be steadily growing competition for second half deliveries

Steel.—Those of the independent sheet producers who announced advances of $5 to $7 per ton over April 1 quotations are reported to have booked relatively little business at these higher prices. What orders they booked were virtually all for rush delivery and the advance is really in the nature of a premium on early delivery. The chief interest is out of the market, except for heavier blue annealed, having enough orders in hand to operate normally and being unwilling to commit itself further pending the clarifying of the situation. Steel supply conditions are such that strip steel producers are not anxious for additional business, although inquiries from the automotive industry continue heavy. Prices are firm. Further advances in bolts and nuts are predicted.

Aluminum.—Automotive foundries have been buying No. 12 alloy freely, but the sheet market has turned somewhat quiet. Rumors have been current that the leading producer of low-priced motor passenger cars was planning the use of aluminum sheets in closed cars. This rumor makes its appearance at regular intervals, and naturally never meets with authoritative denial.

Copper.—Domestic consuming demand is fair with production on the steady increase. The market is steady.

Calendar

SHOWS

Nov. 13-18 — Chicago. Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

May — Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague, Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24 - June 5 — Barcelona, Spain, Automobile Show under Dealers' Direction.

May 28-June 5—Prague, Motor Show. Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiserdamm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

May 30 — Indianapolis, International Sweepstakes.

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

May 16-17—Detroit, Semi-Annual Convention, Factory Service Managers, National Automobile Chamber of Commerce, Hotel Statler.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 19-20—St. Louis, Annual Meeting of the American Automobile Association.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee Annual International Convention of the Associated Advertising Clubs of the World.

June 19-20 — Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer Meeting of Society of Automotive Engineers. Detroit, May 19. The Pennsylvania section will hold an outing at Torresdale or a body meeting on May 25.

New Reimportation Bill Undermines Old

WASHINGTON, May 9—Senator Frelinghuysen of New Jersey, Republican, has introduced a bill in the Senate which provides for the return from Europe of motor-propelled vehicles and other equipment used by the American forces in Germany for distribution to the state highway departments. In effect, this bill, if passed, would circumvent the purposes of the so-called Graham resolution which was drafted for the express purpose of protecting automotive manufacturers and dealers from unfair competition, due to the reimportation of war supplies.

Bill Referred to Committee

The Frelinghuysen bill is known as S. 3562 and has been referred to the Committee on Military Affairs. It provides that the Secretary of War should transfer to the Secretary of Agriculture "all motor-propelled vehicles and other machinery, equipment and supplies, suitable for road-building purposes, and now in the possession of the American forces in Germany for return to the United States for distribution to the state highway departments for use in the construction, reconstruction and maintenance of public highways under existing legislation. The Secretary of Agriculture is also authorized to transfer to the Secretary of Interior, upon his request, any of the equipment so returned to the United States for use in the improvement of public highways within and adjacent to the national parks and Indian reservations."

Section two of the measure provides that the Secretary of Agriculture may preserve not to exceed 10 per cent of the equipment for use and construction, reconstruction and maintenance of national forest roads or other highway building under his direct supervision. Otherwise the distribution will be upon the same basis as that provided for in the Federal Highway act for the distribution of Federal aid funds.

This measure would affect 411 motor vehicles now in the possession of the American Army in Germany. Of this number 300 are trucks.

Smith-Springfield Body Has New Set of Officers

SPRINGFIELD, MASS., May 10—Several new directors for the Smith-Springfield Body Corp. were elected at the annual meeting here. The new men on the board are F. A. Woods of Holyoke, Lewis Tifft of Springfield, Hugh Govern and A. H. Wolfe of New York, C. S. Dame and F. M. Livingstone of Springfield.

The directors elected an entirely new staff of officers. Dame was chosen president in place of Hinsdale Smith. He also will serve as treasurer of the company. A. H. Wolfe was made vice-president; Livingstone, assistant treasurer, and Raymond A. Bidwell, secretary. A. P. Smith formerly was secretary and treasurer.

Stockholders were informed that the plant is running at about 60 per cent of capacity, and that orders in prospect and inquiries indicate that it will be running at capacity by early summer. About 200 men now are employed. The company is making bodies for such companies as Rolls-Royce, Minerva, Renault, Lincoln, Winton, Packard and Marmon.

50 HARVESTER TRUCKS DAILY

SPRINGFIELD, OHIO, May 9—Although handicapped by lack of material, the Springfield works of the International Harvester Co. is keeping up with its schedule of 50 motor trucks a day. This schedule will be maintained until July. Orders are coming in steadily.

Japanese Army Test Following Old Lines

TOKIO, April 13 (*By Mail*)—Local automobile dealers received notice to-day that the annual motor test held by the Imperial Japanese Army will take place this year on May 10 and 11.

It is probable that the test will follow closely the lines laid out in the 1921 test, which was considered to be very successful, but dealers are not informed beforehand as to its exact nature.

Last year 16 different makes of trucks and 22 makes of passenger cars competed. The first day's test was held at Yoyogi Parade Ground, on the outskirts of Tokio, and covered design, acceleration, brake action and spring action in the passenger car class. The trucks were required to proceed a quarter-mile in low speed at full throttle, and then the same distance at full throttle in reverse, after which temperature tests were taken.

Observers With Vehicles

The second day's test consisted of a trial run, 97 miles for passenger cars and 65 miles for trucks, the two routes being different, but both covering a variety of difficulties in the way of hills, bad roads, etc. From two to five military observers rode on each vehicle, and both trucks and passenger cars carried their full rated capacity. In this test particular attention was paid to gasoline consumption, hill-climbing ability and cooling. General performance was closely observed. Owing to the very narrow roads, several accidents occurred, and four trucks were unable to finish.

The test is of great interest to dealers, as the results are published and are available to the public. No winner is announced, but the Automobile Department of the Army usually places an order for one or more of the vehicles which have done the best in their class.

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Foreign Trade Turns Losses into Profits

Export shipments may consist of only 15 per cent of total volume, but they are essential to insure profit. Bankers must play more important role in promoting foreign business. Speakers at National Foreign Trade Convention are optimistic as to the future.

By David Beecroft

A MORE definite realization of the importance of foreign trade to any manufacturer, even though that manufacturer's foreign trade constitutes only 10 or 15 per cent of his business, was one of the major topics emphasized repeatedly by many of the leading speakers at the Ninth National Foreign Trade Convention, held in Philadelphia May 10-12 and attended by upward of 1500 delegates from all industries in all parts of the country.

For nine years the National Foreign Trade Council, under the leadership of James A. Farrell, president of the United States Steel Corp., supported by a majority of the big manufacturers of the country, has been emphasizing the importance of foreign trade and the necessity for American manufacturers engaging in it, even though the percentage of exports is small as compared with domestic consumption, but never before has there been such a note of intense earnestness and appreciation as this year.

The leading bankers of the country, and they were very generously represented, for the first time admitted that they had made many errors in connection with handling foreign trade affairs, but that they were organized as never before. Standardization of forms in connection with foreign trade has been carried out, and a world-wide campaign for the adoption of these forms is under way. Bankers in the Middle West were well represented, and they too are prepared to handle foreign trade as well as those in the seaports.

The bankers being so heavily involved in many factories that were expanded during the war, and now must be kept working at as high capacity as possible, if they are to show a profit, showed a realization of the fact that their work in foreign trade is much more essential than merely that of their clerical organization to handle remittances and documents. Leading bankers from New York, Philadelphia, Cleveland, St. Louis, Chicago and other cities showed a practical realization of a larger part that the banker must play. He must do his part in keeping the factories at a greater capacity, and he has realized that while a manufacturer may export but 10 per cent of his product, that very frequently this 10 per cent represents the difference between a distressing loss and a very comfortable profit in business.

James S. Alexander, president of the National Bank of Commerce of New York City, devoted considerable time to establishing this fact. He put it this way:

"By a process of reasoning, which we now know to be fallacious, it was argued in some quarters that America might recover a considerable degree of her prosperity irrespective of the conditions of our foreign trade. This view was held by many a year ago, but the fallacy of it has been seen and realized during the past year by many business houses.

"From 10 to 15 per cent is a fair average of our foreign trade, as compared with domestic trade. In other words, a manufacturer has 90 per cent of his product consumed in the domestic market and 10 per cent in the foreign market.

"The so-called smallness of this percentage has surprised many business men and has made them, in some instances, lukewarm toward foreign trade. A 5 to 10 per cent loss, according to this theory, might suggest that 95 to 90 per cent of total trade would be left. This is absurd, because it presupposes that the 95 to 90 per cent does not in any way depend on the 5 to 10 per cent export business.

"A percentage of itself means nothing until we raise the question as to how much of a percentage change is necessary to fundamentally alter business conditions.

"For example: The difference between the normal volume of business and the volume of business at the bottom of a depression is only 20 per cent, and the average reduction from normal business during the entire period of depression may be under 15 per cent. Variations in operating ratios of not more than 5 to 15 per cent in some lines of business may cover the range of ample profits down to important losses. In other words, a so-called small percentage means nothing until we can inquire into the effect of that change upon the fundamental course of modern business.

"The relation of small percentage changes in the volume of trade to business prosperity is one of first importance. A full understanding of it involves much more than the relation of domestic to foreign trade. It involves the very significant relation between changes in gross business and profits, the demoralizing effect of a relatively small surplus of stock on domestic prices and hence on profits, and the fact that a change in foreign trade representing only 5 per cent of total trade may mean a loss of 20 to 40 per cent of the trade of some important industries.

"The re-establishment of normal trade conditions in the United States and the saving of this tremendous investment in extended plants depend to a large degree upon the extension of our foreign trade."

No Isolation for America

A Pittsburgh banker, J. P. Holdsworth, of the Bank of Pittsburgh, established the same fact with regard to the essential character of foreign trade and its necessity in our industry, even if the percentage is not greater than 10 per cent of total production. Mr. Holdsworth is one who shared the general opinion of the convention that a policy of economic separateness for America is impracticable and indefensible. People favoring economic separateness generally advance the argument that at best our foreign market is not more than 10 to 15 per cent of our total production, and that since there is not enough liquid capital to finance Europe's needs and our own as yet undeveloped natural resources, it would be better to restrict our own capital to our own internal development. Admitting freely the dominating importance of domestic business and the urgency of adopting every sound measure to stimulate it to the utmost, it still remains true that foreign trade is an integral and essential element in our continued prosperity.

Here is how Mr. Holdsworth put it to his auditors:

"In all lines of production there is a portion varying from 10 to 20 per cent, the sale of which is necessary to the profitableness of the entire operation. Our productive capacity, greatly expanded during the war, is substantially in excess of normal consumption requirements of the domestic market.

"Thus far our farms and fields have produced each year more than we need at home. In 1921 the export of agricultural products totaled more than $2,000,000,000, or a little over 50 per cent of our entire export business.

"Normally over 60 per cent of our raw cotton is exported. Normally nearly 50 per cent of our tobacco crop is exported. Normally 15 to 25 per cent of our wheat is exported. In 1921 we exported 35 per cent of our wheat. We normally export 13 per cent of our dressed meats.

"As a result of our steady industrial expansion we had reached the stage, even before the war, where we were exporting each year $1,000,000,000 worth of manufactured products.

"In many industries it is now necessary to market abroad 20 to 30 per cent of the output in order that the works may be kept running and labor fully employed.

"It must be understood that if the 10 per cent of production that is sent abroad were shut off, domestic business could not continue upon a 90 per cent basis. In numerous industries this export of 10 per cent makes possible economies of large scale production and measures the difference between prosperity and dullness in the industry concerned as well as in other related industries.

"The fact should not be overlooked that behind every $1,000 export of merchandise there are various domestic transactions preliminary to exportation several times the value of the export itself."

The fact that we require imports for the sustenance of our people and the development of the country, while not new in export parlance, was emphasized by Mr. Holdsworth in his effort to establish another reason for the imperativeness of foreign trade. Each year we import $250,000,000 worth of coffee, which has become a necessity of life and which cannot be grown within our borders.

Each year we import $235,000,000 worth of sugar.

Each year we import $200,000,000 worth of silk.

Each year we import $200,000,000 worth of hides and skins.

Each year we import $26,000,000 worth of tea.

Each year we import $54,000,000 worth of cocoa.

This story of imports of essentials of life and industry could be continued.

The American manufacturer must keep steadily in mind the fundamental facts that to sell abroad we must buy abroad, or the reverse, to purchase abroad we must sell abroad.

An attitude of isolation of America from the world's perplexing economic problems is no longer possible. The rehabilitation of Europe and restoration of order in world trade depend in a large measure upon financial cooperation from America. Not only must we sell abroad and purchase products from abroad, but we must invest money in sound foreign securities.

Export Era at Hand

Julius H. Barnes, of Barnes-Ames Co., of New York, was one of the many delegates who believe that a sound and substantial future for America in foreign trade is at hand, and that the substantial increases in foreign trade in the last few months indicate what the future

has in store. He believes that the next era of trade revival, and particularly foreign trade, will be one of such extent and so long sustained that America as the world leader in industrial production will prosper as never before. Mr. Barnes is another believer in that school of business men who realize the importance of a 10 per cent export trade in its effect on factory production and domestic trade.

Here is how Mr. Barnes expressed it:

"We have seen in the past year the differing views of men of equal ability and sincerity as to the short road back to prosperous industry.

"One school has argued that the 90 per cent of home trade should be conserved and developed, without venturing too far into the troubled area of foreign commerce.

"The other school has argued that the 10 per cent of foreign trade was the balance wheel which ran our industries without the destructive over-production which would wreck it at home.

"Both schools would agree that the home market would be more secure if, without losses and undue risk, there could function also the surplus foreign trade production.

"I am sure there is general agreement that no cause contributed so directly to trade prostration in America and the resultant unemployment, which automatically further reduced the buying power of our people, than the agricultural depression which flowed from unprofitable farm prices. No influence has been the source of so much confidence in the stability of our present reviving trade as the fact that the economic position of agriculture has magically altered in the last six months, due to foreign trade in the form of agricultural exports. The fact that we export 60 per cent of cotton and that a year ago cotton was 9 cents per lb. and to-day is 17, is a part of the story. In wheat we normally export 25 per cent of our production, but it has been greatly in excess of this recently.

"We should always bear in mind that a small surplus of production over demand for consumption fixes the price of the entire amount produced.

"The problem, therefore, is to at least maintain the existing volume of export trade, even though for the moment the volume cannot be increased. This thought was expressed in the report of the Unemployment Conference held in Washington Oct. 11."

James A. Farrell, president of the United States Steel Corporation, is to-day as optimistic and as enthusiastic on the possibilities of foreign trade as he has ever been, and for ten years has stood as a leader of the movement. Here is how he looks upon future trade possibilities:

"The world to-day is practically bare of stocks of all commodities, whether necessities or luxuries. The world-wide enforcement of economy during the past two years has been a blessing.

"The markets of the world are recovering their buying power because of this economy.

"Because of reduction in prices, buyers throughout the world, who have been withholding, are now buying.

"Now is the time for us to exert our maximum effort for extension of our foreign trade.

"The domestic market can be most highly developed only when substantially all that our industry can produce under normal conditions can be sold. It is the export market that is the controlling factor in determining the prices of most of our agricultural products, those of which our farmers produce a surplus above domestic requirements.

"The defeatist who singles out American foreign trade as the important object of attack on the ground that it is of minor importance, as compared with our great home market, is singularly shortsighted."

Foreign Trade Essential to Maximum Development of Domestic Market

THE domestic market can be most highly developed only when substantially all that our industry can produce under normal conditions can be sold.

Those who think that our domestic market can be developed best with a minimum of foreign trade must realize that our industrial establishment has reached a stage where it can produce more than our domestic market can consume.

The calamity which overtook this country after the outbreak of the war was due to the almost complete suspension of our foreign trade, and that is why we are to-day concerned with an extension of banking and other facilities which will assist in finding international markets for our products.

Money is now migrating abroad in the form of loans at the rate of $1,500,000,000 annually.

The economic recovery of Germany is a world problem whose solution must be striven for without regard to sentiment or consideration.

There is no doubt that once Germany is put in a position to stabilize her exchange she will be on the road to economic recuperation.

We cannot maintain our hold upon foreign markets automatically, or count on keeping a favorable merchandising balance indefinitely without corresponding endeavor.

The American people, as a whole, must be brought to a clearer understanding of the vital relationships of foreign trade to their personal welfare. There must be a clear, general understanding of the fact that none of us can stand wholly alone. We all do and we must take something from and give something to our fellows and there must be developed among us a fuller realization that in helping others we are indirectly helping ourselves.

It is the export market that is the controlling factor in determining the price of most of our agricultural products, those of which our farmers produce a surplus above domestic requirements.

The greatest subsidy our ships can have in overseas trade would be the support of the American people. The greatest hardship under which they are at present laboring is the lack of such support.

JAMES A. FARRELL.

The depression that has existed in our export trade has been due not to the competition of Germany, Austria, France, Belgium or Great Britain, but to a world lack of purchasing power. German exports are only at 25 per cent of pre-war records and German production at approximately 70 per cent of 1913 production. Charles M. Muchnic, of the American Locomotive Sales Corp., not only believes that the lack of buying capacity throughout the world has been responsible for the depression, but that many of the European countries, particularly Germany, have made a serious error in connection with their currency. The real cause of German currency depreciation is not due to reparation payments exacted by the Allies but to false economic measures and theories indulged in by the German Government ever since the termination of the war.

The German Government has failed to impose adequate taxes and to collect such taxes after imposed. The government has erred in a criminal dissipation of its national wealth through the maintenance of a fictitious value of the mark and the granting of absurdly large subsidies. This applies to Austria and other central European countries.

Raw Materials Depleted

While the Germans had raw materials they were able to push their export trade, but they soon found themselves unable to replenish their stocks of raw materials required for further production of articles for export, and to-day many German manufacturers are unable to quote prices on export products and are endeavoring to sell on prices that may prevail at date of shipment. A show of hands from the convention floor indicated that many American manufacturers are getting orders that were formerly placed with German concerns but were cancelled because of the price situation.

It is now generally agreed that Germany and other central European countries have been victims of false political economists who advanced the theory that the country enjoying a low foreign exchange value of its currency, like Germany, is assured of ample employment for its labor and a larger field for its exports. This theory was believed in by many people in America and even by experts on the reparation commission.

Sober thoughts and the events of the past two years have shown the fallacy of this theory, but which is still widely believed in Germany. The imposition of the 26 per cent tax on German exports was, to a large extent, dictated by the British and French spheres of foreign competition.

The German Government has been slow in promulgating an adequate system of taxation, it has not imposed rigorous measures for collecting the taxes when imposed and has indulged in the most extravagant systems of subsidies that inevitably brought about the collapse of its currency.

Subsidies Cause Annual Deficits

It was, and to a large extent still is, the government that paid a very large proportion of the wages of the German workmen through subsidies on food supplies, through rent laws which made the owning of real estate a liability instead of an asset, through railway rates and passenger rates that converted a large pre-war revenue into billions of marks of deficit, through postal telegraph and telephone rates that mean billions of deficits annually.

These acts, added to the evasion of the payment of taxes, particularly by the large industrialists and capitalists who succeeded in transferring their fortunes abroad, have impoverished the German Government, and when the German manufacturer sells his products abroad for gold and leaves, say, 50 per cent of it on deposit and to his credit abroad, that 50 per cent represents the various government subsidies granted on food, rent, railway rates, etc.; it represents the savings of the great middle and professional classes of Germany and that which was in German Government securities or in trust and insurance companies.

Obviously such a situation cannot last indefinitely. The reserves are already exhausted or nearing exhaustion. The reparation commission realizing this, has demanded that the German Government abandon all subsidies, that it increase its postal, freight and passenger rates so that the receipts would at least balance the expenditures, that it discontinue the unlimited printing of money and institute other financial reforms, and that it separate the German Reichsbank from the government. If these measures are honestly carried out, it will put German production costs on a sounder and more natural basis that would be nearer our own, British or French cost of production.

That depreciated currency, when government subsidies are exhausted or eliminated, causes a rapid rise in wages and the cost of living is strikingly illustrated by the conditions in Austria during 1921, where the costs of practically everything is 50 to 100 per cent more than in Germany and nearly as costly as in London, Paris or New York. There are many leading bankers and business men in Germany who believe that Germany is only a matter of months behind Austria in its financial and economic tendencies. If this is correct, we can expect to see German manufacturing costs reach a more normal and sound gold basis.

There are three natural conclusions:

1. Money inflation and its consequent depression does not lower costs of production.
2. Depreciated currency is only a temporary factor in international competition. It will disappear when the reserves have been exhausted and government subsidies of every character materially reduced or entirely eliminated.
3. As a general disturbing element and destructor of values it has about reached its end.

Production Capacity Doubled

Germany during the war doubled her pre-war productive capacity, and with this increased facility the present German production is just under 70 per cent of her pre-war production, according to C. J. Warren, of the Remington Typewriter Co., who has recently returned from spending 8½ months in central and western Europe.

Mr. Warren has some very interesting information on general conditions in Germany.

There was more building going on in Germany than in any other European country visited. In Berlin three large banks were adding two or three stories. Most of the building was, however, of residential character.

There was less unemployment in Germany than in any other country. There was suffering among the people with fixed incomes, such as widows, old people, school teachers and others whose incomes had been increased but relatively little.

Last autumn the retail stores in Berlin had practically empty shelves. This was due to Germans deciding it was better to have anything on hand but marks, and hence they rushed to the stores and bought articles of all characters.

The large Berlin hotels were occupied almost exclusively by foreigners.

German exporters are pushing their wares more energetically in the countries of low exchange value than

elsewhere. While we are feeling German competition keenly in some markets, she is less able to supplant our foreign trade than she was before the serious drop in her exchange.

Labor is generally considered less efficient than formerly. Some of Germany's industries were so specialized that one process was finished near the coal fields. The partly finished goods were then transported to where there was a better water supply or to where the necessary chemicals were produced. In some cases the new frontiers have come in between the different units necessary for the completion of a given article. Delays occur in spite of all that can be done, which makes economical operation impossible in some plants and processes.

There are other difficulties which the German manufacturer has to face, export duties and ever-increasing taxes. Wages were increased at thirty-day intervals while the exchange was dropping, which is the reason for some German manufacturers only accepting orders subject to market price at time of shipment.

Formerly Germany drew many valuable supplies from Alsace-Lorraine and those parts of Silesia which she no longer controls. If she gets supplies from these sources to-day she does so in competition with others and not on any preferential basis. The lower her exchange drops the more difficult it is for her to buy raw materials.

For concerns considering the possibility of manufacturing in Germany it should be kept in mind that should the German exchange become stabilized or improved, prices of commodities will drop much more rapidly than will wages. Germany will then encounter the same difficulties which Great Britain has recently with the improvement of her exchange.

One of America's best authorities on exchange, Fred I. Kent, of the Bankers' Trust Co., New York City, analyzed ten factors that will help the exchange, provided they are worked out intelligently. They are:

1. Co-operation with Russia along lines aimed to reduce the menace of the Red Army.
2. Eliminate the menace of the vicious propaganda of its present rulers.
3. Obtain recognition of the rights of the Russian people to have a free press, a free expression of opinion, free elections of government officers and definite property rights.
4. A quick settlement of the German reparations with terms of payment compatible with existing conditions even though they recognize, as they should do, that Germany should pay a real penalty.
5. A cancellation after agreements as to co-operation of some percentage of the Inter-Allied loans that can fairly be estimated to represent a direct and legitimate war charge to the nations taking part in cancellation.
6. Reduction of governmental waste.
7. Stoppage of inflation caused by the issuance of new currency and increase in floating loans.
8. The removal of trade barriers by means of special commercial treaties and agreements between nations.
9. Greater co-operation between capital and labor so as to allow for the increase of production as rapidly as concurrent developing conditions enable its absorption.
10. A better world morale working toward the elimination of class and national hatreds and the increase of integrity and square dealing.

There are three principal factors that have worked together since the armistice to prevent the stabilization of the foreign exchanges around the gold points:

1. Unequal trade between nations
   (a) induced by the destruction of war, and
   (b) through the raising of barriers between the nations by their governments represented by tariffs, embargoes, etc.
2. Inflation.
3. Uncontrolled governmental expenditures exceeding income from all sources.

Persistent Sales Efforts Will Produce Results in Foreign Trade

IF business is dull at home, do we usually sit idly by and make large reductions in our sales efforts?

Rather, do we not study the various causes and effects of the conditions producing such a decline, and do we not apply ourselves to study them, and perhaps to modify our plans and methods, so that, if possible, we may combat the dullness and encourage buying in either old or in new lines?

If this is the feeling regarding home business, why should it be any different with business away from home?

My own conclusions are that it is only because we are not so familiar with oversea conditions and methods as we are with those in our own country. So far as I am able to discover, those larger exporters who have been operating abroad for years are not curtailing their efforts to promote business, for the reason that they have the experience behind them which leads them to believe that renewed and continuous efforts will, in the long run, produce business, and repay their efforts.

We will, of course, acknowledge that in some countries, by reason of their poor financial conditions, rapid returns may not be expected, and further, perhaps sales efforts are not worth considering at the moment, but we must remember that in spite of that fact, there are enough countries where business may be done to justify serious thought as well as serious effort.

We have been really spoiled during the war period by the ease with which we got business —buyers were hunting for materials from the United States, and terms were made by suppliers, which were onerous and dictatorial to buyers. I will not say some were not justified, but we are now operating under entirely different conditions.

We must modify our terms of sale, we must approach the buyer with an effort to meet his ideas of details as to shipping, as well as in arranging credits and in making quotations. Many of us are now doing this.

STANLEY G. FLAGG, JR.,
Stanley G. Flagg & Co.

Rising Tide of Automotive Exports Brings Out Importance of Foreign Trade

FEW lines of commerce were better represented than the automotive industry at the annual meeting of the National Foreign Trade Council, held in Philadelphia the three days ending May 12. Executives and export officials of the producing companies were uniformly optimistic concerning the revival of overseas demand and it was readily apparent that international shipments are again playing an important part in the manufacture of passenger cars, motor trucks, motorcycles, tires and other equipment. The increasing demand has reached such a character throughout the industry as to warrant an unqualified statement that it is analogous to the better situation prevailing in the domestic markets and is, indeed, an immediate reflection of improving business conditions throughout many parts of the world.

Numerous export officials of the automotive companies were in attendance at Philadelphia. In actual number, they were exceeded only by the banking, shipping, commission house and steel representatives who always form such large groups at general conventions like the one just held in Philadelphia. But no group was more thoroughly optimistic over the future of their export markets and no industry reported a similarly high comparison of present shipments with those of the peak periods of 1919 and 1920. In fact, it is possible—probable may be the more nearly correct word—that the 1922 shipments of automobiles to other countries will exceed those reached in 1919 and that the year's trade will reveal itself as the second largest in the history of the industry. This prediction seems warranted by the business already done, particularly in passenger cars, tires and equipment, and export officials expressed themselves as having little fear that later months of the year would see any slowing up of foreign demand.

General Betterment in Export Market

Practically every line of trade, of course, has undergone some betterment in the export market since the year turned. The steel demand has improved materially and textiles are moving in larger volume, just as are many other lines. But the automobile, with its attendant equipment, stands above practically all others as being an American product that has attained a commanding position throughout the civilized world and consequently has made a return to more nearly normal proportions. No competition worthy of other than passing interest, excepting perhaps in a few lines of equipment, has appeared to offer equal service in providing the transportation required in developing territories and in this respect the American automotive industry has very definitely placed itself above all others. The result of this leadership was taken to mean, by the executives at Philadelphia, that the present demand not only would continue but that it would grow from month to month as various countries emerge farther from the depression period.

The position of the automotive industry in the foreign markets had but little recognition in the set program of the Philadelphia convention and, therefore, it was not this part of the convention that holds the greatest interest. What will be of interest, however, is that the automotive representatives evidenced a changing feeling among company executives toward the necessity of cultivating and working more actively for the upbuilding of their international trade. This feeling was lacking in previous years. No more than twelve months ago, only here and there in the industry could be found a belief that the export trade in automobiles would survive the depression period short of two, three or four years. In 1919 and 1920, for instance, a negligible percentage of production was alloted to the overseas representatives; to-day, the companies have taken a more "favoring spirit" toward foreign trade and the export official—particularly of the more important lines—has been strengthened materially. This is a healthy sign, as it means a recognition of the value of foreign selling in keeping production up to better levels, throughout the entire year.

Nevertheless, the "favoring spirit" is not everywhere in evidence. Some export officials already are finding it difficult to get shipment on their orders but there was a feeling evident that a bigger proportion of the output would be so allotted. This was not true in 1919 and early 1920. Export orders came into the factories in large volume, but in many instances they were subordinated to other calls and few export departments filled anything like the orders that came to them.

Dealers the Biggest Problem

Dealer representation is one of the biggest problems confronting the exporter, practically every one of the officials at Philadelphia saying that more adequate distribution was needed. One of the larger companies, whose line ranks it among the first three or four producers, shipped in March, April and early May at a rate equal to 80 per cent of its peak in 1920. This company, like others, needs additional dealers and is appointing them under their distributors in the various countries. A third company, with a smaller output, made a much similar report, and while its dealer connections are satisfactory in many districts, its export representative feels that many territories are yet uncovered. This is typical, affecting practically every sort of automotive equipment.

The car and tire companies have been the first to be affected by the rising demand and they are, of course, doing the most to cultivate the overseas markets. The tire makers are keenly alive to foreign possibilities and are pushing their products with much vigor. This is in contrast with other automotive lines, notably accessories and equipment and, to a smaller extent, trucks.

Financing and credit arrangements as regards foreign shipments also form a subject that has drawn close attention from the industry. The banking and financial group meeting at the Philadelphia convention was attended by practically all automotive representatives in attendance and each listened closely to the exposition covering the use of bankers' acceptances in export trading. The bankers, they learned, are still scrutinizing every foreign credit with very watchful eyes and are frowning upon too liberal grants on overseas shipments. But a great deal of progress has been made in setting the financial field into more stability, so that this problem is not nearly so acute as it was only a few months ago. Exchange values have increased from 10 to 50 per cent in the important buying territories within the last six or twelve months and, excepting for Europe, further betterment is generally predicted by the various bank representatives who attended the convention.

What Should Be the Weight Limit for Trucks Operating on Highways?

Highway official says 10 tons, truck operator says 15 tons. Committee appointed to study this problem by the National Highway Traffic Association recommends at its annual meeting, that the maximum be set at 14 tons. Other reports dealt with the railroads as operators of highway transport, highway transport clearing houses and highway construction.

THAT highway officials are not all agreed upon maximum axle loads of 22,000 lb. or maximum truck axle loads, was well established at the annual meeting of the National Highway Traffic Association, held in New York City, May 12, when James W. Synan, Assistant Associate Commissioner, Division of Highways of Massachusetts, announced that his State was not agreed as to the permissible motor truck load and that for the purposes of creating discussion throughout the State the Division of Highways was anticipating announcing that the maximum gross weight of trucks of 10 tons only might be desirable on their highways. His reason was that Massachusetts cannot see where the money is coming from to continue building her highways as it seems necessary, and he announced that in another year something drastic might be expected by way of limitation of gross truck load, or increase in registration fees from the Commonwealth of Massachusetts. He suggested the fact that he considered the motor truck industry rich beyond comparison, and quite capable of paying the bills.

An attack of this character furnished an excellent opportunity for George H. Pride, treasurer of the National Highway Traffic Association, and president of the Heavy Haulage Co., New York City, who placed before Associate Commissioner Synan a saner view of the truck situation. The reason for the heavy truck rests with the community which eventually pays the bills of highway transportation. If smaller trucks were employed the cost of transportation would increase and such loss through inefficient transportation service would be paid by the consumer of all commodities within the community.

Mr. Pride struck a keynote of community transportation when he declared that the duty of highway officials is a much broader one than merely that of deciding on some type of highway and constructing it. Their work is one of the most economical transportation in the community, and roadbed and truck weights must contribute to this end. The public must not be penalized by payment of higher costs on transportation solely because a highway commissioner fails to see where the money is coming from. The community must understand that it makes little difference at the end of the year whether the money is paid direct for highway construction or if it is paid in the added cost of every commodity used in the household and in industry because of increased transportation charges. The broader view of the highway commissioner which considers the problem of transportation is the one that must be kept in mind.

HIGHWAY transportation in all its many phases is of vital interest to the truck manufacturer. Study must be carried on with a broad understanding of the interests of all groups, the highway engineers, highway authorities, railroads and the general public.

A complete understanding must be brought about between these interested parties if we are to secure harmony of operation. Without this harmony there will be a constant impediment in the way of steady progress and stabilizing of our whole transportation system.

Research must be carried on before we can have a final solution to the problem of highway transportation and a concerted action by all on the findings of this research. Those who wish to see the progress of motor truck transportation can, and must, view the problem in its broadest aspect and lend whatever assistance is within their ability.

The attack by Associate Commissioner Synan came as a result of a committee report made by Mr. Pride on Regulations Covering Speeds, Weights and Dimensions of Motor Trucks and Trailers.

The recommendations for regulation of motor trucks were as follows: maximum width 96 in., maximum height 12 ft. 6 in. and maximum length 30 ft. The maximum load per inch of solid tire was recommended to be set at 800 lb. The only regulations regarding trailers was that they should not weave when in motion. Maximum loads were recommended to be set at 22,000 lb. The following suggestions were made in regard to vehicle speed:

Weight in lbs.	Speed in m.p.h. Ordinary roads	City
4,000	25	20
8,000	20	20
12,000	20	15
16,000	15	15
20,000	15	15
24,000	15	15
28,000	15	15

The committee also reported that they found that pneumatic tires wore down roads quite as much as solids owing to their increased speed and in the case of some macadam and gravel even more.

Rialroads in America should, and undoubtedly will, purchase motor trucks in great numbers to supplement their existent service, and in this way following the ex-

ample set by British railways, said Arthur H. Blanchard, in charge of highway engineering of the University of Michigan, and president of the National Highway Traffic Association, will do a useful work for highway transport.

The present attitude of railway officials is not simple. Some of them have appreciated the value of highway transport and have collaborated with the existing agencies. They have also recognized, in many cases, the economic necessity of motor transport as a feeder to the railways. Other officials have been against highway transport and have endeavored to curtail development through legislative procedure and have advocated curtailment of highway improvement. As a matter of fact they can do good by helping highway improvement.

He also stated that the motor truck can help solve congestion at terminals and the short-haul problem. Some of the uses to which the railroads can put trucks are:

1. Inter-terminal transportation.
2. Intra-terminal freight yard transportation.
3. Collecting and delivery of freight—store to door delivery.

In regard to present attitude and laws Mr. Blanchard says: "One should realize that laws of the product of the mind change rapidly."

Expansion of Railroads Through Trucks

Of the opportunity for expansion which the motor truck offers the railroads, he says, that urban and interurban lines may be expanded; steam railways may utilize trucks to increase passenger and freight service and railways having scenic lines may supplement them. In respect to these latter two, England furnishes a very good example. Rail cars are the logical solution to non-paying short lines and even these may have to be discontinued and busses utilized.

He believes that the railroads have some economic advantages in that they have already established traffic and maintenance departments, and in many cases idle real estate and buildings which can be used to house motor trucks and busses. In the future we may expect to see railroads using trucks to supplement their work and this may be carried further to their using their own motor lines. Again they may seek to eliminate competition by means of franchises or cutthroat methods. In closing Mr. Blanchard urged that all elements; electric and steam railway men and all parties who are connected with transportation should be included within the Association to guard against this danger from franchises when the Legislature meets in 1923.

A series of constructive resolutions designed not only to expedite highway traffic but make it much safer, was presented by H. Eltinge Breed, highway engineer of New York City, who as chairman of the committee that considered this subject, presented recommendations on banking of curves, elimination of all signs on the highway, excepting those for direction and danger; and recommended marking the center of the roadway with a visible line on curves, and also sudden rises on grades where they approach the danger point at the summit.

Safety Measures

The resolution includes the standard distance of 500 ft. for posting railroad signs and other points of danger. The resolutions would make it a misdemeanor for one motor vehicle to attempt to pass another on a sightless curve, where the unobstructed line of vision is less than 500 ft. Mr. Breed recommended in addition banking of approximately 1 in. per ft. of road width on curves of 20 deg. or shorter, that is, a curve of 280 ft. radius, that the earth slope on the inner edge of the highway should be carried on a 4 to 1 grade. Recommendations included standardizing the shoulder on highways, making them 2 ft. wide and 4 in. deep where they meet the highway, and using coarse gravel. Because of the greatly increasing number of railroad accidents at grade crossings it was recommended that highway departments set aside a definite sum each year to create a fund for the elimination of grade crossings.

Favors Two-Lane Highways

For a year a committee of the National Highway Traffic Association has been making studies in the Detroit zone on traffic capacity, and widths of highways outside of municipalities, this work being in charge of Herschel C. Smith, Assistant Professor of Highway Engineering, University of Michigan. The research had to do with the desirability of two-lane, three-lane and possibly four-lane highways. Recommendations were that three-lane highways increased the number of accidents and should be discouraged. The results of uniform speeds showed that the capacity of a highway is, to a very great extent, dependent on speed.

To carry on experiments on this subject a condition was taken wherein on a two-lane highway 750 vehicles passed every hour, 500 of them in one direction. An assumption in variations in speed was made as follows:

3 per cent travelled at 3 m.p.h.
10 " " " " 10 "
57 " " " " 20 "
30 " " " " 30 "

In the second case the following assumption was made:

13 per cent travelled at 10 m.p.h.
57 " " " " 20 "
30 " " " " 30 "

In the last case assumptions were

13 per cent travelled at 10 m.p.h.
87 " " " " 20 "

The results of these three experiments showed that the meeting of slow-going vehicles caused such congestion that in the first case the traffic could not be handled on a two-lane highway; in the second case it was possible and in the third case it was possible to increase the number of vehicles using one road.

Mr. Smith's conclusions were that the design of roadways must seriously consider variations in speed, also that:

Two-lane highways must be 20 ft. wide and have 5-ft. shoulders capable of sustaining heavy loads.

That where speed of vehicles is reduced by slow-moving vehicles two lanes should be increased to four if the economic loss of time justifies the expenditure.

And lastly, that the building of three-lane highways should be discouraged.

Designate Highways by Numbers

The designating of highways by numbers placed on telegraph, telephone or other poles, instead of by a series of different colored bands painted around the poles, or by other methods, was recommended by the National Highway Traffic Association. Such a method of designation has been adopted in New England in which highways running north and south are designated by even numbers, such as 2, 4, 6, 8 or 500, and those running east and west by odd numbers, such as 1, 7, 333, 99, etc. This plan had its inception in the fact that the use of painted bands has passed its point of usefulness, owing to the difficulty of color combinations and confusion.

Under the number system it is planned for a highway for example, from Quebec to Miami, Fla., to be known as No. 2, or perhaps No. 10, or any other even number

throughout its length. The same would apply to transcontinental highways running east and west. The Yellowstone Trail might be No. 1, or the Lincoln Highway No. 1864.

There is a possibility that this plan will be pretty generally considered. New York State has practically accepted it, and plans are to be presented to all of the states.

Other reports were presented at the meeting. Thomas Snyder, secretary of the National Association of Commercial Haulers, Indianapolis, Ind., gave a comprehensive report on the motor clearing house system of Indianapolis. F. W. Fenn, secretary, National Motor Truck Committee, New York City, presented a report on state regulations concerning motor vehicles as common carriers. Dr. Hatt, director of Highway Research, Division of Highway Engineering, National Research Council, Washington, D. C., gave a report on his highway research work.

The delegates and members were welcomed to New York by Col. Arthur Woods, president of the Automobile Club of America, where the annual meeting was held.

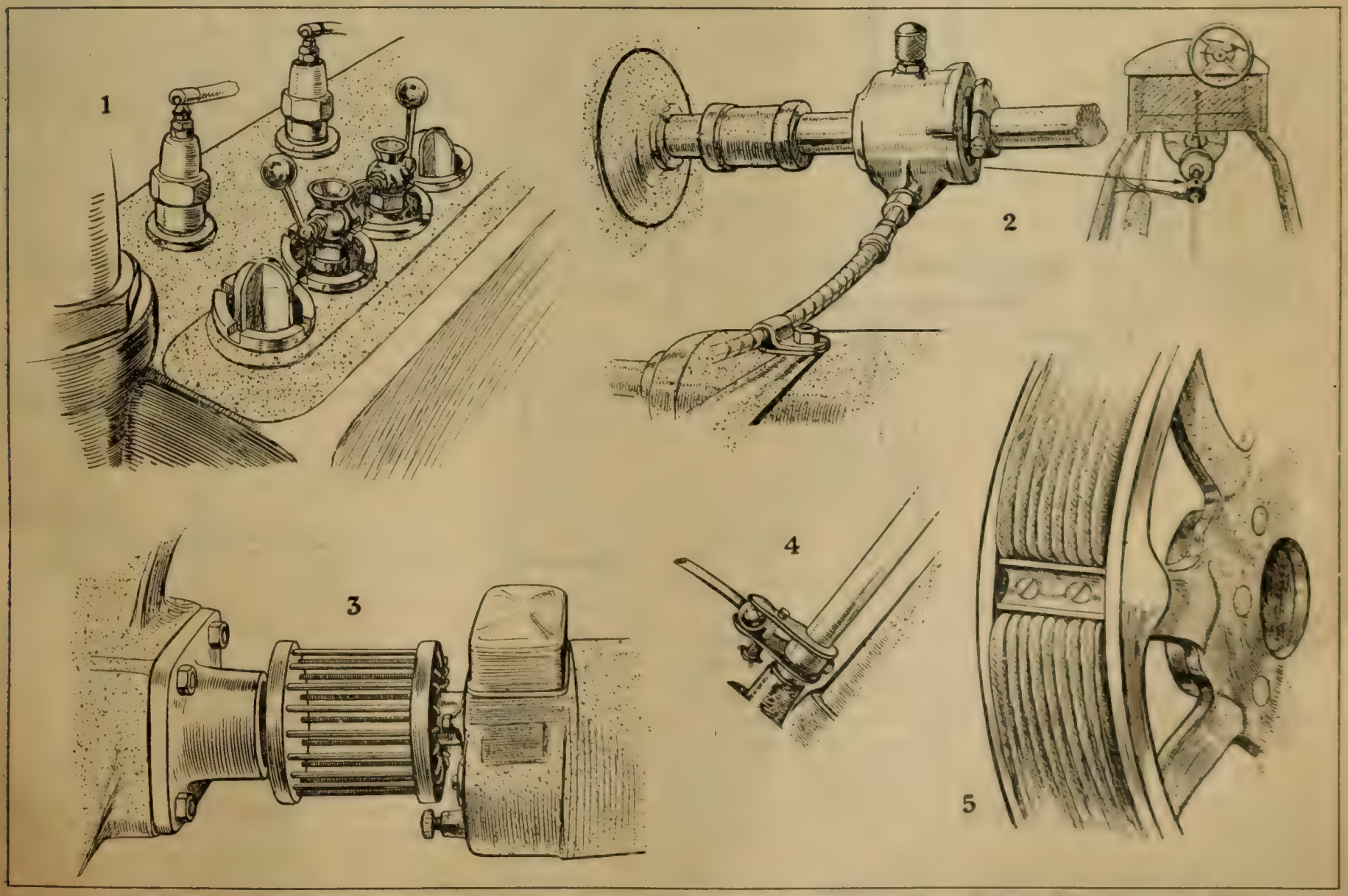
Precision in Weighing

PERFECTION of a standard of measurement to such a degree of accuracy as to immediately detect the withdrawal of a single steel rivet from an ocean steamship with a displacement of 25,000 tons, is the accomplishment of the Bureau of Standards of the Department of Commerce, it was learned to-day. The Department of Commerce says that this represents the most precise work of the kind done by the Bureau of Standards in many years.

In an item entitled "Comparison of Standards of Mass," the Bureau of Standards in its monthly Technical News Bulletin says that comparisons have just been completed between certain high grade standards of that Bureau with the "National Standards." The National Standards are small cylinders made of an alloy of platinum and iridium and are the standards for every weight used in the United States. In intercomparing these standards or when comparing them with other weights, a balance which will give results of almost unbelievable accuracy is employed. The accuracy of the results are well within 2 parts in 100,000,000, that is, in comparing two kilogram or pound weights, differences as small as 0.02 of a milogram, or one part in 1,000,000, can be detected.

IN 1919 China's motor imports had a total value of $3,750,000 (at par) and about 95 per cent of the total number were American cars. In 1920, 987 out of 1,320 imported cars in Shanghai were American, 188 from Canada, 111 British, 19 from France, and two from Italy. For the first two months of this year the British proportion showed a distinct improvement.

Engineering Details of Some Recent European Cars



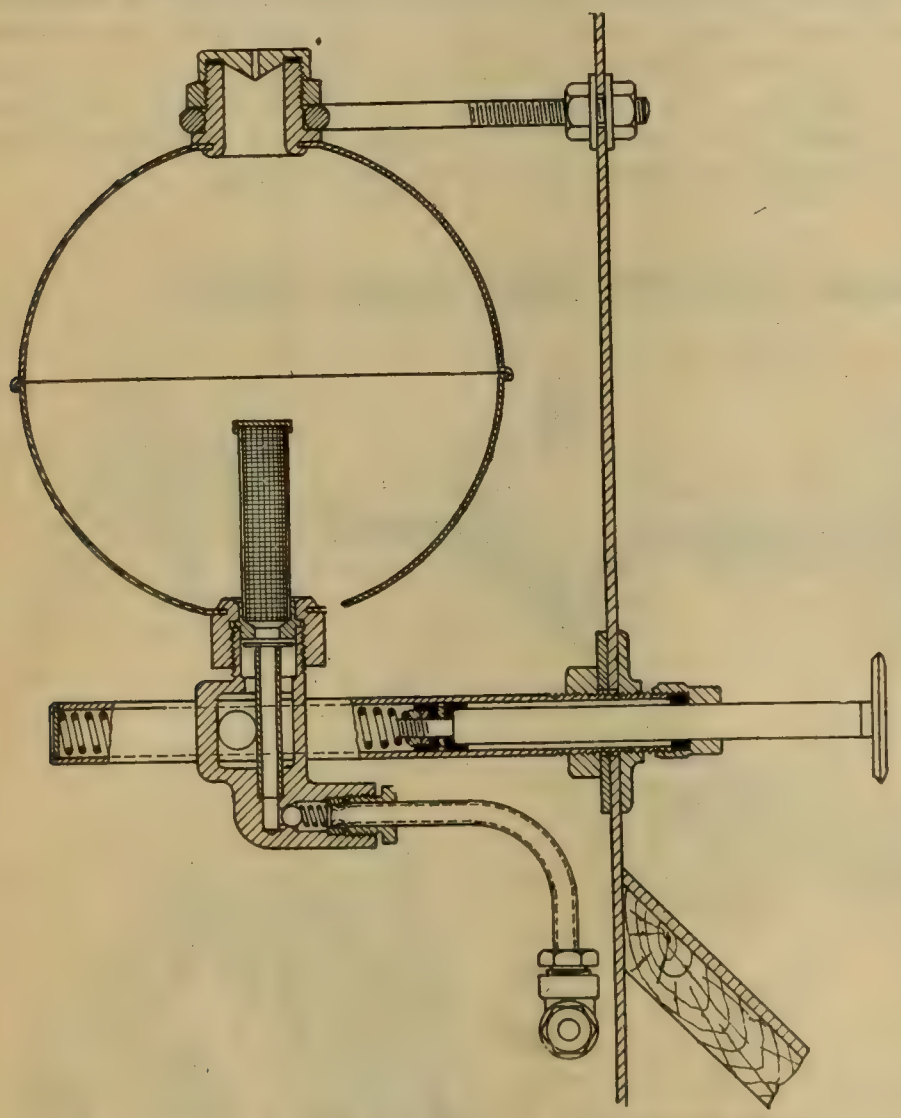
1—Position of spark plugs and valve caps with aluminum radiators in detachable head of new Turner engine. 2—Ansaldo skew gear speedometer drive for an open propeller shaft. 3—Lorraine-Dietrich squirrel cage universal coupling for accessory drive. 4—Lorraine-Dietrich control rod ball joint. 5—Jewett cone clutch with asbestos fabric cord for facing

Improved Distribution Given by Centralized Oiling System

Correct amount of oil to be fed to each bearing is regulated. Over-oiling troubles minimized. This system takes care of all chassis bearing surfaces.

A CENTRALIZED oiling system, in which a small tank with an integral pump located behind the dash or some other convenient place on the car is used to take care of the chassis bearing surfaces, is being put out by the Kellogg Manufacturing Co. The device is known as the Bloom chassis oiler and will be marketed under the O-K trade-mark.

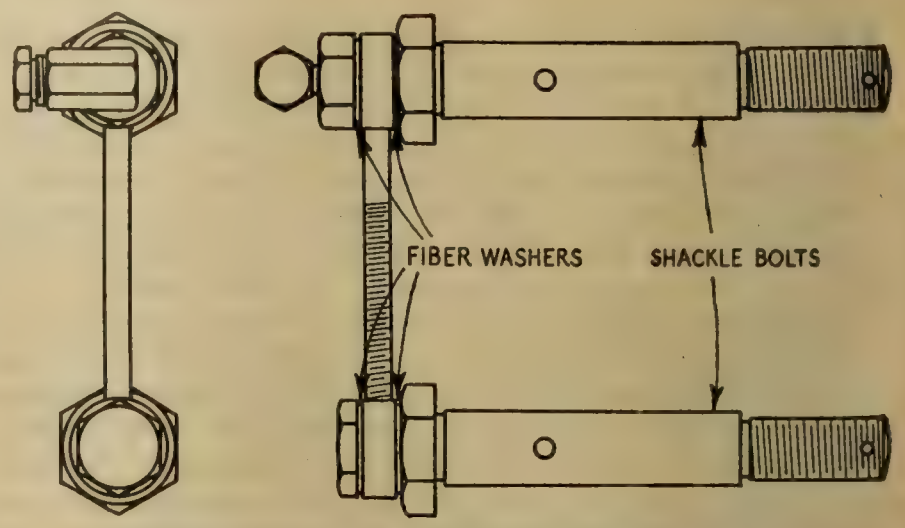
The small tank in a typical installation is of spherical shape, with a capacity of 1 quart of oil. The integral plunger pump mounted in connection with it is operated



1—Sectional view through tank and pump of the Bloom chassis oiler

from the driver's seat by hand. Pulling out the plunger draws a supply of oil into a chamber and pushing out on the plunger forces the oil through a lead which divides into two main pipe lines running down the frame on either side of the car. From these main supply lines are tapped off other leads for each part requiring oil. The pipes are rigidly clamped to the frame, and with one or two exceptions where flexible tubing is employed, are rigid.

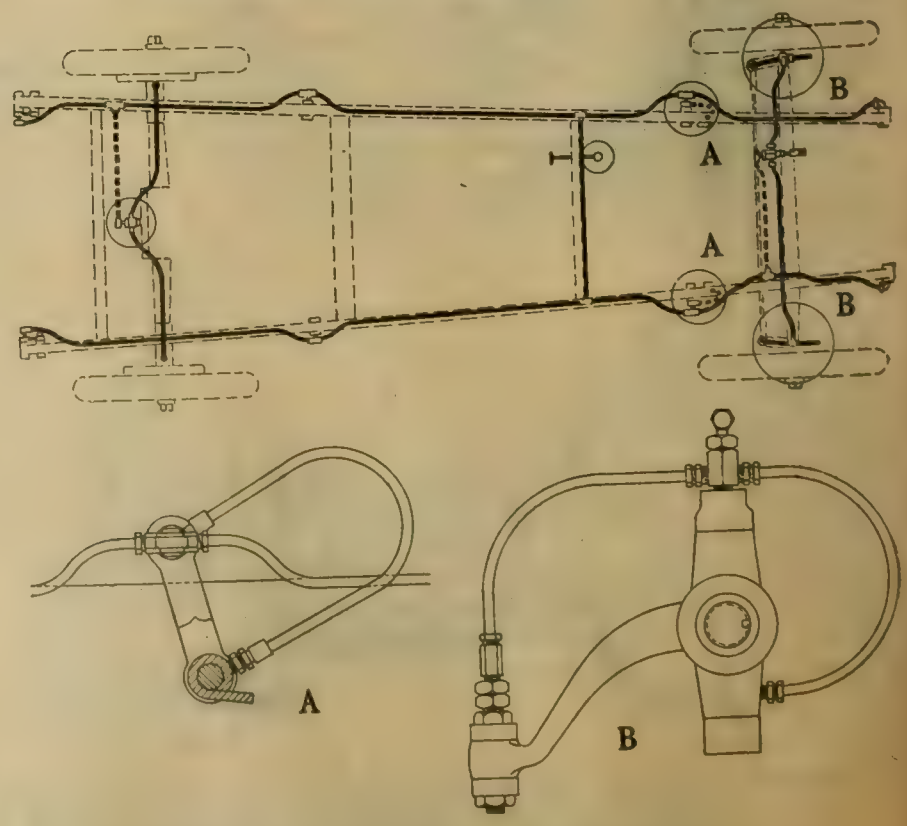
One of the most important features of the outfit and one which meets the objections usually offered to a centralized system is the method employed of damming up the various connections, leaving only a small hole for the



3—Oil connections for shackle bolts showing method of carrying oil to both bolts with one oil connection

oil to go into each bearing. Just before the point of oil distribution a small disk is introduced into the feed line, this disk being pierced with a hole which is proportioned to the amount of oil required for that particular bearing. With this device the oil in the feed pipe is so distributed that when the pressure is applied the oil is forced into all bearings. The connections are also equipped with these reducing plugs which reduce the amount of oil to be fed to bearings which do not require so much. The various connections are standard, all threads being ⅛ in. Briggs standard pipe thread and all connections for ¼ in. O. D. tubing.

It is possible to install the tank and plunger pump in a variety of positions about the car.



2—Installation of the Bloom chassis oiler on the Hudson super-six and Essex. Details of installation enlarged

How to Make Better Bearing Pressure Diagrams

Smooth curved lines connecting points on such a diagram give a more nearly true picture of the bearing pressures than do the straight lines usually employed. The reasons for this are given here in brief.

By P. M. Heldt

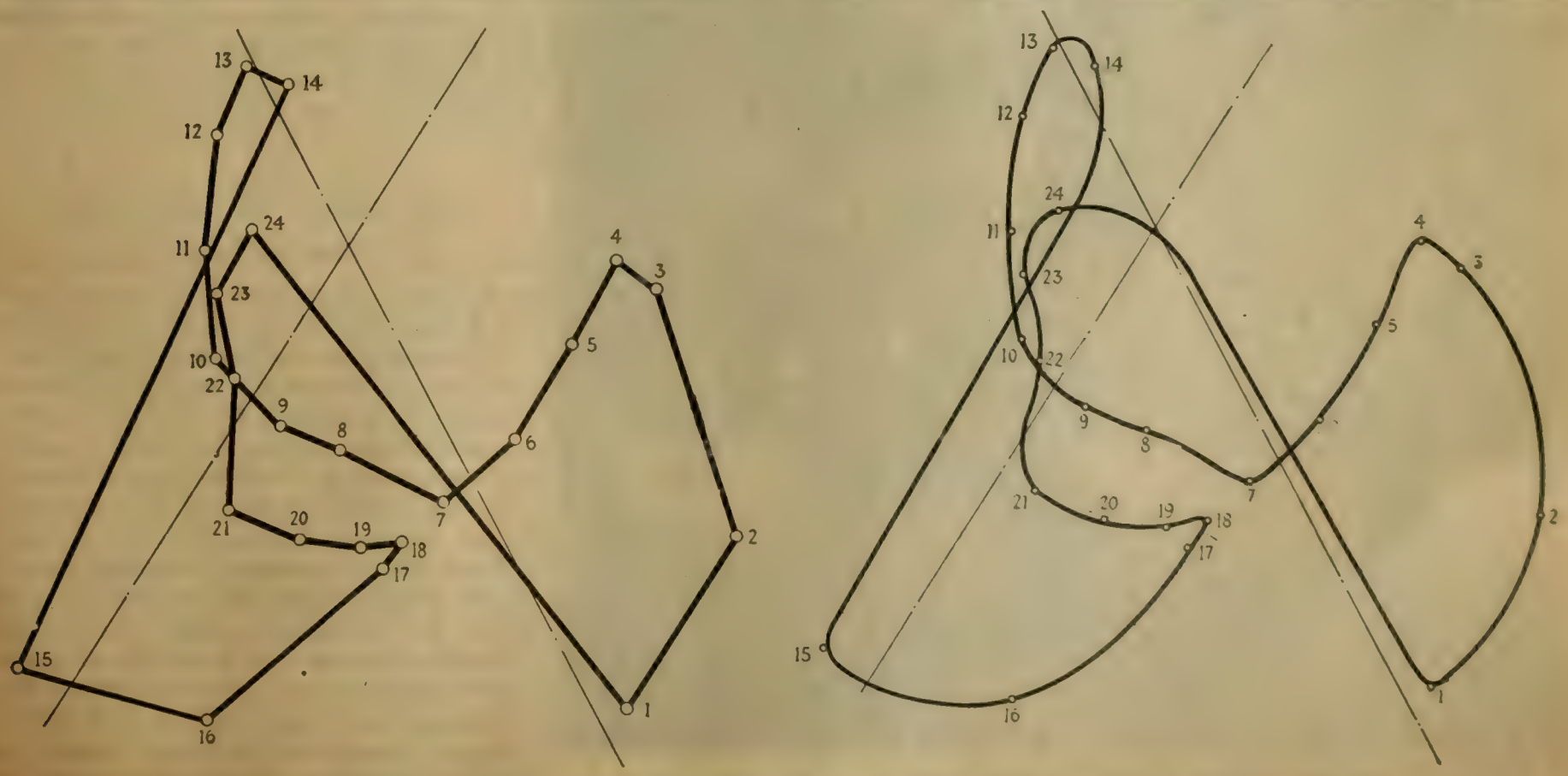
THE analytical investigation of forces and stresses in gasoline engines is constantly being extended and more exact views of the working conditions of their parts are being obtained. A marked step in advance in this connection was the introduction of bearing pressure diagrams in the construction of which account is taken of gas pressures, inertia forces and centrifugal forces. We believe that this form of diagram was first prepared some years ago by Otto Burkhardt of the Pierce-Arrow company for the purpose of making comparisons between six cylinder and eight cylinder engines and six cylinder and twelve cylinder engines with regard to relative bearing loads.

Mr. Burkhardt calculated the resultant pressures for twenty four equi-distant points on the cycle, plotted these pressures on a polar diagram, and connected the points found by straight lines. This custom has since been followed by others. This gives a rather rugged form of diagram which certainly does not accord closely with the actual variations of the bearing pressures. The diagram makes it appear as though there was a more or less abrupt change in the rate of increase or decrease of the bearing load at nearly all of the twenty-four calculated points.

As a matter of fact, the pressure on the crankpin varies fairly uniformly except at the moments of explosion. Perhaps the greatest error introduced by the practice of connecting the calculated points by straight lines is between points 24 and 1. Point 24 denotes a point on the cycle 30 deg. ahead of the top dead center at the beginning of the explosion stroke, while 1 denotes the dead center position. If these two points are connected by a straight line it makes it appear that the explosion began 30 deg. ahead of dead center and the rise in pressure proceeded uniformly to dead center, at which time combustion was completed and the maximum pressure attained. This hardly accords with the indications of a cylinder diagram.

The writer believes that for the most accurate picture of the bearing pressures the points on the diagram plotted from the calculated values should be connected by smooth curved lines, so as to give as nearly as possible a continuously variable or smooth curve. This is illustrated by the diagram below.

While completing the diagram, the laws governing the changes of the various component forces should be kept in mind. Thus at the time of explosion there is a quite sudden change in the value of the bearing pressure. The total amount of this change is fairly well known from the calculated values for points 24 and 1. In drawing the connecting line between these two points it should be borne in mind that it takes some time for the full pressure to be developed and that the whole of the pressure does not come on instantly. Moreover, the period of pressure



Bearing pressure diagrams with points connected by straight and curved lines

growth is certainly not located midway between points 24 and 1 but is very close to point 1. Thus the line of pressure rise should not absolutely parallel the cylinder center line but make a slight angle with it, this angle representing the time required for the completion of the combustion process. This swing into this line should be more gradual than the swing out of it, because just previous to ignition the pressure in the cylinder has been increasing for some time owing to the compression, whereas when the combustion is completed there is a very rapid drop in the pressure due to the expansion and the cooling effect.

The difference in a bearing pressure curve constructed along these lines, as compared with one in which the points plotted from the calculated values are connected by straight lines, may be seen from the diagrams herewith. Both of these diagrams represent the same results. Of course, it cannot be claimed that the curved line diagram will fall together absolutely with points based on calculated values intermediate between those plotted, but it will certainly be closer to these values than the corresponding points on the straight line diagram. Moreover, the curved line diagram appears a good deal simpler and clearer to the eye. The writer realizes that, since the maximum pressures and the general distribution of pressure indicated by the diagram are not changed by the proposed method of drawing it, there are no very serious errors in the straight line diagram, but the curved line diagram is more accurate and as it can be drawn with hardly any more effort, it is preferable.

Portable Crane for Factory Use

HANDLING of heavy material or equipment in and about the factory is often greatly facilitated by the use of a portable crane. The Elwell-Parker Electric Co. is now marketing such a crane, same being mounted on truck which is equipped with a storage battery and motors which not only propel the truck but furnish power for operating the crane. A heavy vertical column with long bearings in the steel pedestal bolted to the truck platform supports the 12-ft. boom. The latter can be racked in and out by the operator without his leaving the position which he occupies when operating the truck. The hoist is operated by a separate motor connected direct to the hoist mechanism, the controller being located on the dash. The battery and motor are mounted on a steel frame in such position as to counterbalance the boom and its load. A special trip switch mounted on the front of battery box stops the inward motion of boom.



The Elwell-Parker portable factory crane mounted on self-propelled truck

The crane is said to be capable of handling loads up to 3000 lb. It will pick up 1000 lb. at 8-ft. outreach at side or end of platform, or with outriggers as shown in position, will lift 3000 lb. at 6-ft. outreach. The boom can be lowered to permit entrance of doorways. The outriggers are quickly adjusted or folded and swung in beside the crane column when not in use. The truck is equipped with 21½ x 3½-in. drive wheels and 15 x 3½-in. trailing wheels, all four of which steer. Large wheels permit use in yards. A coupler is furnished on rear to permit the use of the unit for intermittent tractor service.

The inclosed E.-P. motors, differential worms, wheels and crane pillar column are all fitted with ball bearings. The single battery furnishes power to propel truck as well as operate crane.

Artificial Wood from Refuse Materials

A RECENT invention of an artificial composition of interest to automobile bodymakers is reported from Australia. The material, which is similar to veneer, is produced from waste fibrous products and other vegetable matter, sawdust being used for the manufacture of cheap grades of the composition. It is claimed that it can be used for various purposes, including furniture veneers and wall panelling, and can be made to produce excellent marbling effects. It is capable of being bent easily for a variety of commercial purposes, can be worked with tools, sawed, bored and planed as freely as wood and takes nails or screws readily.

Are Cables Superior to Rods for Brake Couplings?

European makers think they are. It is claimed that cables are stronger for a given weight and less liable to sudden failure. Disagreement exists as to relative cost. Sunbeam, Minerva, Ansaldo, Lorraine-Dietrich and La Licorne furnish some excellent examples of current practice.

By M. W. Bourdon

IN a large number of post-war European chassis the designers have reverted to the use of cable couplings for rear wheel brakes, and in some cases cables are used also for transmission brakes. This step evidently was not taken merely to avoid a multiplicity of rods and prevent the possibility of rattle where pairs of rods must run back side by side and adjacent.

Cables have not been readopted to simplify the means of compensation, for in quite a number of examples no compensating arrangement is provided, the same as in 50 per cent of chassis where rods are retained. In isolated cases the cable runs from one wheel brake to the other through the cross tube from which the levers depend, providing compensation by the freedom of the cable to move axially in the tube and through the lever eyes. In one instance (Sunbeam) this arrangement is modified to afford adjustment; the cable as it passes across the chassis alongside the cross tube is divided and the ends are secured to lugs which can be varied as to their distance apart by a milled disk on a left-and-right-hand threaded coupling. In another case, where all the brakes are on the wheels, the two cross-shafts are fixed, and on the driver's side each carries a double-ended rocking lever, from the upper end of which a cable runs forward, passes round a roller attached to hand lever or pedal and then runs back to another lever on the end of a sleeve surrounding the cross-shaft; from a lever on the other end of the sleeve and from the lower end of the rocking lever single cables run to the brake camshaft levers. Thus the compensating device is in the first-motion coupling. (See Fig. 1.)

Function of Cables

Generally speaking, the cables do nothing more than is asked of rods, i. e., form a coupling between two levers; further, they are rarely provided with any direct means of adjustment other than the clips which form their anchorages. This, again, is merely following a tendency in connection with rods, for the internal expanding shoes of quite a number of European rear wheel brakes have no means of adjustment behind the finger nut at one end or the other of the single coupling rod from the hand lever to the cross tube; the shoes are of such dimensions and the cam or toggle between them is so designed as to provide the levers with a full range for wear, and when the lever angles become excessive the need for the renewal of friction surfaces is made evident.

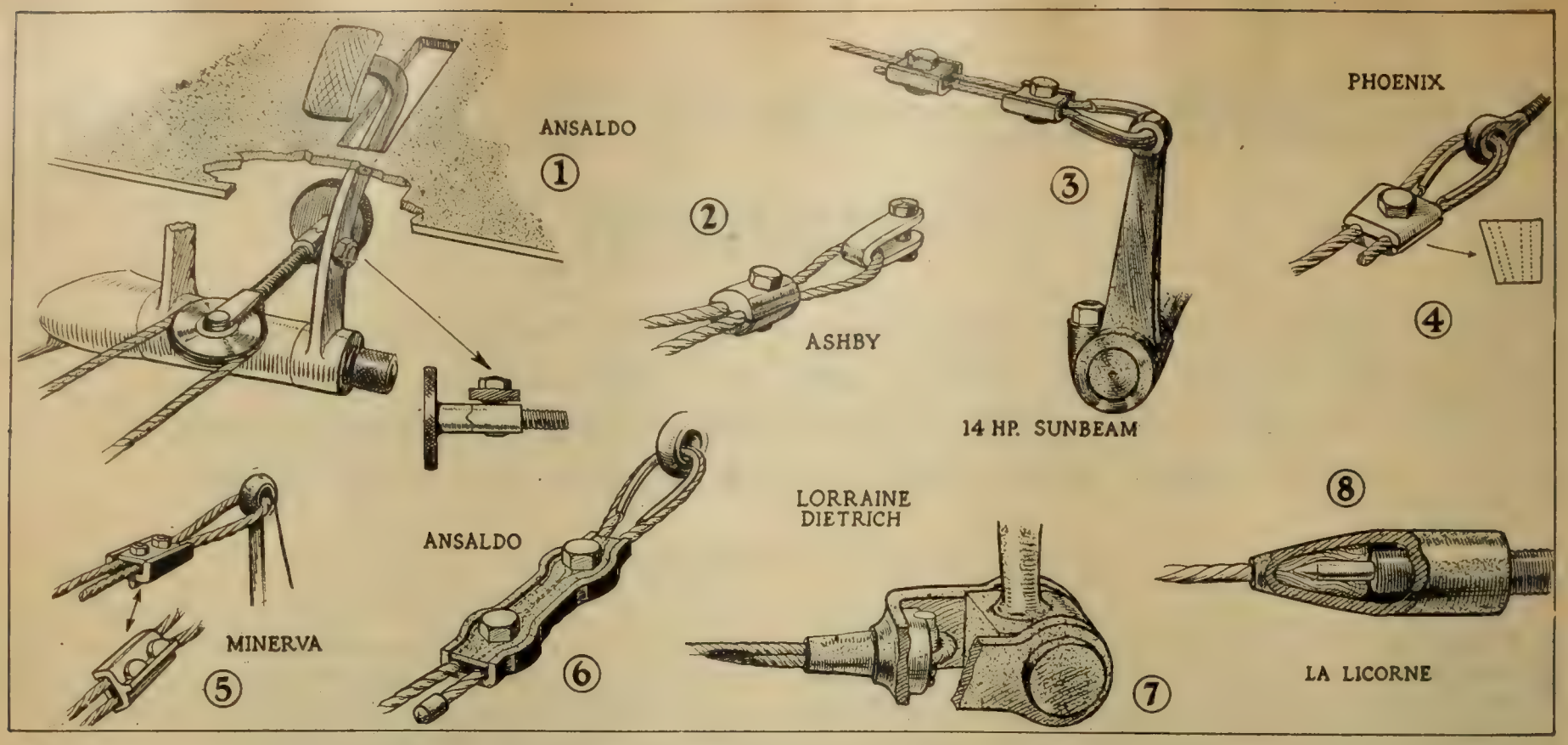
But primarily this reference to cable couplings for brakes is to indicate some of the various means of anchoring the ends of the cables to their operating and operated levers. The simplest arrangement now in use is very similar to that common in early days and which was discarded mainly because adjustment as to length was difficult and other means of brake adjustment were either unsatisfactory or non-existent. Two present-day examples of cable clips are seen in Figs. 2 and 3. In that shown in Fig. 3, which is found on the new 14-hp. Sunbeam, a pair of U-shaped pressings with a flat clamping plate and bolt are used, while the cable is kept from chafing and from assuming too sharp a bend where it passes through the lever eye by a horseshoe-shaped piece of channel steel. No such provision is made in the case of Fig. 1, where a pair of grooved stampings form the clip and the cable passes through a U coupling piece; the latter is made from flat stock, and its natural tendency to assume a curved inner surface when bent over so sharply is depended upon to prevent the cable being bent round two right-angled corners; but obviously this arrangement is too crude to be satisfactory, and the cable will certainly be cut in course of time where it makes contact with the corners of the coupling piece.

To Obtain Straight Line Pull

With either of the clips shown in Figs. 2 and 3 the cable is bent more or less where it enters the clip adjacent to the lever eye. To overcome this and to give a straight-line pull from the lever, the grooves in the clip shown in Fig. 4 are not parallel with one another; one is at right angles to the ends of the clip, and it is in this groove in which the "long side" of the cable is intended to lie, the short side lying in the other groove and both entering the clip without being kinked. This is a refinement of very small magnitude attained without additional cost; but the chances are even that when the driver removes the clip at any time he will replace it the wrong way round and make the kink on the long side even more pronounced than it would be if the grooves were parallel.

In Fig. 5 is shown the Minerva clip. It is a parallel-sided stamping with a flat pinch-plate and two bolts; under the U is a flange out of center to form an abutment for the D heads of the bolts and prevent them from turning when their nuts are tightened. Beyond this consideration for the user or assembler there is nothing out of the ordinary in this example. The Ansaldo clip (Fig. 6) has two bulges in line with the boltholes, which have the effect of kinking the cable at both sides and assisting the bolts to discourage the cable from pulling through the clip; the sleeve soldered to the short end is merely to prevent fraying.

An expensive fitting, hardly justifying its cost, but one which will, nevertheless, suggest variations of the same



Examples of European practice in use of cable couplings for rear wheel brakes

principle attainable at a lower cost is that of the Lorraine-Dietrich (Fig. 7). The sketch is self-explanatory up to a point; beyond that it should be said that the boss through which the looped cable passes within the U coupling on the lever end is a separate unit. The pin which passes through the loop takes the pull from the cable and is prevented from falling out of place when the pull is released by being shouldered and by the ends of the cable being soldered together and to the U coupling where they leave the latter.

The sketch, Fig. 8 (La Licorne), is reminiscent of certain ignition cable terminals, a taper-ended plug screwing into a tapered sleeve, where it spreads and binds the strands of the cable end. Although not shown in the sketch, it should be said that the outer extremity of the threaded plug has an eye to secure it by means of a pin to the operating lever. This arrangement removes one of the chief advantages of cables for brake couplings, in that it reintroduces dependence upon screw threads to take the direct pull of brake actuation, though admittedly there are not the potentialities for wear of the threads that exist where a rod is used. But it should be easy to remove this shortcoming entirely in a fitting embodying a taper spreader by making the eye—or a double eye—integral with the outer sleeve; such an arrangement would then represent probably the best and cheapest of those now used.

As to the points for and against the use of cables in lieu of rods, it is claimed that they are stronger for a given weight, less liable to sudden failure, discourage rattles, lend themselves readily to compensation if required and in some cases tend to reduce cost, though on the latter point there is considerable divergence of opinion. The cables are, of course, twisted from hard steel strands and are galvanized. They are, it would seem, not objected to by European buyers of cars.

Market for Spark Plugs in Czechoslovakia Supplied by Germany

THERE is a considerable demand for spark plugs in the consular district of Prague, Czechoslovakia, according to a report from the United States Consul. This demand is met almost entirely by the Bosch and Eisemann manufacturers, the former having a branch office in this city and the latter a representative only. Spark plugs are imported mainly from Germany, a very insignificant supply being imported from France and England.

The trade names of the principal spark plugs sold are "Bosch" and "Eisemann," being German makes. Other German makes sold are the "Meah," "Beru," "Siemens," and the "Halske and Norris." The French makes are "Bougie-Pognon," "Oleo," and "Nilmerior." The English make is "Lodge."

The Bosch spark plug is a three-pole plug, and the Eisemann spark plug a one-pole plug, and it is stated that all spark plugs of European manufacture are uniform in size. In the newer makes the porcelain cap may be exchanged when broken, so that it is not necessary to purchase a new plug when the porcelain becomes defective.

The terms and conditions of sale to distributors or representatives are practically the same, three months' credit usually being allowed. All orders direct to the factories are referred to the distributors or representatives, who receive a certain commission on all sales.

The retail price of a Bosch spark plug is 28 Czechoslovak crowns, about 56 cents at the present rate of exchange, the Eisemann plug being a few cents cheaper.

The duty on spark plugs is 120 crowns per 100 kilograms net weight, with a surcharge of 2500 per cent. The duty on cardboard boxes in which the spark plugs are packed is 720 crowns per 100 kilograms (kilogram equal to 2.2046). A luxury tax of 12 per cent on the invoiced price of the spark plug is also charged.

This Consulate is informed that the American standard screw thread spark plugs are not suitable for gasoline engines used in this district, inasmuch as the thread and size are not the same as those in use here. Moreover, dealers state that, inasmuch as the cost of American spark plugs is more than those manufactured by European concerns, expensive advertising would be necessary before a market could be created.

A Double End, Center-Drive Lathe for Production Work

This lathe is designed for turning shafts and tubes that require work to be done at both ends. By performing all the operations at the same time it accelerates production. It is well adapted to automotive manufacture.

By P. M. Heldt

ONE of the latest types of production machines for automotive plants is a lathe for the turning of shafts and tubes that require work to be done at both ends. It is said to have been developed as a result of industrial conditions during and immediately following the war, when labor was scarce and there was a great demand for rapid production. The machine is known as a double end, center-drive lathe and is the product of Greenlee Bros. & Co.

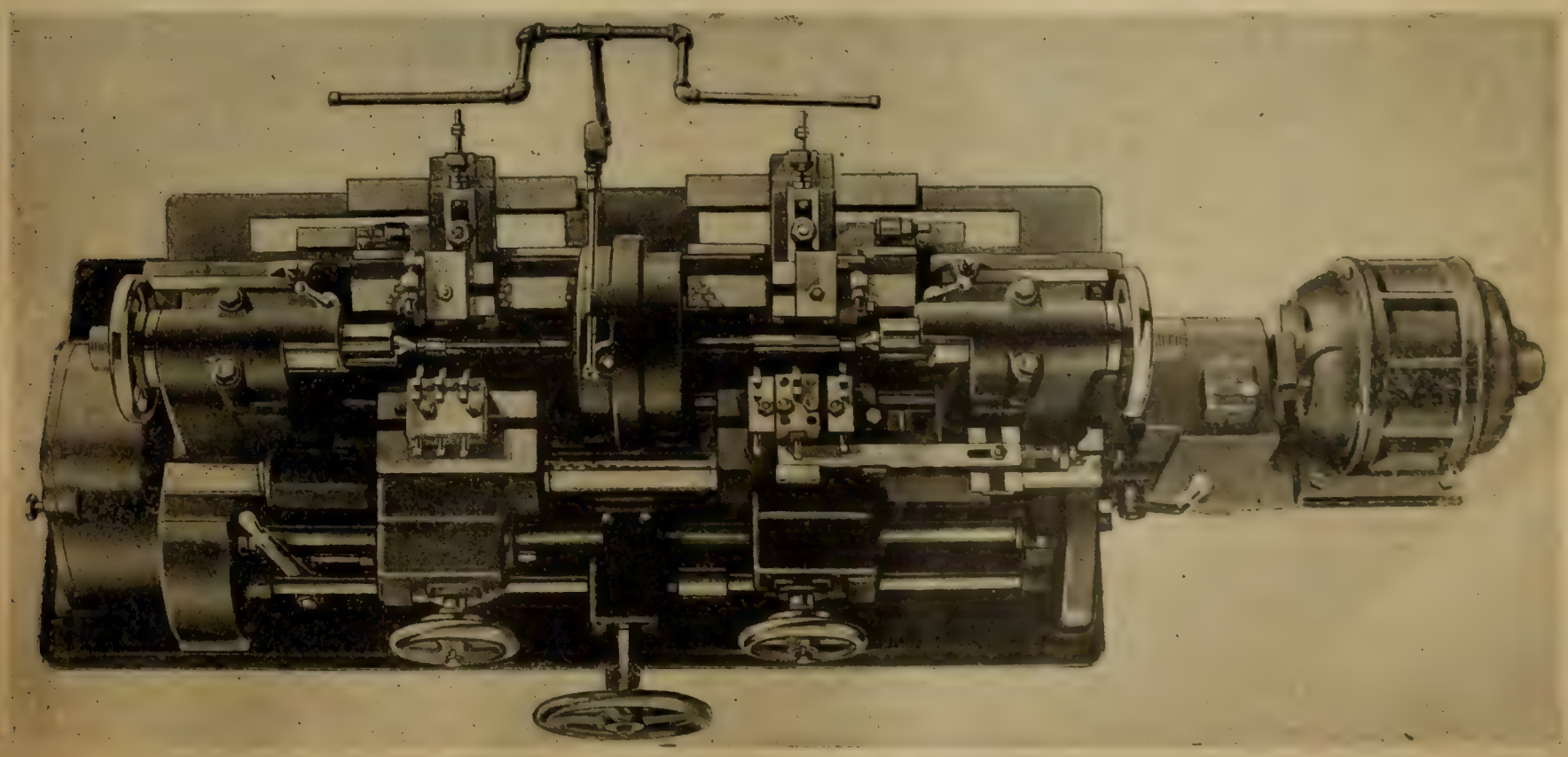
In turning such parts as automobile rear axle shafts in an ordinary lathe, the different operations are performed successively, one at a time, and this is naturally a slow and expensive process. In the Greenlee lathe all of the operations are performed at the same time. The machine is particularly well adapted to a number of operations in the manufacture of automobiles and trucks, such as the machining of rear axle shafts, tubular members of built-up axle housings, propeller shafts, camshafts, armature shafts, etc. The lathe is being built in two sizes, capable of handling maximum lengths of 36 and 60 in. respectively.

The bed of the machine is of heavy box section, closed at both ends and strongly ribbed to withstand the cutting strains. Two pairs of ways are provided, one consisting of a pair of Vees 15 in. from center to center, for the carriages; the other of one flat and one Vee way for the tailstock and the center drive. Underneath the bed is a pressed steel chip pan which drains to the cast iron coolant tank below.

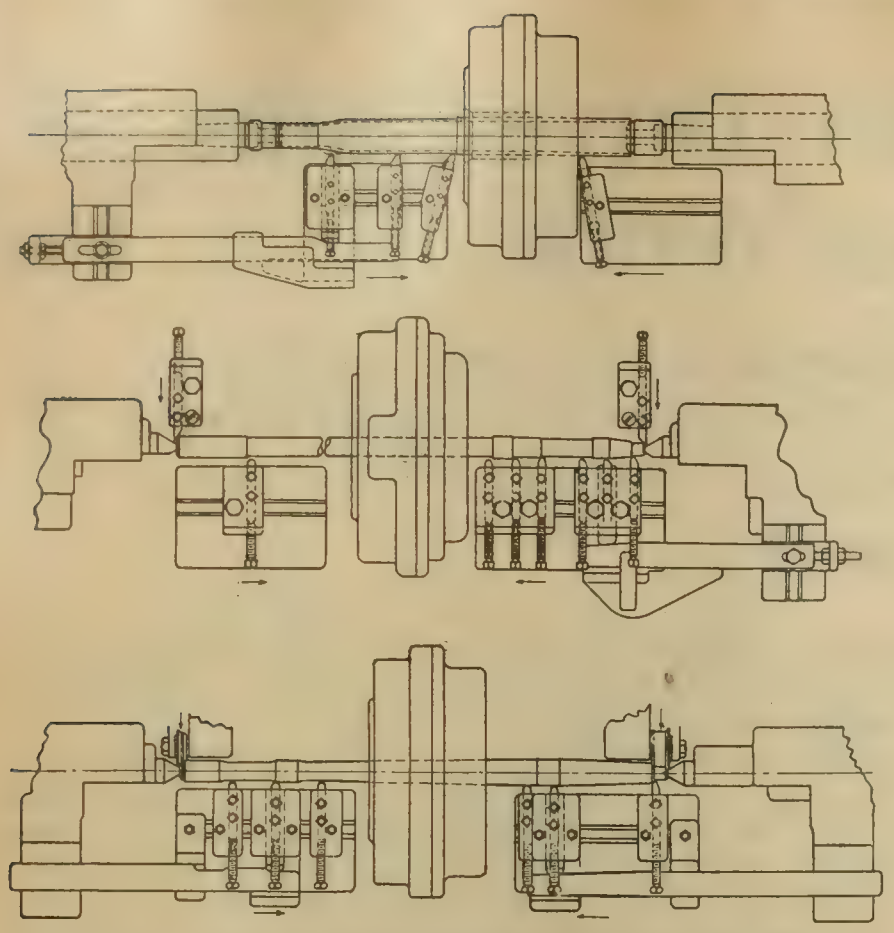
The center-drive head can be adjusted along its ways, and is driven by a keyed shaft running the entire length of the bed. From this drive shaft the power is transmitted to the main gear of the drive head through a pinion and an idler, at a reduction of 3 to 1. The main drive gear is mounted in two ball bearings of large size. The drive is through steel gears with helical cut teeth, and all of the gears are enclosed and run in a bath of oil.

To allow for work being out of center, a universal floating chuck is provided on the center drive head. It is fastened to the main drive gear and consists of two sliding plates which are centered by springs bearing on their peripheries. Shoulder bolts, through clearance holes, hold the plates to the gear. Three self-centering jaws are mounted on studs on the outer plate and are fitted with springs to hold them in contact with the work. A throw-out plate, operated by a convenient handle, is provided to open the jaws when work is to be removed or inserted.

A tailstock is provided for each end of the lathe, and both are adjustable along the ways. The spindles are 3½ in. in diameter, are bored to receive No. 5 Morse



Top view of Greenlee double end, center-drive lathe



(Top)—Layout of tooling for automobile axle tube for production of 60 per hour
(Center)—Layout of tooling for automobile pinion shaft for production of 40 per hour
(Bottom)—Layout of tooling for automobile axle shaft for production of 30 per hour

taper centers, and are run in and out by hand wheels operating on quick-acting threads cut on the ends of the spindles. The nose of each center and spindle is cut away on one side, to provide clearance for the tools when turning small diameters.

Each end of the lathe is provided with a separate carriage operating between the center drive head and its tailstock. These carriages have a bearing on the V-ways 21¼ in. long and are fitted with oil wipers at their ends. Both carriages have 8 in. of travel on the 36-in. machine and 20 in. on the 60 in. machine when the drive head is in the center. A power-operated feed screw is provided for each carriage. The carriage can also be operated by the large hand wheel at the front of the machine for making the set-up.

Cross slides or tool block carriers 12 in. wide are mounted on the carriages. They operate on long, narrow dove-tail guides fitted with taper gibs. These cross slides have ⅝ in. automatic movement for advancing the tools to the proper working depth and for withdrawing them when the proper length has been turned. Each cross slide also has adjustment of 4¼ in. by a graduated hand wheel for making the set-up.

When the feed lever is moved to the starting position, the tools are advanced to their working depth and the carriages then fed toward the center drive head to the proper length to be turned. At this point a dog on the carriage engages a stop which reverses the feed screws. The tools are then retracted and the carriages return to their starting positions.

The feed gears are located in the housing at the left end of the bed and are driven from the main drive shaft, through pick-off gears. The feed and rapid traverse motions are controlled through a system of planetary gearing. Pick-off gears for each feed screw are also provided, so that different feed rates for each carriage may be obtained.

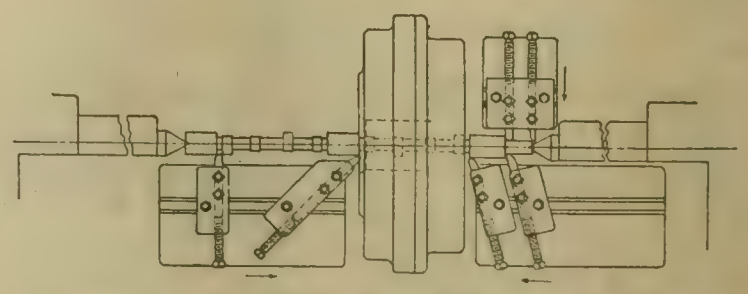
The tooling is varied to suit the character of the work. The steel tool blocks are made with from one to four tools, depending upon requirements, and are mounted on the cross slides by means of T-bolts. Taper turning is done by means of a taper form bar carried on a bracket secured to the tailstock. As the carriage is advanced along the ways, the form bar acts on a sliding tool block carried in a holder mounted on the front cross slide. This fixture can be used for turning odd shapes by having the profile outlined on the bar. It is also used for turning a short straight diameter preceding the taper. When the taper is very steep, requiring a large reduction at the small end, two or more slide blocks are used in one holder.

Rear tools for necking, chamfering, or forming, are carried on slides inclined at 30 deg. to the horizontal. These back tool slides are carried on brackets securely fastened to the center drive head and tailstocks. The connections to the tailstocks are by means of bolts fitted in T-slots, so that the tailstocks, and also the brackets and center drive head, can be moved. The tool block slides are clamped to the brackets when in use and can be located in any position between the tailstock and center drive head when the set-up is made. The tool blocks have only in and out movement. The bracket carrying the tool slide is fitted with a hardened steel block having a cam path cut in its upper surface to produce the cross movement of the tool slide. Each cam block receives its longitudinal movement by being attached to one of the main carriages by an adjustable bracket. A hardened steel roller, connected to the tool block, operates in the cam path and thus produces the in and out movement. One or two rear tool slides are used, depending upon the work to be performed.

When extended cuts are to be made on long shafts of small diameter a roller back rest is furnished. It clamps on the bracket which carries the rear tool slide and can be easily adjusted to the proper location. The top member, which carries the rollers, is hinged to the base so that it can be swung back when stock is being removed from the machine. A quick clamping lever is provided for locking the two members together, and each roller has independent adjustment.

The main driveshaft extends lengthwise through the center of the bed and is driven through reduction gears by means of either a motor or a belt. For belt drive, a clutch between the pulley and the gear driveshaft is furnished. For motor drive, this is omitted as suitable push button control is provided. Both machines are also equipped with a lever operated brake to aid in stopping quickly.

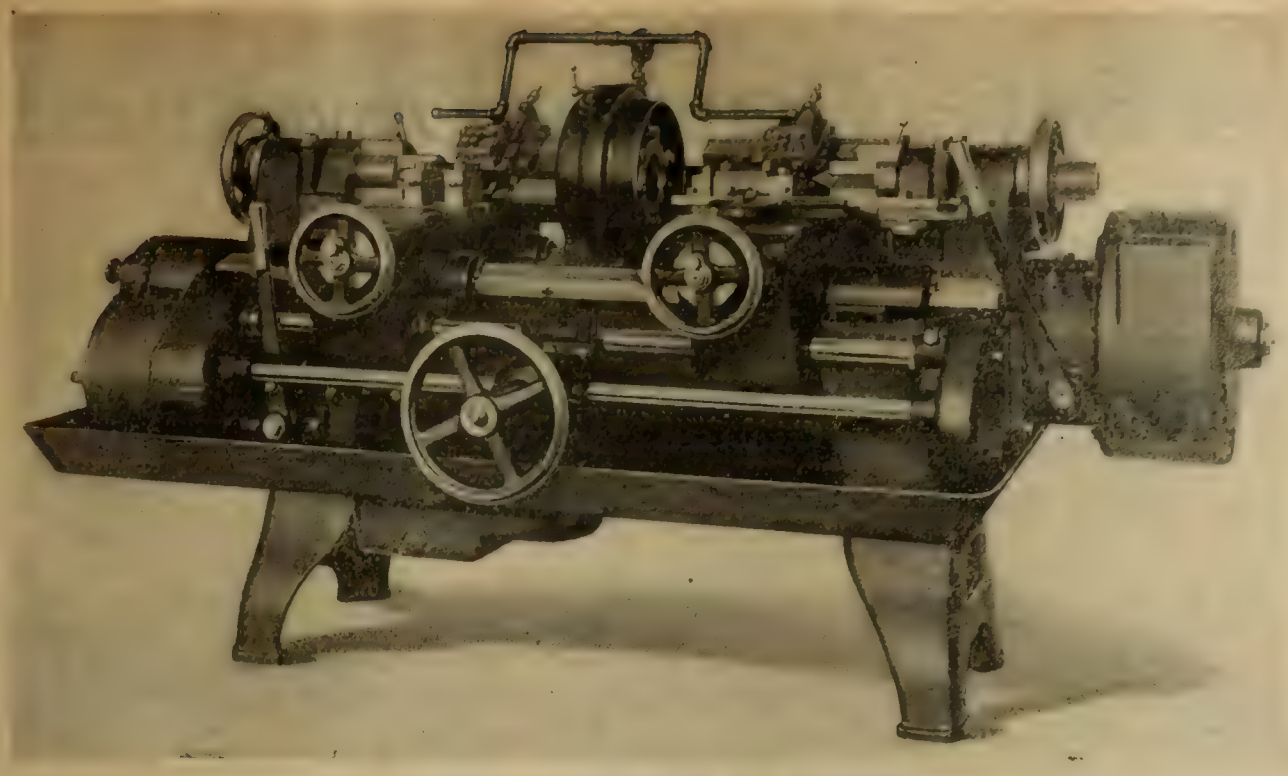
For single purpose production work, no speed changes are provided for the main driveshaft, but these can be



4—Layout of tooling for turning line bearings on cam shaft for production of 30 per hour

furnished for special cases. The drive gears are located in a box at the right end of the bed and are easily accessible for changing the gear ratios.

A liberal supply of coolant is furnished the tools by a geared pump located at the back of the machine. It is driven from the main shaft by a completely housed chain drive. The piping is fitted with a swivel joint which permits it to be swung out of the way while work is being removed or inserted. The coolant flow is regulated by a



Operating side of Greenlee double end center-drive lathe



Universal floating chuck on the center drive head

valve operated from a rod extending through the center drive housing to the front of the machine.

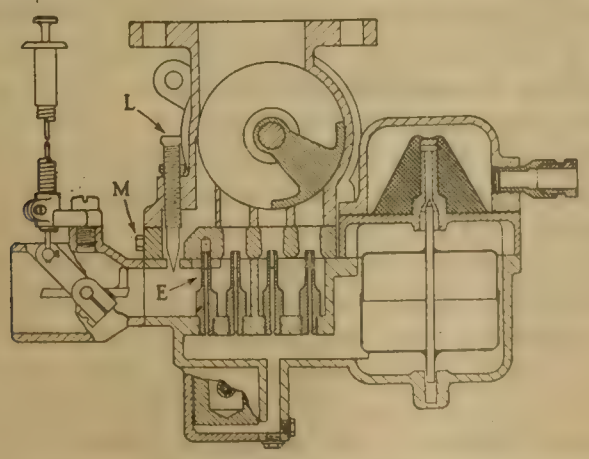
Number of tool layouts for machining automobile parts are shown herewith. On the camshaft the four parallel bearing surfaces are turned and one end of the shaft is chamfered. The production on this job is at the rate of 30 per hour. The camshaft has a total length of about 22½ in. and the bearing diameter is about 1½ in.

In turning the axle tube only the front tool carriages are used. There are three tools on one carriage; while the other has only one, and all take plain cylindrical cuts. The production rate is 60 per hour. A rather more complicated job is that of the pinion shaft, which calls for the use of eight tools, including turning, taper-turning and chamfering tools. As in all operations, the front carriages feed in the direction toward the center drive head, while the rear carriages feed inward. The production on this job is 40 per hour.

Another typical layout for this machine is that for machining a rear axle shaft, evidently for a semi-floating axle. Each of the two front carriages carries three tools, while the back carriages carry special chamfering and necking cutters of the circular type. These shafts pass through the machine at the rate of 30 per hour.

A New Multiple Jet Carbureter

A NEW carbureter, a section of which is shown in the accompanying cut, has recently been placed on the market. It consists of a base casting containing a number of jets of various sizes and a direct acting float with needle valve at the top. A venturi plate in which is formed a number of venturi passages equal to the number



Sectional view of Omac Constant Unit carbureter

of jets is fitted between the base casting and the flanged casting which attaches to the manifold. In the flange casting is a sector shaped throttle arranged to progressively uncover the various venturi openings and thus bring the jets successively into operation. There are from two to four jets and tubes in each range, depending upon the size of the carbureter. The jet E is the idling jet and is controlled by the screw M. Screw L determines the speed of the engine under idling conditions. A choke with dash control is fitted on the main air inlet, while above the float and opposite the fuel inlet is a conical screen of large area. The original setting of the instrument is accomplished by inserting jets of the proper size in the tapped holes opposite the venturi. Thereafter the only adjustment which can be made without changing jets is that provided in the idling screws L and M. The instrument is made by the Jennings Corp. and is known as the Omac Constant Unit.

INVESTIGATIONS into the use of metal in the construction of aircraft have been made in the research department of the British Air Ministry, and they have reported satisfactory progress in the testing of metal propellers, wings, struts, spars and fuselages. Various types of propellers have been tested, including variable pitch propellers adjustable during flight and propellers with metal hubs and detachable blades which can be set at any desired pitch before flight.

In the sphere of navigation steps have been taken to measure the amount of deviation of compasses carried on aircraft containing a large proportion of steel in their construction. A report has been presented to the Aeronautical Research Committee giving the results of laboratory tests on the probable oscillations in flight of various standard and experimental compasses.

New System of Bevel Gearing Developed by Recent Research

Investigation determines quietest form of tooth consistent with strength and durability. Addendum and dedendum for any pitch vary with ratio. Usually different for pinion and gear. Pressure angle depends upon number of teeth and ratio. Standard system needed for spur gears.

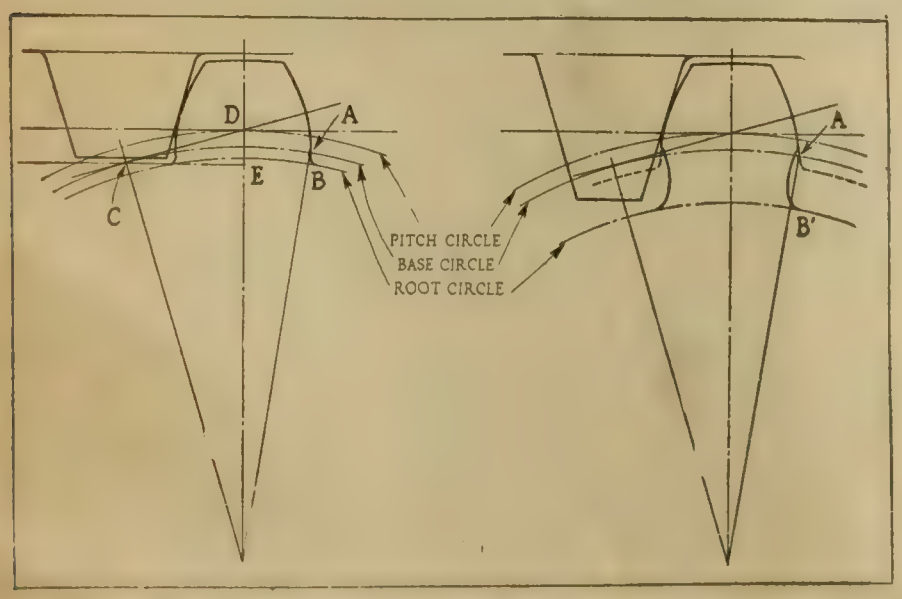
By F. E. McMullen and T. M. Durkan*

FOR a long time a need has been felt for a definite system of designing bevel gear teeth, which would give the most desirable tooth form for use under average conditions. It has been common practice in the past to use spur gear formulas, such as those of Brown & Sharpe, in figuring bevels. These formulas were worked out for an interchangeable spur gear system, which necessarily required some compromise, so that when they are applied to bevel gears, where interchangeability is not a factor, the possibilities of the involute curve are not fully utilized.

The Gleason 0.3 and 0.7 long and short addendum tooth was brought out to improve this condition, and various other alterations of the standard spur gear design have been used, but for the must part these can be applied to certain combinations only and, therefore, are not universal. Recent applications of bevel gearing covering a wide range of ratios have made it imperative that a progressive system embracing all ratios and any number of teeth in common use, be worked out.

An investigation has been conducted by the Gleason Works with the idea of developing a practical system of designing the quietest form of tooth consistent with strength and wear considerations, and the results of this research have been incorporated in a simple table. This system applies to any pair of generated spiral or straight tooth bevel gears operating at right angles where the pinion is the driver and has 10 or more teeth. Bevel gears cut on former type planers are the subject of a special study, as certain practical limitations prevent the application of the system to this class of gearing without modification.

*Paper read before the American Gear Manufacturers Association, Buffalo meeting.



Figs. 1 and 2—Short and long involute teeth in mesh with a rack

Silent Operation Primary Aim

The principal qualities considered in arriving at this system, arranged in the order of their importance, are quietness, strength and durability. In regard to quietness, experience shows that bevel gears cut with a lower pressure angle will operate more quietly than those with a higher one, other conditions being equal. Several reasons account for this: With the lower pressure angle a greater arc of action is obtained, any eccentricity has less effect and the radial component of the tooth load is minimized. Thrust forces also make it desirable to avoid the higher angle, not only because of the introduction of an axial or cone thrust not present in spirs, but also because the majority of bevel gears are overhung from their supports, so that the total load should be kept as low as possible. For these reasons the basis of the system is the use of the lowest pressure angle which will not sacrifice strength by introducing excessive undercut.

It may be well to describe here what is meant by undercut. In Fig. 1 is shown an involute tooth in mesh with a rack. The tooth profile consists of two parts: (1) the involute curve which has its origin at A and continues to the top of the tooth, and (2) the fillet AB lying between the base and root circles. If the rack, which represents the generating tool, does not project below the point C, beyond which involute action cannot take place, the fillet AB will always lie outside of a radial line OA drawn from the origin of the involute. When the rack tooth is made longer so that it extends below point C, the condition shown in an exaggerated form in Fig. 2 is realized. In this diagram the fillet A′B′ is seen to come inside of a radial line O′A′ and also to cut away part of the involute curve slightly. An examination of Fig. 1 shows that the value for dimension DE, which is the distance from C to the pitch line, is equal to the back cone radius DO x $\sin^2$ pressure angle, so that we might make a definition of undercut by stating that a generated bevel gear tooth is said to be undercut when the dedendum is greater than the back cone radius x $\sin^2$ pressure angle. However, it can be shown mathematically that it is possible to exceed this value considerably before there is any appreciable undercut; in fact for the ordinary automobile rear axle pinion having anywhere from 10 to 13 teeth, the dedendum is nearly always more than this critical value, sometimes being as much as 100 per cent greater. The point at which to limit successful automobile practice, because that application represents a condition where both silence and strength are of equal importance. The 10T-47T 14½-deg.

spiral bevel ratio shown in Fig. 3 has a pinion dedendum 60 per cent greater than the back cone radius x $\sin^2$ pressure angle, and although the undercut is about as great as for any job in the spiral bevel system, it cannot be called excessive. Likewise, the 14T-16T 14½-deg. straight bevels seen in Fig. 4 represent as extreme a case of undercut as will be encountered in the straight tooth system, yet they have a tooth profile which is not weakened to any great extent. The same ratio with a 17½-deg. pressure is shown in Fig. 5, but the strength of the gears is increased less than 5 per cent, although it has the appearance of being more than this.

Low Pressure Angle vs. Strength

The selection of a low pressure angle in preference to a higher one does not result in a considerably weaker tooth, as is ordinarily supposed, because the stronger section of the higher pressure angle tooth is offset by the greater arc of action with the lower angle. Reference to Figs. 3 and 6 will make this clear. Fig. 3 shows a 10T-47T ratio drawn with a 14½-deg. pressure angle and in Fig. 6 the same ratio is laid out with 20 deg. In each case the pinion tooth at the left is just on the point of engaging, so that the tooth at the right is carrying the full load. This will be the worst condition of loading on each tooth, as any further movement to the right brings another tooth into contact, with consequent distribution of the load over two teeth, while movement to the left lowers the line of application of the force toward the base of the tooth. In this position the comparative strength of the teeth can be found by passing a parabola through the intersection, Point A (See Figs. 3 and 6) of the line of action and center line of tooth, and tangent to the tooth profile. The value of $BC^3 \div AD$, which is a measure of the strength, can then be obtained. For the 10T-47T ratios shown in Figs. 3 and 6 the 20-deg. gear is about 14 per cent stronger than the 14½-deg., but the pinions are of equal strength. The 20-deg. ratio, however, is much worse for case hardening on account of the narrow width of top land. A pair of 15T 14½-deg. and another pair of 15T 20-deg. miter gears are shown in Figs. 7 and 8; here the 20-deg. gear is less than 10 per cent stronger than the 14½-deg.

IN ordinary bevel gearing the tooth elements, such as pressure angle, addendum and dedendum, are constant for any given pitch and are determined by the same rules as used for the elements of spur gear teeth. These rules for spur gearing were determined by the desire to make such gears interchangeable, so that any pinion would mesh properly with a gear of any number of teeth from twelve up. This involved certain sacrifices in the way of strength of teeth, efficiency of operation and quietness of action, but these sacrifices were believed to be fully compensated for by the advantage of interchangeability gained.

When the same rules for the proportion of tooth elements were applied to bevel gears the same sacrifices were made, but no corresponding advantages gained, as in right-angled drives a bevel pinion will mesh properly only with the particular size of gear for which it was designed. The Gleason Works in its new system here described, therefore has broken away from the old rules and varies the tooth elements with the number of teeth and the ratio of the drive, so as to favor silence of operation, efficiency and durability in the order named.

Point of Application of Load

This method of calculating the strength is similar to the one used in deriving the Lewis formula, except in regard to the point of application of the load. The Lewis formula is based on the assumption that the load is applied at the end of the tooth, but in modern generating gearing this is a condition which practically never occurs. Prof. Marx in his experiments at Leland Stanford University, found that the force was not at the end of the tooth when failure took place, and also proved that the strength was increased as the arc of action became greater. From a consideration of these conditions it is evident that the choice of a 14½-deg. instead of a 20-deg. pressure angle is not made at any extreme sacrifice of strength, but that for a large number of designs there is very little difference between the two.

Durability

The question of durability viewed from a theoretical standpoint would seem to resolve itself into a problem of obtaining a minimum of sliding and a maximum of rolling motion, as it is natural to assume that the wear would vary directly with the sliding action. But it is well known that the greatest wear often takes place near the pitch point where there is no sliding action. This is because the big factor causing wear is unit pressure and not sliding action. When the point of contact is near the pitch point all the load is borne by one tooth, while it is distributed over two teeth near the beginning or end of action, with a consequent reduction of unit pressure. In Figs. 7 and 8 the part of the pinion profile which will wear most rapidly is FG, because it has to carry the whole load; EF and GH will not wear as fast even though the sliding action is higher, on account of the lower unit pressure. For this reason no attempt has been made in this system to maintain any predetermined percentage of rolling action but rather to balance up between approach and recess the amount of rolling already fixed by the requirements of quietness and strength. Wherever possible, the action during approach has been favored in order to compensate for the change in direction of the friction component which tends to increase the obliquity of the line of action during approach and decrease it during recess. Account has also been taken of the high velocity of sliding action which occurs at the top of long addendum pinion teeth and which, in extreme cases, has led to abrasion. Safe values for this sliding action were obtained from jobs in service and the design regulated so that these were not exceeded.

In establishing the various factors which go to make up the system, the aim was to arrange them in as simple and practicable a form as possible without sacrificing any of the three principal qualities of quietness, strength and durability. In a non-interchangeable system like the one here presented, any of the factors can be made to vary for each ratio and number of teeth, but simplicity and the interests of standardization are opposed to expressing these factors as variable quantities where the probable accuracy of the assumptions made in determining them does not warrant it.

Reasons for Three Pressure Angles

An example of this is the pressure angle. In a purely theoretical system it might have any value, while the same practical results are obtained in this system, which includes all ratios having 10 or more teeth in the pinion, with the use of three angles (14½, 17½ and 20-deg.) for

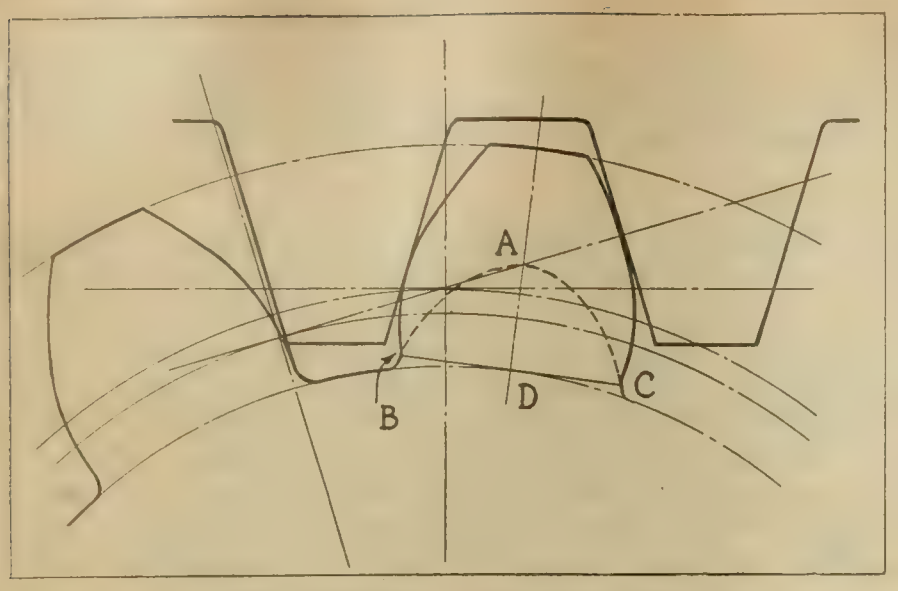


Fig. 3—10T-47T spiral bevel ratio

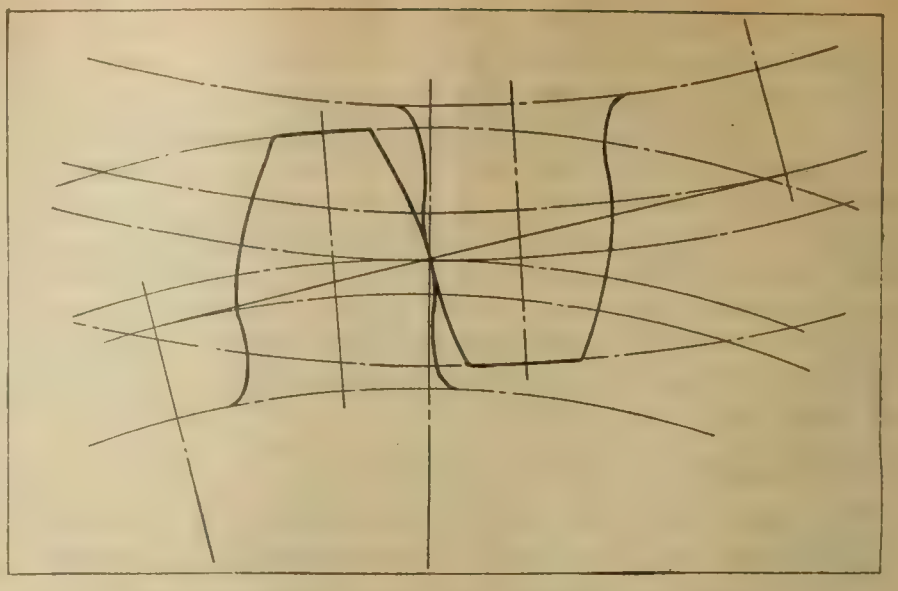


Fig. 4—14T-16T 14½-deg. straight bevel ratio

straight tooth bevels and one angle (14½-deg.) in all except a few unusual cases, for spiral bevels. The pressure angle to be used for any given pair of gears is specified in Tables 1 and 3, and has been selected as the lowest angle which avoids excessive undercut. The introduction of the pressure angle of 17½ deg., which is not universally used, is considered necessary in order to live up to the stated purpose of developing a practical system which will give the quietest form of tooth consistent with strength and wear. It has been found by experience that there is a decided increase in noise when the pressure angle is changed from 14½ deg. to 20 deg., so that in order not to compromise the system when the undercut becomes too great with 14½ deg., an intermediate pressure angle must be called for. The angle of 17½ deg. has been selected because it has already been used to quite an extent by different gear manufacturers. Although at least one pressure angle between 14½ deg. and 20 deg., which are 5½ deg. apart, is required, more are unnecessary because any new angle would not be more than 1½ deg. different from the three selected (14½, 17½ and 20 deg.) and this change is too small to have any practical effect.

Working Depth

The working depth of tooth, which has been fixed as 2.000 in. ÷ D.P. for straight tooth bevels and 1.700 in ÷ D.P. for spirals, is the same as has been successfully used for a number of years. For the average spiral angle of about 30 deg., the normal pitch is approximately 85 per cent of the linear, so the normal section of a spiral tooth will be proportioned about the same as a straight tooth. Originally the working depth for both straight and spiral bevels was made equal to 2.000 in ÷ D.P. but some years ago the depth for spiral bevels was decreased to 85 per cent of this amount because the top of the tooth on the normal was too thin and gave rise to hardening troubles. Stubbing the tooth more than 85 per cent decreased the arc of action and gave a noisier gear. It would be desirable from the standpoint of standardization to use the same working depth for straight tooth bevels as for spirals, but after considerable experimenting along this line, it was found that straight bevels having an 85 per cent stub tooth ran noticeably noisier than similar gears with the full depth tooth. Consequently the standard of 2.000 in. ÷ D.P. has been retained for straight tooth bevels.

The bottom clearance specified in the system is 0.188 in. ÷ D.P. (which is 0.06 x circular pitch) and is the minimum amount which experience shows is necessary for the average job to insure against any bottoming of the teeth. In the past 0.05 x circular pitch has been used and found to have been insufficient while 0.07 x circular pitch, which has also been tried out, is more than is required.

Addendum and Dedendum

The method followed in proportioning the addendum and dedendum was to adjust them until the amount of sliding during approach was about the same or slightly less than the sliding action during recess. This also had the effect of making the arc of recess greater than the arc of approach, which is very desirable, since recess action is quieter than approach. To obtain these conditions it was necessary to decrease the gear addendum and increase the pinion addendum as the ratios of the numbers of teeth in the gear and pinion became greater. These values of addendum for gear and pinion were originally worked out for each ratio and number of teeth, and from an examination of them it was found possible to make an arrangement

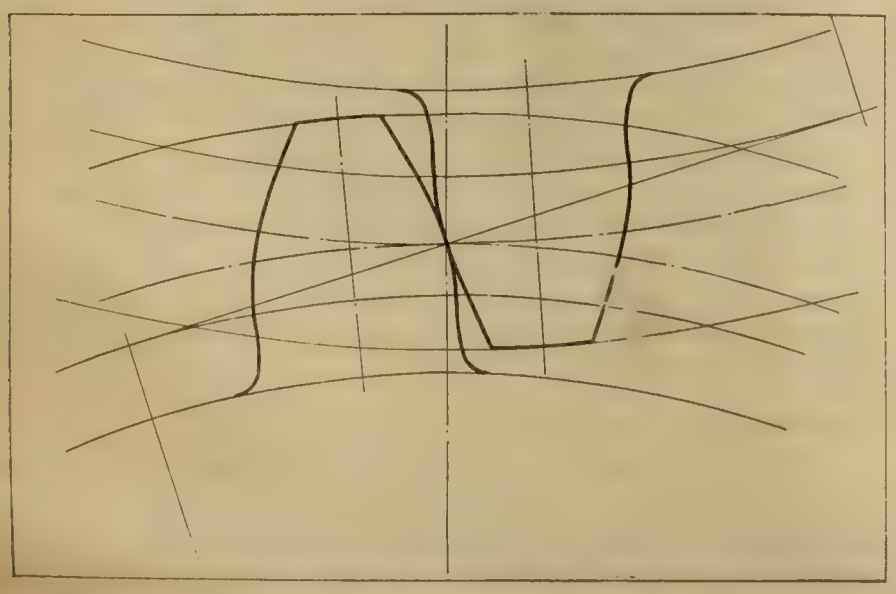


Fig. 5—14T-16T 17½-deg. straight bevel ratio

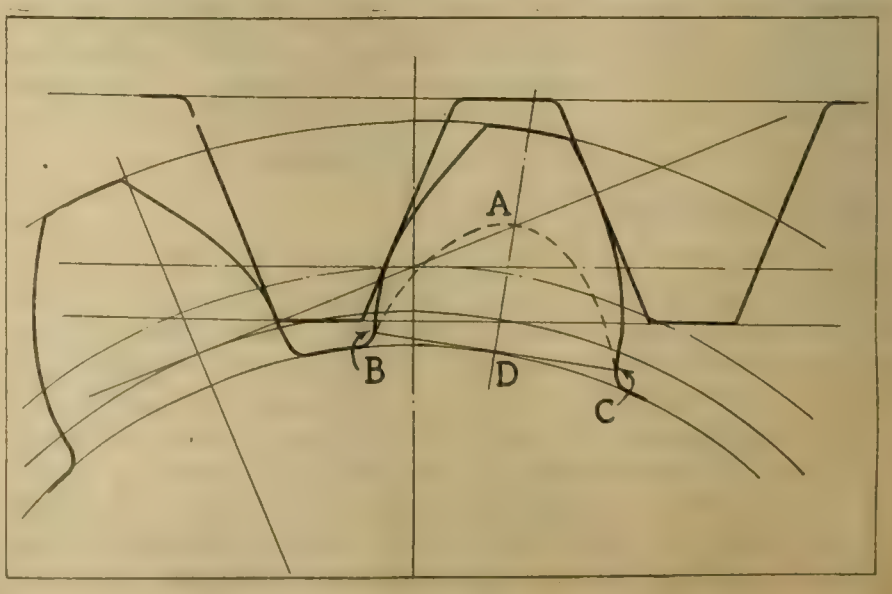


Fig. 6—10T-47T 20-deg. spiral bevel ratio

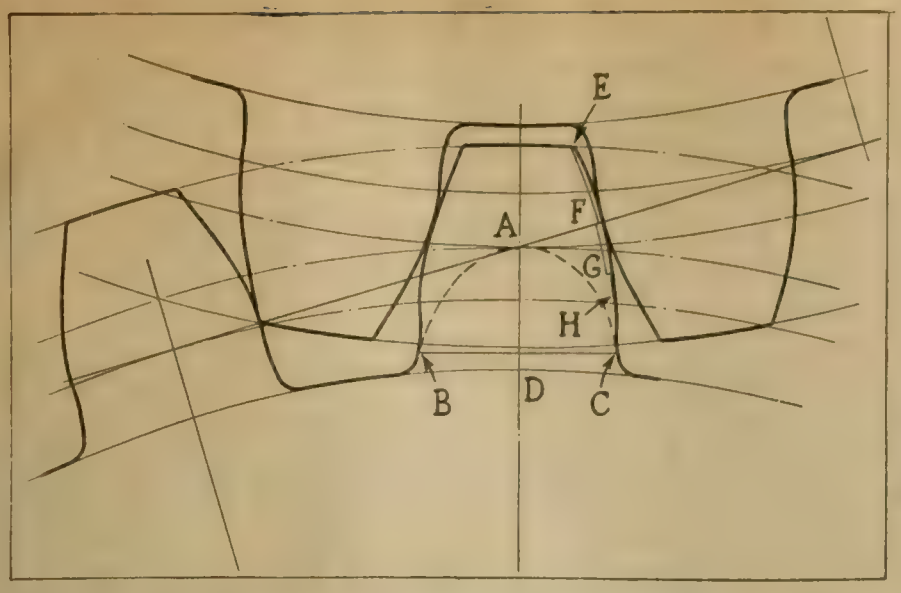


Fig. 7—15T spiral bevel miter, 14½-deg. pressure angle

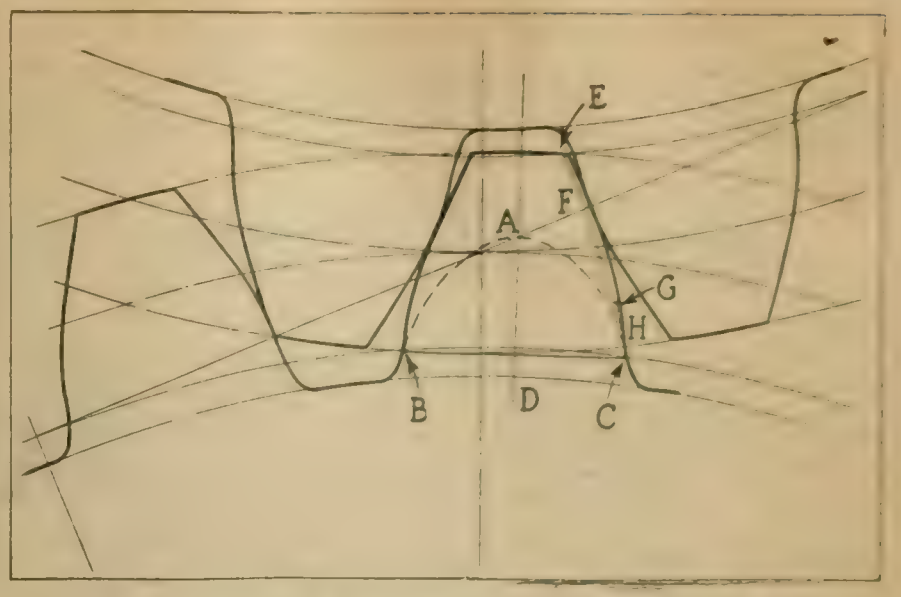


Fig. 8—15T spiral bevel miter, 20-deg. pressure angle

in a simple tabular form according to ratios (see Tables 2 and 4) without any sacrifice of practical qualities.

Circular thicknesses were found entirely by making enlarged layouts in which the teeth were balanced up partly on a width of top land and partly on a strength basis. The formulas given in Tables 1 and 3 were worked out so that they would give the same results as were obtained from the layouts.

Not Untried

In conclusion it can be said that this system is not something new or untried but in the case of spiral bevels at least is represented in practice by a large number of very satisfactory jobs. It also checks up closely with successful straight tooth bevel gear practice although the long and short addendum tooth has not been used as universally for straight tooth bevels as for spirals. The system, as presented, represents in a simple and usable form an intensive study of the question of bevel gear tooth design, treated from both a practical and theoretical standpoint.

It might not be out of place here to express the opinion that a standard non-interchangeable system, possibly along similar lines to the one just presented, is needed for spur gears. In fact, such a system should be of as great importance as a standard interchangeable system since a large proportion of spur gears, like bevels, are intended to operate in pairs only. The concessions made to allow interchangeability are so great that the case of the non-interchangeable gear should be granted as much consideration in the way of a standard system as is given to the interchangeable gear.

TABLE 1—GENERATED STRAIGHT TOOTH BEVEL GEARS

For straight tooth bevel gears operating at right angles where the pinion is the driver and has ten or more teeth.

For straight tooth bevel gears only.

$$\text{Working Depth} \quad \frac{2.000 \text{ in.}}{\text{D.P.}}$$

$$\text{Full Depth} \quad \frac{2.188 \text{ in}}{\text{D.P.}}$$

Pressure Angle

Ratios having 14 or more teeth in pinion .....14½ deg.
Ratios 13-13 to 13-24 .....17½ deg.
Ratios 13-25 and higher .....14½ deg.
Ratios 12-12 and higher .....17½ deg.
Ratios 11-11 to 11-14 .....20 deg.
Ratios 11-15 and higher .....17½ deg.
Ratios 10-10 and higher .....20 deg.

Addendum

$$\text{Addendum of gear} = \frac{\text{Addendum for 1 D.P. (From table)}}{\text{D.P.}}$$

$$\text{Addendum of pinion} = \frac{2.000 \text{ in.}}{\text{D.P.}} - \text{Addendum of gear}$$

Dedendum

$$\text{Dedendum of gear} = \frac{2.188 \text{ in}}{\text{D.P.}} - \text{Addendum of gear}$$

$$\text{Dedendum of pinion} = \frac{2.188 \text{ in}}{\text{D.P.}} - \text{Addendum of pinion}$$

Circular thickness

Circular thickness of gear for all ratios using 14½ deg. $= \frac{1.071 \text{ in.}}{\text{D.P.}} + [.5 \times \text{Addendum of gear}] - \frac{K \text{ (From table)}}{\text{D.P.}}$

Circular thickness of gear for all ratios using 17½ deg. $= \frac{.971 \text{ in.}}{\text{D.P.}} + [.6 \times \text{Addendum of gear}] - \frac{K \text{ (From table)}}{\text{D.P.}}$

Circular thickness of gear for all ratios using 20 deg. $= \frac{.871 \text{ in.}}{\text{D.P.}} + [.7 \times \text{Addendum of gear}] - \frac{K \text{ (From table)}}{\text{D.P.}}$

Circular thickness of pinion for 14½, 17½ or 20 deg. $= \frac{3.142 \text{ in.}}{\text{D.P.}}$ — Circular thickness of gear

TABLE 2—STRAIGHT TOOTH BEVEL GEARS

These vaues are for straight tooth bevel gears only.

Table giving addendum for 1 D.P.

To obtain addendum select from table value corresponding to ratio given by this formula:

$$\text{Ratio} = \frac{\text{Number of teeth in gear}}{\text{Number of teeth in pinion}}$$

Ratios From	Ratios To	Add. In.	Ratios From	Ratios To	Add. In.	Ratios From	Ratios To	Add. In.	Ratios From	Ratios To	Add. In.
1.00	1.00	1.000	1.15	1.17	.880	1.42	1.45	.760	2.06	2.16	.640
1.00	1.02	.990	1.17	1.19	.870	1.45	1.48	.750	2.16	2.27	.630
1.02	1.03	.980	1.19	1.21	.860	1.48	1.52	.740	2.27	2.41	.620
1.03	1.04	.970	1.21	1.23	.850	1.52	1.56	.730	2.41	2.58	.610
1.04	1.05	.960	1.23	1.25	.840	1.56	1.60	.720	2.58	2.78	.600
1.05	1.06	.950	1.25	1.27	.830	1.60	1.65	.710	2.78	2.07	.590
1.06	1.08	.940	1.27	1.29	.820	1.65	1.70	.700	3.05	3.41	.580
1.08	1.09	.930	1.29	1.31	.810	1.70	1.76	.690	3.41	3.94	.570
1.09	1.11	.920	1.31	1.33	.800	1.76	1.82	.680	3.94	4.82	.560
1.11	1.12	.910	1.33	1.36	.790	1.82	1.89	.670	4.82	6.81	.550
1.12	1.14	.900	1.36	1.39	.780	1.89	1.97	.660	6.81	.....	.540
1.14	1.15	.890	1.39	1.42	.770	1.97	2.06	.650	.....	.....	.....

TABLE GIVING VALUES OF "K" FOR CIRCULAR THICKNESS FORMULA

Select value corresponding to number of teeth in pinion and ratio given by above formula.

Number of Teeth in Pinion	Ratios →	Values of "K" for Different Ratios (In.)														
		1.00 to 1.25	1.25 to 1.50	1.50 to 1.75	1.75 to 2.00	2.00 to 2.25	2.25 to 2.50	2.50 to 2.75	2.75 to 3.00	3.00 to 3.25	3.25 to 3.50	3.50 to 3.75	3.75 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 and higher
10		.025	.070	.100	.120	.140	.160	175	.190	.205	.215	225	230	240	250	.255
11		.010	.015	.050	.080	.105	.125	.145	.160	.170	.180	190	.195	.200	.210	.220
12		.000	040	.070	.100	.120	.140	.155	.170	.180	.185	.190	.195	205	.210	.215
13		.000	.015	.040	045	.050	.060	.070	.080	.090	.100	.110	.120	135	.150	.165
14		.000	015	.030	.050	.065	.080	.090	.100	.110	.120	.125	.130	.140	150	.160
15 to 17		.000	.000	.010	.020	.030	.045	.060	.070	.080	.090	.095	.100	.110	.115	.120
18 to 21		.000	000	.000	.000	.010	.030	.045	060	.070	080	085	.090	095	100	.100
22 to 29		.000	.000	.000	.000	.010	.030	.040	.050	.060	065	.070	.070	.080	.085	.085
30 and up		.000	.000	.000	.000	.010	.025	.035	.040	.045	.050	.055	.060	.065	.070	.070

TABLE 3—GENERATED SPIRAL BEVEL GEARS

For spiral bevel gears operating at right angles where the pinion is the driver and has 10 or more teeth.

For spiral bevel gears only.

Working Depth $\frac{1.700 \text{ in.}}{\text{D.P.}}$

Full Depth $\frac{1.888 \text{ in.}}{\text{D.P.}}$

Pressure Angle

Ratios having 12 or more teeth in pinion .....14½ deg.
Ratios 11-11 to 11-19 .....17½ deg.
Ratios 11-20 and higher .....14½ deg.
Ratios 10-10 to 10-24 .....17½ deg.
Ratios 10-25 and higher .....14½ deg.

Addendum

$$\text{Addendum of gear} = \frac{\text{Addendum for 1 D.P. (From table)}}{\text{D.P.}}$$

$$\text{Addendum of pinion} = \frac{1.700 \text{ in.}}{\text{D.P.}} - \text{Addendum of gear}$$

Dedendum

$$\text{Dedendum of gear} = \frac{1.888 \text{ in}}{\text{D.P.}} - \text{Addendum of gear}$$

$$\text{Dedendum of pinion} = \frac{1.888 \text{ in.}}{\text{D.P.}} - \text{Addendum of pinion}$$

Circular Thickness

Circular thickness of gear for all ratios using 14½ deg. $= \frac{1.061 \text{ in.}}{\text{D.P.}} + [.6 \times \text{Addendum of gear}] - \frac{K}{\text{D.P.}}$ (From table)

Circular thickness of gear for all ratios using 17½ deg. $= \frac{0.976 \text{ in.}}{\text{D.P.}} + [.7 \times \text{Addendum of gear}] - \frac{K}{\text{D.P.}}$ (From table)

Circular thickness of pinion for 14½ deg. or 17½ deg. $= \frac{3.142 \text{ in.}}{\text{D.P.}} -$ Circular thickness of gear

TABLE 4—SPIRAL BEVEL GEARS

These values are for spiral bevel gears only.

Table giving addendum for 1 D.P.

To obtain addendum select from table value corresponding to ratio given by this formula:

$$\text{Ratio} = \frac{\text{Number of teeth in gear}}{\text{Number of teeth in pinion}}$$

Ratios From	Ratios To	Add. In.	Ratios From	Ratios To	Add. In.	Ratios From	Ratios To	Add. In.	Ratios From	Ratios To	Add. In.
1.00	1.00	.850	1.15	1.17	.750	1.41	1.44	.650	1.99	2.10	.550
1.00	1.02	.840	1.17	1.19	.740	1.44	1.48	.640	2.10	2.23	.540
1.02	1.03	.830	1.19	1.21	.730	1.48	1.52	.630	2.23	2.38	.530
1.03	1.05	.820	1.21	1.23	.720	1.52	1.57	.620	2.38	2.58	.520
1.05	1.06	.810	1.23	1.26	.710	1.57	1.63	.610	2.58	2.82	.510
1.06	1.08	.800	1.26	1.28	.700	1.63	1.68	.600	2.82	3.17	.500
1.08	1.09	.790	1.28	1.31	.690	1.68	1.75	.590	3.17	3.67	.490
1.09	1.11	.780	1.31	1.34	.680	1.75	1.82	.580	3.67	4.56	.480
1.11	1.13	.770	1.34	1.37	.670	1.82	1.90	.570	4.56	7.00	.470
1.13	1.15	.760	1.37	1.41	.660	1.90	1.99	.560	7.00	.....	.460

TABLES GIVING VALUES OF "K" FOR CIRCULAR THICKNESS FORMULA

Select value corresponding to number of teeth in pinion ratio given by above formula.

Number of Teeth in Pinion	Ratios →	Values of "K" for Different Ratios (In.)														
		1.00 to 1.25	1.25 to 1.50	1.50 to 1.75	1.75 to 2.00	2.00 to 2.25	2.25 to 2.50	2.50 to 2.75	2.75 to 3.00	3.00 to 3.25	3.25 to 3.50	3.50 to 3.75	3.75 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 and higher
10		.020	.055	.085	.105	.125	.125	.110	.120	.130	.140	.150	.155	.160	.170	.180
11		.030	.075	.105	.070	.085	.095	.105	.115	.125	.135	.140	.145	.150	.155	.160
12 to 13		.005	.015	.025	.035	.045	.055	.065	.075	.085	.095	.105	.115	.125	.135	.135
14 to 16		.000	.005	.015	.025	.035	.050	.060	.075	.085	.095	.100	.105	.105	.105	.105
17 to 19		.000	.000	.005	.015	.025	.035	.050	.065	.075	.085	.090	.090	.090	.090	.090
20 and up		.000	.000	.000	.005	.015	.025	.040	.050	.055	.060	.060	.060	.060	.060	.060

Commercial Aviation Developing Through Successful Operation

ONE important development in American civilian aviation is the successful operation of the Aeromarine Airways, Inc., of New York, Key West and Havana. Convinced that commercial aviation could be made a safe and financially successful business enterprise if conducted by an efficient organization possessing proper equipment, officials of Aeromarine Airways started their Key West-Havana service in the winter of 1920-21. At the close of their second Southern season on April 1 last, Charles F. Redden, president, set to work checking up figures, operating costs and statistics. The books of the company showed that it had made money but he wanted to know how closely the practical results coincided with the theories on which they have based their operations.

He found that Aeromarine Airways from Nov. 12, 1920, to April 1, 1922, had flown an aggregate distance of more than 150,000 miles and carried a total of 10,700 passengers—without an accident.

Since last November (1921) Aeromarine Airways made:
184 flights between Key West and Havana.
55 flights between Key West and Miami, Fla.
91 flights between Miami and Bimini.
53 flights between Miami and Nassau.
16 flights between Miami and Palm Beach.
345 special charter and miscellaneous sightseeing flights.

In that period, the season just closed, 268,535 passenger miles were flown, in a total of 713 hours in the air. Out of the total of 749 flights, all but five were completed; the five being discontinued because of weather conditions, and the planes returned to the starting point. Not a single passenger or employee was injured in these operations. The schedule was maintained throughout with the exception of the five postponed flights. Three types of flying boats were used: the 11-passenger flying cruisers of the F.5-L type; the Navy Coast Patrol 6-place Hs2L type, and Aeromarine 3-place flying boats.

"Efficiency of the operating personnel, pilots and mechanics and officials at each base, continuous inspection and maintenance of aircraft, adherence to the rule of 'Safety First,' observance of weather conditions and knowledge of routes combined to bring about this progressive situation," says Mr. Redden in his report. "We know now that aircraft can be operated at a profit, without endangering lives."

Ceylon Builds Rubber Pavement

THE Ceylon Public Works Department is experimenting with rubber for road paving. A Chilaw bridge paved with rubber blocks has stood wear and tear fairly satisfactorily. The P. W. D. intends to experiment on a stretch of road in the Fort of Colombo, where traffic is specially heavy. Ceylon, of course, is a rubber-producing country and in times of over-production there may be the same justification for using rubber as a paving material there as there is in using corn as fuel in Nebraska. But rubber at 50 cents a pound does not stand much chance of competing with cement at 50 cents a bag in road paving generally.

American Automotive Products Competing Successfully in World Markets

Some markets are expanding rapidly while others are still far from normal. American cars leading in New Zealand but England making rapid strides. Supply of parts necessary in Denmark to compete with Germans.

A GENERAL survey of many of the foreign markets may be gleaned from the following reports which are for the most part obtained from Consular Reports. In several instances statistics are given which show the extent of competition between the leading manufacturing and exporting nations of the world.

It will be seen that our chief competitors are England, France, Germany and Italy, and the strength of competition varying in different countries. We may say in general that the favorable factors for the American exporter are the products themselves and their low price while the unfavorable factors are the rate of exchange with the various countries and the high tariffs.

Reports to the Department of Commerce show that the American and British exporters are running a neck-and-neck race for automotive business in South Africa. Prices of American cars are lower, but an active campaign of propaganda carried on by British manufacturers is helping their sales. The British makers enjoy several advantages in South Africa, including a 3 per cent preferential tariff; a sentimental preference declared to be equal to at least 10 per cent; an advantage in exchange amounting to 10 per cent or 12 per cent and the advantage of lower freight rates.

Lower prices of American cars as compared with those of European-made motor vehicles have offset almost entirely the effects of adverse exchange and high duties in Trinidad, British West Indies. There now are registered 1961 motor vehicles in the colony, or about double the number three years ago. This includes about 200 motor trucks. Imports in 1921 were only about 100, but in 1920 they were 624, all but 18 of which were from the United States. The present demand is relatively much larger for motor trucks than for passenger cars. The trucks are used chiefly for the transportation of cocoa and in the petroleum district. There also has arisen a demand for buses.

British imports of motor vehicles in March were: Cars and cabs, 887 as compared with 696 in March, 1921; trucks 59, as compared with 172; passenger car chassis 636, as compared with 285; motorcycles 119, as compared with 25. The big increase in imported car chassis is explained by the reductions in prices of certain American cars. Exports of British motor vehicles in March were: Cars and cabs 126, as compared with 227 in March, 1921; trucks 41, as compared with 65; chassis 67, as compared with 115; motorcycles 709, as compared with 817. These figures reflect the effect of the labor trouble to a small degree.

Ground lost in New Zealand by British motor manufacturers during the war is now being made up, according to a report in the London *Times*.

From figures furnished by the Customs, the New Zealand Motor Trade Association, Inc., has made deductions which are as follows:

Origin of Imports Cars	1919 Per cent	1920 Per cent	1921 Per cent
Canada	54	44	32
United States	44	46	42
Great Britain	2	10	20
Continent	..	..	6
Trucks and Lorries			
Canada	70	58	35
United States	27	26	30
Great Britain	3	16	29
Continent	..	..	6
Total values, including chassis.	£1,125,088	£2,921,173	£1,210,762

Origin of Imports of Tires, Tubes, etc.	1921 Value	1921 Per cent
United States	£247,383	34½
Australia	160,459	22½
France	134,120	19
Great Britain	66,174	9
Canada	65,062	9
Italy	40,554	5
Belgium	531	1
	£714,283	100

The values are fair market values in countries of export at time of shipment, *plus* 10 per cent.

New Zealand can offer but a limited market for the higher priced English cars, but the desire to possess them persists. The cheaper American or Canadian cars meet the needs of people of moderate means.

There are 79,500 passenger cars, 5400 trucks and 35,000 motorcycles registered in Australia. The majority of the passenger cars, 32,000, are in New South Wales and Victoria, which has 22,000 passenger vehicles.

Exports of Italian motor vehicles are increasing as a result of recovery in the home industry. Italian cars are selling particularly well in Rumania, Bulgaria and Jugoslavia. The co-operative land movement is growing steadily, and more than 500,000 acres were cultivated co-operatively last year. This suggests a growing market for tractors and trucks.

A recent census of automobile trucks in Naples, Italy, showed about 2500, the major portion of which were old stock Italian army motor equipment disposed of by the government to private firms and individuals. The most popular truck in use is the 2½-ton Fiat equipped with pneumatic tires and double rear wheels of the disk type. There is said to be little opportunity for the sale of American trucks because of the fact that all American automotive equipment must pay a high import duty.

Approximately 3000 passenger automobiles, 400 trucks and 500 motorcycles are used in Bilboa, Spain, of which 30 per cent are of American make.

The sale of automobiles in Spain on a consignment basis by German, French and Belgian manufacturers has been threatening the American automobile market in that country, and the depreciation of the monetary systems in these three countries is a decided factor in their favor. However, recent reports indicate that automotive business conditions are improving. Representatives of American firms report increased sales. A much larger volume of business it is expected will result from the recent tariff which went into effect on April 17 with an average of somewhat lower rates.

In Hungary there are very few American passenger cars, trucks or motorcycles, due to the high import duty and the low purchasing value of the Hungarian crown. German and Italian cars are well known and favored. It is estimated that there are 3000 passenger cars in Hungary, about one-half of which are in running order. The motor trucks number about 200 and motorcycles about 600. A good car can be bought in Hungary now for about 2,500,000 Austrian crowns, although a few of the smaller cars can be sold at a less amount.

American exporters are advised that if they expect to do any business in Denmark it will be necessary to carry a full stock of parts and accessories due to German competition. At the present time German competition is strong in this market and is undoubtedly the cause of the constant fluctuations in automotive prices. American cars are under the additional handicap of high taxation on any car over 10 taxable horsepower, which amounts to about 30 horsepower, American rating.

The vital need of machine power in Turkey has become obvious and urgent, as a result of the exhaustion of the available supply of animals in the long-drawnout wars, most of the draft animals having been used for cavalry and artillery purposes and many of them to supply food for the soldiers. Consequently a demand is arising for the tractor and the plow, says Consul General Ravndal in a report to the Department of Commerce. American tractors, as well as other American-made farm machinery, possess a fine reputation in Turkey, and at present dominate the market. The Hahnemann (German), Fiat (Italian) and Renault (French) tractors are in the field, but they cannot compete successfully with the American machines which are being offered. The chief desiderata are price, efficiency and simplicity and the American tractors have been found to fill these requirements.

Of the 400 automobiles in Salvador only 330 are in actual use, according to a report to the Department of Commerce by Vice Consul Franklin, San Salvador. Eight are of European make, the rest American. As millimeter clincher tires are not imported from Europe, car owners have been forced to change the rims to receive American size tires. Due to the very rough and mountainous roads, oversize tire equipment is quite common. Seventy-five per cent of the tires sold are of cord construction. American tires are regarded as superior to the European makes, they arrive in much less time and are in fresher and better condition upon arrival than those from Europe. American and European prices delivered are practically on a par, though there is a tendency for European prices to drop from time to time. Distribution is effected through exclusive agents who sell at retail. No mileage guarantees are given as a rule. Terms vary, though they are generally 60 days' draft after arrival of goods. Some European manufacturers are offering 60 to 90 days, and when the individual case will warrant it, it would be well for American firms to meet this practice. The average car owner uses from 4 to 5 tires per year. Red inner tubes are preferred.

There are about 15 trucks in use, nearly all of which employ solid tires. American motorcycles and tires dominate the market entirely.

Latest statistics show that there are 740 tractors in Tunis, ranging from 10 to 70 hp. Of these, 580 are American, 95 French and 20 British. Ten to 20-hp. tractors are most popular in French North Africa.

A census of motor vehicles in Cuba indicates that there are about 20,000 on the island at this time. About half the number are in Havana, which is known as a city of taxicabs. The registration of motor trucks shows 2923 with 30 trailers.

American motor vehicles, especially the heavy types, are popular in Poland chiefly because of the surplus war stock sent into that country. Sales at this time are hampered by the low value of the Polish mark and the high price of gasoline. The Poles have consequently turned their attention to the lighter cars with a lower gasoline consumption. With the exception of motor equipment for agricultural purposes the motor vehicles in Poland are largely concentrated in the cities.

There are some 250 privately owned motor cars and trucks in Smyrna, practically all of American manufacture, says Consul General Horton, in a recent report to the Commerce Department. Ten per cent of the cars are equipped with metric clincher tires, 50 per cent with inch clincher tires, and 40 per cent with straight sides. Ninety per cent of the cars are equipped with fabric tires because of their lower price. American tires are more popular than foreign makes and compare favorably in price, which is the controlling factor rather than quality. The roads are bad and very severe on tires.

The possibility of automobile imports in Nanking Consular District of China is reported to be remote, according to reports received by the Bureau of Foreign and Domestic Commerce. In the district comprising 90,000 square miles having 60,000,000 population, the census figures show there are only 300 miles of automobile roads. Roadbuilding enterprises are reported to be in progress and plans for a large amount of road construction are now being undertaken by the states.

Due to this lack of roads the district offers only a limited market at the present time for American motor vehicles, but one which in the coming decade will in all probabilities attain considerable dimensions.

As the present-time market demands are limited and as the three localities in which motor vehicles are in actual use are widely separated, there are no firms in this district conducting direct import of motor vehicles or accessories. The demands of this market are supplied from Shanghai. For the present any connection made in that city by American manufacturers may be considered as covering the subsidiary markets of the Nanking District. Exact figures as to the number of automobiles in the district was not available, but it is estimated that over 90 per cent of the motor vehicles now in use in this district are of American manufacture.

Study the Individual Worker to Solve the Human Problems of Industry

This is one essential principle brought out in Harry Tipper's new book, "Human Factors in Industry." The volume is fundamental in character and forceful as to treatment. The present upward swing of industrial activity makes this discussion of industral relationships especially timely.

By Norman G. Shidle

HARRY TIPPER is business manager of AUTOMOTIVE INDUSTRIES. Consequently, we felt it best to make an agreement with him before we read this new book of his that we could say all the unkind things about it that, as an editor, we take pleasure in saying about the writings of others. This critical pleasure is not due to any inherent maliciousness in our nature, but probably to that very human characteristic of desiring to do unto others as they do unto you. Anyhow, we had our critical pencil all sharpened to a fine point.

Having read Tipper's sentiments on the problems of human relation in industry as expressed in our columns for the last two or three years, we had some idea of what to expect. We expected something very good. But we still had hopes of getting a chance to play the critic. We have been disappointed.

We are forced to state that "Human Factors in Industry" is a brief, forceful and interesting analysis of the factors underlying the human elements in industrial organization, and that it contains the clearest and most fundamental thinking that has been made public on this subject.

Before reading this volume many executives will not agree with all of Tipper's conclusions. The logic and clarity of the reasoning leading to those conclusions, however, as brought out in the book is certain to make converts—and is certain to be of practical value to automotive executives in handling the problems of industrial organization which are again becoming pressing.

Automotive production has swung rapidly upward during the last four months. Unemployment has materially decreased and a shortage of workers of certain kinds is already reported in important manufacturing centers. All the problems of labor and industrial relationships bid fair to become more or less acute again, after a year and a half of comparative quiescence.

Thus, the publication of "Human Factors in Industry" by Harry Tipper is opportune. The volume is being published by the Ronald Press Company of New York City.

To discuss adequately a book of this fundamental character in a brief review is difficult. The best the reviewer can do is to give some idea of the topics covered and the conclusions drawn, leaving to those interested the pleasant task of reading the full text for themselves.

Three ideas stand out prominently in this book:

1. The study of industrial relations must be approached from the standpoint of the individual—his development, his reaction to his work, the effect of education upon that reaction, the effect of mental and physical fatigue, his attitude toward management, etc.

2. There is greater need for decentralization in industry than for further centralization. As centralized control increases, the necessity for supervision increases, until at a certain point efficiency begins to decrease. Efficiency can best be developed, in the long run, through the development of the individual capacities of the various workers.

3. A better leadership is necessary. The employer in olden times was the master craftsman and held his position of leadership by reason of his constantly visible superiority as a workman. Modern industry does not tend to develop leaders. Workers are bound to have leaders, whether from their own ranks, from the labor unions or from employers. Leadership must be given and developed.

Building up his discussion of these points, Tipper treats the principles behind labor union growth in Great Britain and in America and points out the differences. He shows the effect of increased specialization upon our social organization and says that "the progress of the social organization must be made as a whole, if we are to continue its development without disaster. This separation of the home, the occupation, and the school, until they possess little or no visible connection with one another, has altered the whole aspect of industry. . . . The effect of this is seen in the constant struggle of different groups of the

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CONCERNING human relations in industry Harry Tipper says:

"It is not possible to provide more knowledge to the individual, increase his ambition and quicken his desires, and at the same time demand that he limit himself to work that is becoming more automatic in its character and less intelligent in its necessities."

"The expressed obligations representing the moral advancement of the social organization have become so separated from the industrial obligations that there is no co-operation between the two and the social rewards are not in any way related to the business morality."

"In principle there is no difference between the actions of the manufacturers' organizations upon labor matters and the actions of a trade union. The group of employers are concerned with maintaining as much control of labor as possible, while the group of workers are concerned with establishing their own objects as far as possible."

population to advance their position as a group, without respect to the difficulties such advancement may impose upon the whole structure, and therefore the limitations that may be put upon their own development. . . . At present there is no direct training in the necessary morals of industry, and the only moral training which exists has no visible connection with the industrial life."

Manufacturers' organizations are discussed very frankly and collective bargaining as related to the balance of power in industry is treated in detail. The failures of present group organization are pointed out and many of the typical experiments in industrial representation are critically examined.

"Incentive" and "Fatigue"

Two specially good chapters are those on "Incentives" and "Fatigue." In the former, the five factors of incentive are listed as follows:

1. The visible object of the work.
2. The importance of the visible object.
3. The opportunity for individual expression or skill.
4. The character of the surroundings.
5. The reward.

The relation of these factors to actual practice is discussed and methods of applying principles to production practice are laid out.

The chapter on "Industrial Relations' Departments" points out the possibilities and limitations of such departments and emphasizes the dangers of attempts to standardize methods and technique at the present time. It shows the necessity for a careful study of human problems by every executive who has any workers under his supervision.

Bonus schemes are discussed, as well as the open shop and the failure of both employers and labor unions to approach the human problem from a sound, constructive angle.

To those who have followed Harry Tipper's articles in AUTOMOTIVE INDUSTRIES, this volume will be a welcome summary, in logical and clear form, of the various ideas and ideals that have been expressed from time to time. The book is a complete, fundamental study of the human problem, however, and is in no sense a series of articles.

To those who are unfamiliar with the articles, the book will give a wealth of new ideas on this most important industrial problem.

Weston Pneumatic Cushion Wheel

A TRUCK wheel with a pneumatic cushion between the rim and the hub is being manufactured by the Weston Wheel Mfg. Co. The hub of the wheel is made in the form of a five armed spider. Its arms are forked at the outer ends to take linkages which bear on the inner surface of the double tube pneumatic cushion by means of driving pins and supporting rollers. The driving pins bear on what are called post plates which are in the form of cylindrical half shells riveted to the inside of the cushion cover, and the rollers bear on wear plates which are concentric with the wheel and are also riveted to the inside of the cover. All bearings of the linkage are provided with self-lubricating bushings. The inner tube and cover of the pneumatic cushion are made with five recesses on their inner side into which the post plates are fitted. It will readily be understood that the radial loads are taken up chiefly on the wear plates, while the tangential loads, both driving and braking, are taken up mainly on the post plates. The posts are made of nickel steel. Provision is also made for taking up lateral shocks on the wheels. The nickel steel posts surrounded by the post plates are forced into bosses on an inward flange of the rim which takes the felloe band. On the rear wheel there is a dust cover fastened to the rim which covers the whole wheel, including the hub. On the front wheel there is a similar cover, but the outer end of the front hub projects through this cover. From the cushion the drive is transmitted to the rim by friction, which is materially increased by casting the inner surface of the rim with five flats.

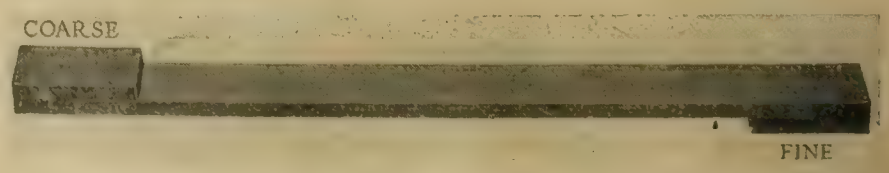


Weston pneumatic wheel

The object aimed at in the design of this wheel is, of course, to relieve the shocks to which a heavy truck wheel is subjected and which are very destructive. This includes both the road shocks and the driving and braking shocks. A maximum cushioning range of 1¾ in. is obtained which is very much greater than the slight cushioning range of the solid rubber tires. It is claimed that the life of the solid rubber tires is very greatly increased as a result of the reduction in shocks due to the cushion. A Weston rear wheel designed for a Packard 3½-ton truck weighs 860 lb.

Commutator Dressing Stone

A TOOL which is designed to make it unnecessary to remove an armature from the generator when it has become necessary to true up and smooth the commutator has been put out by the Martindale Electric Co. It consists of a handle with a block of artificial abrasive stone at each end, one block being coarse and the other fine. Each stone is said to grind at least ten commutators.



Imperial dressing stone for use on commutators

The abrasive is an insulating material; it is said not to be injurious to the mica and to be usable on commutators of machines of all voltages. The stones are made L-shaped, to permit their use at any angle. Ordinarily when a commutator becomes slightly rough it is trued up or smoothened with a piece of sand paper, but this will not cut down projecting strips of mica. The tool is known as the Imperial automobile commutator stone.

The Argentine Is Buying American Automotive Products

Excellent wheat and corn crops, together with large increases in wool and hide exports, have brought Argentina back into the buying market. Crisis in livestock industry passing. Nearly five hundred American cars were sold to this market in March. Financial condition fundamentally sound.

By M. T. Meadows

TO-DAY the products of the American automotive industry, especially of that section dedicated to the production of popular-priced passenger cars, find their way into every city, town and rural district of Argentina—merchants, manufacturers, professional men and the moneyed classes in the cities are no more desirous of owning a car than the prosperous farmers of the grain growing regions or the substantial cattle men on the grassy plains.

Prospects for cars are still to be found among the owners of vineyards and fruit orchards of Mendoza, the cane growers of Tucuman and Jujuy and the cotton planters of the Chaco. Lonely goat herders in the hills of Salta, like their colleagues who pasture millions of sheep on the wind-swept ranges of Chubut and Santa Cruz, look forward to the day when the bleakness of their surroundings will be lessened through good roads and automobiles. Mine owners in San Luis, San Juan and Catamarca too have their transportation problems which only motor cars and trucks can solve, while the lumbermen of Santiago del Estero and Misiones see in motor transportation a valuable ally. Yerba Mate interests, rice growers and tobacco planters in fertile sections of the country are also producers of wealth, a portion of which is spent on automotive products. Truck and dairy men, as well as those engaged in the poultry business, are not to be overlooked. In fact, there are but few lines of American manufactures which encounter more universal demand in Argentina than those turned out by makers of motor vehicles and their accessories.

Sales Depend on Exports

Given the universal demand for cars already created, the rate at which the Argentina market absorbs them logically depends, within the bounds of the present-day population, upon the purchasing power of the country. This purchasing power in turn is determined exclusively by the export demand for Argentina's foodstuffs and raw materials, as well as upon the prices these bring in the consuming markets of Europe and the United States. Consequently a clear conception of the present status and the future prospects of the local automotive market can only be gained when a full understanding is had of what is occurring in Argentine exports.

Since 1914 Argentina's capacity for production has expanded on a scale proportionate to that of the United States. Consequently the country was never in a better position to produce real economic wealth than to-day. Moreover, her production is limited to foodstuffs and raw materials, which constitute prime necessities. These may be, for determined reasons, a temporary drug on consuming markets, but such cannot be the case over a long period of time. It is reasonable to assume, therefore, that Argentina, holding as she does the largest exportable surpluses in her history, will continue the progress toward the recovery which set in during the closing months of 1921.

The list of Argentina's minor export items is a long one. Each of these naturally affect the purchasing power of those engaged in their production. But fully 80 per cent of Argentina's exports are limited to a few bulk commodities: Livestock industry—beef, mutton, pork, wool and hides; farm produce—wheat, corn and linseed. Prosperity or hard times are accurately shown when the movements of these are traced on Argentina's graph. With these commodities as a guide, let us examine the present state of general business conditions in Argentina:

Wheat Crop Portends Buying

The 1921-22 wheat crop has been good both in yield and quality. From January 1 to April 7 1,352,257 tons have been sold at remunerative prices against 579,820 tons for the same period of 1921. The exportable surplus now on hand is 2,880,896 tons. The prospects of disposing of the entire crop are promising and the market tendency is toward further strength. An increase of 10 per cent in prices has taken place since January 1. With the exception of the southern part of the province of Buenos Aires and certain districts of the Pampa Central, the wheat farmers are in good shape. They have purchased a large percentage of the cars sold since January 1, and it is upon them that the local dealers must depend for the bulk of sales during months to come.

Weather conditions throughout the growing season of the present corn crop have been exceptionally favorable. Corn exports in 1922, however, 464,364 tons, are barely in excess of those for the same period in 1921; namely, 420,530 tons. They are hardly one-half of what they were in 1920.

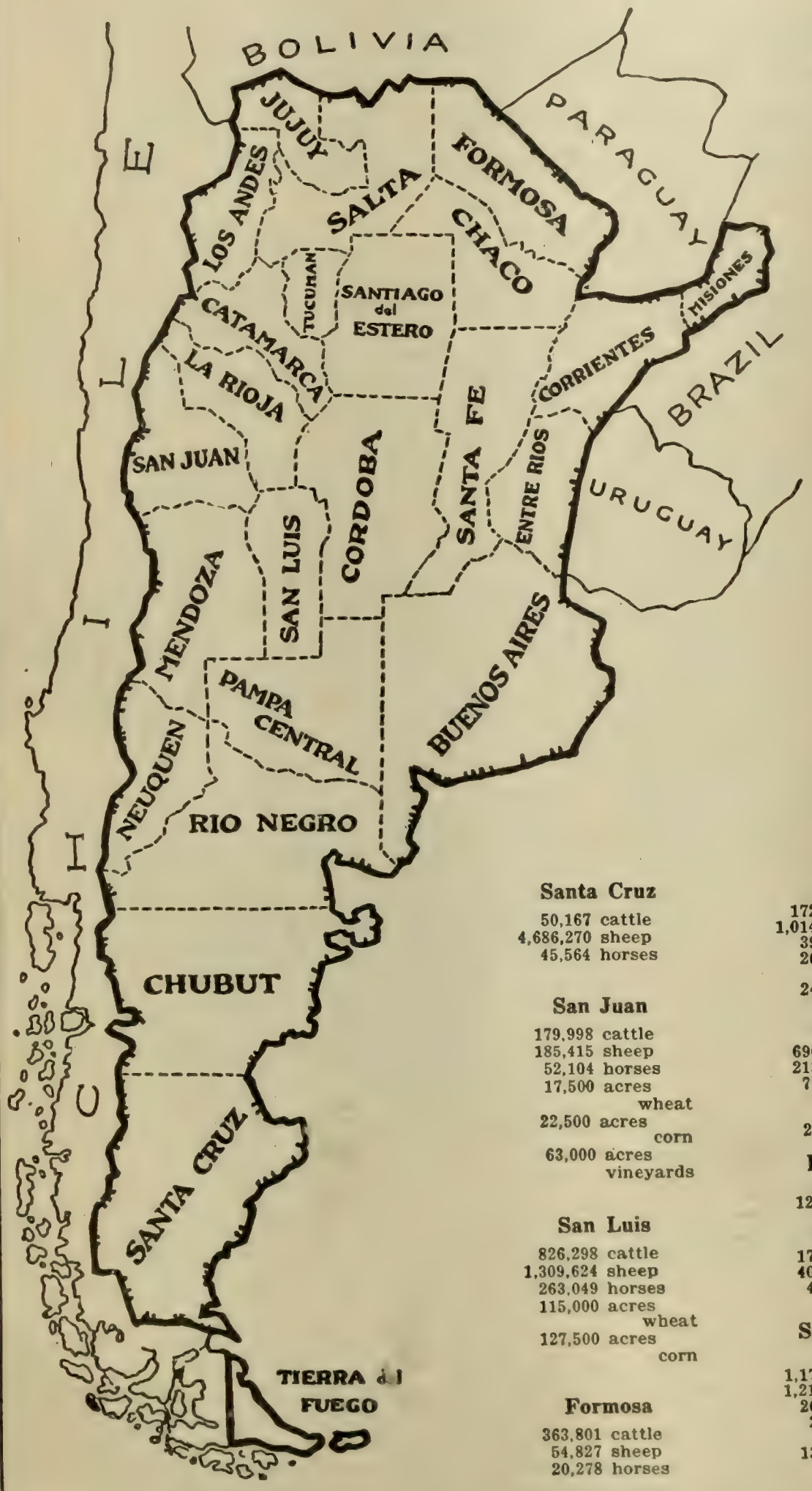
Prices are remunerative, and were it possible to market the 3,878,000 tons on hand—which is to be expected—farmers in the corn belt around Rosario should be in a position to purchase motors and supplies liberally.

Linseed exports this year have fallen below those of 1921—212,609 tons against 354,684 tons. It is believed that the demand for the stock on hand, 1,248,412 tons, will be slack and prices comparatively weak.

Broadly speaking, the Argentine grain trade is back to normal and is to-day the mainstay of the business life of the country. Farmers have bought the majority of

ARGENTINA

The Agricultural Wealth of Its Provinces



Buenos Aires
7,540,354 cattle
33,328,807 sheep
3,148,283 horses
5,382,250 acres wheat
4,555,000 acres corn

Catamarca
380,356 cattle
216,841 sheep
71,759 horses
43,750 acres corn

Chaco
637,417 cattle
22,003 horses
19,250 acres corn
5,750 acres sugar

Chubut
678,011 cattle
4,437,351 sheep
207,682 horses
12,500 acres wheat

Cordoba
2,109,286 cattle
2,909,935 sheep
1,248,601 horses
5,125,000 acres wheat
11,125,000 acres linseed
1,500,000 acres corn

Corrientes
5,706,971 cattle
5,345,311 sheep
746,172 horses
155,000 acres corn
28,125 acres tobacco

Entre Rios
2,508,501 cattle
6,731,455 sheep
798,899 horses
826,500 acres wheat
1,008,500 acres linseed

Neuquen
276,390 cattle
858,432 sheep
131,086 horses
17,500 acres wheat

Pampa Central
272,390 cattle
6,464,514 sheep
360,451 horses
2,257,500 acres wheat

Rio Negro
351,920 cattle
6,809,795 sheep
228,418 horses
16,250 acres wheat

Salta
851,788 cattle
592,873 sheep
122,805 horses
120,000 acres corn

Santa Cruz
50,167 cattle
4,686,270 sheep
45,564 horses

San Juan
179,998 cattle
185,415 sheep
52,104 horses
17,500 acres wheat
22,500 acres corn
63,000 acres vineyards

San Luis
826,298 cattle
1,309,624 sheep
263,049 horses
115,000 acres wheat
127,500 acres corn

Formosa
363,801 cattle
54,827 sheep
20,278 horses

Jujuy
172,199 cattle
1,014,948 sheep
39,177 horses
26,250 acres corn
24,500 acres sugar

La Rioja
696,939 cattle
213,671 sheep
77,311 horses
8,750 acres wheat
21,875 acres corn

Los Andes
3,000 cattle
127,000 sheep

Missiones
175,016 cattle
405,183 horses
41,250 acres corn

Santiago del Estero
1,173,987 cattle
1,210,891 sheep
261,210 horses
25,000 acres wheat
132,500 acres corn

Santa Fe
4,699,150 cattle
1,676,524 sheep
1,140,253 horses
2,593,100 acres wheat
3,125,000 acres corn
1,391,250 acres linseed

Tierra del Fuego
18,376 cattle
2,100,667 sheep
12,771 horses

Mendoza
358,024 cattle
859,526 sheep
164,961 horses
40,000 acres corn
138,500 acres vineyards

Tucuman
766,088 cattle
240,003 sheep
156,870 horses
102,500 acres corn
227,500 acres sugar

cars sold during the past spring and summer selling season, and they must be depended upon to absorb a big percentage of the comparatively heavy importation of cars now under way.

The livestock industry of Argentina is writhing under the severest blow received during a lifetime. The decline in prices from inflated levels has not only been spectacular but unprecedented in the history of the republic. The general run of cattle, when a demand can be found, is sold at from 5 to 15 per cent of their value a year and a half ago. These, however, are nominal prices, for the supply is far in excess of the demand. Breeders in sections far removed from consuming centers find that the market value of their stock will not pay cost of transportation and many renters face bankruptcy, since the sale of their cattle holdings will not pay a year's rental. Those who during 1920 were owners of thousands of heads and who placed a small mortgage on their stock to expand their business cannot now pay off a $10,000 mortgage which was placed a year ago on stock worth $100,000, even though they sell every animal they have. Under such circumstances it is exceedingly difficult to sell automobiles to cattle men, who make up normally the largest body of buyers in the republic. It is true that some of these during the prosperous times of war-inflated prices made provisions against hard times. However, in Argentina as in other countries, business foresight is not a gift of the many but the rare possession of the few. Consequently the cattle people with cash reserves are the exception rather than the rule.

Time Payments Not Favored

Some importers, in order to stimulate sales, are offering cars on time. This policy is not productive of real results, for so large a portion of the present-day tribulations of Argentine cattle men may be ascribed directly to the alacrity with which they assumed credit obligations heretofore that there is little inclination to take advantage of credit terms. The lack of confidence in the ability of the cattle business to "come back" in the near future is also responsible for the wariness of ranchers in parting with their hoarded cash reserves or assuming any new obligations.

Fortunately in this crisis the cattle interests of the country are finding in the "Banco de la Nacion Argentina" their friend in need. Long time loans are being granted at a low rate of interest and small amortizations. Great leniency is shown in renewals and foreclosures of cattle mortgages are postponed to the very limits of prudence. All manner of artificial remedies have been proposed for righting the situation, but none of these have proved worthy of serious consideration. The recently established Livestock Exchange (Bolsa de Cotizacion de Productos Ganaderos) for regulating prices and trade in livestock and the products derived therefrom is, however, a direct result of the present crisis whose influence for good should be lasting. The National Government is also bending every effort toward finding new markets for Argentine meats, and to this end diplomatic and consular representatives abroad have been authorized to offer loans to foreign governments who are desirous of purchasing Argentine produce.

As matters stand to-day the only hindrance to "business as usual" is this livestock crisis. Once this has disappeared, a lasting reaction will set in and progress will be steady. Little signs of improvement in the meat trade are in sight at present, but it is logical to suppose that Argentine livestock prices will eventually reach the level of intrinsic value which will permit the producer to earn a legitimate margin of profit.

Wool exports during the first quarter of 1922 have been almost double those for the same period of 1921. The enormous surplus held here is gradually being liquidated and the conditions of the market as regards demand and prices are normal. Wool sales, together with grains, have largely been responsible for the rise in the value of the Argentine peso, which has so favorably affected the importation of American cars during the past three months.

The exportation of hides and skins has shown a large increase as compared with last year. The demand is active and prices, which are firm to-day, have a tendency to further strength.

Sound Business During 1922

American manufacturers of automotive products, without indulging in undue optimism, can, however, look forward to a reasonable volume of business during 1922. The financial condition of the country is fundamentally sound. The purchasing power of the people, although temporarily crippled, is not permanently impaired. The steady rise of the peso in its comparative value with the American dollar indicates a healthy reaction in the country's economy. Bankruptcy figures, except where in a given month the failure of one or two large houses run these up, continue to decline.

The agitation attendant upon national elections is now over, and while the definite results are not yet known, there seems to be no doubt as to the final outcome. In the event that the popular conviction is confirmed by Dr. Alvear's election, the country is assured a progressive administration for the coming six years. Argentina has learned much of economy since the middle of 1920; hard work is the order of the day. Unemployment is decreasing and, in fact, has never constituted a real problem here. Money is relatively abundant and interest rates are declining. The gold guarantee for paper currency continues well above 80 per cent. Progress, though slow, is on a sound basis. Once the upward swing gets well under way, Argentina should see a period of development and trade expansion such as she has never experienced. American manufacturers of automotive products can look forward to the growth of their Argentine business with greater confidence than perhaps any other group in the United States.

Popular Priced Cars in Demand

During March 301 American automobiles, 3 chassis and 3 trucks entered the country. Ford cars are not included in the above figures. The local Ford plant assembled and sold an average of 61 cars daily during the month. This constitutes a monthly record and is largely to be explained by the present-day demand for popular priced cars in opposition to more expensive models. During the month 42 European cars, 28 chassis and 8 trucks were imported. The higher percentage of European chassis imported is explained by the local demand for these with custom built bodies. The trucks mentioned were of German origin and were sold due to their low cost in comparison with American trucks. In March, 1921, only 64 American cars arrived here against 22 European. Argentina took 216 cases of automobile accessories during March, 1922.

COMMERCIAL Attaché Arnold reports from Shanghai to the Bureau of Foreign and Domestic Commerce that motor car and tire dealers of China are showing a tendency to standardize on American sizes of tires, and that practically every dealer is instructing his manufacturers to equip any cars shipped to China with American sizes of tires.



Chassis Lubrication

Editor, AUTOMOTIVE INDUSTRIES:

Answering Mr. Frier's letter commenting on your synopsis of Cornelius T. Myers' S. A. E. paper on the subject of "Chassis Lubrication," which was published in AUTOMOTIVE INDUSTRIES for Dec. 1, 1921, I believe the paper itself covers the automatic application of oil in a fairly comprehensive manner.

I cannot agree with Mr. Frier that, as between oil and grease for chassis lubrication, it is a question of "which of the two has given the best results *in the past*" (italics are mine). On that record grease stands under a serious indictment. Neither do the remarks of Mr. Battle (quoted in the letter as advocating a heavy bodied lubricant for heavily loaded bearings at rest) tally with automobile experience. Mr. A. Ludlow Clayden, among others, is authority for the statement that the thinned engine oil, which is ordinarily thrown away when drained from a crank-case, makes an excellent chassis lubricant, and that he has personally used it for years back with very satisfactory results.

As to the unsightly oil cup, I agree with Mr. Frier. It is almost as bad as the grease cup; but I cannot agree that pressure grease fittings embody a satisfactory answer to the chassis lubricating problem. Experience with such fittings has demonstrated that they are far from foolproof for several reasons:

1. They are easily broken off.
2. The dust caps are easily damaged and often lost. Dirt then enters with every new application of grease; and water from the washing hose can also enter.
3. Many of the fittings are in positions awkward to reach and are overlooked.
4. They are not automatic in feeding action.
5. They call for daily attention at many points, and there are few points that should not be fed at least twice a week, if thorough lubrication is to be afforded.

Millions of owners daily demonstrate that they will not be bothered with this attention to chassis lubrication. They will pay a repair bill at the end of a year or so, and this bill is less than what their time is worth. They are far from pleased to pay the bill, however, but it is the less of two evils.

It is not surprising that pressure grease fittings have been widely used. A great deal of money has been spent in pushing their sale, and they are much better than the archaic grease cups. They are comparatively cheap to install and do not call for much change in chassis design. By an extensive advertising campaign the user has been misled into thinking that if grease exudes from a bearing, that bearing is properly lubricated. The user sometimes thinks, too, that the pressure method of grease application is really cleanly and that he will use it regularly. Experience shows that he must still "get out and get under," and when the novelty of the new method wears off he neglects it as much as he neglected the grease cups. Then, too, if he misplaces the grease gun, or damages the flexible connection, he more often than not lets it go until a bearing squeaks or binds and the initial damage has been done.

The answer to the chassis lubricating problem is magazine lubrication, automatically filtered and fed. This means the addition of integral oil pockets to chassis brackets. Fifteen minutes once in 2 or 3 months, 1½ hrs. per year per car will assure thorough lubrication. It will save from $75,000,000 to $150,000,000 per year in repair bills. It will eliminate squeaks and keep springs soft. It will relieve an owner from all anxiety and trouble, because the garageman who puts oil in his engine will oil his chassis at the same time and in the same way—quickly from a spout can.

B. DARRACH, JR.

Percentages

Editor, AUTOMOTIVE INDUSTRIES:

In your editorial column, March 30, under the heading "Percentage," I think you will find you have made an erroneous statement in regard to the percentage of profit or loss on sales. Profit or loss on the sale of goods should always be figured, using the **cost** price as a base, never the selling price. I think you will admit that it is possible to make 100 per cent profit on a sale will you not? Also you will admit that it is impossible to lose more than 100 per cent.

If you double your money you make a profit of 100 per cent, and if you lose your goods or give them away you lose 100 per cent. If you figure the way you state in the editorial, what price would you sell the 80-cent article for to make a profit of 100 per cent?

CHAS. A. SMITH.

Our correspondent is correct. The percentage of profit should be calculated on the basis of cost and not of sale price.—Editor.

Stratified Charge Engines

Editor, AUTOMOTIVE INDUSTRIES:

After reading Mr. Ricardo's paper in the Jan. 19, 1922, issue of AUTOMOTIVE INDUSTRIES, I have watched "The Forum" for comment. Ricardo says "That the highest thermal efficiency is always obtained with an excess of air, about 15 per cent," and "I have always believed that the benefits of working with a weak mixture could be realized by the employment of stratification." Ricardo got a relative efficiency of 64 per cent at a compression ratio of 4 to 1. He got it using a 10 per cent volume of correct mixture and 90 per cent volume of air. The writer cited the above volumes in *The Automobile*, June, 1916, and in *Engineering* (London), June 3, 1921. I recently received a letter from a scientific investigator who says, "After reading your patent I was struck by the fact that Ricardo's recent paper in the *Automobile Engineer* (June, 1921) is largely a corroboration of the results you hope to obtain in your engine," reference being made to the value of stratification and the use of excess air as against a homogeneous mixture.

Now we read of doped fuel, the use of iodine, xylidine and other compounds to stop detonation and make possible the use of higher compressions. Assume that it is possible to increase the efficiency 50 per cent, due to some

dope or compound. This means that the usual grades of gasoline are useless without it, or the engine is. Exhaust gases have been used and air is always available. If an excess of 15 per cent of air is always necessary to obtain the highest thermal efficiency, does it seem logical to use it?

If Ricardo can obtain a relative efficiency of 64 per cent with a 10 per cent volume of correct mixture, using a 4 to 1 ratio and 69 per cent with a 7 to 1 ratio, then it does seem that there is some virtue in stratification.

In view of the above, why advocate dope to improve an engine that operates on a homogeneous mixture when the dope suggested is not always available and when, if it is not available, the engine is useless, unless it is fitted with a device to regulate the compression?

What is the solution? I suggest (1) an engine that uses 15 per cent excess air at the power output required to propel the usual car on high gear and (2) an engine that operates at its highest efficiency at all times, due to gear changes instead of 6 to 60 miles on high and with the result that a 20 per cent efficiency on full throttle drops to 5 per cent on one-third throttle, all due to an obsolete throttle acting on the compression and a carbureter made to deliver a larger fuel ratio when a larger volume of air at constant or higher compression can be used. JAMES MCINTOSH.

Proportion of Unsprung to Total Weight

Editor, AUTOMOTIVE INDUSTRIES:

I should be thankful to know what you consider to be a fair percentage of unsprung weight of the total weight, front and back, of a loaded car and truck. R. A. P.

Some years ago we collected data on the weights of the different components of passenger cars and trucks and averaged them on a percentage basis. This gives us a means of determining the proportion of unsprung to total weight in actual cars. The data upon which these figures were based covered a majority of the cars and trucks on the American market at the time, about five years ago. In determining the proportion of unsprung weight we have assumed that two-thirds of the spring weight is unsprung and one-third sprung, which is about correct for the half-elliptic springs with which most of the cars were equipped.

For passenger cars the front axle unsprung weight figures out to 7.75 per cent of the total weight of the car with fuel, oil and water, and the rear axle unsprung weight to 15.8 per cent. At the time these figures were collected the weights on the front and rear axles, respectively, were not obtained. We have available, however, the weights on the front and rear axles for 15 different passenger cars. The proportion on the front axle varies between 45 and 49.5 per cent, the average being 46.8 per cent, leaving 53.2 per cent for the rear axle. On the basis of the total weight on each axle, the front axle unsprung weight, therefore, is 16.5 per cent and the rear axle unsprung weight 29.7 per cent.

In the case of trucks the weight distribution varies considerably with the load capacity. For instance, in the investigation referred to it was found that in a 1-ton truck the rear wheels weigh 11.43 per cent of the whole truck, while in a 5-ton truck they weigh 20 per cent. In the smaller trucks the proportional weights of the components approach the corresponding figures for passenger cars. We have, therefore, taken the case of the 5-ton truck. The average front axle unsprung weight is 14.20 per cent of the weight of the complete truck chassis, and the average rear axle unsprung weight is 34.87 per cent. The data with respect to weights on front and rear axles of 5-ton truck chassis is somewhat meager, but we have those figures for two such trucks. In one case the proportion of the weight on the rear axle is 58.3 per cent and in the other 59.4 per cent, so we may assume 59 per cent to be a practical average. This gives for the proportion of unsprung weight 34.7 per cent and for the rear axle, 59 per cent.

These figures apply to the chassis only and those given for the passenger car to the car without passengers. You ask for the proportions for the loaded car and truck. These figures may be derived from the above.

Let us take the case of a five-passenger car weighing 3000 lb., of which, according to the figures given above, 1400 lb. would be on the front axle and 1600 lb. on the rear axle. Of the passenger weight four-fifths may be assumed to be on the rear axle, say 600 lb., making the total weight on the rear axle 2200 lb. and that on the front axle 1550 lb. The front axle unsprung weight is then 15 per cent and the rear axle unsprung weight 21.5 per cent. As these figures are based on the weight distribution of 15 actual cars, they may be regarded as representing a consensus of opinion of passenger car designers what the proportion of sprung to unsprung weight should be, considering the limitations imposed by requirements of strength, manufacturing cost, etc.

In the case of the truck the load plays a much more important factor, and the proportion of unsprung weight for each axle depends to a considerable extent upon the division of the load between the front and rear axles. The average American 5-ton truck chassis weighs about 8000 lb., which, according to the proportions given above, gives 3280 lb. for the front axle and 4720 lb. for the rear axle. The body allowance for such a truck is 1800 lb. and the load is 10,000 lb., making together 11,800 lb. Of the weight of body and load one-eighth may be considered to come on the front axle and seven-eighths on the rear axle. This makes the total weight on the front axle 4755 lb. and for the rear axle 15,045 lb. As the unsprung weight in this case would be 1135 lb. for the front axle and 2790 lb. for the rear axle, the front axle unsprung weight is 23.9 per cent of the total weight on the front axle, and the rear axle unsprung weight, 18.5 per cent.

The results obtained are summarized in the following:

PROPORTIONS OF UNSPRUNG WEIGHT, LOADED

	Front Axle	Rear Axle
Passenger car	15.0%	21.5%
5-ton truck	23.9%	18.5%

—Editor.

Petroleum Production

INTERESTING figures regarding petroleum production have just been published by the American Petroleum Institute. These figures, which deal with the production of crude petroleum for the years 1920 and 1921, are listed below and for the sake of comparison the figures for our own domestic production have been added:

United States	1921	470 million barrels
United States	1920	443 million barrels
France	1921	392,360 barrels
France	1920	388,700 barrels
From the Basin of Pechelbronn, Alsace.		
Algeria	1921	3,205 barrels
	1920	3,916 barrels
Trinidad	1921	2,354,159 barrels
	1920	2,083,027 barrels
India	1921	6,864,000 barrels
	1920	6,336,000 barrels
Egypt	1921	1,181,477 barrels
	1920	1,042,000 barrels
Canada	1921	173,893 barrels
	1920	196,937 barrels
Provinces of Ontario and New Brunswick.		
Japan	1921	2,438,960 barrels
	1920	2,376,991 barrels
Including Formosa.		

Coal Strike Shows Need for Labor Investigations

When conditions are such as to induce men to stay away from work although starvation faces them, the necessity for some careful analysis is evident. Basic nature of coal industry makes serious its inability to solve problems. Manufacturers should consider conditions in coal industry.

By Harry Tipper

THE attitude of business toward the coal strike well illustrates its general position as regards labor unrest. Although this strike has greatly limited the production of coal for a number of weeks, no important discussion of a public character has occurred, and in very few instances has there been any attempt to investigate the conditions in the coal mining industry of which the strike is partly the result. Both sides of the conflict seem to be equally determined to stand out to the last regardless of the ultimate cost of the proposition or its future effect.

Whether the demands of the labor leaders are unreasonable or not, the conditions which will induce a large body of workers to separate themselves from their work to the point where starvation begins are susceptible to some analysis and some careful consideration. The coal mining business, along with the mining of the metals, is fundamental and the stability of its operations is of great importance to all industry.

So long as the differences between the employer and the worker are bitter and their disputes acute, business cannot reach the stability required for the proper progress, and the other processes of industry are dependent upon a fundamental business that is in itself inefficient and unstable. So long as there is coal in the coal pile and the season for the domestic use of coal has gone by, it is not likely that the general consumer will pay much attention to the matter, but it is somewhat surprising to find other industrial owners so completely indifferent to the progress of the matter or the conditions out of which it arose.

Strikes are symptoms of a troublesome state of affairs in the industrial relations of any organization or industry. This trouble cannot be charged to the labor leader entirely, because the worker is not sufficiently anxious to rob himself of his work without previous reasons of a strong character. All men of observation who have investigated the actions of the workers carefully have found the economic fear of starvation to be one of the most impelling motives in keeping the worker at his job. This fear will keep the difficulties from becoming acute unless they accumulate so that they are amplified and enlarged in the minds of the workers to the point of irritation. Labor discipline is strong in well organized unions. It is strong because the workers find it necessary to have that strong discipline in order to accomplish their purpose. Where there are no grievances, or these grievances are not important, the discipline of the union suffers and workers will not hesitate to stay at work or disregard their leaders if they do not feel that the circumstances warrant the action.

It is unfortunate that the coal industry, because of its basic importance, should be disrupted with such bitter disagreements, and it is a charge against the management in the industry that the labor union should have acquired so strong a hold and that the workers have been forced to such desperate means in the endeavor to support their position.

Some of the publications, in commenting upon this coal strike, have complimented the people of the United States, particularly other industries, on their refusal to become interested in the strike situation. This is only making the matter worse. The effort of every intelligent business man has been at all times to insure the stability of his supply of raw materials and power. Most of the industries of the country are dependent upon the supply of coal for their power and are completely at the mercy of the coal industry for their own profitable continuance.

The principal difficulties in the coal industry for a long time have been those difficulties arising out of the human side of the industry, out of the deficiency of the management from a human standpoint and the acute grievances of the workers, whether real or imaginary. The whole business has been uncertain in many of its conditions for many years, and there is no doubt that the lack of decent agreement between the workers and the owners has affected the cost of producing coal and the profits to be secured from that production.

Activity in business is just reaching an almost normal condition and the prospects are very much brighter than they have been for eighteen months or two years. Unless the difficulty in the coal field is removed, production in business will be delayed by the difficulties in this basic industry. Even if the strike peters out, it will have deferred the difficulty only. It will not have solved the trouble nor will it have put the coal industry on any more stable basis than it has been in the past. It is not likely that the strike will be successful, but it is not likely, on the other hand, that the maximum production in the coal field will be secured for a considerable time.

Furthermore, the difficulties of providing continuous employment, of distributing the product without excessive cost, etc., have not been met and the profits from the industry have not been stabilized. The workers may be wrong in their attitude, their demands may be excessive, but a strike of this intensity does not arise without original

grievance and irritation. In some of the coal mining fields these grievances have been sufficiently bitter to bring about more or less continual warfare between the workers and the representatives of the management.

Strikes which have occurred in other industries within the past few years have been developed strongly and pursued with obstinacy on both sides, but very few of them have been operated with such intensity of difference and bitterness between the parties concerned characterizing this strike. So long as basic industries of this kind remain unstable because of the character of the human organization and the differences arising between workers and management, the very fundamentals of the industrial system are in such a position that the manufacturer cannot depend upon the stability of his source of major supplies. Regardless of his belief, every manufacturer is deeply interested in the difficulties in the coal business, and that interest should be toward a definite consideration of its conditions.

Worm Variable Reduction Gear for Single Unit Electric Sets

A RATHER novel reduction gear for combined generators and starters is described in a recent issue of *Engineering*. It was invented by E. C. Hatcher and is being developed by the H.-R. Reduction Gear Syndicate. The gearing, which consists entirely of worms and worm wheels, transmits the power direct when the dynamo machine is acting as a generator, whereas it passes through three pairs of worms and worm wheels when the machine acts as a starter. An advantage of the mechanism is that it does away with the necessity for the usual large gear ring on the flywheel, but it would seem that the transmission of the starting power through three successive worm and wheel combinations would entail a considerable loss of power.

The principle of the gear is illustrated diagrammatically in Fig. 1. The driving shaft is direct-connected to the motor generator. The worm *C* is not fixed to the driving shaft, but slides on a key thereon, its movement being limited to a range of about ¼ in. by a collar on the driving shaft on the side of the worm *C* remote from the driven shaft. On the face of the worm *C* nearest the driven shaft dog clutch teeth are formed. Similar co-acting teeth are provided on the adjacent end of the driven shaft, which for this purpose is enlarged and bored out to accommodate loosely the end of the driving shaft. To start the car, energy is supplied to the motor generator, the power being transmitted through the gearing at a slow speed to the driven shaft and thence to the engine. While the motor is thus driving the engine the thrust on the worm *C* is such as to move and hold the worm against the collar on the driving shaft. When, however, the engine picks up its speed the worm wheel *F* tends to overrun the worm *C*, the direction of the thrust on the latter is reversed, and it slides forward on its key until the clutch teeth come into engagement. The motor generator thus becomes directly coupled to the engine, and instead of driving it is driven by it. It therefore changes its function to that of a generator and charges the lighting batteries. In order that this arrangement may be made effective it is necessary to mount the shafts *A B* and their worms and wheels in a frame that is free to rotate in one direction inside the casing inclosing the whole gear and prevented from rotating in the opposite direction. To this end, when the motor is driving the engine, the frame is prevented from turning in the direction opposite to that in which the motor armature rotates by means of six friction balls lying against cam faces inside the casing and nipping against a plain cylindrical surface on the frame. When the engine is driving the generator directly, the balls moving on the cam faces release their grip on the frame and allow it and the shafts *A B*, etc., to rotate at the same speed and in the same direction as the coupled driving and driven shafts. It is to be added that the cam faces are formed on the inner circumference of a ring held within the casing by two spring plungers. Should the engine backfire during the starting period the plungers allow the ring to slip and thus damage to the ring, balls or frame is avoided. It may also be noted that an additional shaft connected through worm gearing to the driven shaft is provided. This shaft is intended for driving the magneto or speedometer. Fig. 2 illustrates the general arrangement of the gearing portion.

The application of the system to motor car lighting and starting as described above represents the original object for which the gearing was invented. It was, however, soon appreciated that the field for its employment could be greatly extended, and a four-speed and reverse transmission gear on the same principle has been designed.

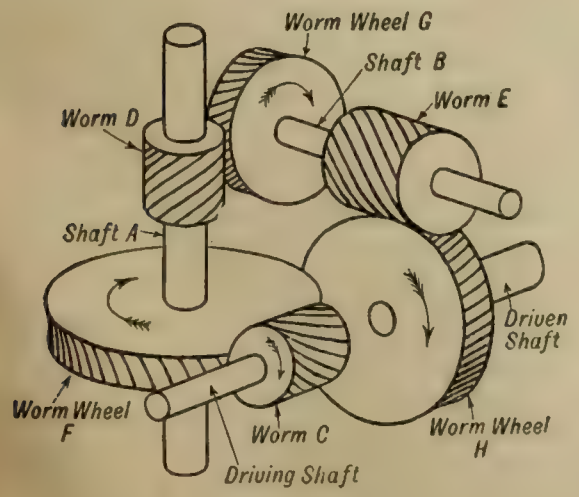


Fig. 1—Diagram of H-R reduction gear

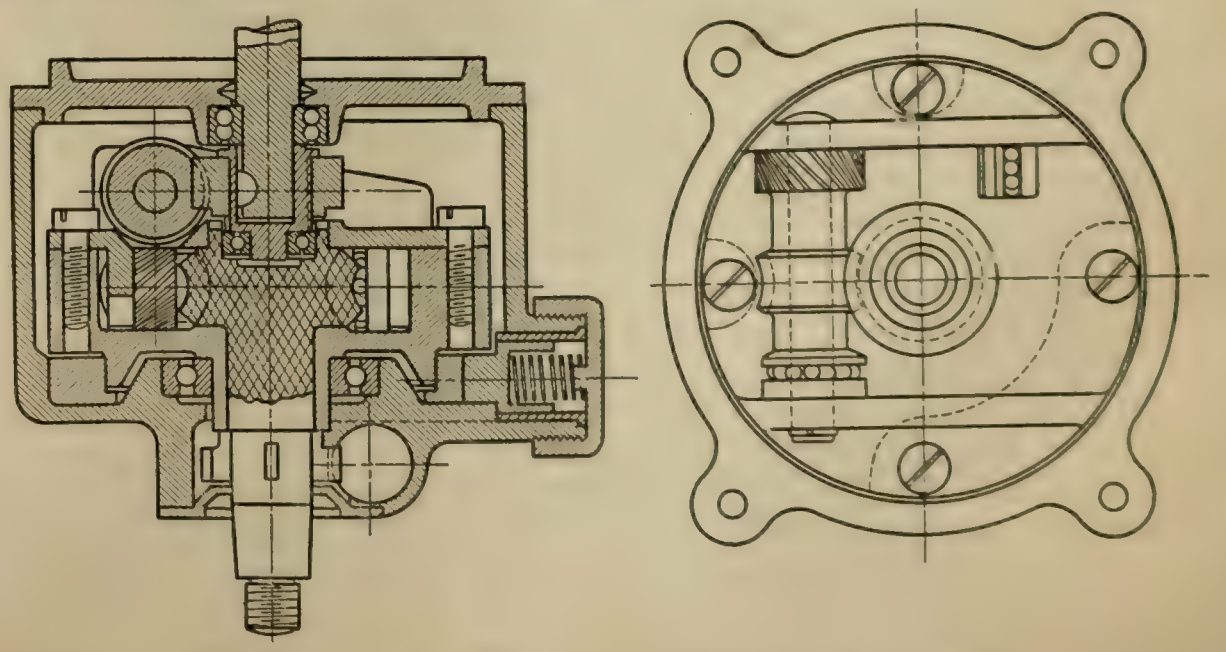


Fig. 2—Gear designed for combined generators and starters

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Capitalizing Crime

TAKING as their precedent the repressive methods of the wild and wooly West in dealing with horse thieves, an organization of municipal lawyers have undertaken the seemingly impossible task of writing a compulsory registration law for automobile owners. This bill was introduced in the House by Congressman Ogden Mills of New York, at the request of several district attorneys. Nobody questions the claims of the sponsors that the bill would lessen the number of automobile thefts in this country. Yet the evils which would multiply from the enactment of this measure overshadow the possible compensating advantages. The innumerable irritations which would arise from the enforcement of this proposal would increase the sales resistance for automotive products because the average citizen has little use for the red tape of governmental regulations.

Witnesses testified before the House Committee of the Ways and Means Committee recently that there would be difficulties for manufacturers, who would be obliged to obtain Federal numbers for their products.

The Mills Bill proposes to assess a registration fee of $2 on all motor vehicles. It would be necessary to have number plates on the car and engine. As an illustration of the wrath-provoking tendencies of the bill, an owner of a car would be subject to arrest in event a garage man or dealer had loaned an engine during a period of repairs. If the number on the borrowed motor did not correspond with the chassis number, the operator of the car would be arrested and fined.

It is easy to imagine the wholesale arrests which would follow the enforcement of the Mills Bill. Thefts of motor vehicles can be prevented whenever we have judges and juries who will enforce the law as it now exists on the statute books. The claim of the sponsors for a precedent in the branding of horses is indefensible, as Congressman Garner of Texas emphasized when he declared that thefts of horses were stopped in Texas by the liberal application of the Judge Lynch formula—the noose.

Full Length vs. Stub Gear Teeth

THE stub tooth, which has been extensively used in automobile transmissions during the past fifteen years, was evolved to meet the requirement of increased strength. A gear tooth is generally considered as a cantilever beam loaded at the end, and it is therefore obvious that the strength of the tooth increases with increasing root thickness and as the height of the tooth decreases. To increase the root thickness, the pressure angle was increased from the 14½ deg. common in industrial gearing, to 20 deg.; and in order to decrease the tooth height, the working depth for any particular pitch was made the same as the standard working depth for a pitch one or two numbers higher. This gave such pitches as 4-5, 5-7, 6-8, etc., in which the first figure is an inverse measure of the pitch, and the second a measure of all radial dimensions of tooth elements.

In this way the strength of the teeth was materially increased, and one of the results has been a reduction in the size of automobile transmissions. It was at first urged as an objection to the 20 deg. pressure angle that it increased the pressure tending to force the two shafts connected by the gears apart, but since it was shown that this radial pressure is only a small fraction of the total load on the bearings, this argument is seldom heard.

To-day the chief demand in transmission gears is not for increased strength but for more silent operation, and the stub tooth is being given up for the full length 20 deg. pressure angle tooth. The net result of this change is that a greater number of teeth are in contact simultaneously and the contact area, therefore, is greater. That the full length tooth is more nearly quiet in operation than the stub form or foreshortened tooth, has been proven to their own satisfaction by various manufacturers, and the explanation is undoubtedly the greater amount of tooth contact surface and the consequent more effective action of the oil cushion.

Building Motor Transport Progress

BOTH the motor bus and the motor truck have an economic place in our transportation system. Since the commercial and engineering development of these units has been comparatively recent, however, the exact scope of their activities has not been accurately defined. Considering the youth of these new transportation mediums, there is nothing startling in the fact that each of them is groping to a certain extent at the present time to determine the methods and conditions under which it can operate most efficiently and how it can co-ordinate with existing transportation facilities.

In the long run, the bus and the truck will handle just as large a part of our transportation as can be justified on the basis of economy and efficiency. This outcome is certain. Just what proportion this part will be cannot be determined with any degree of accuracy on the basis of the data available at present. Research studies and practical experience are combining, however, to define the scope and function of these motor transport units, and progress is being made.

In the meantime there is a natural tendency on the part of existing transportation organizations to fear the competition of the truck and the bus and to attempt to arrest that progress through the erection of artificial barriers to normal economic progress. Such a tendency is natural. The necessity for profits on investments already made constitute the basis for consideration on the part of existing transportation agencies rather than a pure consideration of the economic transportation needs of the community.

The public at large is primarily interested, of course, in getting the best transportation at the lowest cost. It will not permit the permanent exclusion or hindrance of any transportation unit which will help achieve that goal. The fundamental power of economic law will finally be the determining factor.

But the artificial barriers set up in the meantime will have the effect of lengthening the time necessary for these economic laws to begin to function freely. Individual difficulties will probably continue to arise in various parts of the country for some years to come. The difficulties are and will be largely local in character and can best be met by local bodies in specific cases.

It is just as natural that there should be opposition to bus and motor truck development as it was that there should have been opposition on the part of stage coach lines to the development of railroads, and opposition on the part of organized labor to the introduction of machinery in manufacturing processes. The natural opposition of the older order to the development of the new builds up certain artificial obstacles in the path of the latter which, while they may be only temporarily effective, do have a decidedly retarding influence and should be offset to the greatest possible degree.

Every manufacturer of buses must expect to meet opposition from certain sources, which can be easily anticipated, and every dealer selling buses must be prepared to meet the natural opposition which will eventually arise when these buses are put into service.

Destructive opposition to truck and bus transportation can best be met in general by constructive education. As more knowledge is gained as to the true function of motor transport, its advocates will be better able to point out specifically how existing transportation agencies can be supplemented and helped by the bus and by the truck. In many instances, existing agencies will be greatly benefited by the coming of motor transport as a feeder.

In some places the bus will replace the electric railway eventually, regardless of artificial barriers, and time and money is simply lost in the erection of such barriers. In still other cases, the electric railway will be found to be the most efficient transportation unit and the bus will not be suitable. Frequently a correlation of both units will be found to be the most practicable.

The possibilities of mutually beneficial co-operation between the truck and the railroads are even more obvious. Studies have already been made showing that the railroads do not profit from the transportation of certain types of freight over short distances and that the truck is a better unit in these cases. The profit potentialities of store-door delivery, if organized by the railroads, appear to be good.

The advantages of co-operation and correlation have already been recognized by many electric railway and railroad interests and considerable impetus is being given to truck and bus development through that recognition. The growth of this broad-gage attitude is practically assured, although too rapid progress cannot be expected. Automotive interests can best serve their own ends, as well as those of the public, by playing a constructive, rather than belligerent, part in the development of the truck and bus as transportation units.

Dealer Reports Show No Let Up in Sales

Impression Gains Ground That Some Plants Will Be at Capacity All Year

By JAMES DALTON

NEW YORK, May 16—Reports from dealers in all parts of the country show that no sign of slackening in the demand for motor vehicles is apparent. Producers are exerting every effort to turn out this month more cars and trucks than were made in April. In most cases output will be circumscribed only by plant facilities. Total production for May is almost certain to exceed the high mark set last month.

While it still seems likely that there will be a decline of sales in the third quarter, the impression is gaining ground that some companies will find business so good they will be able to operate their factories practically at capacity the entire year. Each manufacturer hopes he will be able to keep in this class.

General Motors Corp. expects the third quarter to be better than the second in the sale of its three most popular lines. Henry Ford finds the outlook so encouraging that he has abandoned certain plans he had in mind early in the year for using surplus factory space. He has no surplus space now and there are no indications that any will be available this year.

Foreign Demand Increasing

One striking feature in connection with the extraordinary sales of motor vehicles in this country has been the almost simultaneous increase in foreign demand. Ford's foreign assembling plants are establishing new records and General Motors reports large gains in sales, especially in Great Britain. Demand also is much better in Brazil, Argentina, Spain, Denmark, France and other countries.

Output of closed passenger cars still is handicapped by a body shortage although body makers are resorting to all kinds of expedients to enlarge their production. One of their serious difficulties is the shortage of skilled labor. Another influx of workers is under way at Detroit although there is plenty of unskilled help.

Cars of the closed body type are in greater demand this year than ever before. In some cases it is 50 per cent of the output. The new type of soft top, glass inclosed vehicle is most popular. This is the result of materially lower prices in comparison with the former cost of closed models.

Business in Brief

NEW YORK, May 16—Better weather and crop conditions, more activity in retail trade, continued improvement in industry and a larger export business constitute the more favorable developments of the last week. The stock market is somewhat reactionary and apparently is waiting for the industries, whose improvement it has more than discounted, to catch up. The automotive industry is leading all others, and it alone appears to be ahead of the stock market in its advance.

Production of steel ingots for April was at the rate of 36,500,000 gross tons a year, as compared with a rate of 30,000,000 tons at the beginning of March. This shows an increase in production since the coal strike began, but the rate of gain has been slowed up. Additional plants are resuming operations, however.

Lumber and other building lines continue their activity.

Agricultural implements are selling more readily as the season progresses.

The latest government crop report confirms improvement in winter wheat.

Machine tools are selling better to railroads and automobile manufacturers.

Apparel trades have lagged at wholesale, but retail buying has been heavier.

Increased loadings of freight cars, exclusive of coal, continue steadily.

Bonds are less active, money is easier and sterling exchange is higher.

Bank clearings for the week ending May 11 were $7,185,030,000, a loss of 9.7 per cent from the previous week, but a gain of 24.2 per cent over the same week last year.

A survey made by the Federal Reserve Board indicates a much brighter trade outlook for the country as a whole.

Except for the body situation, the parts shortage is not so serious as it was last month because parts manufacturers have been speeding up production. Collections are highly satisfactory and all but a comparatively small percentage of bills are being paid when due.

Factories turning out the more popular lines of passenger cars have enough orders booked to keep production at the present pace for several weeks. Distributors in agricultural districts are placing orders for July 1 delivery to take care of demand from farmers which is expected to show a sharp increase at that time.

Truck Gains Shown In Engine Schedules

Steady Increase Forecast—Capacity Car Production Likely to July 1

By D. M. McDONALD

DETROIT, MICH., May 15—The Continental Motors Corp. reports that production of its light six engine now is about equal to that of its other passenger car models. Starting in January of this year, when the new engine was first shown mounted in cars of several makes, the production has expanded steadily until it now is on an even basis with the older Continental models.

The company is now abreast of requisitions on practically all models, including the light six, an official declared, through the completion of additions at the Muskegon plant and installation of equipment. The Muskegon plant is essentially a four-cylinder plant and will figure most prominently in the production of engines for both the Durant and the Star. Four-cylinder truck engines are also made at the plant.

Foundries supplying the Continental factories are about caught up with deliveries and for the first time in several months the plants will be enabled to set up a small store of advance material. In reaching its present production stride the company doubled several times the number of men employed a few months ago and will make additions as fast as mechanics can be obtained.

Steady Business Evident

Production schedules as outlined call for the largest output the company has ever known. Truck business is growing by leaps and bounds and is already an important factor in the Continental gross business. On the basis of reports received from its customers, there will be a steady business throughout the year in both car and truck lines, with the latter increasing every month.

Manufacturers in the Detroit district as a whole are making a very close study of the general business condition of the country and the possibility of continued heavy absorption of automobiles. Capacity business to July 1 in most factories is assured now by the orders on hand. As a general rule, it is believed that with proper merchandising effort on the part of the dealer, a very strong measure of business will continue during the year.

Intensive sales development is the order of the day at the factories. Those companies which have developed strong dealer organizations are busy now with plans which will keep those organizations functioning at the highest point of sales efficiency. In the carrying out of these plans there will be little left to chance. Multiplication of sales forces and dealerships are being carried out in many localities to make certain that the districts are fully covered.

(*Continued on page* 1087)

Plans Are Approved of New Moline Plow

Reorganized Company Starts Business with Current Assets of $16,000,000

MOLINE, ILL., May 15—Reorganization of the Moline Plow Co. and its subsidiaries is complete, and plans for its future program have been ratified, according to an official statement from the company's offices. "The financial housecleaning was done with unusual thoroughness," the statement asserts.

Certificate of change of name to the Illinois American Plow Co. was filed with the secretary of state last week. It is understood, however, that this action later was reconsidered and that the name will not be changed, the company preferring to operate under the title by which it has been known to the trade for 60 years.

The reorganized company starts with $16,000,000 current assets and, except for $70,000 current accounts and the accrued and current expenses, has cleared indebtedness from its books. Conversion of $25,000,000 indebtedness into 20-year debentures and first preferred stock in equal amounts was a feature of the refinancing. Former first preferred stock to the amount of $7,500,000 was converted into an equal amount of second preferred issue under this plan.

Vigorous readjustment and conduct of business has been ratified by the directors, and the new plan, which, it is promised, will lower implement prices to the farmer, is "dedication of the company to a policy of improvement in implement distribution," according to George N. Peek, president.

Peek further said:

Implement sales to farmers have been on a system suited to frontier development before good roads, the parcel post and the automobile. We have had too many small dealers at cross-roads and not enough strong distributors in natural trade centers — too much factory canvassing, small shipments and too long terms. Too large a part of the price of the implement represented the cost of getting it to the farmer. Our new plan cuts out the waste of distribution. It will leave more of the profit of sales in the community where it is achieved. It will pull business by attractive discounts rather than push people into buying by weight of sales force.

Lea Continues With Stephens

Chief of the subsidiary companies affected by the reorganization is the Stephens Motor Car Co., with factories in Freeport. R. W. Lea continues as general manager of the subsidiary. Commenting upon the inauguration of the new plan, he said:

We are signalizing the reorganization with a price cut which averages $130 a car on all models. No company is now more firmly established and our whole organization from factory to dealer is enthusiastic. This cut and the reception of our car in all parts of the country assures us a great jump in business and popularity.

Frank O. Wetmore, who headed the committee which completed plans for the reorganization, remains as chairman of the board of directors; George N. Peek is president; H. S. Johnson, executive vice-president; R. W. Lea, vice-president and general manager of the Stephens Motor Car Co.; F. W. Edlin, vice-president and sales manager; C. B. Rose, vice-president in charge of the tractor works; H. B. Dineen, vice-president in charge of implement manufacture; L. C. Shonts, secretary; L. C. Blanding, assistant secretary; F. J. Hoenigman and John Hammerich, assistant treasurers.

The board of directors includes Wetmore, Peek, Johnson, John E. Blunt, Jr., C. P. Coffin, Herman Waldeck, F. F. Winans, all of Chicago; S. A. Mitchell and J. Herndon Smith of St. Louis; Rumsey W. Scott, Henry R. Johnston and R. I. Barr, all of New York City; C. Jaffray of Minneapolis, Horace Fortescue of Philadelphia and H. H. Cleaveland of Rock Island.

IOWA BUYS HIGH PRICED CARS

MARSHALLTOWN, IOWA, May 16—More high priced cars have been sold in Marshall county in the last two months than in the same period in 1921 and 1920, according to the county treasurer.

Increased Production Is Based on Sound Upgrade in Business Conditions

By EDWARD S. JORDAN,

President of the Jordan Motor Car Co., Inc.

Cleveland, May 15.

THE present increased production is based upon a sound upgrade in the curve of general business. While it is not anticipated that production will proceed at its present rate after July 1, there is no indication that a slump will occur after that date. Rather the curve of production will more closely align itself to the business graph which is on a steady, normal, upward slant.

It is certain from the present outlook that the industry will easily exceed the peak production of 1920. In that year about 1,940,000 were made. In 1922 production will go well over 2,000,000. As the year unfolds itself month by month business prospects look better. While local conditions in certain spots in the country are still bad, these points are in most instances quite isolated and often immediately contiguous to prosperous territory.

People who have sold their higher priced cars during the period of depression and contented themselves with others below the price class to which they have become educated and accustomed are starting to come back. This bit of human nature is of tremendous importance in the volume of production and sales. The trend is always upward unless business reverses cause it to be otherwise, and then as soon as the reverses have been overcome, the owner goes back to the type of car to which he has accustomed himself.

This is a period of education in closed car conveniences and comforts. The coming business in closed cars is going to be tremendous. Increasing business prosperity as indicated by the general advance in business volume in practically all lines is increasing the number of prosperous prospects who are moving up in the price class and also introducing new prospects into the lower-priced fields. One of the big factors of to-day is the fact that 80 per cent of the cars sold are on a time basis.

The sales at the present time are in the industrial centers; the farmers have not yet started to buy in anything like the volume that they will in the future. The demand, however, without any real assistance as yet from the farmer, has overrun the ability of the industry to produce at this time. On a majority of model types the factories are behind on orders which, of course, accounts for the production curve being at its present height. In April, the industry produced 213,000 cars and trucks. May will exceed this. At the rate of May production the industry would produce 3,000,000 per year. This is just a little too many automobiles for this year, but the total figure will go over the 2,000,000 mark.

Trustees to Begin Sale Of Parenti Assets May 23

BUFFALO, May 16 — The Marine Trust Co., trustees for the Parenti Motors Corp., will begin selling the property of the concern on May 23. This announcement was made yesterday by letters to stockholders of the Parenti firm.

Frank M. Hickok of the Marine Trust said that the property, appraised at $388,000, exclusive of stock and raw materials, is all of the tangible assets to show for more than $3,000,000 worth of stock that has been issued to more than 11,000 stockholders.

A month ago the Marine Trust Co. took the assignment of the Parenti concern at the request of the board of directors of the company, who hoped to avoid waste, delay and expenses involved in bankruptcy proceedings.

The letter states that the directors have been unable to do anything apparently and that they and representatives of stockholders refused to put more money into the proposition in an effort to rebuild the organization. The letter calls attention to the fact that if the property does not sell for enough to pay the debts, the stockholders will lose everything.

Spicer Makes Offer for Hartford Parts

Will Form New Company and Pay $220,000 Cash to Creditors Committee

HARTFORD, CONN., May 15—The creditors' committee of the Hartford Automotive Parts Co., which bid in the property for $350,000 at the recent receiver's sale, announces that the Spicer Manufacturing Co. has offered to purchase all the assets and property except the real estate and buildings and the outstanding accounts receivable.

The Spicer Manufacturing Co. will organize a new corporation and will pay $220,000 in cash to the creditors' committee. Of this amount, $120,000 will be raised by the Spicer company on the notes of the new corporation, which is to have a capital of $330,000 of 7 per cent preferred stock and $100,000 of common stock. The creditors' committee will receive $230,000 of the preferred. The creditors' committee will retain all of the real estate and buildings, but will lease to the new corporation about one-third of the area of the present plant.

The proposed agreement with the Spicer company provides that no dividends shall be paid upon the common stock until after the preferred has been retired and that after the notes for $120,000 have been paid 50 per cent of the net earnings of the new corporation shall be deposited to retire the present stock.

The creditors' committee urges that this plan be accepted.

Smith & Gallatin Acquires Large Interest in Mercer

NEW YORK, May 15—A large interest in the Mercer Motors Co. has been acquired by Smith & Gallatin and their associates. George P. Smith has been elected a director of the Mercer company and will represent these interests on the board.

A special committee of directors of the Mercer company has been appointed to confer with the new interests in regard to strengthening the position of Mercer. This committee consists of former Governer Stokes of New Jersey, Walter G. Kimball, vice-president of the Columbia Trust Co., and John Davis, vice-president of the Liberty Industrial Corp.

A. J. Drefs, vice-president of the McQuay-Norris Manufacturing Co. of St. Louis, who is widely known in the automotive industry, is associated with the new interests, and will take an active part in Mercer affairs in an advisory capacity.

NORTHWAY SEEKS FUNDS

BOSTON, May 15—Directors of Northway Motors have decided to ask stockholders to subscribe $400,000 in cash, which will be required to continue the business. The assets of the company are estimated at $2,000,000, consisting of the plant at Natick, machine tool equipment valued at $935,000, and the inventory priced below present market costs. The liabilities total only about $100,000, but additional working capital must be obtained if operations are to be continued. The company has discontinued the manufacture of the passenger car and is concentrating its efforts on the Northway truck.

Wood Wheel Association Names White President

CHICAGO, May 15 — Thomas A. White, president of Crane & MacMahon, Inc., Saint Marys, Ohio, has been elected president of the reorganized Automotive Wood Wheel Manufacturers Association. C. F. Field, general sales manager of the Hayes Wheel Co., Jackson, Mich., has been made vice-president. Trustees, in addition to the president and vice-president, are C. C. Carlton, secretary of the Motor Wheel Corp., Lansing, and S. Vance Lovenstein, president of the Schwarz Wheel Co. of Philadelphia.

The association is very much interested at this time in studies which have been made of the wearing qualities of solid rubber tires on wood wheels and of steel wheels used on trucks. The inquiry is said to show that solid rubber tires last longer and give greater service on wood wheels.

Miniger Plans to Control Auto-Lite When He Buys It

NEW YORK, May 15—C. O. Miniger, one of the receivers of the Willys Corp., who is in New York for a series of conferences this week, expects to be successful in his bid for the property of the Electric Auto-Lite Co. when it is sold May 29. He states that if his bid is accepted he will be in control of the company and that no automobile manufacturer will be associated with him. The Auto-Lite plant is now operating practically at capacity. Sales of farm lighting outfits are increasing rapidly. Business in this field for the first 11 days of May equalled the entire month of April.

Miniger stated to-day that the affairs of the Willys Corp. are being worked out in a way which is gratifying to the receivers and that negotiations now are under way for the sale of the New Process Gear Corp. of Syracuse. He declined to state what interests were seeking this property.

LINCOLN OBJECTIONS FILED

DETROIT, May 16—The Detroit Trust Co., as receiver for the Lincoln Motor Co., has filed objections in the United States Court to the War Department's claim of $9,000,000 for alleged over-payment of war contracts. The bill stated the receiver has not been fully informed of the nature of the Government's claim and urged that all claims should have been presented in 1919, when an agreement was reached on the contracts and settled in full.

Creditors Purchase Maibohm for $110,000

Will Turn Property Over to Arrow Motors Co., New Sandusky Company

TOLEDO, May 15—The Maibohm Motors Co., Sandusky, was bid in for approximately $110,000 by E. G. Kirby of the Commerce Guardian Trust and Savings Bank, this city, chairman of the creditors' committee, at sale in bankruptcy conducted by Referee Fordyce Belford at Sandusky to-day. There were no other bidders for the plant.

The creditors' committee, which held authorizations to act on behalf of more than 80 per cent of the creditors, will turn the property over to a new Ohio company, known as the Arrow Motors Co., Sandusky, in accordance with the plan previously approved by the creditors.

The new company is composed largely of the Sandusky interests which had been identified with the old company as stockholders and creditors. It will have an active working capital of approximately $200,000 and assets of $700,000, and, in addition, the complete co-operation of the creditors. This capital is expected to put the company firmly on its feet.

None of the officers of the old company will be identified with the new company. E. C. Burch will become president and general manager of the Arrow Motors Co., and E. G. Kirby will also be identified with it when a permanent organization is effected.

The new company will start to work immediately on a refined Maibohm, which, it is said, will sell in the $1,500 class.

Simplex Was Mentioned

NEW YORK, May 15—It was reported at the time the sale was pending and when efforts were being made to reorganize the company that New York bankers were considering a $500,000 bond issue and a stock issue of at least that amount contingent upon the acquisition of the rights to manufacture the Simplex car now owned by the Mercer Motors Co., but not being produced at the present time.

H. C. Maibohm, who organized Maibohm Motors, was active in efforts to reorganize the company and was understood to have obtained an option on the Simplex assets. The plan as outlined at the time was to discontinue production of the Maibohm and produce an entirely new car, embodying many of the Simplex features but selling at a price radically lower.

Arrow Motors Co. Incorporated

SANDUSKY, May 13—The Arrow Motors Co. has been incorporated to take over the plant and other property of the Maibohm Motors Co. here in the interest of creditors and local stockholders. The incorporators are Joseph G. Pyle, M. N. Osborn, C. R. Spahn, E. B. King and E. C. Burch, all of this city.

Germany Will Build Dirigible for U. S.

Council of Ambassadors Grants Credit of $750,000—Ship Bigger Than ZR-2

NEW YORK, May 11—Representatives in this country of the Zeppelin interests have been informed that the Council of Ambassadors has decided to grant the German Government a credit of $750,000 for the construction of a dirigible of the newest type which will be turned over to the United States Navy. The funds used for the construction of the huge airship, which will be larger than the ZR-2, will be credited in gold marks to the German reparations payments.

The American Zeppelin agents have been informed that before the dirigible is delivered to the Navy Department it will be flown across the Atlantic 12 times to demonstrate its airworthiness. The new Zeppelin will be the last word in German airship construction because the fate of that branch of aviation in Germany will depend very largely upon its success.

If the navy Zeppelin works out as successfully in its tests as it is expected to do, construction of similar airships for commercial use in this country will be undertaken at once. They will be designed to carry both freight and passengers, and the ultimate purpose is to establish a line from the Atlantic coast to the Pacific.

The United States is the only one of the principal allies in the World War which failed to receive a reparations airship from Germany. England, France, Italy and Japan each received a dirigible of the Zeppelin type. Vigorous representations were made by the United States Government to the Reparations Commission and as a consequence the Council of Ambassadors now has granted the credit to the German Government for the construction of a ship of the same general type.

Schuette Sues Zeppelin Company

NEW YORK, May 15—An Associated Press dispatch from Berlin says:

An action alleging libel has been instituted by Prof. Johann Schuette of the Schuette Lanz Airship Co. against the Zeppelin company.

The Zeppelin concern is said openly to have insinuated that Prof. Schuette's agreement with the General Air Service of America probably would reveal the unconditional surrender to foreign interests of notable German inventions, and further to have claimed priority rights to patents not now controlled by Schuette.

The Zeppelin concern intimates that it shortly will proceed legally to establish its right to the patents in question. It hints that the American corporation probably will be called on to contest the suit, as the patents on which it claims to own control probably are the same as those registered by Schuette in Germany, which largely "constitute the intellectual property of Count Zeppelin."

The forthcoming suit is expected to involve litigation by both the German airship concerns over patents which for a long time have been the source of hostility between them. The Zeppelin concern recently concluded an alliance with Spanish and American financial interests with the purpose of founding a transoceanic air service.

While in the United States recently, Dr. Schuette said that he had signed contracts which would give the General Air Service Co., which includes in its directorate men prominent in the General Electric Co., the manufacturers' rights and patent interests in the Schuette-Lanz airships for the entire world. He asserted at that time that these rights would give the United States the leading position in aeronautics.

Special Sales Dispose of Last of Briscoe Line

DETROIT, May 16—Earl Motors is closing out the last of its Briscoe line through the medium of special sales which will be held in cities within easy delivery distance of the Jackson factory. Sales in Cleveland and Detroit have resulted in a heavy business which has practically closed out the last of the roadster model, leaving only a limited number of phaetons and closed cars. These are expected to go within the week.

The phaeton, equipped with front and rear bumpers and with side windshield wings, sold in Detroit for $675 and the closed models for $1,000. Service on the car is guaranteed and will be handled through the regular Earl dealer organization.

Good Roads Association Backs Frelinghuysen Bill

WASHINGTON, May 15—One of the sponsors for the Frelinghuysen resolution providing for the reimportation of motor equipment now used by the American army in Germany, is the Lee National Good Roads Highway Association. According to a statement of M. Johnson, general manager of the organization, the motor equipment is needed to reduce the cost of highway construction throughout the country.

Johnson has estimated the value of all motorized equipment owned by the War Department in Germany at $200,000,000, but this figure is questioned by Government officials, who claim that there are less than 500 trucks and passenger cars along the Rhine.

Old Obenberger Trustee Makes Final Accounting

MILWAUKEE, May 15—Unsecured creditors, with aggregate claims of $490,457, probably will realize nothing from the winding up of affairs of the John Obenberger Co. of Milwaukee, bankrupt. The final account of J. F. Gerdis, trustee, shows income of $363,974 and disbursements of $334,808, leaving a balance of $29,166. Against this as a preferred claim is the unpaid Federal income tax for 1918, amounting to $64,393, so that nothing is left to reimburse unsecured creditors.

Wisconsin Used Car Bureau Is Dissolved

Action Taken Voluntarily After Attorney General Ruled on "Anti-Trust" Phase

MADISON, May 15—Attorney General William J. Morgan's ruling that the Wisconsin Automotive Statistical Bureau, an organization of automobile dealers, was in violation of Wisconsin's anti-trust laws, has resulted in the corporation's voluntary dissolution.

Articles dissolving the bureau were filed with Secretary of State Elmer S. Hall this week. This action brought to a close what was characterized by Attorney General Morgan, in an opinion recently on the bureau, as "a combination to control the used car market."

The articles of the bureau declare its purpose to "efficiently collect from among the members of the automobile trade reliable information pertaining to the automobile industry and the exchange and dissemination of the same to promote the industry."

A conference with the officers of the bureau was held by Morgan, in which he asserted that their association was an attempt at price fixing and was incompatible with the laws of Wisconsin. The dealers considered this contention, and this week withdrew their incorporation papers. Morgan had told the dealers that unless they dissolved he would institute court action.

Price List Prepared

At the time of the conference Morgan produced a price list bearing the bureau's name, which he declared was issued by the association. It contained price lists for every make and model car for the past five years.

Morgan was reluctant to make any statement on the dissolution, which was made public through a daily statement issued by the secretary of state giving incorporations and dissolutions. He explained that the purpose of his department was to correct conditions without taking drastic action if possible.

Klaxon Co. Asks Lower Freight Rates on Horns

WASHINGTON, May 15—The Interstate Commerce Commission has given a hearing on the complaint filed by the Klaxon Co. of Newark, N. J., against the Alabama Great Western Railroad and 40 other railroads, regarding the present freight classification of horns used as warning signals on automobiles, motorcycles, motor boats, etc.

The Klaxon company asked that the rate be reduced from 1½ times first class rate in less than carload lots to the first class rate, and from the second class rate on carloads to the third class rate. If the claim is allowed it will result in a considerable saving in freight charges for automobile manufacturers.

Ford Sales in April Exceeded Estimates

Increase Due Chiefly to Unexpectedly Greater Business in Foreign Countries

DETROIT, May 15—April sales of Ford cars and trucks in both the United States and foreign countries totaled 127,249, according to the revised figures just disclosed by the company. This exceeded the schedule of 120,000 fixed by the company as the April figure and indicates an unexpectedly increased demand in foreign business rather than in sales within the United States.

The former previous high record month, June, 1921, was exceeded by 15,467. The May figure has been fixed at 135,000, and preparations are already being made in the purchasing department of the company to prepare against an output of 150,000 in June. Even with an output of 135,000 in May, there will be approximately 30,000 orders carried over into June. Daily average sales in the United States reached a total of 5210 at the end of April. Production for the year is expected to reach 1,100,000, a 10 per cent gain over 1921.

Fordson tractor sales in April totaled 11,181, a daily average of 469 being reached by the end of the month. This is a new high sales record for tractors and shows a 100 per cent gain over the best month of 1921. Truck production and sales approximate 10 per cent of the Ford business, giving an approximate sale in April of 12,725.

Price Cuts Helped English Sales

DETROIT, May 12—Recent price reductions on Ford cars and trucks in England have brought sales to a high volume, the company now operating on a scale which has not been equaled since 1920 and which is reported advancing to new high record points. In one week in March the output and sales total reached 1009.

Production at the Copenhagen plant in March approximated 800 vehicles, this being a higher total than for any month in 1921.

In South America sales are reported running higher than in 1920, despite the handicaps of poor road facilities. In the first three months of this year 3465 Ford cars and trucks were absorbed in the Argentine market alone, a considerably higher number than for any similar period. Importation of American cars and trucks into the Argentine is said to outnumber European imports three to one.

The company reports an extensive road building program undertaken by the city of Sao Paulo, Brazil. Rio Janeiro business is reported handicapped by the poor roads outside the city.

Orders Dry Kiln Equipment

INDIANAPOLIS, May 15—The Ford Motor Co. has placed an order for 66 carloads of dry kiln equipment with value in excess of $200,000 with the National Dry Kiln Co. of this city. The order, said to be one of the largest single orders for kiln equipment ever placed, is to be shipped to the Iron Mountain plant of the Ford company.

The total dry kiln equipment made for Ford by this local concern will amount to 140 carloads when the last of the present shipments is made. The first order was received September, 1919, and was for the River Rouge plant. The Highland Park and Hamilton plants have also had equipment of this sort from the local firm. To house this equipment the Ford company will have to build 2,500,000 feet of dry kiln buildings, exclusive of storage buildings and transfer ways.

Sales by Stewart-Warner Nearly Double Last Year's

CHICAGO, May 16—The great activity of automobile manufacturers is strikingly reflected at the plant here of of the Stewart-Warner Speedometer Corp., which is working at high speed and increasing its output as rapidly as new employees can be absorbed. Since early in the year the number of employees has been doubled and is now in excess of 2000.

The sales of the company for the first week in May came within a few dollars of being twice as much as the sales for the corresponding week last year. Officials of the company state that the orders now on hand and the increased factory output indicate that the money value of this month's business will be the greatest of any month in the company's history. The previous high month was the May of 1920.

In addition to factory products, the company also has a great demand for replacement products which are sold to branches and dealers. Orders from these sources have come in such volume recently that the company is having great difficulty in filling them. There is an unusual demand for the new Ford speedometer which indicates by colored dials when and where the car should be lubricated. That part of the factory making these speedometers has had to work day and night.

Business Revival Helping Consolidated School Idea

PONTIAC, MICH., May 16—Change in industrial and business conditions generally is expected to have a beneficial effect on the consolidated school situation which holds strong promise for motor bus manufacturers. Michigan a year ago was swept by a school consolidation wave, and many communities in the rural districts considered merging several school districts into one, with a central building and bus lines to bring in the pupils.

Business depression, affecting the farmers and villagers, however, resulted in the defeat of several of the bond issues proposed to put up the consolidated schools, with the result that the movement received a setback. A more favorable attitude toward bonding for such purposes is now being manifested.

Credit Conditions Steadily Improving

Past Due Accounts Decrease—Few Companies Ask Parts Makers to Take Notes

NEW YORK, May 12—Credit conditions in the automotive industry are steadily improving. Parts manufacturers report that they are being asked to accept notes only by a comparatively few companies, which have been in financial difficulties for months and have not obtained additional financing.

Vehicle manufacturers who are producing on a large scale are rapidly wiping out their past due notes, and many of them already have cleared their books. All but a comparatively small percentage of the current business is being paid for when due, and some companies are discounting their bills.

There has been a steady whittling down of past due accounts for the past three months, and continued progress in this direction is being made, except by the companies which have been unable because of lack of working capital, to take advantage of the present extraordinary demand for cars and trucks.

The rapid improvement in collections has made it possible for the parts makers to liquidate a large part of their own indebtedness, and their position in this respect is much stronger than at the beginning of the year. They also are able to pay their bills when due and have ceased in large measure to ask the indulgence of the companies from which they buy their supplies of raw materials.

Gasoline Extracting Process, Basis of Suit

NEW YORK, May 15—Trial of the action of George T. Rogers of Plainfield, N. J., against Joseph H. Adams to establish claim to a 40 per cent interest in the defendant's process for extracting gasoline from crude oil has been started in the Supreme Court here. The process is now controlled by Adams and the Texas Co.

The Standard Oil companies of New Jersey and Indiana are said to be paying royalties for use of the process. The suit is based on an alleged assignment by Adams to Rogers of a 40 per cent interest in the original process patents which the plaintiff contends also gives him the same interest in the improved process which is said to separate 15 per cent more gasoline than the original. Millions of dollars are said to be involved in the suit.

LOUIS E. STROTHMAN DIES

MILWAUKEE, May 16—Louis E. Strothman, vice-president and general manager of the Richardson-Phenix Co., now a division of the S. F. Bowser Co., Fort Wayne, Ind., died here after an illness of six months, at the age of 43 years.

Tire Output Is Now 85 Per Cent of Peak

Production Far Ahead of Normal —Demand Was Generally Underestimated

AKRON, May 15—Akron tire factories are finding it impossible to meet the current demand for tires. Although several thousand seasoned tire builders have been re-employed within the past six months, many companies are finding it necessary to draw upon reserve supplies and upon their finished goods inventories to meet the rush orders being received daily from both dealers and motor car manufacturers.

Plainly the demand for tires has been underestimated not alone by tire manufacturers but by car manufacturers and tire dealers. A policy of ultra-caution in ordering stocks and in getting a quicker turnover of stocks on dealers' shelves has brought the tire industry to the verge of an absolute tire shortage, unless there is a slight let-up in the demand of sufficient duration to permit manufacturers to catch up.

85,000 Casings Daily

Tire production in Akron by an actual survey now exceeds 85,000 casings a day. The same companies reporting this aggregate output show a combined peak production during the abnormal season of early 1920 of slightly over 101,000 tires a day. These figures show that output now is 85 per cent of peak and far ahead of normal tire production, for normal is based at 75 per cent of peak.

Numerous companies are producing above the old 1920 peak marks. This is more particularly true of the smaller companies. The larger companies are operating three eight-hour shifts daily and have exhausted the available supply of experienced tire builders. They have sent out urgent appeals for tire men, seeking to recall former employees who now are employed elsewhere.

How long the current spurt will last no one will venture a prediction, although most manufacturers are confident that it will continue for some time and have given reasonable assurance of steady employment at least until August 1 to the hundreds of men taken on since April 1. There are a few exceptions, however, with some manufacturers feeling that June will bring a seasonal slump in tire sales. These men still advise a policy of caution and warn against too swift a pace which will result in an overproduction.

Goodyear Adding Men

The Goodyear Tire & Rubber Co., as compared to a peak production obtained in 1920 of 31,000 casings a day, now reports a production of 26,000 tires daily and is still putting on men. Goodyear has jumped from about 20,000 tires at the first of April. Firestone is running proportionately closer to its old peak record of 28,500 casings a day with a present output of 25,000 daily. The B. F. Goodrich Co. reports considerable sales improvement through the introduction of new tire lines and is producing about 16,000 daily as compared to a peak of 26,000. The Miller Rubber Co. is straining its plant to the utmost, producing 6500 a day as against a peak of 6000. Miller recently acquired 100,000 square feet of storage space near its factory and will use it for stock supplies, so as to free factory space for installation of new equipment to increase production.

The smaller tire companies all are booming. Mason at Kent, near Akron, is running 3500 casings a day as against a peak of 2500. General of Akron has passed its old peak of 1200 daily and is averaging over 2000 a day. Kelly-Springfield's Akron plant is back to the old top record of 1600 casings. Mohawk is producing 800 and Swinehart 750. Each of these companies had a peak of 1000. India is above its old high watermark of 500 and reports an output now of 700 a day. The American Tire & Rubber has climbed back to its highest production mark of 750 daily.

The Seiberling Rubber Co. is producing over 1200 cords a day at its Barberton plant and over 800 Portage fabric tires at New Castle, Pa.

Price of Cotton May Advance

CHICAGO, May 13—Continuation of good business in the tire industry was reported by members of the Midwest Rubber Manufacturers Association, who attended the association's monthly meeting here. Representatives of tire fabric producers said there is a very heavy demand for their product and that there are indications of an increase in the price of cotton, which would have to be passed on in the price of tires.

Truck Gains Shown in Engine Schedules

(*Continued from page* 1082)

A discussion of centers of the largest automobile buying at the present time shows the industrial cities of the middle west, particularly those between the Alleghanies and the Mississippi, to be leading. The eastern industrial districts have fallen off, especially in the New England states, it is declared, owing to strikes and industrial unrest, from which the middle west has been free.

Factory officials in the sales end of the industry are not concerned over the business probabilities for the remainder of the year. There is little speculating being done over this but on the contrary there is much sound planning under way which it is expected will keep the cars moving into the hands of owners as rapidly as they can be made. One executive of a company whose product is enjoying wide popularity in the present market said there would be no attempt to force the cars into the hands of dealers, but on the contrary, care would be taken to ship them only as fast as they can be readily absorbed. In his estimation the best months will be from February to June and September and October.

Car, Truck, Tractor, All Share in Demand

Power Farm Operating Equipment Industry, Also, Is Experiencing Definite Revival

MILWAUKEE, May 15—With all passenger car factories in this district shipping cars to distributors and dealers as fast as they come through the shops, and unfilled orders, especially for closed types, piling up at a rate that is reminiscent of 1919 conditions, the automotive industry at the middle of May stands in an especially gratifying position. The improvement noted in motor truck demand in the last sixty days is steadily being accentuated as the transportation problem of general business becomes more difficult with the increasing demand for commodities of all kinds. The tractor and power farm operating equipment industry is now experiencing a definite revival, although it still has far to go to get to a satisfactory basis.

In Milwaukee makers of motors, transmissions, universal joints, steering gears and similar units are unable to make deliveries in the volume demanded by shipping directions, which have advanced sharply in the last four to six weeks. Makers of car manufacturers' equipment, such as lamps, switches, coils, grease cups, etc., also have fallen behind on deliveries because production has not been able to keep pace with requirements, despite great effort.

Equipment Makers Gain

Tire manufacturers are making further increases in working forces and enlargement of daily output. Concerns making automotive equipment for the wholesale and jobbing trade as distinguished from manufacturers' stock equipment report a marked increase in sales, due to the improved condition of consumer demand. Producers of fenders or bumpers are especially busy, the demand at this time being of relatively enormous proportions. Discounts on collision insurance rates for bumper equipment have helped bring about this condition.

What is of distinct interest at this time is the substantial confidence held in the immediate future of the industry among men engaged in all of its manifold phases. At first apprehension was expressed that the sharp revival of passenger car sales might be merely a flurry of temporary nature, but analysis of conditions by keen students indicates that the automotive industries have to look forward to a well sustained call for an indefinite period, with activity holding up at or probably above the present rate until October and later.

BEGIN G. M. TRUCK TEST HOUSE

PONTIAC, MICH., May 16—Construction has begun this week on the new test house of the General Motors Truck Co. here, into which will be moved special test house equipment built to order at a cost of approximately $300,000.

Men of the Industry and What They Are Doing

Mock Heads Body Company

Ralph D. Mock, until recently an executive officer of the Hydraulic Steel Co. of Cleveland, has become president of the Colonial Body Co. of Boston. He was one of the organizers and is president of the Cleveland Finance Co. as well as the Metropolitan Securities Co., with which the former is now affiliated.

Since incorporation in 1919 Mock has served as the financial vice-president of the Hydraulic Steel Co. and later was associated with the sales department. He also served as treasurer of its predecessor, the Hydraulic Pressed Steel Co. During this period of nearly 10 years he was in close contact with many executives of the leading automobile and motor truck manufacturers of the country, as well as many bankers in the East and central West. Prior to the war he served as Chairman of the Credit Committee of the Motor and Accessory Manufacturers Association and more recently on the Open Shop Committee of the National Association of Manufacturers, both of New York City.

Willys Spending Week on Farm

John N. Willys is spending a week with his family on his Long Island farm. He is enthusiastic over the outlook for the Willys-Overland Co., but unhappy because the factory is unable to meet the demand for cars. After spending his time for months stimulating the sale of automobiles, Willys now is devoting considerable attention to digging up supplies of essential parts in order to speed up production at the factory.

Elwood Haynes Honored

Elwood Haynes, president of the Haynes Automobile Co., has been awarded the John Scott Medal, certificate and premium "for his discoveries in stainless steel, stellite and chrome-iron," according to an announcement by the faculty of Worcester Polytechnic Institute, from which Haynes was graduated in 1881. The medal and certificate will be presented at the June commencement exercises of the institute. The fund yielding the income from which these awards are made was left to Philadelphia by John Scott of Edinburgh, who provided in this way the honoring of "ingenious men and women who make useful inventions."

Search to Advertise Carter

Major C. W. Search of the Carter Motor Car Co., Inc., of Washington has been placed in charge of the domestic and foreign advertising of the Carter car.

Lord Resigns from Moline Plow

Henry S. Lord, vice-president and treasurer of the Moline Plow Co., has resigned his position after an association with the company covering a period of ten years. He has not announced his plans for the future.

Le Fevre Leaves S. A. E.

C. D. Le Fevre, formerly actively identified with the work of the Society of Automotive Engineers, has resigned to become eastern manager of manufacturers' sales of the Westinghouse Union Battery Co., Swissvale, Pa., with headquarters in New York City.

Clark in Importing Business

W. W. Clark, for a number of years export manager of the Hart-Parr Co., will enter the wholesale importing business with headquarters in Charles City, Iowa, where he will also have a retail sales display room. A large line of goods both in art and utilities from European countries and the Orient will be imported by him.

Monk with U. S. Ball Bearing

Marvin E. Monk has been appointed assistant sales manager in charge of general sales of the U. S. Ball Bearing Manufacturing Co. of Chicago. Monk was formerly special sales engineer for Manning, Maxwell & Moore, Inc., New York City. J. J. Torpey will continue as assistant sales manager in charge of bearing distributors.

Jefferson with Agency

G. C. Jefferson has resigned as assistant advertising manager of Earl Motors, Inc., and has joined the western staff of Grandin-Dorrance-Sullivan, Inc., advertising agents. He will make his headquarters at the new South Bend offices of the agency. Before joining Earl Motors, Jefferson was identified with the Oakland Motor Car Co. and the William N. Albee Co., Detroit.

Kinstler, Van Wheel Sales Manager

Leon L. Kinstler has been appointed sales manager of the Van Wheel Corp. of Syracuse. For several years Kinstler was in charge of inspection and acceptance of the Government's automotive engineering work. He has a wide acquaintance among passenger car and truck manufacturers.

Lorch Goes with U. S. Tractor

George L. Lorch, superintendent of the Eagle Manufacturing Co., Appleton, Wis., manufacturing Eagle tractors and power farm tools, has resigned to accept a similar position with the U. S. Tractor & Machinery Co., Menasha, Wis., manufacturing Uncle Sam tractors and now engaging also in the production of tractor implements and power farm machinery.

Latta Enters Financial Field

L. E. Latta, secretary of Earl Motors, Inc., and a member of the Earl board of directors, has resigned to take charge of the legal department of a large financial corporation. Latta has been connected with the automobile industry since 1906. After four years in the accessory field, he became secretary and business manager of the Maxwell-Briscoe Motor Co. at Tarrytown, N. Y., in 1910. Later he joined the United States Motor Corp. as secretary, taking charge of the legal department in New York.

When the United States Motor Corp. was reorganized as the present Maxwell company, Latta joined Benjamin Briscoe in the organization of the Briscoe Motor Co. and the Argo Motor Co. continuing as secretary after this merger in the Briscoe Motor Corp. and the latter's reorganization as Earl Motors, Inc.

Packard Promotes White

George White, assistant purchasing manager of the Packard Motor Car Co., has been made manager of that department, succeeding F. W. Boynton, who has resigned to join the Anderson Motor Car Co. in an executive capacity.

Shartle Joins Inland Products

R. H. Shartle, for several years master mechanic for the Wagner Electric Co. and previously identified with the Dalton Adding Machine Co., has associated himself with the Inland Products Co., St. Louis, as works manager in charge of factory production.

Burn Changes Companies

Walter P. Burn, formerly assistant sales promotion and advertising manager of the Tide Water Oil Co., New York, has been appointed sales promotion and advertising manager of the Transcontinental Oil Co., Pittsburgh, succeeding E. D. Mason.

John B. Hurst Forms Company

John B. Hurst, who has been connected for more than twelve years with Herbert Brothers, Philadelphia distributor of Chandler and Cleveland cars, has formed the Hurst Co., to handle the sale of the same cars, together with the Lovejoy shock absorber for Berks county, Pa., with headquarters in Reading.

Harrington to Address Convention

Howard Harrington, advertising manager for the Moline Plow Co., will be the only advertising man west of Chicago to speak at the eighteenth annual convention of the Associated Advertising Clubs of the World at the Milwaukee meeting, June 11 to 15. Another speaker will be Edward S. Jordan, president of the Jordan Motor Car Co.

Plants Speeding Up in All Branches of the Indusry

Hanson Doubles Production

ATLANTA, May 17—April production of the Hanson Motor Co. of five cars daily is being doubled this month and the company is still behind on orders. While orders are being received from all sections of the country, New England business is declared to be showing an unusual increase. New agencies recently opened include New Orleans, Pittsburgh, Milwaukee, Cincinnati and Knoxville. An agency contract has also been closed with Scott-Young, Ltd., of Australia and orders have been placed by this concern for 20 cars monthly.

Tank Factories Active

FORT WAYNE, IND., May 16—Wayne Tank & Pump Co. reports that it now has 725 employees and is adding to its force. Two shifts are working in the machine shop, putting in 80 working hours a week, and other factory departments are operating at nine and a half hours a day.

S. F. Bowser & Co., Inc., tank and pump manufacturer, is employing 1400 men. S. B. Bechtel, the president, says: "We are working a full force full time on the day side and are working a small night force in the machine shop. Business is picking up, and general conditions are looking very good."

Thousandth Rickenbacker Shipped

DETROIT, May 15—The Rickenbacker Motor Car Co. produced and shipped its one thousandth car, May 10, this total output having been reached in less than three months, and about 60 days after the company got into volume production. The feat was made the occasion of a factory celebration in which all executives participated. The car, after a short triumphant trip, was made part of a shipment to the Kaar Motor Car Co., San Francisco distributor.

Greater Parts Schedules

PONTIAC, MICH., May 15—The Standard Auto Parts Co.'s branch here has been increasing its production schedules, chiefly on spring for Fords and other jobs, to such an extent that some sections of its shop are now working three shifts daily.

Growing Demand for Tires

SPRINGFIELD, OHIO, May 16 — President H. S. Berlin of the Victor Rubber Co., upon his return from a visit to the branches and various cities in the Southwest, stated that he and H. A. Grubb, salesmanager, found conditions very encouraging. "Things are improving in the Central West and the Southwest," he said. "We have just returned from a trip to Chicago and the Southwest, including, Kansas, Texas, Oklahoma, the oil country and the wheat belt. Weather conditions have been trying lately, but now there is an improvement. As a result there is an increasing demand for rubber tires."

Berlin stated that the Victor plant is operating full time five days a week. This schedule will be continued until inventories have been reduced.

EMPLOYMENT STILL GAINING

DETROIT, May 15—A further increase of 3,683 employees, making a new high total of 158,889 on the payrolls of the members of the Employers Association, was reported for the week ending May 13. This is 40,000 above the corresponding week last year, and only 30,000 less than for the corresponding week of 1920.

Franklin Schedule Increased

SYRACUSE, May 15—The Franklin Automobile Co. reports that it has increased its production schedule 43 per cent, the company expecting to operate at the rate of 14,000 cars a year by May 27. May shows every indication of exceeding all former records done by Franklin dealers in that month, 403 deliveries having been registered May 1 as a start.

Tire Company Gets Year's Contract

MARION, OHIO, May 15—The Studebaker-Wulff Rubber Co. has received an order from the Stewart Oil Co., Macon, which distributes through the State of Georgia, calling for 50 casings and 60 inner tubes a day for one year from May 1. The tire company reports that since it started production in March it has received orders faster than it could increase its output.

Peerless Cars by Trainloads

DETROIT, May 17—Peerless cars are leaving the plant by trainloads, says an announcement from the factory. Not less than five freight trains of cars have left the plant during the last few weeks, and plans are now being made for two more trainloads to follow. Each shipment consists of more than 60 automobiles. Orders are being received in increasing numbers from the West.

Haynes and Apperson Gain

KOKOMO, May 16—The plant of the Haynes Automobile Co. is said to be operating near to capacity and working up to a schedule of forty cars a day. The Apperson plant is also feeling the increased spur of the revival and is now said to be at about 75 per cent of capacity.

Maxwell Increases Force

DETROIT, May 16—Maxwell Motor Corp. has added a sufficient force to produce 300 cars a day, the capacity of its plant.

Truck Output Increasing

SPRINGFIELD, OHIO, May 16—Additions were made during the past week to the force at the plant of the Kelly-Springfield Motor Truck Co. Production is steadily increasing to meet the demands of the trade.

Owing to the scarcity of material, the Springfield works of the International Harvester Co. is having difficulty in keeping up its schedule of 50 light motor trucks a day. It is hoped to get up to the schedule this week.

Dudlo Adding to Factory

FORT WAYNE, IND., May 15—Dudlo Manufacturing Co., which produces coils for Ford and a number of other concerns, is rushing a new building to completion to relieve the crowded factory condition. The Peru plant of the company which has just been opened will probably put in winding machines for Ford coils. There are now 1200 men employed at this plant, which is the greatest force in its history. A night force has been installed, and within the month more men will be placed on the force to operate winding machines.

Moon Exports Show Big Gain

ST. LOUIS, May 15—Foreign shipments of Moon cars for April were greater than for any one month since July, 1920. Present indications are that May will show a further increase, E. H. Serrano, director of exports, reporting that the company has enough unfilled orders on hand to exceed April shipments by 100 per cent. While business is well scattered, Mexico offers the best market. At the present time shipments are going forward to Spain, Canada, Sweden, Canary Islands, Australia and Argentina.

Sterling Tire Increasing

RUTHERFORD, N. J., May 13—The Sterling Tire Corp. reports that by the middle of summer it expects to be producing 1500 tires daily. At the present time and since February, it has been turning out 1200 tires a day, which has necessitated 24 hour a day operation. Unless the capacity is increased, the company will be heavily oversold by July. March sales were larger than in any one month in the entire previous 14 years history of the company. The good conditions with the concern are stated to be due to increased production, more efficient management and sweeping cuts in selling overhead.

Motor Wheel Employing 1800

DETROIT, May 16—The Motor Wheel Corp. is now employing 1800 men as compared with 800 sixty days ago, and is working many of its departments three shifts daily. The rim department at the Prudden unit is on a 24-hour basis and the machining department at the automobile wheel unit is on the same schedule.

Pierce-Lafayette Merger Abandoned

Smaller Bank Reported to Have Held Out for Higher Rates

NEW YORK, May 15—Announcement is made by the banking house of J. & W. Seligman & Co. that negotiations for the consolidation of the Pierce-Arrow Motor Car Co. and the Lafayette Motors Co. have been abandoned because of inability to agree upon terms. No further explanation has been given up to this time, although Colonel Charles Clifton, chairman of the board of the Pierce-Arrow company, said in Buffalo that a statement of the reasons would be given out in New York by committees representing both boards of directors.

It is understood that the negotiations failed because one of the smaller banks carrying part of the Pierce-Arrow loans would not come in under the plan tentatively agreed upon by other banks and directors of both companies. Under this plan the consolidated company was to issue approximately $10,000,000 notes or bonds, the proceeds to pay off bank loans of both companies and provide working capital. The dissenting bank held out for a higher interest on the new securities than other interests thought should be paid.

Action a Surprise

Announcement that negotiations were off came as a complete surprise, because it had been understood only a few legal difficulties, based upon the fact that the companies were incorporated in different states, stood in the way of their completion.

Under the consolidation plan, C. W. Nash, president of the Lafayette company and of Nash Motors, was to be in charge of operations as chairman of the board of the consolidated companies, while Colonel Clifton was to serve as president. The only explanation ever offered for the proposal to unite the two companies was that some of the surplus factory space of Pierce-Arrow could be used to build bodies for the Lafayette. It was stated that both cars would be continued as at present.

Pierce-Arrow is operating at a slight profit, with passenger car sales holding up well and truck business better than for the corresponding period last year. There is no pressing merchandising liabilities, but bank loans aggregate $8,000,000. Elimination of these through a note or bond issue has been under consideration and probably will be accomplished upon the first favorable opportunity.

WILL MAKE COATS BODIES

CHICAGO, May 15—The Coats Steam Car Co. announces that the F. Y. Stewart Manufacturing Co. of Bowling Green, Ohio, has acquired the factory of the Buckeye Body Co. at Columbus and will manufacture the bodies for Stewart-Coats steam cars and assemble the cars in that factory. The engines and boilers are being manufactured in the Stewart plant at Bowling Green. The Columbus factory is said to have a capacity of 35 cars a day. The general sales offices of the Coats company will be in Chicago.

"SPEEDIACS," NAME APPLIED IN SPOKANE

SPOKANE, WASH., May 15—Reckless and speedy automobile drivers—violators of the state motor vehicle laws—will be known as "speediacs" in the Spokane public press hereafter as the result of a slogan contest conducted by the Inland Automobile Association, to ascertain a fitting name to be used in branding automobile drivers who disregard the safety of fellow motorists and pedestrians.

For the best name offered, Frank W. Guilbert, secretary of the association, gave a prize of $10 cash. Three superior court judges, associated with speeders in the public courts, were named to select the winning name, as well as nine other best names.

"Speediac," the winner, with the nine other names, was sent to the American Automobile Association headquarters, Washington, to compete for national honors and a prize of $25.

Robbins & Myers Makes Financing Arrangements

SPRINGFIELD, OHIO, May 16—The Robbins & Myers Co., manufacturer of motors and fans, has completed arrangements for the underwriting of $3,000,000 bonds and $1,500,000 new stock, thus carrying out its refinancing plan.

F. S. Hunting of Fort Wayne, Ind., for 34 years with the General Electric Co., has been chosen president of Robbins & Myers, succeeding C. F. McGilvray, who has been in ill health for the past year. Hunting will also serve as general manager of the company. Wilbur J. Myers continues as vice-president, Warren A. Myers as secretary and H. E. Freeman as treasurer.

The company is now employing 1000 men and women. Its normal force is 2800 to 3200.

JORGENSON TO CONTINUE

MILWAUKEE, May 15—At the first meeting of creditors on May 11 of the Jorgenson Manufacturing Co., Waupaca, Wis., a voluntary bankrupt, opinions were expressed that the organization will be rehabilitated and the manufacture of Jorgenson primers and other automotive equipment resumed with but little delay. Lack of working capital caused the officers and stockholders to petition for a trusteeship to facilitate reorganization. Assets scheduled are $120,215, compared with liabilities of only $44,802.

Plant Service Heads Endorse Flat Rates

Change of Sentiment Evident at Convention—Small Number Against System

DETROIT, May 16—Flat rates turned out to be the big subject the first day of the factory service managers' convention being held at the Hotel Statler. Sentiment has undergone a great change in the last few conventions, and practically all managers are now in favor of the system in one form or another, but there was considerable discussion as to just the best way. Some prefer a flat rate on both time and material, but the majority prefer a flat rate on time only.

There is a small minority still prejudiced against the system with a rather surprising lack of knowledge displayed as to the extent of its application. Many dealers and distributors are far in advance of the factories in working out and applying flat rates.

Edward S. Jordan, president of the Jordan Motor Car Co., opened the session with a talk on fundamental thinking in the industry. He said it was possible to make money in the automobile business by advertising enough and promising enough, but that the business would not stick without service and if too much were promised the service department would not be able to make good and the product would fall down.

He made a strong appeal for a single purpose and a single model, and said that producing 20 models in one plant brought all the service problems of 20 service departments in 20 plants.

"Pirate" Parts Discussed

Other topics taken up were pirate parts and the difference between them and substitute parts. It was conceded that the problem of the substitution part is a competitive one and can be met only by right prices, quality goods and extensive distribution. A communication from the Body Builders Association, asking for co-operation in formulating suggestions for the June convention was referred to a committee headed by S. T. Norton.

H. H. Rice, president of the Cadillac Motor Car Co., related some early experiences in the industry and spoke highly of the service work done in the past few years.

Don Hastings, Hupmobile distributor in Detroit, presented a comprehensive picture of the retailers' problems and told how necessary it was for the retail organization to be prepared to service the vehicle correctly. In his opinion the retail service station is the feeder for the sales department, and fully half the prospects are secured through satisfied customers. The subject of dealer education was handled by R. A. Shelly of the Dort Motor Car Co., and Harry Moock of the Hudson Motor Car Co. told of the great need of the small town dealer for information and real assistance in his service problems.

Hudson-Essex Fixes Ratio of Exports

Heavy Increases in Demand Abroad Have Made Settled Percentages Necessary

DETROIT, May 17—Heavy increases in the Hudson-Essex export business have caused the company to establish a fixed percentage of the total output of the two lines for its export business and orders are now being taken subject to delivery as the export proportion of its product permits. In fixing the export ratio, factory officials declare that the company has taken into consideration the plight of the export agents in the past eighteen months and has favored them slightly over the domestic distributing organization.

European business, hitherto slow, is picking up briskly, and orders are booked up for some time to come. England for the first time is reported ordering closed cars in surprising volume. Shipments have been resumed to the northern European countries, including Denmark, Norway and Sweden. Canadian business is reported becoming especially good.

The receipt of a letter recently from a dealer in Java is reported by the company, in which the dealer said business prospects were very poor and that he did not know when an order for a volume shipment might be placed. The day the letter arrived a cable was received from the same dealer ordering $50,000 worth of Hudson and Essex cars for immediate shipment.

South American business, especially in the Argentine, is reported increasing rapidly. South African business continued steady despite the recent labor disturbances and showed slight increases. Good business is reported from Australia in which the closed car demand features in increasing quantity. Shipments are now being made to fifty companies, and to date these exceed 1921 shipments by 250 per cent.

G. M. President Reports Good Export Conditions

NEW YORK, May 16—Good conditions in export business were reported by Pierre S. duPont, president of General Motors Corp., upon his return from an inspection trip of the plants of General Motors of Canada, Ltd., at Oshawa and Walkerville, Ont., taken in company with other officials of the corporations.

In speaking of conditions, duPont said:

The corporation is developing in its Canadian plants a line of export models which meet the requirements of foreign countries in the matter of taxation, fuel consumption, weight, tire mileage and economical upkeep, which are major considerations in influencing the purchasing of American products in foreign countries.

The export business of the corporation is running three times what it was forecast six months ago. Recently a solid trainload of automobiles left for St. John, N. B., whence they will be shipped to General Motors, Ltd., our English subsidiary, for distribution in Great Britain. In this one shipment there were 315 passenger cars. The value was $320,000 and transportation charges were $40,000.

The foreign demand for all General Motors cars is strong, especially Buick and Chevrolet. In the three and a half months from Jan. 1 to the middle of April the total shipments of all General Motors cars from the factories of General Motors of Canada were 10,126, compared with 4,102 cars in the corresponding period of 1921.

Marmon Has Unfilled Orders Exceeding 500

INDIANAPOLIS, May 16—Manufacturers here are experiencing the phenomenal increase in business that has been general the last two months. Marmon has over 500 unfilled orders, or approximately one months' delivery. The factory is producing 20 cars a day and may reach capacity of 25 daily before the end of the month. The recent price reduction had a very stimulating effect and an unexpectedly heavy increase for wood wheels is following the newer prices.

The Midwest Engine Corp. is producing at the rate of 500 engines per month, and releases on engine shipments to tractor companies are coming in, some of these being the first for many months.

F. A. BURGESS DIES

CHICAGO, ILL., May 16—F. A. Burgess, president of the Burgess-Norton Manufacturing Co., Geneva, Ill., manufacturer of B-R piston pins, died suddenly from heart disease, May 14.

N. A. C. C. COMPILES FIGURES OF INDUSTRY WHICH COVER YEAR 1921

NEW YORK, May 16.—Automobile statistics for the year 1921 as prepared by Alfred Reeves, general manager of the National Automobile Chamber of Commerce, show the registration in the United States of about 10,448,632 cars and trucks, a gain of 13 per cent over 1920. Production of cars and trucks for the year is given as 1,668,550, of which 154,550 are trucks. The combined wholesale value of these was $1,260,000,000. The figures are shown in the following table:

PRODUCTION IN 1921	
Cars and trucks produced	1,668,550
Passenger cars produced	1,514,000
Motor trucks produced	154,550
Wholesale value of cars and trucks produced	$1,260,000,000
Wholesale value of passenger cars produced	$1,093,918,000
Wholesale value of motor trucks produced	$166,082,000
Wholesale value of parts and accessories output	$409,710,000
Value of tire replacements	$542,358,420
MOTOR VEHICLE MANUFACTURING BUSINESS	
Capital invested	$1,423,500,000
Cost of material bought	$1,057,230,000
Number of employees	186,000
Wages and salaries	$299,098,780
TIRE AND FUEL FIGURES	
Gasoline produced, gallons	5,153,549,318
Gasoline consumed, gallons	4,516,012,979
Tire casings produced	27,275,000
MOTOR VEHICLES USED ON FARMS	
Cars and trucks on farms (approx.)	3,000,000
Automobiles on farms (approx.)	2,850,000
Motor trucks on farms (approx.)	150,000

Associated Industries Approaches Launching

CHICAGO, May 15—An announcement is expected to be made this week of the formal launching of the Associated Motor Industries—but under another name that it is felt will be more distinctive and have greater selling power. The consolidation will probably include ten of the strongest automotive companies that have been considered, but what they will be will depend upon the attitude of the banking interests that have carried on the investigations.

The consolidated organization plans to operate factories making completed cars and all parts except tires in various parts of the United States, probably in nine different states, with general offices, which will exert centralized control over all activities, in Dayton, Ohio. Dealer and purchaser financing will be arranged.

Associated Motor Industries was incorporated nine months ago in Delaware with a capitalization of $80,000,000.

NEW BODIES FOR HAYNES "75"

KOKOMO, IND., May 16—The Haynes Automobile Co. is fitting its model "75" chassis with two bodies which are new to the chassis, these being the 5-passenger brougham and the 2-passenger "Blue Ribbon" speedster. These body types were previously fitted to the model "47" chassis. The driver's seat in the brougham is upholstered in leather, and the side tire carriers are mounted at the front end of the three-quarter length runningboard on each side.

Brands Registration Bill as Monstrosity

Former A. A. A. President Denounces U. S. Measure Calling It Impracticable

WASHINGTON, May 13—Characterizing as a "monstrosity" the Mills bill providing for a $2 registration tax on all automobiles, Dr. H. M. Rowe, former president of the American Automobile Association, denounced the measure before the Ways and Means Committee of the House, and declared it was impracticable. Much additional opposition to the proposed legislation was also voiced by other witnesses at the first hearing before the committee. Melvin P. Bender, attorney for the New York Automobile Federation, declared that the measure, if enacted into law, would cost American motorists an average of $22 in time and money.

If the bill is passed, it was charged at the hearing, automobile manufacturers will be charged with the duty of stamping on each body and each engine a serial number. For this, it was contended, there must be a charge and consequently an increase in price. In the changing from winter to summer bodies, the owner of an automobile, under the provisions of the bill, must get a special title for the new body not stamped.

American motorists at the present time are paying $344,000,000 Federal and state taxes, the figures presented showed. Under the Mills bill it is expected that the $2 tax will bring in $26,000,000 a year and will mean the creation of thousands of new Federal jobs, in the opinion of Dr. Rowe.

Hiram Todd, U. S. District Attorney for the Northern District of New York, appeared in favor of the bill, contending it would prevent the theft of cars, would reduce insurance and states that the bill had the approval of the Treasury and Justice departments.

Salt Lake City Reports Best Week for Past Year

SALT LAKE CITY, May 13—According to Carl L. Snow, secretary of the Inter-Mountain Automotive Trades Association, more cars were sold last week in this city than in any other single week for the past year. Many dealers have sold out all their stocks and make deliveries direct from the cars. Snow says one reason for the rush is that spring was a month late this year and many buyers held up their orders until the weather was good.

The industrial situation in this territory is better now than it has been for the past eighteen months or two years. The metal mines are open again.

CHANGES AT MITCHELL BRANCH

NEW YORK, May 16—A. G. McMillan, general sales manager of the New York Mitchell Motor Co., has been transferred to the factory at Racine, where he will supervise the working out on a national scale of the plan of sales organization adopted by the New York company. Paul C. Lott, sales promotion manager, has also been transferred to the parent company, his position in New York being occupied by N. R. Cooper. T. L. Coleman has been appointed vice-president and general manager of the New York company as successor to N. W. Dingwall, resigned.

Reo Lengthens Day and Shortens Week

DETROIT, May 18—Reo Motor Car Co. has adopted temporarily a five-day work week made up of five 10-hour days instead of the former five-and-a-half-day week which, after two weeks operation, is declared to be working satisfactorily and giving the company a better production week than formerly. Fifty hours each week are put in by workmen as before without the breakover into the half-day at the week end.

Officials said the schedule, while adopted primarily for the summer so that workmen would have more time for gardens and for week-end vacation trips, might be extended over the full year as a more economic method of factory operation. Divided interest among the men on the short day made it difficult to keep up the high production of the rest of the week. In five 10-hour days, production is found to run considerably higher. The company is operating on a schedule of about 130 motor vehicles daily, divided almost equally between speed wagons and passenger cars.

New York Registrations So Far Aggregate 20,081

NEW YORK, May 15—Registration of new cars in ten counties in and around New York aggregated 21,081 for the first four months in 1922, as compared to 11,510 for the same period last month. April showed a good gain over the preceding month, both in the high and lower priced classes.

Of the cars priced at $2,500 or less, 14 have registered more than 200 since the first of the year, 3 have gone over the 2000 mark and 1 has nearly approached that figure. The remaining go from 228 to 579. In the higher priced class 9 cars have registered more than 40 for the first four months.

A summary of registrations for the ten counties, taken from the monthly report of Sherlock & Arnold, publishers of the Automobile Sales Analysis, is as follows:

Cars Below $2,500	1922	1921
January	2,018	483
February	2,231	1,409
March	6,354	3,396
April	8,407	4,810
Total	19,010	10,098

Cars $2,500 and above	1922	1921
January	283	145
February	273	210
March	632	487
April	883	570
Total	2,071	1,412

Federal Department Is Filming Industry

Work Starts at Studebaker Factory—Pictures for Foreign Distribution

WASHINGTON, May 16—Advertising of the American automotive industry by moving pictures will be one of the biggest steps in the progress of the industry, and the long realized "dream" will be a reality in less than a month, according to the Department of Commerce. Actual work of filming the industry, the department announces, has already begun, under the immediate supervision of Morton F. Leopold, engineer in charge of motion picture activities of the Bureau of Foreign and Domestic Commerce.

The film, which will be called "The Story of an Automobile," is being made at the plant of the Studebaker Corp., at South Bend. When it is completed, it will be brought here and reviewed by a board composed of government engineers and other representatives of the Department of Commerce, who will pass upon it before giving it the government's official endorsement.

Government to Handle Films

Distribution of the film will be entirely under government supervision. Fifty copies will be released simultaneously for showing in South America, Australia and Africa, these being considered by the government as being the most potential fields for automotive export business. Arrangements have been made to show it in Rio de Janeiro during the World's Fair to open there this fall.

Hundreds of scenes are being taken both inside and outside the factory. An airplane was brought from Chicago to film exterior scenes, in order to give a bird's eye view of the magnitude of a modern American automobile plant. At all times a government check will be made on titles and quotations.

BLACK IS A. E. A. CHAIRMAN

BALTIMORE, May 16—S. D. Black, president of the Black & Decker Manufacturing Co., has been appointed chairman of the foreign trade committee of the Automotive Equipment Association. Through his efforts, Gordon Lee, chief of the automotive division of the Department of Commerce, will address the convention of the association at Colorado Springs in June as the representative of Secretary Herbert Hoover.

S. A. E. MEETING IN NEW YORK

NEW YORK, May 17—The metropolitan section of the Society of Automotive Engineers will meet at the Automobile Club, May 25, at 8 p. m., to discuss rail cars. Introductory remarks will be made by Roy H. Wright of *Railway Age*, and a paper will be presented by W. L. Bean of the New York, New Haven & Hartford Railroad, who recently had charge of the trip to New Haven.

Many Firms Occupy Big G. M. Building

Companies With Offices Outside City Locate Detroit Headquarters in Structure

DETROIT, May 13—Space in the General Motors building which has been set aside for Detroit headquarters of companies prominent in the automotive industry whose principal offices are located outside of Detroit is rapidly being taken over. It was the plan of the corporation to set aside the first two floors in the east wing of the building, but this has been extended so that more space might be available.

A list of the companies now maintaining their Detroit headquarters there follows:

American Brass Co., American Enameled Magnet Wire Co., American Wood Working Machine Co., Anchor Webbing Co., R. W. Angstam, Atlas Lumber Co., Auburn Button Works, Bound Brook Oil-Less Bearing Co., John W. Brown Manufacturing Co., John W. Brown Lamp Co., Bryant Engineering Co., Buffalo Bolt Co., Builders Iron Foundry. Carbonater Sales Co., Garrick Engineering Co., Casko Fabrics Corp., Clapp Manufacturing Co., Collyer Insulated Wire Co., Charles F. Craig, Cutter Electric & Manufacturing Co.

Doehler Die Casting Co., Dryden Rubber Co., Dunbar Bros. Co., Duratex Co., Electric Dynamic Co., Endicott Forge & Manufacturing Co., Felters Co., T. P. C. Forbes, Fowler Batting & Fibre Co., Garlock Packing Co., G. & W. Specialty Co., General Devices & Fitting Co., Gibb Instrument Co., C. T. Goodwill, J. C. Haartz, Inc., Hadley Bros.-Uhl Co., Haynes Stellite Co., Hill Pump Valve Co., Hinkley-Meyers Systems Co., Instrument Supply Co., Nathan H. Jewett, Joyce-Koebel Co.

Kent-Moore Organization, Keystone Battery Co., E. G. Krentler, J. J. Lamb & Co., Lasalle Steel Co., Liggett Spring & Axle Co., Linde Air Products Co., Liptak Fire Brick Arch Co., MacBeth-Evans Glass Co., Maring Wire Co., Markomi Co., Inc., Mica Insulator Co., Moloney Electric Co., Mono Corp. of America, Walter G. Morley, Motor Industries Corp., National Seal Co., National Spring & Wire Co., Nugent Sand Co., Ohio Electric & Controller Co., Otis Steel Co., Pittsburgh Steel Products Co., Portland Monson Co., Prest-O-Lite Co.

Republic Flow Meter Co., Henry Richardson, H. G. Seal Co., Schweitzer & Conrad, Inc., Seneca Iron & Steel Co., J. Spaulding & Sons Co., Stackpole Carbon Co., H. A. Strickland, United Conveyor Co., Washburn Wire Co., Whaling & Hartman, Wickwire Spencer Steel Co., C. E. Wise, Youngstown Sheet & Tube Co., N. C. Leidgen, Penco Corp.

STRATTON WITH VACUUMETER

CLEVELAND, OHIO, May 18—F. S. Stratton has resigned as general sales manager of the Grant Motor Car Co. and has accepted a similar position with the Vacuumeter Manufacturing Co., this city.

NEW TIRE VALVE EXHIBITED

CHICAGO, May 12—Representatives of the All-Metal Valve Co. of Detroit exhibited the Holt all-metal tire valve to members of the Midwest Rubber Manufacturers Association at the association's meeting here. It was claimed that the patented construction of the valve, in in which there are neither springs nor washers, makes it absolutely non-leakable.

Production for April Now Placed at 216,000

NEW YORK, May 16—While final figures on April production have not been compiled, additional carload shipments reported to the National Automobile Chamber of Commerce since the first estimate of 213,000 was made now bring the total output of cars and trucks for the month to 216,000. This figure is 4000 below the record established in March, 1920, which was the largest month in the industry, but far in excess of August, 1921, which was the biggest month that year with a production of 180,781.

Predicts Early Adoption of Rural Roads Program

WASHINGTON, May 16—Early passage of the Federal Government's bill embodying the rural post roads program, funds for which were provided in a bill by the House on May 1, has been predicted by the Senate Post Office and Post Roads Committee.

The funds for the good roads program in the Senate are tied up in this committee at the present time in the form of an amendment to the Post Office Appropriation bill.

Price Cuts on Westcott Range from $200 to $600

SPRINGFIELD, OHIO, May 15—The Westcott Motor Car Co. announces price reductions ranging from $200 to $600. The list follows:

	Old Price	New Price
A-44 Standard Phaeton	$1,890	$1,690
A-44 Special Phaeton...	2,190	1,890
A-44 Special Sedan.....	2,890	2,690
C-48 Phaeton	2,090	1,890
C-48 Sedan	3,490	2,890
C-48 Limousine—Sedan.	3,690	3,090

HYDRO TIRES REDUCED

POTTSTOWN, PA., May 15—The Hydro United Tire Co. announces a price reduction of 20 per cent on all Ford sizes and 10 per cent on all other sizes.

TWIN CITY TRACTOR LOWER

MINNEAPOLIS, May 15—The Minneapolis Steel & Machinery Co. has reduced the price of its 20-35 Twin City tractor from $2,950 to $2,750.

CORRECTION

Prices of the 3 and 4 passenger models of the Paige car continue at $2,495 and $2,245, respectively, no revisions having been made as was stated in the May 4 issue of AUTOMOTIVE INDUSTRIES.

New Gasoline Prices Rouse U. S. Senator

Congressional Investigation Demanded—Production of Refineries Show Increase

WASHINGTON, May 15—A Congressional investigation into the price of gasoline has been demanded by Senator McKellar of Tennessee in a resolution introduced in the Senate. McKellar asked that a probe be conducted immediately to explain why the price of gasoline has been increased throughout the country, despite the decreased cost of crude oil, and hinted that there has been an agreement between various companies to make price increases simultaneously.

Production Increased.

Simultaneous with the introduction of the McKellar resolution, the Bureau of Mines announced that the production of refineries shows an increase in March of 3 per cent over the month of February.

Data gathered by the Federal Government show that the present stocks of gasoline amount to 854,232,000 gallons, which is 20 per cent greater than for April 1 last year and 36 per cent greater than for April 1, 1920. Domestic consumption of gasoline shows an increase of 7 per cent over the first quarter of 1921 and 25 per cent over the first quarter of 1920. Exports and shipments are the only figures for the past three months that do not show material increases over those of previous years.

The daily average output of gasoline for March amounted to 15,234,770 gallons, as compared with a daily average of 13,541,787 for the same month last year. The total production of gasoline during March amounted to 472,277,870 gallons. The daily average production of lubricating oil during March, 1922, amounted to 2,367,460 gallons, as compared with 2,354,945 gallons for the same month last year. The present reserve of lubricating oil is 236,886,000 gallons.

Louisiana Takes Action

NEW ORLEANS, May 15—Sweeping investigations are being made here as a result of the rise of from 23½ cents to 27½ cents per gallon for gasoline in four days. State Attorney General Coco has already begun an inquiry as to the sudden jump in prices, which were made simultaneously by all the oil companies operating in the city. In behalf of the state, it is stated that an investigation is about to be started by the American Automobile Association and the Motor League of Louisiana, and it is expected that the Department of Justice of the United States will shortly launch an investigation.

NEW D. T. & I. MANAGER

INDIANAPOLIS, May 15—Fred L. Rockelman, general manager of the Ford Indianapolis branch, has been made manager of the Detroit, Toledo & Irontown Railroad, taking office immediately.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Continued ease was manifest in the local money market last week, with call loans covering a range during the week of 3½ per cent to 4½ per cent, as compared with 3½ per cent to 5 per cent in the previous week. On May 12 the renewal rate was 3¾ per cent, the lowest since April 30. The market was reported dull and inactive for fixed date maturities. Few, if any, large loans were made, and although funds were in fair supply, the inquiry was light. All maturities from sixty days to six months were quoted nominally at 4¼ per cent. The prime commercial rate was 4¼ per cent as in the previous week.

On May 10 demand sterling went to $4.45, marking another new high record in the current upward movement and the highest point reached in nearly three years. This advance was not sustained, however, and subsequent quotations sagged.

Unfilled orders on the books of the United States Steel Corp., as reported for April 30, totaled 5,096,917 tons, the largest amount since June 30, 1921, and an increase of 602,769 tons as compared with the end of March. This increase in unfilled tonnage, together with heavy shipments during the month, estimated at approximately 1,000,000 tons, indicates that new business received in April was approximately 1,600,000 tons, the largest amount reported in any month for nearly two years.

The steel ingot production in the United States in April is reported to be 2,439,246 tons, an increase of 68,495 tons in excess of the March output and more than double the output for April 1921. Production in April, 1922, was at the annual rate of 34,746,000 tons, or an equivalent of 66.2 per cent of the country's capacity. In March the annual rate of production was 33,787,400, or 64.3 per cent of capacity; in February it was 24,889,600, or 47.2 per cent.

After its recent advances, our foreign trade showed a decrease in April. Exports for the month totaled $321,000,000, compared with $330,000,000 in March, and imports amounted to $217,000,000 against $256,000,000 in the previous month. Exports during April were the lowest for any month of the current fiscal year, and about $19,000,000 less than for April, 1921. Imports were the lowest since February and approximately $37,000,000 less than for the corresponding month last year.

For the ten months ended with April, exports aggregated $3,131,000,000 against $5,850,000,000 during the corresponding ten months of 1921. Imports for the period were $2,095,000,000, as compared with $3,264,000,000 during the ten months ended April, 1921.

BLOEMFONTEIN DEALER HERE

NEW YORK, May 16—J. S. Short, manager of Lambon & Co., Ltd., Bloemfontein, Orange Free State, reports, on the occasion of a visit to this country with his wife, that conditions in South Africa are greatly improved, with every indication that the diamond mines will soon reopen. He states that despite the fact that British cars are favored by preferential tariffs and have the additional advantage of an adverse exchange rate, American cars practically have a monopoly of the situation for the reason that British cars are still too high priced.

Hudson Land at Pontiac Not for Airship Building

PONTIAC, MICH., May 16—Denial has been made by Vice-President Howard Coffin of reports that the Hudson Motor Car Co. proposes to utilize for aircraft manufacture the large holdings of land in the vicinity of this city which were purchased by him and President Roy D. Chapin.

Under the name of the Calumet Development Co., Chapin and Coffin bought the 200 acres comprising the holdings two years ago, and since then have been doing development work there in the way of improved roads. Coffin is actively interested in the project for a belt line railway to be put around three sides of the city by the Grand Trunk Railroad, right-of-way for which has nearly all been secured. Construction work is expected to start this summer. No definite statement as to the use to be made of its holdings has been made at any time by the development company, but the Michigan Air Line tracks and the new belt line are expected to make it available for factory sites.

Manila Company Formed to Promote New Engine

LOS ANGELES, May 15—Advices from Manila, Philippine Islands, tell of the formation of a company to promote the manufacture of a new type of two-cycle engine, applying the so-called Junker principle, which has been invented by C. J. H. Penning, resident engineer for the Honolulu Iron Works.

In the new Penning engine the explosion takes place between two pistons which are working in a cylinder open at both ends. The exhaust gases escape through a port in the cylinder wall, which is uncovered by one piston at the end of its stroke, and immediately afterward the other piston uncovers another port which admits a fresh charge into a cylinder. The result is said to be complete scavenging of the exhaust gases from the cylinder.

DODGE BROTHERS, LTD., FORMED

DETROIT, May 15—Instead of requiring its dealers in Great Britain to finance car shipments from Detroit personally, Dodge Brothers has organized Dodge Brothers, Ltd., which will handle sales as an intermediary between company and its British dealers. Similar companies may later be established elsewhere.

FINANCIAL NOTES

U. S. Tractor & Machinery Co. at Menasha, Wis., is marketing an issue of $250,000 7 per cent gold bonds, secured by a first mortgage, the trust deed running to the First Trust Co. of Appleton, Wis. Work will begin at once on the construction and equipment of a new foundry, and several extensions of the machine shops and assembling floor. J. M. Robinson, formerly of the International Harvester Co., is now president and general manager of the Menasha corporation. The bond issue is to enable the company to carry out its plan of enlarging its tractor manufacturing business to embrace tractor implements and power-driven farm machinery.

Republic Rubber Corp. receiver, C. H. Booth, says: "The proceeds from the sale of certificates of indebtedness have been used entirely for the purpose of carrying larger accounts receivable and larger inventories commensurate with the increasing volume of sales. Overhead expenses are still at a minimum, but an equitable adjustment of salaries will have to commence at an early date thus somewhat increasing expenses." The company is behind orders to the extent of 60,000 tubes and sales of casings are exceeding production at its Youngstown plant. The Canton property is turning out 1800 casings daily.

Daniels Motor Co.'s 8 per cent cumulative preferred stock to the number of 10,000 shares is being offered through Gillespie, Meeds & Co. The stock has a par value of $100 and yields 8.42 per cent. With each share of this stock there will be given a warrant for two shares of common stock of no par value upon payment of $10 a share. The purpose of the new issue is to provide funds to pay off all bank loans and increase the company's working capital to care for the increased business now being received.

Stewart-Warner Speedometer Corp. for the quarter ended March 31 reports a surplus of $95,451 after providing $64,867 for Federal taxes and $356,100 for dividends. Profit and loss surplus totaled $7,871,803. Current assets were $6,810,207, against current liabilities of $462,843. Cash was $590,793; accounts and notes receivable $1,717,602, and accounts and vouchers payable $307,402.

Autocar Co.'s first mortgage sinking fund 7 per cent convertible bonds to the amount of $2,500,000 are being offered through Janney & Co. and Redmond & Co., New York. They are due May 1, 1937 at 100 and interest. Bonds are convertible into 8 per cent cumulative preferred stock par for par.

Packard Motor Car Co. has retired $1,000,000 of its 10-year notes, reducing the amount outstanding as of May 10 to $8,250,000. In addition, the company has increased its investments in United States bonds $1,700,000. On May 10 the cash on hand totaled $5,107,000 compared with $3,890,000 Feb. 28.

Vig-Tor Axle Co., Cleveland, manufacturer of internal gear drive axles for motor trucks, is marketing 5000 shares of 8 per cent cumulative preferred stock of a par value of $100. The company offers this stock, subject to prior sale, with a bonus of common to yield more than 8 per cent.

Sterling-Knight Motor Co., Cleveland, is offering through the Cleveland Trust Co. $600,000 8 per cent first mortgage ten-year gold bonds and 20,000 shares of no par value common stock at $10 a share.

J. I. Case Threshing Machine Co. has declared the regular quarterly dividend of 1¾ per cent on the preferred stock payable July 1 to stock of record June 12.

INDUSTRIAL NOTES

Amco Co., Indianapolis, which bought the assets, plant, manufacturing and sales rights of the American Metals Corp. that went into the hands of a receiver in February, has completed its incorporation with William B. Paul president and Guy Lemmon secretary and treasurer. For the present the company is limiting the scope of its production, but expects to broaden its activities to take in the automotive accessories and equipment specialties originally produced by the American Metals Corp. Distribution will be through a limited number of large automotive equipment jobbers.

Six Wheel Truck Co. of Fox Lake, Wis., which recently arranged with Waupun capital to assist it in relocating, has purchased a site at Waupun, Wis., and work is already under way on the first unit of its new plant there. Construction is expected to be completed by June 15. The company manufactures a heavy-duty motor truck designed by F. N. Pettigrew of Fox Lake, who is president and chief engineer. The design has been in limited production for two years at Fox Lake.

Motor Parts Corp., Forestville, Conn., has been closed as a result of the vote of directors to terminate the business. The directors are acting as trustees with William L. Cafferty as their agent. Sept. 30 has been set as the time limit for filing claims and in the meantime an inventory of all assets and liabilities will be taken. There is considered to be every probability that the company will pay claims in full. The corporation was seriously affected by the past business depression.

Jack Tire & Rubber Co., owning the former plant at the Washington Tire & Rubber Co., Spokane, has started operations under the direction of T. G. Richards, president and manager. The daily production of the plant at this time is estimated at 70 tires and inner tubes. The plant has a capacity of 500 tires and tubes daily. Richards is assisted by W. E. Grier, plant superintendent, who was formerly general manager of the Boston Woven Hose & Rubber Co.

Batavia Rubber Co., manufacturer of the Batavia tire, has been placed in the hands of former Supreme Court Justice John Woodward of New York as receiver. This is the second time a receiver has been appointed, the last time the creditors being paid off in full with interest. It is stated that the receiver has power to either sell the plant or to continue to operate it, the probability being that operations will continue.

Duncan Truck Body Works has completed the erection of a modern brick factory in New Orleans. The company plans shortly to begin distribution throughout Louisiana, Mississippi and Arkansas, according to James H. Duncan, president. Sales are made direct to truck users as well as to dealers.

Capitol Motors Corp.'s building at Tiverton, Mass., has been sold to J. Edward Newton of Fall River, treasurer of the Barnard Manufacturing Co. The corporation formerly was engaged in manufacturing Capitol trucks but recently went into bankruptcy. The sale does not include the machinery.

Durant Motor Corp. has obtained a permit from the Oakland, Cal., building department for the construction of an office and administration building in that city to cost $100,000. The building will be of reinforced concrete, all-daylight construction and of one story.

Dixie Belle Refining Co. has been reorganized as the Louisville Refining Co. and will begin immediately the erection of a plant in Louisville. The company has a capital stock of $650,000 and the plant will have a capacity of 2000 barrels daily.

Miller Rubber Co. has leased a portion of the Standard Oil Cloth Co.'s plant near the Miller factory for storage purpose. This will release additional manufacturing facilities in the Miller plant, which has been operating close to capacity.

Columbus Auto Brass Co., Columbus, will soon complete the erection of a new building adjoining its plant for use as a repair department. This department now is being maintained a half mile away from the factory. New machinery will be installed.

American-La France Fire Engine Co., Inc. and its subsidiary, S. F. Hayward & Co., have moved their New York offices to the Fisk Building in Fifty-seventh street between Broadway and Seventh avenue.

U. S. Indestructible Gasket Co., New York, announces the consolidation of its executive, manufacturing and warehouse departments and its removal to 829 East Fifteenth Street, Brooklyn.

Eastern Parts Manufacturing Co., New York City, has been placed in the hands of Louis S. Posner as receiver. The liabilities are estimated at $150,000 and the assets, $25,000.

Garnishee Proceedings Approaching Decision

DETROIT, May 16—Testimony in the garnishee proceedings instituted by General Motors Corp. against two Lansing, Mich., banks to recover $490,000 paid Edward Ver Linden, as president of the Olds Motor Works, has been heard before William S. Sayers, master in chancery, and referred to Judge Tuttle for final disposition.

Bank witnesses testified that the money was issued to Ver Linden on a company's check drawn by himself and countersigned by another officer of the corporation, on which it was written that the money was an advance pending the adjudication of disputed claims. At Ver Linden's request, it was testified, the bank issued two cashier's checks for $170,000.

General Motors garnisheed the two banks in which the checks were deposited and their face value drawn, contending that the banks should have retained possession of the proceeds and not allowed the money to be withdrawn until the validity of the transaction was established.

WILSON WITH MOTOR WHEEL

LANSING, May 15—W. H. Wilson has been appointed works manager of the Prudden plant of the Motor Wheel Corp. Wilson has been identified with the automotive industry since he helped to build the first three cars turned out by Oldsmobile. He later became chief inspector at Olds, and subsequently was with the Cadillac and Leland organizations. Following the war he returned to Cadillac and then went to the Elizabeth plant of the Willys Corp. He left Willys to join Motor Wheel.

METAL MARKETS

Within the next few days sheet prices for third quarter delivery are expected to take on more definite shape. Some automotive orders for mid-summer shipment are said to have been placed with the price left open. In fact, sheet interests once more sing the praises of automotive consumers which class of buyers, they aver, is far more concerned about service and deliveries than about price. The independents predict that the chief interest will in the near future advance its sheet prices, the wish, of course, being father to the prophecy.

Non-integrated sheet producers are in a dilemma because of the tight conditions in the sheet bar market where $35 is seemingly the inside price for the relatively scant tonnage for which makers of this semi-finished description are willing to commit themselves. Surface indications, look where you will, tend to encourage the bullish frame of mind in which the steel industry finds itself these days. Building and railroad demand is expected to be active during the third quarter. With the return of the jug-handled accordion contracts, however, the danger of producers overselling and of consumers overbuying looms up. Sooner or later there must come a day of reckoning and, in spite of all theorizing regarding the sanctity of contracts, a readjustment of values to lower levels following top-heaviness is invariably attended by wholesale cancellations or evasion of contracts.

So far the volume of this sort of contracts which in a declining market invariably turn out to be nothing more than "scraps of paper" is very light but it is well to look the problem in the face before it becomes again so burning a one as it did following the post-armistice boom. Steel producers say they will not permit a repetition of the conditions that prevailed then. Some of them, however, are seemingly ready to book once more contracts against which they know full well there will be no specifications in a declining market. This means that sooner or later these contracts will become dormant which is a polite way of saying that they will be repudiated when the market declines. Of course, there have been periods in the past when steel producers succeeded in resurrecting such lapsed contracts by announcement of an impending advance.

Pig Iron.—Automotive foundries are buying mostly from hand to mouth, the feeling that the market has reached top becoming more and more general. Increase in production as the result of additional furnaces being blown in is not as rapid as had been expected.

Steel.—Heavy automotive buying of strip steel, involving orders ranging from single carloads to 1,000 tons, has taken place. Deliveries are slow. One producer is reported to have taken hot-rolled business in 3-in. sizes and narrower at 2.25¢ against recent quotations of 2c. Wider sizes are firm at 2 @ 2.10¢, base Pittsburgh. Hot-rolled bars for early shipment are held at a premium and as a result cold-finished steel bars wanted quickly could hardly be obtained below 2c, base. Good buying of spring wire by automotive consumers is noted and a $3 per ton advance in wire prices is predicted.

Aluminum.—The market for 98 to 99 per cent pure virgin ingots is fairly active, one inquiry for 1,000 tons being noted. Imports continue relatively heavy but most of the metal arriving has been sold.

Copper.—The market is steady.

Calendar

SHOWS

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

May — Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 6-21—Scheveningen, Automobile Show.

May 24 - June 5 — Barcelona, Spain, Automobile Show under Dealers' Direction.

May 28-June 5—Prague, Motor Show. Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiserdamm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Oct. 12-23—London (Olympia), International Commercial Vehicle Exhibition.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

May 30 — Indianapolis, International Sweepstakes.

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

May 19-20—St. Louis, Annual Meeting of the American Automobile Association.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee Annual International Convention of the Associated Advertising Clubs of the World.

June 19-20 — Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer Meeting of Society of Automotive Engineers. Detroit, May 19. The Pennsylvania section will hold an outing at Torresdale or a body meeting on May 25.

New "Fronty" Racer Has Ford Features

INDIANAPOLIS, May 15 — Two Fronty-Fords entered in the 500 mile speedway race seem to have aroused considerable interest. How much are they Fords? To get an answer to this question a visit was made to the Chevrolet Brothers plant to-day, where Louis and Arthur Chevrolet make Fronty-Ford eight-valve heads for Fords.

The two Fronty-Ford cars were nearing completion, with parts here and there, so one could check up. Regular Ford motor blocks and crankcases are employed with the Fronty-Ford, eight-valve head. Beside this, special oversize, counterbalanced crankshafts are used with larger than standard main bearings. Connecting rods, camshafts and pushrods are Ford standard.

The Ford transmission, main drive, differential, radius rods and rear axles are employed with special steel drive shafts. The frame and entire front axle assembly is special, with special front semi-elliptic springs, special steering knuckles and steering mechanism. Part of the frame and chassis change was said to have been necessitated by weight requirements of the race, but the reinforcing of the frame is noteworthy. Standard cross members of Ford make are to be used, it is said.

The Delco ignition set, with all parts aluminum weighs just four pounds. Aluminum alloy pistons, invented by R. E. L. Schaap and to be manufactured by the Rels Manufacturing Co., will be employed.

First One-Man Car Since 1911

INDIANAPOLIS, May 13—Frank E. Davidson, a New York engineer, has entered the D'Wehr Special in the tenth annual 500 mile international sweepstakes race on the Indianapolis speedway May 30 and will drive it alone. This is the first year since 1911 that the rules permitted one man to ride in the car alone.

The engine of Davidson's car measures 120 cu. in. piston content, the cylinders being approximately 2½ inches in diameter and the piston traveling a distance of 4¾ inches in its stroke. Rotary valves are used.

It is announced that Captain Eddie Rickenbacker will occupy the position of starter for the race.

Shipments of Casings Continue Steady Gain

NEW YORK, May 16—Statistics of the rubber industry for the first three months of the year as compared with the same period in 1921 follow:

PNEUMATIC CASINGS

1921—	Inventory	Production	Shipments
Jan.	5,319,605	703,430	965,417
Feb.	5,193,018	819,892	1,073,756
March	4,597,103	1,163,314	1,614,651
1922—			
Jan.	4,174,000	2,055,000	1,597,000
Feb.	4,691,000	2,084,000	1,562,000
March	5,183,286	2,645,790	2,073,963

INNER TUBES

1921—	Inventory	Production	Shipments
Jan.	5,586,163	740,824	1,042,617
Feb.	5,415,464	916,627	1,129,881
March	5,044,861	1,346,483	1,643,690
1922—			
Jan.	5,247,000	2,343,000	1,890,000
Feb.	6,142,000	2,597,000	1,703,000
March	6,991,118	3,017,511	2,090,737

SOLID TIRES

1921—	Inventory	Production	Shipments
Jan.	303,753	21,220	29,116
Feb.	304,374	23,365	29,599
March	283,800	28,710	43,926
1922—			
Jan.	182,000	40,000	33,000
Feb.	183,000	39,000	37,000
March	182,197	49,433	48,350

"Production" and "Shipments" figures cover the entire month for which each report is made. "Inventory" is reported as of the last day of each month.

"Inventory" includes tires and tubes constituting domestic work in factory and in transit to, or at warehouses, branches (if any, or in possession of dealers on consignment basis, and as a total represents all tires and tubes still owned by manufacturers as a domestic stock.

"Shipments" includes only stock forwarded to a purchaser and does not include stock forwarded to a warehouse, branch, or on a consignment basis, or abroad.

Columbia Operating Highway Machinery

BARRANQUILLA, COLOMBIA, April 21 (*by mail*)—The first road grading machinery to reach Colombia has recently been put into operation and will be used on the roads joining this city with the interior, passing through the cities of Galapa, Baranoa, Usiacuri and going as far as Sabanalarga. This road, it is expected, will also connect with the one being built from Cartagena toward the same destination. The government of this department also is purchasing a tractor for use with this road building machinery.

The petroleum industry is already an accomplished fact, and it is announced here that one of the larger companies will start local sales this month, bringing the price of gasoline from 70 to 42½ cents per gallon. This is expected to improve the possibilities of automobile sales very materially.

The last quarter of 1921 was quite lively, so far as the sale of new cars was concerned, but in January and February it quieted somewhat. Some importations are being made, and the trade is expected to better itself, especially with the decrease in gasoline prices and as more roads are built. The rise of coffee prices in the United States also will put the country in a better position for the future.

The interior is quiet, particularly in Bogota, which has been hit harder than any other part of the country; but on the whole, business is improving.

FLYING MEET IN MARYLAND

NEW YORK, May 16—The Aeronautical Chamber of Commerce is co-operating with the Flying Club of Baltimore in arranging a flying meet to be held at Logan Field, Dunalk, Md., on May 30. The program embraces events calling for participation by commercial airships.

AUTOMOTIVE INDUSTRIES
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Domestic Sales Depend Upon Export Stability

Buying power of Americans, especially farmers, determined chiefly by activity of export market. Business men at Chamber of Commerce of the United States meeting say industrial activity will continue. Complete recovery depends largely upon Europe.

By Norman G. Shidle

THE continued upward swing of business in the United States depends very largely upon the ability of American manufacturers to sell their surplus products abroad. Domestic business rests directly upon the stability of foreign countries and upon their ability to absorb a certain percentage of American products. The buying power of the American farmer, particularly, is strongly dependent upon the recovery of his foreign markets since a comparatively large percentage of the market for agricultural products in the past has been abroad.

Foreign trade can, therefore, be considered as an index of probable prosperity at home, since its advance or decline affects to a marked degree the buying power of the people of the United States. Some improvement has taken place in many of the countries of Europe, but stability has not yet been reached. Consequently, it is apparent that full industrial prosperity is not to be expected in the United States immediately.

The United States should not erect tariff barriers likely to hinder the free exchange of commodities with foreign nations. Europe can buy from us only through the exchange of goods and that exchange can take place only if our tariff laws are such as to encourage easy commercial intercourse with foreign merchants.

There is every indication, viewing both the foreign and domestic situation, that American business has started well on the road to recovery and that the present increase in industrial activity has a sound and permanent basis in general economic conditions.

These were the keynotes sounded at the Tenth Annual Meeting of the Chamber of Commerce of the United States, held in Washington last week.

The analysis of the general economic situation as presented at this meeting is specially encouraging when viewed from the standpoint of the automotive industry, since the constantly increasing volume of automotive exports during the last few months places it in a position of greater soundness than that enjoyed by some other industries. Fundamentally, however, automotive exports—and consequently domestic sales—will be subject to the same economic forces which affect other lines of business. Until European stability is achieved, complete domestic industrial recovery is not possible. Thus, the American automotive manufacturer has a definite and

practical reason to interest himself in the discussion concerning methods of obtaining European stability.

The necessity for such interest was emphasized throughout the big convention. It was brought home to the automotive industry most closely perhaps, when James R. Howard, President of the American Farm Bureau, pointed out the fact that the American farmer exports more than one half of his total cotton crop, almost one-fourth of his wheat, as well as vast quantities of other cereals and pork products. He then said that for this surplus production the farmer "must have, not only a market, but a profitable market" and that "because that market lies almost exclusively in Europe, the American farmer has a vital interest in the reconstruction of Europe." In this way, he showed that the prosperity of the American farmer is directly bound up with the European situation.

The farmer is one of the largest buyers of automotive products in this country. We have heard much about his "coming back" recently. It is undoubtedly true that the farm market for cars and trucks is again opening up. But it is apparent also, that the farmer will not be buying automotive products to a maximum degree so long as the countries upon which he depends to take his surplus production remain with budgets unbalanced and industry unstabilized.

This point was emphasized by other speakers throughout the convention. C. H. MacDowell, President of the Armour Fertilizer Works, said "The recovery and maintenance of a steady European market for our raw materials is one of our most important problems. . . This nation is still primarily a producer of surplus raw materials and foodstuffs. . . There is but one broad market to-day for our surplus cotton, copper, wheat, oil, coal, packing house products, naval stores, sulphur, timber, phosphate rock and many other things. This market is Europe."

Speaking for the lumber industry, Axel H. Oxholm, chief of the Lumber Division of the Bureau of Foreign and Domestic Commerce, brought out the same idea in this way: "The lumber industry should not forget that although an export trade of 7 per cent in volume seems of small importance, when 93 per cent of the total production is marketed at home, still if the lumber export trade is curtailed or entirely interrupted, this means that the 7 per cent of the total quantity of lumber produced will be thrown back on the domestic market and will seriously upset conditions at home."

These views of American export trade, give to automotive executives an interest in a phase of export that has not been much emphasized in the past. If the opening and broadening of foreign markets is essential to the domestic prosperity of many basic industries in the United States, the automotive industry has a vital interest in lending its aid and support to whatever program seems best adapted to help stabilize those foreign countries which may be expected to absorb our domestic surplus. Only in this way, can the domestic industries, upon whose prosperity the automotive industry depends for progress, go forward rapidly to sound and permanent industrial activity.

European Stability Essential

The general expression at the convention was conservative but optimistic in tone as regards the basis of general business prosperity in this country.

Starting from the basis that European stability is a fundamental of permanent industrial return in this country, the general opinion was that the corner has definitely been turned and that greater stability will continue to be evidenced during coming months.

The increased stability of exchange was noted as a favorable sign, while the recent rise in sterling caused considerable optimism. The comparative failure of the Genoa conference, however, and the unsettling factor of the Russian problem made it difficult to predict the date at which complete stability is to be attained.

Francis H. Sisson, Vice-President of the Guaranty Trust Co., struck the keynote of the general sentiment as regards the present business situation when he said, "Broadly speaking, there has been a decided trend toward slow but steady improvement for several months, and despite the continuance of certain adverse factors, the business outlook is decidedly more promising than at the beginning of the year."

Better Business Assured

This general feeling throughout the business world, as evidenced at this convention, is of great significance to the automotive industry. Our industry has made phenomenal strides since the first of the year. But increased sales and capacity production have been accompanied by conservative buying, conservative financing, and conservative planning on the part of automotive executives. The general upward trend of business, though thoroughly sound, has not been as rapid as that of the automotive industry. It has been so thoroughly founded on a firm basis, however, that good business for the automotive industry, and better business for the entire country is practically assured throughout 1922.

That the automotive executive, however, may visualize briefly the ideas on the general domestic business situation held by leaders in other industries, the following quotations from speakers at the convention are given.

Joseph H. Defrees, President, Chamber of Commerce of the United States:

"Have conditions failed to improve since the close of the greatest war in history now three and one-half years ago? I would hate to think that I would go so far as to aver it. What I must aver is that there has not been sufficient improvement to justify optimism as to the future —to create a feeling of stability as to conditions abroad or as to the effect of those conditions upon this country."

Silas H. Strawn, Chairman of the Board, Montgomery, Ward and Co.:

"The European nations cannot continue to purchase goods unless we purchase theirs. They cannot purchase our raw materials unless they have credit. They cannot establish credit until there is peace. There can be no peace until the reparation controversy is settled. Until then they will maintain large armies and until they reduce the armies they cannot balance the budgets. Until they balance the budgets they cannot stabilize exchange. . . How can there be any solution of international problems unless all the nations interested participate?"

Dwight P. Morrow, J. P. Morgan & Co.:

"With courage, with patience, with tolerance, this great country with its manifold activities should soon pass through its period of depression. In fact, the signs are many that we are already on the upgrade."

Arthur Balfour, Vice-President, Association of British Chambers of Commerce:

"I can say to you that in England certainly, and in some of the other countries, we have seen the worst. We are reaching economic conditions where trade on a proper basis will again be possible, and I am very hopeful that before the end of the year trade will begin to flow in its normal channels."

Franklyn Hobbs, Franklyn Hobbs Co.:

"Those of you who expect to see manufacturing capacity of this country running close to 100 per cent during the

next few years are sure to be disappointed. Don't shout prosperity; work for prosperity; 'The Lord helps those that help themselves.' "

W. Irving Bullard, Vice-President, Merchants National Bank, Boston:

"Unless there is an explosion in Europe May 31 over reparations, the tangle of public finances in that continent —so basic a factor in affecting trade—should be brought much nearer straightening out in the remaining seven months of 1922. With another harvest reaped, the physical state of the nearly half a billion people in Europe should also progress nearer normal."

James R. Howard, President, American Farm Bureau Federation:

"The agricultural gloom of December dispelled by the smiles of May is directly reflected in the mirror of international exchange."

L. T. McFadden, Chairman House Committee on Banking and Currency:

"We have so recently experienced the difficulties involved in deflation that it does not seem necessary to emphasize the need for caution in preventing an over-extension of credit and currency at this time.

"Our banks are doing what they can to control this condition, but banks need the hearty co-operation of those engaged in business and industry. We must hold tenaciously the ground already gained that the Nation's industrial prosperity may be safeguarded, and our progress toward complete reconstruction be not further delayed."

All the great business interests gathered for this convention were seemingly agreed as to the necessity for the United States to play some part in aiding the economic reconstruction of Europe. Several prominent speakers, including John Ross Delafield, formerly Chairman, Board of Contract and Adjustment of the War Department, and W. Irving Bullard, Vice-President, Merchants National Bank, Boston, advocated the cancellation by the United States of the foreign debts owed to it. There was no general sentiment in agreement with this proposal, however.

James R. Howard apparently voiced the almost unanimous opinion of the delegates when he made the more general statement that "the greatest fundamental need is to have exports and imports of goods and services more nearly in balance. This in turn can be accomplished only by a resumption of business activities in countries now disorganized in order that they may have more goods to sell and with which to make purchases of our products."

The lay opinion of the gathering, expressed informally by individuals rather than publicly by speakers, was rather strongly opposed to the cancellation of our foreign debt. A. J. Brosseau, who may be said to reflect the opinion of a typical automotive manufacturer, said that after having heard the economists and bankers speak in favor of the cancellation of the loans and then having heard some manufacturers speak strongly against it, he had come to the conclusion that, at the present time, we do not know enough about the constantly changing conditions, to determine whether we should collect the interest on the debt, or cancel the debt entirely. He pointed out that by refraining from taking radical action during the next three, four, or five years the normal laws of economics would be given some opportunity to function and that at the end of that time we would be in a better position to act upon the basis of sound knowledge. In the meantime, he showed, foreign trade would be possible anyhow.

The international and commercial aspects of standardization and the possibilities of foreign competition during the next few years were discussed. While there were no radically new thoughts brought out, the discussions served to emphasize again the great importance of standardization in gaining and holding foreign markets for American automotive products.

Analysis of foreign labor and manufacturing conditions show that America is in a strong position and that only in a few lines can foreign manufacturers, including German, be expected to compete as to quality and value with American products. D. T. Farham of Knoeppel & Co., discussing this aspect of the foreign situation as related to American manufacture, said that his recent personal investigations show that the American workman is superior in efficiency to the workman of any European country with the exception of Germany. In this case, the efficiency of the workmen is about equal.

He said, however, that it is a mistake to conceive all European manufacturing plants as old fashioned and inefficient. The best plants in England, France, Germany, and Italy, he said, are equal to the best plants in this country and in many cases have added refinements and improvements. This means that eventually all European industry will rise to that same level, although the process will take a considerable length of time.

He pointed out also that one big factor in Germany's industrial success is the widespread and efficient apprentice system which is in operaton and which enables German manufacturers to have constantly on hand a good supply of very efficient and intelligent workers. He also discussed the great industrial organizations of Europe and pointed out the fact that the United States is not specially ahead of Europe so far as highly centralized organization is concerned.

The importance of South America as an outlet for many American products was not brought out at the convention. This is probably because the convention speakers were concerned chiefly with export possibilities of grain and raw materials rather than of fabricated products. The point is mentioned here, however, because the possibilities of the South American continent as the buyer of surplus American products inevitably comes strongly to mind after this discussion of the comparatively unstable condition of many European markets at the present time. Especially does this concern manufacturers of fabricated products such as those produced by the automotive industry.

STARTING from the basis that European stability is a fundamental of permanent industrial return in this country, the general opinion of the business men at the Tenth Annual Meeting of the Chamber of Commerce of the United States was that the corner has definitely been turned and that greater stability will continue to be evidenced during coming months.

"In general, it may be noted that the process of normalizing the industrial situation in Europe is proceeding slowly but steadily," says Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce. "This recovery has meant a gradual improvement in the purchasing power of countries which have long been our best customers—a most encouraging sign from the point of view of American foreign trade, even though it may also be accompanied by a stimulating competition with our trade in certain markets in the Orient and South America."

Highways Must Be Made Self-Supporting

The automotive industry must give attention to highway development or it will find it has been building upon sand. A greater conception of highway importance demands a nation-wide policy of financing and regulation. Highway construction must proceed on a scientific basis in the future.

By James C. Dalton

TWO long forward strides in relation to highway transport were taken at the annual convention of the Chamber of Commerce of the United States which closed in Washington, May 18th. In the order of their importance they were:

Enunciation by Thomas H. MacDonald, Chief of the Bureau of Public Roads, of a new policy for the financing of highway construction and maintenance.

The fact that a highway transport group was set up within the division of Transportation and Communication and an entire session devoted to consideration of the newest means of communication.

These two developments, taken together, mark the opening of a new chapter in the development of the motor vehicle. MacDonald speaks with the authority of the Federal government behind him and he is recognized as the foremost advocate of highway development.

The Chamber of Commerce of the United States represents business in the broadest sense. Its membership includes hundreds of individual Chambers of Commerce in every city of importance in the country as well as hundreds of other trade and commercial organizations. Any message sent out by it carries tremendous weight. Inclusion of highway transport on the agenda of the convention was a distinct concession, for it was one of the few purely American questions considered. Practically the entire program was devoted to a discussion of the effect of European problems upon American business.

Evidence of the importance attached by MacDonald to his statements is found in the fact that he declared before he began that he did not intend to depart from his prepared address because he did not want his statements garbled. His declarations on this occasion were preliminary to a conference next week with representatives of the automotive industry and the National Association of State Highway Officials. Adoption of a nation-wide policy of financing and regulation will be taken up at the meeting May 24 which will be held behind closed doors.

Translated into the simplest terms the contention of MacDonald is that the original cost of highways should be a capital charge against all the property which will be benefited by them while the rental, or maintenance costs, should be paid by the users of the roads.

As a corollary he believes careful attention should be given the transport needs of each locality before the type of highway is determined. When a gravel road will carry all the traffic likely to develop that is the type which should be built. In other words there should be enough vehicle traffic to make the road self supporting from the start. Maintenance, MacDonald declared, should begin the day the road is thrown open. If that is done there need be little fear of destruction. The type of surface can be changed as traffic increases.

Leaders of thought within the automotive industry have arrived at the conclusion that so long as attention is concentrated exclusively upon the production and sale of motor vehicles, the industry is building on a foundation of sand.

They feel that motor transport is in its infancy provided highways are developed upon a systematic basis but that unless this is done they will find themselves with a tremendous amount of highway rolling stock with nothing upon which to roll it.

Agricultural interests are exerting a greater political influence in this country than ever before and the sentiment of the farmers is crystallizing against the building of anything except what they term "farm to market" roads. They have been led to believe that motor vehicle users are concerned chiefly with the construction of great transcontinental highways, many inches deep with cement, on which they can speed from the Atlantic to the Pacific and from one resort to another.

This feeling, unless it is controverted by constructive action, will mean a tremendously adverse effect upon Federal and state aid for the building of good roads carefully thought out in trunk line systems. The farmers will insist upon having this money spent upon the construction of highways which will enable them to get their produce to market most easily and expeditiously.

Deep students of highway building realize that the animosity of taxpayers against good roads must be dispelled and that farm to market roads must reach every corner of the land if motor transport is to have its full development. The importance of MacDonald's opening gun in the campaign is therefore evident. He considers a sound financial policy more important at this time than the regulation of motor vehicles. Federal regulation of post road transport is not practical at this time, he feels.

When asked by the House Committee on Roads what he thought should be done to regulate motor traffic, he said:

"In my judgment we might arrive at a fair taxing of motor trucks employed in commercial trucking by licensing companies to operate over a fixed route on a fixed schedule with a responsibility to the public for the property which they undertake to transport and also for any injury which they might cause to the traveling public."

MacDonald's views on the regulation of motor vehicles are similar to those of E. J. Mehren, editor of the *Engineering News-Record*, another speaker before the highway transport group at the convention here. The cardinal points outlined by Mehren were:

1. That regulation should be encouraging to highway transport and not punitive.

2. That it should protect the rights of road users and prevent abuses.

3. That there should be a minimum of regulation consistent with maximum economic use of the road.

4. That there should be rigid enforcement of motor vehicle laws.

5. That it is desirable, when the traffic warrants, that highway carriers engaged in regular transport service be designated and treated as common carriers and be subjected to common carrier regulation, to the end

a. That the public may be better served, and
b. That the business of highway transport may be stabilized.

6. That common carrier regulations, where adopted, should not be punitive but should permit highway transport to develop its own inherent economies and particularly that it be not artificially penalized and handicapped in favor of competitive forms of transportation.

The meeting of the highway transport group brought out practically all the automotive men in attendance at the convention. They included Alfred H. Swayne, vice-president of the General Motors Corp.; F. A. Seiberling, president of the Seiberling Rubber Co.; F. C. Van Cleaf of the Goodrich Co.; Alfred Reeves, J. M. Marvin and Pyke Johnson of the National Automobile Chamber of Commerce, M. L. Heminway, general manager of the Motor and Accessory Manufacturers Association and A. L. Viles, general manager of the Rubber Association of America.

A. J. Brosseau, president of Mack Trucks, Inc., and a director of the Chamber of Commerce of the United States as well as of the N. A. C. C. presided. He has long been a student of highway economics and he stressed the importance of the meeting in his opening remarks. It was his thought that any message from the United States Chamber would carry great weight throughout the country.

The first speaker was MacDonald. Among the points he made were the following:

"The whole future of our nation will be largely modified and determined by the factor of transportation in the sense of covering all forms of interchange.

"There are no precedents from which we may accurately estimate the cost of providing the necessary improved highways but the financial aspects even now are such as to demand the most careful and scientific policies which may be determined. As the costs accumulate from year to year the increasing demands upon the financial foundation will cause failure unless the governing policies are properly determined and planned for that future.

"No reason can be offered not to plan well for the future for we are yet near the beginning of highway building activity in its major sense.

"There is plenty of evidence that the tax-paying public is rapidly nearing the end of its ability, or at least its willingness, to act further in the capacity of a shock absorber. There is no reason why the highways should not be placed in the self-supporting class. They are not a luxury nor an incidental but one of the indispensable facilities to the life of the nation and the individual in all its phases. The highways are possessed of a real earning capacity and this must be recognized and admitted.

"There is no difficulty in allocating the earnings of the highway between the different services which it performs. This may be accomplished acceptably by fair and impartial study and investigation. Up to the present too many such studies have been made for the purpose of determining a pre-determined conclusion. All the aspects of highway improvement are so modified by the particular and specific conditions of the locality, small or large, under consideration, that he is wise who will not make either general or dogmatic assertions.

"Many of these assertions which have been accepted as almost axiomatic, fall down as soon as examined in the light of real facts. For example, it has been accepted as a to-be-rigorously observed tenet that highway bonds shall be issued for a shorter period than the life of the road.

"Again, suppose that capital is borrowed to establish a business. Is it an evidence of unsound financing that the owner has continued to carry the original investment using his earnings to maintain and to increase the value of the plant by enlargements and betterments?

"The term 'permanent roads' is a fallacy which is responsible for more or less of the unsound theory which has been advanced with reference to bond issues. There are certain of the essentials of road construction that can be so built that the deterioration is so slow that they may be properly termed permanent. Road surfaces of whatever type deteriorate. Maintenance should begin as soon as the surface is thrown open to traffic, and the higher the cost of the road the more careful in detail should be the maintenance.

"There is also the fallacy of the imposition of detailed and arbitrary legal limitations upon the character and weight of the loads which shall use the roads. Proper regulation within certain reasonable legal limits of the use of the roads is an administrative matter and should be so regarded. Even in a single state conditions vary to the extent that loadings which may be carried without deterioration of some road surfaces will inflict untold damage upon others.

"There are many other fallacies which must be cleared away before we can hope to reach sound conclusions as to permanent policies which will justify themselves over a long term of years. Our total expenditures for highway purposes in the United States last year were approximately $600,000,000. This is the maximum expenditure for one year, but even this rate will not satisfy, within any reasonable period, the demand for improved roads.

"In the development of highway transportation the individuals composing the public have equipped themselves with rolling stock to the extent of more than 10,000,000 motor vehicles, to say nothing of the large number of horse-drawn vehicles in use, and the public as a whole is charged with the task of providing the roadbed.

IT must be remembered, in discussing the contention of the railroads that motor vehicles should bear a greater proportion of the cost of highway building, that whereas a railroad's right of way is for its exclusive use, the highway is for the free use of everybody and everybody benefits from it.

Obviously, sound economics demand that we allow each type of transport to develop its utmost economies and find its place in the transport system in accordance with the advantages it offers the public. If an earlier form of transport suffers thereby it cannot be helped.

While it is conceded that motor transport is in its infancy, this fact stands out: The railroads of the country paid approximately $276,000,000 in taxes in 1921 upon an estimated valuation of $19,000,000,000. The motor vehicles of the country paid approximately $262,000,000 in taxes in 1921 upon an estimated valuation of $9,000,000,000.

"There can be no question of the service the highways render to the owner of the motor vehicle privately operated. There can be no question as to the service which is rendered by the highway to operator of motor truck lines and motor 'bus lines. There can be no question that the improved highway serves the real property in the rural districts. There is, although more questions may be raised, a real service rendered by the rural highway to the property within the urban limits. Or, if more acceptable, to the people as a whole within the cities. All foodstuffs originate upon a highway at some place, and the more quickly and directly they can be transported from the point of origin to these people the cheaper will be the cost and the better will be the quality.

"The relative share of the cost of highways may change but it is difficult to harmonize with the tenets of fairness and equity any plan of financing which does not distribute some part of the cost to each of these services.

"A proper financial policy cannot be established unless there is functioning an efficient highway administration. This applies regardless of the unit that is under consideration.

Type of Roadway Surface All-Important

"The selection of the type of roadway surface is the all-important item from the standpoint of the highway service and highway finance policies. The service to be rendered must determine the selection of the type of highway. Such a selection will determine the financial policy for it will provide the basis for the establishment of an annual highway expenditure budget. The major items of the budget will include maintenance, reconstruction and new construction.

"Reconstruction is included separately from maintenance for in the progress of highway improvement the replacement of old surface is usually by a higher type surface and consequently the road is improved beyond its first condition.

"The new construction requirements in the majority of the States are capable of absorbing all the funds that can be made available so that it is in the fixing of this fund that the most care should be exercised.

The budget for the State highway department would, of course, apply only to the State system which in general includes the 7 per cent system. The estimates would determine the amount of revenue needed for the year's program, for the different classes of work. The amounts needed for maintenance and reconstruction will be determined by the examination of the roads in the system, for the administration of the State highway systems has developed to the point where it is possible to determine within reasonable limits the necessary annual maintenance and reconstruction requirements.

Care Needed in Use of Funds

The new construction requirements in the majority of the States are capable of absorbing all the funds that can be made available, so it is in the fixing of this fund that the most care should be exercised, but it should be sufficient to complete the first construction of the State system within the shortest period consistent with good management and the maintenance of competitive prices.

The total amount as well as the division of the total between the three funds will vary in the different States, but it is believed that it will be possible to apply practically the same principles to the raising of the total fund required. It is freely admitted that this suggestion is tentative and subject to revision in keeping with the studies which are now being made. Also the relation of urban expenditures and local expenditures must be given very careful thought. Outside of the cities and towns, however, it appears more than probable that the State systems will be ultimately extended to provide a sufficient mileage of roads to take care of all the main highway transportation needs of the State.

With these qualifications, then, it is believed that a proper financial policy will require first that all of the maintenance funds be met from the revenues derived from the road user; second, that the costs of reconstruction be met from the revenues derived from both the road user and from State taxes, the relative percentages being different for different States and for the different types of roadways built; third, after deducting the Federal aid, the cost of new construction should be divided between the road users and other State taxes from both urban and rural sources.

Distribution of Revenue

Just how the respective revenues for reconstruction and new construction shall be divided between revenues from the road users and other classes of revenues, and how these costs, once apportioned, shall be divided to the several classes of road users and the different classes contributing to the other revenues, must be determined by the most thorough research and investigation, and there are many facts which must be given consideration. It has been stated that the total expenditures for the past year were approximately $600,000,000. These revenues came from the following sources:

	Per cent
Federal aid	14
State road bonds	7
State taxes and appropriations	12
County, township and district taxes and assessments	14
Motor vehicle revenues	19

Federal aid and motor vehicle revenues constituted 33 per cent; the remaining 67 per cent came from other sources, which are either paid directly or will eventually be paid by State and local taxes. It is believed that a very considerable readjustment of these sources of revenues must be made, so that a larger percentage will be paid by the road user and a lesser percentage from State or local taxes. It must be remembered that this statement is not fairly representative of the funds collected directly or indirectly from the automotive vehicles, for our estimates show the following revenues paid during the fiscal year 1921:

Federal taxes paid by manufacturers on passenger cars and motor trucks	$115,546,249
State registration fees	122,478,654
Personal property taxes	52,500,000
Wheel and privilege license	3,636,543
Gasoline tax, 17 States, calendar year 1922, estimated	11,000,000

A total of $305,161,146, or approximately $30 for each car and truck registered during 1921. This total sum, it will be noted, amounts to over one-half of the total estimated road expenditure for 1921.

Consider also in this connection the question of gasoline consumption. It is probable that the total gas consumption for use in operating automotive vehicles is not far short of four billion gallons per year. An advance of one cent in the price of gasoline on the annual consumption would amount to approximately $40,000,000.

Facts as to the character of construction which goes into the road building program must also be given consideration. For over 11,000 miles of Federal Aid roads involving a total cost of over $188,000,000, the surfacing cost is 60 per cent and the remaining 40 per cent is made up of grading 22 per cent, structures 14 per cent, shoulders 1 per cent, engineering 3 per cent. That is, 40 per cent

of the expenditures were for the permanent features of the road and the great part of the expenditures for surfacing can be rightfully considered in the same class, for it is being successfully demonstrated that by supplementary construction, such as the placing of new surfaces, the widening by addition of shoulders, the greater part of the investment can be continually maintained and thus preserved indefinitely. Expenditures of this class fall into the category of maintenance and reconstruction, and if continuance of these two can be relied upon the original investment is preserved indefinitely. Therefore, little fault can be found with the soundness of the financing if bonds are issued for new construction if the original investment is thus continually preserved, and as a matter of fairness it is questioned whether during the period when the public is being called upon for large expenditures for initial construction, whether the attempt should be made to pay for this construction out of current revenues. Rather is it fair and equitable to distribute the cost over a long period of years by bond issues, or else adopt the other alternative of proceeding at a very slow rate with the construction of modern roadways.

Uses of Highways

It will be noted that little has been said as to the uses which are to be made of the highways. It must be remembered that the whole question of highway transportation is in its infant stages. Very careful investigations and studies are now going forward to determine the economic limitations of highway transport, which includes the necessarily adjusted highway construction. We have made rapid progress during the past two years toward such determination, and the suggestions which have been made are based upon an administration of a highway program predicated upon the results and determinations of these scientific researches and investigations. The objective, after all, is to furnish the cheapest possible highway transportation, which involves both the rolling stock and the roadbed.

Mehren followed MacDonald, taking a highly sympathetic view of the indispensable service rendered the public by motor vehicles. His subject was "Practical Highway Transport Regulation" and he argued for sane rules to govern operation.

"There is need right now," he said, "for a new consideration by both interested and impartial parties of the present laws to the end that there may be prepared for the meetings of the Legislatures next winter sound conclusions as to the present statutes and the desirable lines of revision."

Mehren said it was possible to make a strong theoretical case against regulation of motor vehicles as common carriers, arguing that there are sharp differences between motor vehicle transportation and that of steam and electric railroads. The investment in other types of carriers is stable and competition is difficult.

Regulation of Common Carriers

He asserted, however, that the public has determined that common carrier regulation is necessary and that where motor transport is heavy the public is better served by regulated service. He added that regulation offers the possibility of stabilizing the highway transport business by saving it from the destructiveness of uninformed, fly-by-night competition.

Mehren stated that after taking over regulation of highway transport and promulgating rules to govern it, the Nebraska State Railway Commission had relinquished its regulatory powers on the ground that motor transport in that State had not reached the point where common carrier regulation was necessary.

Discussing the contention of the railroads that motor vehicles should bear a greater proportion of the cost of highway building, Mehren asserted that whereas a railroad's right of way was for its exclusive use, the highway is for the free use of everybody, and everybody benefits from it.

"Obviously," he said, "sound economics demand that we allow each type of transport to develop its utmost economies and find its place in the transport system in accordance with the advantages it offers the public. If an earlier form of transport suffers thereby it cannot be helped.

"Naturally, the motor vehicle engaged in common carrier service must pay for the use of the road just as a privately owned and operated vehicle does. A tax graded by extent of the use of the road is the preferable one, and where that does not exist a somewhat higher tax on the common carrier is warranted because of the certainty of greater use of the road. The common carrier must expect to pay a franchise tax."

In the discussion which followed representatives of brick and cement interests contended that there was no such thing as building too good a highway for any particular district and that heavy traffic always followed a good road. Exception was taken to this contention by Van Cleaf, Seiberling, Henry D. Shirley, chief of the Good Roads Board of the American Automobile Association and MacDonald. They asserted that gravel surfaces were often adequate for farm to market highways.

MacDonald inquired pertinently, "What is the earning capacity of a highway?" He indicated strongly that this would be one of the cardinal points in his creed by asserting that it does make a great difference where good roads are built and that the railroads have learned this lesson.

W. K. Hatt of the National Research Council declared that the day of opinions in highway building has gone by, and that construction in the future must be based on a scientific basis. He deprecated the number of organizations engaged in highway work, declaring there was duplication of effort and lack of purpose.

Important Developments Pending

The purport of the entire meeting was that tremendously important developments are pending in relation to highways and that the time has come for every man in the automotive industry to study the question from a broadgage viewpoint if the future of his business is to be assured. This applies not only to the manufacturer but to the distributor and dealer as well as to the operators of trucks and passenger cars.

Study of the highway transport question has just begun. Its importance as a factor in the industrial life of the nation has been recognized by the Federal government, by Congress and by the most important business organization in the country. Further conferences will be held in Washington and a definite program will be mapped out in which all elements concerned in the building of highways and in the operation of motor vehicles can reconcile their viewpoints.

While it is conceded that motor transport is in its infancy, this fact stands out:

The railroads of the country paid approximately $276,000,000 in taxes in 1921 upon an estimated valuation of $19,000,000,000.

The motor vehicles of the country paid approximately $262,000,000 in taxes in 1921 upon an estimated valuation of $9,000,000,000.

ONE HUNDRED AND TWENTY-FIVE established companies, operating 500 to 600 two and three-place machines, made 130,736 flights, covering 2,907,245 miles and carrying 122,512 passengers in the twelve months from Oct. 1, 1920 to Oct. 1, 1921.

More Manufacturers Adopt Flat Rate System of Service

Factory service managers, members of the N. A. C. C., make flat rate system chief topic of discussion at convention. Nine factories now using flat rates and others preparing similar systems. Question of piece-work for mechanics in connection with flat rates under discussion for first time.

CONTINUED progress is being made in the conventions of factory service managers who are members of the N. A. C. C. The convention held in Detroit last week centered largely on discussion of the problems of flat rates, "pirate parts" and better service to the car owner. This last subject might have been placed first because, after all, all other subjects are subsidiary to it.

Edward S. Jordan, president of the Jordan Motor Car Co.; H. H. Rice, president of the Cadillac Motor Car Co., and O. E. Hunt, chief engineer of the Chevrolet Motor Co., were the speakers of the convention. Aside from the planned addresses, other subjects were taken up for discussion and certain delegates were picked out to lead the discussions.

Recognition of the dealer, dealer service manager and the independent garage is progressing. Three years ago much time was given to criticism of these classes of automotive men, especially the independent garage men. At the present convention the consensus of opinion is that the dealer and the dealer service manager are working along with the industry and in many service problems they have been able to work considerably in advance of factory departments on account of close contact with the customer and a realization of the customer's service problems. Independent garage men are being accorded the benefit of factory information and, in a great many cases, are being given discounts on parts and other benefits that they did not previously enjoy.

Flat Rates for Repair Work

One topic that was of the most interest and is one of the most important is that of flat rates for repair work. Nine factories represented at the convention are working on a flat rate system and practically all the others have in preparation a system of one kind or another to be put in effect upon its completion.

An entirely new subject is that of piece-work for mechanics in connection with flat rates. While there have been a few sporadic attempts to introduce this system, this is the first time it has come up at one of these conventions.

Edward S. Jordan made the first address at the Tuesday morning convention and confined his talk largely to the advantages of fundamental thinking rather than detailed thinking. He said that the service department was related to the sales department and the production department largely by what the sales department promised a customer. He said that if you advertised a thing enough and promised enough, you could make money on it, provided the price is right, but if you promise too much the service department will have difficulty in making good your promises.

He called attention to the fact that service, as it is growing nearer perfection, is receiving more attention and more favorable mention and cited the recent advertisements in national publications and newspapers which mentioned service as one of the features of the automobile to be sold. He strongly advocated a single purpose policy and a production of one model and said that a multiplicity of models in one factory constituted the problems of a multiplicity of factories.

A telegram from the Body Builders' Association, asking for assistance in formulating a body servicing policy and the opinion of the convention on servicing bodies, was referred to a committee headed by S. V. Norton, of the General Motors Corporation.

"Pirate Parts" Defined

A great deal of time was given to the discussion of "pirate parts." Secretary H. R. Cobleigh stated that the Federal Trade Commission had defined the "pirate part" as one which infringed a patent or misrepresented the goods as original parts and therefore the term "substitute parts" should be used on all parts not made by the original manufacturer but not coming under the head of "pirate parts." A great many companies are spreading propaganda through their printed literature and by other means advocating the use of original parts for a car. From the discussion it appeared that most of the service managers felt that the substitute parts evil could only be met by competition as to price and distribution. Harry G. Moock, assistant sales manager of the Hudson Motor Car Co., stated that the Garland Stove Co. had suffered severely from this kind of competition and had practically eliminated it by going right ahead making parts as cheaply as possible and giving them wide distribution.

H. R. Rice, president of Cadillac, gave a reminiscent talk on his experience in the industry and said that service was very much better than most people were saying. In his belief, a few bad examples of service were being held up and a great many good examples of service were being hidden.

The discussion of flat rates was led by F. A. Bonham, of Durant. After relating his own experiences in working up a flat rate system, he went on to say that the need of such a system of selling repairs is so great that many distributors and dealers have gone on in advance of the factories in making up their own schedules.

A show of hands disclosed that nine companies who were represented are actually working on a flat rate system. Really, the only point for discussion was whether to use a flat rate for labor and material or for labor alone. Of the sixteen who were either using the flat rate or had it nearly prepared, twelve were working on flat rates for labor only and the remaining four on flat rates for both labor and parts. Chairman Voyles

told of the Marmon flat rate of $265 for a complete engine overhaul and said that other flat rates were being worked out by a department formed for that purpose.

Some discussion arose as to the cost of identical repairs in various localities. Some thought that the small shop without special tool facilities would take longer to do the jobs and so lose money, but it was generally counterbalanced by the large overhead and the high rents of the large establishments. Mention was made of an independent garage in Louisville, Ky., that had flat rates on all makes of cars and made money on them. Davock, of Packard, said that his company had worked out about two hundred operations on each model of the current cars and that these represented about 75 per cent of the operations.

Piece-Work for the Mechanic

Something practically new in service to the owners is the use of piece-work for the mechanic. Joseph Kenny, service manager of Bishop, McCormick & Bishop, Dodge dealers in Brooklyn, said that this system had been inaugurated on the basis that mechanics were paid 65 cents an hour and allowed so many hours for the job. If they finished in less time they still received the rate for the time given. If they take longer they get no more. In Kenny's opinion, the time on many of the operations will be cut in half under this new system and a great deal of this saving will be later passed to the customer. Fred Schlueter, service manager of the Detroit branch of the Cadillac Motor Car Co., in a discussion later on in the convention said that his mechanics were working on a system very similar to this and that it had worked out satisfactorily and the mechanics would not care to go back to the old system of straight time. Don Hastings, Detroit Hupmobile distributor, operates his shop on the same basis. There was considerable interest in this subject and many questions were asked of the three advocates of the system.

One of the very interesting talks of the convention was that of Don Hastings. He described conditions as he found them when he took over the service part of the business and then told of the improvements that had been made in the building, stock keeping methods and facilities for rendering good service. He said there were two organizations necessary to the rendering of satisfactory service:

1. Selling service.
2. Doing service.

He told of the great help of the flat rate system and said that he had been working on that basis for about five months. He described in some detail his system of handling service to the customer, the policy of free service and replacement and the follow-up on new customers to insure satisfactory working of the vehicle. In speaking of the amount of time that cars were in the shop for repairs he mentioned the fact that nineteen out of twenty repair jobs were in the shop less than a day and that the busiest hours were the first and last hour and a half of the day.

Wednesday's session was opened with an address by O. E. Hunt, chief engineer of the Chevrolet Motor Co. He thought that much real good could be accomplished by considering the service problems of the industry as a whole rather than the problems of the individuals or companies. He spoke at some length on the relation between the service department and the engineering department and said that the owner was not buying a car but was really buying transportation service and that is what the industry had to furnish him. He said that cars in the hands of owners were undergoing a gigantic road test and that one of the duties of the service department was to make reports of this road test to the engineering department so that from the faults observed in this test improvements could be incorporated into the design of future vehicles.

Servicing cars in outlying districts where the company has no representative was one of the topics of discussion. It seems that many companies have a service contract for their product with independent repair shops or garages. A discount is given on parts and sometimes a small discount on the sale of new cars which have in any way been brought about by the independent garage man.

24-Hours' Service Disapproved

The question of twenty-four hours' service, which was advocated by Norval A. Hawkins, did not meet with general approval. A very few service stations in the larger cities are giving either twenty-four-hour service or sixteen-hour service, but most of the service establishments in the smaller towns operate on ten and twelve hours.

The Wednesday afternoon session was devoted largely to the subject of co-operation between the sales and service departments. The topic was opened by F. J. Wells, of Pierce-Arrow, and several speakers gave their ideas as to methods of making this contact closer. It developed there was much need for co-operation with the engineering department in the planning of new designs. Clyde Jennings, editor of *Motor Age*, was called upon as having views which were not biased by any department affiliation. He said that the village blacksmith was the forerunner of the service manager of to-day and that it was up to him to build for himself a place in the hearts of his customers that had inspired Longfellow's great poem.

The last topic to be taken up at the convention was the planning of future meetings. It was suggested that the May meeting be held each year in Detroit and the November meeting be held in different cities. Accordingly Chicago was selected for the November convention.

Davis Producing a Smaller Six

THE George W. Davis Motor Car Co. is now in production on a new six-cylinder car to be known as Model 61, equipped with a five-passenger phaeton body. The new car is similar to the larger model 71, but has a 114-in. wheelbase, as against 120 in. and uses the new Continental 6Y engine with 3⅛-in. bore and 4¼-in. stroke, which has a displacement about 10 per cent less than the engine in the larger car, but is said to develop 50 hp. at 2600 r.p.m. This engine has a four-bearing hollow crankshaft arranged for pressure lubrication and a chain drive for camshaft and generator. The same make of component parts are used for axles, clutch, ignition, etc., as are used in the larger six, these being Timken, Borg & Beck and Delco respectively. The wheels now used as standard equipment are Disteel, five of which are furnished, the spare being carried on a bracket at the rear of the frame. The 31 x 4-in. tires are 1 in. smaller in diameter than those used on the larger car.

The road weight of the car is given as 2645 lb. The price is $1,195.

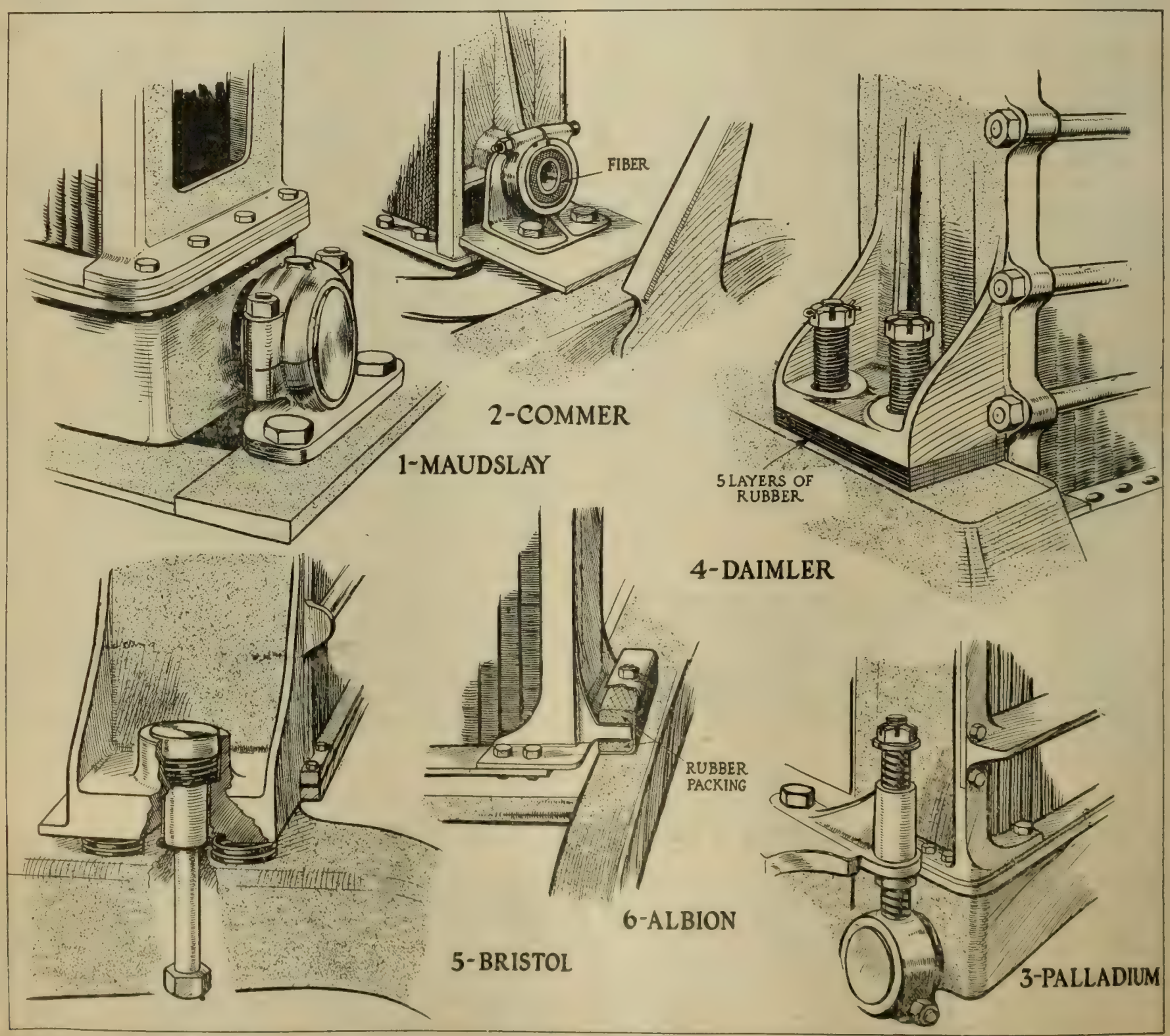
Protecting Truck Radiators Against Frame Distortion

British truck makers employ various mountings to protect radiators from torsional stresses and vibration. Maudslay arrangement closely approximates ideal. Albion is good example of inexpensive flexible mounting.

By M. W. Bourdon

THE need for protecting the radiators of truck chassis against the ill effects of frame distortion should be obvious, and yet one not infrequently observes radiators bolted down rigidly to the front or side members, with results which are made evident in due course by "weeping," if not well-defined leaks which cause needless expenditure.

There is a close approximation to the ideal in this respect in the Maudslay arrangement shown in Fig. 1, where a spherical trunnion at each side forms the support. Admittedly this is a comparatively expensive mounting, with



1—Maudslay radiator supported by spherical trunnion at each side. 2—A projecting boss, hollow and supported by webs, on each side plate of the Commer radiator. 3—Palladium employs a parallel-sided boss on the bottom tank. 4—Daimler uses two bolts and five layers of rubber to prevent distortion. 5—Bracket extension on Bristol rests on three short helical springs. 6—Inexpensive type of mounting on Albion

its machined, parallel-sided boss integral with the cast bottom tank, its bronze bushing with a parallel bore and hemispherical outer surface, and its two-part bracket machined within to suit the bushing. But apart from failing to afford any insulation from vibration, it meets all requirements, being able to take care of frame distortion in any direction and allowing the radiator to be easily dismounted.

Lacking some of the characteristics of the Maudslay is the Commer arrangement (Fig. 2). In this case there is a projecting boss, hollow and supported by webs, on each side-plate of the radiator. Encircling the boss is a thick bushing of fiber, itself encircled by a steel bush, the whole being carried in a split bracket with a pinch bolt. Doubtless the fiber bushings, with their slight inherent flexibility, permit variations in alinement between boss and bracket, but they cannot fail to convey torsional stresses from one to the other when road surface inequalities are pronounced.

The Palladium scheme (Fig. 3) embodies a parallel-sided boss on the bottom tank, located within a split clip which has an upward extension supported between square-section helical springs by a bracket projecting forward from the front cross-member. The only provision for counteracting frame distortion is the clearance of the clip extension in its bracket—a feature tending, despite the springs above and below, to permit hammering from vibration, and consequently rapid wear.

The remaining three examples exemplifying British practice eliminate trunnion supports and depend upon intervening springs or rubber between the bracket extension of the radiator and the frame. The two bolts at each side in the Daimler (Fig. 4) and the single ones at each side in the other two cases have plenty of clearance in the holes in the bracket through which they pass. Of these three arrangements, the Bristol (Fig. 5) seems most likely to retain its original flexibility, for it embodies no rubber packing liable to perish, the bracket extension at each side resting upon three short helical springs located by recesses in the lower surface of the bracket. The sketch of the Albion (Fig. 6) is self-explanatory and illustrates what is certainly one of the least expensive of flexible mountings.

Semi-Pneumatic Motor Truck Tire

A SO-CALLED semi-pneumatic tire for motor trucks which, it is claimed, possesses the characteristic endurance of the solid rubber tire and much of the cushioning quality of the pneumatic, is being brought out by the B. F. Goodrich Rubber Co. Cushioning and shock-absorbing qualities are provided by the air chamber running through the center of the tire, as clearly shown in the sectional view herewith.

The outside design of the tire also presents features of interest. A groove molded in the tread helps to prevent skidding. In addition there are a number of side blocks on the tread, designed to give traction in soft going. The side slots between the blocks add to the resilience of the tire and are claimed to materially reduce gasoline consumption by breaking up and reducing the tractional wave. This tire fits the regular S. A. E. wheels and may be applied with the regular solid tire press.



Sectional view of Goodrich semi-pneumatic tire

New Disteel Wheel

A NEW design of disk steel wheel has been brought out by the Detroit Pressed Steel Co. It has an outside valve stem, takes a standard tire tube and is claimed to be lighter than a wood wheel with demountable rim. The wheel is composed of a tapered disk curved inwardly for some distance and having a rim riveted to it so that the side ring is inside instead of outside the rim.

It is stated that on account of its much lighter weight the new wheel can be produced at materially lower cost. A certain amount of flexibility results from the curvature of the disk.

The outside valve stem used with this new wheel is that of any standard inner tube, so that any air chuck may be used. There is sufficient room between the stem and disk to permit of the use of the largest size air hose chuck.



Cross-section of new design Disteel Wheel

The reduction in the weight of the wheel will result in lessened tire wear.

A RESIDENT of South Africa has written that, in his opinion, the success of the American manufacturer in that field may be summed up in the words "Price and Propaganda." With regard to the former he says that if the British manufacturer cannot compete in prices with the American then the overseas trade is lost to them forever, and that "against the foreign product the British manufacturer enjoys a three per cent Customs preference, a sentimental preference equal to at least ten per cent, and the advantage of lower freight rates and shorter distance compared with the United States. The exchange advantage will disappear and possibly the sentimental preference, too, unless kept alive by well-directed propaganda."

With regard to propaganda he says: "American cars are forever in the limelight with consumption tests, reliability trials, speed races, endurance "stunts" and non-stop road runs. The American exporting companies organize publicity campaigns on national lines and share half the costs with their distributing agents. The latter are responsible for their own local advertising." In closing he says that the British may yet recover lost ground.

Novel Starter Armature Eliminates Use of Soldered Commutator Joint

Closed end of armature coil located at what is usually commutator end. Separate commutator dispensed with. Two armature bearings are placed closer together. Simplified construction greatly reduces production cost.

THE coils of starting motor armatures ordinarily consist of copper bars drawn out and cut off so that one bar forms a complete turn or coil. At the commutator end the ends of this bar are soldered to the riser lugs of the commutator. This soldered joint has sometimes given trouble. The starter, as a rule, operates only for very short periods, but while it is operating it draws very heavy currents. Any imperfection in the joint between the armature bar and the commutator may add materially to the internal resistance of the armature and thus cut down the maximum value of the armature and field current. As the torque of the starter depends upon the armature current, the magnetic flux and the armature conductors, its maximum value will also be materially reduced.

Separate Armature Unnecessary

The Splitdorf Electrical Co. some years ago started development work to overcome this difficulty and incidentally secure several other advantages. In the Splitdorf design, as illustrated herewith, the closed end of the armature coil is located at what would usually be the commutator end. A separate commutator is dispensed with and the brushes bear directly on the outer faces of the armature bars, which are turned down for that purpose. The tangs of the armature bar beyond the core do not run parallel with the armature shaft but at an angle thereto, the upper part of the bar in one direction and the lower part in the opposite one.

At the rear or driving end of the armature the bars must, of course, be joined together. The ends may be placed in a ferrule and then soldered, and it is claimed that a soldered joint can be made much better in this way than where the ends of the bar lie in a deep groove in the commutator lug. It is planned, however, to do away with soldering entirely and make the joint by electric arc welding.

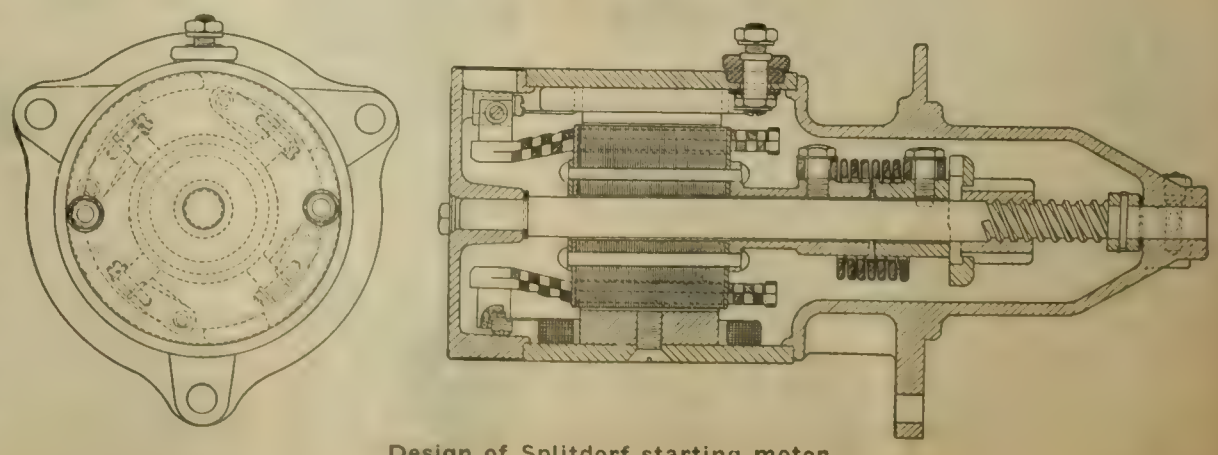
The ends of the armature bars therefore serve as commutator bars. They are arranged helically and are separated by air spaces. The carbon brushes get onto any particular bar gradually, and this, in connection with the absence of mica insulation between bars which makes projecting mica ridges an impossibility, is claimed to obviate all danger of chattering of the brushes. The brushes may also be arranged to bear against the ends of the bars, or against both the ends and the outer edges, but the plan here indicated is probably the most practical one, as it eliminates the problem of providing in the brush construction for the end play of the armature.

An incidental advantage of this arrangement is that it permits of placing the two armature bearings much closer together, providing a more substantial support for the armature, reducing the over-all length of the starter, and—in the case of the usual flange mounting—the overhanging length.

Another improvement made has to do with the armature shaft and reduces its cost of construction. The usual method of building up an armature core consists in taking a shaft turned with a shoulder and having a keyway cut in it. The core disks are then pushed over the shaft, pressed together in a press and secured on the shaft by "staking" or by the use of a clamping nut engaging threads on the shaft. Turning down of the shaft from stock of a diameter equal to the diameter of the flange against which the armature end plate bears involves considerable machine work. In the Splitdorf design, as shown in the sectional view, the shaft is of uniform diameter almost from end to end. At both ends the diameter is slightly reduced for the bearings and at the driving end the screw thread for the Bendix drive is turned directly on the shaft. The core disks are punched with three holes for driving pins through them and are assembled with end plates of heavier stock and with the driving sleeve of the Bendix drive, as shown. The core has clearance on the shaft and the armature can be completely finished before being put on the shaft. Thus the core is easier to handle in winding and occupies less space in storage and especially in the baking oven.

The reason for turning the thread for the Bendix drive directly on the shaft is that this permits of the use of a pinion with a smaller number of teeth, thus giving a maximum reduction between the starter and engine.

Two other advantages claimed for the design of starter motor here described are that the cost of a separate commutator is eliminated and that carbon dust cannot accumulate on the commutator and cause short circuits, as there is such a large space between the commutator bars and any small amount of carbon dust that may be formed is thrown off by centrifugal force.



Design of Splitdorf starting motor

Do Overhead Camshafts Increase Efficiency in Engine Operation?

Part I

This design usually leads to symmetrical engine with high degree of accessibility. Contrary to general impression, there is no inherent reason why an engine of this type should not operate noiselessly. Four American makers use overhead camshafts, which are common in European practice.

By P. M. Heldt*

FOR a number of years there has been a gradual trend toward the use of overhead valves in automobile engines. This movement probably was accelerated by the success of aircraft engines with this valve arrangement, as well as by the publicity given this construction by its almost universal use on racing engines. That valves located directly in the cylinder head are not merely a fad but possess practical advantages may be concluded from the fact that practically all of the tractor engines brought out the past several years have the valves so located.

Valves in the cylinder head can be operated either by tappet rods extending up one side of the engine or else directly from an overhead camshaft. There is a third method, which consists in arranging the valves at right angles to the cylinder axis and operating them from a camshaft in the crankcase through the intermediary of long, double armed levers, as exemplified in the Duesenberg engine. This arrangement, however, necessitates the provision of a valve pocket on top of the cylinder head, and in most respects—especially as regards the form of the combustion chamber—it resembles more the L head engine than the true valve-in-head engine which has no valve pockets.

The advantage of the valve-in-head engine over the L and T head is that the combustion space of the former has a much more favorable form. It has less cooling area in proportion to volume than either of the other types, in consequence of which the heat loss to the jacket is reduced, and, besides, the distance from the firing points to the most remote part of the firing chamber is smaller, so

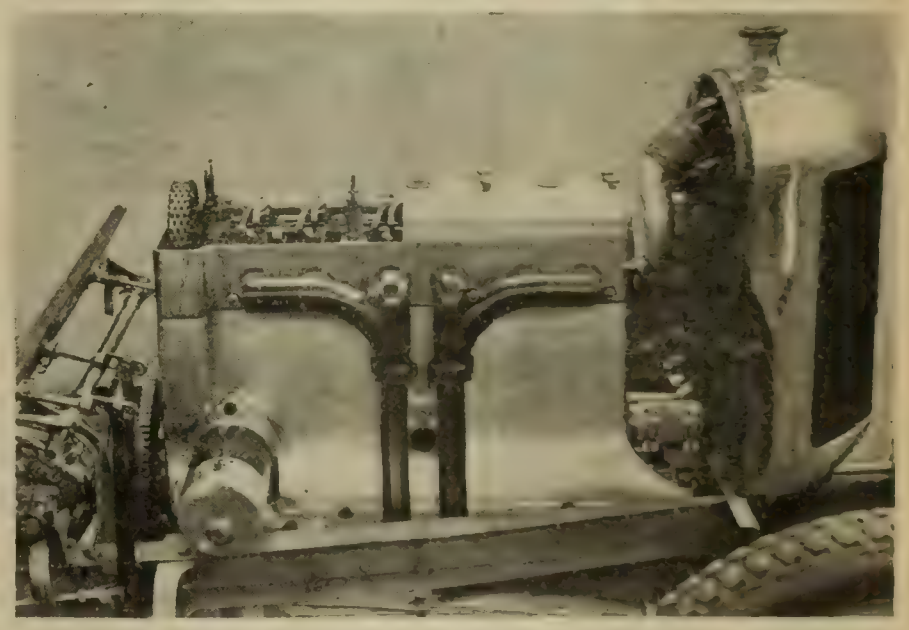


Fig. 2—British A. C. engine with chain-driven overhead camshaft

that the flame is propagated through the entire mass of the combustible charge in a shorter space of time, which also tends toward increased power and higher fuel economy. The decrease in the loss of heat to the water jacket facilitates the problem of effective engine cooling, and the simple form of the combustion chamber also helps in this connection. The combustion chamber, that portion of the cylinder casting subjected to the highest temperatures, is more symmetrical, and the cylinders therefore are less likely to be distorted by unequal expansion. There is also less likelihood of the presence of considerable masses of metal in the upper part of the cylinder casting, which would be difficult to cool, as well as of the formation of steam pockets.

While considerable emphasis is here laid on the advantages of the valve-in-head construction from the standpoint of engine cooling, the majority of designers who have adopted the practice have done so because they expected from it increased engine power and reduced fuel consumption. The inlet as well as the exhaust valve passages can be made shorter and more direct than in any other cylinder form, and the overhead valve type of engine lends itself particularly well to high speed operation. It is also claimed by some that there is less knocking

*Paper to be read before the summer meeting of the Society of Automotive Engineers, White Sulphur Springs, June 20-24. For information concerning British practice the author is indebted to M. W. Bourdon, British correspondent of AUTOMOTIVE INDUSTRIES.

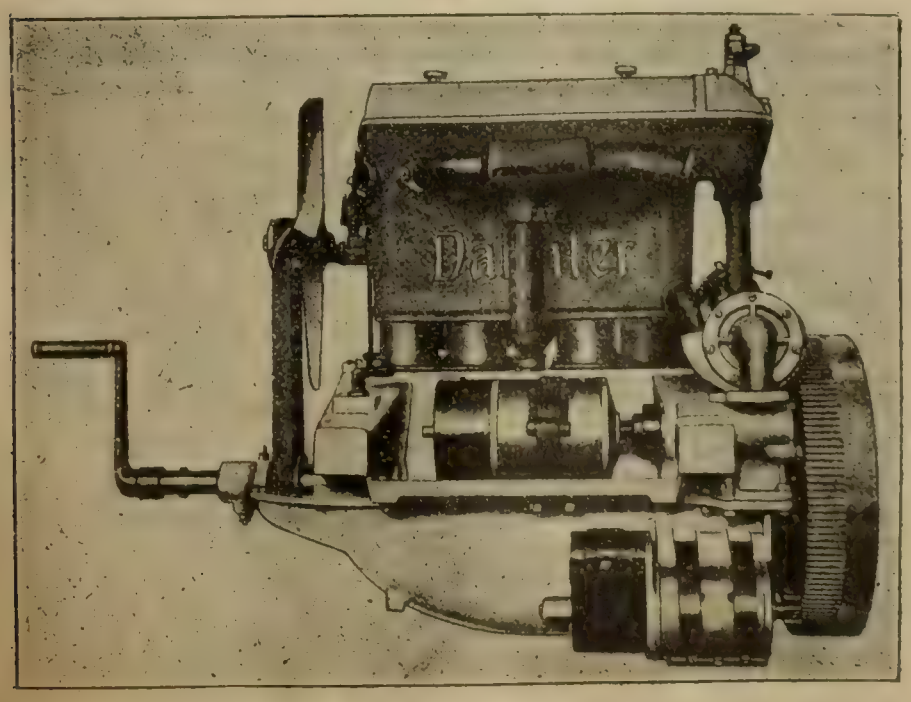


Fig. 1—Mercedes four cylinder engine with rear end camshaft drive

tendency with this type of engine, and in view of the greater ease of effectively cooling the combustion chamber this claim does not sound altogether unreasonable, but no definite proof of it seems to be available.

The tendency toward overhead valve engines is reflected by the analyses which are being made annually of car specifications. In 1914 only 6 per cent of the cars listed had such valves, while in 1922 the proportion had increased to 31. This applies to American cars. In Europe, the valve-in-head engine has made progress particularly the past year. Disregarding engines of the sleeve valve type, 32 per cent of European models listed for 1922 had overhead valves, as against 20 per cent of those listed for 1921. Many British makers seem to be in a state of transition, offering cars with both valve-in-head and side pocket valve engines this year, and if the public takes kindly to the newer design there will undoubtedly be another increase in its representation next year.

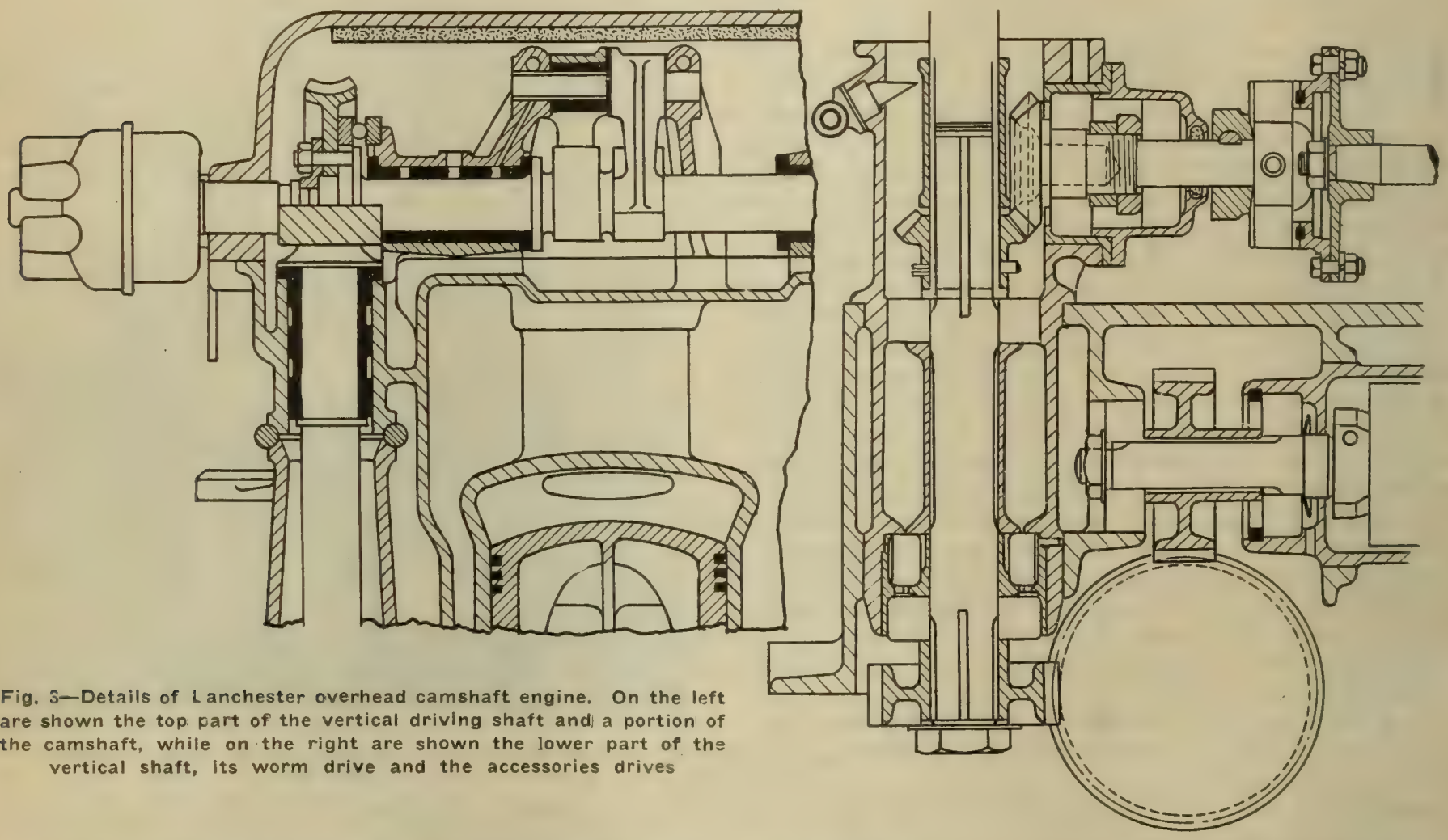


Fig. 3—Details of Lanchester overhead camshaft engine. On the left are shown the top part of the vertical driving shaft and a portion of the camshaft, while on the right are shown the lower part of the vertical shaft, its worm drive and the accessories drives

Most engines of this type used on passenger cars have the valves operated by tappet rods, whereas most racing and aircraft engines with the valves in the head have overhead camshafts. It is interesting to analyze the reasons for this difference in practice.

The side rod method of overhead valve operation is the oldest, at least in the sense that it was first to gain any considerable degree of popularity. In one way it seems also the simplest and most natural; for all that is wanted for the valves is a reciprocating motion, and what means for transmitting a plain reciprocating motion over a moderate distance could be simpler than a pushrod? However, when engines get up to high speeds the problems arising as a result of inertia effects must be considered, and it is precisely to permit high speed operation that overhead valves are generally resorted to. The increased power output results directly from the increased operating speed and the gain in economy is also in part dependent upon it.

In discussions of racing and ultra high speed engines the statement has often been made that what limits the speed of the engine is the inability to close the valves promptly at extreme speeds. The inertia of the valve reciprocating parts then becomes so great that it is practically impossible to get the cam followers to follow the contour of the cams. The force necessary for closing the valves, which is furnished by the valve springs, is greater in direct proportion to the weight of the valve reciprocating parts. In one way there is almost no limit to the force which can be obtained from a coiled or other form of spring, but in practice, if the pressure of the valve spring is increased, generally the stress in the material of the spring is also increased, with consequent greater risk of spring breakage. Besides, a very stiff spring puts great stresses upon the valve itself. For these reasons it is generally a much better plan to reduce the weight of the valve reciprocating parts in order to permit of higher operating speeds than to increase the stiffness of the springs. Therefore, for extremely high speeds, to reduce the stress on the valves and their springs, motion should be transmitted in the rotating form as close to the valves as possible, and then converted into reciprocating motion. This makes it plain why racing engines are so frequently provided with overhead camshafts.

There is another aspect of the valve problem that needs consideration, particularly in connection with a view to passenger car applications, where engines are required to operate without appreciable noise. One of the causes of noisy operation under certain conditions is the clearance which must be given the valves—particularly the exhaust valves—when cold. The need for this clearance is due to the fact that as the engine heats up the exhaust valve stem expands materially, much more than the engine as a whole, and it must be given freedom to expand or the valve will not close, which is generally quickly followed by disastrous results. It has been argued that if the cams are directly over the valves the chances for unequal expansion and the consequent need for clearance are greatly reduced. In this connection the relative temperatures of the cylinder block and of the valve rods at the side are a factor. For instance, if the cylinders are air

cooled and the valve rods are so located that they are not greatly influenced by the heat of the cylinders and remain relatively cool, it is conceivable that the cylinders will expand much more than the rods. This difference in expansion has the same effect as the expansion of the valve stems, and, therefore, additional clearance must be allowed the valves. On the other hand, if the engine is water cooled and the valve rods extend up through enclosed spaces within the cylinder block, rods and block will be of substantially the same temperature and there will be no difference of expansion. Noiseless operation does not count particularly in racing and aircraft engines.

There seems to be a general impression that it is difficult to make overhead camshaft gears operate noiselessly. Just why this should be so—if it is so—is not immediately apparent. Any noise in cam gearing depends on the one hand on the cam outline, and this could be made the same as in engines with the camshaft in the crankcase; and, on the other hand, on the mass of the reciprocating parts, which, as already pointed out, can be, and usually is, considerably less than in a valve-in-head engine with valve rods extending up the sides of the engine. It may be that the impression was created in the early days when overhead camshafts were exposed. In all modern engines of this type not only the camshaft but the whole valve mechanism is enclosed, so that from this point of view the construction should be as easy to render noiseless as an engine with camshaft in the crankcase.

If there is justification for the belief, one reason probably is that there are generally more wearing contacts in overhead camshaft gearing than in the more conventional type of valve gear. At each of these contacts wear will occur, and the play or slackness in the camshaft operating train therefore will increase more rapidly in an engine of this type than in the ordinary L-head engine. Every time the nose of a cam passes from under the cam follower there is a tendency—which is more pronounced in the case of a four-cylinder engine than in that of an engine with more cylinders—for the camshaft to jump ahead and take up the slack of the drive, thus creating noise.

In connection with the older engines with side tappet rods the rapid wear of the tappet lever bearings is unpleasantly remembered. The only means of lubrication of these tappet levers was an oil hole, and the excessive wear was probably due not so much to inadequacy of the lubricating means as to neglect to make use of them. Presumably, with the newer engines of this type, which have wick or even force feed lubrication, this difficulty has been overcome. Of course, with some of the overhead camshaft engines tappet levers are also used, but they are now always inclosed, and therefore can be effectively lubricated. The difference is therefore not one of camshaft location

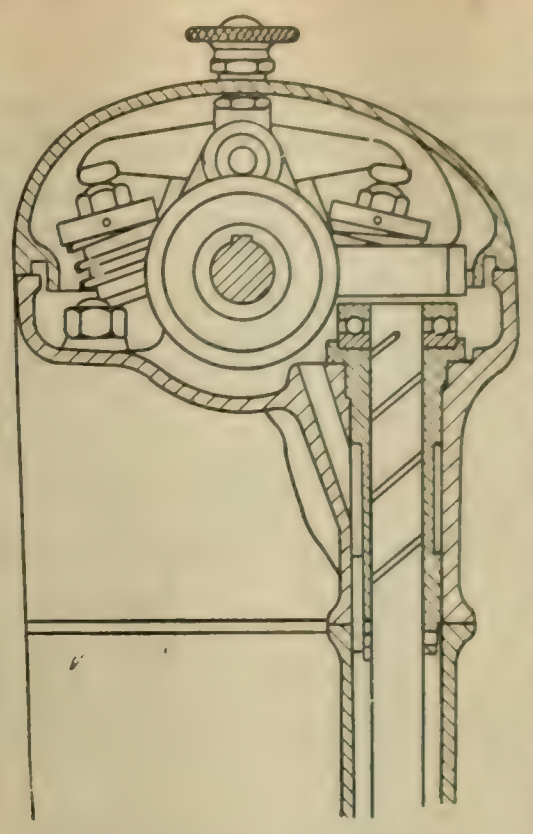


Fig. 4—Ansaldo camshaft drive

but rather of valve actuation and of details of construction.

Another thing in favor of the overhead camshaft is that it generally leads to a very symmetrical engine with the accessories so located that they are quite accessible and with the sides of the engine comparatively free from obstructions.

From the standpoint of manufacturing cost the overhead camshaft is not a very attractive proposition. The provisions which must be made for the complete, oil-tight enclosure of the camshaft, for its lubrication, the enclosure of the drive between members of which one is carried by the crankcase and another by the cylinder head, and the lubrication of this drive, involves considerable expense. There are certain ways of manufacturing overhead camshaft engines comparatively cheaply, but these engines are likely to prove unsatisfactory for one reason or another.

A design of an overhead camshaft engine should be judged from the maintenance standpoint on the basis of the ease of removal and replacement of the cylinder head for the purpose of carbon removal, and of the ease with which the valves can be ground. In other types of detachable head engines the disassembling and assembling work connected with decarbonization of the cylinders is practically the same as that connected with the grinding in of the valves, but this is not necessarily the case. and the merits of an otherwise well thought out overhead valve engine may be greatly detracted from if it requires an excessive amount of disassembling and re-assembling in order to grind in the valves

The overhead camshaft engine has not as yet made much headway in this country, only four cars at all well known having such engines at present. In Europe, on the other hand, many of the leading makes now employ this type of engine, including Lanchester, Napier, Wolseley, Straker-Squire and Leyland in England; Bugatti, Farman and Hispano in France; Ansaldo and

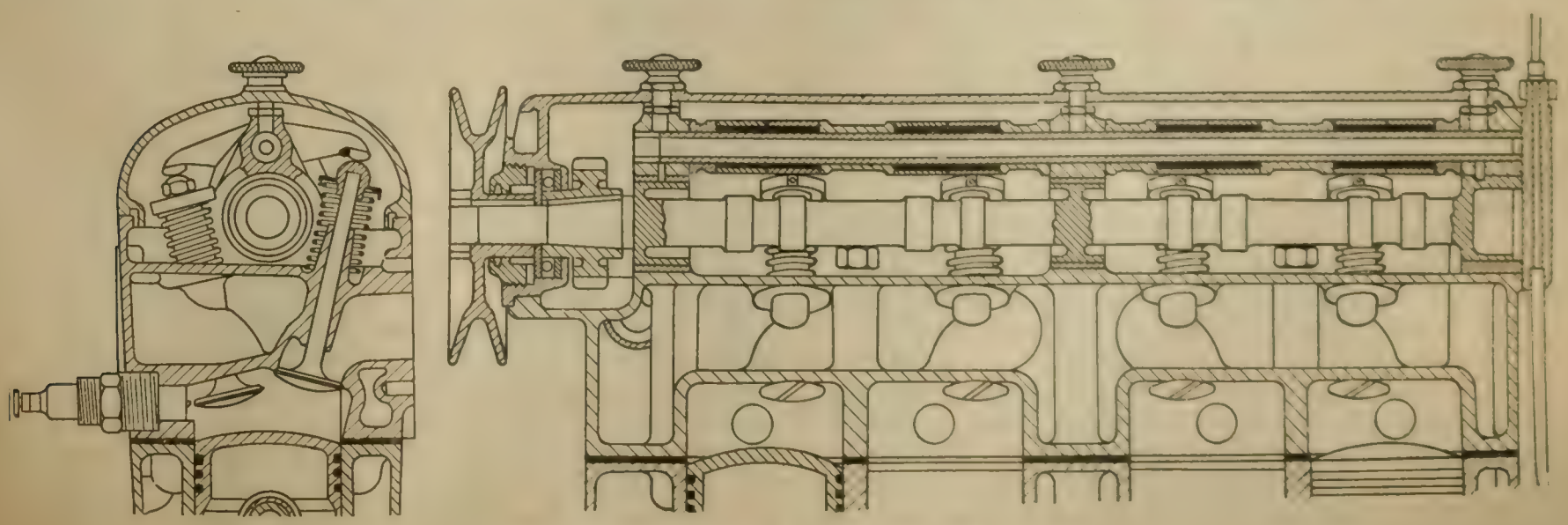


Fig. 5—Ansaldo engine cross section and side view

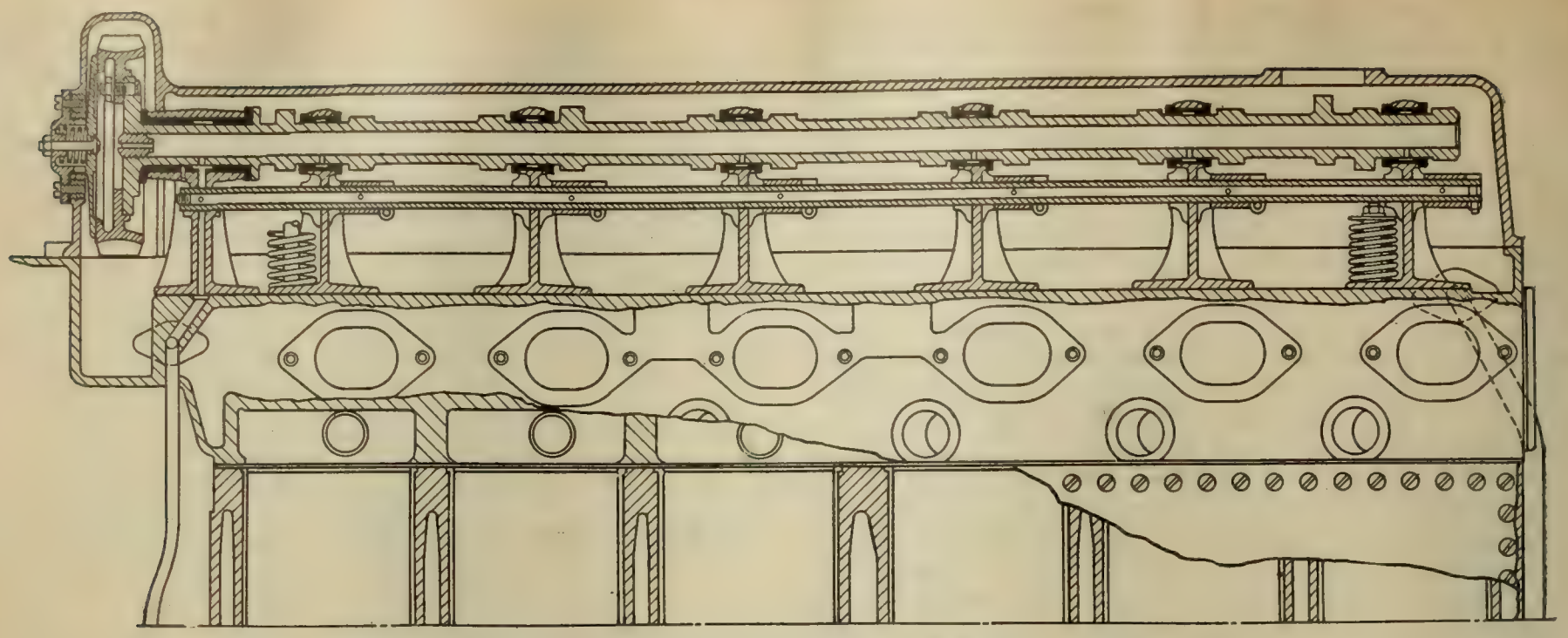


Fig. 6—Napier overhead camshaft

Diatto in Italy and Mercedes and Szawe in Germany. As a passenger car engine the overhead camshaft type is practically an after-war product, while motor truck engines with overhead camshafts were used by several manufacturers in Germany prior to the war.

The writer assumes that the four American overhead camshaft engines, the Wills Sainte Claire, the Leach Biltwell, the Duesenberg and the Frontenac, are well known to the reader, as all have been described in these columns within the past several months; consequently, in the following only overhead camshaft engines of foreign design will be considered.

In connection with the drive the question of its location, at the front or rear, comes up. It is the almost universal practice to have the camshaft drive at the front, and this location is practically standardized. However, it is well known that trouble has been experienced with camshaft drives in the past several years, and there is some suspicion that the fact that the drive is at the front, where it is subjected to the effects of torsional vibration of the crankshaft, has something to do with this. Since the introduction of engines with six and more cylinders running at high speeds a great deal of trouble has been caused by torsional vibration. Owing to the periodic impulses in a gasoline engine, the engine naturally tends to accelerate and decelerate periodically, and the flywheel is provided to minimize these speed fluctuations. The greatest fluctuations in speed occur at the forward end of the crankshaft. If the natural period of vibration of the shaft happens to coincide with the periodicity of the impulses received by this end of the shaft, a periodic torsional rocking motion is superimposed upon the regular rotary motion of the shaft. After each explosion in one of the forward cylinders the crankshaft will jump ahead, only to snap back the next moment. This effect, of course, occurs only at certain critical speeds of the engine, and in engines with exceedingly stiff crankshafts these speeds may never be reached in regular operation. But where a critical speed is reached in the regular operation of the engine it is quite obvious that it must be rather hard on the camshaft gears if they are located at the forward end.

Mercedes has located the camshaft gears at the rear for a good many years and another German maker, Szawe, has recently followed the example. If there is any part of the crankshaft that rotates more uniformly than the rest it is that part at the flywheel, and this therefore would seem to be the best part from which to take the camshaft drive. The objection has been made to this practice that it renders the camshaft gears much less accessible. This is true, but if it renders the gears at the same time invulnerable, what does it matter? With the light work the camshaft gears really have to do it should not be at all difficult to provide a set of gears that would last the life of the engine, and in that case the question of accessibility would not arise.

The writer believes that anyone contemplating the manufacture of an engine with overhead camshaft should give the location of the camshaft driveshaft the fullest consideration, especially if the engine has six or more cylinders. From the standpoint of silent operation also the rear drive has something to commend it, and conditions are still further improved if the fan is driven from the forward end of the camshaft, making the resulting or total torque on the camshaft non-reversible and thus eliminating the cause of noisy operation referred to in the foregoing.

One of the methods of driving an overhead camshaft is by silent chains, and this has been used in a few cases for a good many years. One of the four American overhead camshaft engines, the Frontenac, has this form of drive. From the manufacturing standpoint the chain drive is very attractive, as evidently all that is required is a sprocket or chain wheel on the crankshaft and another on the camshaft and a chain to connect the two. In practice, however, various difficulties crop up which have militated against the more extensive use of chains for this purpose. A single chain between the crankshaft and camshaft is unsatisfactory, because it would have to be abnormally long, and with the wearing of the links or the "stretching" of the chain would whip and be likely to hit the wall of the casing, unless the latter was made with a great deal of clearance space. Two chains, therefore, are generally used, one transmitting the motion to a short intermediate shaft, which may be the fan shaft, and the other transmitting it from this shaft to the camshaft. This does not dispose of the question of chain adjustment, however. One way of solving this problem consists in driving not directly to the camshaft but to a short shaft at the end of it which drives the camshaft through a Hookham joint, and then providing both this short shaft and the intermediate or fan shaft with an eccentric adjustment. Another consists in the use of chain tensioning idlers.

In the British A.C. six-cylinder the camshaft drive is by means of a long silent chain direct from crankshaft

to camshaft, with a spring-loaded jockey pulley to take up slack. The drive is at the rear end of the engine (see cut). The ill-effects of the intermittent torque which the chain must withstand, even in this six-cylinder engine, are reduced in degree by reason of the water circulating pump being located at the end of and driven directly by the camshaft; the load represented by the pump being positive and uniform puts the torque always above the zero line, and though it does not eliminate or even reduce the torque variations due to cam-succession it maintains a positive pressure between the teeth of sprockets and chain. For this reason this pump location seems to be worth considering no matter what form of drive is used and particularly on four-cylinder engines.

On the Wolseley engine there is a short silent chain for transmission to an intermediate shaft directly above the crankshaft. Because of the shortness of this chain the troubles of whipping, etc., are absent and no means for tensioning the chain are required.

Spur gear drive has done excellent service in racing engines. This involves a train of spur gears extending up the front of the engine, and one would expect it to be rather difficult to make such a train quiet, even if helical teeth were used. In racing engines the shafts of the intermediary gear are mounted on ball bearings, and this would no doubt also be required in high class passenger car engines, which would make the drive rather expensive. Another objection to the spur gear train is that since there is a considerable number of wearing surfaces, once the gears begin to wear seriously there will soon develop a considerable backlash, and it would then probably be next to impossible to keep the drive quiet. The gears might be so liberally proportioned that wear would be a negligible quantity, but the high cost and the rather unsightly appearance of the large gear case would remain.

An advantage shared by the two methods of drive is that they require no thrust bearings, whereas all of the other more common forms of drive require such bearings. These involve considerable expense, including not only the cost of the bearings themselves but also the cost of machining the mountings and fitting the bearings.

A form of drive for overhead camshafts that has met with success and is now used on several well known makes of cars is that through helical gear with axes at right angles, or that improved form of the same—the worm drive. The so-called spiral gears were formerly largely used for the camshaft drives of stationary gas engines and possess as their most valuable feature their silent operation. If made of liberal size and provided with adequate means of lubrication they give satisfactory service, but as there is theoretically only point contact, the unit pressure at the contact surface is quite high and if the lubrication is not dependable the backlash is apt to increase rapidly. It is for this reason

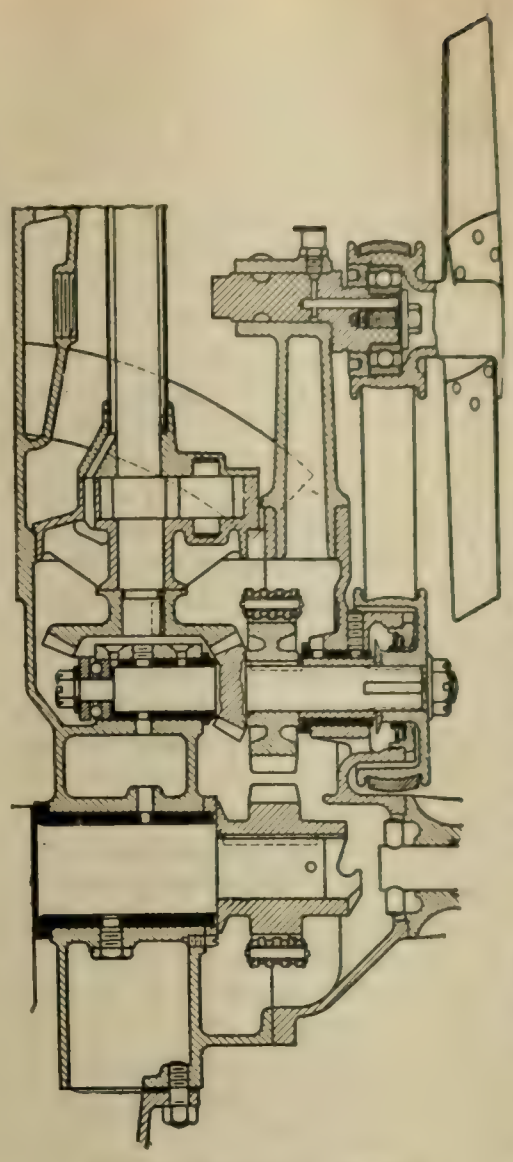


Fig. 7—Wolseley overhead camshaft drive

that several British manufacturers use true worm gears for the drive. Worm gears differ from helical gears in that the face of the worm wheel is throated, conforming to the circumference of the worm, whereby increased bearing surface is obtained.

One advantage of the helical gear or worm drive is that the vertical shaft is offset from both the crankshaft and the camshaft and therefore can have extensions for accessories coupled to it at both top and bottom. With a bevel gear driven intermediary shaft extra gearing is required for accessories at the bottom at least.

It is probably between the worm gear and the spiral bevel gear that the chief competition for supremacy in the overhead camshaft field will arise. The strong and the weak points of the two are practically the same. Both are absolutely quiet in operation—which constitutes their strong point—but both require means for accurate adjustment of their mesh if they are to work satisfactorily. The advantage of the worm in respect to greater handiness for the driving of accessories in certain locations is offset by its somewhat lower efficiency and its lack of symmetry.

An overhead camshaft is one of the features of the six cylinder aluminum engine brought out by Napier of England some years ago. The camshaft is hollow and is supported in seven cast brackets bolted to the aluminum cylinder head. It is located centrally above the cylinders and the valves are staggered, one being on one side of the camshaft and the other on the opposite side. There are two rocker shafts supported on the same brackets as the camshaft, and the rockers or valve levers extend underneath the camshaft and are so arranged as to give a greater lift to the valves than the height of the cam nose.

The camshaft drive on this engine is by worm gearing.

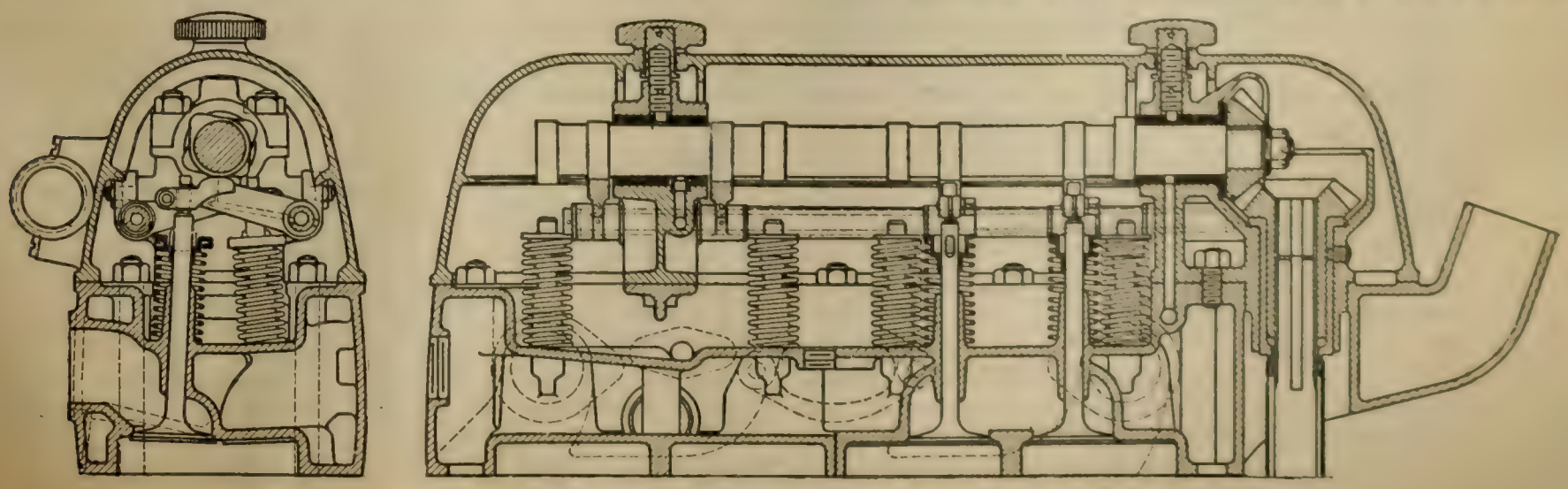


Fig. 8—Sectional views of Wolseley cylinder head and valve cover

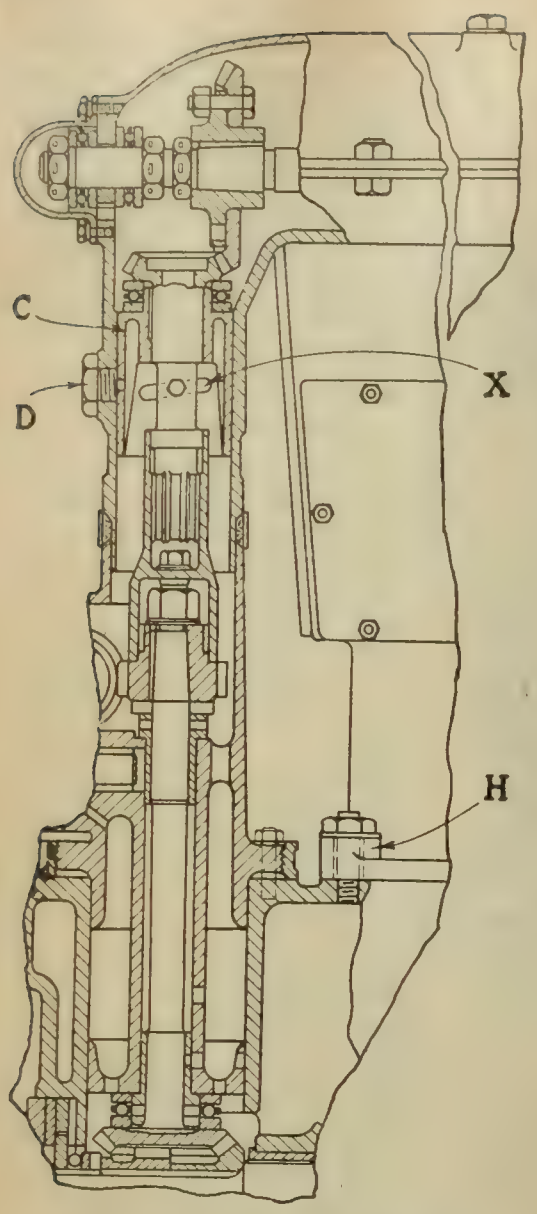


Fig. 9—Bentley camshaft drive

The vertical shaft is made in three parts, one carried by the housing at the forward end of the crankcase; the second carried by the cylinder head and the third an intermediate shaft secured to the top and bottom parts by flanged couplings. From the bottom of the vertical shaft the oil pump is driven, while the generator and magneto drive is taken off the vertical shaft at the joint between the bottom and the intermediate section, the worm being combined with a coupling flange.

In connection with the Napier camshaft drive a description may be given of its camshaft brake, which is a feature found only on a few high grade engines. There is a possibility that such a camshaft brake is more necessary in an engine having a worm drive for the camshaft than in an ordinary L head engine with direct spur gear drive to the camshaft, owing to the fact that the worm drive may permit more backlash in the drive. The object of the camshaft brake is of course to prevent the camshaft from snapping ahead as the nose on any particular cam passes its cam follower. As will be seen from the accompanying cut, the brake consists of a metal disk mounted in the housing of the worm gear in such a manner that it cannot rotate but is forced against a flange on the rim of the worm gear by a coiled spring in a mounting hub bolted to the worm gear housing from the outside. Adjustment is apparently provided for by means of washers under the flange of this hub.

Probably the most prominent make of small car employing an overhead camshaft is the Wolseley. The construction is similar in some respects to that on the Napier engine but is simplified. Besides, the drive of the camshaft is through spiral bevel gear instead of worm gear. However, this spiral bevel gear drive is preceded by a silent chain drive from the crankshaft to a parallel shaft directly above it at a ratio of 1 to 1 and with a very short chain. The 2 to 1 reduction is obtained by the lower pair of bevel gears, which permits of the use of a small pair of gears at the top, thus making for neatness. It would be practically impossible to obtain this reduction at the bottom of the vertical shaft and still have the driving pinion on the crankshaft, for the reason that in order to clear the crankshaft bearing the pinion must be of large diameter, and this would necessitate such a large diameter driven gear that the whole drive would become unduly bulky. As it is, the fan drive pulley is mounted on a forward extension of the horizontal shaft and the gear type oil pump forms part of the mounting of the vertical shaft. The shafts of this drive are mounted in plain bearings exclusively, except for a ball thrust bearing on the horizontal shaft.

This is a small bore four cylinder engine and the camshaft is supported in two bearings only. In order to reduce the unsupported length as much as possible, the two rearmost cams are arranged to overhang the rear bearing. The general arrangement of the valves, rocker levers and cams is practically the same as on the Napier. Both the camshaft and rocker lever shafts are supported by brackets on the cylinder head, and the rocker levers are located underneath the camshaft and give a greater lift to the valves than what might be called the cam throw. Clearance adjustment is made by means of set screws in the ends of the levers which are locked by clamping bolts in the split ends of the levers.

The spiral bevel gear drive seems to have much to recommend it for overhead camshaft engines, but it must be realized that in order that the gears may run together quietly and efficiently they must be accurately adjusted. As there are two pairs of gears, four adjustments are required, and, besides, provision must be made for any want of alignment or relative motion due to differences in heat expansion between the upper and lower bearings of the vertical shaft.

This problem has been attacked by two engineers of Bentley Motors, Ltd., an English concern, who have taken out several patents covering a number of design points. Referring to the sectional drawing herewith, the vertical shaft is made in two parts, which are joined together by means of a telescopic splined coupling. Each part can be accurately adjusted endwise with or in its casing. At the bottom this end is attained by providing the casing with a flange, which, instead of being bolted directly to the crankcase, is provided with a threaded ring. This ring can be screwed up or down over the integral flange and with it forms a flange of adjustable thickness. At the top a bearing box C can be rotated slightly by inserting a bar through the hole closed by plug D, and by being rotated is being adjusted up or down by means of the helical slots X and pin screws in the casing extending into them.

The camshaft is held against endwise motion by means of two thrust bearings at the forward end, and can be adjusted endwise by simultaneously turning the two nuts at opposite sides of these bearings. It will be noted that the upper part of the casing for the vertical shaft is integral with the camshaft casing while the lower part is integral with the crankcase and the intermediate part bolts to this lower part. In order to permit of complete alignment of the upper and intermediate parts of the case the bolt holes through the cylinder base lugs H are made oblong. The endwise freedom of the connecting rods on the piston pins permits of slight variations in the position of the cylinder block on the crankcase. It is thus possible to adjust the mesh of both sets of gears and also the alignment of the two parts of the vertical shaft housing.

(To be concluded)

THE Bureau of Standards, Washington, D. C., has issued Technologic Paper No. 206 on the Effect of Heat Treatment on the Mechanical Properties of 1 per cent Carbon Steel (spring steel). The paper gives the effects of varying time-temperature relations in heat treatment on tensile and impact properties, hardness, and structure of 1 per cent carbon steel, as follows: (a) Effect of temperature variations in hardening; (b) time of hardening temperatures above A_{cm} between the A_{c_1} and A_{cm} transformation; (c) effects of tempering steels hardened in different ways and effects of "soaking" just under the lower critical range, and (d) comparison of oil and water hardening for production of definite strengths. Under the described conditions of treatment and test, the features observed are described in detail under eight headings.

New Tractor Gearsets Have Novel Reverse Mechanism

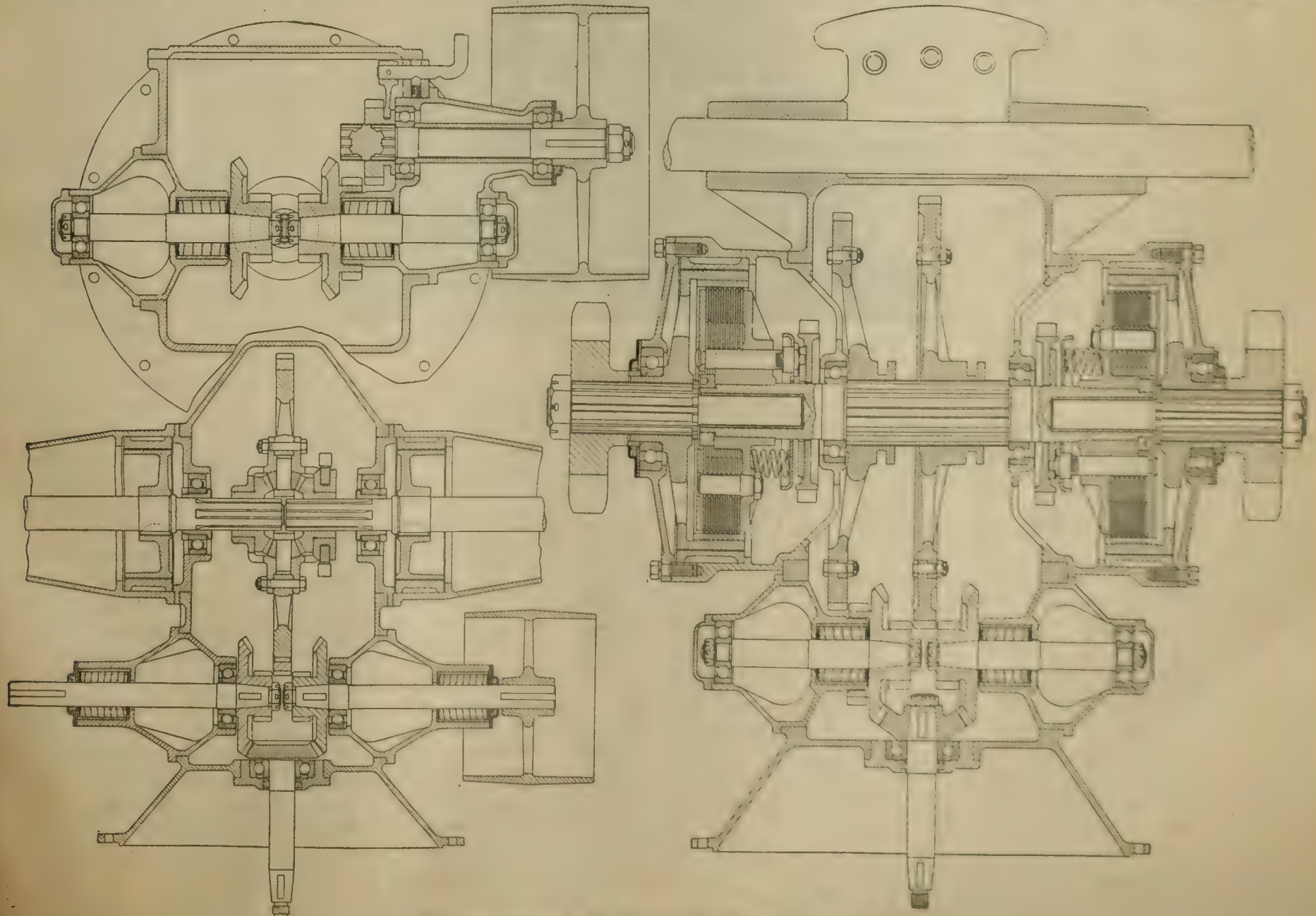
Reverse accomplished by sliding differential gear sideways. Designed for unit powerplant construction and both provided with a belt pulley.

TWO new gearsets—one of them for a cultivator gives only a single speed and reverse; the other a two-speed and reverse gearset for creeper type tractors—are illustrated herewith. The designs are the product of Thomas L. Fawick of the Twin Disc Clutch Co.

The cultivator gearset is intended to be used in connection with a final speed reduction at the drive wheels, in accordance with general practice in motor cultivator design. The novel feature of this gearset is that for reversing the direction of motion of the cultivator the differential gear is slid sideways on the splined differential shafts, whereby the gear ring on it is brought into mesh with one or the other of the two spur pinions which are formed integral with bevel gears on intermediate shafts. The design of the gear is quite simple and the gearset is claimed to be a good manufacturing proposition for this reason and also because most of the parts are duplicated, so that the number of different parts is small. Bronze bushings are entirely eliminated in this gearset.

The creeper type tractor gearset is similar in some of its features to the cultivator type, but it has two forward speeds and reverse and is fitted with Twin Disc clutches for steering, while the differential is dispensed with. One of the bevel gears on the intermediate shafts is provided with two spur pinions, one on each side, and two large sliding gears are mounted on a splined shaft carrying the steering clutches. The shafts for the chain wheels are supported in bushed pilot bearings in the ends of the splined shaft and in ball bearings mounted in the gearset housing.

This gearset is provided with a power take-off which can be thrown out of mesh when not in use. The pulley shaft is located directly above one of the bevel gear shafts, the one on the right side of the tractor, and its pinion, which is adapted to slide on the splined end of the shaft, can be engaged with the high-speed pinion on the back of the bevel gear. The gears are meshed and unmeshed by means of a pull rod extending through the wall of the housing and locked in the "in" and "out" positions by means of a spring-pressed locking dog. Both of the gearsets have the same efficiency for reverse as for forward motion.



Sectional views of the new Fawick tractor gearsets

Speeding Up Screw Thread Inspection by Optical Projection

Speed and accuracy obtained in this operation by the Hartness Screw Thread Comparator. Method applied to test cutters and to locate imperfect edges of gear teeth by tracing outline of a median tooth section.

By Ralph E. Flanders*

THE Screw Thread Comparator, originally devised to test screw threads, was the invention of Mr. Hartness, president of the company with which the writer is connected. It related particularly to a special means of supporting the screw between a source of light and a projection microscope, and a special chart with tolerances indicated on it to receive the projected image. The combination of these novel elements made it possible to inspect all the significant dimensions of a screw thread at a single glance, indicating the degree of error in major diameter, pitch diameter, root diameter, form, lead, quality of finish, etc., and, more important still, the total effect of all these errors on the fit of the screw in a standard hole for any desired length of engagement.

An arc lamp is ordinarily used as a source of light. Its brilliance permits the apparatus to be set in any suitable dimly lighted location, a completely dark room being desirable but not necessary. The small area of the light source also adds to the sharpness of the image—a prime requirement where accuracy is desired.

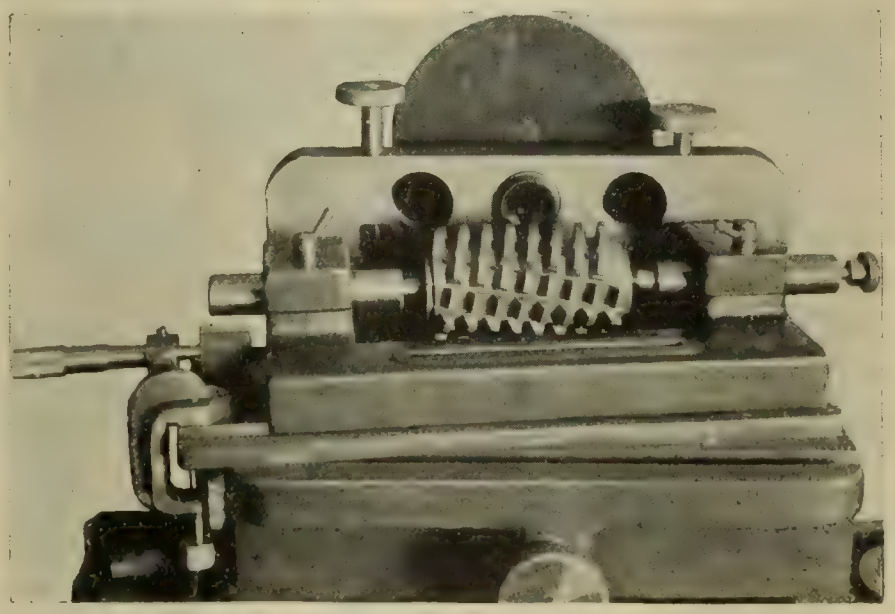


Fig. 1—Hob mounted for test on the Comparator

The microscope is of special construction, the lenses having been figured by Dr. Hastings of Yale, and ground and mounted by Brashear of Pittsburgh. The problem solved in this special microscope is that of getting a magnification of 200 diameters at a distance from the operator of about 5 ft., without chromatic diffusion (that is to say, without having the edges of the image show wide bands of color instead of clear, sharp black and white), and without measurable distortion. Now it is easy enough to meet these requirements if the screen or chart is permitted to be 40 or 50 ft. away, but in this case the magnification does the operator no good, for he must leave the machine and walk up to the screen to get the benefit of it. It is likewise easy enough to get the magnification at close range and with a sharp outline if we do not care about distortion; or with an undistorted image if we are not troubled about hazy color bands instead of a sharp edge to the shadow. But to get all three conditions of nearness, sharpness and accuracy of image is very difficult. We believe it has been attained in this microscope to a degree hitherto unknown. Our success in the matter has been due to putting the problem of lens calculation and manufacture into the most skilled hands we were able to discover.

Note that the machine is a *Comparator*, as its name indicates. The final standard is not the outline on the chart, but the plug gage whose shadow is set to coincide with the chart. This principle of using the apparatus as a *Comparator* will be followed in all the subsequent demonstration on the measurement of gear and cutter outlines in that they will ordinarily be referred to an outline on an actual standard instead of to a drawn outline on a chart. The advisability of this will be demonstrated later.

We now pass to the distinctive use of the machine in connection with gear and gear cutter inspection, of which the simplest is the inspection of gear cutter outlines.

For this work the machine has to be entirely rearranged. The cutter is mounted on a true arbor between dead centers in front of the lens. The microscope in this case must have a large aperture to take in the whole tooth. A stop is provided against which the cutting face registers to keep it in the vertical plane for which it is focused.

Now to get the required degree of magnification (say 90 or 100 diameters for the work) at a distance of 5 ft., where the operator can observe it and at the same time manipulate the work, would require an angle of projection so wide that no lens system can be devised to preserve both freedom from distortion and achromatism, or freedom from color bands. We are therefore led to the expedient of reflecting the image against a mirror placed at a distance and bringing it back to the operator's position, where it is received on the back of a ground glass screen. On the front of this the operator can work freely, drawing lines or erasing them, comparing the image with his drawings, etc., all without throwing his own shadow on the screen at the operating position of the apparatus. What is equally important, a considerable group of men can examine the image at close range.

The mirror, it should be noted, is not an ordinary one with a "silvered" or amalgam back, but has an actual

*The Jones & Lamson Machine Co. Paper presented at the Buffalo meeting of the American Gear Manufacturers Association. Condensed.

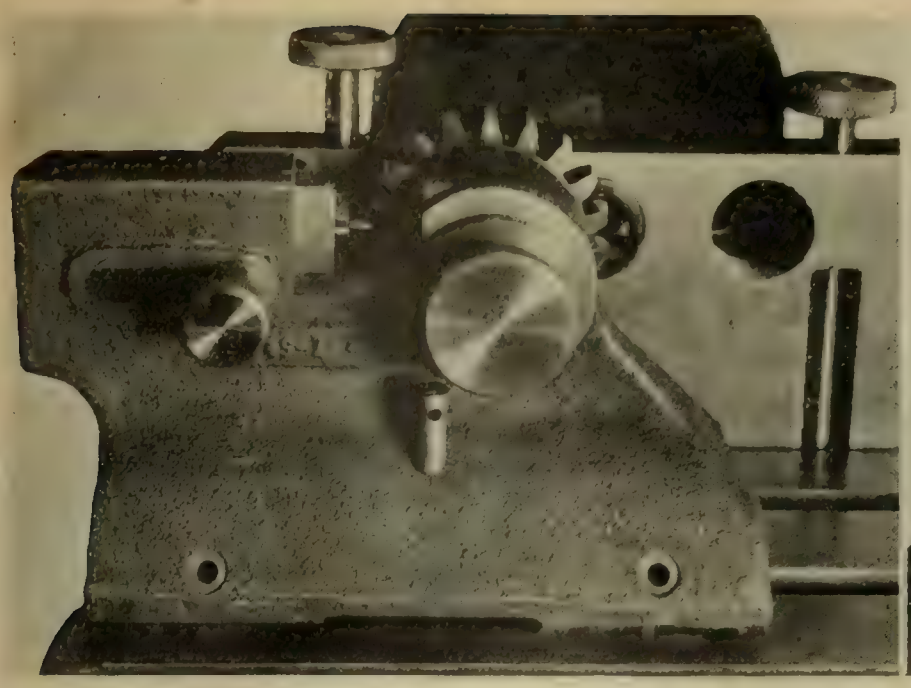


Fig. 2—Front view of fixture for projecting spur gear or Fellows cutters

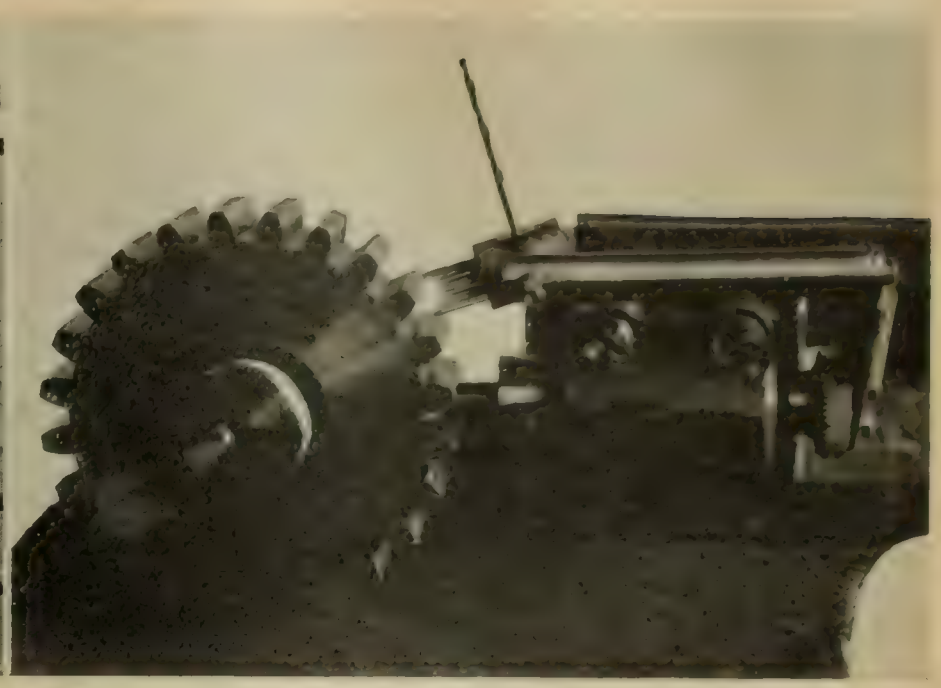


Fig. 3—Rear view of the same apparatus

deposit of silver on its front surface from which the reflection is made. This is the same method as is used in coating the parabolic mirror used in reflecting telescopes. This gives a more nearly total reflection of the light, and above all avoids the double reflection from both front and back faces of the ordinary mirror. The accuracy of the result can be judged from the fact that with a magnification of 100 diameters differences of 0.0001 in. can be detected.

Testing Regularity of Teeth

What use can be made of the machine set up as shown for projecting a form cutter? A most direct and valuable use lies in testing the regularity of the teeth, one with another. If the outline of the first tooth projected is carefully drawn on the screen, successive teeth may be indexed around into position and compared with the first one. By this means we may discover differences in outline, whether due to hardening distortion or inaccurate grinding; and also any run out of the teeth whether sidewise or radially. Furthermore, the teeth of a cutter giving satisfactory results may be compared with one which is not satisfactory and the reasons determined. By reversing the cutter on the arbor it can be determined whether or not the tooth outline is symmetrical. All the above determinations result from the use of the machine as a *Comparator*.

The use of this or any other projection apparatus for the direct comparison of tooth outlines with diagrams drawn to an enlarged scale is a more difficult matter—more of a laboratory job than an ordinary shop process. In the first place we would either have to replace the silvered plate glass mirror with one more nearly optically perfect (which might cost two or three hundred dollars) or place the screen at a great enough distance from the lantern to get the required magnification directly. The latter solution throws away the advantages of the mirror and ground glass screen just enumerated.

Some Precautions to Be Taken

Besides this, a very high degree of accuracy in the location of the work holder, microscope and screen with reference to each other would be necessary. All must be centered on the same optical axis at the proper distances, and the screen must be perpendicular to that axis. Then all must be firmly held to prevent accidental shifting by jar or otherwise. The most practical way of effecting this would be to place in the focal plane of the machine an object of known and easily measurable dimensions, provide on the screen an outline of it drawn to the scale desired, then focus and shift the screen until the image and outline match. Any other outline in this same focal plane will then be correctly magnified on the screen. But the screen must not be shifted, nor can the work be focused anew, nor the microscope be screwed in or out. To do any of these things would throw the image out of scale.

The work, however, can be shifted in the focal plane to match the diagram, or the microscope can be adjusted in a plane perpendicular to the optical axis to obtain the same result.

In Fig. 1 is shown a hob mounted to be tested on the *Comparator*. Here the additional element of lead variation has to be considered, and this is taken care of by mounting the hob, its arbors and the centers on which it is mounted in a frame which rolls on ball bearings in tracks, machined in the base of the device. The advance of each tooth is measured by matching it with the outline on the chart, and reading the axial distance moved from the micrometer, or by means of Johansson blocks, or both.

Excellence of Microscope Objective

The center line of the hob must be set at the proper angle to bring the face of the tooth to be inspected as nearly as possible in the focal plane. This angle is presumably the helix angle of the hob measured at or near the pitch diameter. A stop is preferably used to locate the cutting edge in the focal plane. In expert hands the stop can be omitted, as bringing the outline to a sharp focus indicates that it is within less than .001 inch of the required position. A movement of this amount either way will blur the outline. This, incidentally, shows the excellence of the microscope objective.

In Figs. 2 and 3 are shown front and rear views respectively of a fixture for projecting spur gears or cutters of the Fellows Gear Shaper variety. It is shown with a cutter mounted in place in Fig. 3. It consists simply of a frame carrying a stud on which the gear or cutter is mounted, and an index pin or spring plunger carried in a holder adjustable for diameter, having a conical point to engage and locate the tooth space. The stud on which the gear or cutter is mounted is cut away to give two fixed contacts on the side toward the index pin, and one with spring pressure behind it on the opposite side. In the case of gears with holes varying in diameter, this insures a nearly uniform presentation of the teeth to the microscope.

Going back now to Fig. 3 and the testing of the gear shaper cutter, the following important points should be noted: The tops of the teeth are not ground square but at an angle of 5 deg., so that it is necessary to set the at-



Fig. 4—Showing use of needle in exploring the outline of an intermediate section of the gear

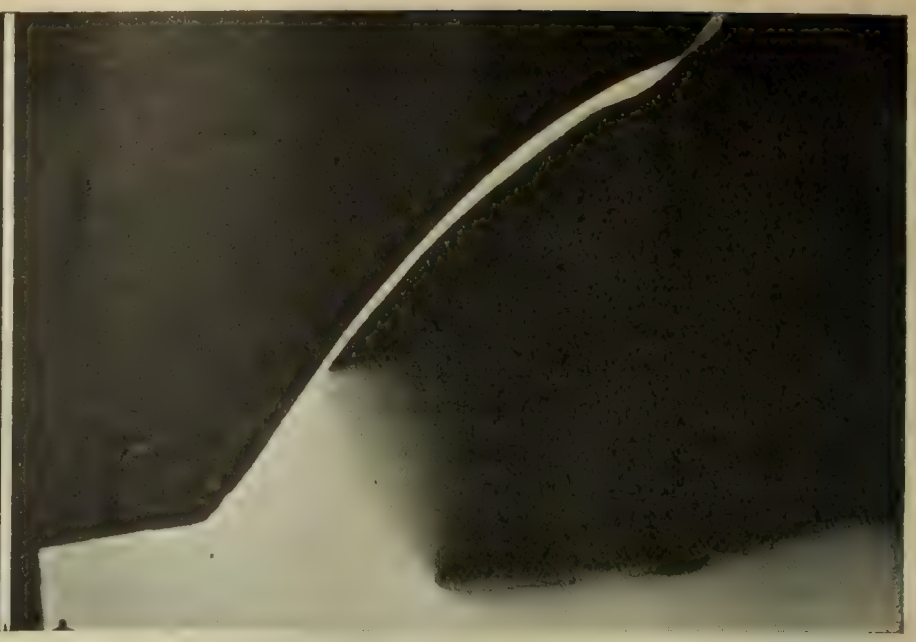


Fig. 5—Showing effect of a roughly formed templet applied to the surface to be outlined

tachment at that angle on the work table of the machine to bring the cutting edge uniformly into the focal plane. Secondly, in comparing one cutter with another, owing to the nature of the relief on the cutter, the image must be brought to a focus, not by shifting the cutter along the optical axis by the regular focusing screw, but by shifting the cutter along its own axis which is at an angle of 5 deg. with it. Otherwise the comparison will be worthless.

Two kinds of test may be made with the gear shaper cutter. The first is for indexing. In this test an outline of one of the teeth is drawn on the screen, and then successive teeth are indexed past this outline and the amount of variation in position is noted.

Comparison of Teeth Outline

The other and perhaps more interesting test is for comparison of the outlines of the different teeth on the same cutter, or with those of another cutter, or with a standard made for the purpose. In this case the accurate index pin previously used is replaced by one having a point slightly eccentric. By turning this pin the cutter may be very delicately rotated to bring the image of each tooth to an accurate match with the drawn diagram, irrespective of any slight errors in indexing. Besides the precautions mentioned above, other points inherent in the involute system must be observed. The thinner tooth of the ground down cutter as compared with the new one is an essential for theoretical accuracy, and not a mistake. Within certain limits changes in shape at the fillets, or anywhere below the base circle of the cutter, do not affect the acting surfaces of the cutter or of the gear cut. In the event of an attempt to compare cutter outlines with drawn diagrams, due regard must be had in this case as in all others to the precautions mentioned early in the paper. In this case also the most satisfactory use of the machine is as a *Comparator*, to compare outlines with each other or with a standard, rather than with an unregistered diagram.

So far we have been talking about projecting cutter outlines, a problem which is comparatively simple, owing to the sharp, definite character of the cutting edges. When we come to gears themselves, however, the problem is a serious one. The edge is rubbed over on the entering side of the cut and provided with burrs on the other side, which cannot be removed with any assurance that the true outline will be retained. Worse than this, many gears, especially in automobile work, have the teeth chamfered at one or both edges, thus making a reliable outline impossible. Until recently, the best method available was to clamp a thin sheet of metal between two thicker blanks of the same material and cut teeth in all at the same time. This produced a thin templet, practically free from burrs, and of correct outline, and thus suitable for projection. This was all right theoretically, but such a gear could not be tested in actual running, nor could it be compared with one which had been run. The problem was thus practically unsolved. What was needed was some method of project-



Fig. 6—The whole apparatus at work with gear mounted in fixture shown in Fig. 3

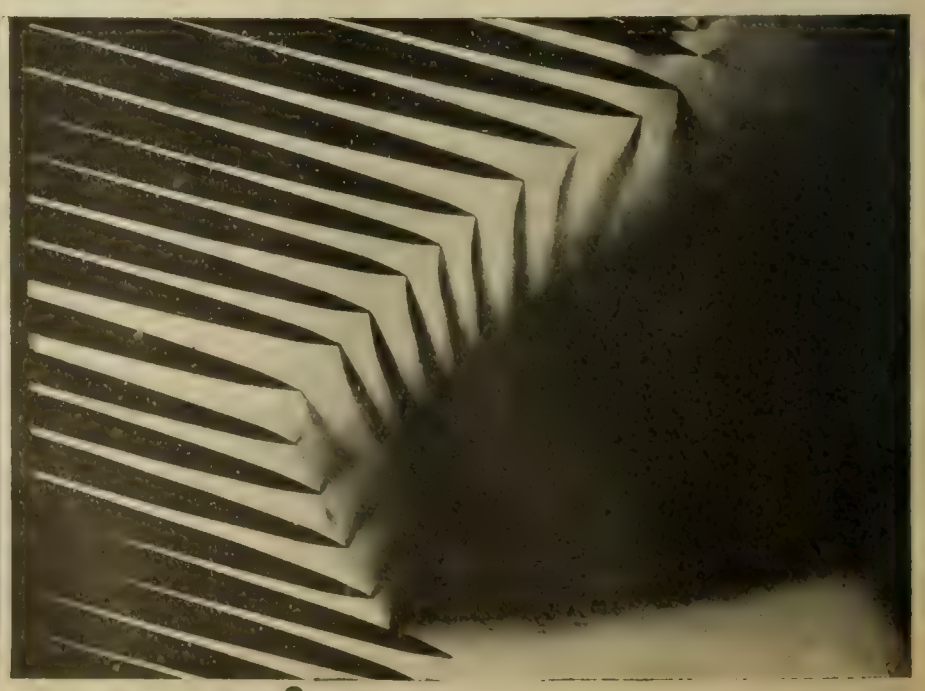


Fig. 7—The image of the gear teeth projected on the screen

ing and tracing the tooth outline on any section from one end to the other. This difficult problem was solved in a very simple and beautiful way by Messrs. Beardsley and Porter of our organization.

If a gear with ground, lapped, or otherwise polished tooth surfaces is placed in the device shown in Fig. 3, and the device clamped on the work table so that it makes a slight angle with the optical axis (say 1 deg.) in a direction which tends to display the tooth surfaces to the microscope, we notice an interesting thing. The diagram on the screen tends to show an outline on the focal plane, whether that be located close to one end of the tooth or somewhere midway. This is due to the fact that the microscope tends to define anything in the focal plane and confuse everything else. Owing to the *"thinness"* of the focal plane of these special microscopes, the infinitesimal details thus picked out tend toward a sharp outline, but yet not sharp enough for practical purposes. How shall this outline be developed?

It was done in a most simple manner. As shown in Fig. 4, a needle was mounted and focused in the plane it was desired to explore, and then the tooth outline was traced by its point. The junction of the point and its reflection, as shown, furnished a location for the surface measurably accurate within .0001 in.; and it made possible the rapid drawing of the outline with nearly this degree of accuracy. With the outline once drawn, other teeth of the same gear, or of other gears, can be likewise indicated with the moving needle point, and satisfactorily compared with the drawn outline.

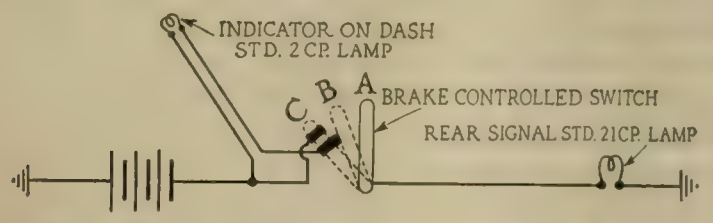
For extreme accuracy the reflected image of the needle is required, but this does not confine the use of the process to highly polished surfaces. Even roughly cut, hardened gears, with the black of the furnace on them, show some reflection under the glare of the arc. It is our conclusion that, in general, any ordinary gear will show reflection enough to allow measurement in reasonable proportion to the accuracy of the surface measured.

Variations of this method were developed later. For instance, Fig. 5 shows the effect of a roughly formed templet applied to the surface to be outlined. That surface is not indicated, as might be supposed, by the adjacent tooth outline shown. That is merely the reflection of the templet. The real tooth-shape lies midway between the two outlines and would have to be so drawn. With a somewhat more accurately made templet this method might well be used in practice.

What promises, however, to be the most practical application of this principle is embodied in the device shown mounted above the index pin in Fig. 3. Here we have a whole battery of needles laid side by side in the shallow groove of a suitable holder and held in place by a sheet rubber pad between them and a rotatable spindle (shown in the illustration as a small twist drill.) When a gear is mounted in the fixture as shown and the spindle is revolved between the fingers, the needles approach the tooth outline, stopping in contact with it for its entire length from top to root. Fig. 6 shows the whole apparatus at work, with the inspector in the operating position, and Fig. 7 shows the image on the screen.

An Improvement for Rear Signal Lights

AUTOMATIC rear signals for automobiles have rapidly increased in use during the past year, especially in the cities, and some of their defects are beginning to attract attention. When a car is equipped with such a signal

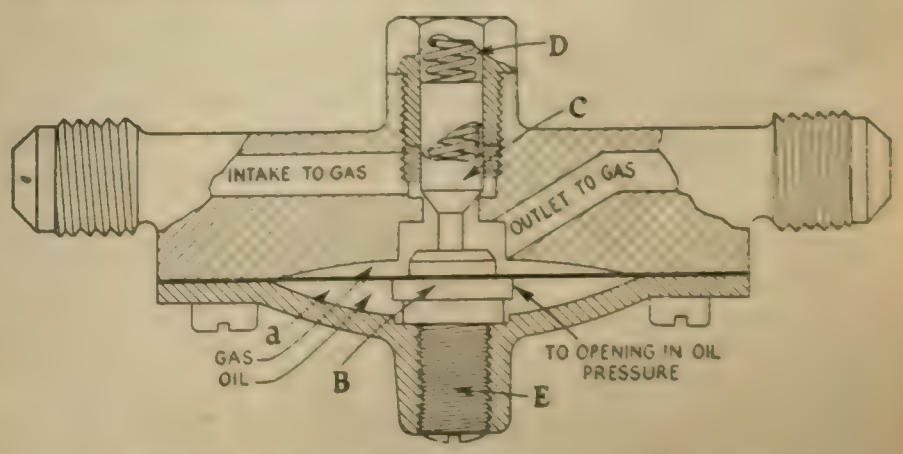


Details of dash indicator lamp for rear signal light

the driver naturally relies upon it, but if it is in the form of a signal light mounted on the rear of the car there is nothing to show him whether it really operates. Some of the signals which have been put out are said to be rather cheaply made and not to warrant this reliance. The National Lamp Works have now brought out a small dash indicator lamp to be wired in such a manner that it is momentarily connected in circuit with the signal lamp when the circuit of that lamp is closed by the operation of the brake or clutch pedal. The arrangement is shown by the diagram herewith. A device has also been worked out to be used in cases where it is desired to give warning to drivers in the rear that the car is to be turned to the right or left. This necessitates three signal lamps and two switches, one of them a two-point switch, but only a single dash indicator lamp. The indicator lamps remain in circuit only for a moment and not for the entire period that the signal lamp is alight.

Safety Fuel Valve

AN automatic valve designed to protect the engine in case the oil circulation fails or becomes inadequate for any reason has been placed on the market by the Xplo Corp. of Indiana under the name of the Xplo automatic gas control valve. It consists of a diaphragm valve inserted in the gasoline line. Evidently a valve of this kind is applicable only to engines having a pressure lubricating system. A lead from the pressure system is connected to the diaphragm chamber. A conical valve is secured to the center of the diaphragm and is held in the closed position by a coiled spring within its hollow shank. When the pressure of the oil against the diaphragm exceeds the pressure of the coiled spring the valve will be opened and the gasoline can flow from the vacuum feed chamber to the carburetor. Should the oil pressure drop below ½ lb. p. sq. in. the fuel valve will shut automatically and prevent the delivery of more fuel to the carburetor, thus protecting the engine bearings against burning out.



Sectional view Xplo automatic gas control valve

Automotive Transportation for the Farmer Has Hardly Begun

Highway transportation system program of the American Association of State Highway Officials calls for 186,700 miles of improved highways. 69,100 miles under construction or finished. Program will be completed in 15 years and will open up a vast rural market for motor truck sales.

By William C. Markham*

THE use of automotive transportation by the farmer has hardly begun despite the fact that there were 1,346,000 trucks in use over our highways in 1921. When we realize, however, that already 12,000 trucks are used in the country to take farmers' children to school, that hundreds of motor express lines with regular schedules have been established, that 6,000,000 head of cattle were transported by truck in 1921, it is sufficient to indicate the possibilities of automotive highway transportation.

Some idea of the scope of the program of the American Association of State Highway Officials for a highway transportation system, which is, we believe, the foundation for almost unlimited possibilities of the utilization of trucks for farmers, may be secured from a paragraph description of the work to be done. Actual work has been under way now for two years and the program is not merely one on paper.

The highway transportation system throughout the United States is 186,700 miles, of which 69,100 miles have already been improved or are in various stages of construction. This program of 186,700 miles constitutes only approximately 7 per cent of the road mileage of the states but is a representative 7 per cent of roads in each state. In other words, the first 7 per cent of good roads improved in each state are those roads which best serve the rural districts and afford a connecting link in each state for a national highway automotive transportation system. That part of the mileage which has been constructed by the use of Federal aid has been done at an average cost of $18,000 per mile, of which the Federal Government has contributed 42½ per cent and the States 57½ per cent.

Investigation has shown clearly that up to a distance of 150 miles truck transportation is superior to railway transportation and it is only by the development of a national highway transportation system that the greatest amount of benefit can be derived by the farmers.

It is not necessary to enumerate the advantages of automotive transportation in short line hauls, but an investigation among the 1,500,000 members of the American Farm Bureau Federation, which is co-operating with the Association of State Highway Officials, shows that within the past three years farmers in some States have about giving up their own trucking.

The establishment of an adequate automotive highway transportation system has made this possible and the advantages are many, principally the saving in time of the farmer, and the saving of the uneconomical loss sustained by a farmer when he gets in his truck and goes to town for some sort of repairs or takes a load of produce in to the city, returning home empty.

So firmly has Congress been "sold" on the idea of Federal aid in developing highway transportation that I feel that it is a safe prediction to state that the question of Federal aid in the future, as a policy, is as thoroughly intrenched as rural mail delivery.

As a prediction for the future the writer is also willing to hazard a prediction that the next five years will bring about such strides in highway transportation that the average farmer will get his mail twice a day instead of once. He will also be served by highway transportation fleets making daily deliveries and offering 24-hr. service to him in the shipment of produce to the city.

There is no better way to approach a study of the necessity for proper highway construction and upkeep of roads than an investigation of the cost of highways in relation to the cost of the methods used for transportation over them. Comparing the funds used for the construction of roads and the public's money tied up in highway rolling stock of a motorized character, we find some very interesting comparisons.

Placing a value of $1,500 on each truck and $750 on each passenger car, we find that in 1910 the value of the motor vehicle investment was $386,250,000. That year we spent for new road construction $95,000,000. The States expended for new construction from 1910 to 1916, inclusive, $1,056,000,000, but the motor vehicle investment had jumped to $2,822,250,000. The entire funds for

MR. MARKHAM predicts that the next five years will bring about such strides in highway transportation that the average farmer will get his mail twice a day instead of once and that he will be served by highway transportation fleets making daily deliveries and offering 24-hour service to him in the shipment of produce to the city.

The writer also believes that with the completion of the program, already under way, giving the farmers of the United States an adequate highway transportation system over which they can have a regular automotive transportation service, the possibilities of sales by truck manufacturers in the transportation field will be almost beyond limitation.

*Representative of the American Association of State Highway Officials and affiliated with the American Farm Bureau Federation.

road construction from 1910 to 1921, inclusive, was $2,526,000,000, while motor vehicle investments in 1921 had reached the peak of $8,322,000,000. Some idea of the strides that are being made in highway transportation systems may be gained from the fact that last year a total of $600,000,000 was spent by the Federal Government, States and counties on its highway system.

For the future the outlook for a continuous and steady growth of our program is exceedingly bright. The Dunn bill appropriating $65,000,000 for the fiscal year ending June 30, 1923, and $75,000,000 for the following year, which is receiving the active support of our association, passed the House on May 1 and is now up for conference with the Senate, with the practical assurance that the appropriation will be passed to carry on the Federal aid program adopted under the National Highway Act.

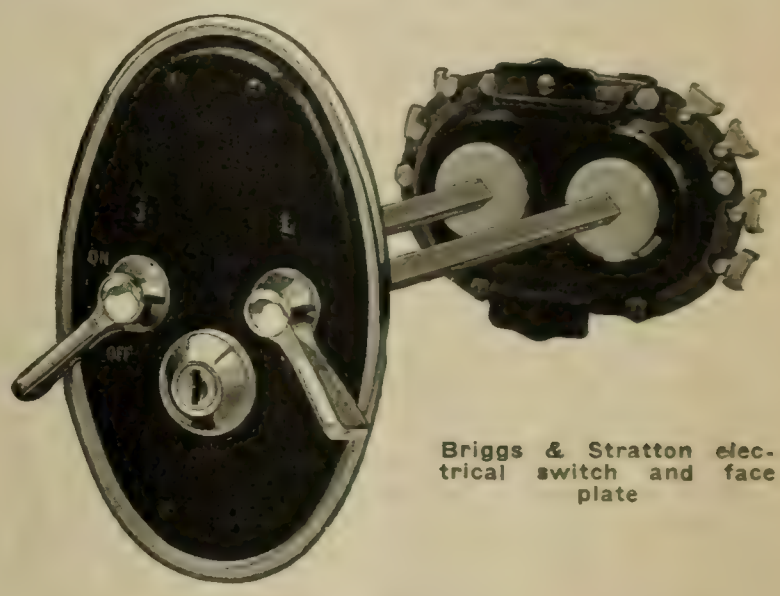
To date something like $350,000,000 has been appropriated by the Federal Government during the past five years in the national highway transportation system. A careful survey of the probable time necessary to complete the first step in the building of good highways throughout the country, which includes but 7 per cent of the total mileage shows that the first 7 per cent of good roads aggregating 186,700 miles, can be completed in 15 years if the Federal appropriations aggregate as much as $75,000,000 per year. On an appropriation of $100,000,000 per year, which is the sum recommended by the association, the first link of national highways could be completed in ten years.

With the completion of this program, already well under way, giving to the farmers of America an adequate highway transportation system, over which they can have regular automotive transportation service, I feel perfectly confident in making the assertion that at the present time the use of automotive transportation by the farmer has hardly begun and the possibilities of sales by truck manufacturers in the transportation field are almost beyond limitation.

New Automotive Lighting and Ignition Switch

A NEW lighting and ignition switch which has the operating levers placed at the end of long, rigid rods by means of which the actual switch mechanism is operated, has been brought out by the Briggs & Stratton Co. The extended handles make it possible to mount the face plate of the switch and the levers on the dash, while the actual switch mechanism is placed under the hood, usually on the bulkhead, where the switch terminals are easily accessible. This construction frees the space immediately behind the dashboard of the usual conglomeration of wiring.

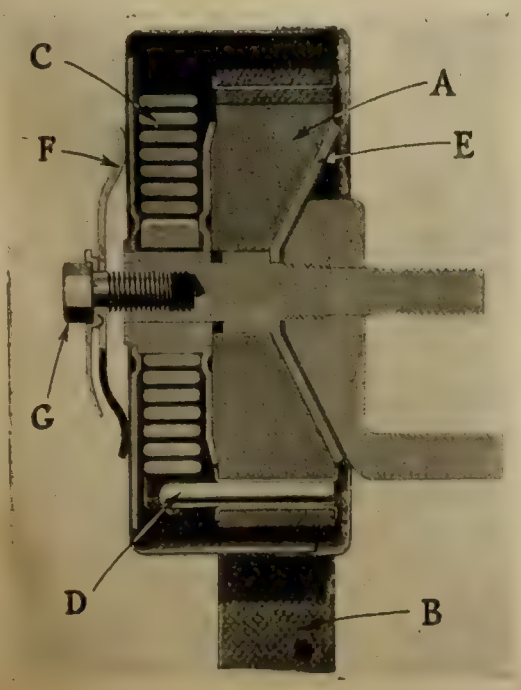
The advantages of the new switch are self-evident. With all the switch connections under the hood, trouble in the ignition or lighting system can be more readily located, fuses more quickly replaced and other changes made. The complete chassis can be wired before the body is fitted, and thus a material saving effected in both the time of assembly and the amount of wire required.



Briggs & Stratton electrical switch and face plate

The operating parts of the Basco extended handle switch (as the device is called) are of the same general design as those of other switches manufactured by the Briggs & Stratton Co. The dash plate can be furnished in any shape to conform to the general arrangement and style of other instruments to go on the dash.

Star Rebound Controller



The Star rebound controller

A SPRING rebound check of the type comprising two co-acting friction members, one stationary and the other rotatable, is being made under the name of the Star rebound controller, by the Kulas-Snyder Mfg. Co. It comprises four working parts, viz., the rotating drum A, the belt B, the spring C, and the swivel hook D. The resistance to rebound is produced by the friction between the self-lubricating wood drum A and the conical stationary friction plate E. This resistance may be adjusted by means of the star spring F and cap screw G. There is a combined indicator and lock on the cap screw which turns with it and engages into any of five locking depressions on the star spring. The object of the coiled spring is to keep the belt taut when the chassis spring compresses. The inner end of the coiled spring is secured to the spring collar which is mounted on the center bolt so that it can slide but not rotate on same. The large area of the friction surface and the means provided for taking up play due to wear should assure long life of the device.

France May Make Use of Alcohol Mixture Compulsory

Use of alcohol mixture as a so-called national fuel would reduce gasoline imports and stabilize the wine and sugar beet industry by utilizing the surplus product converted into alcohol. Plan tax on all wine and cider marketed to enable the alcohol mixture to be sold as cheaply as gasoline.

THE use of a State-produced gasoline substitute may become compulsory in France. Various interests in France have been attempting to find an assured market for the alcohol distilled from sugar beets, surplus wines and other vegetable products. The quantities of such alcohol produced in any year fluctuate according to whether the respective crops are excessive or deficient; and these fluctuations have been very detrimental from the standpoint of the growers. The growers would like to be assured against over-production by an arrangement which would always enable them to convert their surplus into alcohol at remunerative prices.

During the war the necessity of alcohol production for use in the manufacture of munitions came into prominence; and accordingly the persons interested in the manufacture of alcohol can claim that as a matter of national defense France must have an assured supply at all times. The wine growers have procured legislation which prevents the sale of beet alcohol for use in the production of potable beverages, thus reserving for their wine alcohols the most remunerative French markets.

The French Government itself has been forced to purchase alcohol and relieve the strain upon the producers and is now said to hold nearly 1,000,000 hectoliters. The production of alcohol during the months of October and November, 1921, is shown by the following table:

(Hectoliter = 26.4 U. S. Gallons)

	Hectoliters
Wine	33,246
Ciders and Perry	50,832
Fruit and grape pulp	68,892
Grain	31,482
Sugar beets	242,289
Molasses	12,515
Other substances	338
Total	439,594

A French official commission was appointed in February, 1922, by the Ministry of Finance to fix the price of alcohol derived from the current beet crop.

The solution which has been hit upon for disposing of the excess stocks of alcohol and providing a regular market for it in the future is the enforced use of alcohol as an adulterant of gasoline. There have been earnest efforts and continual propaganda, in favor of a so-called "carburant national," i.e. a mixture of gasoline and alcohol which would reduce the dependency of France upon the United States, England and Holland for mineral oils, and would furnish a profitable outlet for locally produced alcohol.

During the early days of April, 1922, a national congress was held at Beziers (Department of Herault) in this consular district, attended by authorized representatives of the beet alcohol interests and the wine alcohol interests. Elaborate automobile and cyclecar tests were held at great expense, in order to prove the practical value of the formula which has been developed for the carburant national. This formula, which represents the results of protracted research by several French scientists, is now associated with the name of M. Godchot, the Dean of the Faculty of Science of the University of Montpellier, Montpellier being situated in the heart of the wine region. It is as follows:

Gasoline	900
Alcohol at 95 deg	100
Cyclohexanol	17.5
Phenol	37.5

As a result of the Beziers conference it is claimed that the utility of this formula is completely vindicated, and the conference also resulted in the adoption of an agreement, or concordat, between all the interests involved, for national legislation to compel the substitution of the new mixture throughout France in the place of gasoline for all purposes.

The difficulties have hitherto been that the price of the alcohol has been somewhat higher than the price of gasoline so that the resulting mixture would be somewhat more expensive than gasoline. Under the terms of the Beziers concordat, the French Government would establish a national alcohol office possessing a monopoly of the purchase and sale of alcohol, and this office would produce the carburant national. It would be subsidized by a tax of one franc per hectoliter on all wine marketed in France and of 50 centimes per hectoliter on all cider marketed. It is claimed that the resulting funds could be used to reduce the price of alcohol to such an extent that the ultimate consumers of the new mixture would not suffer financially. It would thus appear that the wine and cider consumers of France would ultimately pay in the share of a slightly increased price of wine for a subsidy which would keep the alcohol industry afloat and would diminish by at least 10 per cent the French importations of gasoline.

The movement appears to be politically very strong, and there is said to be a strong possibility that legislation will be enacted which will result in the replacing of gasoline throughout France henceforth by a mixture containing 90 per cent gasoline and 10 per cent alcohol. The weakest point in the project seems to be the amount of the wine tax which would be necessary to reduce the price of alcohol to a level with that of gasoline. It is feared in some quarters that the tax of one franc per hectoliter on wine would not yield a sufficient fund to provide the necessary subsidy.

American Manufacturers Must Co-operate With Latin Distributors

South America offers ready market for the one-ton truck and short wheelbase taxicab. Good roads campaign opening up a large automotive market. Inadequate transport systems must be aided by motor bus lines.

NOT so many years ago there existed in the United States of North America the same road conditions one finds throughout all the Latin countries to-day; the same sparsely settled areas, pioneering conditions and drive on the part of the Nation for good roads.

The greatest help to the betterment of roads proved to be the automobile. It has helped because owners have demanded better roads over which to operate their cars. Likewise in the Latin countries, the motor truck as well as motor car has helped because it was used to haul passengers from the railroad to their new inland homes. The settlers built new roads so that light motor trucks could carry them and at the same time bring the products of the soil back to the railroads for transportation to the city.

Two events will take place in South America during the season of 1922 that will duplicate the events that have helped to open up many sections of the United States. The first is the Good Roads Convention in Argentina in May and the other the Brazilian Centennial Exposition opening next September. These two events will do more to open the eyes of the automotive trade of the Latin world to the value of the so-called speed-wagon or one-ton truck and the taxicab than anything else.

The one-ton truck is a vehicle especially adapted, at present, to the needs of all Latin countries. Leaving aside its great value in the large cities as a delivery wagon, its use as a means of transportation in sections of the countries that are being opened up, leading inland from the main arteries, such as railroads or highways, is of far greater value than the motor car. Such trucks can be equipped to carry not less than twenty passengers, and while the roads at present may be bad, the sturdy construction of these one-ton vehicles will enable those who purchase them to operate them at a profit. Wherever speed should not be over twenty or twenty-five miles an hour, where the country is rough, as all new country is, these vehicles will be of great benefit.

Good Roads Campaign

In Brazil and Argentina, on the east coast of South America; in Chile, Peru and Ecuador, on the west coast; in Venezuela and Colombia on the north, there is a great campaign for road building. These one-ton trucks, besides hauling passengers and being used as buses, can be used in hauling road building material, where the heavier trucks are unable to travel, due to poor traction and lack of road bed sufficiently strong to support them. Near the large cities they can be used in hauling the product of the market garden to the city. On the farm, the coffee and the sugar plantations; in Patagonia, on the great sheep ranches, one-ton trucks at this time will prove their worth.

Late in 1922, in Rio de Janeiro, there will be great need of such vehicles as the one-ton truck and the taxicab. Vast numbers of people will visit there during the progress of the exposition and transportation will be required to the exposition grounds. At present there are practically no buses. There are many old time motor cars used as taxis and a few more up-to-date chassis of American-made cars now used as taxicabs. The one-ton truck of say 106 to 116 inch wheelbase with a bus body will be of great value at the time of the exposition and likewise the taxicab of not over 110 inch wheelbase. The short wheelbase is necessary because of the narrow streets in the city.

These ideas and plans cannot be developed in a day and the sooner the North American manufacturer and the Latin distributor get together on the problem, the quicker each will profit by the business in sight.

Bus Lines

The day is not far distant when a regular bus line will travel from Buenos Aires to Rosario; thence to Mendoza; and from there across the Andes to Los Andes and along the beautiful river into Santiago. At first it would be a sightseeing tour, and later assist in developing that wonderful country that now remains unopened. Not only the route from Buenos Aires to Los Andes and Santiago will be opened to motor travel, but there is no reason why trips cannot be made by buses between Mendoza and Tucuman, and the famous summer resort of Cordoba at the foothills of the Argentine Andes.

Going north to Rio de Janeiro someone will step in and start a line of buses running from Rio de Janeiro to the beautiful mountain and Brazilian summer resort of Petropolis. The road is beautiful and well made. Buses operated along this road on Saturday and Sunday would be patronized by those who cannot afford to pay for private cars. The writer believes no less than 3000 to 5000 of the population of Rio de Janeiro would be carried every Sunday. Then, too, there are other drives in and around the city that the poorer classes would favor, such as along the Flamingo, out toward the Botanical Gardens to Leme and along the bay. Some active American manufacturer and a much more active dealer is undoubtedly going to start these bus lines sooner or later, for the tram system of Rio de Janeiro to-day is unable to provide the necessary transportation. There are two lines of buses traveling along the Avenida Rio Branco in the city that do a thriving business, and that are always crowded, but these buses do not carry a fraction of what could be carried with the one-ton truck of the speed wagon type.

There are numerous instances all over South America where the short wheelbase taxicab can fit in very profitably. There are so-called taxis working and attempting to operate in Buenos Aires that should be ruled off the streets sooner or later because they are dangerous to life and limb. During the months of July and August there is great need in Buenos Aires for a closed taxi due to the dampness and rain. Long wheelbase motor cars are also at a disadvantage in many narrow streets.

The author thinks these facts would be advantageous for the Latin dealer and the American manufacturer to consider during the season of 1922.

Switzerland Demands Cheap and Light Motor Vehicles

Domestic Swiss car makers in bad slump because they have concentrated on luxury type vehicles. Export business at a standstill. Truck manufacturers protected by tariff and import restrictions. Few American cars imported during 1921, but American motorcycles took second place.

AN analysis of the statistics recently published by the Swiss Federal Government show that the automobile industry of that country has passed through a period of hard times and has fallen off materially. One of the reasons for this is undoubtedly the fact that the industry specialized on luxury types and as a consequence of the economic crises the home market is practically closed. The concerns which manufacture trucks and bus chassis, while feeling the depression, have not suffered as much as the car manufacturers. The increase in railway freight rates has caused a reaction in favor of the trucking companies with a resultant demand for trucks. The Federal Post Office is also placing a large number of orders in preparation for the extension of its passenger service in the Alpine region and other outlying districts. On the whole the truck industry is fairly well protected against foreign competition by the customs tariff and import restrictions.

The export trade is at a standstill owing to the depreciated currencies in neighboring countries, and the general raising of customs tariffs. It can easily be seen how serious this stagnation in the exporting of automotive products is, when one realizes that before the war exports absorbed as much as two-thirds of the total production of the country.

An examination of export figures shows that Switzerland exported 842 motor vehicles in 1913, 501 in 1920, while in 9 months of 1921 there were only 142 exported. Of the 1921 exports Spain took 58 vehicles, Dutch East Indies 20, France 19, Great Britain 17, and Belgium 13. In view of this great decline in exports it was hoped by the Swiss automobile industry that they could regain a foothold in the South American markets but it appears that they cannot compete with the American and English manufacturers.

Imports

Statistics show that imports have been steadily increasing. In 1913 there were 986 motor vehicles imported, in 1920 there were 5,841 and in nine months of 1921 the number dropped to 3,107. The majority of cars imported are of the small, light type, for which there is a very good demand. The countries from which the principal imports are made, the number of cars and the total values for the year 1921 follow:

Country	Number	Value (in Swiss francs)
France	1,070	11,685,000
Italy	732	8,330,000
Germany	627	6,841,000
United States	433	5,159,000

Automobiles were also imported from Austria, Great Britain and Belgium but in much smaller quantities, for example, a total of only 27 cars came from Great Britain.

It is worth while to look into these figures carefully and understand why the countries contribute in the order that they do. The fact that France takes first place in number of imports into Switzerland while Germany takes third place in spite of the extremely low rate of exchange in that country, is due to the fact that the German manufacturers demand very high extra charges which nullify the advantage of the low rate of exchange. The French on the other hand sell their automotive products at exactly the same rate to the foreign buyer as to the domestic buyer.

American cars are losing ground in the Swiss market which is due, according to experts, to the fact that our manufacturers do not supply a certain refined type of four seater so much in demand in Switzerland and other European countries. This type of car is being built pretty generally in Italy and France. It may be added that our rate of exchange is not as favorable as many other countries.

Motorcycles

Approximately the same economic conditions apply to the motorcycle market as apply to the automobile although the status of the industry is not the same. The Swiss manufacturers have turned their attention to the production of motorcycles with favorable results to the domestic producers. The export of motorcycles increased 15 per cent in 1921 over 1920. The principal markets in the order of their importance are Italy, France and the Dutch East Indies. Imports fell off one-third in 1921. The countries from which imports are made are listed below in order of importance with the total import values for 1921:

Country	Value (in Swiss francs)
Great Britain	750,000 (approximate)
United States	507,000
Germany	381,000
France	326,000
Italy	237,000

A comparison of the above table with that of automobile imports shows that the role of the countries is practically reversed, the United States playing a large part when it comes to motorcycle imports.

To show the increase and decrease in the exports and imports of the Swiss automotive industry as a whole, which includes motorcycles as well as automobiles, a table covering the ten years from 1912 to 1921 is given.

The table indicates a general increase in imports and a steady decline in exports. These two trends are modified during the war years 1915 to 1918 inclusive, in fact the movement was strongly reversed for those years, imports fell off greatly and exports mounted. It may also be

noticed that both exports and imports fell off in 1921, which may be taken as indicating a period of stagnation in the use and manufacture of automotive products. An explanation has been given for stagnation but it would be well to add here that the use of automobiles has been affected by a heavy increase in taxes in many of the Cantons.

	Imports (in Swiss francs)	Exports (in Swiss francs)
1912	7,987,000	14,306,000
1913	9,195,000	13,951,000
1914	7,445,000	14,669,000
1915	2,241.000	28,745,000
1916	1,458,000	25,323,000
1917	3,824,000	24,425,000
1918	1,395,000	28,110,000
1919	31,246.000	22,088,000
1920	75,574,000	18,113,000
1921	38,587,000	5,208,000

The replacement of automobiles for diligences for carrying people over the passes is shown below to have resulted in a materially increased traffic. It is claimed that the traffic would have been much greater had it not been a bad tourist season.

	August, 1921 Motorcar No. of Passengers	August, 1913 Diligence No. of Passengers
Grimsel Pass	3,398	2,129
Furka Pass	3,719	1,383
Oberalp Pass	2,607	1,300
Simplon Pass	889	439
Spluegen-Misox Pass	3,198	2,081

It is an interesting fact that no serious accidents have occurred over the steep passes, and it reflects to the credit of the Swiss concerns who have made a special study of construction for mountain work. Owing to the very favorable results of last year's business, it has been decided to put 20 additional cars into the Alpine service this year and 16 motor buses are being ordered for other districts as well.

Postal Motor Service

There has been instituted recently an automobile postal service for carrying passengers which has proved very successful. Passengers to the number 751,633 have made use of the service as against 154,720 carried by the horse drawn vehicles. In fact success has been such that it is now planned to extend the new service to the Klausen and Gothard districts.

The following figures give an idea of the cost of the new motor service as compared with the horse post:

	Horse Post (in francs)	Motor Post (in francs)
Expenses	1,225,990	2,233,626
Receipts (parcel receipts not included)	337,380	1,785,733
Excess of expense over receipts	888,610	447,893

Three-wheel, electrically driven cars carrying 300 pounds are extensively used by the Post Office for parcel delivery in the cities. These have worked out so successfully that more have been ordered. The new ones will be of an improved type and constructed to carry 500 lb. The cost of both gasoline and electrically driven cars in the postal service has proven most economical and the estimate for 1921 which was 2,610,000 francs has been reduced to 2,150,000 francs for 1922, of which 800,000 francs is for gasoline and electricity.

Uganda Opening Up as an Automotive Market

IN 1920 a loan of £1,000,000 was raised to develop the transport facilities of Uganda. Committees were formed to consider programs of road construction and waterways development, while the financial resources for this work were augmented by the cotton tax, specifically raised to improve communications in the cotton-growing districts.

During the last nine months of 1920 some 55 miles of new motor roads were constructed, says a British Colonial Report.

There are now 650 miles of excellent roads fit for motor traffic in all weathers and about 800 miles of roads suitable for light motors in the dry season. This mileage would have been even greater but for an insufficient supply of labor.

Last year the Government Transport Department had 16 motor trucks in use. The department has been handicapped by the considerable delay occurring in the supply of spare parts from England, but the mileage run shows a substantial increase and, in spite of the higher cost of materials and wages, running expenses have decreased. From April to December, 1920, goods totaling 4742 tons were carried as compared with 5091 tons handled throughout 1919.

Private contractors have supplemented the Government service, more especially in the cotton-growing districts of the eastern province. There has been a steady influx of motor cars and motorcycles and the extensive use of motor transport is certainly warranted by the excellence of the roads.

For the purpose of testing the Stronach-Dutton system of road rail transport an experimental line four miles in length was laid.

The trials proved extremely satisfactory, and in view of this it was decided to purchase 50 miles of track with the necessary rolling stock and to construct in the first instance a line from Kampala to Bombo and Kalule, some 26 miles.

An effort is being made to interest native landowners in the advantages of motor cultivation. It is recognized that demonstration in improved agricultural methods is essential to proper progress in the development of agriculture and steps are to be taken to provide the necessary instruction. The success of this movement will mean a demand for tractors.

In the near future, too, will come a demand for motorboats, for this type of vessel is especially suited to tap the economic resources of the shores of Lakes Victoria, Kioga and Kwania.

FRENCH WEST AFRICA, totaling nearly 1,000,000 sq. m., has but 245 motor vehicles. If the ivory coast has its share of this poor total, it possesses 31 automobiles. Yet the Ivory Coast roads are truly wonderful. A party of tourists recently returned from the country and stated that 2000 kilometers of smoother roads could not be found anywhere in the world. Most of the resources common to West Africa abound in the Ivory Coast. Apparently the one thing necessary for the country's development is motor transport to use these fine highways.

Exports of Passenger Cars, Trucks, Tires, Tractors,

COUNTRIES	GASOLINE PASSENGER CARS						GASOLINE TRUCKS						PARTS	ELECTRIC PASSENGER CARS AND TRUCKS	
	Up to $800		$800 to $2000		$2000 and over		Up to 1 ton incl.		Over 1 to 2½-tons		Over 2½ tons				
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value
Europe															
Azores and Madeira Islands			1	$1,400			4	$1,699					$54		
Belgium	32	$19,716	17	18,219	9	$27,900							12,703		
Czechoslovakia	2	864													
Denmark	25	16,042	18	18,645			1	250					132,268		
Finland	10	3,835					10	4,247					343		
France	1	800			3	8,000							66,458		
Germany	1	110	3	2,765					10	$15,000			3,542		
Gibraltar			1	815									20		
Greece	18	8,697											3,779		
Hungary															
Iceland and Faroe Islands													486		
Italy	2	1,000	5	7,217	1	10,000							7,591		
Lithuania													276		
Malta, Gozo and Cyprus Islands	38	14,039			1	2,500							1,641		
Netherlands	50	32,313	9	9,369			10	4,247	4	6,365			9,481		
Norway	38	16,912	1	827			32	13,591	3	2,813			3,097		
Poland and Danzig													35		
Portugal	1	60	1	1,060									1,589		
Roumania	4	1,516											2,248		
Spain	53	35,094	44	50,949	7	18,312			2	2,000			28,054		
Sweden	94	55,663	52	52,999	1	2,500	15	6,371	2	2,112			15,303		
Switzerland	8	5,792	10	10,883	3	8,880							2,209		
Turkey in Europe	1	750	1	1,800											
Ukraine															
England	111	43,597	91	103,933	2	10,000	5	3,868					423,933		
Scotland	24	15,216	11	10,307									401		
Ireland	4	2,205	3	2,784	1	4,800	1	506					5,200		
Yugoslavia, Albania, etc.	1	526											2,787		
Latvia											2	3,800			
North and South America															
Bermuda													66		
British Honduras	1	422											717		
Canada	359	213,004	443	530,370	65	184,985	32	23,632	51	72,547	27	66,725	1,736,658		
Costa Rica			1	890									971		
Guatemala	4	2,896											841		
Honduras	6	2,634	3	3,818					1	200			1,254		
Nicaragua													187		
Panama	1	800	2	1,976			2	849					2,745		
Salvador	3	2,172											377	1	$1,809
Mexico	412	194,236	161	181,183	23	59,086	23	13,270	8	9,550	4	14,626	112,310	1	62
Newfoundland and Labrador			1	920									2,563		
Barbados													855		
Jamaica	11	4,692	4	3,962			7	2,972	1	1,610			7,270		
Trinidad and Tobago	10	3,962							1	1,524			11,745		
Other British West Indies	5	2,218	2	1,950	2	6,700	3	1,099	2	3,846			1,553	1	300
Cuba	123	50,037	17	23,197	13	36,834	30	14,684					73,482		
Dominican Republic													3,421		
Dutch West Indies	3	1,152	1	1,350					1	2,000	1	3,500	2,673		
French West Indies													1,373		
Haiti	5	2,753	8	10,450									2,791		
Virgin Islands of U. S.	1	150											705		
Argentina	113	79,630	91	99,582	8	29,458			8	10,874			421,480		
Bolivia													307		
Brazil	22	15,448	77	77,698	3	10,384							15,176		
Chile							8	3,397	1	1,052			9,493		
Colombia	3	1,846	1	1,241			2	849					5,443		
Ecuador			1	1,379									1,790		
British Guiana	3	2,172											2,054		
Dutch Guiana													64		
Paraguay	1	800													
Peru	4	1,498	1	1,000			1	500					11,315		
Uruguay	10	7,240											17,497		
Venezuela	17	7,313	4	4,221	1	2,878							7,102		
Asia															
Aden													177		
Ceylon	13	8,716	2	2,021									434		
China	16	12,017	18	20,817	1	2,500	8	4,350	1	506			5,096		
Kwantung	15	7,092											4,684		
Chosen													1,105		
British India	41	29,583	45	41,966					10	13,564	8	8,999	37,829		
Straits Settlements			1	984									6,636		
Other British East Indies													15		
Other Dutch East Indies			7	6,957									2,445		
Java and Madura			26	27,502	3	9,732							37,864		
French Indo-China									1	1,080			2,748		
Hejaz, Arabia and Mesopotamia													2,261		
Hongkong	1	300	3	2,691									3,201		
Japan	109	44,372	31	33,467	9	36,171	100	49,888	15	27,876	4	8,967	36,036	21	41,760
Palestine and Syria	21	9,538	6	6,048			33	14,016					17,492		
Philippine Islands	29	16,736	19	19,749	4	13,723			4	6,760			39,296		
Greece in Asia													1,199		
Siam	4	2,896											762		
Turkey in Asia	3	1,191													
Oceania															
Australia	477	29[illegible] 679	306	312,799	3	9,251	7	5,911	28	40,809	2	2,513	117,467	12	8,817
New Zealand	46	3[illegible] 439	55	58,820					13	19,678			29,221		
Other British Oceania													294		
French Oceania	3	1,[illegible]56											474		
Other Oceania													595	1	600
Africa															
Algeria and Tunis	15	6,159													
Belgian Kongo	5	2,124					15	5,376					13,622		
British West Africa	23	15,730	3	3,599	1	2,064			3	3,210			5,[illegible]50		
British South Africa	49	35,468	117	117,709	2	5,930	5	3,978			3	11,500	27,714	4	3,978
British East Africa	3	2,172											326		
Canary Islands	2	1,210							3	2,889			4,409		
French Africa	7	3,215											1,397		
Egypt	54	23,333	3	4,487			12	5,247					9,127		
Morocco			4	3,232									5,881		
Portuguese Africa	2	689											11		
Portuguese East Africa													1,895		
	2,573	$1,426,837	1,732	$1,902,007	166	$502,588	366	$184,797	173	$248,865	51	$120,630	$3,596,539	41	$57,884

Motorcycles and Aircraft for March, 1922.

TIRES						FARM TRACTORS		PARTS	MOTORCYCLES		AIRPLANES AND SEA-PLANES		PARTS	COUNTRIES
Casings		Inner		Solid										
No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value	No.	Value	Value	
														Europe
16	$201								2	$438				Azores and Madeira Islands
532	7,172	503	$945			11	$6,636	$769	112	31,461				Belgium
									2	539				Czechoslovakia
3,953	58,437	4,596	7,793					782	130	33,668				Denmark
91	2,312	144	432						52	12,595				Finland
2,162	25,898	784	1,426	16	$1,024	7	3,740	4,790	28	7,803				France
122	3,251					1	140	40	15	4,439				Germany
12	132													Gibraltar
1,417	16,707	1,089	2,021	10	386				1	56				Greece
								189						Hungary
														Iceland and Faroe Islands
92	622							22	122	26,451				Italy
														Lithuania
124	1,264	24	57			1	383	80						Malta, Gozo and Cyprus Islands
1,537	24,850	702	1,783	39	708			49	185	53,619				Netherlands
1,237	28,424	962	2,156	88	2,635				12	3,733				Norway
3,936	81,503	6,480	37,025			1	480	1,779						Poland and Danzig
132	2,325	288	737											Portugal
								85						Roumania
1,145	17,106	363	706	205	4,220	4	5,100	1,245	6	1,922				Spain
3,610	69,059	2,017	5,697	20	324			1,318	35	11,251				Sweden
156	2,396	69	165					270	30	8,697				Switzerland
272	3,816	482	873			13	5,487	498						Turkey in Europe
						4	1,958							Ukraine
41,936	402,885	14,464	21,713	746	14,752	1	826	16,999	57	15,024			$70	England
347	5,163	140	265											Scotland
21	387	17	37					22,616						Ireland
322	6,112	430	800			1	387							Yugoslavia, Albania, etc.
10	104					8	11,645	77						Latvia
														North and South America
														Bermuda
37	434	4	9			2	676	920						British Honduras
4,549	65,524	3,168	7,073	275	7,554	211	111,649	34,798	122	31,964			2,456	Canada
283	5,807	142	422											Costa Rica
34	856	34	79	4	86			189						Guatemala
92	3,279	78	202	44	1,765	1	472	135						Honduras
26	468	18	30											Nicaragua
830	11,123	820	1,674	26	626	2	619	243						Panama
77	2,557	73	279											Salvador
7,421	96,882	6,383	11,705	139	3,652	18	20,368	51,886	5	1,440	23	$19,850	270	Mexico
17	152	18	34					130						Newfoundland and Labrador
134	1,661	63	113	6	200									Barbados
736	9,679	671	1,241	66	2,051			58	1	50				Jamaica
639	10,277	313	810	62	1,413	2	5,657	798	1	335				Trinidad and Tobago
159	1,626	181	445											Other British West Indies
8,202	107,736	6,320	11,884	695	22,420			8,111	1	100				Cuba
881	10,436	1,253	1,886	18	500			1,845						Dominican Republic
72	1,389	132	270					27						Dutch West Indies
647	8,018	162	358	49	1,080			46						French West Indies
226	3,053	303	582					99	1	376				Haiti
152	2,005	116	228					126	1	100				Virgin Islands of U. S.
7,686	94,816	5,105	10,128	160	1,944	210	83,034	1,836	74	19,941			291	Argentina
66	1,000	31	250						2	440				Bolivia
6,536	70,421	4,055	5,373	84	1,566									Brazil
1,598	15,998	1,014	4,569	87	5,648			559						Chile
697	12,100	601	1,265	10	249	1	364	3,988						Colombia
174	3,264	140	322	4	218				1	301				Ecuador
172	2,112	203	417											British Guiana
														Dutch Guiana
24	188	4	5											Paraguay
2,269	36,505	975	2,224	32	728			2,530	2	224				Peru
3,123	42,738	1,337	2,044			25	9,115		13	2,900				Uruguay
2,090	22,638	1,735	3,347	4	134			6,573						Venezuela
														Asia
75	831	75	131											Aden
233	3,240	65	93	12	141			159						Ceylon
691	13,062	437	1,020											China
														Kwantung
6	101	6	14											Chosen
2,527	28,133	2,821	4,984	622	16,768	9	42,915	4,869	1	475				British India
8,360	78,079	3,525	4,880	489	11,665	1	4,716	1,203					100	Straits Settlements
														Other British West Indies
460	4,863	424	631					261	1	100				Other Dutch East Indies
3,860	58,695	2,033	5,689	50	2,128			3,054	44	11,526				Java and Madura
82	1,156	72	288					1,058						French Indo-China
		240	599											Hejaz Arabia and Mesopotamia
														Hongkong
626	6,579	400	400	80	1,357	15	6,078	2,142	85	15,717				Japan
1,011	10,104	575	1,052					184						Palestine and Syria
5,595	78,873	5,261	9,790	444	9,934			62						Philippine Islands
46	1,375	32	108						1	170				Greece in Asia
		10	59	10	617			369						Siam
20	230					1	381	80						Turkey in Asia
														Oceania
3,733	64,297	1,053	2,874	219	6,918	4	5,802	4,426	364	88,223				Australia
3,692	64,836	1,905	6,101	210	9,719	1	652	237	32	9,518			43	New Zealand
10	95	12	26	2	44									Other British Oceania
24	454	36	81	9	246									French Oceania
4	79													Other Oceania
														Africa
								15						Algeria in Tunis
						9	3,523		4	418				Belgian Kongo
373	6,421	617	1,164											British West Africa
4,307	60,084	4,800	7,689	1	21			82	13	3,178				British South Africa
208	2,277	238	500											British East Africa
240	1,902	220	347	6	250									Canary Islands
150	1,824								1	184				French Africa
1,425	14,236	329	517					837						Egypt
34	517	40	75			1	291	12	14	2,663				Morocco
8	138													Portuguese Africa
20	358													Portuguese East Africa
150,651	$1,907,647	94,232	$203,011	5,043	$135,691	565	$333,094	$185,555	1,573	$402,039	23	$19,850	$3,230	

Credit Requirements Have Outgrown Facilities for Financing Car Sales

Present methods of handling time-payment sales are inadequate for volume and value of business done. Retailers unable to furnish necessary credit machinery. Factors which bear on financing automotive sales are more complex than in other industries, hence new methods are needed.

By Harry Tipper

THE problem of financing the sales of automobiles in the retail field is one of very much larger proportions than the financing required for the sale of any of the other types of commodities which are sold to a considerable extent upon time payments. An investigation into the retail field showed that in 1920 approximately 52 per cent of the total retail sales in the automotive business was represented by the sale of passenger cars. Seventy-five per cent of this 52 per cent involved time sales. Approximately 40 per cent of the total money in the business, therefore, is involved in financing time payment sales. This is a much larger proportion of the total involved in the whole business than is absorbed by time sales in any other line of retailing, and in several other respects the problem is different and more difficult to cover thoroughly. A large number of these sales represent trades involving the turning in of the old car in order to complete the transaction on the new car. The transaction in these cases involves a loan on the original car; a mortgage on the proportion of the new car for the proportion of the sales involved; and the sale of the used car.

THE growth of time-payment sales in the automotive industry has been such that in 1920 approximately 75 per cent of passenger car retail sales were made in this manner.

The difficulties which attend the safeguarding of financed sales limits the extent to which the local banks can aid the retailers in handling this large volume of business.

Some of these difficulties can be overcome by the use of centralized clearing houses of information as used in the conduct of other businesses.

From this consideration of the total volume involved in the financing of time payment sales, it is evident that the retailer cannot be expected to do this financing in the way that such matters are being handled in other retail fields.

It is evident also that there are difficulties in securing all of this financing from local banks because of the other conditions involved. Other means of financing are probably necessary in a large majority of cases and the proper working out of these methods is a very important item for the automotive manufacturer.

Some corporations have been developed for the particular purpose of financing retailers on individual car mortgages and corporations of this kind are likely to be necessary if this financing is to be kept stable and orderly.

The depreciation between the price of a new car and the price of a second hand car introduces a larger element of risk in connection with this time payment method of sales and makes the financing more burdensome. Furthermore, this depreciation is complicated by the condition in which the owner keeps his car and the attention he pays to its servicing and maintenance. To the bank there are other difficulties, more important than these, which have become visible in the rapid growth of the business and the entry of so many new retailers into the field in a short time. These difficulties are concerned with the necessity of following the chattel mortgage on the car so that there can be no duplication, no substitution, and the property can not be moved out of the range of the mortgagors. To some extent these difficulties are presented in other cases of retailing where time payments are a necessary part of the transaction. They exist in a more difficult form in the automotive business because the product itself is simply a means of transportation. It is possible for the retailer to duplicate the mortgages and to cover the transaction so that the duplication is difficult to unearth and the car itself is moved about with so much ease that it is a somewhat difficult matter to keep it within the range of action necessary to protect the mortgagor and to secure a constant steady payment of the instalments.

This problem has not been met thoroughly and the financing of automobile sales will be surrounded with some difficulty until it has been worked out by whatever means are necessary to secure thorough co-ordination. Fluctuating prices add to these difficulties, of course, because the value of the article seized for non-payment is somewhat uncertain; and the amount to be spent in its reconditioning, and the amount to be secured from its sale, are factors that cannot be determined within narrow limits.

In other lines of merchandising, the amount involved in the time payments is not a sufficient proportion of the total business done by retailers in those fields, to make it a difficult matter to overcome in the general credit of the retail establishments or in the credit relations between the retail establishment and the manufacturers from whom they buy. In this field, the amount of money involved is a very considerable proportion of the total gross business done by the retailer because it averages between 38 and 40 per cent. and, in many of the establishments devoted primarily to the sale of cars, the proportion of gross income involved, in the sale on credit, is very much larger.

Consequently, the stability of the retail outlets of any manufacturer and the flexibility of his own credits are more directly involved in the proper arrangement of this financing of time sales so that the financing will be orderly, surrounded with the proper safeguards, and easily arranged. Banks and other financial institutions cannot be expected to loan as much money on individual chattel mortgages for automobiles so long as the uncertainties involved in this type of transaction are as considerable as they are to-day.

In other lines of retailing, the elimination of some of these credit evils with the individual consumer have necessitated centralized clearing houses of information so that the dishonest retailer or consumer will be automatically discovered by the exchange of information on the individual credits and the individual mortgage transactions. In these older lines, the business has settled down to a regular procedure; is absorbed in the ordinary transactions between the retailer and his bank, and does not disturb (to any great extent) the credit relations involved in the flow of the business.

Up to the present, it has been difficult to reduce the credit losses in such transactions in the automotive field, to a safe percentage because of the lack of centralized systems whereby the information would be properly cleared and the conditions properly observed. In a field growing as rapidly as the automotive field, bringing into its distribution and sales so many new establishments each year, some of the people starting in business in the retail side would be tempted to make money by dishonest methods of dealing with time payment sales, bank credits on cars, and similar credit transactions.

IT is perhaps amazing that the business should have reached its present point with so little trouble from these difficulties, considering the rapidity with which it has grown and the number of retailers who have come into the business within the last five years. In view of the present, and the probable future, market conditions, however, it is not likely that the percentage of time sales will decrease, so that the credit transactions will require a closer and more careful consideration of the stability of the individual buyer; the profit or loss involved in the trade of the used vehicle; the depreciation in the price of the new vehicle; and the safeguards against fraud or lax methods of doing business, which must be instituted by the financial concerns who advance money to the dealers on such transactions.

Because of the difficulties involved in this situation, a number of concerns have grown up who make it a business to finance individual mortgages on automobiles sold on time payments, and these companies report a comparatively low percentage of fraudulent transactions although they have found it necessary to mark retailers who have been involved in questionable deals, and of late, several of them have found it necessary to exchange information through a central clearing house in order to limit the number of these questionable transactions.

ONE of the great difficulties has been the elimination of duplicate mortgages on the same machine. Various methods have been resorted to by retailers, sometimes in collusion with their customers, in order to secure a larger credit from the financial institutions than the actual transactions would permit. In the large cities, this difficulty has been considerable and has arisen mainly because of the lack of thorough information regarding the mortgages issued by the various concerns to various retailers on particular cars and, consequently, the possibility of the retailer securing additional mortgages through different institutions on the same vehicle.

A similar difficulty has been found from time to time in establishing the credit of the mortgagee, or individual owner, and in maintaining a definite hold upon the vehicle until the payments have been completely disposed of. Without a thorough co-ordinated system of handling such matters, it is difficult to act, if a car is taken out of the locality. It becomes more difficult when the state line is crossed, and the difficulty is not lessened when the owner disposes of the car to some other party.

The restrictions which must be put upon the loaning of money by banks makes it impossible for the banks to go as far as they should go for the necessities of the industry in the matter of credits on automotive sales. The amount involved in these credit transactions is too large a percentage of the total gross business to enable the retailer to finance the considerable portion of it himself, and so get along with the bank credit and his own financing.

Out of this situation, the special financial institutions for financing dealers on individual mortgages have been established, but their work is still very fragmentary and the present system is not sufficiently developed to fill the probable needs of the industry in the near future.

Some further discussions on these institutions is important, and an article will be devoted to this subject in the near future.

Proposed French Horsepower Formula for Taxation Omits Engine Speed

A HORSEPOWER formula for taxation purposes which will ignore engine speed has been proposed by the technical services of the French Government. At present automobile taxation in France is largely based on horsepower, and the power is determined by a formula which takes account of bore, stroke, number of cylinders and number of revolutions.

Under the new formula horsepower will be calculated on piston displacement only, the basis being one horsepower for 12.2 cubic inches with a four-cylinder engine. When the engine has more than four cylinders the horsepower will be calculated at the rate of one per 14.03 cubic inches. For twin cylinders the rate will be one per 10.98 inches and one per 9.15 inches for single cylinder engines. This basis only applies to passenger car engines, which are assumed to run, on an average, at 1600 revolutions a minute. For truck engines, which always run at a slower speed, horsepower will be at the rate of one per 18.3 cubic inches for a four-cylinder engine. For more than four cylinders the rate will be one per 21 cubic inches of piston displacement.

Generally speaking, the new formula, if adopted, will give an advantage to taxpayers, this advantage being most pronounced on big cars. While the Ford will remain at 14 hp., the Cadillac will drop from 36 to 22 hp. and the Rolls-Royce from 40 to 32. The Liberty truck, which is at present rated at 32 hp., will be taxed at the rate of 23 hp.

The great advantage of the new formula is that it is simple and easy to apply and will eliminate all the discussions which have taken place in the past between automobile owners and the taxation authorities.

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Nothing More Important

MARKETING problems are more important today than any other problems facing the industry. Because the marketing trail has not yet been blazed in the automotive industry, study and thought of a fundamental character are essential.

The chief executives of the various plants are the only men thoroughly capable of thinking out and putting into motion these fundamental plans. The study necessary will demand considerable time; it will require hard study of facts and statistics; it will make the executive think he is back for a time in the little red schoolhouse. But the whole structure of the individual company and of the industry rests upon the proper solution of these problems. Whatever time is necessary for detailed study and analysis is fully worth while for a highly paid executive.

It is false economy for the executive to pass over to a subordinate a major part of the market research task. Such action is logical where the general principles of procedure and methods are pretty well recognized everywhere. In the case of the marketing problems of the automotive industry, however, investigation is in a primary stage. Original thought and study by thoroughly competent men are necessary.

Thomas Edison did not turn over to subordinates the details of his electrical research until he had fully determined the principles and laws of operation. He did not make his discoveries and inventions without much thought and analysis of collected detail data.

Inspiration and Perspiration

AN automobile dealer in China says that a large part of his business comes from the desire of Chinese people to have an automobile in a parade. Strange, isn't it, the things that make people want to buy motor vehicles? Nevertheless, the best way to sell cars is to find out as intimately as possible what buyers want and then try to give it to them.

The "parade" stage of the automobile has passed many years ago, of course, so far as the United States is concerned. Different things influence buying today. These things have changed materially during the last decade and will change materially during the next decade. The motor vehicle salesman has on his hands the difficult task of keeping up with these changing influences. He must know what they are, when they change, how they change, and how they can be met. Selling automobiles is a dynamic problem; it cannot be solved on the basis of a static economic survey. Changing forces of buying habit must be studied.

Buying values fluctuate constantly. Economic conditions change periodically. Mechanical design is constantly improved. All these tend to make planning difficult in the field of automotive sales and production. But they emphasize the necessity for a careful accumulation of accurate data, a constant study over that data, and an intelligent interpretation of past trends as a means of predicting future progress of reasonably long business periods in the future. The difficulty simply emphasizes the necessity. Inspiration will never take the place of perspiration.

Used Car Solutions

RECENT discussions concerning the used car problem have brought forth many suggestions for its solution which, although valuable, have for the most part a common weakness. Briefly stated, this weakness lies in the fact that they are made from the manufacturer's viewpoint and not from the dealer's; that they deal with minor phases rather than with fundamentals. This latter is perhaps to be expected when a subject is comparatively new as regards application of any concentrated study.

It must be remembered that the adoption of suggestions to an individual concern which apply to every concern in the industry, would in many cases place a terrific competitive pressure on the individual dealer and thereby disrupt the sales force. This must be foreseen or the dealer organization will suffer from a lack of intelligent co-operation.

When suggestions are made for the industry as a whole, the competitive nature of the industry must

not be forgotten. They must be adopted by all, or they lose value. There must be concerted action.

If we would make an improvement in the used car situation a great deal of investigating, analyzing and right thinking must be done, with the retail sales organization, not the factory, as the source of information. The difference between minor phases and fundamentals must be recognized. There is no short cut to the solution and any attempt at taking one will lead to pitfalls. By all means let us have action but let us understand the potentialities before the start.

Representation

OF all sales which will be made during this year, 90 per cent will be to persons already owning cars. These owners will make their choice depend largely on the character of the service rendered by dealers in their locality. This fact makes success depend for the major part on the ability with which local representation is chosen. Evidence that this is true may be seen daily in almost any territory.

That the importance of this fact is not fully appreciated by all manufacturers and likewise distributors in turn is evidenced by the different methods employed to pick representatives, and the ease with which contracts can, in many cases, be secured when really against the company's interest in the long run.

The manufacturer may consider it strictly a problem for the distributor, and it is no doubt often arranged so that it appears to be on the face of it, but fundamentally it goes much deeper. With proper supervision, good representation may be secured without taking initiative from the distributor.

The industry as a whole, suffers whenever local representation is poor. With a sound knowledge of the automotive market and quotas established on a basis of this knowledge rather than on optimism, there would be no place, no economic value in a method which would permit unsound representation to exist.

An Instruction Book Suggestion

CONSIDERABLE ingenuity is being displayed by the larger manufacturing organizations in getting up instruction books which tell the owner exactly what to do to keep his car in good running order. More attention is generally given to the lubricating system than to any other part. The requirements of the various bearings are made clear, so that the owner has no excuse for neglecting them. Manufacturers have come to recognize that neglect to attend properly to the oiling of a car is responsible for rapid wear and depreciation, and that such abuse on the part of owners will give their cars a bad name in the neighborhood. To oil and grease some thirty or forty more or less inaccessible joints on the chassis is a rather onerous task in any case, and should be eased as much as possible by proper instructions.

A rather interesting innovation in instructions for chassis lubrication has been made by a well-known manufacturer of cars. A plan view of the chassis occupies the center of the chart, with little circles around the points that need periodical lubrication. Reference lines extend from these circles to enlarged photos or "close-ups" of the points to be lubricated, arranged on a border panel. Some of the points on the chassis are necessarily rather inaccessible, and this chart enables the operator to familiarize himself with the exact location of the oil hole, etc., without going into contortions.

Removing Misunderstandings

OVERLOADING trucks has caused much sorrow to owners as well as highway authorities. With the idea of removing this trouble, many manufacturers have made an effort to regulate more closely the load carrying of their products by selling trucks with a definite understanding with the buyer and informing the authorities handling registrations what the maximum load limits are.

The Transportation Engineering Department of the Packard Motor Car Company has recently published a bulletin which contains specifications of all models of their trucks produced since 1905, with special reference to load carrying capacity ratings and chassis weights. This bulletin is sent to all municipal and highway authorities as well as to the selling organizations with the understanding that all their trucks will be sold on the basis of the information contained therein.

This may be taken as a distinct step forward in removing the misunderstandings which arise between what a truck is supposed to do and what it is sold to do and that between operators and highway authorities. It should also tend to remove sales resistance arising from such misunderstandings.

Sport More Efficient Than Business

SPORT is more efficient than business. That statement is one to which many will take exception, but it is a fact. For example, the history of baseball is one of the most carefully preserved records of human activity that exists. It is possible to find records of every game since baseball was an established sport and the records are specific as to names, places, exact dates and character of the plays made.

The automotive industry may well envy these records. If the like existed for automobiles the wealth of valuable material that could be secured from analysis and compilation would pay many times over for the cost of collection and market analysis would have a concrete foundation on which to build.

The size and importance of the automotive industry demands that we follow the example set. Statistics which seem trivial can furnish more value to the manufacturer and the public at large than ever can be secured through statistics of sport.

Many realize the need of collecting data regarding the industry. It is not enough that a few should recognize the importance of such procedure. The value of data collected depends in a measure on their completeness, hence the industry as a whole must secure the desired material. Data lost can never be regained.

Orders Keep Plants at Top Speed

No Let Up Is Likely for Month at Least

Despite Good Outlook, Car and Truck Manufacturers Continue Cautious

By JAMES DALTON

NEW YORK, May 23—It now is no exaggeration to say that the manufacturers of practically all popular lines of passenger cars are far behind on orders. There is no doubt that May will be the biggest production month the industry ever had, and unless there are wholesale cancellations of orders now on the books of dealers, the business in sight will keep the plants going at top speed until the middle of July.

If cancellations are in prospect there are no indications of it now. Buying is as brisk as it has been for two months. As demand slackens slightly in one section of the country it shifts to another so there is no diminution in the total. Farm buying will not begin in earnest before July 1.

While the industry is running at capacity, most car and truck manufacturers are keeping a weather eye out for squalls and up to this time they have shown no disposition to cast caution aside as they did when buying was at its peak in 1919 and 1920. It is admitted that they have ample plant capacity to meet all needs for a long time to come, except in isolated cases.

Shortage of Malleables

There is a shortage of certain parts and materials, notably malleables, but the parts handicap is not so pronounced as it was last month except in the case of bodies. All the year-round demand for closed cars has increased sharply in the last year, with falling prices for models of this type, and body manufacturers have been unable to keep pace with it. It is probable there will be some expansion of plant facilities in this field to meet changing conditions.

Few vehicle manufacturers are making commitments for more than 60 or 90 days and they are not accumulating inventories. While they do not now expect any sudden sharp falling off in demand they propose

(*Continued on page* 1142)

Business in Brief

NEW YORK, May 22—Business and industry generally continue on the up-grade, and increased optimism becomes apparent week by week.

The entire steel industry is approaching normal, with operations at about 80 per cent of capacity, or double the output at the low point. The most encouraging factor is the placing of substantial orders for delivery the last half of the year, showing reversal of the hand to mouth buying policy. Output for May will exceed April.

Crop conditions are more favorable, and sentiment in the agricultural districts is vastly improved. World consumption of cotton has been restored almost to normal. Acreage has been increased, and the outlook for cotton growers is exceedingly bright.

There have been fresh advances in cotton, cotton textiles, wool and woolen goods, and some improvement in hides, leather and shoes. The new wool clip has advanced fully 20 per cent in the eastern markets and rather more in the west.

Continued activity and price strength is shown in the construction trades. Lumber, builders' hardware, mechanics' tools, cement and paint, all are strong.

Stocks are strong, bonds quiet, money is easier and sterling firmer.

Bank clearings for the week ending May 18 were $6,990,653,000, a loss of 2.7 per cent from the preceding week, but a gain of 6.5 per cent over the same week last year.

Freight car loadings in April, except coal, showed an increase of 286,353, or 15.91 per cent over April of last year.

DURANT MAKING 275 DAILY

DETROIT, May 22—Durant production in all plants is now at a rate of 275 daily, according to a statement from the Lansing office. At the local plant 100 are being made, which is about the same as at Long Island City. Thirty are turned out at Leaside, Ont., and 40 at Muncie.

HEADLIGHT MEETING JULY 17

NEW YORK, May 23—Highway departments of ten Eastern states will send representatives to Baltimore, July 17, to adopt, if possible, uniform lighting regulations. Some of the states now favor the present Massachusetts headlight laws.

Ford Demand Brings Big June Schedule

Company Estimates Car, Truck, Tractor Output for Month Will Total 140,000

DETROIT, May 19—Ford dealers in the United States have asked for 194,750 cars, trucks and tractors for June delivery, according to a factory statement today. As a result the estimated output for June has been boosted to 140,000, an increase of 10,000 over May and a new high production month. The tractor output will approximate 10 per cent of the gross figures.

Ford sales have been constantly increasing since the first of the year, the statement says, the demand growing in the past two months faster than it is possible to increase production. On May 16 a new production mark of 4878 for a single day was set. This was an increase of 15 over the day before, the previous record bearer. On May 18 the 6,000,000th Ford engine was assembled. Five and one-third seconds afterward number 6,000,001 was built. The first model T engine was made Oct. 1, 1908; the 1,000,000th December 10, 1915, and the 5,000,000th May 28, 1921. The present numbering system began with the first Model T, although a number of different models were manufactured previous to 1908.

Building 5400 Engines Daily

The engine department at the Highland Park plant is now building 5400 engines daily which are shipped in carload lots to Ford assembly stations throughout the country for assembly in cars. A number of these are used for replacements, but the bulk go into new cars and trucks.

Of the 6,000,000 cars and trucks made since 1908 the company notes that 5,517,956 were delivered to purchasers in the United States alone and that 4,472,248 of these are still in service. Distribution of these has been even in all parts of the country, the sparsely settled Mid-western States showing practically the same ratio as densely populated sections. In the East, Ohio has the highest number of Ford cars registered, the statement says, the total showing 290,769. Illinois is second, Pennsylvania third, Texas fourth, and Michigan fifth.

ASK TOWNSEND TRUSTEE

JANESVILLE, WIS., May 22—Creditors of the Townsend Manufacturing Co., manufacturer of tractors, have applied for a trusteeship to facilitate a reorganization. The concern will continue to operate in the meantime. A hearing will be held in the bankruptcy court at Madison on May 26.

May Will Set New Production Mark

Factories Operating At High Efficiency

Night Work on Established Basis in Most Plants—Some Supplies Run Low

By D. M. McDONALD

DETROIT, May 22 — Production marks which have been climbing steadily in practically every factory in the Detroit district since early spring, will reach their highest point in the last ten days of May. With scarcely an exception, new production marks for a single month will be set unless there is a combination of circumstances now unforeseen to prevent.

Material is now being received in quantities to meet requirements, and men who have been added to the factory forces in the past two months are at high efficiency. More men are being added daily in all factories, especially the body plants, which have found it necessary to break in new men in the absence of recruits from skilled ranks.

Night work, up to this time more a matter of day to day decision, is now on an established basis in the final assembly departments of most plants. Now the night schedules have been posted several days in advance, so workers might make necessary preparations. Sunday work for the present is an accepted fact and Saturday afternoon holidays in most plants have been abandoned.

Change in Unit Parts

In the stress of getting cars out on schedule a number of companies have adopted unit parts of makes other than their own to help speed up and to overcome shortages of labor. Though this is for the most part an arrangement made necessary by the heavy production strain, there is certainty that in several cases these parts will be permanently incorporated in the make-up of cars, as announcements of various models later on will show.

Tool supplies in many of the factories are getting low. Some plants which thought several months ago that they had an inexhaustible inventory on the high speed cutting tools and others are coming into the market for supplies, and companies which make a business of salvage work are now among those working nights to keep up with demands.

Despite the speed and the addition of hundreds of new men in recent weeks, inspection on work is being kept very strict. The spirit of building for the future is manifest. The cars of May, which probably will be the highest production month the industry has known, will be as mechanically perfect and exact as the cars built in the height of the slack season last year.

One of the developments of the dull period was the building-up of a very strict inspection on the part of distributors and dealers of new cars before turning them over to the owner. This dealer inspection is now a bulwark against the possibility of inferior work reaching the final owner. There is no record of any cars being turned back to the factories, which is an indication of the high grade of workmanship insisted upon.

Temptations are very strong upon the factory sales organization these days to divert shipments to certain quarters, but all requisitions are being treated strictly on a proportionate basis. Distributors are continuing to visit factories to urge greater consideration of their particular needs, but they are getting only what the factory originally selected. Trainload shipments have gone out of fashion for the present.

Rate of Improvement in Industry Depends on Pace of General Business

By C. S. MOTT,

Vice-President of the General Motors Corp. and Chairman of the Advisory Committee

DETROIT, May 22.

THE owning of an automobile is getting to be more a matter of business every day. As individual transportation of a quicker and more comfortable nature than any hitherto known, the automobile fills every important need in general business life. Because of the improvement in general business the automobile industry is to-day experiencing a very satisfactory business.

Whether the automobile business is to continue at the present rate is largely a matter of whether it has been outdistancing by too wide a margin the general improvement in other lines. If it has, there may be expected a recession until other business has advanced to a point where the need for transportation again asserts itself.

The automobile as a means of business will always be in the advance of a general business movement. It is because of this that the industry was favored with the big buying movement of the present season. It is a season that was confidently looked forward to in the industry, though in volume it has exceeded the early expectations.

Because of the general use of the automobile in business the standardized production vehicle of to-day will continue to be generally accepted. The desire for individuality in car design or appearance is the exception, but will be met by manufacturers at higher prices as affording a certain volume of outlet for their product.

Steady progress is being made toward reducing the operating and maintenance costs of automobiles, and as these improvements are perfected and incorporated into present vehicles there will be an increasing market for the manufacturer. New price classes will be opened in the next five years which will bring thousands of potential owners into the buying market.

The development of highways in the next few years will also have an important part in the general advance of the industry. As it makes it more possible for owners to realize on the inherent time saving capabilities of their vehicles, they will become more and more indispensable in business. Indiscriminate speeding as it is known to-day will be eliminated with the construction of highways with space for both fast and slow moving vehicles. There is also much to be accomplished in the perfection of safety devices and provision for overhead crossings in cities.

267 Delegates Attending Argentine Roads Meeting

BUENOS AIRES, ARGENTINA, May 23 (By Cable)—The Argentine National Good Roads Congress, the first ever held in South America, opened here yesterday with an attendance of 267 delegates, representing national, state and municipal governments, trade organizations and business houses. The congress is performing its work through daily conferences and in three committees, devoted to finance, legislation and road construction. The impression prevails that the congress will pave the way for the construction of a permanent system of public highways.

The Argentine road congress is being held at the instance of the Touring Club Argentino, one of the important automotive associations of Buenos Aires, for the purpose of working out a national highway plan for the Republic. Information received here indicates that it has attracted wide interest and attention and that all parts of Argentina are represented by delegates.

Firestone to Build New Plant in Canada

Present Plans Call for Initial Capacity of 3,500 Tires Daily —Company Shows Profit

AKRON, May 22—The Firestone Tire & Rubber Co. expects to start work soon, it is reported, on a new tire building plant at Hamilton, Ont. Firestone secured the site for the Canadian plant during the war, but deferred building operations. Under present plans the Canadian plant will have an initial capacity of 3500 tires daily.

The Firestone factory in Akron is now producing 25,000 tires a day. This is nearer to proportionate peak output than of any other of the major tire companies in Akron, with the exception of the Miller Rubber, which is running in excess of its 1920 peak of 6000 tires a day. Firestone's peak was 28,500 casings daily.

For the first six months of the Firestone fiscal year, which began Nov. 1, an operating profit of approximately $2,500,000 is reported. This includes the six month period up to May 1 and does not cover the past 60 days during which the tire industry has taken an unprecedented spurt, indicating that the Firestone operating profit for the next six month period will be proportionately much larger.

Goodrich on 8-Hour Shifts

This substantial operating profit does not necessarily mean resumption of dividend payments, it is understood, as the company at the end of its last fiscal year had $21,000,000 in notes and acceptances payable, to which net profit will have to be applied. Last year the Firestone company wrote off approximately $16,000,000 in commitment losses and inventories.

The B. F. Goodrich Co. has restored its factory to the eight-hour shift basis, after operating ten-hour shifts, and has increased production over 25 per cent. This increase brings Goodrich tire production up to approximately 16,000 tires a day. The company is said to be working on several new types of tires to be offered in competition with new cord lines introduced by Goodyear and selling at considerably under the standard cord tire market lists. Goodrich officials, however, say no announcement of new tires will be forthcoming for some time.

Hudson-Essex Business Greatest in Closed Cars

DETROIT, May 23—Hudson Motor Car Co. reports closed car business since Jan. 1 to be 55 per cent of the entire output as compared to a total of 31 per cent in 1921. Essex Motors business is reported to be running at slightly more than 50 per cent in the closed car as against 19 per cent in 1921. Both companies declare that the proportion of this business is continuing at approximately the same rate even with warm weather at hand. Production totals for May when compiled are expected to show that the closed car percentage for that month is higher than the yearly average to date. Heavier proportion of closed car business is expected in the fall.

The new coach model, and the ability of both companies through volume sales to offer it at a slight increase over the open model prices, are accepted by officials as the principal reason for the rise in the closed car demand. The demand for closed vehicles has slowed down the general production capabilities of the two plants somewhat, owing to the greater time required to make closed bodies.

RAIL BUSES BOUGHT BY GREAT NORTHERN

ST. PAUL, May 22—As the first step in a determined effort to meet the competition of highway motor transport, the initial purchase of four rail motor buses by the Great Northern Railroad is announced by President Budd. One of the buses will be allotted to each of the four main divisions of the railroad, and they will be placed in operation within six weeks.

The Great Northern will operate two buses on Minnesota lines and the other two in Washington and in Montana. Manufacturers of rail cars will be placed in competition in the experiment to determine which will provide the most satisfactory and most economical service, as the railroad has ordered one Mack, one Service, one White and one Four Wheel Drive.

"The railroads must meet motor bus competition," said President Budd. "We will use the rail buses wherever they will afford the best opportunity."

Nash Adds Body Plant to Milwaukee Division

MILWAUKEE, May 22—A new body factory and general sheet metal working plant, costing $250,000, will be erected immediately by the Nash Motors Co. as a further extension of its Four Cylinder Car division at Milwaukee.

This extension was planned a little more than a year ago, but intermitted to await more favorable conditions in the industry. For some time past production of the Nash Four has been limited by the lack of finishing facilities, which will be provided by the new building and make it possible to manufacture approximately 100 per cent of the car under one roof. Between 55 and 60 Nash Fours are being turned out daily at present, which not only is below orders, but does not represent full capacity, due to the shortage of bodies, which makes it necessary to transfer cars for finishing.

The addition will be ready about Aug. 15 or Sept. 1, according to B. W. Twyman, general manager of the division.

Akron Employs Fewer Men for Big Output

Factories, Avoiding Transient Labor, Maintain Forces at Highest Efficiency

AKRON, OHIO, May 22—Although Akron's tire plants are producing 85 per cent of the old peak output of early 1920, they are gaining this output with scarcely more than 50 per cent of the total number of factory wage earners employed in the forepart of 1920.

The readjustment of the tire industry has brought about an average increase in individual and collective factory efficiency of 100 per cent. When Akron was turning out 100,000 tires a day, the nine major plants here were employing 72,000 factory wage earners, in addition to thousands of inspectors, foremen, factory office employees and business and general office employees. When the slump came, this number of producing workers in the factories dropped to 18,300 by December of 1920. It rose to 26,000 last July and then receded again.

Labor Turnover Reduced

To-day actual tire production in Akron is slightly over 85,000 casings a day. Yet the number of day wage earners in the factories does not exceed 43,000. In tube departments efficiency has increased several hundred per cent, as based on output. In rehiring men all Akron companies have avoided the transient element of labor, the "floater" and the "suit case chap" who all were responsible for a heavy labor turnover in peak times. They have re-employed only former employees who were the most efficient, showing a decided preference in favor of married men with families. This not only has brought about increased efficiency, but has materially reduced labor turnover.

And with these same companies following a hand-to-mouth policy by letting production fluctuate with current demand, only the most efficient of the tire builders are assured of permanent work. Efficiency checking systems have been established. When sales slump, production is cut and men are laid off, and it is the less efficient workers who are dropped from the payrolls, with the best workers kept. This practice in itself, say manufacturers, has tended to encourage a higher type of factory work and to keep efficiency at a maximum.

NO BRITISH TRUCK SHOW

LONDON, May 15 (*by mail*)—The Society of Motor Manufacturers, Commercial Vehicle Section, has definitely decided not to hold a truck show this year. Opportunity, however, will be afforded truck makers to exhibit models suitable for special purposes; for instance, at the Royal Agricultural Show—a national event—and at the Municipal Exhibition. But no chassis may be shown at such places, only complete vehicles.

Four Months' Output by Ford Is 281,066

Includes Cars and Trucks and Shows 55,850 Gain Over Last Year

DETROIT, May 24—Production in Ford American and foreign plants for the first four months of this year, excluding the Ford Canadian plant, is 281,066 cars and trucks, an increase of 55,850 over the same period last year. Demand in the United States and abroad is running a month ahead of former business, as indicated by the fact that April business of this year approximated that of May last year.

Total production of all plants for April was 111,944 cars and trucks, the output of the Ford Motor Co. of Canada being 5808 cars and trucks and the output of the company's foreign plants 5904. The Canadian plant showed an increased output over that of March of 600 cars and trucks. Detroit ranked first in assembly of all United States branches with a record of 11,155 cars and trucks; the Kearney, N. J., plant with 11,125 was second, and Philadelphia, Chicago and Buffalo ranked in that order.

Fordson Production, 15,906

At the River Rouge, 7445 tractors were built during April, a considerable increase over the April, 1921, total. The Cork, Ireland, tractor plant built 121 Fordsons. Total Fordson production up to the close of April was 15,906, which compared with 13,470 for the corresponding period in 1921. Production of tractors is expected to continue at the rate of 400 daily, this figure being reached in April.

Wood wheel production at the Hamilton, Ohio, plant of the Ford Motor Co. reached 200 sets daily early in April, and this schedule has been increased steadily so that by May 1 a schedule of 600 sets per 16 hours was reached. Facilities at the plant will be gradually extended until a capacity of 2000 sets daily is reached. The dry kilns at this plant were completed in May and complete conveyer systems installed so that all handling of material is done mechanically. New units will be added to the plant to meet the requirements of the increased production planned. All of the parts for the manufacture of the complete wheel will be built and assembled there.

In addition to the wheel construction, the Hamilton plant is building 7000 phaeton locks daily. Machinery for the manufacture of sedan and coupe door locks is being completed and will permit this plant to supply all of the locks for the closed cars.

FUEL RESEARCH COMMITTEE

NEW YORK, May 22—The following committee has been appointed to serve with Dr. Van H. Manning, director of research of the American Petroleum Institute, to take up various research problems with the aim of insuring adequate future fuel supply for motor vehicles: W. F. Faragher, chairman, Mellon Institute, Pittsburgh; R. E. Wilson, Massachusetts Institute of Technology, Cambridge; R. P. Anderson, United Natural Gas Co., Oil City, Pa.; N. A. C. Smith, Bureau of Mines, Pittsburgh; C. E. Waters, Bureau of Standards, Washington; R. R. Matthews, Roxana Petroleum Co., Wood River, Ill., and E. W. Dean, Standard Oil Co., 26 Broadway.

APRIL NOW ONLY 1,500 BEHIND MARCH, 1920

WASHINGTON, May 22—With reports still lacking from a few small companies, the automotive division of the Bureau of Foreign and Domestic Commerce announces that April production of passenger cars and trucks aggregated 218,456, which is only approximately 1500 less than the record for a single month, established in March, 1920.

Passenger car production totalled 196,512, an increase of nearly 30 per cent over March, while truck production was 21,941 compared with 19,449 for the same companies in the preceding month. The following table gives the production for identical companies for the past four months.

	Passenger Cars	Trucks
January	81,638	9,204
February	109,039	12,968
March	152,647	19,449
April	196,512	21,944

Times Square Auto Will Be Reorganized

NEW YORK, May 24—The Times Square Auto Supply Co. has been incorporated in Delaware with a capital of $3,400,000 to acquire the assets of the Consolidated Distributors, Inc., which has been in receivership since September last. The incorporation is in accordance with the reorganization plan which has been accepted by creditors.

The Consolidated Distributors was incorporated in this state in September, 1916, as the Times Square Auto Supply Co. and operated under that name until March, 1921. It was engaged in the wholesale and retail distribution of automobile accessories, but when the name was changed its wholesale business was separated from the retail. Consolidated Distributors had a capital of 300,000 shares of no par value common of which 190,396 shares are outstanding. An issue of 7 per cent cumulative preferred stock was redeemed in July, 1920.

It is understood that the policies which were successful until the depression in business became pronounced will be continued to a large extent by the reorganized company, which has its offices at Broadway and Fifty-sixth Street. The company has stores in fourteen cities.

Overland Companies Elect Wilson as Head

Willy-Morrow and Wilson Foundry Hold Elections—Plants Speeding Up

TOLEDO, May 24—Increased activity in the subsidiary plants of the Willys-Overland Co. at Elmira, N. Y., and Pontiac, Mich., as well as at the main plant in Toledo indicates an effort to bring production up to the sales and the demands of dealers.

Annual meetings of both subsidiaries resulted in the election of C. B. Wilson, vice-president and general manager of the Willys-Overland Co., as president of the Willys-Morrow Co. at Elmira and of the Wilson Foundry & Machine Co. at Pontiac.

C. E. Killinger was elected vice-president and general manager of the Willys-Morrow Co.; George R. Spencer is secretary, and H. C. Hobler treasurer. Directors are H. L. Thompson, W. L. Milner, G. M. Mather, George M. Jones, L. A. Miller, all of Toledo, and Wilson and Killinger.

D. R. Wilson of Pontiac was chosen vice-president and general manager of the Wilson Foundry & Machine Co.; C. E. Killinger, treasurer, and E. W. MacKenzie, secretary. Directors are H. L. Thompson, W. L. Milner, G. M. Mather, George M. Jones, and the two Wilsons.

The Willys-Overland Co., here, reports that unfilled orders now on the books are equal in amount to those at the busiest period in the plant's history. Sales continue good.

Production is considerably more than 400 cars daily, and nearly 8500 men are employed.

Advertising Managers to Discuss Problems

NEW YORK, May 23—A tentative program has been prepared for the meeting of advertising managers representing members of the National Automobile Chamber of Commerce, which will be held at the University Club in Chicago, June 13. Edward L. Jordan, chairman of the advertising committee, will preside. Among the topics which will be taken up will be:

"Relationship of the advertising department to the dealer," with discussion led by A. B. Batterson of the Buick Motor Co.

"Special problems in motor truck advertising," with discussion led by L. B. Dudley of the Federal Motor Truck Co.

"The next big selling punch," with discussion led by Jordan.

"Selling cars to women," with discussion led by Elizabeth Hallam Bohn.

"Advertising used cars," with discussion led by G. V. Radoye of the Haynes Automobile Co.

"What automotive happenings are news," with discussion led by W. A. Birmingham of the Chicago Evening Post.

"The place of pictures in advertising," with discussion led by W. K. Towers of the Page-Detroit Motor Car Co.

Seating Delegates Causes A. A. A. Split

Five States Bolt at Annual Convention and Will Form New Organization

ST. LOUIS, May 23—Seating of the seventy-two delegates of the Chicago Motor Club at the annual meeting of the American Automobile Association, held here, resulted in a split in the organization led by the Ohio, Illinois and Indiana state associations. Kentucky and Texas followed.

The insurgents have named a general committee which will formulate plans for a new association which probably will be called the National Motor League. It is proposed to call a convention in June at a city not yet designated. The leaders of the bolting delegations are Judge Walter D. Meals and Fred H. Caley of Cleveland, and Richard Lee of Chicago. Meals was a candidate for president of the A. A. A. The insurgents claim to represent 243,000 members.

Diehl Re-elected President

After the bolt, the remaining delegates re-elected George C. Diehl of Buffalo as president. The other officers chosen were Arthur Fifort of Hartford, Conn., as secretary, and H. A. Bonnell as treasurer. The executive board, which is composed of fifty-six representatives of all sections of the country, soon will select a new executive secretary to take the place of the late A. G. Batchelder.

The insurgents base their radical step on the contention that the Chicago Motor Club, which is headed by Charles M. Hayes, has invaded the territory of other clubs and that it is not legally a member of the A. A. A. It also is alleged that the Chicago club is selling insurance and other service not provided for in the constitution to its members and to members in the territory of other clubs. Hayes is in the insurance business himself and the bolters contend he is using his strong influence in the A. A. A. to commercialize the organization.

Hayes Makes Denial

This is vigorously denied by Hayes, who is chairman of the membership committee and a member of the executive committee of the A. A. A. He asserts that there is no basis for the charge that he receives commissions from garages along the routes mapped out by the Chicago club. He says that the plan of the Chicago club of giving service to motorists in addition to the legislative aid provided for by the constitution has been approved by the executive committee of the A. A. A. and does not violate its constitution.

The Chicago club recently withdrew from the Illinois State Association after differences over the activities of the Chicago organization. The insurgents contended this removed the Chicago club from the A. A. A. as the Illinois State Association holds the Illinois franchise, and that clubs can enter the national association only through the state organization. This contention was not supported by a majority of the delegates, and the bolt followed.

Caley Elected in Ohio

CLEVELAND, May 20—Fred H. Caley has been elected president of the Ohio State Automobile Association. He has been secretary of the organization, working for its interests simultaneously with those of the Cleveland Automobile Club and the Cleveland Automobile Dealers Association, of which he has been secretary. Caley has divorced himself from trade interests and will give his entire attention from now on to owner interests in Ohio.

At the meeting of the association resolutions were adopted to wage a determined fight against automobile stealing and to oppose any further legislative efforts to saddle unjust burdens on motorists in the form of special taxes.

M. A. M. A. Members Report Further Sales Increase

NEW YORK, May 25—Another sharp increase in sales by members of the Motor and Accessory Manufacturers Association was recorded in April. The total was $33,830,000 as compared with $28,670,000 in March, $22,720,000 in February and $17,330,000 in January. The increase for April over March was about 18 per cent. The total of past due accounts showed an increase of about 2 per cent in April, bringing the total to approximately $3,000,000. There was a decline of 1½ per cent in the total of notes outstanding, bringing the figure to about $2,500,000.

Commonwealth Receiver Disposes of Contracts

CHICAGO, May 22—A receiver has been appointed for the Commonwealth Motor Co. by the Federal Court here upon application of a number of creditors, whose claims aggregate $35,000. The company was organized a few years ago to manufacture the Commonwealth car, which later was discontinued. Recently the company has been manufacturing taxicabs at its plant at Rockdale, near Chicago.

The material on hand and the contracts of the bankrupt company have been sold by the receiver, Edwin D. Buell, to the Checker Manufacturing Co.

N. A. C. C. MEETING JUNE 7

NEW YORK, May 23—The annual meeting of the National Automobile Chamber of Commerce to elect successors to the directors whose terms have expired will be held at headquarters in this city June 7. The directors whose places will be filled are H. H. Rice, J. Walter Drake, C. C. Hanch, John N. Willys and Roy D. Chapin. It is probable that they will be re-elected. In addition to the election there will be a general discussion of what is in prospect for the industry for remainder of year.

Racine Tire Claims to Be Paid in Full

Creditors Will Receive Stock in Holding Branch of New Company

RACINE, WIS., May 24—Reorganization of the defunct Racine Auto Tire Co. is being effected through the incorporation of a new concern known as the Racine Horseshoe Tire Co. under the laws of Wisconsin by O. W. Johnson, M. F. Eldred and F. K. Camp. The capitalization consists of 1000 shares without par value.

The plan of reorganization calls for the formation of two new concerns, one a holding company and the other an operating company. The former will hold the entire capital stock of the operating company, which is acquiring practically the entire property of the defunct corporation.

The liabilities of the Racine Auto Tire Co., as indicated in a statement issued by the creditors' committee, amount to $1,547,552. Creditors will receive 100 per cent on claims, payable 60 per cent in gold notes and 40 per cent in first preferred shares in the holding company, which will issue serial 6 per cent gold collateral trust notes in the sum of $1,200,000. Until 50 per cent of these notes have been retired no dividends will be paid upon the common stock of the holding company.

Start with Few Obligations

The operating company will commence business with practically no indebtedness or obligations of any kind save first mortgage bonds amounting to $300,000. The balance sheet of this corporation will show assets of $1,160,913, with plant and real estate worth $970,401 additional, giving total resources of $2.131,314.

All of the stock of the holding company is placed in a voting trust consisting of O. W. Johnson, H. J. Haigh, W. L. Lyall and H. H. Whitman, who represent the principal creditors of the defunct concern.

Court Sustains Bakelite in Suit for Infringement

CHICAGO, May 22—The Redmanol Chemical Products Co. has made a settlement of the action brought by the General Bakelite Co. against the General Insulate Co. for infringement in the use of Redmanol. Although the action was brought against a customer it was defended by the Redmanol company.

Judge Chatfield handed down a decision sustaining the Bakelite patents covering the combination of phenol condensation products with fiber and fibrous materials, as well as the simultaneous use of heat and pressure in the manufacture of articles made from these products. The Redmanol company has now consented to a decree and paid heavy damages in liquidation. It will manufacture henceforth under a license.

40,000 Units Built by G. M. C. in April

Rapid Rate of Production of Cars and Trucks Makes Deep Cut in Inventory

NEW YORK, May 22—The automobile and truck divisions of the General Motors Corp. produced and sold approximately 40,000 units in April. This total undoubtedly will be exceeded in May. General Motors plants in the United States and Canada produced approximately 115,000 motor vehicles in the first four months of 1922. This more than doubles the production for the same period last year.

Chevrolet heads the production list and is now making cars at the rate of 1000 a day. It is reported that even with its new plant operating at capacity, Cadillac is unable to meet the demand for cars. Buick is operating at 65 per cent more than last year and is expected to reach a new high mark in May.

Earnings of the corporation for the first quarter of this year were in excess of $8,000,000. It is expected the second quarter will show earnings of at least $18,000,000. This indicates that the corporation is rapidly approaching the earning basis established in its most prosperous period.

At the present rate the common stock will show substantial earnings for the year. The present rapid rate of production has made a deep cut in the inventory which has resulted in a 50 per cent reduction in the floating debt since the first of the year, and it is expected the remainder will be wiped out in two or three months.

Industry Gets No Place on U. S. Chamber Board

WASHINGTON, May 22—The automotive industry failed in its efforts to elect C. E. Kettering, W. O. Rutherford and J. Walker Drake to the directorate of the United States Chamber of Commerce at the annual convention here last week. The reason was that there were too many candidates from the sixth district, in which all of them reside.

The National Automobile Chamber of Commerce failed also to have the Chamber adopt specific resolutions protesting against the reimportation of motor vehicles sold by the Government in foreign countries, advocating the repeal of war excise taxes and an endorsement of Federal aid in highway construction. The position taken in refusing to adopt the resolutions specifically was that the Chamber already had gone on record in favor of them in the broadest sense and nothing was to be gained by reiterating its attitude.

WINS SUIT AGAINST G. M. C.

BOSTON, May 22—A jury in Federal district court has awarded Rollin Abell of Milton, a mechanical engineer, a verdict of $154,816 in his suit against the General Motors Corp. for breach of contract. According to Abell's attorney, the engineer entered into a contract with the corporation under which it was agreed that General Motors should take a patent applying to the cylirder valves of automobile engines and pay Abell a minimum of $50,000 a year for three years if they took a contract with the non-exclusive license for the use of the patent. The corporation argued that it had not agreed to contract for the license.

Detroit Air Cooled Car to Be Begun in 90 Days

DETROIT, May 23—Production of the Detroit air cooled car will be started in 90 days, according to a statement by W. J. Doughty, president of the Detroit Air Cooled Car Co. Bids for material and parts are being sought in 1000 lot quantities. Jigs and patterns for the car are complete, Doughty said, so that the company is prepared to get into immediate production. Men identified with the Doughty organization are:

G. R. Tremolada, designer of the twin-three engine; C. H. Bennett, president and general manager of the Daisy Air Rifle Co.; August Gieseler, superintendent of the National Tool Co., Cleveland; John McArthur, coach and automobile body builder, Detroit; Frank Sanders, former Franklin distributor, Chicago; George Gagnier, Detroit, and Earl B. Newton, secretary-treasurer Mansfield Steel Corp. and treasurer of the King Trailer Co., Detroit. L. M. Bradley has been named advertising manager.

A factory site will be selected in Detroit within a short time, Doughty said. A phaeton, coupe and sedan will be built at the start. The list price on the phaeton has been fixed tentatively at $1,280 and the prices on the closed models will be fixed later.

Financing Companies Prepare for Meeting

NEW YORK, May 22—Arrangements have been completed for a meeting of the National Association of Automobile Financing Companies at Indianapolis on June 7 which is one of the days set for the convention of the National Association of Credit Men. The constitution and by-laws of the financing association will be offered for approval at the meeting, the business session of which will be held at the Columbia Club. There will be a banquet at the Claypool Hotel in the evening at which the speakers will be Hon. Charles A. Bookwalter, Walter E. Heller, Henry Warrum, Fred A. Weber, Jr., and C. C. Stratton.

Members who attend the meeting will be able to avail themselves of the special railroad rates offered for the convention of the National Association of Credit Men.

The arrangements for the meeting have been made by the Indianapolis branch of the National Association. Various problems of vital importance will be considered.

Lee to Meet Trade in Next Two Months

Trip Planned Will Take Him from Coast to Coast Delivering Addresses

WASHINGTON, May 24—In order that the automotive division of the Department of Commerce may place its finger on the pulse of the American automotive trade, thus enabling it to function for the benefit of the trade, a series of addresses has been arranged by Gordon Lee, chief of the division.

The ultimate object of Lee's trip, which will occupy two months, taking him across the continent and enabling him to speak before practically all the larger automotive organizations of the West, is to sell more automobiles.

"The automotive division of the department may be considered by the automobile industry as its selling agent, wherever and whenever a market can be developed," Lee said, "and I am making this trip for the purpose of explaining first hand to the industry the equipment of the department to help them in their problems and to find out how we can best serve the automobile industry."

Begins at New York

The itinerary up to and including Aug. 10 is as follows:

June 12 and 13, New York, before the N. A. C. C.; June 14, 15 and 16, Rochester, Chamber of Commerce; June 19, Des Moines, joint meeting, automobile club and chamber of commerce; June 20 to 24, Colorado Springs, annual meeting of the Automotive Equipment Association; June 27, Denver, Denver Civic and Commercial Association;

July 6, San Diego, joint meeting, dealers association, chamber of commerce and automobile club; July 7, Los Angeles, automotive trades association; July 8, 9 and 10, Yosemite Valley, joint meeting of the San Joaquin Automotive Trades Association and the Sacramento Dealers Association; July 11, Oakland, California Automotive Trade Association; July 12, San Francisco, California Automotive Trade Association;

July 14, 15 and 16, Medford, joint meeting, Southern Oregon Automotive Trades Association, Roseburg, Grants Pass, Ashland and Medford participating; Salem, joint meeting, Willamette Valley Automotive Trades Association and the Cherrians; July 18, Portland, Automobile Dealers Association; July 19 and 20, Portland, joint meeting, Portland Ad Club and Womens Advertising Club;

July 21, 22 and 23, Olympia, state convention, Washington Automotive Trades Association; July 24, Seattle, automobile dealers association; July 25, Tacoma, joint meeting, dealers association and chamber of commerce; July 26, Seattle, Rotary Club; July 28, Seattle, members council, chamber of commerce; July 29, Spokane, joint meeting of the dealers association, Inland Automobile Association and chamber of commerce;

Aug. 2, Butte, joint meeting, dealers association and Rotary Club; Aug. 4, Bois, dealers association and Rotary Club; Aug. 7, Salt Lake City, Intermountain Automotive Trades Association; Aug. 10, Sheridan, Wyo., joint meeting, Custer Battlefield Hiway Association and chamber of commerce.

Men of the Industry and What They Are Doing

Van Sicklen Made General Manager

N. H. Van Sicklen, who has had an intimate and influential connection with motor cars since the day the first "horseless vehicle" came down an American highway, has been appointed general manager of Apperson Brothers Automobile Co. at Kokomo, Ind.

Van Sicklen's interest in wheels goes far back beyond the advent of the automobile. He rode his first high-wheel bicycle in 1878; in 1882 he won his first race and for the next nine years was an important contender in the series of track and road races that swept the country, getting more than his share of cups, medals and purses.

Aside from these activities he established a printing business and in 1890 began publishing *The Bearings*, a journal of the bicycle trade, which in 1898 was consolidated with two other papers and became the *Cycle Age*. After he sold this paper he became a farmer, but returned to the industry in February, 1901, as an American Steel and Wire representative.

He left this work upon buying *Motor Age* from Samuel A. Miles, and when he sold it in January, 1908, after being identified with it for four years, became branch manager at Chicago for the Knox Automobile Co., helped develop the Automobile Blue Books, an interest he later disposed of, and then took charge of the F. A. L. Motor Car Co., of which he continued the head until the business was sold. Van Sicklen helped organize the Chicago Motor Club and the Chicago Automobile Association, and served as president of both bodies.

In February, 1913, he began to build the Van Sicklen speedometer, which subsequently was sold to John N. Willys and by him to Stewart-Warner. During the war he and his organization were largely occupied with the development and manufacture of special instruments for the aviation departments of the Army and Navy. Early in March of this year he was appointed assistant general manager of the Apperson organization.

Stutz Appoints Crawford

Charles F. Crawford, who for many years has been identified with the Cole Motor Car Co. as chief engineer, has been appointed chief engineer of the Stutz Motor Car Co. of America. He was chief engineer of the Cole concern for seven years and later became chief engineer and vice-president of the Premier Motor Corp. Later he conducted a consulting engineering business and not long ago went back to Cole as chief engineer. His successor at the Cole has not yet been announced.

C. B. Phelps, Jr., Goes to England

C. B. Phelps, Jr., has been appointed as assistant to the managing director of Dodge Brothers, Ltd., which was organized recently to handle Dodge Brothers business in the British Isles. He has been with the Dodge company since 1916 with the exception of two years in the Navy, and has had extensive experience in both foreign and domestic merchandising. He has sailed for London with Joseph H. Willson, the managing director.

Jackson, Mott's Assistant

J. B. Jackson, formerly with the E. I. du Pont de Nemours & Co. of Wilmington, Del., and more recently connected with the Buick Motor Co. at Flint, has become identified with the central office of General Motors Corp. as a personal assistant to C. S. Mott, vice-president and chief of the advisory staff.

Robinson With Campbell-Ewald

Loren T. Robinson, who has been assistant advertising manager of the General Motors Truck Co., has resigned and joined the Campbell-Ewald advertising agency in Detroit. Robinson is a former Detroit newspaper man. While with General Motors he had charge of its publication *Truck Talk* and a periodical for sales agencies. His place will not be filled immediately, according to Advertising Manager Baird, who says that for the present the duties will be divided among the staff.

R. M. Cowhan Promoted

R. M. Cowhan has been appointed export sales manager for Earl Motors, Inc., succeeding Clarence Thurston, who died some time ago. He was formerly an assistant sales manager at the factory and will continue the export headquarters there. Business in this department has been showing a steady improvement, and the company will designate a part of its output for export business.

Stratton Resigns as Sales Manager

Frank S. Stratton, who has resigned as general sales manager of the Grant Motor Car Corp. after an association covering a year and a half, was previously passenger car sales manager for the Packard Motor Car Co. He has been identified with the industry since 1912. He has made no announcement of his plans.

Rugg Joins Dodge Brothers

Harry M. Rugg who for the past year has been director of educational expansion of the Michigan State Automobile School, Detroit, has been made assistant experimental engineer for Dodge Brothers.

New British Aviation Director

Major-General Sir W. S. Brancker K.C.B., A.F.C., has been appointed director of civil aviation in the air ministry of Great Britain.

Garlent Now Works Manager

J. E. Garlent has been appointed works manager of the Auto Wheel and Gier Pressed Steel plants of the Motor Wheel Corp. of Lansing. Garlent assumes charge of operations in both divisions after considerable experience as works manager of each separately. It was decided to combine the works management of both under one head for greater efficiency in the operation of these two large units of the corporation. Before joining Motor Wheel, Garlent was factory manager for Hupmobile and factory manager of the King plant.

A. E. Hoffman Given Dinner

A. E. Hoffman, director of the Clydesdale Motor Truck Co., Clyde, Ohio, was a guest at a dinner in the Hotel Martinique, New York, given by several directors and the entire staff of employees of the Clinton Truck Sales Co., New York, of which he is president. Talks on highway transport and improved conditions in the motor truck industry were made by A. J. Banta, general manager of the Clydesdale corporation; J. H. Baynen, secretary, and R. Miller, treasurer of the Clinton Sales Co., J. V. Boise and A. B. Neiber of the Chatham and Phoenix National Bank.

Griffin Changes Companies

H. B. Griffin has resigned as vice-president of the Doehler Die-Casting Co., Brooklyn. He is well known throughout the automotive industry, having been connected with the Doehler company for the last fifteen years. Griffith is now associated with the Light Manufacturing & Foundry Co., in charge of the sales of the company's die casting division.

Hart-Parr Advances Bloom

L. H. Bloom, assistant sales manager of the Hart-Parr Co., Charles City, Iowa, has been promoted to general sales manager. He has been identified with the Hart-Parr organization for the last six years.

Neale Is Lines Successor

A. W. Lines has resigned as sales manager of the Spencer Smith Machine Co., Howell, Mich., effective June 1. He was formerly sales manager of the Detroit Twist Drill Co. and the Parker Rust Proof Co. His plans for the future have not been announced. He is succeeded by J. E. Neale, formerly of Chicago.

R. W. Chalmers in District Work

R. W. Chalmers has been appointed district sales manager in the Eastern territory for the Windsor gravity dump body and the Trail-Ford for the Automotive Utilities Corp. of Detroit. He was formerly associated with tractor and trailer business in a retail capacity.

Men of the Industry and What They Are Doing

McCormick Visits Springfield

Cyrus H. McCormick, works manager of the motor truck division of The International Harvester Co., visited the Springfield works a few days ago and conferred with Superintendent C. H. Smart regarding production. McCormick has just returned from a business trip abroad during which he visited France, Germany and England. It is expected that orders for foreign shipments will soon be placed with the Springfield plant as a result of his trip overseas. Owing to the receipt of material, the Springfield works is again able to keep up to its schedule of fifty high speed motor trucks a day. Orders from municipalities and large business concerns are being received at the local plant.

A. B. C. Hardy Dined

A dinner was given by the factory organization of the Olds Motor Works at Lansing in honor of the first anniversary of A. B. C. Hardy, president and general manager, as chief executive of the company. Hardy was presented with a silver testimonial in appreciation of his leadership.

Civic Work for Belnap

L. J. Belnap, president of Rolls-Royce of America, Inc., has been named as aeronautical commissioner for the city of Springfield, Mass.

McGonigal Heads Cletrac in Canada

S. A. McGonigal has been elected president and managing director of the Cleveland Tractor Co. of Canada, Ltd., succeeding J. L. Hibbard, resigned. McGonigal's connection with the Cleveland company includes four years of intensive work both at the company's home office and in the field. He has been assistant to the vice-president in charge of sales and manager of the company's Atlanta office as well as sales manager of the central district comprising Michigan, Indiana, Kentucky and Western Ohio. The Cleveland Tractor Co. of Canada, Ltd., is located at Windsor, Ont., with branch organizations at Montreal and Winnipeg and distributors at the important agricultural and industrial centers.

Loudon Made Resident Engineer

W. P. Loudon, formerly of Pittsburgh, has been appointed resident engineer of the automotive equipment department of the Springfield, Mass., plant of the Westinghouse Electric & Manufacturing Co.

Scrimshaw on College Faculty

Stewart Scrimshaw, manager of industrial relations of the Kearney & Trecker Corp., Milwaukee, manufacturer of milling machines and other machine tools, has been appointed to the faculty of the college of engineering of Marquette University, Milwaukee. He left May 19 for a tour of Europe to study educational and industrial problems and will assume his new duties at the university on Sept. 1.

Buell Directs Fender Sales

C. D. Buell is now sales manager of the Michigan Crown Fender Co. of Ypsilanti

Walsh Advertises Motor List

Robert T. Walsh has been appointed advertising manager of the Motor List Co., and Arthur Livingston, quota statistician. Walsh was at one time assistant advertising manager of the Ford Motor Co. and later served as advertising manager of Maxwell, King and Briscoe. New officers of Motor List Co. recently elected are R. L. Polk, Detroit, president; Martin Tuttle, Des Moines, vice-president; Ward Gavett, Detroit, secretary, and R. L. Polk, Jr., Detroit, treasurer.

Englebeck Goes With Peerless

C. A. Englebeck, who has been prominently connected with the marketing of automobiles in Chicago since the early days of the industry, has been appointed general manager of the direct factory branch which the Peerless Motor Car Co. has opened in Chicago. He has resigned as sales manager of the Chicago branch of the Cadillac Motor Car Co. to renew his affiliation with R. H. Collins, Peerless president, with whom he was associated while Collins was at the head of the Cadillac company.

Dearing Succeeds Whipple

R. M. Dearing has been appointed Denver branch manager of the Bearings Service Co., succeeding H. C. Whipple, who has resigned. Previous to the Denver appointment, Dearing was assistant branch manager of the Chicago headquarters.

Frederickson Joins Clark

W. S. Frederickson has resigned as general sales manager of the Hart-Parr Co. to join W. W. Clark, former export manager of the company, in a wholesale importing business with headquarters in Charles City, Ia.

O. E. Utz with Fedders

O. E. Utz, who has become sales manager of the Canadian plant for the Fedders Manufacturing Co., Buffalo, served as purchasing agent for the Pierce-Arrow Motor Car Co. for twenty years.

Gibbons Is District Sales Head

Frank Gibbons has been appointed district sales manager of the Cleveland district for the Central Steel Co. of Massillon, Ohio, with headquarters in the Swetland Building, Cleveland. He goes into the Cleveland district from the general offices of the company where he has been connected with the sales department for a number of years. He will handle sales on the entire line of Central Steel products.

Kimball, Territorial Manager

A. D. Kimball has been made manager of the Detroit territory for the Wheeler-Schebler Carburetor Co., Indianapolis, and will be in charge of factory sales in Michigan. Kimball is well known in automotive circles through his connection with the Ball & Ball Carburetor Co. Previous to that association he served as engineer for the Fulton Truck Co.

Shea Sales Head for Amazon

William J. Shea, formerly central district manager of the Portage Rubber Co., has been appointed sales manager of the Amazon Rubber Co. According to Shea, production at the Amazon plant will be more than doubled during the present month.

Howard Leaves Chandler

J. M. Howard, for more than six years advertising manager of the Chandler Motor Car Co., has resigned, but has made no announcement as to his future plans. Howard came here from Washington and formerly was a newspaper man in Virginia. His successor has not been anpointed.

Ford Takes Branch Head to Manage His Railroad

INDIANAPOLIS, May 24—Fred L. Rockelman, for the last three years general manager of the Indianapolis branch of the Ford Motor Co., has been appointed general manager of the D., T. & I. Railroad Co. and will take charge of the line at once, with headquarters in Detroit.

Rockelman is 37 years old but has been identified with the Ford organization for many years. He was among the first twenty-five employees of the Ford Motor Co., entering the work as an inspector. Later he advanced to positions in factory management, and developed into the sales end. For a time he was engaged in Ford agency work in Buffalo and Seattle. While in Seattle he was appointed general manager of the Indianapolis branch.

CANADIAN IMPORTS

MONTREAL, QUE., May 24—From 1918 to 1922 inclusive a total of 46,484 passenger automobiles, valued at $45,749,115, were brought into Canada, paying a duty of $15,960,121. In the same years 7494 motor trucks were imported, valued at $12,497,714 and paying a total duty of $4,253,438. Automobile parts imported during the period mentioned were valued at $47,979,170, and these paid duty to the amount of $14,808,359.

Seiberling Lowers Prices 12½ Per Cent

Company Will Also Absorb Government Excise Tax Collected from Consumer

AKRON, May 24—Frank A. Seiberling announces that a straight 12½ per cent price cut will be made on all sizes of Seiberling and Portage straight side cord tires, effective June 1. This will bring the price of the 30 x 3½ Seiberling clincher down to $10. Another feature of the price reduction is that the Seiberling company will absorb the 5 per cent Government excise tax which the dealer heretofore has collected from the consumer in addition to the regular retail price.

It is stated that Seiberling has put into effect in his two plants advanced methods of manufacture which have brought production costs down to a minimum. It is claimed that the New Castle plant is one of the most efficient manufacturing units in the world. Another factor in the price reduction is Seiberling's view of the future cotton and rubber markets. Seiberling believes that the day of the cord tire has arrived and he has confined the Seiberling brand to that type.

Price of Fabric Casings Reduced by Michelin Tire

MILLTOWN, N. J., May 22—The Michelin Tire Co. announces substantial reductions in its fabric casings. Some of the cuts are:

SOFT BEAD CLINCHER TYPE

Size	Old Price	New Price
30 x 3	$12.90	$10.90
30 x 3½	14.90	12.75

STRAIGHT SIDE TYPE

Size	Old Price	New Price
32 x 4	$26.90	$23.25
33 x 4	27.90	23.80
34 x 4	28.90	24.90

Case Reduces Prices and Expands Its Line

RACINE, May 22—The Case Threshing Machine Co. announces reductions on both its open and closed types of Model X. The 5-passenger phaeton formerly quoted at $1,890 is now priced at $1,790, and the sedan formerly listed at $2,790 now sells for $2,690. A roadster priced at $1,750 and a brougham at $2,550, this model, are now being brought out.

The company has replaced its Model V with a new model to be known as W. The 7-passenger phaeton is priced at $2,250, the 5-passenger or sport roadster at $2,200, the coupe at $2,850 and the 7-passenger sedan at $3,250.

GARY'S PRICES HIGHER

GARY, IND., May 19—The Gary Motor Corp. has increased the price of all models of its trucks, with the exception of model F 1½-ton, which remains at $1,675. The new and old prices are as follows:

	Old Price	New Price
Model I 2-ton	$2,150	$2,250
Model J 2½-ton	2,550	2,650
Model K 3½-ton	3,550	3,650
Model M 5-ton	4,000	4,100

Earl Increases Price on Three Models $100

DETROIT, May 20—Prices on Earl cars in three models have been increased $100, the phaeton now being listed at $1,095 and the sedan and brougham at $1,795. The price of $1,485 on the special roadster remains as formerly. In April Earl prices were reduced from $1,185 in the phaeton and $1,895 in the closed models.

The company notes that orders have grown larger steadily despite the increase, which is ascribed to higher cost of manufacturing, notwithstanding the volume production which has now been reached.

CHEVROLET COUPE REDUCED

DETROIT, May 22—The Chevrolet Motor Co. has announced a reduction in the price of its "490" coupe from $875 to $850.

MINNEAPOLIS TRACTORS LOWER

HOPKINS, MINN., May 22—The Minneapolis Threshing Machine Co. has reduced the prices of its farm tractors. The list follows:

	Old Price	New Price
12-25-hp.	$900	$800
17-30-hp.	1,675	1,600
22-44-hp.	3,000	2,650
35-70-hp.	4,150	3,850

Lincoln Motors Building New Touring Car Deluxe

DETROIT, May 23—Lincoln Motor Co. will make first shipments in June of a new deluxe 7-passenger touring car, the price of which has been fixed at $3,800. The new model is a companion to the phaeton and roadster deluxe on which the company has been in production since last summer and the prices on which are also $3,800. This line is independent of the regular production model, the price on which remains at $3,300, as fixed immediately after the sale to the Ford interests.

Production at Lincoln is now approximately thirty cars daily, dependent on the receipt of materials and bodies, the latter being still a heavy drawback to a steady flow of cars. Lincoln is served by a number of body makers, according to model, but because of the semi-custom nature of the work, it is difficult to get deliveries in the quantity required.

Henry Ford is spending much of his time at the Lincoln factory consulting with the Lelands, in whose hands the active management remains. Changes in the layout and arrangement of factory equipment are continuing, and some new equipment is being added with an eye to facilitating output.

New Rail Rates Aid Makers and Buyers

Interstate Commerce Commission Orders 10 Per Cent Reduction in Freight Cost

NEW YORK, May 25—The horizontal reduction in freight rates ordered by the Interstate Commerce Commission, averaging 10 per cent, will result in material savings not only to the automotive industry but to purchasers of motor vehicles. It has been estimated that the freight bill for a normal year on shipments of finished passenger cars and trucks approximates $100,000,000. A 10 per cent reduction will mean a saving of about $10,000,000, or an average of about $5 on an annual production of 2,000,000 vehicles.

No statistics have been compiled showing how much freight is paid in a year by the various branches of the automotive industry on the shipment of supplies and raw materials, but it is believed it would amount to another $100,000,000.

Inasmuch as purchasers of cars and trucks now have the freight from the factory added to the price of the vehicle, they will profit directly by the reduction in rates.

The reduction will make a saving of from $15 to $30 a car, according to weight, on shipments from Detroit to the Pacific Coast, and of from $5 to $10 a car on shipments from the Detroit territory to New York.

It is believed the railroads will accept the reduction ordered, and they are asked to inform the Interstate Commerce Commission not later than May 31 whether the findings will be carried into effect without formal order by the commission.

For all practical purposes the new rates are those in effect Aug. 25, 1920, prior to the granting of an increase at that time by the I. C. C.

The decision of the commission that rates should be reduced was unanimous, although some of the commissioners expressed the belief that a reduction of 10 per cent would have no positive influence in lowering the cost of living, stimulating industry or ameliorating economic conditions.

EXPORT LUNCHEONS RESUMED

NEW YORK, May 24—The monthly luncheons of the New York export representatives of the National Automobile Chamber of Commerce will be resumed here on June 29, the last Thursday in the month. George F. Bauer, secretary of the N. A. C. C. foreign trade committee, in announcing their resumption today, said that the meetings would be opened to all automotive export officials and invitations will be sent to members of the Motor and Accessory Manufacturers' Association, the Rubber Association of America and other allied organizations.

Uniformity in Colors of Lights Endorsed

American Engineering Standards Committee Starts Movement for Standardization

NEW YORK, May 23—A movement for standardized colors for traffic signals for highways, buildings, etc., was started to-day by the American Engineering Standards Committee, which called a meeting attended by delegates of more than fifty associations interested in such work. The meeting went on record as favoring a program of national uniformity in colors of lights used as signals by night and non-luminous colors used as day signals.

The plan is not only to standardize colors for day and night, but the position of different colored lights when used for signal purposes.

The meeting was represented by practically all associations connected with the automotive industry, as well as associations representing railroads, trolley companies, safety engineers, electrical engineers, Bureau of Standards, Bureau of Public Roads and many other organizations. An international character was added by the presence of the Canadian Engineering Standards Associations.

General Recommendations Adopted

No definite action was taken at to-day's meeting beyond adopting a series of general recommendations to outline the scope of the work. A sectional committee of the American Engineering Standards Committee, composed of delegates from all interested organizations, is to be appointed to carry out the details of the work.

The recommendations accepted at to-day's meeting were as follows, the delegates first going on record as favoring national uniformity in the use of colors for traffic signals:

1—The use of colored lights on all vehicles using the highways.

2—Their use on signals along highways and its curbs, both for permanent and temporary purposes.

3—Their use for highway crossings for steam and electric railways.

4—A co-ordinated relation of color, position, form and number of signals.

5—A co-ordinated relation to systems of flashing, or similar signals.

6—Colors for non-luminous signals.

7—Recommendations on the use of colors for emergency signals.

8—Methods of specifying or defining colors for other signal purposes.

9—Any other uses for which color should be employed as signals.

Change to Yellow Opposed

It was planned by chairmen who had drafted the agenda that the question of signals for steam railroads and electric railroads would be considered in connection with those for highways, but strong opposition was brought forth by the railroad and trolley interests with the result that recommendation No. 3 was eliminated from consideration, except where highways cross steam or trolley lines.

The question of railroads favoring the elimination of the red tail light from the automobile was suggested and met with opposition. Railroad interests were not looked upon favorably as wanting to keep entirely out of this research on railroad signals and yet attempting to dictate the lights that highway vehicles should carry. This matter will have to be carried to a solution in the sectional committee.

The necessity for an international standardization of color for traffic signals was suggested and this will doubtless be considered by the sectional committee.

Some delegates went so far as to recommend that in an investigation of this character the possibility of standardizing in all forms of transportation, namely, marine, air, railways, trolleys, highways, etc., should be broadly considered.

3,700 PASSENGER CARS PRODUCED IN 1899: TOTAL OF 1,514,000 WERE BUILT LAST YEAR

NEW YORK, May 22—Interesting statistics with reference to the automotive industry are contained in the 1922 issue of Facts and Figures, the annual year book of the National Automobile Chamber of Commerce, which is now on press. In view of the fact that if passenger car production continues at anything like the present rate, a new record will be established in 1922, the following table showing passenger car production and wholesale value since 1899 is valuable:

Year	Number	Wholesale Value	Year	Number	Wholesale Value
1899	3,700	$4,750,000	1915	818,618	$565,978,950
1904	21,281	23,634,367	1916	1,493,617	797,469,353
1909	127,731	158,918,506	1917	1,740,792	1,053,505,781
1910	181,000	213,000,000	1918	926,388	801,937,925
1911	199,319	240,770,000	1919	1,657,652	1,461,785,925
1912	356,000	335,000,000	1920	1,883,158	1,809,170,963
1913	461,500	399,902,000	1921	1,514,000	1,093,918,000
1914	543,679	413,859,379			

Motor truck production and wholesale value for years since 1904 follows:

Year	Number	Wholesale Value	Year	Number	Wholesale Value
1904	411	$946,947	1915	74,000	$125,800,000
1909	3,255	5,230,023	1916	90,000	157,500,000
1903 to 1910	10,374	20,485,500	1917	128,157	220,982,668
1911	10,655	22,292,321	1918	227,250	434,168,992
1912	22,000	43,000,000	1919	316,364	423,326 621
1913	23,500	44,000,000	1920	322,039	423,756,715
1914	25,375	45,098,464	1921	154,550	166,082,000

Cleveland Radiator Co. Succeeds Old Division

CLEVELAND, May 24—The Cleveland Radiator Co. has been organized to succeed the Cleveland radiator division of the Sparks-Withington Co. H. K. Hall, formerly general manager of the Sparks-Withington property, will be president and treasurer. E. S. Weidle, vice-president and sales manager, formerly was Cleveland branch manager of the McCord Manufacturing Co. of Detroit, and L. V. Grantier, the chief engineer, also was formerly connected with the McCord as the assistant chief engineer. D. A. Bird, superintendent of the Sparks-Withington Co., will be production manager.

The organization and plant now are complete, and both tubular and cellular radiators are in production. The output now is about 250 radiators a day.

Maibohm Overruled in Fight on Sale

SANDUSKY, OHIO, May 24—Objections to confirmation of the sale of the assets of the Maibohm Motors Co. to a creditors' committee headed by E. G. Kirby of Cleveland, filed by H. C. Maibohm, president of the old company, and F. W. Cushing, the vice-president, have been overruled.

Maibohm and Cushing informed Referee in Bankruptcy Belford that the creditors' committee for which Kirby acted represented only a part of the creditors and that if a new sale was ordered a larger bid would be made. Maibohm said he was willing to file a bond against loss. It was brought out at the hearing that Storey & Co., New York brokers, were back of the Maibohm proposal. It is understood, that they had plans under way for reorganization of the company by issuing $500,000 in bonds and acquiring from the Mercer Motors Co. the manufacturing rights for the Simplex car, which would have been put out in a modified form at a moderate price.

The creditors' committee which bid in the property last week represented more than 80 per cent of the creditors. It proposes to turn the assets over to a new Ohio corporation known as the Arrow Motors Co.

It is understood Maibohm may appeal to Federal Judge Killits.

Sue Insurance Directors

ROCK RAPIDS, IOWA, May 24—Charging that seven Rock Rapids residents, former directors of the Interstate Automobile Insurance Co., defrauded the company of $347,500, E. H. Hoyt, receiver, has secured an order to bring action to recover that amount.

Improvement Is Real, Milwaukee Bank Says

Parts and Equipment Makers in District Are Operating at Capacity

MILWAUKEE, May 22—Constantly increasing production, which is carrying passenger car factories to within 100 per cent of normal operations, and manufacturers of automotive parts and equipment to the limit of capacity to make deliveries according to specifications, is the distinct feature of the automotive industries at this time in the Milwaukee and Wisconsin district.

Testimony that the improvement up to this time has been real and not in any way artificial or fictitious is adduced by the research experts of Milwaukee's largest bank, the First Wisconsin National, which in the May number of *Business and Financial Comment*, a monthly summary of local conditions issued by the bank, says:

"Automotive parts and accessories manufacturers continued to have good business during the past month. Employment in this group increased 5 to 10 per cent during the month of April, and this has been accentuated so far in May."

Conservative View Taken

The summary then takes a conservative view and says:

The seasonal nature of the automobile business, however, has to be taken into consideration. From about June 1, activity generally slows down and starts up again in August. Despite the good showing of the automobile companies for the last two months, it is too early to assume that this will be a year of spectacular motor car production except for a few concerns.

Delving into retrospect and prospect, the summary says:

Study of automobile statistics has developed the fact that for several years new demand has centered on the low and medium-priced cars. It would be interesting to find out the progression of buying from the lower to the medium and higher-priced cars. There must be a more or less regular tendency for buyers to go from a cheap to a medium-priced car, but the number who graduate into the higher-priced class is naturally much smaller. The production and registration figures show that the expensive car class has increased relatively little for the past five or six years.

Good Bus Outlook

Regarding the motor truck industry, the review says:

Production and sales of motor trucks have been making slower progress than is the case with passenger cars. On the other hand, however, the possibilities of passenger and freight transportation by motor bus or truck are just beginning to be realized. Heretofore the railroad and traction lines have occupied the field of mass transportation as distinguished from the individual service of the automobile. Now we appear to be coming into a period when, for distances within a radius of 100 miles, the truck and bus will to some extent supersede or supplement rail transportation.

Tangible evidence of the improved position of passenger car and parts factors in this as well as other districts in the United States is provided by the reports coming daily from various industries, telling of progress of a substantial sort.

CENTRAL CHINA GETS ITS FIRST TRACTOR

WASHINGTON, May 22—The first tractor ever used in central China was included in a shipment of American agricultural machinery recently received at Hankow, the Department of Commerce has been informed by Consul General Heintzleman.

The order was placed through an American house at Hankow in connection with the development by a group of Chinese capitalists of 13,000 acres of land in northern Honan on the Yellow River. The promoters intend first to undertake the cultivation of peanuts. If the machinery just received proves satisfactory, additional orders will be placed.

Orders Keeping Plants Running at Top Speed

(*Continued from page* 1132)

to be prepared for emergencies and with commitments only for short terms they will be able to turn around, no matter what happens.

Skilled automotive labor is scarce in the principal centers, such as Detroit, Cleveland and Indianapolis, and many young men who returned to the farms when they were laid off during the slump of 1920 are going back to the factories. The consequence is that farm help is getting scarce, especially in Michigan.

Up to the present motor vehicle builders have not begun to bid against each other for factory help as they have in other boom days. They are operating on a much smaller margin of profit than they did then and if labor costs go up materially it will be necessary to raise car prices. Metals are somewhat higher than they were a few weeks ago and parts prices have stiffened since makers cleaned up their inventories and partly fabricated stocks.

STUTZ DEALERS TO MEET

INDIANAPOLIS, May 24—The custom of holding sales conventions during the week of the 500-mile international sweepstakes will be followed by but one Indianapolis factory this year. The Stutz Motor Car Co. of America will hold a three-day sales convention May 29 to 31 inclusive.

Rail Official Urges Roads Aid Shipments

Circular Outlines Helpful Measures—To Add More Automobile Freight Cars

NEW YORK, May 22—The traffic department of the National Automobile Chamber of Commerce has been informed that M. J. Gormley, chairman of the car service division of the American Railway Association, has sent to all members a circular calling attention to the extraordinarily heavy shipments of automobiles. The circular states that it is highly important, in order to fully supply rail transportation, for the heavy automobile shipments that:

(1) Automobile cars be moved promptly, loaded or empty, to owners or nearest automotive producing territory.

(2) Cars be not loaded with traffic which takes them out of route either to the owner or to the territory where this equipment is required for automotive loading.

(3) Automobile cars be not loaded with commodities such as cement, lime, plaster and other bulk freight that leaves a residue of dust in the car that will damage the finish of automobiles when later used for that loading. Many hundreds of automobile cars have been rejected at automobile plants for this reason, and in view of the generally ample supply of other suitable equipment such service for automobile cars is not justified.

(4) Owners give such special attention as may be necessary to the repair of automobile cars to keep sufficient number in service to supply demands.

Additional substantial orders for automobile freight cars have been placed by the railroads. The Missouri Pacific is planning to build 2000 which will be reinforced for double decking. The Southern Railroad has ordered 500, and the Chesapeake & Ohio 100. The St. Louis and Southwestern is building 350 in its own shops, and the Chicago, Milwaukee & St. Paul proposes to build 500.

OLD KNOX OFFICERS INDICTED

MT. VERNON, OHIO, May 22—Indictments charging embezzlement and violation of the Ohio blue sky laws have been returned against five former officers and directors of the Knox Tire & Rubber Co. The men indicted are F. D. Spencer, E. Scott Cannell, D. E. Frantz, V. V. Hendershot and C. B. Carpenter. The five are charged with the embezzlement of an amount aggregating $26,200. The blue sky law indictments supersede similar indictments found a year ago, which were declared to be faulty.

TRAFFIC TO JOIN MERGER

ST. LOUIS, May 22—Stockholders of the Traffic Motor Truck Corp. have ratified the plan calling for the transfer of all the assets of the company to the Associated Motor Industries, Inc., which, in turn, will assume all the liabilities of the Traffic Corporation. Stock of the truck company will be exchanged for securities of the Associated Motor Industries.

Plants Speeding Up in All Branches of the Industry

Working on Fisk Contract

PONTIAC, MICH., May 24—The tire mold department of the Wilson Foundry & Machine Co. is being worked at capacity on a schedule which is expected to last until fall. The company closed a large contract during the winter with the Fisk Rubber Co., which will probably not be completed until September.

Efforts are being made to boost the production of Knight engines for the Willys-Overland Co. to 175 daily, which is 25 in excess of the largest prediction for production in the Knight plant when it was removed here from Elyria. At present the production runs around 100 daily. Night shifts are being put on to reach the higher figure. The Overland engine department maintains a fairly steady schedule in the vicinity of 400 daily.

Seiberling Speeding Up

BARBERTON, OHIO, May 24—Operations of the new Seiberling Rubber Co.'s plants here and at New Castle, Pa., have been speeded up to 2400 tires a day, including over 1500 Seiberling cords made at the Barberton plant. The New Castle plant is making Portage tires exclusively for Seiberling.

While orders for large size tires now are being filled immediately, production is behind orders for small sized Seiberling tires. The estimated net profits of the company for April were $25,000, while profits this month are expected to reach $100,000. As there is $800,000 of 8 per cent preferred stock outstanding on which the annual dividend aggregates $64,000, the company will more than earn the dividend for the year this month.

Rolls-Royce Program Enlarged

SPRINGFIELD, MASS., May 24—As orders are running ahead of production at the Rolls-Royce plant here an increased rate of output for June is scheduled, notwithstanding the big May expansion. The company has leased the large six-story factory building of the Knox Motors Co. for the manufacture of bodies.

This branch of production is being organized under George W. Kerr, superintendent of coach work, and it is expected the plant will be in full operation by the latter part of June. Mudguards are the first item to be made in this building and others will be added until practically the entire body work for the Rolls-Royce car will be done in the building.

Fyrac Gains 102 Per Cent

ROCKFORD, ILL., May 24—The Fyrac Manufacturing Co., manufacturer of spark plugs, reports a 102 per cent increase in sales for April, 1922, over April of last year. Orders received thus far, the factory states, make it a certainty that May will be an even bigger month than April. The company is planning production on that basis and its factory is working full time continuously.

MORE MEN AT WORK

DETROIT, May 22—Additional workers to the number of 5217 were engaged last week by the members of the Employers Association. This brings the total to a new high mark of 164,106, as compared with 118,497 for the same week in 1921 and 189,000 for the same week in 1920.

Durant Working on Plant at Oakland

OAKLAND, CAL., May 24—Announcement is made by R. C. Durant that within 60 days from May 15 the factory of the Durant Motors Co. of California, now being erected in this city, will be in operation. The plant is being built at a cost of approximately $3,000,000, says the announcement, and has 300,000 sq. ft. of floor space, with capacity for an annual output of 50,000 cars. Employment will be furnished for 800 to 1000 men, with an office force of 200. The annual payroll at the start will be $2,000,000 a year, according to this announcement.

50 Franklins Daily

SYRACUSE, May 25—A production schedule of fifty cars a day will be started May 29 by the Franklin Automobile Co. This basis of permanent production will be the largest in the history of the company, except for a short time about two years ago when the plant here produced cars at the rate of fifty-five a day. The schedule has been forty-five cars a day.

Packard at Highest Point

DETROIT, May 23—The Packard Motor Car Co. is now at the highest production and sales point of its career, according to a signed statement by President Alvan Macauley. New orders are developing in increasing volume, the statement said, and indications are that the peak has not been reached.

Wills Expands Factory Space

DETROIT, May 24—C. H. Wills & Co. have taken over the building formerly occupied by the Illinois Tool Co., which adjoins the Wills plant at Marysville, and will operate it as a department of the Wills factory. A large number of men will be added to the payroll.

Transport Surpasses Records

MOUNT PLEASANT, MICH., May 22—Transport Truck Co. reports that the total number of orders placed by distributors for April delivery topped the record of any corresponding month in previous years of Transport history.

Spring Demand Heavy

MILWAUKEE, May 25—At present lack of body production facilities is keeping the output of the Nash Four at Milwaukee to 55 or 60 cars a day, it being necessary to transfer cars for finishing. When the company's new shop is finished, this will be eliminated and the Nash Four will be practically a 100 per cent Milwaukee product. The Kenosha plant is now making 97 per cent of the Nash Six under one roof.

The Harvey Spring & Forging Co., Racine, Wis., has brought production up to 100 per cent of ultimate capacity and is not able to accept all orders tendered, especially car manufacturers' equipment business. The call from the wholesale and jobbing trade for springs is very heavy, while contracts from passenger car makers is taxing capacity to the utmost.

Motor Wheel Adds to Plant

LANSING, MICH., May 24—Taxed to capacity by orders which have necessitated overtime production in both the wood and steel wheel departments, as well as in the Gier Stamping plant, the Motor Wheel Corp. has let a contract for the construction of two additional units.

Work will start immediately on both these additions, the completion of which in about sixty days will not only release space in the present plants needed for various departmental expansion, but will furnish a very considerable amount of added manufacturing space.

Oakland Business General

PONTIAC, MICH., May 24—April sales by the Oakland Motor Car Co. were larger than in September, 1920, which was the second largest month in the history of the company, according to C. J. Nephler, general sales manager. Sales for the first half of May were 66 per cent in excess of the same period in April, and it is stated that orders are coming from all sections of the country rather than from any particular territory.

Hard to House Employees

ALMONT, MICH., May 24—The Almont Manufacturing Co., making gray iron castings, has experienced such a rush of business that it has been necessary to promote a housing campaign in the town to provide quarters for additional employees. Twenty-five residences are now under way on property near the plant.

Maxwell at Top Speed

DETROIT, May 24—The Maxwell Motor Corp. will go into production on a basis of 400 cars a day for the remainder of May. The company now has a second assembly chain in operation and is working at top speed.

FINANCIAL NOTES

Packard Motor Car Co. comparative balance sheet as of Feb. 28, 1922, shows accounts receivable on that date of $2,523,594, as compared to $3,290,994 on Aug. 31, 1921; inventories of $16,778,062, against $21,230,445; cash $3,890,950, compared to $4,523,716, and deferred installments, notes and bills receivable $1,466,827, against $1,144,260. The accounts payable and payrolls were $428,659 on Feb. 28 and $2,188,270 on Aug. 31. On Feb. 28, 1922, net tangible assets applicable to the common stock amounted to $26,516,806, or $22.31 per share of $10 par value.

Chandler Motor Car Co. for the four months to May 1 earned in excess of $1,000,000. In this month and June it expects to earn a similar amount. On 280,000 shares of capital stock this is the equivalent of just over $7 a share. The company will have more than earned its $6 annual dividend with a slight margin to spare, in the first six months, leaving earning power of the second half year available for strengthening surplus account, which in 1921 was drawn down $2,300,000 in the maintenance of dividends.

Moon Motor Car Co. is marketing through a syndicate composed of Lage Brothers & Co. and William H. Colvin & Co. of Chicago 60,000 shares of a total of 154,213 shares outstanding of no par value common stock at $9.50 a share. This stock has always been closely held and has never before been offered to the public. Application will be made to list the stock on the New York curb.

Hudson Motor Car Co. has declared an initial dividend of 50 cents a share on the capital stock, payable July 1 to stock of record June 20. The company when incorporated issued in compliance with the state laws of Michigan 100 shares of $10 par stock. A dividend of $2.50 a share has been declared on this stock, payable on the same date as the capital stock dividend.

Republic Motor Truck Co., Inc., announces that all coupons on its first mortgage and collateral trust 7 per cent serial notes, which matured May 1, 1922, and Nov. 1, 1921, will be paid upon presentation at Bankers Trust Co., New York. Also six months' interest at the rate of 7 per cent will be paid upon Series "B" notes, which matured Nov. 1, 1921.

Hood Rubber Co. reports sales for 1921 of $23,844,436, against $32,867,000 in 1920 and $25,444,016 in 1919. Sales for the first three months of 1922 were $5,767,965, for the same period of 1921 they were $4,376,293. Regular dividends for 15 months amounting to $921,750 were paid on preferred and common, leaving a substantial surplus.

Martin-Parry Body Co.'s preliminary earnings statement for April shows a net income of approximately $250,000, compared with less than $100,000 in the corresponding month last year. New orders show an increase of approximately 100 per cent over those booked for the same period in 1921.

Stewart-Warner Speedometer Corp.'s 8 per cent convertible bonds, which will mature on March 1, 1926, have been called for retirement on Sept. 1 at 104 and interest. There are $1,850,000 of the bonds outstanding. The company has decided to anticipate the maturity.

Detroit Air Cooled Car Co. has been given authority by the Michigan Securities Commission to sell stock in the state. The company, which is incorporated under Delaware laws, has a capital of $1,200,000.

Lee Rubber & Tire Co. for the first quarter of 1922 reports net earnings of $139,360, against $77,742 for the same period last year. The quarterly dividend calls for the payment of $75,000.

Mack Trucks, Inc., estimates net profits in April to be in excess of $300,000, equitable at the annual rate of about $8 a share on the common stock.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

During last week call money was much easier, ruling at 3½ per cent throughout most of the week. The range was from 3 per cent to 3¾ per cent, as compared with 3½ per cent to 5½ per cent in the previous week. There was some relaxation noted in time money, the range being from 4 per cent to 4½ per cent for all maturities up to six months, as compared with 4¼ per cent in the previous week. This ease in time money was displayed despite Government withdrawals from local institutions amounting to $18,000,000, and a shipment of gold to the amount of $1,000,000 to India. The prime commercial rate remained unchanged at 4¼ per cent.

The Federal Reserve statement of May 17 showed a decrease of $151,000 in gold reserves but an increase of $1,308,000 in total reserves. Total bills on hand decreased $14,284,000, total earning assets $36,806,000, and deposits $3,167,000. Federal Reserve notes in circulation showed a decline of $12,530,000 to $2,146,656,000, which marks the lowest level since August 31, 1918. As a result of these changes the reserve ratio increased from 77.3 per cent to 77.6 per cent.

For the month of April the output of bituminous coal amounted to 15,780,000 tons, or a little less than one-third of the March production. This is the smallest production of bituminous coal for any month in the last ten years. Up to the close of the sixth week of the strike (May 13) the total output of coal since the strike began was 23,826,000 tons of bituminous and 39,000 tons of anthracite.

In the corresponding period of the 1919 strike, anthracite mines working to capacity produced 11,816,000 tons. The bituminous mines which remained in operation contributed 29,329,000 tons, making a total of 41,145,000 tons. It must be noted, however, that 1919 was a "boom" year and the willingness of industrial plants to pay high prices in order to ensure continuous operation at full capacity led to a greater effort on the part of the mine owners to provide the coal necessary in spite of the strike conditions.

TAXICAB COMPANY INSURED

OMAHA, May 24—The Zurick General Accident & Liability Insurance Co. has issued to the Yellow Cab & Baggage Co. of this city a policy for $760,000, indemnifying it against accident.

Program Submitted by Tractor Makers

Advanced Plans for Educating Farmer Proposed to Department of Agriculture

WASHINGTON, May 23—An educational program to educate the American farmer to power tractors and other power driven farm equipment has been proposed to the Department of Agriculture by the National Association of Farm Equipment Managers. The program, if adopted and carried out by the department, it is declared, will be one of the most advanced plans ever advocated for the successful farmer.

Primarily the program as outlined, which will be submitted to Secretary Wallace, is one of educating the farmer to use power farm equipment instead of horse and mule power. If the Department will adopt some sort of program to disseminate information showing the relative cost of horse power vs. mechanical power, the National Association of Farm Equipment Managers has agreed to compile statistics on the relative cost, working in co-operation with the industry.

In discussing the program to-day, F. R. Todd, vice-president of the Deering company, Moline, Ill., said:

The thing in a nut shell, which we have proposed to the Department of Agriculture, is to educate the farmer, through its various mediums available, to power equipment. Statistics already available show that power equipment is far superior to horse power and there is no way of estimating what the farmer loses annually by his continued use of horses and mules to till his land, as compared to what the cost is under the most improved methods of mechanical farming.

Wish Government Appropriation

The idea of educating the farmer to mechanical equipment will be under the active supervision of the tractor and thresher department of the association which has offered its services to the department, and which, it was stated to-day by Todd, will follow up the idea placed before the agricultural officials in an endeavor to secure an appropriation for the department in furthering the use of mechanical equipment on farms.

Guy H. Hall has been chosen by the tractor and thresher department to represent that association in co-operating with the Government. Hall was selected because he is a director of the National Institute of Progressive Farming, with headquarters in Chicago. He will act as liaison officer of the association in co-operating with the Department.

The delegation of equipment manufacturers in addition to Hall and Todd was composed of Finley P. Mount of the Advance-Rumely Co., La Porte, Ind., and J. B. Bartholomew of the Avery Plow Co., Peoria, Ill.

A full report of the final recommendations made by this committee and the action taken by the department will be made to the association at an early date.

INDUSTRIAL NOTES

Arrow Tool & Manufacturing Co., Bridgeport, Conn., will change its name on June 1 and do business under the name of the Forsberg Manufacturing Co., the change being due to the fact that another company, longer in the field but doing the same character of business, uses the word "Arrow" in its name and trademark. The Forsberg company will continue making tools and special machinery. There will be no change either in the ownership or management of the company. A modern, up-to-date press room has been added to the company's plant to take care of orders for stampings and sheet metal specialties in large quantities.

Simms Foundry Co. of Racine, Wis., has effected a consolidation with the **Racine Furnace & Foundry Co.**, and the merged concerns have been jointly reincorporated as the Simms Foundry Corp., with $200,000 capital. The combined capacity of the two plants is 50 to 60 tons a day, with a normal force of 300 operatives. Officers of the new company are: President, Horace R. Simms; first vice-president, J. Harvey Manny, Chicago; second vice-president, Griffith G. Jones; secretary, George L. Buck; treasurer, James V. Rohan.

G. F. Armstrong, president of the Armstrong Rubber Co., has purchased the Martin Tire & Rubber Co. at West Haven, Conn., and incorporated it under the name of the West Haven Rubber Co., with the same officers that are now serving with the Armstrong company. Production will center on cord tires, the plant having a present capacity of about 200 daily. Armstrong Rubber Co. is now making additions to its Garfield, N. J., plant that will increase its present output of 500 a day.

Johns-Manville, Inc., and the Johns-Pratt Co. announce that after June 15 each company will manufacture and market its respective products separately. The former corporation has acted as exclusive selling agents for the products manufactured by the latter for a number of years. It is felt now, the companies state, that the greatest economy to all interested will be in direct sale by the manufacturer through organized distributors.

Rotary Tire & Rubber Co.'s plant at Zanesville, Ohio, which is in the hands of Guy Winegarner as receiver, will probably not be put into operation in the immediate future. Previous to the appointment of a receiver prospects were bright for the reorganization of the company, and there was a likelihood that the plant would be purchased by the Studebaker-Wulff Co. of Columbus, but these negotiations fell through.

P. E. Werner, formerly of Akron but now of Kansas City, has purchased the Kansas City Tire & Rubber Corp., which has been in the hands of a receiver since May, 1919. The plant, which is equipped for the manufacture of tires and tubes, has been leased since the receivership by the Rubber Manufacturing Co., of which Werner is the head. Werner has also assumed management of the Sioux City Tire & Manufacturing Co.

Harmon D. Palmer, chief engineer of the **Kissel Motor Car Co.**, Hartford, Wis., has been granted patents on a new design of cast steel spring hanger to overcome rattling and other noises. The patent has been assigned to the Kissel company, which is equipping its cars with the new device as stock equipment.

Lomar Manufacturing Co., Middletown, Ohio, manufacturer of shock absorbers, has been incorporated in Ohio for $100,000, all common stock. The officers are: C. W. Shartle, Jr., Middletown, president and general manager; Tom Randolph, Houston, Texas, vice-president and director; L. L. Lomar, Middletown, general superintendent.

Kelly-Springfield Tire Co. of New York has executed a lease of the first and second stories of a large building in Milwaukee for warehouse and general headquarters purposes. The lease is for a period of ten years.

Unique Storage Battery Co. has begun the manufacture of storage batteries at its plant in Buffalo. W. F. McClashan is president and A. A. Brehm, secretary of the company.

Federal Motor Co.'s plant at Indianapolis, formerly occupied by the Empire Motor Car Co., is being placed in readiness for occupancy by the Frontenac Motor Co. of America.

Anderson Spring Lubricator Co., Inc., announces its removal to its new home, Revere Parkway at Spring Street, Everett Station (49), Boston.

Paramount Rubber Consolidated, Inc., announces that it has removed its executive offices to its factory at Little Falls, N. J.

Stutz Reports Net Loss of $632,370 at End of 1921

NEW YORK, May 25—The Stutz Motor Car Co. of America for the year ended Dec. 31, 1921, reports a net loss of $632,370, after expenses, inventory losses, etc.

There was a decided change in the balance sheet at the end of 1921 as compared with the end of 1920. The inventory was reduced from $3,049,238 to $1,890,608, while accounts and notes receivable declined from $285,297 to $75,222. Current liabilities including notes were $302,482, as compared with $1,339,871 at the close of the previous year.

In his report to stockholders, William M. Thompson, president of the company, reviews conditions in the automobile market last year. He states that the efforts of the corporation and its officers have been centered almost entirely on problems of manufacturing and sales efficiency, and describes improvements in the car.

DURANT PLANT ANNIVERSARY

LANSING, May 24—The Lansing plant of Durant Motors celebrated its first anniversary yesterday by turning out 123 cars. A year ago the site which the plant now occupies was an apple orchard. In that period the factory has been built and substantial production reached. The output will be increased as rapidly as possible.

REGAL TIRE IN LIQUIDATION

SHERBROOKE, QUEBEC, May 23—Shareholders of the Regal Tire & Rubber Co. have been advised that the company has been officially placed in liquidation and it is most likely that the property will be offered for sale in the near future. The Red Arrow people will probably secure the property.

METAL MARKETS

It is in those steel products of which representative tonnages enter into automotive consumption that tight conditions prevail with reference to the supply, so much so that in sheets, for instance, premiums are becoming more and more frequent. It is true that in isolated instances premiums have also been paid by the oil industry for tank plates needed for immediate construction of storage tanks. Price conditions surrounding steel products chiefly entering into the building industry and railroad equipment compared with those prevailing for the steel products which the automotive industries require are, however, relatively easy. Of course, there are some very good reasons for this state of affairs. Having bought earlier in the year from hand to mouth and steadfastly avoided all commitments for deferred deliveries, automotive buyers could hardly hope that when the tide turned they would find the steel producers in a mood to make sacrifices for the sake of accommodating them.

Costs of production have not declined. If any change has taken place in the last few weeks, it has been in the opposite direction. Freight rates are still high and the fuel situation, while not critical, entails additional cost burdens. Moreover, in spite of the slow formation of a premium market on some products, the bulk of the steel that is now being shipped, billed, and paid for was sold at prices that did not ease the load of financing perceptibly. The last few days, however, have witnessed a return to conditions that can not help but result in further accentuation of the tight fit of supply and demand, especially in the sheet market. Automotive purchasing agents, as in the days of the post-armistice flurry, are again waiting on sales managers and begging, hat in hand, for early shipments. The "price no object" attitude is once more to the fore.

It is just two years ago that $75 was considered a low price for open-hearth sheet bars and, while to-day's quotations are less than one-half that level, conditions bear much resemblance to those hectic days. Again we hear of negotiations by passenger motor car builders for sheet bar tonnages to be delivered to non-integrated rolling mills for conversion. Certain it is that the steel market, in so far as the automotive industry's requirements are concerned, is once more dominated by the seller.

Pig Iron.—The market which is now 20 to 25 per cent higher than it was three months ago, continues strong, the Chicago foundry market now being on a $23 base. There are still quite a number of furnaces out of blast and production could be materially increased. Some English iron has begun to come in.

Steel.—Nonintegrated sheet rollers fight shy of naming a third quarter price for full-finished automobile sheets, but in one quarter a 5 cent price has been forecasted, based on a $38 sheet bar market. As intimated several weeks ago in this report, prices for bolts and nuts have been advanced 10 per cent. Some strip steel interests now ask 3.75c. base Pittsburgh, for cold-rolled and quotations for hot-rolled range all the way from 2 to 2.50c. Pittsburgh.

Aluminum.—Some of the importers are now asking 19c for 98 to 99 per cent virgin ingots, but others continue to name 18 50c. Automotive demand is broader.

Copper.—Fractional advances have taken place in copper, copper products and brass. Good demand from the automotive industries is noted.

Calendar

SHOWS

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

May — Shanghai, Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 6-21—Scheveningen, Automobile Show.

May 24 - June 5 — Barcelona, Spain, Automobile Show under Dealers' Direction.

May 28-June 5—Prague, Motor Show. Hotel de Ville.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiserdamm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

May 30 — Indianapolis, International Sweepstakes.

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

May 19-20—St. Louis, Annual Meeting of the American Automobile Association.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee Annual International Convention of the Associated Advertising Clubs of the World.

June 19-20 — Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer Meeting of Society of Automotive Engineers. Detroit, May 19. The Pennsylvania section will hold an outing at Torresdale or a body meeting on May 25.

Highway Conference Appoints Committee

WASHINGTON, May 24—Discussion preliminary to a series of conferences between Federal, state and automotive engineering officials to-day resulted in the appointment of a standing committee to meet on call of the chairman to study the whole question of motor vehicle restrictions.

The conferees discussed the necessity of developing roads from an economic standpoint and advantageous maintenance standards of weights, sizes, loads and weight distribution, advisability of seasonal restrictions, and if advisable by whom they should be made. Overloading and overspeeding also were taken up.

In regard to highway finance, the advantages and disadvantages of the present system were discussed. Advisability of laying down a uniform program as between states and the proper distribution of the cost of highways were gone into by the conferees, but action was deferred pending further discussion.

The following were named as a standing committee to consider the problems involved at a series of conferences, the first of which will last two days and will be subject to call of the chairman:

T. H. McDonald, chief of the Bureau of Public Roads, chairman; C. H. Bennette of the Connecticut Highway Department; William O. Uhler of the Pennsylvania Highway Department; J. H. Mullen of the Minnesota Highway Department; N. J. Machall of the Maryland Highway Department; George P. Coleman of the Virginia Highway Department; W. C. Markham of the Kansas Highway Department; R. D. Chapin, W. T. White, A. J. Brosseau, George M. Graham, Alvan Macauley and Pyke Johnson.

"There is not very much that can be said of what we accomplished at to-day's meeting," Chapin said, "but the big thing is that for the first time in the history of the automotive industry representatives of that industry have met with Federal and state officials to discuss common problems, and to-day's meeting is but the first of a series of conferences out of which a great deal is expected to come."

Canada Sent 2312 Cars Overseas During April

WASHINGTON, May 24—The April exports of passenger cars from Canada totaled 2312, with a value of $1,358,222, while overseas truck shipments numbered 96, with a value of $41,663. Parts shipments were valued at $100,884.

These figures, just received from Canada, were announced to-day by the automotive division of the Bureau of Foreign and Domestic Commerce. The shipments in March were 2983 passenger cars valued at $1,731,886; 176 trucks valued at $81,982, and parts valued at $61,562.

DEDICATE BATCHELDER PARK

SUMMIT, N. J., May 22—A tract of 10,000 acres of land on top of Baltusrol Mountain has been dedicated as Batchelder Park in memory of the late Amos G. Batchelder, for many years secretary of the American Automobile Association, who was killed in an army ambulance airplane crash at Indian Head, Md., May 28, 1921. Part of the property was the home of Batchelder and is now occupied by his wife and daughter. The land was dedicated for building purposes and was named by Miss Marion Spooner, daughter of F. E. Spooner, secretary of the Old Timers' Club.

ACCESSORY MAKERS EXPAND

SPRINGFIELD, OHIO, May 23 — William F. Nutt, president of the Victor Products Co., has purchased the plant of the Excelsior Drill Co. here, owing to the increase in business. The company manufactures automobile accessories, including accelerators, glass wings, etc.

National Postpones Decision on Merger

NEW YORK, May 25—Stockholders of the National Motor Car & Vehicle Corp. of Indianapolis decided at a special meeting held at the corporate office here to refer back to the board of directors for further investigation the proposal to merge with Associated Motor Industries. Another special meeting will be called later to determine what shall be done.

The proposition submitted to the stockholders was either to accept the offer of the Associated Motor Industries for the assets of the corporation upon the basis of an exchange of securities or as an alternative the sale of all the property and assets of the corporation. It is understood that some of the creditors of the National company are opposed to the consolidation plan.

No date has been fixed for again submitting the views of the directors to the stockholders.

TO HOLD PETROLEUM MEETING

WASHINGTON, May 22—The United States Bureau of Mines announces that the interdepartmental petroleum specifications committee which prepares tentative specifications for all petroleum products, including gasoline, fuel and lubricating oil for the United States Government, will hold an open meeting in the auditorium of the Interior Building here at 9 a. m., July 3. At this meeting specifications for petroleum products will be discussed in detail and all persons interested are invited to attend and express their views on the subject.

BIG MAXWELL EARNINGS

DETROIT, May 25—William R. Wilson, president of the Maxwell Motor Corp., states that April net earnings of Maxwell consolidated, after interest and charges, is more than $500,000.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Better Cars at Lower Price—A Production Achievement

Marketing and production closely allied. Unbalanced inventories unlikely in future. Machine tool development important. Careful shop planning major factor in ability to join quality with quantity production.

By J. Edward Schipper

AUTOMOBILE prices are about on the same level as before the war, but the car of to-day is far better than the pre-war vehicle. We are getting better automobiles for less money. At the same time labor employed in the automobile industry is making more money, and the car owner is getting a better return for his investment.

The tremendous strides which have been made in production methods are chiefly responsible for this remarkable accomplishment. The improvements go from one end of the line to the other. The raw materials are better, methods of fabricating are better, inspections are closer, assembly is more carefully conducted, and yet, with all of this added value in the product, the manufacturing departments are turning over the cars to the sales departments for about the same money as in the pre-war period.

Young as the automobile industry is, it has already passed through well-defined phases. It is quite possible now to look back and see that during the years of 1900 to 1912 we were in the design and engineering phase. New things were tried out and research and development work played an important part.

Starting at somewhere around 1909 and up to 1916, we had a development phase in the shop. During this time the increased use of alloy steels and better manufacturing methods for handling them were developed, both in a small way and as a big production proposition. Then came the wonderful experience in which our automobile and parts factories participated of manufacturing war munitions on a huge scale. This involved the combination of engineering and manufacturing in a way which the industry never before attempted.

The lessons learned from 1915 through 1918 are now being incorporated into the industry. The insistence of our own and the foreign governments on the highest class of workmanship on a product which had to be produced in tremendous quantities and whose life when brought to the war front was possibly measured in an average period of only minutes, opened the eyes of our manufacturing men to a new standard in production.

At the outset, men who had been in commercial manufacturing lines all their lives threw up their hands at the specifications of the government, which required working to fractions of a thousandths of an inch in quantity production. Within a few months the limits imposed by the Government ceased to present any problems. New machining methods, new single purpose machines and new types of jigs and fixtures solved the problem.

Since the war we have entered into another period. We have been educated to quality in a way which would never have been possible without the war. Due to the stringent times after the war a burden of cost cutting was thrown on every department in the factory. The engineering department was forced to arrange its designs to accommodate the tool equipment of the factory so as to secure proper performance and keep production costs at a minimum.

Never again will the automobile factories be caught with the tremendous inventories which resulted in the sudden coming of the deflation period which started in the fall of 1920. When it is considered that March, 1920, was the biggest month in the history of the automobile business, and that December of the same year was one of the worst, some idea of the quick changes which can occur, due to a radical change in fundamental conditions, is gained. This furnished another lesson which is having its effect to-day on methods.

With this short sketch of the background behind present manufacturing improvements, we can discuss the possibilities of further progress towards still greater improvements in design and manufacture so as to take an even greater step in turning out a better vehicle for less money.

Not so long ago a design was judged by its performance. To-day a design is not good unless it has, outside of its performance, the qualifications which make it possible to produce the product at a low cost. It is customary and proper, therefore, that in these days before an automobile is put into production, after the engineering department has fully gone through its tests and become satisfied with the performance standpoint, the design should be turned over to the manufacturing expert to see that it is adaptable to high speed production methods and tools. The engineer is primarily interested in seeing that the car has good acceleration, economy, lightness, good power output for the engine size, that it performs quietly, has long life, accessibility and that the layout is so arranged that the wear is taken by parts which are easy to replace, so that the car can be kept young.

Critical Study of New Design

When the production manager gets hold of this same design he goes over it to see that the rough cuts can be slabbed out, that the parts to be milled are as near as possible all in the same plane on all four sides of the engine. He scans it critically to see that the number of operations on the new job are just as few as they can consistently be. He looks to see if it is adaptable for multiple drilling, if suitable sub-assemblies can be arranged and if the assembly work is simple, so that not too much time is consumed in putting it together. He is also anxious to use regular shop tools on assemblies and not special tools to any great extent. When a design is satisfactory from the standpoint of both the engineer and the production man, it is finally passed upon and turned over to the shop to build.

Before taking up the methods in the shop, let it be clearly pointed out that the history of the automobile business has shown that only those who are honest in their production methods have survived. In spite of a mushroom growth when big profits were made during the first few months, concerns who have not had an honest manufacturing policy have invariably failed.

In choosing his equipment, the manufacturer must bear in mind the number of machines he intends to turn out per day. He must consider whether his output is sufficiently large to put in a progressive conveyor system. He must consider also whether he should use single purpose machines which are of a stock character. As one manufacturing executive expresses it, "single purpose machines will effect wonderful economies and a few idle machine hours per day cannot be compared to the expense of numerous set-ups on some particular machine and the possibility of a large percentage of defective parts made by new set-ups. This, of course, does not refer to manufacturing done on a tremendous scale."

Choosing Machinery

The judgment required in selecting and purchasing the machinery for manufacture cannot be over-estimated, as it is this judgment which will, more than anything else, determine the success or failure of the enterprise. Tremendous strides in machine tool design have been made since armistice day. The automobile industry is responsible for not a few of these big developments, and the war has been responsible for a number of others. At the same time, the manufacturer should not let his enthusiasm over new machinery run away with his judgment to the extent that he will put his machinery either out of balance with the merchandising capacity of the plant, or that the plant itself will be out of balance, so that certain machines will run so far ahead of others in the production scheme that the machines will be standing idle for a considerable length of time.

A company has always just so much working capital to utilize. Some of this is going into machinery, some of it is going into material in process and the rest is going to carry the overhead and sales expense. A careful survey of the amount of cash available must be made before any logical manufacturing program can be laid down. It is then necessary to balance all of the factors.

It will be interesting to quote the words of the factory manager of a concern which has just recently gone into the automobile manufacturing business and is now turning out 25 per day, making its own engine and a large number of other units, and which will shortly be manufacturing about 50 per day and will gradually manufacture its entire car.

In discussing this matter, this production manager said, "Having perfected a satisfactory design of vehicle, the next step is in the selection of suitable manufacturing equipment, and it is here that many errors are made. The greatest care must be exercised in planning the manufacturing operation and equipment arrangement.

"Much has been said and done in the past in regard to feeds and speeds of tools and the steels used in cutting tools. The automotive industry owes a great debt to that great genius, Frederick K. Taylor, the inventor of high speed steel. It was he who forced a complete redesign of all metal-cutting tools that they might withstand the speed and strains that are imposed on them to-day. I do not look for any radical or great improvements to be made in our machining methods of to-day, and one would have to cut corners very closely in any well-organized plant to effect any great savings in the cost of a vehicle by altering the processes.

Small Production Savings

"I recall an experience I had recently where I was called in to make a cost analysis on a vehicle marketing at about $5,000. After going over the operations of every part and assembly very carefully, I could only guarantee a saving slightly over $14 on direct labor per vehicle, and this would have required quite an outlay of new machinery and jigs. The difficulty in this particular plant was the tremendous manufacturing, administrative and investment burdens.

"There are two very important factors which are worthy of careful consideration, and when properly dealt

with, will have a great bearing on the cost reduction of automotive manufacturing. The most important of these is the laying out of a conservative manufacturing program, intelligently based on the sales requirements. Then a careful survey must be made of the manufacturing equipment to definitely insure that the manufacturing departments can perform in accordance with this program on an economical manufacturing basis.

The Planning Department or Materials Division must plan a concrete program indicating the minimum amount of material required in process between the shipping docks and the receiving room in order to maintain the schedule. This particular division must operate intelligently and on a scientific basis, using such information as is provided them by the plant engineering department, in the way of machine loading and the man hours required in the various assembly departments, so as to direct a uniform flow of material through the plant. The gathering of this information must be based upon actual facts, and guess work must be eliminated. If such a procedure is carefully followed, and the purchasing division brings the material in in accordance with the requirements as laid down by the material division, it is possible to operate with a comparatively small inventory, which lessens the investment burden, eliminates a great amount of non-productive labor, and enables the manufacturing departments to operate on material in suitable-sized lots so that the manufacturing can be done economically.

"The mistake of carrying tremendous unbalanced inventories is often made, production being limited by the smallest amount of material on hand. The unbalanced portions throw a very heavy burden upon the manufacturing departments in many ways. I do not believe in resorting to a lot of red tape in the material or planning division, but in using a few sound and essential principles devised by a few intelligent and energetic men, and after having devised a satisfactory plan, then see that the plan is made to work.

"I believe a greater saving can be effected by intelligent planning in the materials division and by the elimination of unnecessary non-productive work which creeps into every manufacturing institution and which is due principally to unintelligent planning, than can be effected by the employment of a large crew of feed, speed and process experts. Efficiency in manufacturing must start from the top down and not from the floor sweeper up.

"We will now assume that the engineering program is satisfactory, that the plant engineering has been conducted intelligently, and that the manufacturing processes are suitable and efficient in proportion to the quantity of vehicles to be manufactured and that the sales program has been dealt with intelligently, and the materials division has laid out a suitable and efficient manufacturing program and has forwarded the necessary information to the purchasing department so that they can have ample time to shop around and purchase economically, and insure that the material will be brought into the plant in accordance with the requirements as laid down by the material division.

"The next important step is the selection and training of proper executives for the various departments. We have neglected to develop production executives along the proper lines. In the past few years the tendency has been to specialize men along certain lines of work, and the all-around mechanical executive is a rare specimen. I believe that it behooves every manufacturer of automotive equipment to put a great deal of effort in the proper training of manufacturing executives because it is upon them that the success of the manufacturing program is finally dependent.

"Quality cannot be introduced into an article unless the manufacturing executives are thoroughly trained, all-around mechanics with broad executive ability. Inspection cannot detect and correct all the errors that are introduced into an article due to the lack of knowledge of foremen or the men directly in charge of manufacturing. Quality in every article must go all the way through. Every operator must be properly instructed and patiently dealt with until he finally understands how to perform his work in a high-grade and efficient manner. When an organization of men are so trained, great savings will be effected all along the line. There will be less defective material made in the machine shop, less expense involved in the inspection of good material, and less hand-work necessary in the assembly, and also less time required in the running-in process of units that are built from correct material, and running-in processes never correct defective workmanship.

"In fact, there is no substitute for quality, and I believe any manufacturing institution which is run along the lines I have outlined above will show a lesser monthly or yearly productive cost than if that institution is operating under haphazard methods with resultant defective or questionable workmanship.

"The productive cost of any article cannot be measured wholly by the cost required to place that article in the shipping department, but should also be measured by the amount of service and the expenditure required to advertise and keep the article sold, and in the end the institution which does not manufacture an article worth every dollar of the selling price cannot be successful financially or otherwise."

This is a very accurate summary of what confronts the factory executive when he determines upon a production schedule, and when he sets about lining up his factory to produce according to that schedule, and also to line up his merchandising department so that his selling plans coordinate themselves to his production, not only in regard to the number of distributors he takes on, but as to their geographic situation so that he will be strategically located in his sales strength in such a way as to make expansion possible with the least degree of trouble.

(*Continued on page* 1157)

THE motor car is the only complicated mechanical device that has ever been marketed in quantity for the use of unskilled operators. Its production involves problems of design and manufacture unique in industrial history. There are more machine tool operations on a four-cylinder passenger car motor than on a steam locomotive.

Production of this kind involves numerous difficulties. Constant study has been essential to progress. Further developments are in store.

Present car prices are about equal to pre-war prices. But the vehicle is far superior to the pre-war product. That is an achievement of which the industry may be proud.

This article tells something of how these results have been achieved, but is chiefly concerned with an analysis of what we may expect in the future as a result of production studies now under way. Mr. Schipper has studied the field carefully and treats the subject from a broad administrative angle.

Railcars Are Needed—But What Type?

Close co-operation between automotive and railway engineers is necessary to produce right type of car. Railway men are not yet sure what size or type of vehicle will best suit their needs. Quantity production unlikely in the near future. Large six-cylinder engines a probable development.

By Herbert Chase

THE railways need railcar equipment but are themselves uncertain as to the size and type which will best meet their needs under various conditions of service. Dependability is a factor of first importance and some installations of railcars have already shown greater freedom from trouble than steam equipment. Nevertheless much development work will be required before the railcar is satisfactory from all standpoints. The railways are disposed to co-operate and are removing some obstacles which have hitherto precluded rapid or wholly satisfactory development. They are looking to the automotive industry for aid in solving some of their problems which steam equipment has failed to meet.

These and many other factors of importance to the automotive industry were brought out at a meeting of the Metropolitan Section of the Society of Automotive Engineers held in New York on May 25. The speakers were chiefly railway men practically all of whom appeared to be convinced of the possibilities of successful railcar construction and operation once the right type of equipment has been found. It was made clear that the wide variation in conditions met in service will make it difficult to standardize either on type or size of equipment needed so that quantity production probably lies some distance in the future. On the other hand, it was shown that many installations have already established enviable records which have never been equalled by steam-driven equipment. It was made clear, however, that present railcars leave much to be desired in certain directions, especially in the matter of comfort to the passengers. Experienced railway men are inclined to the belief that the light railcar can never be made so comfortable as the heavy railcoach, but there are certain compensating advantages especially in the matter of lower operating costs and the consequent possibility of giving more frequent service which tend to offset the drawbacks.

Railway Men Skeptical

R. H. Wright, editor of *Railway Age*, called attention to the fact that there have heretofore been several cycles of development in the railcar field which started with considerable enthusiasm and good prospects but usually ended in unsatisfactory service due in large part to lack of reliability and high operating costs. For this reason railway men are apt to be skeptical about present developments, although they realize that there are possibilities of material reductions in expense as compared to steam equipment which can seldom be operated profitably on short branch lines when the traffic is light. It is coming to be realized, however, that the rapid development of the motor truck and the greater experience in relation to factors which make for dependability and lower operating and maintenance costs tend to overcome certain disadvantages heretofore encountered.

Motor truck manufacturers are inclined to favor light-weight construction, Wright said. Such construction is necessary because of the relatively small power which is developed by existing types of truck engines. For production reasons they are also inclined to favor the use of standard parts which may not in all cases be suitable for rail service. It is his belief that it will be necessary to develop special engines of larger size and greater flexibility. There is some doubt as to whether the conventional mechanical type of transmission will be suitable. Hydraulic and electric transmissions must be considered as possible substitutes.

Wind Resistance Must Be Considered

The question of wind resistance must also be given careful consideration, as this is one of the important factors affecting speed. Safety considerations and government requirements in this connection are now controlling factors in certain directions. It is probable that in some cases a car which can be controlled from either end will be required and it will be necessary to sell the public upon the advantages of the railcar before they can be utilized extensively.

L. G. Plant, associate editor of the *Railway Review*, submitted a paper which was read in his absence. This drew attention to the fact that high maintenance costs had resulted in many failures in connection with the earlier applications of railcars. Plant is of the opinion that the present type of light car using alloy steels is a big advance due in part to the development of more flexible and higher speed engines. He drew attention to the development of light cars for electric railway service some of which weigh only 11,000 lb. complete but are capable of seating forty-two people. Cars of this type he believes present possibilities for railway use when fitted with suitable internal-combustion engines. He is of the opinion that cars with a capacity as high as eighty passengers can compete successfully with steam trains having the same passenger capacity.

Plant indicated that some competition may be expected from equipment of the unit steam car type, especially in view of the fact that such cars are readily equipped with an engine of 300 hp. as compared with a maximum of about 60 hp. now available from truck engines. It is his opinion that the possibility of using cars with two truck-type engines should be investigated, since they can probably make possible greater reliability and economy, although they present certain problems in transmission design which are not to be easy of solution. The problem of preventing excessive vibration must be given careful consideration as must also the type of railway truck employed. The present type of truck used in railway work has certain practical advantages which should not be overlooked in the development of railcars.

W. L. Bean, mechanical assistant to the president of the



Examples of railcars produced by various American manufacturers. 1—F. W. D. used in street railway service. All four wheels are drivers. 2—Edwards railcar and trailer. All four wheels of rear truck on leading car are driven by chain from a jackshaft. 3—Service railcar. All four wheels of leading truck are positively driven by bevel gears. 4—White. 5—Duplex. 6—Service railcars are based largely on truck chassis of the same make and have two driving wheels with live axles, and a four-wheel leading truck of more or less conventional railway type

New York, New Haven & Hartford Railroad, frankly admitted that he is an enthusiastic believer in the railcar, several of which have been developed and are used under his supervision. He recognizes, however, that only a beginning has been made and that there is yet abundant room for improvement. He expressed the belief that the cycle of railcar development now in progress is more apt to succeed than earlier efforts along similar lines, because of the greater experience gained in recent years through the development of the motor truck. But it will be necessary, he said, to get away from highway vehicle construction in some cases. The relatively short and light railcars now employed are admittedly not so comfortable as the heavier railway coaches, which, because of their great weight, deflect the roadbed and are therefore less subject to the effect of irregularities than is lighter equipment. For this reason railcars should not be made too light, though of course their weight must be kept within limits which can be handled by engines of the power available. While not dissatisfied with the present Mack railcars now in use on the New Haven road, he believes that more satisfactory cars can be developed possibly through the construction of six-cylindered engines which will transmit less vibration to the body of the car.

Bean stated that it would also be desirable to develop transmissions which are more suitable especially when the engine is running at light loads with the car "drifting" on down grade. Under present conditions the engine must usually run at high speed when the car is coasting, with the result that vibration is excessive and fuel is consumed unnecessarily. Experiments with variations in gearing are now being made. Radiating surfaces must be made adequate for continuous operation at full power. The subject of car heating also requires study, and steps to keep gas fumes out of the body must be taken. He believes that the automotive industry is the logical one to develop the railcar in co-operation with the railroads.

Referring to railcar equipment now in use on the New Haven road, Bean stated that one such car had been run 15,000 miles without losing a single trip because of any failure of automotive features in the car. No repairs of importance have been required during this time, and the car had thus established a record which, he said, could not be equalled by any steam equipment. One railcar on a New Haven branch line makes a 146-mile run every day, 6 days a week. These cars are now operated on an income which varies from 25 to 85 cents per train-mile. The cars weigh 15 tons and are fitted with shock insulator and a two-wheel driving axle which, he said, had proved quite satisfactory.

Two-end Operation Would Save Time

Bean stated that cars equipped for operation from either end would be of considerable advantage in certain cases on the New Haven roads, because of the saving in time which such construction would effect in some terminals.

For the purpose of comparison and discussion C. B. Veal, a consulting engineer who is also one of the officers of the Section, gave a brief description of some existing types of railcars used in this country and in Europe. These included the Edwards, Bowen, White, Indiana, Service and a car built by the Swedish General Electric Co. and equipped with a Diesel engine and electric transmission.

R. B. Abbott, chairman of a committee which is making a study of railcars on behalf of the Philadelphia & Reading Railroad, stated that this committee has not yet reached a decision as to the type most suitable for use on their branch lines, but have about concluded that it will be necessary to use a car capable of handling one or possibly two trailers in order to take care of wide fluctuations in traffic. He stated that the railcar finally selected must be comfortable, not noisy or ill-smelling, and should be capable of control from either end.

The Pennsylvania Railroad is studying the possibilities of railcars, but no such cars are now in operation by the Pennsylvania system, according to Mr. Burrell. One such car, however, operated by another company on a branch line, has been under close scrutiny.

A. J. Scaife stated that the White Co., with which he is connected, has had railcars in operation for nine years, but is still desirous of learning more about the requirements of service. In some cases he believes two small cars will be much superior to one of large size when the latter must frequently run with very light loads.

A. F. Masury of Mack Trucks, Inc., spoke especially of the unusual co-operation they have had in connection with their work for the New Haven Railroad. The two organizations have, he said, interchanged much information in order to secure a better knowledge of the respective conditions to be met by the two organizations in developing the railcars now in use.

Light Railcars Feasible

L. G. Nilson, who several years ago was engaged in the development of the Strang railcar, stated that he is pleased to see the present evidences of willingness to accept lighter cars than were formerly demanded. Heretofore compliance with Master Car Builders' standards, which provide for very heavy equipment, have stood in the way of light construction and thereby made it impossible to use existing automotive engines for propulsion. Nilson suggested a possible reversion to the McKean car type in which the powerplant is mounted on the truck and independent of the frame of the car body. In this case he stated it would be readily possible to make arrangements whereby the body could be easily uncoupled from the driving truck and another driving truck substituted so that little delay would result when extensive repairs are required. He recommended the use of spur as opposed to bevel driving gears, stating that the latter, when made in large sizes, are less durable than the spur type.

In concluding the discussion, H. G. Chatain, who has had long experience in building gas-electric cars for the General Electric Co., stated that there are nearly 100 of these cars in operation to-day, and that one of them has recently completed 1,000,000 miles in actual service while several have seen service of over 600,000 miles. He stated that he much prefers the gas-electric type of drive to the wholly mechanical type owing to the greater flexibility of the former and the fact that it permits a more nearly constant loading of the engine which can be readily operated below normal speed even though the car may be "drifting" at high speed.

Many of the General Electric cars have been fitted with eight-cylinder engines, but Chatain stated that he regards the six-cylinder type or some multiple of six more suitable on account of a less tendency to vibration. He said that best success has been attained with the engine mounted on a combination of felt and springs intended to relieve the body of the car from engine vibration. It has also been found desirable to arrange the exhaust pipe in such a way as to discharge exhaust gases well above the top of the car, since in other locations the exhaust is apt to enter any window which may be open. Chatain stated that it has been found that the operating costs of a car with a mechanical drive is sometimes less per mile than is that of a gas-electric, but that the greater expense in the repair of the mechanical type more than offsets any decrease in operating expense.

European Makers Adopt Quarter Elliptic Springs for Light Cars

This mode of suspension is increasing in popularity on light and medium weight European cars. Modifications in original application have been found necessary in practice. Standard and Wolseley offer good examples of a "safety leaf." Carrow shows use of a radius rod in construction.

By M. W. Bourdon

THE quarter elliptic type of spring, which at one time was considered to be suitable only for cycle cars, has since the war found an increasing measure of popularity on European—but particularly British—cars of all sizes from the cycle car to the eight-cylinder seven-passenger chassis. Its use has presented new problems for solution, not the least important of these arising from the localized stresses imposed upon the side members of the frame due to each unit of the suspension having but one point or area of attachment to the chassis. This factor has been overlooked or ill-considered in a few instances, and frame distortion under load and shock has then been followed by fractures.

No matter what type of spring is used it is preferable that the anchorages on the frame be immediately under the latter, as this avoids torsional stressing of the members, and this desirability is obviously more pronounced when quarter elliptics are adopted. This, however, necessitates a wider frame than usual, unless the spring supports on the axle are located comparatively near the center line of the chassis, which is undeniably bad practice, owing to the resulting overhang of axle ends and wheel bearings. The usual tendency, therefore, is to make use of projecting brackets for the butt ends of rear quarter elliptic springs and to provide a deep cross member of the frame in transverse alignment with the brackets, besides making the side members of deeper section thereabouts.

Citroen Spring Suspension

Variations from the tendencies mentioned are, however, not infrequent, and two of the accompanying sketches (Figs. 1 and 2) show examples of divergences. The first of these depicts the Citroen scheme, which is applied to a frame tapering outward from front to rear. The back springs continue this taper and are therefore not parallel with one another. The top flange of the frame side is extended to form a tongue, which is shaped so as partially to encircle the butt of the spring some 8 in. from its ends; two bolts and clamping plates hold it in position here, the holes in the frame for the top plate being large enough to allow the spring to be securely clamped. Through the extreme end of the butt is a bolt passing also through the frame flanges with a suitable distance washer above the uppermost leaf.

In the A. C. six (Fig. 2) the spring butt is located in the frame channel, but the channel faces outward and the lower flange is cut away in front of the spring pad on the axle and is omitted from the upturned rear horn of the frame side. To overcome the weakness which such an arrangement would entail with a spring having a square butt end, the leaves are continued progressively, as indicated in the sketch, so that the lowest one extends forward 5 in. or so on the bottom flange. U-bolts alone thus suffice to clamp the leaves to the cut-away portion of the channel. The frame in this case again has a continuous taper from front to back, the rear springs similarly departing from the longitudinal center line of the chassis.

Divergent Practice on Standard

In the Standard chassis the frame is of exceptional width at the rear with parallel sides behind the offset of the members in line with the dashboard; the quarter elliptic spring is, therefore, located under the frame members, being secured by a bolt passing through the butt end and the bottom flange of the channel. (Fig. 3.) There is also a pair of clamping plates and bolts, but only one of these—the outer and longer of the two—serves to locate the spring by passing through a small bracket attached to the outside of the frame web. This method of securing the butt end may not be ideal in failing to clamp the whole of the channel to the spring; but it has the merit of providing an unbroken surface on the top of the channel for mounting the body frame. The rear ends of the springs slide on brackets depending from the axle casing, and a torque tube encloses the propeller shaft.

Three out of four Wolseley models now have quarter elliptic springs back and front, but divergence in practice is evident in their mountings. On the 15 hp. the butt ends are attached to frame brackets on the outside; but on the smallest model they are under the channel, secured to the latter on each side by a long bolt adjacent to the front end and passing through both top and bottom flanges of the frame, and by a U-bolt also taking in the top flange. (See Fig. 4.) In this case a single stout blade runs from the top of the channel to a bracket above the axle casing, so that, with the main spring having an anchorage for its rear end under the axle, a parallel motion arrangement is provided to take torque and drive. Also in the G.N.—a very popular light car—a spring blade is used to provide a parallel motion arrangement for the front axle, as shown in Fig. 5.

One or two other makers provide a radius rod. On the Carrow light car (Fig. 6) the spring slides in a "box" attached to the axle, the box having a rearward extension to form a lug for the tubular radius member; the latter is supported at the other end by a bracket depending from the butt end of the spring, the trunnion bearing being of the self-aligning ball type. Another instance of the use of a radius rod is seen in Fig. 7, a parallel motion effect being secured.

There is also a problem involved in the fastening of

the thin ends of quarter elliptic springs, for which various solutions are in evidence. It is not usually considered safe to depend only upon a single master leaf for attachment, for a fracture would lead to a serious smash by the displacement of the axle. But the inter-movement of two full length leaves due to their being flexed prevents both of them being rigidly secured to their point of attachment or support. A "safety leaf" in one form or another is therefore provided as a rule, and Fig. 8 (Standard) affords an example. As will be seen, a short leaf and the extreme end of the master leaf are bolted to a plate resting on the channel axle, the other end of the short member being curved around the bolt of a spring clip of the usual kind attached to the third main leaf; a U-bolt locates and secures the axle plate and the full-length, safety and second leaves on the axle.

This scheme is obviously open to criticism, for the reason that if the U-bolt is sufficiently tightened to hold the front end of the spring firmly to the axle, relative movement between the first and second leaves is prevented. In practice, it would seem, the tip of the second leaf is sure to become loose enough under the U-bolt for inter-movement to occur, and when that happens the whole assembly will have a precarious anchorage on the axle; obviously it would be better if the plate were integral with the axle and the U-bolt clamped down only the first and safety leaves.

Modifications on Wolseley

The 7-hp. Wolseley (Fig. 9) has the modification last mentioned, the spring plate or pad being integral with the axle. In this case, however, the second main leaf does not reach as far forward as the coiled end of the safety leaf, whereas the writer's suggestion is that the point of the former should overlap the latter but not run under the U-bolt. In the 15-hp. Wolseley (Fig. 10) five of the main leaves run forward beyond the coil of the safety unit; the full-length leaf is coiled at the end and located by a transverse bolt passing through the sides of a separate plate, the latter being located on the axle by a U-bolt passing through wings of the plate and through the axle pad; the safety leaf is held in position only by being clamped by the U-bolt. This plan obviates the need for a bolt hole through the end of the master leaf, but this is hardly, it would seem, a feature justifying the additional cost of the scheme.

An arrangement which has nothing to warrant its adoption unless it be the designer's preference for a tubular front axle, is that illustrated in Fig. 11. Here two horns fixed to the axle take the spring pin and a fixed bracket extending rearwardly some 6 in. prevents the axle from rotating by being attached to the spring by means of a clamping plate and two bolts. But, as three of the spring leaves are clamped together, intermovement is checked and the spring acts, in effect, as one 6 in. shorter than the master leaf and as though the latter were in thickness equal to the three leaves.

Examples of Common Practice

The most widely used system is shown variously applied in Figs. 12 and 13. It consists of two approximately full-length leaves, of which only one is fixed to the axle, the other being allowed to move relatively by reason of the clamping plate taking effect upon the lower one alone. But it is not sufficient to prevent that corner of the frame from dropping if a master leaf should fracture; the safety leaf or its alternative must also keep the axle in approximately normal alignment. So in the Talbot design (Fig. 12) and in other examples not illustrated, the second leaf is slotted at each side where the clamping plate occurs and the amount of relative movement possible between this leaf and the axle is just sufficient to permit the two leaves to be flexed without restraint. In the example just referred to the isolated bolt passes directly through the end of the master leaf and the axle pad, the clamping plate being a supplementary means of securing the spring. But in the A.C. Six (Fig. 13), the clamping plate is held down on to the master leaf by all three bolts; the front one also passes through the slotted end of the second leaf, which, again, is permitted free relative movement due to flexion and yet is prevented from escaping if the master leaf should break.

Advantages of Quarter Elliptic Spring

Figs. 12 and 13, as well as others, show methods of attaching the butt ends to the frame and incidentally bring to notice an advantage of quarter elliptic springs as compared with most other types. That is to say, the inherent weakness in a half-elliptic, for instance, due to the presence of an assembly bolt at the center of the spring length, is eliminated. The majority of quarter elliptics have a combined assembly and anchorage bolt at the extreme end of the butt, where there is no risk of load and flexion causing stresses that might result in a fracture. The examples in Figs. 12 and 13 have this feature, though in other respects there is marked divergence in the mounting to the frame; in the former a bracket intervenes between spring and frame, the springs being parallel with one another, whereas in Fig. 13 the springs are splayed to make their mountings on the axle wider apart and an angle steel plate forms the bracket on the outward-facing channel of the frame.

The A. B. C. front anchorage (Fig. 14) embodies two full-length leaves, as well as a safety leaf. The clamping plate scheme previously mentioned appears to be preferable to the use of a pair of stepped bolts for fastening to the axle as shown, for two reasons: It affords a bigger area of spring surface gripped and does not call for the second series of holes in the leaves at a point where fractures would take place—there is, in other words, a weakening of the leaves in Fig. 14 just where they should be strongest, which probably accounts for the use of the additional leaf referred to.

The Singer Six

An altogether different arrangement is that shown in Fig. 15 (the Singer Six). Here there are again two full length leaves, but both are secured rigidly to the axle by a single bolt and clamping plate. The second leaf is, however, allowed relative movement by being narrowed at the butt end of the spring, the clamping bolts and plate at this end being prevented from clamping the tongue of this leaf by the presence of a distance plate at each side between the master and third leaves, these plates being slightly thicker than the second leaf. The only advantage attaching to this arrangement is that the whole width of both the full-length leaves is available to resist fracture adjacent to the clamping plate on the axle, whereas in the alternative scheme exemplified in Figs. 12 and 13, there is a narrowing of the upper of these two leaves at what is certainly a vital point in its length. While this narrowing may not be objected to when both leaves are intact it might well mean that if the master leaf fractured the other would follow suit immediately through being unable to carry the load unassisted even long enough to enable the driver to realize that the car at that corner was sagging and that something was amiss. The butt end of the spring is, admittedly, slightly weakened in the arrangement in Fig. 15, but only to an extent which should justify the loss being ignored.

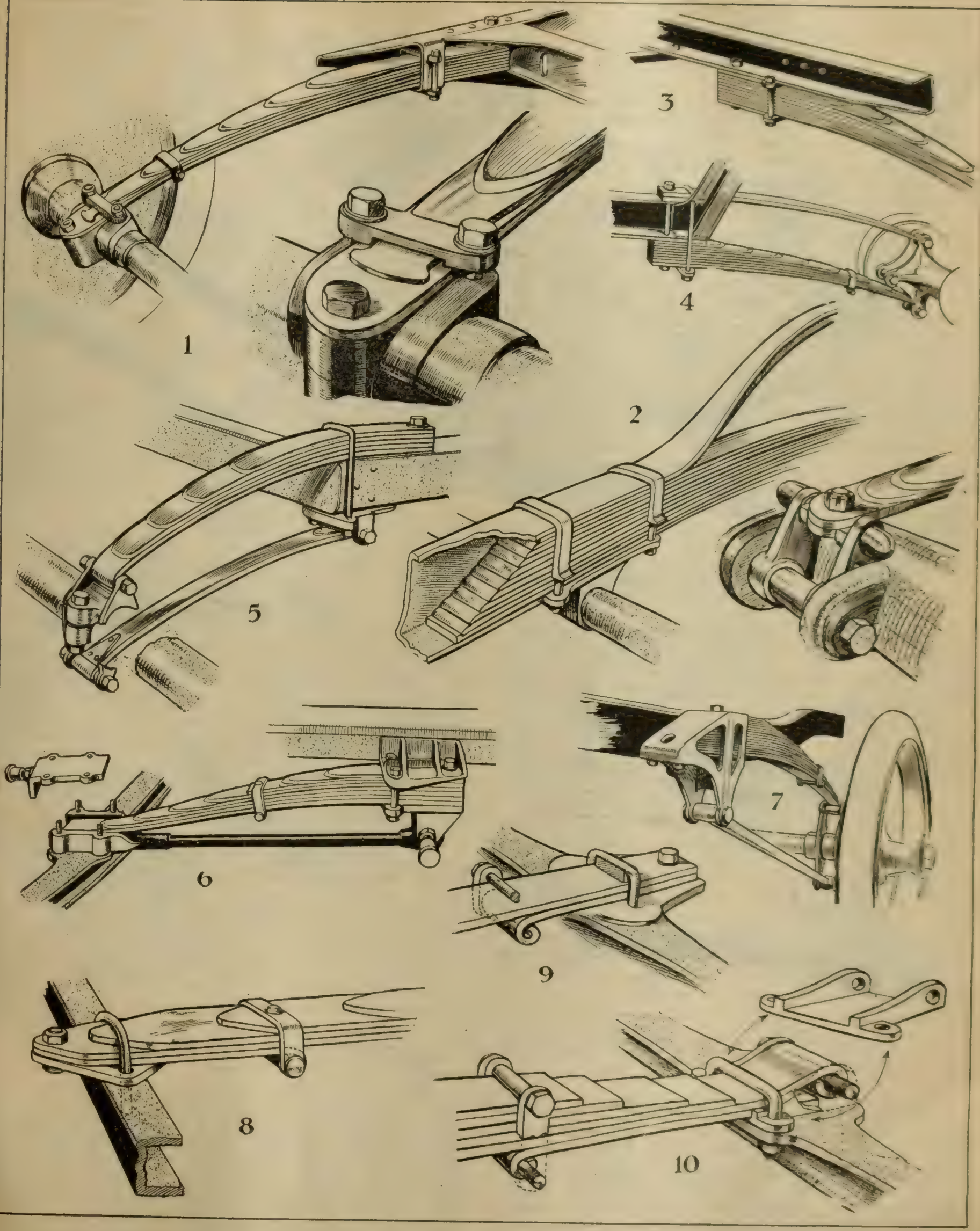


Fig. 1—Citroen scheme (rear) applied to tapering frame. Fig. 2—A. C. Six (rear) spring butt located in frame channel. Fig. 3—Standard method places rear spring under frame members. Fig. 4—Single blade from top of frame to bracket on rear of 7-hp. Wolseley. Fig. 5—G. N. spring blade used to provide parallel motion arrangement for front axle. Fig. 6—Front radius rod used on Carrow. Fig. 7—Turner use of radius rod (rear). Fig. 8—Standard (front) "safety leaf." Fig. 9—Seven-hp. Wolseley (front) spring plate integral with axle. Fig. 10—Fifteen-hp. Wolseley (front) longest leaf coiled

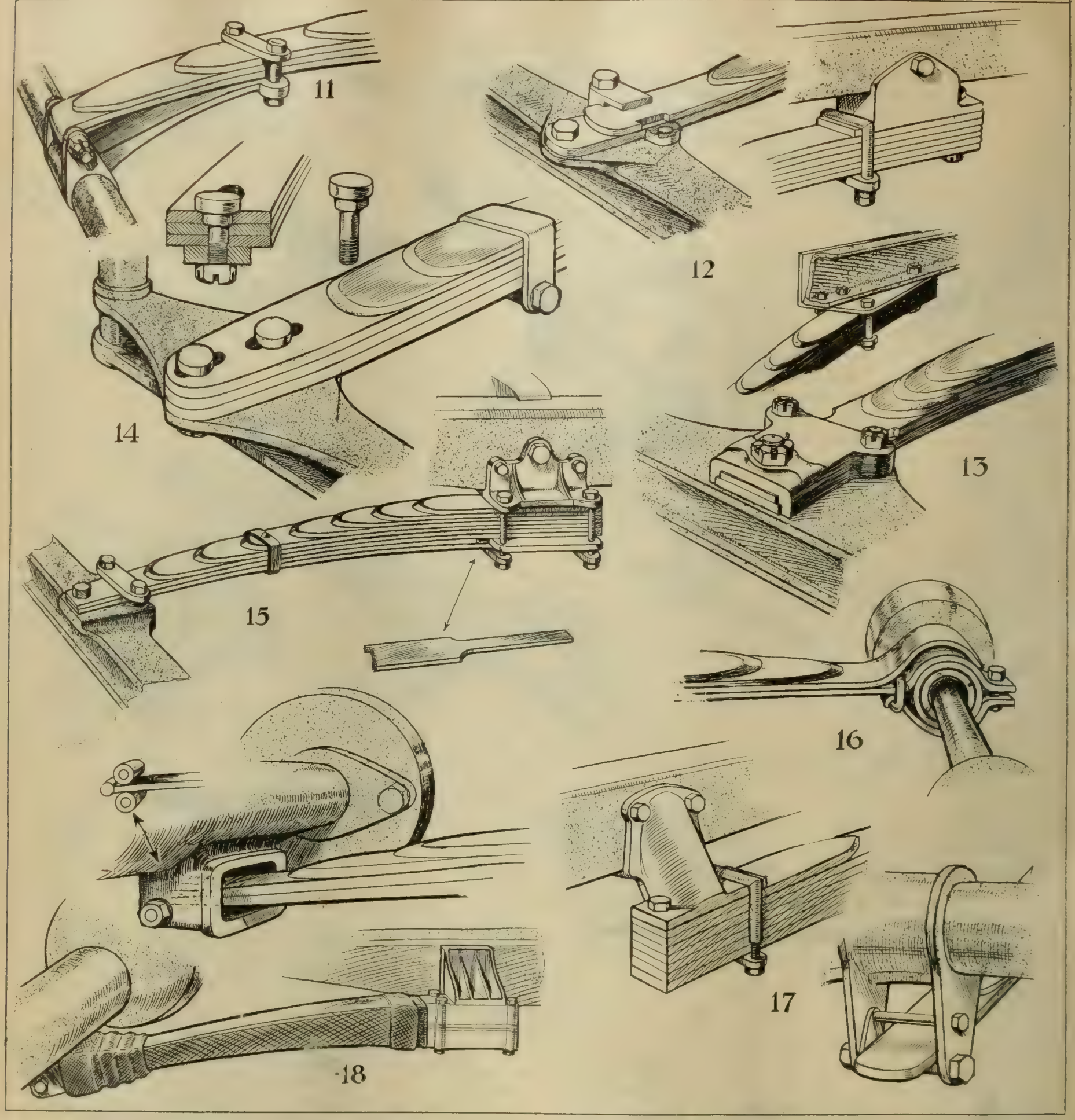


Fig. 11—Front spring attached to tubular axle on Rhode. Fig. 12—Talbot (front) shows common practice. Fig. 13—A. C. Six front spring. Fig. 14—A. B. C. front anchorage uses two full length leaves as well as safety leaf. Fig. 15—Single Six front, two full length leaves secured rigidly. Fig. 16—M. A. S. E. rear spring. Fig. 17—Front and rear ends of Talbot rear spring. Fig. 18—Rear spring mountings of the Gallowav

A method of anchoring rear springs to the axle casing which has little to commend it, but is, nevertheless, of slight interest as showing how widely divergent assemblies at this point may be, is seen in Fig. 16. It need only be said that the master leaf is curved at its rear end, a stirrup is threaded over it and to this is hooked a clamping plate securing the spring end to a ball bearing on the axle casing; the second leaf is extended and its end curved to approximately the same radius as the master leaf.

The front and rear ends of the Talbot back spring are shown in Fig. 17; while there is nothing unorthodox about the anchorage of the butt, there is a detail connected with the axle bracket which is worthy of note. Located by the bolt upon which the master leaf rests, and also by another transverse bolt, are two triangular plates inside the horns of the bracket; these are of hardened steel, are readily renewable and serve to prevent the sides of the leaf from wearing the inside surfaces of the bracket horns, the latter being parts which obviously cannot be replaced without a lot of difficulty and expense. This is a feature that might well be applied to cantilever springs mounted in similar fashion.

The final illustration (Fig. 18) shows the mountings

of the rear springs of the Galloway, a light car made by the Beardmore interests. As shown in the lower view, the whole spring is completely enclosed in a well-fitted grease-retaining "gaiter" which extends over flanges on the frame bracket and a socket integral with the axle casing. Within the axle socket the end of the master leaf lies between two rollers, resting upon one which is threaded over the transverse bolt, of which the nut is in view; the tip of this leaf has a boss formed on it to prevent the spring end from becoming displaced if the spring should open out beyond the normal—for example, when the frame as distinct from the axle is jacked up. The spring can be withdrawn at this end only by first removing the lower bolt and roller.

In conclusion it may be said that the rapidly increasing popularity of the quarter elliptic spring is fully justified in practice. It gives results in passenger comfort fully in keeping with those of the cantilever, and compares favorably with any other type as regards cost; it has the same merit of reducing unsprung weight as the cantilever and its total weight is little if any more than half that of the latter.* It can be used with either Hotchkiss drive or a torque tube, and in its simplest rendering with the former all need for grease cups or oilers is eliminated. Shackles are not required in any case and there is no trunnion bearing to consider. It appeals to British users by reason of its ease of maintenance coupled with the degree of passenger comfort it affords. For light and medium-sized cars it has proved entirely satisfactory with the modifications from its original applications which experience dictated; in fact, some of the best if not the very best sprung of British light and medium-sized cars now have quarter elliptics and their use is increasing.

Admittedly its application and design call for careful consideration. It may, like the cantilever, cause a car to be prone to roll pronouncedly on corners taken at speed; but this tendency can be and has been overcome. One seemingly inherent feature appears to make the quarter elliptic unsuitable for the front of heavy and high speed cars; that is to say, its single point of support and the lateral flexibility of the spring give the driver an impression of lack of precision in steering control. This is an impression which soon wears off when a speed of 40 m.p.h. or so is not exceeded; but there is undoubtedly some lateral movement of the front axle relative to the frame under most conditions of running and this might well prove to be disconcerting, to say the least, at really high speeds. Up to the present this type of spring has not appeared at the front of British or European cars of over 20 hp.; where it is used on larger sizes it occurs at the back only.

*This statement is open to question, as for the same deflection per 100 lbs. increase in load (which determines the riding comfort) and with the same grade of steel and the same factor of safety the same amount of steel is required in a quarter elliptic as in a cantilever spring.—EDITOR.

Better Cars at Lower Price—A Production Achievement

(*Continued from page* 1149)

The close relationship and the interlocking interests between the designing, manufacturing and merchandising ends of the business constantly become more clear. Superimposed on all of these problems we have the detail considerations of such matters as the reduction in scrap, the reduction of industrial wage, the elimination of unnecessary operations and the elimination, particularly, of hand operations by the employment of machinery.

Labor situations sometimes arise which call for delicate tact and proper handling, so that justice may be done the men in the shop, and, at the same time, the costs of manufacture may not be run up to a degree which makes the product commercially unprofitable.

There is always a possibility of effecting savings by scanning new processes as they come into being. Pieces which have been sand cast, for instance, may often be made more economically by forgings or die castings. The quantities produced will, of course, be a factor in this. Stampings of certain circular shapes may be made better in automatic screw machines, and often parts which have been cast may be more economically made from bar materials or tubings.

Careful consideration should be given the new machine tools appearing on the market, to determine whether or not existing equipment cannot well be replaced by machines capable of larger production. Operations which require one or more general purpose machines should be studied from the standpoint of special purpose tools of higher capacity.

The average mechanic working in a shop represents the interest on a $20,000 investment, which pays at the rate of 6 per cent per year. If, by investing, therefore, in five machines which can be taken care of by one operator, these machines are paying for themselves immediately, whether or not they have cut the actual producing time. In all probability, however, such machines would materially save actual production time as well as direct labor wage.

In one particular department of an automobile factory producing at the rate of 30 cars per day it was recently found possible to take 35 per cent of the men out of the department and still have a higher production and consequently increased wages for the individual workers in this department.

American Tractors Are Most Popular in Greece

THE total number of tractors in Greece is about 500, of which about half are of American make, according to a report to the Department of Commerce. There are 150 track-laying tractors and 350 wheel type. Two hundred of the latter are of American make, 70 are German, 40 English, 10 French and the balance from Sweden and other countries. Germany is also supplying 40 tractors on account of war indemnity. About 70 per cent of the track-laying tractors are of British make. The others are French, Italian, German and American. Germany is to deliver 25 of this type on account of war indemnity.

The most popular among the European makes are the German "Stock" and "W. D.," the English "Wally," "Fowler," "Aveling Porter" and the Swedish "Excelsior." All these types do not seem, however, to have quite met the requirements of this market, which needs a small tractor of about 12 hp. to be used on the many small-sized farms. The types in use are too big for pulling one plow and to small for two plows.

Do Overhead Camshafts Increase Efficiency in Engine Operation?

Part II

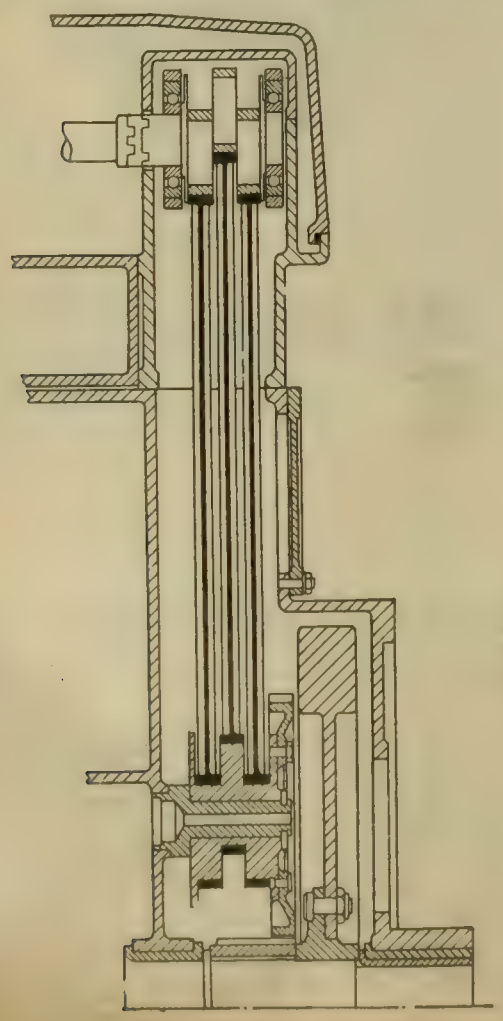
Europeans producing a number of overhead camshaft drives and overhead valve actuating mechanisms of very radical design. Leyland eight-in-line offers a good example of unconventional practice without regard to costs of production. Application of a more simple design found on the Rhode.

By P. M. Heldt

WE now come to a number of rather radical designs of overhead camshaft drive and overhead valve actuating mechanism which have become known through recent patent publications. One of the cars that has been talked of a good deal the past year and a half is the Leyland eight-in-line. On the engine of this car an eccentric mechanism is used for transmitting motion from a half-speed shaft located close to the crankshaft and driven by spur gear therefrom, to a short shaft normally in line with the camshaft. In order to obviate difficulties due to unequal expansion of the cylinder block and the eccentric rods the short shaft at the top has a support separate from the cylinder head and is connected to the camshaft by means of an Oldham coupling which compensates for any slight disalignment between the driving and driven members. The eccentrics are evidently set at angles of 120 deg. This drive ought to have something to commend it from the standpoint of continuity.

A still more radical design of valve gear has recently been patented in England by the Fiat Co. Upon the upper part of the valve stem is mounted a trunnion carrying two conical rollers. The trunnion is mounted between a shoulder on the valve stem and a coiled spring which is backed up with a nut and lock nut at the top of the stem. Surrounding the valve stem guide is a shell with opposite vertical slots through which the arms of the trunnion extend. On ball bearings upon this shell are mounted a pair of face cams upon the circumference of which are cut spur teeth. In the particular design shown there are four valves in the cylinder head and all of the cams are geared together. It is obvious that as the cams are revolved the valves are opened and closed positively, except for the slight play of the springs. A valve gearing of this type should permit of very high engine speeds, but the cost of manufacture is undoubtedly quite high.

As regards the operation of the valves from overhead camshafts, there are at present three methods in vogue. The cams may either act directly on cam followers secured



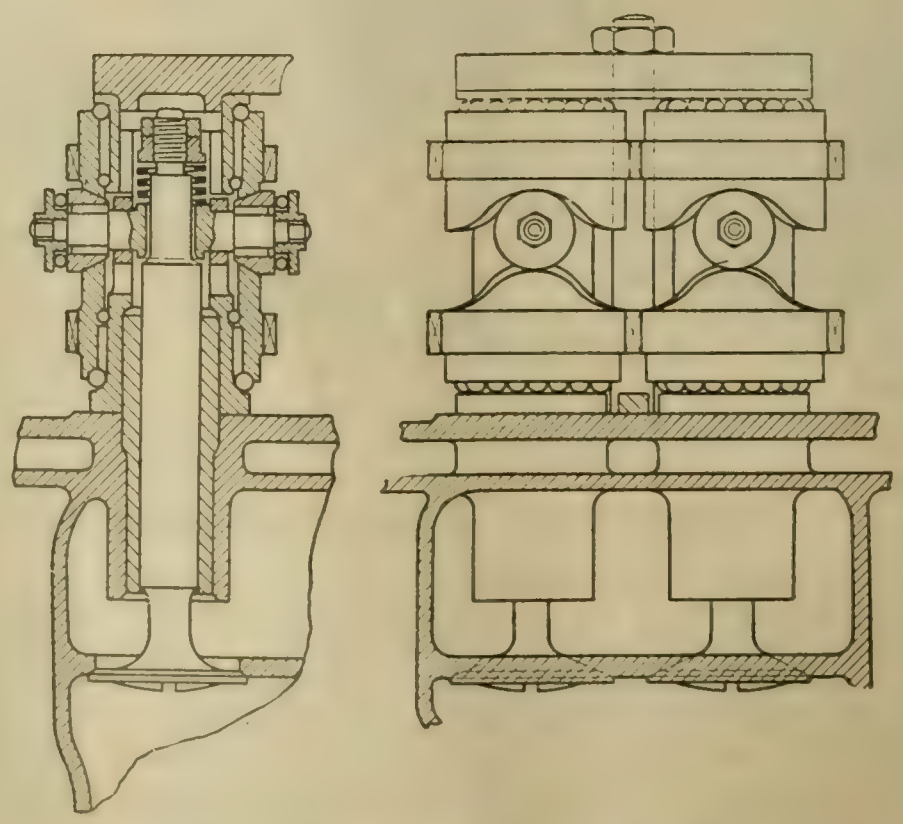


Fig. 10—(Left)—Leyland straight eight camshaft drive (sketch)

Fig. 11—(Above)—Flat camshaft

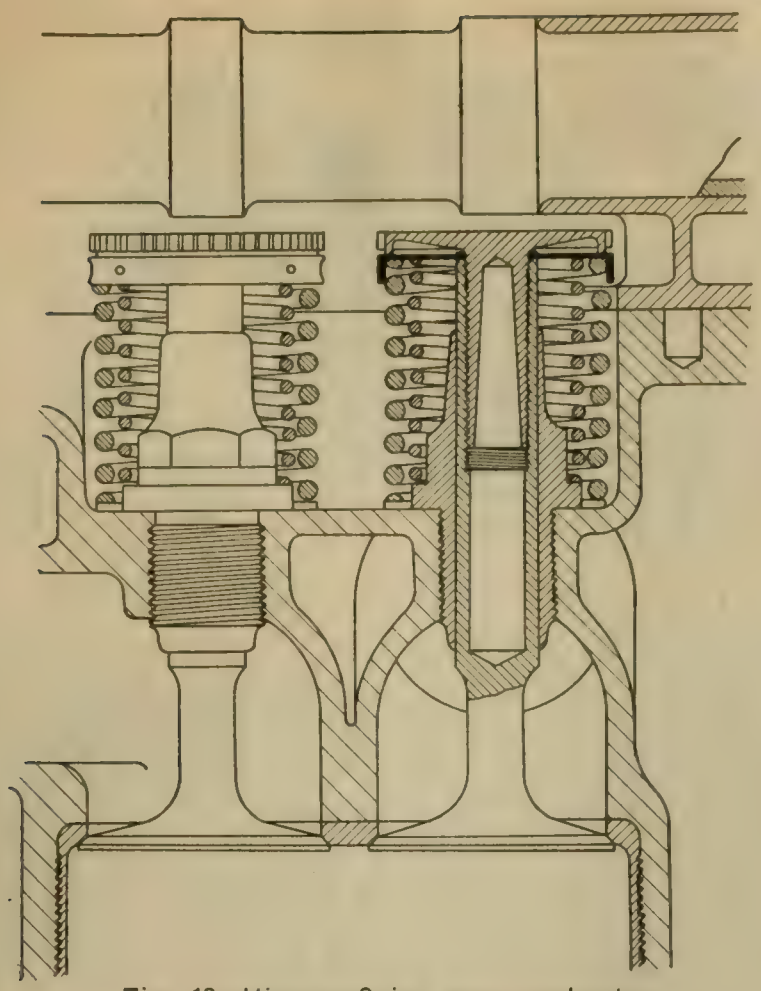


Fig. 12—Hispano-Suiza cam mechanism

to the end of the valve stem, as in the Hispano-Suiza engine; single armed levers or adjusting blades may be interposed between the cams and the valve stems, or the cams may act on the valves through the intermediary of tappet levers as in the Liberty aircraft engine.

With the first mentioned arrangement the means for adjusting the valve clearance must be provided on the valve stem itself. This problem was solved in a rather neat manner by Birkigt, the designer of the Hispano engine. He drills out the valve stem and inserts a screw with a flat head with slotted rim. Underneath the screw head is a washer which has splines or keys on its inner circumference that engage into slots in the end of the drilled valve stem, so that the washer can slide longitudinally on the valve stem a limited distance but cannot rotate with respect to it. The valve spring presses the washer strongly against the screw head, and the screw is thus locked. On the circumference of the washer there are several radial drill holes, and a pin wrench is provided which engages into the holes and slots of the washer and screw head and permits the adjusting screw to be screwed farther into or out of the valve stem.

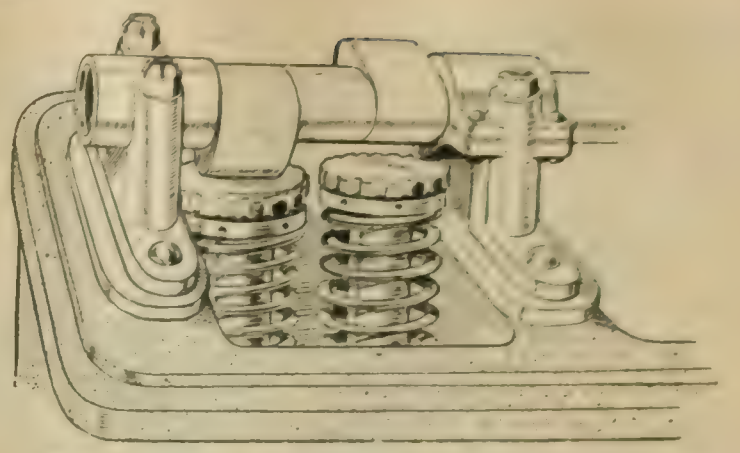


Fig. 13—Sketch of Hispano-Suiza cam mechanism

Fig. 14 shows the system applied to the British Dawson car (now defunct). As will be seen, it resembles the Hispano in being of the direct acting type and has similar means for valve clearance adjustment; despite the prevalent idea that Hispano claims a master patent on direct operation, Dawson continued to turn out engines with this type of valve system without serious interference for a couple of years. The failure of the firm was not ascribable in any way to the type of valve gear used on the engines. The scope of the Birkigt (Hispano) patent apparently includes only the particular means of adjustment, including the pin wrench.

It is, of course, quite possible to arrange overhead valve mechanisms in a way similar to the mechanism used with the ordinary L head engine. That is, between the valve and the camshaft can be placed a pushrod provided with an adjusting nut or adjusting screw and lock nut. The objection to this construction is that it gives an abnormally high engine. An overhead camshaft engine is much higher than an L engine in any case, and if a pushrod is placed between the valves and the camshaft the height of the engine is increased by the length of the pushrod. There may be instances where this is of no great consequence, as where a very small engine is placed under a normal sized hood, but in most cases it would be objectionable.

Bugatti developed an overhead valve gear which overcame this objection. He uses curved push rods (quadrant shaped) with rollers at both ends. The cams on a camshaft centrally over the engine press against one of these rollers in a horizontal direction, while the other roller presses vertically down upon the valve stem. The quadrant shaped push rods were located in guides that were bolted to the sides of the cylindrical camshaft housing with three bolts. The design here illustrated is an early one. But the curved pushrod construction has been retained by Bugatti in a modified form. In this early design

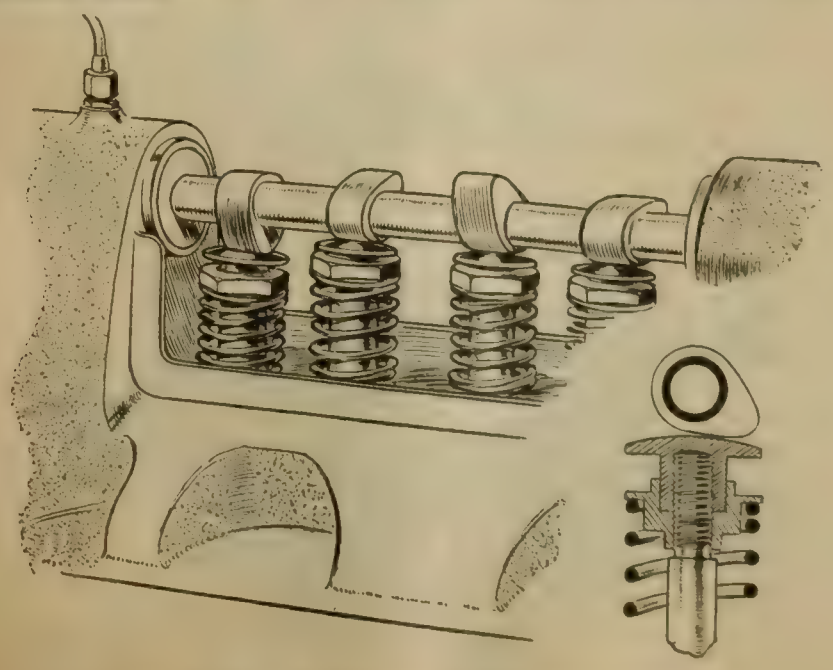


Fig. 14—Sketch of Dawson cam mechanism

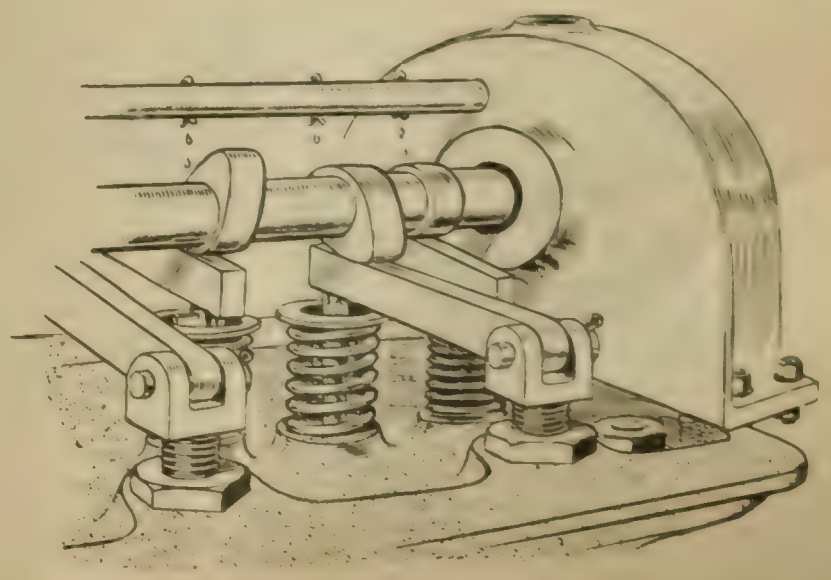


Fig. 16—Sketch of Rhode cam mechanism

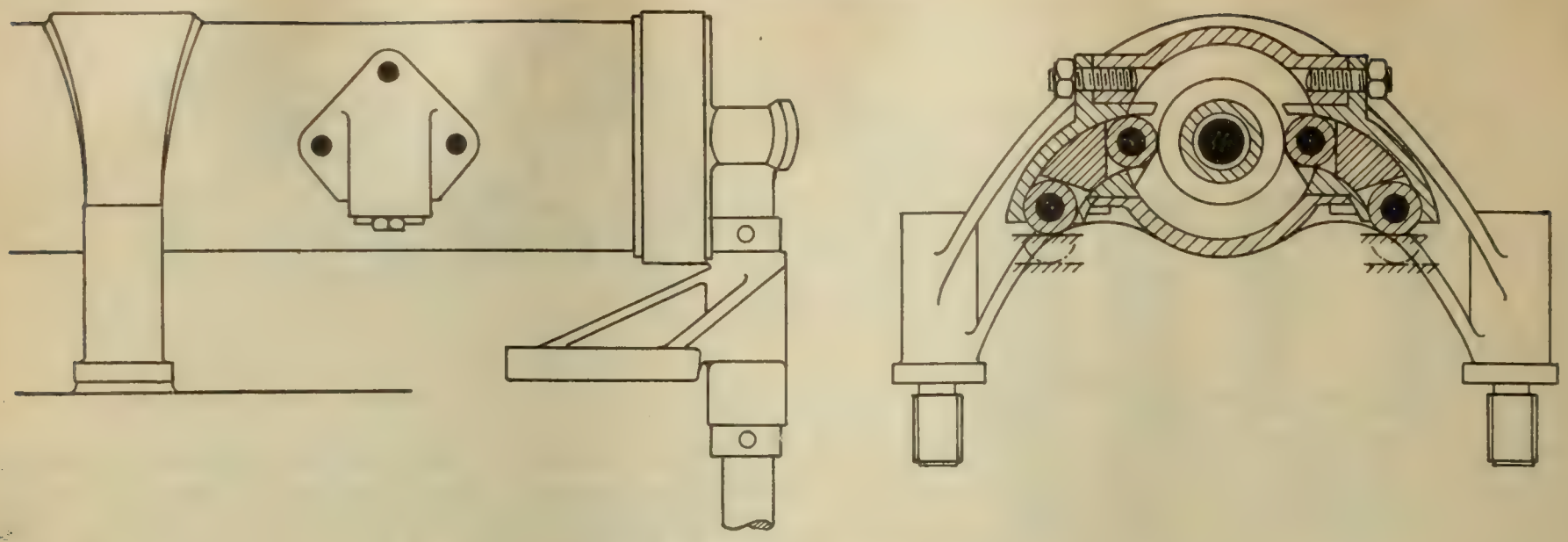


Fig. 15—Bugatti valve mechanism

the provision for the adjustment of the clearance apparently consisted in the use of shims under the pushrod guide. Very frequently in recent designs the valves in the head are placed at an angle with the cylinder axis, one valve to each side of the central vertical plane of the engine, and the camshaft is then placed centrally over the cylinder heads, which makes for symmetry. On smaller engines, however, the plan of setting the valves at an angle is not so practical, for it calls either for a wide cover or else makes it necessary to leave the valve springs unprotected and have the tappet levers extend through the walls of the cover. In aircraft engines this latter practice is widely followed, because dust and dirt are seldom a factor to be figured with in that line, and the additional noise also does not count. In passenger car engines vertical valves seem to be preferred, and in order to make it possible to operate these valves from a central camshaft single armed instead of double armed tappet levers are used. The two valves are sometimes placed on opposite sides of the longitudinal center plane of the engine and are offset in the fore and aft direction sufficiently so that the two levers do not interfere. This arrangement permits the use of comparatively long lever arms, which reduces the side pressure on the valve stems, and at the same time enclosure of the entire mechanism in a compact housing.

One of the simplest, in fact crudest, overhead camshaft applications is that of the Rhode (Fig. 16), a British light car with a four-cylinder engine of 67 cu. in. capacity and selling at a low price. Its camshaft is driven by a train of helical pinions and actuates the valves through levers of rectangular stock pivoted on adjustable standards screwed into the cylinder head and provided with a lock nut. The camshaft is offset from the valve stems, and clearance adjustment is made by varying the height of the pivot pin centers, which implies first removing the pins and then raising or lowering the standards in half turns —not a very precise means of adjustment. As the sketch indicates, this is one of the outfits in which individual oil drips are provided for the cams from an oil pipe running from one to the other of the pressure fed camshaft bearings.

A British chassis of moderate price with a four-cylinder engine of 180 cu. in. capacity having an overhead camshaft is the 18-hp. Phœnix, of which the valve operating details are shown in Fig. 17. This also has pivoted levers interposed between the valves and an offset camshaft, but the levers in this case are built up and somewhat resemble the links of a roller chain; in fact, the cam makes contact with a roller on the intermediate crosspin. Provision for clearance adjustment consists of cap nuts on the valve stems; the lubrication system includes pressure feed to the shaft bearings and separate drips onto the cams from a longitudinal pipe not shown in the sketch; the drive is by helical gears and a vertical shaft with a dog coupling having offset jaws to insure correct reengagement within limits.

The Beardmore (Fig. 18) also comes within the pivoted lever class with an offset camshaft, though in this case the levers for inlet and exhaust valves respectively are pivoted on opposite sides of the cylinder heads as shown. Lubrication details are similar to the Phœnix. Small leaf springs are fitted to prevent chattering of the levers, and pairs of the latter are separated on their pivot shaft by

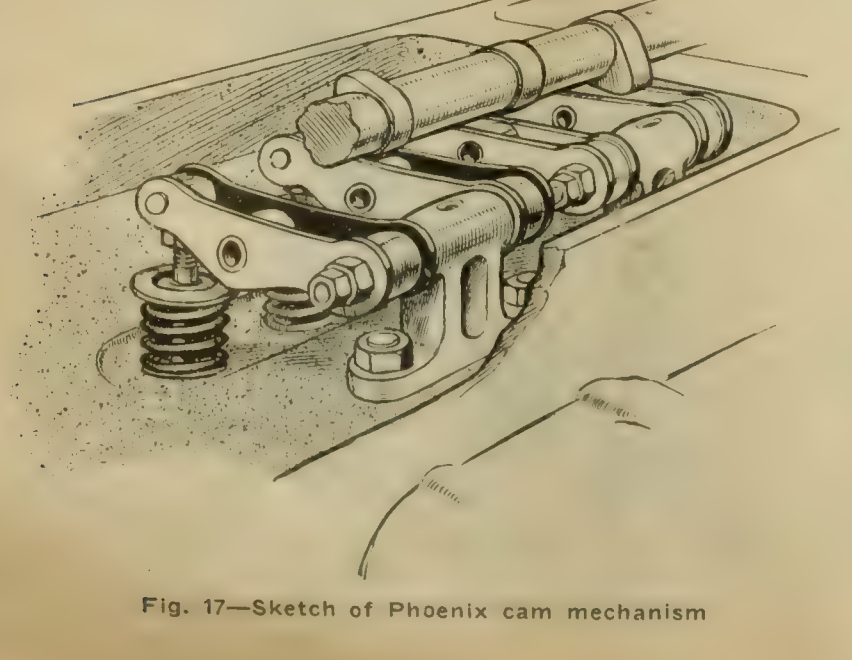


Fig. 17—Sketch of Phoenix cam mechanism

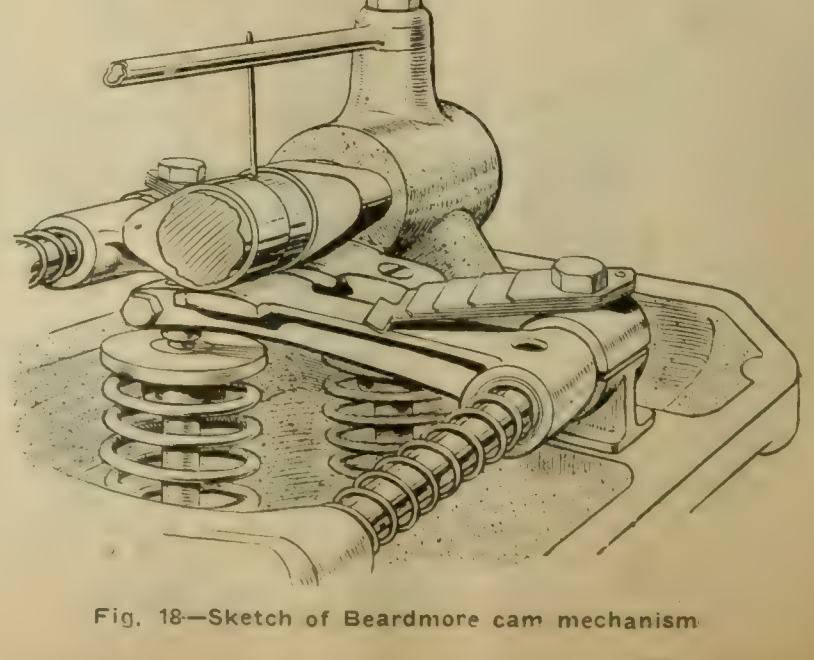


Fig. 18—Sketch of Beardmore cam mechanism

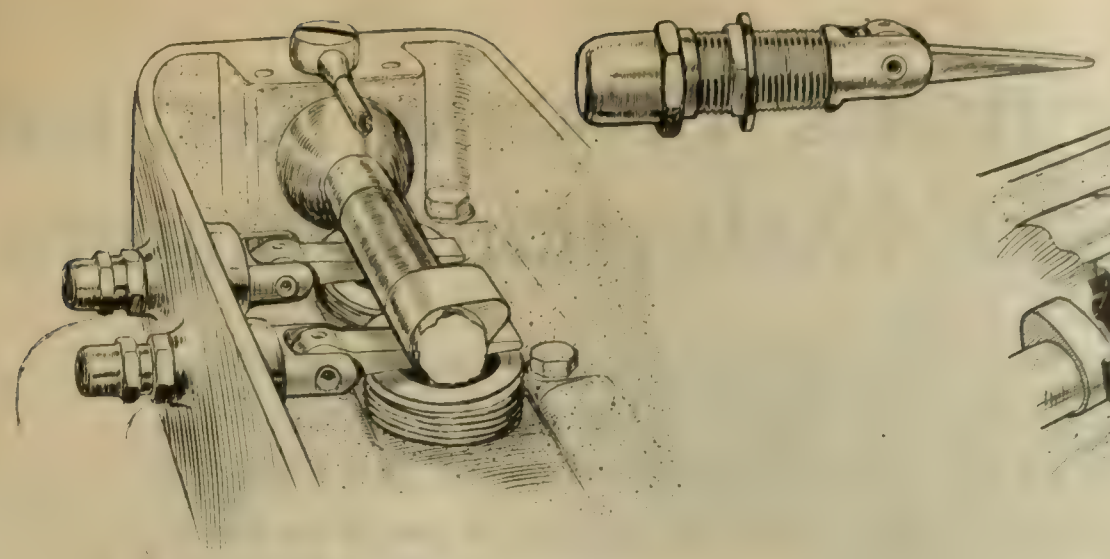


Fig. 19—Sketch of Diatto cam mechanism

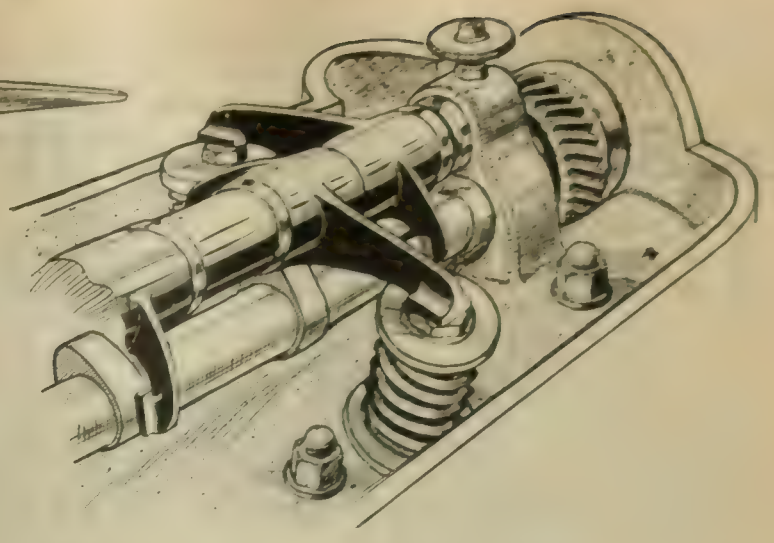


Fig. 20—Overhead camshaft Ansaldo

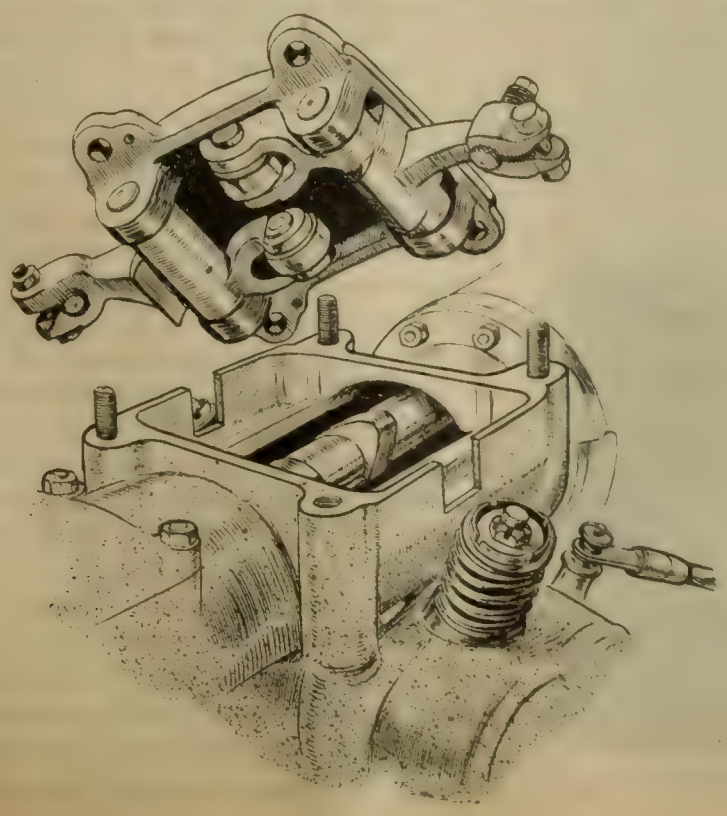
helical springs to take up end play and to allow the levers to be moved to one side to facilitate valve removal and clearance adjustment—the means to the latter end consisting of threaded studs in the lever ends making contact with the valve stems and locked by a pinch bolt.

A design of distinct interest is that of the Diatto (Fig. 19) which has pivoted and tapered tongues interposed between cams and valves, the camshaft center being immediately over the valve stem centers. Clearance adjustment is effected by moving the tongue towards or away from the camshaft center line, the horizontal supports being threaded, located in clearance holes and locked by nuts in the wall of the overhead valve chamber as shown in the sketch. Without being crude this is a simple design which should lend itself to economical production far better than a good many overhead camshaft arrangements. The angularity of the tongues must be considerable at full valve openings and be liable to result in undue side thrust on the valve stems; but there appears to be no valid reason why the tongues should not be longer and pivoted farther away from the valves to reduce angularity and side thrust. With efficient lubrication the wear of the tongues should not be excessive, and in any case the latter could be made easily and cheaply renewable.

Typical of many other overhead camshaft designs, the Ansaldo (Italian) shown in Fig. 20 is in the class embodying rocking levers with bearings on a shaft immediately above and running parallel to the camshaft from end to end, with the valves on opposite sides of the cylinder head. The valves are usually, as in the Ansaldo, outwardly inclined at a slight angle from the vertical. Although in the case illustrated the clearance adjustments are on the valve stems, set screws and pinch bolts in the outer ends of the rockers are more favored.

The Straker Squire arrangement (Fig. 21) is unusual in two respects. In the first place it is used on a six-cylinder engine with separate cylinders and in the second place the valves on opposite sides are outside the camshaft casing. The sketch is practically self-explanatory, except that it does not show that the camshaft casing is a unit casting running from end to end of the cylinders, being secured to the latter by the studs and nuts that hold in place the individual cover plates bearing the roller ended rockers. The drive in this case is by bevel gears at each end of a vertical shaft.

Still more unconventional is the Leyland eight-cylinder-in-line overhead camshaft gear (Fig. 22), the drive for which has been described in the foregoing. Only one cam is used for the inlet and exhaust valves of each cylinder, the cam acting upon slipper followers pivoted to built-up rockers. The latter at their outer ends bear upon T pieces screwed into the hollow valve stems, while the springs are semi-elliptic laminated units forked at their ends to engage with and exert a lifting pressure on the T pieces and through them upon the valves. With a total disregard for cost of production (the Leyland at $10,500 for the chassis is the most expensive British car) the designer has evidently aimed at securing silent operation by endeavoring to prevent valve spring rebound, and so has adopted the laminated type. The pivoted slipper followers may also have appeared to hold out possibilities in the same direction, but by being satisfied with the compromise valve opening diagram which is obviously necessitated by using the same cam for inlet and exhaust, he would seem to have taken away any gain in efficiency induced by overhead valves.



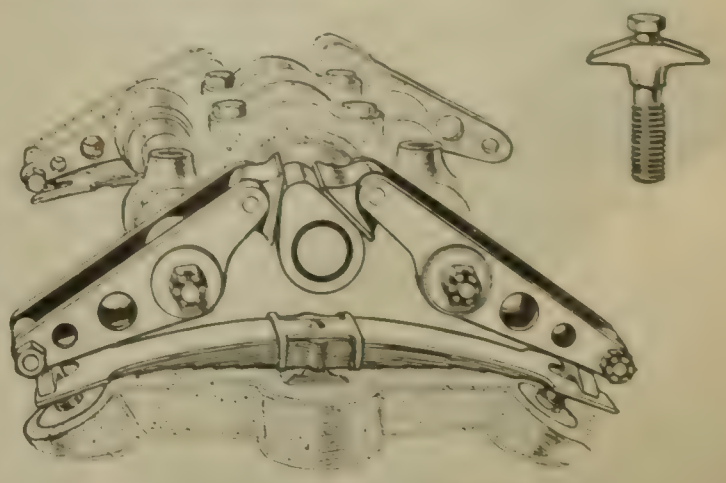


Fig. 21—(Left)—Straker Squire cam mechanism

Fig. 22—(Above)—Leyland cam mechanism

Gear Tooth Grinding Process Reduces Heat Treatment Distortion Dangers

Finish grinding gear teeth after heat treatment of gears to prevent danger of distortion a big factor in eliminating noise. Grinding process permits resurfacing gears which have been already finish cut to size and surfacing of gears which have grinding stock. Gears are ground in gauge up to 12.

THE recent great increase in closed cars has been responsible for a renewed activity in commercially manufacturing transmission gears which will be sufficiently accurate to give silent transmissions. It is a well-known fact that gear noises are magnified in closed cars. It is necessary that the gears be quiet, both while loaded and while idling. It is also recognized that gears which are initially quiet are possessed of a much longer life than the noisy gearing, which indicates badly shaped teeth and consequently tooth shock, which is responsible for increased wear.

It is, of course, a well recognized fact that one of the reasons for noise is the distortion of the tooth form (due to high temperatures required in the heat treating processes). Furthermore, considerable vibration and noise has resulted from the efforts to secure the lightest possible gear, in order to reduce the inertia of the transmission part to the greatest possible degree.

A short review of previous attempts in gear grinding will be of interest. The earliest efforts of which we have record was made by a gear foundryman as early as 1874. Emery wheels are described in the patents filed showing the wheel molded to the approximate shape of the tooth space. This wheel passed between the teeth, removing some roughness and burrs. This, however, was simply a roughing operation intended to replace the hand trueing which had previously been done with files or with a chipping hammer.

The next effort of which we have record is the Leland-Ferris bevel gear grinder, shown by the patent files in 1898, at which time the edge of the wheel was used with a generating type of machine to form a surface on a bevel gear tooth. About this same time Cheney developed a similar machine very little different from the Leland-Ferris type.

About 1891 the Fellows company produced a generating type of machine, showing detail changes from the previous work done by Leland and Cheney. A machine was also developed in Germany by the Reinicke Company of Chemnitz. These machines used the side of the emery wheel and generated the gear tooth form.

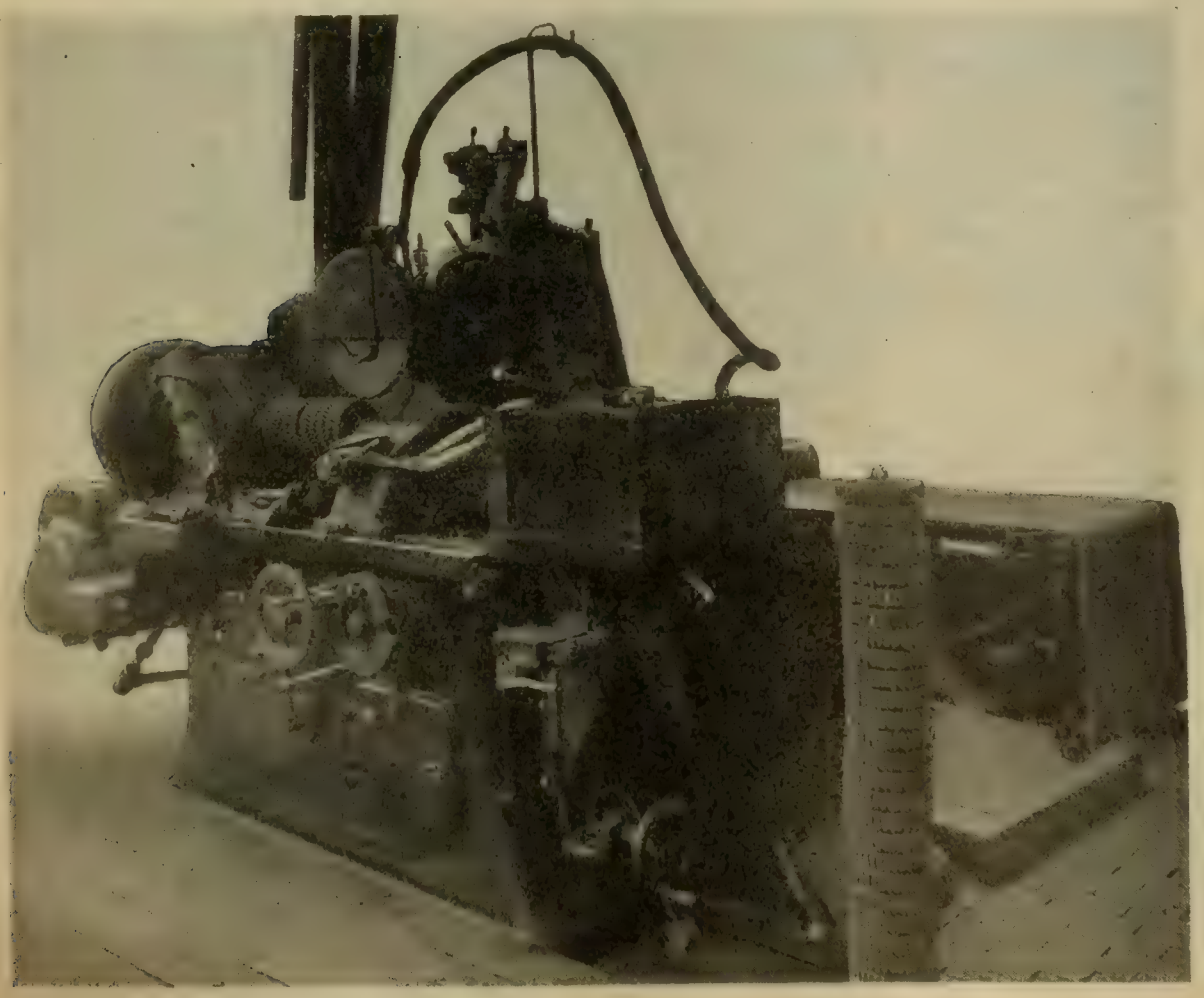
To-day we have in this country generating types of machines made by Pratt & Whitney, Garrison and Lees-Bradner. Another type of gear tooth generator is shown in the patent of the Brown-Lipe Co., issued to A. T. Brown in 1914.

The method to be described herewith was developed by engineers of the Gear Grinding Machine Co., the fundamental behind whose method is the reproduction of the gear tooth form upon the wheel from master forms. It is a feature with this method that the wheel can be re-trimmed in a few moments to replace the worn form without loss of the setting of the machine.

It is claimed that with the Ward gear grinder as used by the Gear Grinding Machine Co. it is possible to trim the wheel and use it for a roughing operation around the gear, removing the serious inequalities and the extreme distortion of the heat treatment and then to re-trim the wheel with great accuracy and remove from the gear teeth a finishing cut of very small amount. This is claimed to give a perfect reproduction on the tooth surface of the master form from which the diamond trimmers are operated.

In this method the wheel normally passes between two teeth, finishing adjacent sides of two teeth and the bottom of the space, although it works with

*Condensed from a paper by R. S. Drummond of the Gear Grinding Machine Co.

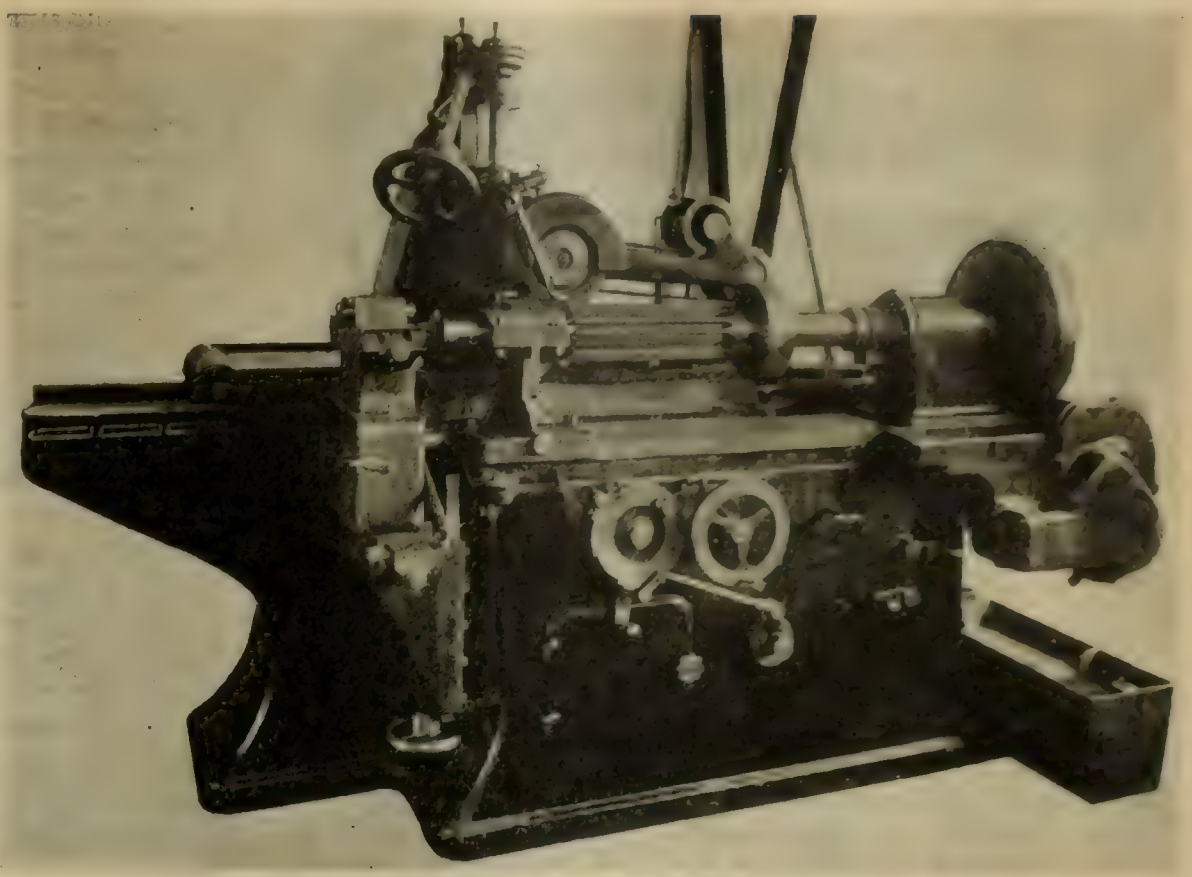


1—Grinding the teeth on ten spur gears at one time

facility on one side of one tooth without grinding the adjacent side of the next tooth if desired.

There are two distinctive uses which are claimed for the grinding process for finishing gear teeth. These are (1) the resurfacing of gears which have already been finish cut to size and (2) the surfacing of gears which have grinding stock, or, in other words, which are manufactured in part by cutting machines and then ground to finish size.

A large volume of business in resurfacing gears was done during the first five years of the company's operations. The process was used principally to salvage parts which had not passed inspection. These gears had failed either because of malformation of the teeth or distortion of their shape in heat treatment. But what apparently is by far the most promising use for the finish grinding of gear teeth is in those which have been rough cut, leaving a grinding stock. To-day this constitutes the largest volume of gear tooth grinding. Automobile transmission gears are required to operate noiselessly at high speed and to show but small wear. Perhaps the biggest feature in this connection is that the gear tooth is finished after the gears are heat treated and, consequently, without danger of distortion.



2—Gear Grinding Machine Co. planer type of grinder in operation

What Causes Noise?

It is very interesting to note what causes gear noise. One must consider that in a gear making tooth contact 14,000 times per minute, irregularity of contact will cause peculiar sounds. Many improperly shaped teeth cause an abrupt acceleration of the mating gear and equally abrupt slowing down. This reversal of acceleration occurring thousands of times per minute gives a sound harsh to the human ear and produces rapid wear.

A most common error is misplaced involute curves and irregular surface contact which cuts the oil film. When the shape of the involute curve is considered and it is realized that near the base circle the shape is approximately radial, whereas at the top it is very much rounded and falls away rapidly from a radial line, and then considers that a curve may be misplaced downward as much as .005 in., it is possible to realize the severe effect at the top of the tooth. In a recent case of this kind idler gears were ground accurate with the bore, but were noisy in the assembled transmission. Upon inspection of the idler, it was found to be bushed and the bushing was eccentric, causing the tooth form to be high on one side and low on the other. The noise was not a sound of eccentricity, but rather a low growl. New, accurate bushings eliminated the noise. One interesting feature of this transmission was that one idler, which was cleaned up accurately with the tooth position and which was a loose fit on the shaft, was relatively quiet.

As a sample of the stock removed from gear teeth by the grinding process, some figures bearing on gears similar to those in automobile transmissions may be mentioned. These gears varied from 2 to 8 in. in diameter, from 6 to 7 pitch and $\frac{5}{8}$ to $1\frac{1}{4}$ in. face width. On such gears it is usual to correct the tooth curve and give a good finish to the tooth surface by the removal of approximately 0.003 in. from each side of the tooth. Where the inaccuracies of machine work or the distortion of heat treatment is excessive, it sometimes becomes necessary to remove as much as 0.006 in. from the surface of the tooth on both sides. The removal of this amount of stock 0.003 to 0.006 in. will remove from the thickness of each tooth from .006 to .012 in., adding that much to backlash in a given gear. Double this amount is added in a pair of gears meshing together. We find that on the average we can expect the backlash to increase 0.010 to 0.015 in. in a pair of commercial transmission gears, due to the removal of stock by the grinding process.

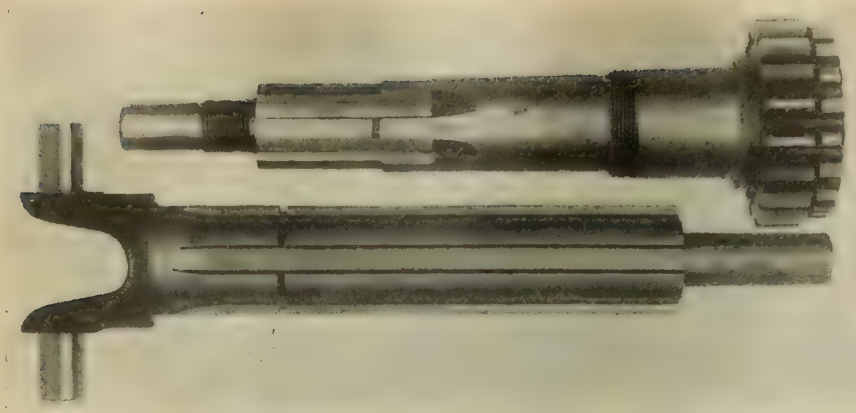
The depth of case hardening of such gears is usually specified as 0.035 in. or more, is amply sufficient to permit of the grinding of gear teeth for salvage purposes without alteration of case hardened limits. Some manufacturers prefer to make the case 0.040 in. deep, and this has proven entirely satisfactory.

For a long time manufacturers held the backlash between gears so close, say, 0.004 to 0.006 in., that a serious oil hammer was evident, especially in cold weather. In the normal operation of gears 0.015 in. backlash has been found highly satisfactory in high grade transmissions. The only unsatisfactory result of additional backlash comes from the accumulated backlash between a series of gears where the driven member overruns the driver, as in a car coasting against the engine, which will accumulate the backlash and cause the gears to tap against one another with a single distinct tap, which is normally not objectionable in automobile transmissions. It is unusual for drivers to continuously surge their cars backward and forward.

Necessary Machine Limits

In the rapid and economical operation of grinding gear teeth, certain machine limits are important. In automobile transmissions the limits on the bore of the gear should be set at .000 minus 0.001 in. plus specified size. The hub face may be permitted to run out 0.001 in. The outside diameter may be permitted to have a run out of 0.005 in. in gears from 2 in. to 8 in. in diameter. Index error may be permitted in a rough machine product up to 0.003 in. Such discrepancies in the rough product are well within ordinary limits of machine production.

The only tooth form of importance is the pure involute curve. Experience has shown that the closer the form of the tooth is held to the accurate involute form without



3—(Above)—Splined shaft which has been ground by Gear Grinding Machine Co. This piece must be very accurate, so that the universal joint will be co-axial with the shaft
4—A piece requiring grinding on the teeth as well as on the splines

modifications the better the gears operate. Ground gears with accurate tooth form will operate silently unless other features of the construction produce noise.

Gear teeth of 6 or 7 pitch and a pressure angle of 20 deg. or more, as used in automobile transmissions, require a relief for such interference as occurs from natural abutting of teeth due to the numbers of teeth in contact. For instance, in 13 teeth running with 14, this abrupt abutting of the teeth is due to the number of teeth and is relieved by increasing the pressure angle until the effect disappears. Teeth accurately formed to the true involute curve will operate accurately. The effect of gears operating with curves placed too high or too low is to cause the gears to move with a speed varying up and down with each tooth action. Another effect is that it is rarely possible to secure double tooth action. This has the effect of giving the full driving force as a wearing pressure on the tooth at the period of greatest sliding action.

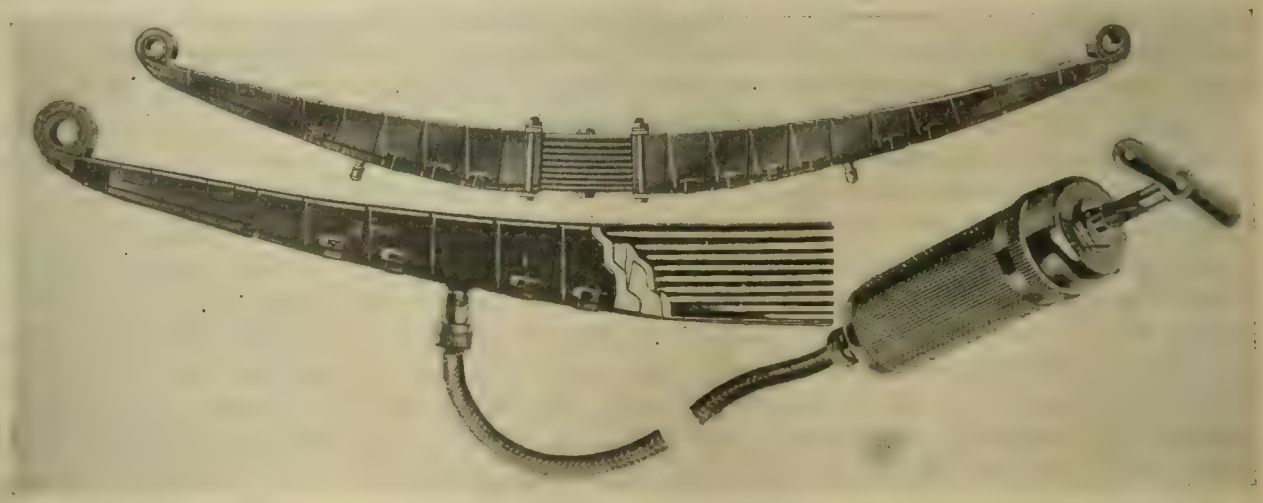
The machines used by the Gear Grinding Company employ a formed grinding wheel. With this grinding wheel a predetermined shape, as established on a form or pattern, is reproduced. This form or pattern is used as one element of a pantograph, the other extreme of which is the diamond point which scribes the side of the grinding wheel to an accurate shape similar to the shape on the master form. The machines in use to-day are chiefly of the shaper or planer type; that is, either the head traverses over the work or the work traverses under the wheel, the grinding wheel thus coming in contact with the faces of the teeth and grinding them to the correct shape. The gears are ground in gangs of up to 12.

Metallic Cover for Chassis Springs

ABOUT ten years ago the practice of enclosing the chassis springs in a leather boot to protect them against mud and dust was introduced in England. Recently the plan has gained quite a foothold in this country also, though the covers are usually of imitation leather or rubberized fabric and in the majority of cases particular attention is paid to the problem of keeping the leaves supplied with lubricant. These spring covers are either laced or buttoned on, and when the supply of lubricant is to be renewed they must be unlaced or unbuttoned.

To facilitate the operation of replenishing the oil supply in the cover, the Bassick Mfg. Co., originators of the Alemite lubricating system, have placed on the market the Alemite lubricating spring cover, which is entirely of metal and can be refilled with grease by means of the Alemite grease gun.

This spring cover is claimed to form a noiseless, flexible armor of lead coated, non-rusting steel, in which the spring works in a bath of lubricant that penetrates between the leaves. The cover is equipped with Alemite fittings and can be easily filled with the Alemite high pressure compressor and hose. The cover, it is claimed, excludes all water, dust and grit, and in conjunction with the lubricant bath prevents rust and friction.



Alemite lubricating spring cover

An Asbestos Brake Lining of Radical Construction

A NEW brake lining, composed almost entirely of asbestos, differing from most brake linings which are woven and contain a good deal of cotton and some rubber and copper wire, the latter giving the material the necessary tenacity, is being manufactured by the Nanbestos Products Co.

Nanbestos lining consists of asbestos mixed with a small proportion of a binder, and the necessary strength to enable it to withstand the breaking stresses is furnished by a sheet brass backing to which the asbestos is molded. The brass strip is formed with small tangs, which extend into the asbestos, and the complete lining is secured to the brake band or shoe by means of solid rivets.

A number of advantages are claimed for this lining as follows: Owing to the absence of cotton and rubber the lining withstands higher temperatures than the ordinary woven lining; the lining forms one solid mass and is impervious to oil and water; not being composed of layers, it will not disintegrate and cast off lint.

More Business at Less Cost Marks Commercial Aircraft Growth

Survey shows distinct progress made in 1921. Practical utility definitely demonstrated. Expansion averages about 20 per cent. A compilation of commercial aircraft operations in 1921 is here presented in detail.

IN the year 1921 progress in aviation was marked by three outstanding events, one of universal and epochal importance, the other two of more national significance.

During June and July there were held, 100 miles off the Virginia capes, a series of experiments in the course of which aircraft flown from land bases bombed and sank, one after the other, a submarine, destroyer, light cruiser and dreadnought, the most modern examples of warship construction.

In the fall the Conference on the Limitation of Armament was held in Washington, and it is asserted that the bombing tests cleared the way, more than any other single event, for a possible solution of the international competition in capital ship construction. For the 2000-pound TNT bomb which crushed in the steel walls of the *Ostfriesland* was, as the Army Chief of Ordnance remarked at the moment, "heard around the world."

Commercial aviation, struggling for nearly three years without assistance of a national policy, found an intelligent and sympathetic friend in the Harding administration. The President in his inaugural address urged the early enactment of an aerial code and the consistent encouragement of civilian flying. In consequence there was drafted a bill regulating the operation of aircraft in interstate and foreign commerce, and establishing a Bureau of Civilian Aeronautics in the Department of Commerce. This bill, introduced by Senator Wadsworth, passed the Senate, and at the time of publication of this volume was before the House Committee on Interstate and Foreign Commerce.

Aeronautical Chamber of Commerce of America

Possibly the most definite proof of growth in interest in commercial aviation, was the establishment, late in the year, of the Aeronautical Chamber of Commerce of America. The need for such an organization had long been felt. With definite assurance that an Aerial Code would shortly be established, manufacturers of heavier and lighter-than-air craft, motors, parts, accessories, materials and supplies; dealers, distributors, operators and owners; associations, corporations, firms and individuals engaged in the commercial phases of the art, decided to equip themselves with a national organization of the type which had proved so useful in the development of other American industries.

The Aeronautical Chamber of Commerce was incorporated under the laws of the State of New York, "to foster, advance, promulgate and promote" aeronautics, and "generally to do every act and thing which may be necessary and proper for the advancement" of American aviation. Formal organization was announced on December 31, 1921.

Commercial aircraft in 1921 definitely began the demonstration of practical utility. More miles were flown, more paid passengers booked and more package freight and goods carried.

Comparative Commercial Aircraft Operations, 1920-1921

	1920	1921
Estimated number of aircraft in operation	1,000	1,200
Estimated total mileage	6,000,000	6,250,000–6,500,000
Operating companies reporting	88	125
Equipment of these companies	365–425	500–600
Mileage flown by these companies	3,136,550	*2,907,245
Number of passengers carried	115,163	122,512
Pounds of freight carried	41,390	123,227
Number of flights by operating companies	Unknown	130,736
Average duration of flights	Unknown	21 minutes
Average charge for short flights	$12.50	$9.00
Average charge per mile for inter-city flights	.65	.55
Average charge per pound for freight	Unknown	.33
States in which operations were carried on	32	34
Air terminal facilities	128	146

(*Decrease explained by less free and more paid flights.)

Approximately one-half the equipment was controlled by established organizations, the other half being in the hands of the gypsy flier. It being known that the operators at fixed points covered approximately 3,000,000 miles, carrying about 122,500 passengers, it is estimated that, all told, rather more than 250,000 persons flew and that, counting the wanderings of the gypsy, 6,500,000 miles were compassed by commercial aircraft during the year.

New Aircraft Operators

Operation in states shows that the pressure upon the surface facilities in Illinois, Massachusetts, New Jersey, New York, Pennsylvania, etc., has encouraged the establishment of eighteen new aircraft operators, all of which engage in occasional transport between cities, but which are handicapped in their endeavors to establish regular service by the absence of landing facilities, properly disseminated weather reports, and aerial law which is primary to the legitimate general capitalization.

In California, Idaho, Iowa, Kansas, Kentucky, Maine, Missouri, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Carolina, South Dakota, Texas, Virginia, and West Virginia, where distances are great and surface facilities backward, commerce is willing to utilize aircraft. For the same service which appeals to the great business establishments of New York or Chicago, eager to hasten delivery and speed collection, appeals likewise to the small community the progress of which manifestly rests upon the rapidity with which it releases itself from isolation and establishes quick contact with purchasing territory hitherto unattainable.

The following pages contain a very complete table of commercial aircraft operations in the United States in 1921. This table was compiled by the Aeronautical Chamber of Commerce of America, Inc., and gives a comprehensive idea of the location, facilities and operations of all established commercial aircraft concerns.

Commercial Aircraft Operations in the United States, 1921.

(Compiled by Aeronautical Chamber of Commerce of America, Inc.)

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—[Inter-city] Flights
Adams Aircraft Co.	Oklahoma City, Okla.	Field (leased), 80 acres; hangar 50x75.	Limited	2 L.S. (W. 150 hp.)	1,000	30 min.	45,000	1,750	0	$10.00 to 15.00		Oklahoma City, Ardmore, Tulsa, Okla. and Dallas, Tex., etc.	$.75 (Minimum within 300 miles—25.00)
Aeromarine Airways, Inc.	Times Bldg., New York, N. Y.	Terminals: Keyport, N. J., New York, N. Y., Atlantic City, Key West, Havana, Palm Beach, Miami, Bimini, Nassau, Tampa, St. Petersburg, Belleair Heights, Fla.	Excellent—Keyport, N. J.. Key West, Fla.	8 A.—Navy 11-pass. Flying Cruisers. (L. 400) 17 A.—Navy H.S. 5-pass. Flying Boats. (L. 400) 5 A.—30 place Flying Boats. (L. 400)			95,020	6,814	24,002	5.00		N. Y.-Atlantic City and intermediate points; N. Y.-Havana; Key West-Havana: Miami, Palm Beach; Nassau, Bimini, Tampa, Belleair Heights, St. Petersburg and Key West; Great Lakes region; N. Y.-Albany: Lakes George and Champlain-N. Y. and New England Coast	
Aero Club of Miles City	Miles City, Mont.	Use Government Reservation. 3000x4500.	Use repair shop in town	1 J.—1 (OXX2) 1 J.N.—4-D. (OX5)	3,000	25 min.	85,000	1,000	0	10.00			.33⅓
American Airways	College Point, N. Y.	Field (leased); hangar 65x100, two floors.	Complete for any airplane job	1 H.S.—1 Flying Boat (L. 400 hp.)	200	15 min.	4,000	600	0	.75 to 1.00 per min.			
Ashmusen Aeronautical Co	65th & Center Sts., Omaha, Nebr.	Field (municipal). 40 acres. hangar 80 x100.	First class, all types aircraft	1 *Blue Bird* (5-pass. 300 hp. Sal.) 1 U.E. Plane (150 hp.) 1 J.N.-4-D. (OX5) 1 J.N.-4-C. (OX5)	1,000	30 min.	40,000	2,500	very little	5.00	.12½ per 100	No established routes	.20
Aurora Aviation Co., Inc.	Aurora, Ill.	Field (leased). 66 acres, hangar.	Minor repairs	1 J.N.-4-D. (OX5)	500	15 min.	8,500	400	0	10.00			
B. B. & B. Aerial Co.	Marshfield, Wis.	Field (leased). 19 acres.	None	1 S.J.-1 (OX5)			12,000	400		.75 per min.			
Beaty Aviation Co.	Dallas, Texas	Field (leased). 50 acres; hangar 30x50.	Fair	1 J.N.-4-D (OX5) 1 Can. J.N. (OX5)	1,200	20 min.	12,000	800	0	5.00	.50	All points in Texas	.35
Nimmo Black Airport, Inc.	Chicago, Ill.	Field (leased). 40 acres; hangar 68x75.	Good	1 J.N.-4-C (OX5) 2 *Swallows* (OX5)	2,000	10 min.	18,000	3,500	0	10.00		St. Louis, Des Moines, So. Haven, Columbus, O., etc.	1.00-one way .60 round trip
Bowen & Hutton	Windsor, Mo.	Field (leased). 35 acres; hangar	Ordinary	1 J.N. (W. 150 hp.)	150	20 min.	3,000	75	very little	10.00		Neighboring towns and Kansas City	
Vincent J. Burnelli	Amityville, N. Y.	Field (Curtiss); leased, at Copiague, L. I.	Complete factory at Amityville	R.B. Airliner, 30-pass. Biplane (L. 2400 hp.)	114	50 min.	8,000	550	0	Experimental			
Central Aircraft Co.	Holdrege, Nebr.	Field (leased). 40 acres; hangar, 32x60.	Have both	1 Can. J.N. (OX5) 1 *Lark* Monoplane (Law 60 hp.)	1,400	15 min.	24,500	432		10.00		Kearney, Minden, Oxford, Lincoln.	.50
Chadwick Bros.	150 Broad St., Newark, N. J.	Brainerd Field, Hartford, Conn., (owned by city), 90 acres.		1 S.J.-1 (OX5) 1 J.N.-4-D. (OX5)	1,100	20 min.	25,000	500		10.00			.75
C. E. Cheney Aero Co.	Greene, Iowa			2 J.N.-4-D. (OX5)	800	20 min.	16,000	750		7.50 & 10.00		North Central Iowa	20.00 per hr.
Cleveland Air Service	Coventry, Vt.	Field (owned). 800x1700; one-ship hangar.	Workshop in hangar: garage ½ mile	1 J.N.-4-D. (OX5) 1 S.J.-1 (C.-6)	125 Sept. 1st, 1921, to Oct. 21 1921	15 min. to 3½ hrs.	1,000	78	0	10.00		Burlington, Vt., Newport, Vt., Concord, N. H., Boston, Mass.	40.00 per hr. .60 per mile
Commercial Airship Syndicate	Kansas City, Kans.	Field (leased). 36 acres; hangar, 40x120.	General shops	*Pony Blimp* (gas capacity, 35,800 cu. ft.)	27	50 miles	1,200	21	350	10.00	.50		
Concord Aircraft Co.	Concord, N. H.	Field (State Mobilization). 1 mile long, ¼ mile wide; hangar, (4 barracks.)	State Highway Repair shop	1 S.J.-1 (W. 150 hp.) 1 S.J.-1 (OX5)	700	15 min.	22,000	1,000		10.00		All over New England	1.00 one way 1.50 round trip

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Cooke Aero Co.	Watertown, S. Dak.	Field (part owned and part leased). 40 acres, western edge of town. hangar, 50x54.	Shop	1 504-K (3-place, LeR.) 1 S.J.-1 (H.S.)						$10.00		Anywhere	$50.00 per hour (average)
Harry Depew Copland	Cambridge, Mass.	Seaplane Base (leased). Hartford, Conn. Indian Neck, Conn. Daytona Beach, Fla.		1 A.-39-B. (OXX6)	400	15 min.	6,000	500	200 (Maine to Florida)	10.00 to 25.00		Portland, Me., Boston, Springfield, Hartford, N. Y. C., Philadelphia, Washington, Richmond, Raleigh, Charleston, Savannah, Jacksonville, Daytona	.75
Robert H. Craig, Jr.	589 Arcade Bldg., St. Louis, Mo.	Field (municipal). Aerial Mail Hangar.		1 *Oriole* (K.-6)	200	10 min.	2,900	250		10.00		Anywhere — on demand	.50
Curtiss Aeroplane & Motor Corp.	Buffalo, N. Y. (Kenilworth Field)	Field (leased). 2000x800. 2 hangars.	Complete	1 S.J.-1 (C.-6) 1 J.N. (OX)	800	15 min.	15,000	200		10.00		Anywhere desired	.80 1 pas. 1.00 2 pas.
Curtiss Aeroplane & Motor Corp.	Garden City, N. Y.	Field(owned). ½ mile square. 14 hangars.	Complete	10-20 J.N.-1 (OX) 5 *Orioles* (C.-6) 2 *Orioles* (OX) 5 S.J.-1 (C.-6) 1 D.-Pusher 2 Navy Racers 1 C.T. 2 *Orencos*	3,000	15 min.	65,000	1,500		10.00		Anywhere desired	.80 1 pas. 1.00 2 pas.
Curtiss Aircraft Corp.	Dallas, Texas. (Love Field)	Field (leased by government). Regulation gov. flying school. 2 hangars.	Complete	Large stock of completed J.N.-4-D. and J.N.-4-C. (OX5)	50	30 min.	2,500	40	0			Local	
Curtiss Eastern Airplane Corp.	130 So. 15th St., Philadelphia, Pa.	Field (leased). 100 acres. 2 hangars, 50x75.	Complete	4 J.N.-4-D. 1 S.J.-1 (K.-6)	1,200	12 min.	60,000	829	0	10.00			.75
Curtiss-Indiana Co.	Kokomo, Ind.	Field (leased). ½ mile square. 3 hangars (1—48x100. 2—66x100)	Excellent	27 planes, including *Orioles*. (C.-6, K.-6, OX) S.J.-1, J.N.-4-D., Can. J.N. and Br. Bomber	10,000	15 min.	300,000	10,000	0	10.00 & 15.00	.50	Indianapolis, Chicago, Dayton and Rantoul	.50
Curtiss Iowa Aircraft Corp.	Fort Dodge, Iowa	Fields, 65 acres each: Ft. Dodge (owned), Des Moines (leased), Oelwein (leased), Fairfield (leased), Monmouth (leased), hangar for 6 planes at Ft. Dodge, for 2 planes at other fields.	Repair shop at each field	1 An. A-300-C, six-place (Fiat) 7 J.N.-4, (OX5) 2 S.J.-1, (OX5) 5 *Orioles* (K.-6)	6,000	15 min.	90,000	4,500		5.00 to 10.00	.15 cross country	Between own fields	.15
Curtiss-Metropolitan Airplane Co.	505 5th Ave., New York, N. Y.	Terminals: (Port Washington, L. I., N. Y. and Palm Beach, Fla.). for flying boats, one at each terminal.	Service at each	1 H.-16 Flying Boat (W.) 2 *Seagulls* 1 F. Boat 1 H. S.	1,000	10 min.	25,000	5,000		10.00		New York, Lake George, New London, Southampton, Newport, Atlantic City, Miami, Havana	50
Curtiss Northwest Airplane Co.	707 Metropolitan Bank Bldg., Minneapolis, Minn.	Field (leased). ½ mile East and West, ¼ mile North and South. hangar, 65x70.	Fuselage and wing repair shop. motor repair shop. motor test stand	Large stock of completed *Orioles* (K.-6 and C.-6), S.J.-1 (K.-6 and OX), J.N.-4-D., Can. J.N.	1,500	15 min.	40,000	1,700	very little	10.00	.03½	Chicago, Twin Cities. Fargo, LaCrosse, Duluth, Sioux Falls, Aberdeen	.50

KEY TO AIRCRAFT AND ENGINE TYPES

A., A. Navy, A.-Navy H.S. and A.-39 B.; Aeromarine Plane & Motor Co., Keyport, N. J. An.; Ansaldo; Ansaldo Co., 65 Broadway, New York City. Ballila Racer; Ansaldo. B., and C.L. 4 S.; Boeing Airplane Company, Seattle, Wash. *Blue Bird*, Ashmusen Aeronautical Company, Omaha, Nebr. Br. Bomber; Breguet. Br. and Bullet Monoplane; Bristol. Camel; Sopwith. D. H.-6 and D.; DeHavilland. D. Special; Earl S. Daugherty, Long Beach, Calif. F.-3 Monoplane and C.-2 Biplane; Netherlands Aircraft Mfg. Co., Fokker, New York City. F. 40 and Sport F.; W. Wallace Kellett, representing H. and M. Farman. J.L.-6 and J.L.-12; J. L. Aircraft Corporation, New York City. J.N., Can. J.N., S.J., J.N.-4 D., J.N. 4-C., J.N.-4-H., D. Pusher, Navy Racers, C.T. Monoplane, O. Scout, *Orioles, Seagulls, F.Boats;* Curtiss Aeroplane & Motor Corp., Garden City, Long Island, N. Y. K.T. and O.W.; Dayton Wright Company, Dayton, Ohio. L.H., L.A.K.; Longren Aircraft Corp., Topeka, Kans. L.S.; Lincoln Standard; Nebraska Aircraft Corp., Lincoln, Nebr. L.W.F.; L.W.F. Engineering Company, College Point, New York. N.28; Nieuport. *Orenco;* Ordnance Engineering Corp., Baldwin, Long Island, N. Y. P. Special; Earl S. Daugherty, Long Beach, Calif. P.S., Pacific Standard; Pacific Aeroplane & Supply Co., Venice, Calif. R.B., Remington Burnelli; Vincent J. Burnelli, Amityville, N. Y. Sp., Sport Plane; Lawrence Sperry Aircraft Corp., Farmingdale, Long Island, N. Y. St., Sturtevant; Sturtevant Aeroplane Company, Hyde Park District, Boston 36, Mass. S. V. A.; Ansaldo. *Swallow;* E. M. Laird Company, Wichita, Kansas. T.-M.; Thomas-Morse; Thomas Morse Aircraft Corp., Ithaca, N. Y. U.E.; United Eastern. V.; Walter T. Varney, San Francisco, Calif. 504-K.; British Avros.

AIRSHIPS

Pony Blimp; Goodyear Tire & Rubber Company, Akron, Ohio.

ENGINES

An.; Anzani. Bd.; Beardmore. B.M.W.; J. L. Aircraft Corp., New York City. Bu.; Benz. Cl.; Clerget. Gn.; Gnome. H. S., H.S.A.A.; Hall-Scott Motor Car Co., Berkeley, Calif. Law.; Lawrence Aero Engine Corp., Farmingdale, Long Island, N. Y. LeR.; LeRhone. L.-12; Liberty; Packard Motor Car Company, Detroit, Mich. and others. Mer. Mercedes. OX, OXX, OX5, OXX6, K.-6, C.-6, V2X; Curtiss Aeroplane & Motor Corp., Garden City, Long Island, N. Y. Sal.; Salmson. Stur.; Sturtevant Aeroplane Company, Hyde Park District, Boston 36, Mass. S.P.; Siddeley Puma. S.V.A.; Ansaldo. T.-M.; Thomas Morse Aircraft Corp., Ithaca, N. Y. W.; Wright Aeronautical Corporation, Paterson, N. J.

(The above is based upon statements made to the Manufacturers Aircraft Association, Inc., and the Aeronautical Chamber of Commerce of America, Inc., in response to questionnaires sent to all known operators of aircraft. No opportunity has been available to determine the accuracy of the information and no responsibility is taken for the data except for the care with which the figures and facts are reported and the manner in which the summary is presented.)

Commercial Aircraft Operations in the United States, 1921 (Continued)

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Curtiss Wisconsin Aeroplane Co.	330 Clinton St., Milwaukee, Wis.	Field (leased). 100 acres. hangar, 50x50.	Good	1 S.V.A. single-seater (SPA, 220 hp.) 1 S.J.-1, three-seater (C.-6, 160 hp.) 1 Can. J.N. (OX5, 90 hp.) 1 S.J.-1, two-seater (OX5)	2,000	20 min.	40,000	500		$5.00			$ 50
Earl S. Daugherty School of Aviation	Long Beach, Calif.	Field (owned); L shape, 1400x400 and 1350x270. 2 hangars. capacity, 11 ships.	Good	1 Can. J.N. (OX5) 2 J.N.-4-D. (OX5) 1 D. Special (OX5) 1 P Special (OX5) 1 N. 28 (Gn. 160 hp.)	1,078	15 min.	27,400	3,220	0	5.00& 10.00		Long Beach to Los Angeles, Venice, Ventura, San Diego, Pasadena, Riverside	50.00 per hour
Wm. R. Davis, Jr.	Oakland, Calif.	Terminal on property of Alaska Packers Assn., Alameda. hangar, 76x35.	Tools and accessories	1 L.H.-4-H. Seaplane (H.S. A.-5-A. Touring, 175 hp.) (OXX3, 110 hp.)	62	30 min.	2,000	20	0	10.00		Oakland, San Francisco, Berkeley, Alameda, Sausalito, Richmond, etc.	
Dayton Wright Co.	Dayton Ohio	Field (leased). 161 acres. hangar space in main plant.		1 K.T. (L.-12) 1 O.W. (W. 150 hp.) 1 S.J.-1 (H.S.L.-6)	800	30 min.	32,450	963				Detroit, Cleveland, Indianapolis, Toledo. (occasionally N. Y. city)	
DeLuxe Air Service, Inc.	Asbury Park, N. J.	Fields: Deal, N. J. (800x1800) and Como, N. J. (1800x1500). hangar at Deal, 160x35. ten at Como.	At Deal	4 Can. J.N. (OXX & OXX5) 1 J.N. (twin OXX)	400	10 min.	6,000	400	200	10.00		New York, Atlantic City	.50
The Ralph C. Diggins Co.	140 No. Dearborn St., Chicago, Ill.	Field (leased). 1 square mile. 3 hangars, 65x40x15.	Excellent	4 Can. J.N.-4 (OX5) 1 504-K, three-place, (LeR. 110 hp.) 1 S.V.A.-9 (SPA, 220 hp.) 1 D.H.-9 (S.P., 240 hp.)	10,000	4-5 min.	60,000	2,000	very little	10.00		Chicago and all Middle Western cities	.25
Edgewater Beach Air Service	3158 No. Clark St., Chicago, Ill.	Terminal: Edgewater Beach Hotel (leased). hangar, 54x30.	Machine shop and mechanic	1 *Seagull* (C.-6, 160 hp.)	250	20 min.	50,000	300	newspapers	15.00-1 25.00-2		Chicago-Evanston. Milwaukee, Waukegan, Benton Harbor and all points on lake	1.00
G. Elias & Bro., Inc.	Buffalo, N. Y.	Terminal foot of Jersey St., 50x200. 2 hangars, 40x50.	Complete		25 (test)	30 min.	3,000	0	0				
F. W. Farris	Stockton, Calif.	Field: Stockton Aviation Center (leased). 64 acres. hangar, 50x35.	Repair facilities	1 J.N.-4 (OX5)	753	10-15 min.	15,000	430	0	10.00 up		Stockton, Fresno, Modesto, San Francisco, Sacramento—any town in San Joaquim Valley	.75
Finger Lakes Air Service, Inc.	Auburn, N. Y.	Terminal: Owasco Lake, Auburn, N. Y.		1 A.-Navy H.S.-2-L. (6-pass.)	150	15 min.	4,500	450	0	10.00		Owasco, Skaneateles, Cayuga and Seneca Lakes, and Thousand Islands	
Flying U School of Aviation	San Antonio, Texas	Field (leased). speedway 2000 acres. Stenson Field, 1000 acres. 4 hangars, 40x150 and 30x70.	Machine shop and assembling plant	7 J.N.-4-D. 1 S.J.-1 1 T.M. 1 *Camel* (OX5, H.S., Cl., LeR., L. ?)	400	25 min.	12,000	150	1,000	10.00		Corpus Christi, Dallas, and San Antonio	.50
Oliver Gies Airplane Co.	Great Falls, Mont.	Field (leased). ¼x½ mile hangar, 40x55.		1 S.J.-1 (OXX6)	100	20 min.	3,000	60		10.00		Great Falls, Helena, Montana	50.00 per flying hour
Good & Foster Aerial Service	Love Field, Dallas, Texas	Love Field (leased). Government. Hangar.	General airplane repair	2 J.N.-4-C. (OX5)	150	Varied	4,000	50	100		.75	Dallas, Tulsa, Ardmore, Oklahoma City and Breckenridge, Texas	.75
Grand Island Aero Co.	Grand Island, Nebr.	Field (leased). 2700x500. 3 hangars (2—Tent. 1—40x90.)	Repairing at field	4 J.-N.4-D. 2 *Orioles*		10-15 min.	20,000	500		7.50 to 15.00			.50
Great Lakes Airways Co., Inc.	Cleveland, Ohio	Terminals: Put-In-Bay, Cleveland, and Detroit. inside harbor at Cleveland (permission of city). 6 miles by 1 mile. hangar for one ship at Put-In-Bay.	Excellent for boat repair. fair for motors	1 A.-H.S.-2-L Cabin Cruiser (L. 330 hp.)	100	20 min.	1,200	100	200	10.00 to 15.00	.30	Cleveland, Detroit, Put-In-Bay, Erie, Sandusky, Toledo	.50 to .75
Gulf States Aircraft Co.	Shreveport, La.	Uses Fair Grounds.		2 S.J.-1, 3 pass (OX5)	1,000	10 min.	25,000	1,000		5.00 to 10.00		Southern States	.25 each way

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Dillard Hamilton	West End Viaduct, Dallas, Texas.	Field (leased), 108 acres	5 mechanics, 1 pilot. Good repair shop	1 Can. J.N. (OX5)		2 hrs.	3,500	Few		$5.00	$1.00 per mile	Texas	$1.00
A. W. Hansen	Rio Vista, Calif.			1 L.S. (W.)									
Heddon Aviation Co., Inc.	Dowagiac, Mich.	Field (leased). 40 acres. hangar, 44x56.	Good	2 Can. J.N.-4-C. (OX5) 1 *Swallow* 1 S.J.-1 (OX5)	1,069	Varied (cross country)	22,000	1,013	500	10.00 up	By contract	Northern Indiana, Southern Michigan	.75 to 1.00
Henderson-Mauldin Aero Service Co.	Fulton, Mo.	Field (leased). 2000x2600. hangar, 60x90.	Good	2 J.N.-4-D. (OX5)	1,500	20 min.	30,000	700	0	5.00		Missouri, Kansas, Illinois, Texas and Oklahoma	.50
William Hill Airplane Co.	Arkansas City, Kans.	Field (leased). 90 acres, 1 mile north of city.	Oil and gas on field. Hill Garage city	1 J.N.-4-D. 1 S.J.-1	2,000	10 min. to 2 hrs.	40,000	1,500		7.50-1 15.00-2		Kansas, Oklahoma, Texas	.50
Hodgen Aerial Service	Enid, Okla.	Hangar for 2 ships.		2 S.J.-1 (OX5)	1,000	15 min.	17,000	800		7.50		Enid, Oklahoma City	.50
Cliff Hogan Aviation, Auto and Tractor School	2623 McGee Trafficway, Kansas City, Mo.		Repair shop	1 Can. J.N. (3 engines)	Few								
E. Hubbard	56 Roanoke St., Seattle, Wash.	Terminals (leased): Seattle, Wash. and Victoria, B. C. Lake Union, Seattle, 2x¾ mile. Victoria Harbor, ¾x¼ mile. hangar, 220x100.	Repair service from Boeing Airplane Co., Seattle, Wash.	1 B.-1 Flying Boat 1 C.L.-4-S. Seaplane	200	2 hrs.	20,000	100	50,000 U.S. Mail	10.00	.0⅓	Seattle, Wash., and Victoria, B. C.	
Fred W. Hungate	Pomeroy, Wash.	Field (owned). Government hangar.		1 J.N.-4	20	15 min.	900	20		10.00		Pomeroy and Spokane, Wash.	.50 one way, .75 two ways
Huron Aerial Rapid Transit Co.	Huron, So. Dak.	Field (leased), hangar.	Shop	1 J.N.-4 (OX5)		10-12 min.	20,000	500	0	10.00		So. Dakota, parts of Nebraska, Minnesota, N. D.	.33⅓ minimum 25.00
Johnson Airplane & Supply Co.	Dayton, Ohio	Field (leased), 1500x2200, hangar, 120x80.	6 buildings. supply station for aircraft material and all leading accessories	1 J.N.-4-D. (OX) 1 J.N.-4-H. (W.) 1 F.E.-2-B. (Bd. 160 hp.) 1 L.V.G. (Bn. 220 hp.) 1 Can. J.N. (OX5)	500 Started May 1, 1921	30 min.	20,000	100	3,000	10.00		Dayton, Columbus, Cincinnati, Kokomo, Piqua, all parts of Ohio, Indiana and W. Va.	1.00
W. Wallace Kellett	717 Widener Bldg., Philadelphia, Pa.	Field (leased), hangar.		F-40 Pushers 3 Sport F., 2 seaters	300 (demonstration)	20 min.	7,500	150	0				
Kelso Aviation Co.	Lewiston, Idaho	Field (leased), 600x1800, hangar, 50x60.		1 J.N.-4 (OX5) 1 S.J.N.-1 (OX5) 1 L.S. (W. 150 hp.)	5,000	15 min.	60,000	3,000	0	5.00		All cities in North West	40.00 per hour
Killapa Harbor Aero Mfg. Co.	Hoquiam, Wash.			Small seaplane,(own manufacture (LeR. 80 hp.)	Test flight	20 min.	15						
C. G. Killingsworth	116 W. 9th St., Dallas, Texas	Field: Viaduct Aviation Field (leased). 200 acres.	Garage	1 J.N.-4-C.	100	15 min.	1,500	100		5.00		Waco, Mexia, Ft. Worth, Breckenridge	.75
E. M. Laird Co.	Wichita, Kans.	Field (owned). N. E. of town. 1300 ft. sq., 4 hangars, 40x50.	Factory building, 66x140	*Swallows* (OX5)	2,500	30 min.	100,000	2,000		10.00		Wichita, Chicago, Kansas City, Tulsa, Omaha, Denver, etc., anywhere	
Lambert Flyers	Ellenboro, W. Va.	Fields at Lamberton, W. Va. and El Dorado, Ark., 40 acres sq.. hangars, 90x100, 40x100 respectively.	Good	6 S.J.-1 (K.6 and C.-6) 1 *Oriole*	300	varied—up to 1 hour	20,000	500		5.00 up		All over U. S. A.	
John M. Larsen	347 Madison Ave., New York City	Field: Central Park, L. I., N. Y. 1000x2600, 3 hangars, 10,000 sq. ft. area.	Complete manufacturing facilities	6-8 J.L.-6 All Metal Monoplanes (BMW, 185 hp.) 1 J.L.-12 (L.)	1,500	varied—up to 26 hours 19 min.	100,000	8,000		demonstration		Many trips N. Y.-MiddleWest. N. Y.-Chicago. N. Y.-Omaha. Transcontinental—N. Y.-San Francisco. Mexico City to Aretic Circle, etc.	
L. W. Leib	Volga, S. Dak.	Field (leased), 720x1000, hangar.	Good	1 S.J.-1 (OX5)	800	10 min.	8,000	400	0	5.00			.50
James Levy Aircraft Co.	Indiana Ave. at 21st St., Chicago, Ill.	Field: Aero Club of Illinois.		Can. J.N.'s 504-K.'s, 3-seater	40 (sales demonstration)	15-20 min.	700	30					

For abbreviations see page 1167.

Commercial Aircraft Operations in the United States, 1921 (Continued)

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per mile—Inter-city Flights
Lexington Aviation Co., Inc.	Lexington, Ky.	Field (leased). 900x2100.	In town	1 504-K., 3-seater	50	30 min.	1,200	40		$ 15.00–2		Central Kentucky	$ .50
Lirette's Flying Circus	Dallas, Texas.			1 J.N.-4	300	30 min.	12,000	200	0	5.00 & 10.00		Texas, Oklahoma and Louisiana	.75
Floyd J. Logan Aviation Co.	Cleveland, Ohio	Field (leased). 70 acres. hangar.	Good	2 Can. J.N. (OX5) 1 S.J.-1 (OX5)	500	7 min.	5,000	442		5.00 to 10.00			.60
Longren Aircraft Corp.	Topeka, Kans.	Field (leased). ½x⅜ mile, adjacent to factory. hangar.	Complete factory	1 L.H. (OX5) 1 L.A.K. (Law. 3 cyl.) 3 L.A.K. (An. 6 cyl.)	demonstration	varied—10 trips of 300 miles	30,000	500	0	10.00		Anywhere	
Lowell Aircraft Co., Inc.	Oberlin, Ohio	Field (leased). 200x900. hangar, 45x50.	Very good for motor accessory	1 J.N.-4-D. (OX5) 1 S.J.-1 (OX5) 1 Can. J.N. (OX5)	50	30 min.	2,500	15		10.00		Oberlin and Cleveland, Ohio	1.00
Lutz Manor Co.	Oshkosh, Wis.	Field (leased). at city limits. 80 acres, rectangular, good approach. hangar, 45x65, for 3 planes.	Good	1 J.N.-4-D. (OX5 and OXX6) 1 Balilla Racer A.-1 (SPA, 225 hp.)	1,000 (100 averaging 1½ hrs.	10 min.	20,000	500	0	5.00 to 10.00			35.00 per hour
Lynchburg Air Service Corp.	Lynchburg, Va.	Field (leased).	Shop, warehouse, 2 mechanics	1 S.J.-1	75	1-2 hrs.		0					
LynnwayAerialTransportationCo.	Lynn, Mass.	Field (leased). 1000x1500. 2 individual hangars.	Good	2 Can. J.N. (OX5) 2 S.J.-1 (OX5) 1 Can. J.N. (OXX6) 1 S.J.-1 (C.-6) 1 S.J.-1 (Mer. 160 hp.)	1,800	15 min.	27,000	2,000	10,000	10.00		Providence, R. I., Lawrence, Mass. etc.	.50
McGraw Aviation Co.	116 W. 9th St., Dallas, Texas.	Field (leased). 108 acres.	Shop 40x30 and shed	3 J.N.-4-D. 9 J.N.-4-C. 1 S.J.-1 (W. 180 hp.) 1 S.J.-1 (W. 150 hp.)		10 min.	14,600	1,460		5.00		All points	1.00
R. W. Mackie	Houston, Texas	Field (small), hangar (rented).	Repairs handled	1 S.J.-1 (OX5)		15 min.	35,000	800	0	10.00 to 15.00		Houston and surrounding country	.40
Massachusetts Aircraft Corp.	Delano Ave., Point of Pines, Mass.	Field: Saugus Race Track (1 mile track). hangar, for 3 ships.	Motor room	1 Bullet Monoplane (LeR. 120 hp.) 1 504-K (LeR. 12 hp.) 1 Can. J.N. (OX5)			3,000	150	0	10.00			
Mattley Aviation Co.	Richmond and San Francisco, Calif.	Fields (public). second class, temporary.	Temporary	1 Can. J.N. (OX5) 1 L.S. (W. 150 hp.)	400	20 min.	8,500	450	100	10.00	Vary	Northern Calif.	.50 to .75
Maxim Air Service Co.	Waterville, Me.	Field (leased). 2400x550.	Repair shop, spare parts	2 Can. J.N. (OX5) 1 S.J.-1 (OX5)	700	15 min.	10,000	600	0	10.00		Central Maine	.75
Mayer Aircraft Corp., Inc.	Bridgeville, Pa.	Fields (owned). No. 1, 30 acres. No. 2, 65 acres. hangar, 50x120.		1 *Oriole* (C.-6) 1 S.J.-1 (Mer.) 1 S.J.-1 (OX5) 1 *Swallow* (OX5)	600	20 min.	12,000		0	10.00		Pittsburgh and vicinity. East to Philadelphia. West to Columbus, and North to Buffalo	1.00
Michigan Aero Service Corp.	Lansing, Mich.	Fields (leased) Lansing, Battle Creek, Jackson, Detroit, 40 acres.	Factory at Lansing	1 J.N.-4-D. (OX5) 3 S.J.-1 (OX5) 1 S.J.-1 (OXX6) 1 S.J.-1 (W. 220)	2,000	15 min.	30,000	1,200	175	10.00	.005	Battle Creek, Lansing, Jackson. all Michigan	.50
Mobridge Aerial Co., Inc.	Mobridge, S. Dak.	Field (leased). 200 acres. hangar for 2 ships.	Good	1 Can. J.N. (OX5) 1 L.S. (W. 150 hp.) (W. 220 hp. extra)	200	10 min.	2,000	100	0	10.00			
Netherlands Aircraft Mfg. Co. (Fokker)	286 5th Ave., New York, N. Y.	Field (uses Curtiss Field, Mineola, L. I., N. Y.). 1½ hangars rented, 60x80.	Own personnel for repairs and overhauling	2 F-3 Monoplanes (BMW, 185 hp.) 1 C.-2 Biplane (BMW, 185 hp.)	215 From July 21, 1921	31 min.	10,000	812		demonstration		N. Y.-Philadelphia, N. Y.-Washington, Philadelphia-Washington, N. Y.-Hartford, N. Y.-Providence	
R. A. Northrup	Great Bend, Kans.	Field (leased). 622x1000. hangar, 48x34.	Good	1 Can. J.N (OX5)	100	15 min.	7,500	100	0	7.50		Gt. Bend to Hutchinson, Wichita, La-Crosse, Kansas City	.50

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Nevada Aviation Corp.	Reno, Nevada	Fields: Reno (Air Mail). Beowa, Nev. and Fallon, Nev., (private) and Yerington, Nev. (city). hangar, 30x40 at Yerington.	Shop at Reno, Nev.	2 J.N.-4-H. (W. Model A, 150 hp.)	500	15 min. up (cross country)	4,000	400	0	$15.00		Nevada	$1.00
Newport News Aero Club	Newport News, Va.	Field (leased) 40 acres hangar, for 4 planes.	Complete	1 J.N.-4-D. (OXX6) 2 Can. J.N. (OX5)	1,200	20 min.	24,000	500	Very little	10.00			.50 to 1.00
New York Aircraft Exhibition Corp.	Troy, N. Y.	Field (leased). small.	Good	1 Can. J.N. (OX5)	3,500	12-15 min.		120		10.00		Troy, Albany and vicinity	
Oakley & Askew Aerial Service	Ardmore, Okla.	Field (leased). 40 acres, 1 mile No. of Ardmore. hangar, 60x90.	Engine and wing work	2 Can. J.N.-4 (OX5) 1 L.S. Model E (W. 180 hp.) 1 S.J.-1 (H.S.L.-6, 220 hp.)	800	30 min.	27,000	1,000	0	5.00		Ardmore, Oklahoma City, Dallas, Ft. Worth, Texarkana, Wichita Falls, etc.	20.00 per hour
Oberlin Aircraft Co.	Oberlin, Ohio	Field (owned). 2 hangars, 80x100	Good	2 Can. J.N. (OX5) 1 S.J.-1 (Bn.) 1 J.N.-4 (OX5)	800	3 hrs.	5,000	400		10.00 & 20.00		North to South	
Oregon-Washington & Idaho Airplane Co.	Portland, Ore.	Field (leased). circular, 1300x700. 6 hangars, 1 water hangar (4 ships). office building.	Large shop, wood work and motor overhaul and testing bldg.	3 *Seagulls* (K.-6 and C.-6) 2 F. Boats (OXX) 3 J.N.-4-D. (OX5) 4 S.J.-1 (OX5) 2 Can. J.N. (OX5) 3 *Orioles* (K.-6) (4 spare OX5 and 1 K.-6)	2,000	30 min.	80,000	1,500	26,000 lbs. papers	10.00		Portland, Astoria, Seaside (daily), St. Helena, Rainier, Oregon City, Salem, Corvallis, Eugene, The Dalles, Pendleton, La Grande, Tacoma	Based on character of country
Parker Aircraft Co.	Perry, Iowa.	Field (leased). ground and basement. hangar, 45x50.	30x60	1 Can. J.N. (OX5) 1 J.N.-4-D. (OX5) 1 D.H.-6 (OX5)	263	16½ min.	3,450	247		5.00 to 10.00		Anywhere	.15
Sidney E. Parker	Lake Placid, N. Y., and Montreal, Can.	Dock at Lake Placid.		1 *Seagull* (K.-6) 1 504-K (LeR. 110 hp.) 3 504-K (Cl. 180 hp.)	1,500	25 min.	40,000	900	.	10.00		N.Y.-Montreal, Lake Placid, Burlington, Vt.. lake to lake in Adirondacks	.50
Penn Aero Corp.	Huntingdon, Pa. and Lancaster, Pa.	Field (leased). 1500x2000. hangar, 75x100.	Small repair shop	1 S.J.-1 (OX5) 1 J.N.-4-D. (OX5)	800	12 min.	10,000	700	500	10.00		Huntington to Lancaster	.50
Harold G. Peterson Aircraft Co., Inc.	White Bear Lake, Minn.	Field (leased). 30 acres. hangar, 66x66.	Shop, 50x16	1 Can. J.N. (OX5) 2 L.W.F. (C2X) 1 Sop., 3-seater (Cl. 130 hp.) 1 N., 2-seater (LeR. 80 hp.) 1 Scout, (Gn. 50 hp.)	600	30 min.	21,000	500	0	7.50			.50–1 .35–2
T. C. Peterson	Santa Ana, Calif.	Field (leased). 400x1200.	Temporary	1 P.S., 3-place, (OX5)	600	20 min.	12,000	1,000		5.00		San Diego, Los Angeles, San Francisco and intermediate cities	.50
Pioneer Aero Co., Inc.	41 Willow Ave., Plainfield, N. J.	Field (owned). 856x300. hangar, 42x42.		1 D.H.-6 (OX5)	100	1 hr.	7,500	50				Plainfield, Atlantic City and Hasbrouck Heights	
Robertson Aircraft Corp., Inc.	5248 Oakland Ave., St. Louis, Mo.	Fields (municipal). 60 acre Flying Club of St. Louis, 183 acres. 2 hangars, for 3 ships each.	Good. opposite municipal landing field	3 J.N.-4-D. (OX5) 2 J.N.-4-C. (OX5) 1 *Oriole* (K.-6) 1 St. (St. 140 hp.)	5,000	10 min.	35,000	1,000	3,000	.50 to 1.00	.35	St. Louis to Chicago, St. Louis to Kansas City, St. Louis to Memphis, St. Louis to Indianapolis	.50–1 .30–2
Rogers Aircraft, Inc.	Venice, Calif.	Field: Rogers Airport, Los Angeles (leased). 73 acres. 7 hangars, housing 22 planes.	Factory, 10,600 sq. ft.. complete repair facilities	4 P.S. (OX5) 1 P.S. (C.-1) 2 N. 28 (Gn. 160 hp.)	7,240	14 min.	101,360	10,860	0	5.00		Los Angeles and San Diego-San Francisco	.30
Roseswift Airplane Co., Inc.	Grand Rapids, Mich.	Field, 2700x2000. hangar, 50x100.	Work shop for repairing motors	3 S.J.-1 (OX5 and OXX6)	250	15 min.	6,000	150	0	10 00		Charlevoix, Ionia, Muskegon	.50
Basil L. Rowe	Sidney, N. Y.	Field (leased). 2000x500.		1 D.H.-6 (OXX6)	350	10 min.	5,000	500	0	10 00	.		
Runser & Turner	Columbia, So. Car.			1 504-K, 3-place (LeR.)			25,000	500	0	10 00 to 20 00		Throughout Southeastern States	.50
Foster Russell Aviation Co., Inc.	Spokane, Wash.	Field (leased). 800x2500. 1 hangar for 4 planes, 1 tent hangar for 1 plane.	Good	1 J.N.-4-D. (OX5) 1 S.J 1 (OX5) 1 S.J.-1 (K.-6)	3,075	10 min.	32,500	2,575	0	5 00 & 10 00		100 towns in Eastern Washington and Northern Idaho	.50
R. W. Schroeder	2276 Logan Blvd., Chicago, Ill.			1 S.J.-1 (OX5) 1 *Swallow*	18	1 hr.	1,500	10					

For abbreviations see page 1167.

Commercial Aircraft Operations in the United States, 1921 (Continued)

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
Seattle & Puget Sound Airway Co.	1519 3rd Ave., Seattle, Wash.	Terminal: Lake Washington, hangar.		1 *Seagull* (C.-6)	310	15 min.	5,800	620		$5.00			
Security Skycraft Co.	Aberdeen, So. Dak., Fargo, N. Dak.	Field (municipal), at Aberdeen, 100 acres.		2 S.J.-1 (H.S.) 1 S.J.-1 (OX5) 1 Can J N.	1,000	30 min.	6,000	980		10.00-2		Fargo, N. D., and Aberdeen, S.D.	.50-2 .40-1
Seery Aviation Co.	Sault Ste Marie, Mich.	Field (leased). 60 acres.		1 Can. J N. (OX5)	50	10 min.	1,500	40	0	10.00		Northern Michigan	1.00 or .60 round trip
Sheldon Air Line	Sheldon, Ill.	Field (owned). 1320x360, perfect approach.	Machine shop, spares etc.	4 J.N-4-C.(remodeled)(OX5)	700	15 min.	18,750	300	2,000	5.00			
Mac Short	Salina, Kans.	Field (leased). 40 acres.	Motor and plane overhauling	1 Can. J.N.-4-D. (OX5)	100 hrs.	2 hrs.	1,600	50	100	7.50	.75	Manhattan, Kans., Kansas City, Omaha, Lincoln, Wichita, etc.	.75 one way .50 round trip
Sierra Aircraft Co.	Pasadena, Calif.	Field (leased). Foothill Blvd., 3 miles E. center Pasadena, 65 acres. 3 hangars, 50-ft. doorways.	Good	1 S.J.-1 (K.-6) 1 J.N.-4-D. (OX5) 1 S.J.-1 (OXX6)	1,500	15 min.	30,000	1,200	0	5.00		Pasadena, San Diego, San Francisco, Fresno, etc.	.35 up
(Miss) Neta Snook Aircraft Co.	Huntington Park, Calif.	Field (Goodyear) (leased). 300 acres, hangar, 40x150.		1 Can. J.N. (OX5)	1,000	7 min.	6,000	183		5.00		Los Angeles, Venice, Beverly Hills, San Bernardino, Riverside, Alhambra	.50
Southern Aircraft Co.	Houston, Texas	Field (leased). 20 acres, adjoining field 150 acres, hangar for 8 planes.	Fair	4 Can. J.N. (OX5) 1 S.J.-1 (OX5)	1,000	30-45min.	20,000	1,200	Verylittle	7.50		All Texas and some Louisiana cities	.50
Southwest Airplane Co., Inc.	Tulsa, Okla.	Field (owned). 120 acres. 2 nangars (steel), 90x65.	Motor and wing and fuselage shop	1 S.J.-1 (K.-6) 1 Br. 3 J.N.-4-D. 1 C. Scout 1 *Oriole* (K.-6) 1 Can. J.N.	1,100	10 min. to 3 hrs.	25,000	1,500	1,000	15.00-2	Vary	Entire Southwest. Kansas City, Dallas, Houston, Oklahoma City, etc.	.50
Lawrence Sperry Aircraft Co.	Farmingdale, L. I., N. Y.	Field(leased).1800x2400, nangar (leased) at Curtiss Field.	Complete for manufacture and repair	1 Sp. Sport (Law. 60 hp.) Many 504-K (LeR. 110 hp.) (Detachable High Lift Wing)	612	25 min.	12,600	500	0			Farmingdale to Garden City, Washington, D. C. and Hampton Roads, Va.	
Standard Airplane Co.	Dallas, Texas	Field (leased). 100 acres.		J.N.-4-D.'s (OX5) J.N.-4-C.'s (OX5) S J.-1 (W.)	600	25 min.	16,000	900		5.00 & 10.00			.50
Marion Sterling	Waco, Texas	Field 25 acres, hangar.	Private	1 S.J.-1 (OXX6)	200	10 min. to 2 hrs.	7,500	100	Very little	5.00		Mexia, Dallas, Austin, etc.	.50
St. Louis Curtiss Airplane Co.	St. Louis, Mo.	Field (municipal). 1000x1500.	Limited	1 J.N.-4-C.	1,000	15 min.	15,000	1,000	0	5.00 & 10.00	.01¼	Within 1000 mile radius	.50 one way .30 round trip
St. Petersburg Air Boat Line	St. Petersburg, Fla.	Terminal (owned). 50x40.	Good	1 C.F. Boat (two W.) 2 J.N. (OX)	500	10-15 min.	7,500	450		15.00		Tampa, St. Petersburg, Key West, Havana and Coastwise	1.00 per min
Strubler Aero Co.	Colorado Springs, Colo.	Field (leased). 270 acres, hangar for 2 planes.	Very little	1 *Oriole* (C.-6) 1 A. (T.M.)	150	15 min.	2,000	300	0	10.00		Denver, Colorado Springs, Pueblo	.75 to 1.00 per min.
Tennant Bros.	Sioux Falls, So. Dak.	Field (leased). 40 acres, hangar, 30x50.	Private	1 J.N.-4-D. (OX5) 1 Can. J.N. (OX5)	1,600	10 min. to 1 hr.	20,000	1,500		5.00 & 10.00		Throughout So. Dakota, Western Minnesota and Iowa.	.60 min. 45.00 hr.
United States Aircraft Corp.	1803 3rd Ave., Spokane, Wash.	Field (municipal). 1000 acres, hangar, 100x50.	Machine shop, welding, all facilities	2 S.J.-1 (H.S.L.-4) 1 S.J.-1 (H.S.L.-6) (2 L. 12 hp.) (2 LeR.) (4 H.S. 97-A) (2 H.S.-A5A.)	500	40 min.	20,000	350	500	5.00 & 10.00		Spokane, Lewiston, Seattle, Kalispel, Eureka, Helena, Gt. Falls, Missoula, Wenatchee, Colfax	.30
Walter T. Varney	832 Post St., San Francisco, Calif.	Field (leased). San Carlo, 2000x6000, hangar for 15 planes.	Excellent. shop, 30x300	1 Br. 3 V. (W. 220 hp.) 8 V. (W. 150 hp.) 1 J.N.-4-D. School ship	6,000	10 min.	200,000	1,000		10.00		Los Angeles, Yosemite, Portland, Reno, etc.	.50 to 1.00
William Westlake	1446 Chase Ave., Chicago, Ill.	Field (leased). 50 acres, tent hangar.		1 J.N.-4-D. (OX5)	500	10-15 min.	7,500	500	0	10.00		Chicago, Evanston, Milwaukee	.60

Name of Company	Address	Air Port Facilities	Shop and Repair Facilities	Equipment	Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per Lb. of Freight	Operating Territory	Charge per Mile—Inter-city Flights
White's Aircraft	Des Moines, Iowa.	Field (leased), 80 acres. 2 hangars (portable.)	Complete repair shop	1 Can. J.N. (OX5) 3 J.N.-4-D. (OX5) 1 Sport Monoplane (own manufacture) (25 hp.) 1 Special Monoplane (St. 5A.)	215	10 min.	5,000	153		5.00 & 10.00		Anywhere. cross-country.	.25
Whitted Air Line	St. Petersburg, Fla.	Terminal (leased). 50x100. hangar (owned), 50x100.	Good	1 C.F. Boat 1 A.39-A. (W. 150 hp.) (two OXX6)	1,100	12 min.	13,000	1,250		10.00 & 15.00		Tampa, Clearwater, Pensacola	1.00 less 10%
Wittemann Aircraft Corp.	Hasbrouck Heights, N. J.	Field, 5000x8000. 800 acres. hangar.	Complete factory and assembly floor	5 D.H.-6 (OX5)	500	20 min. to 3 hrs.	7,500	200	0	Demonstration		Hasbrouck Heights and Washington. Hasbrouck Heights and Mineola	
Wood & Gallatin	2620 Main St., Buffalo N. Y.			1 S.J.-1 (OX.) 1 S.J.-1 (W. 150 hp.)	1,500	20 min.	50,000	1,600		10.00 & 15.00		Eastern States between N. Y. and Florida	.80–2 1.00–1
C. B. Wrightsman	Tulsa, Okla.	Field (Curtiss). Southwest Airplane Co.)		2 S.V.A.-9 1 S.J.-1 (OXX)		30 min.	25,000	50	0				
		Total terminals, 146, including 116 land, 30 sea, of which 16 were public.		Between 500-600	130,736	21	2,907,245	122,512	123,227	$9.00			

For abbreviations see page 1167.

London-Paris Air Services Compared

THE first year of subsidized British air services, ending in March, 1922, forwarded to the Department of Commerce by Commercial Attache Tower, shows the following results for the London-Paris route, where two companies, Handley Transport, Ltd., and Instone Air Line, Ltd., have maintained daily services, weather permitting.

BRITISH AIR SERVICES

	London to Paris	*Paris to London*	*Total*
Number of machines.	526	524	1,050
Number of passengers	2,989	2,709	5,694

The French competitors of these two services, on the London-Paris route, made more flights, but carried fewer passengers, the comparative figures being as follows:

FRENCH AIR SERVICES

	London to Paris	*Paris to London*	*Total*
Number of machines.	775	787	1,562
Number of passengers	2,043	2,380	4,423

The British companies carried sixteen tons of goods, and the French fifty-three tons between Aug. 1, 1921, and the end of February this year.

MESSRS. VICKERS and the Shell oil group have submitted a scheme to the British Government for using five of the lighter-than-air airships for a weekly passenger service to India and Australia, according to information forwarded to the Department of Commerce. The scheme is the outcome of investigations by Commander C. Dennis Burney, inventor of the paravane. A new carbureter which uses gasoline or oil combined with hydrogen is a factor that adds strength to the feasibility of the scheme, as this will allow the load of the ship to be increased 40 per cent.

A company is proposed with a capital of £4,000,000, of which £3,400,000 is to be used for the purchase of new airships. The Government is asked to give a subsidy to be divided between the three countries involved. The journey to Bombay will be reduced to 5½ days and to Australia to 11½ days, while the proposed fares would be £85 to India and £130 to Australia (£30 less than first class mail steamship accommodations).

Commercial Aviation in Hawaii

THE "Star-Bulletin" of Honolulu is favorably impressed with the possibilities for the successful operation of commercial aerial transportation in Hawaii, stating that the conditions, climatic and geographical, are ideal in this group of islands for an all-the-year airplane service. Storms of great severity are extremely rare, and each island offers its haven of peaceful, protected ocean water for seaplanes, which, of course, are the types of flying machines best adapted for inter-island service. It believes that the transportation of the mails, express and passengers should give to a commercial airplane service sufficient business to make the venture profitable and, if not at the outset, at least as soon as a period of successful operation convinced people of its practicability. Army and Navy airmen who have made many inter-island flights are virtually unanimous in the opinion that a commercial service is feasible.

MOTOR buses are being used by thirty-two electric railways in the eastern part of the United States, and motor buses with flanged wheels are being used by twenty-eight short line steam railroads.

Trend Toward Light Car in Belgium Aid to American Manufacturers

American cars stand second only to French in Belgian imports for 1921. Possibilities for installation of bus lines. Exceptionally strong construction necessary for trucks and buses. Use of the tractor is in its infancy.

BELGIUM was one of the pioneer nations in the automobile industry due to the activity and initiative of such concerns as the Fabrique Nationale des Armes de Guerre (better known in this country as "F.N."), Minerva, Pipe Metallurgique, etc.

The automobile manufacturers of Belgium are mainly devoted to supplying the demand of the domestic market. Their exports in 1919 were not phenomenal while in 1920 they amounted to 1199 automobiles, 539 chassis and 1707 motorcycles.

Some of the older concerns have dropped out of the ranks of keenest competition since the war, but there have been many new ones established in 1919 and 1920 to take their places. These concerns have done a moderate amount of business in spite of very strenuous foreign competition. Statistics show the following number of cars imported and exported in 1920 and 1921:

	Imports	Exports
1920	4460	1848
1921	4815	1141

The number of imports in 1921 and the countries supplying them in the order of their importance were: France (2223 cars), United States (846), Germany (824), Italy (661) and Great Britain far behind with only 57, although she absorbed the largest proportion of Belgian exports. Thus we see the United States slightly in the lead of Germany, but trailing France. Belgium has attempted to counteract the importation of cars from Germany.

Automobiles imported into Belgium have to pay a tariff of 20 per cent ad valorem; trucks, 12 per cent; motorcycles, 20 per cent; parts and accessories, 12 per cent; and tires, 15 per cent.

A general improvement took place in the industry during the latter part of last year and it is now understood that Belgian manufacturers are well booked with orders, principally for the domestic market. Minerva, for example, proposes to pay a dividend this year, for the first time since the Armistice.

The export trade has been handicapped, as a glance at above table shows, by increased customs duties or import prohibitions in foreign countries

Competition from Germany has been particularly serious. It is stated in the annual report of the Minerva Motor Company that the cost of labor works out to be about 25 per cent cheaper in Germany if the rate of exchange be taken into account. Recognizing this fact and with a view to equalizing German and Belgian prices, the government doubled the import duty on cars coming from Germany. Subsequent depreciation of the mark nullified the effect of this measure.

American manufacturers should note that light, inexpensive cars are favored. The three large Belgian manufacturers—Minerva, Metallurgique and F.N.—are now manufacturing light cars. Imported light cars, such as the Citroen from France and the Fiat from Italy, find a ready sale. British cars are not favored because they are too expensive.

When it comes to motorcycles the British machine is the most popular. Out of a total of 1677 motorcycles imported in 1921, 548 were British. French accessories like French cars lead in imports.

BELGIUM is a light car market. Her own manufacturers supply her with a large number of high grade, expensive cars but it remains for the exporter to supply the necessary light car demand.

For the first three months of this year exports of passenger cars from this country to Belgium have numbered 542. Of this total, 92 per cent, or 500 passenger cars, were priced under $800.

Export figures for this year evidence two things:

1. The demand for the light, inexpensive car.

2. An increase in the export demand.

The well organized system of main and light railways and trolleys coupled with the very poor and unsuitable roads near the industrial centers has given less encouragement to motor transport than found in most countries. This has been particularly noticeable in the case of bus transportation, but a beginning has been made with bus services in Antwerp and Brussels, while the municipal authorities of other districts have been approached with a view to the establishment of motor transport service as supplementing the vicinal railways.

Manufacturers will do well to consider the posibilities of such enterprises, bearing in mind that close co-operation with the local authorities and with the trolley and railroad services will be essential to the success of any scheme of this kind. Vehicles must be of exceptionally strong construction to withstand the effect of the badly paved roads. In connection with operating expenses, gasoline, tires and labor are relatively cheap.

The use of the tractor in Belgium is at present in the introductory stage. This is due to two reasons:

1. The conservative nature of the small farmers.
2. Land tenure being principally confined to small holdings.

Efforts are being made to increase its use. The 8th Exhibition of Agricultural Machinery was held in Brussels in February and a great variety of both foreign and domestic machinery was displayed. The Boerenbond of Louvain, an important agricultural co-operative society, is doing a great deal to improve agricultural methods and to introduce modern machinery.

Imports of American tractors have been greatly hampered. The policy of the Belgian government is to import tractors from Germany as a payment on account on claims of war damage and then supply them to the farmers. Obviously they consider it to their advantage to get what they can from Germany in the way of finished products.

The Best Service Facilities in China









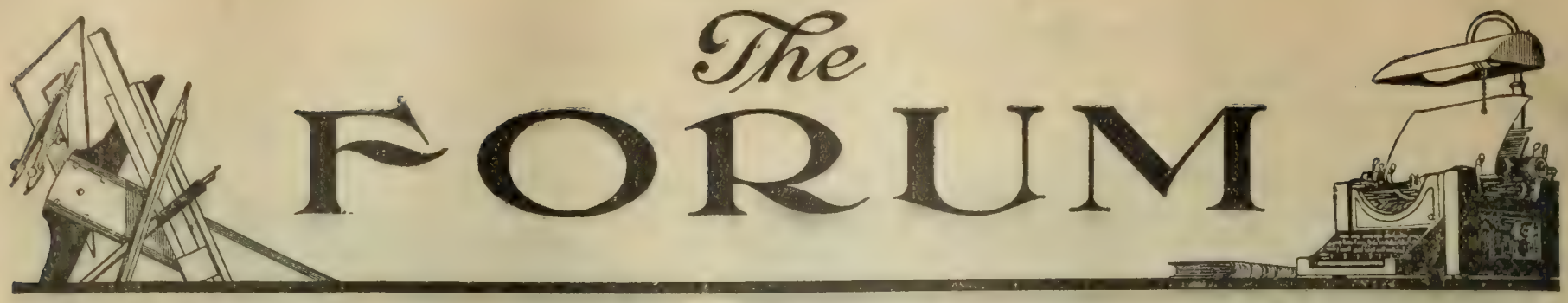






These garages are located in some of the larger cities in China. The pictures give the American manufacturer an excellent idea of the kind of service his cars will get in the Orient. For these photographs we are indebted to Arthur West, Editor, "Oriental Motor," Shanghai, China.

We like the picture in the upper right hand corner. We think it is symbolic. The stable and carriages occupy a major part of the stage, but the motor car is very clearly shoving its nose into the foreground.



Upson Says, "Complete the ZR-1"

Editor, AUTOMOTIVE INDUSTRIES:

My attention has been called to the editorial in your issue of May 11, "Can Airship Builders Walk Before They Creep?" (dealing particularly with the "ZR-1," now building at the naval aircraft factory) which I think deserves some further comment, if you will allow an individual's opinion a place in your valued columns.

With the first half of your editorial there can be no controversy. There is none, I hope, who does not welcome every possible opportunity of playing safe and still more safe. There is also no reason why a subject like this cannot be thrown open to discussion at any time when there is anything of interest to discuss. My further comments will be in line with your question, "as to the wisdom of continuing with the construction of so large a ship at such great expense as is involved, even though the investigation now requested shows that the design is based upon proper stress calculations and appears to be safe, so far as present engineering knowledge of the subject goes."

It is true that the British for the time being have entirely abandoned their military program of development along this line, but they have not abandoned the civil aspects of the subject. On the contrary, the British Government has done everything which should be most effective in developing and perpetuating a real lighter-than-air craft industry in the British Empire by offering all its present lighter-than-air ships and facilities practically free of charge to properly accredited civil enterprises. That they have had some difficulty in "putting over" this project has not been due to any lack of faith on the government's part, nor to any lack of vision in the ultimate future of airship transportation, but simply to the rather questionable value of the present military ships for use on commercial routes. To bring added pressure to bear, the British Government at one time ordered scrapped all present units, but before this could be put into execution business enterprise asserted itself and the order has since been suspended. Whatever may be the fate of the present ships, it is certain that airship development in England must and will go on, and the biggest contribution that can be made to military "lighter-than-air" will be the establishment of a going commercial industry.

Your assumption that the Germans deprecated the value of large airships for anything but military purposes is entirely wrong. The Zeppelin Company, who not only built the great majority of airships used in Germany during the war, but are generally recognized as the leading authorities on the subject, take quite the opposite view. They feel that the large airship is to become even more important from a commercial standpoint than from a military standpoint. The largest airship built during the war was one of approximately 2½ million cubic feet, yet the smallest unit which they would favorably consider for a trans-Atlantic route is in the neighborhood of 3½ million cubic feet, and technical considerations lead to the belief that airships will be still more economical in sizes greatly exceeding this for either *military or commercial use.* In fact, the very biggest factor for efficiency and economy is mere size alone.

The idea of starting military training with smaller units is of course perfectly logical. Personally I am in favor of doing all our experimenting and training with the smallest practical units, which of course is a relative term because the smallest practical "rigid" construction is much larger than any non-rigid ever built. But suppose we admit that the ZR-1, which our Navy is now building, is larger than necessary to fill its particular purpose. The Zeppelin airships, "Bodensee" and "Nordstern," have proved that rigid airships can be built and operated successfully, to a limited extent, in comparatively small sizes. The only purpose in making the ZR-1 smaller at this time would be to save expense, but progress on designs and material for this ship has already reached such a point that it is far easier, safer and less expensive to complete the ship than it would be to scrap all that has been done and start over again. There are other things about the ZR-1 project of which some of us do not approve, but I do want to say most emphatically that it will provide much valuable experience, that our Navy has been doing all in its power to make it safe and that it should be pushed through to completion without unreasonable delay.

R. H. UPSON.

The Permissible Proportion of Unsprung Weight

Editor, AUTOMOTIVE INDUSTRIES:

From information gathered from several firms up to the present, dealing with lorries and cars, I have drawn the conclusion that with pneumatic tires the unsprung weight should not exceed 15 per cent of the weight of the total loaded vehicle. With solid tires the maximum unsprung weight should not exceed 20 per cent of the weight of the total loaded vehicle.

Taking your case of the the 5-tonner, which weighs loaded 19,800 lb. and has unsprung weight, front and back, of 3925 lb., the unsprung weight in percentage to the load is about 20 per cent, the same as found here in England. Taking the case of your 5-pasenger car weighing, if I am right, 3000 lb. empty, but loaded 3750 lb., adding together the unsprung weight taken from the empty car, which is 7.75 per cent for the front and 15.8 per cent for the back, making together 23.5 per cent of 3000 lb., gives 705 lb. total unsprung weight, and 705 lb. divided by 3750 gives an unsprung weight of 18.8 per cent, which seems to me to be high as I thought that on the best of American cars it was considerably less than even 15 per cent.

The difference between 20 per cent for solid tires and 18.5 per cent for pneumatics sounds to me to be too small. The relationship of unsprung weight on the front to back axle is about the same as you have found.

I had an opportunity of weighing up a 1-ton Ford lorry, this weighed with the load 40 cwt., and the un-

sprung weight was 5 cwt., which is only 12½ per cent. This Ford was fitted with pneumatic tires.

I am writing this to make sure that I have understood your figures thoroughly. P. A. P.

The percentage of the unsprung weight on the rear axle of the passenger car was figured as follows:

Total weight of car empty, 3000 lb.

Rear axle unsprung weight, 15.8 per cent = 15.8 x 3000/100 = 475 lb.

Car weight on rear axle, 53.2 per cent = 53.2 x 3000/100 = 1590 lb.

Passenger weight on rear axle, 4/5 x 750 lb. = 600 lb.

Total weight on rear axle, 1590 + 600 = 2190 lb.

Percentage of rear axle dead weight = (475 x 100)-/2190 = 21.7 per cent.

In comparing this figure with others which have been obtained from manufacturers it must be taken into account that in the above two-thirds of the weight of the springs is taken as unsprung weight, and if the weight of the springs were counted as sprung weight—for which there would be a certain justification—it would make quite an appreciable difference.

It is quite possible that the average American passenger car has a somewhat greater proportion of rear axle unsprung weight than the average European passenger car, because practically all American cars have both service and emergency brakes on the rear wheels, which adds somewhat to the unsprung weight, and they also nearly all have wood wheels, which are somewhat heavier than wire wheels. In this connection it is worth while mentioning that an engineer who had investigated the possibility of reducing weight in modern passenger car design found that one of the best chances was in the hubs of the road wheels.

It is doubtful whether there is another car on the American market that has such a low proportion of rear axle unsprung weight as the Ford passenger car. The whole design of the rear structure seems to have been worked out with low unsprung weight ever in view. In the first place, the heaviest part of the spring is secured to the chassis frame and therefore sprung. By transferring the load from the spring to the axle as close to the wheels as possible, a very light axle housing can be used. Only the emergency brake is on the rear wheels, and this is of exceptionally small size. The wheels, too, are held comparatively light.—*Editor.*

Stresses Due to Transmission Brakes

Editor, AUTOMOTIVE INDUSTRIES:

In your article "Stresses Due to the Transmission Brake," printed on page 730 of the March 30 issue, you say that the strains on the transmission, due to braking and to low-gear pull, have both the same limit, viz.: the road adherence of the driving wheels, and that, therefore, their maxima would be the same.

Now that the transmission brake seems to be getting its chance in the United States, it is desirable that it be not handicapped by misunderstanding of its influence.

Since your article leaves out of account the influence of the transmission inertia, and especially that of the driving-wheels, and since thereby you arrive at a wrong conclusion, I feel sure that you will allow me to add the following:

The strain on the transmission is due to the road adherence of the driving wheels and to the inertia of the transmission, including the driving wheels, but this strain is limited: in speeding up, by the clutch capacity; in braking, by the brake capacity; at uniform speed, with the wheels locked by the road adherence.

Since these three maxima may and do occur, it is only safe to base calculations on the biggest of them, which, in general, will be that of the transmission brake. This strain may be a multiple of that calculated on the road adherence basis. That part of the full brake torque, which is not taken up by road adherence, is effective in retarding the transmission. Therefore, the transmission must be calculated to withstand the highest torque that the brake is able to exert. H. C. OLIVIER, A. S. A. E.

Conservative Airship Development

Editor, AUTOMOTIVE INDUSTRIES:

An editorial in your issue of May 11, page 1031, asks: "Can Airship Builders Walk Before They Creep?"; cites the ZR-2 disaster as an example of what might be expected when constructional ambition outstrips exact knowledge of involved stresses and the means to neutralize same; very pertinently questions the justification in continuing the construction of the ZR-1 ship now nearing completion in Philadelphia, and logically concludes—still questioning—"does it not involve unnecessary risk to attempt building an 'Old Ironsides' before a successful smaller ship of similar type has been constructed and flown?"

The writer is prompted to answer all these questions with an unequivocal and emphatic *yes*, and will not recant even should the ZR-1 (by some happy chance) be successfully completed and safely operated. The chances against such a consummation are too numerous and tragic to enlist any engineer's approval of the enterprise.

The writer is an aeronautic engineer, a balloon pilot, a designer and manufacturer of balloons, dirigibles, and airplanes, whose experience, theoretical and practical, has covered every step and development that has been made in aeronautics and aviation. And this knowledge has led him for years to advocate the very program suggested in your editorial. Although at present engaged in the manufacture of airplanes, he foresees a renaissance of the dirigible, and knows that it can be made a successful system of aerial transportation, if conducted along the sane line of development suggested by you, and provided—the vaulting ambition to produce "the biggest ship in the world" is curbed until the greatest constructional knowledge in the world can be combined with the most plentiful supply in the world of expert navigators and crews; men who will have seen years of service in small, large, and very big ships, before presuming to tackle a job like the "ZR" mammoths.

The writer has been pleased to see his views confirmed, and to confirm yours. JOSEPH A. BLONDIN.

THE Association of the Engineering Graduates of the Liege School, on the occasion of the seventy-fifth anniversary of its organization, will convene an international scientific congress at Liege, June 11 to 16 next. One of the sections will concern itself with reciprocating engines and will discuss the following questions: (A) Large internal combustion engines; (B) high-speed internal combustion engines: (1) study of the means to be employed for increasing the specific power of explosion engines (study of the fuel supply system and of the mechanical efficiency); (2) variable compression engines; (3) two-stroke engines (determinations of the conditions to be fulfilled to enable these engines to be applied to automobiles and aircraft); (4) carburetion; (5) use of vegetable oils in the colonies; (6) study of the super-compressor applied to aircraft engines; (7) application of Diesel and semi-Diesel engines to automobiles and aircraft; (C) compressors working at very high pressures. Other sections will deal with practically every phase of engineering.

Low Wage Scale May Not Mean Low Unit Costs

Fluctuations continually occur in wages. Proper quality and quantity work must be secured regardless of levels of pay. Mental and moral incentives more permanent and effective than wage considerations alone. Effect of money rewards on total unit cost not so great as commonly assumed.

By Harry Tipper

THE recent conference between President Harding and the heads of the steel companies at the White House, and the press notices regarding the twelve-hour day, which was discussed at that time, indicate that labor matters still have a bearing upon Washington's situation. The powers in Washington feel that there are many things to be ironed out if industry is to go ahead thoroughly. In some of the districts in the East where building has become very active in the last few weeks, bidding for workers of various kinds has already raised the wages beyond the union scale at present applying and placed them almost where they were at the wage peak in 1920. Indications come from other centers of bidding between manufacturers where there is a pronounced shortage of certain types of skilled labor and the consequent tendency for wages to return to their high levels, even though the union scale or the accepted scale is very much lower.

These items show the difficulty of depending upon labor prices to reduce production costs and the necessity for securing efficiency which will enable the manufacturer to arrive at a decent cost per piece regardless of considerable fluctuation in the wage scale rate. From time to time we have spoken of the general tendency for wages to retain new levels when these levels have been established and the very temporary character of any recessions therefrom. The events of the past few weeks show the ease with which the depressed prices for labor are changed in view of the slight shortage and the hope of continued activity.

It is useless for the manufacturer to blame the worker for high prices when he himself is willing to bid above the union or accepted scale rate in order to get his work finished. There is not much purpose in enforcing reduced wages, running through the difficulties of costly strikes and rearranging the cost basis for production only to have the labor scale advanced or manufacturers cease to consider it in hiring their own labor.

There has been no bidding between manufacturers in the automotive field for skilled labor as yet, but with the employment rapidly increasing and a shortage in cerain lines of skilled labor, it is not likely that any further recessions will occur and it is not unlikely that increases in the wage rate will have to be met.

THESE fluctuations put the problem back where it belongs and where it has always been centered, regardless of how the manufacturers consider it. The job of the able manufacturer in the matter of labor is to secure the proper quality of work in such quantity that the cost per unit of work will not be excessive in accordance with the sales price. The cost per unit of work is affected by a number of factors.

THE wage rate naturally has its bearing upon this, but it is not the only factor to be considered by any means. Turnover of labor enters into this because of the difficulty of adjusting an organization where the workers are being constantly changed and do not remain at work for any length of time.

The pace incentive is a very important element because there is a wide variation between the general pace established in different manufacturing shops and in different lines of work with different groups of workers. The variation in the average pace is frequently greater than the considerable variation in the wage scale and this variation has a direct effect upon the cost per unit of production.

The flexibility of the organization enters into the cost per unit because of its bearing upon the relation between the capacity overhead and the amount of work turned out. Factories which are operating with a rigid and non-flexible system of operation are less able to withstand a period of under capacity production because of their inability to reduce the cost of the organization in anything like the proportion required for the actual work turned out.

The character of the factory organization also enters into this problem because of its effect upon the accuracy, the amount of rejected work, the promptness and dispatch in connection with shop orders, routine records, working drawings and similar items of factory requirement.

In many of the large factories the organization has had a tendency to grow more rapidly from the standpoint of system than the requirements of the factory would suggest, and, as a consequence, there is a burden of over-systematized operation to be carried in connection with each piece of work done in the factory.

Many manufacturers believed that when wages worked up in the latter part of 1920 and the beginning of 1921 the production problem was largely solved by the cutting of the wages and the increase in the production efficiency. The present activity is already showing a shortage of skilled laborers in many lines. The incentive to increased efficiency will be slowly discarded as the activity is maintained and the demand for the increased rate will be met from time to time as the necessity for more production becomes apparent.

We have maintained in these articles that the influence of the wage rate on production costs was of a questionable value because of the inability to maintain wage rates at a given scale and, therefore, to maintain labor costs from that standpoint. The influence of the other elements in the effect upon the total labor cost in production remains the most important, and these elements are distinctly associated with the character and type of organization in the factory, the wisdom of the personnel work and the general development of the proper degree of understanding so that they are actually under the control of the individual manufacturer more fully than the wage rate.

In those districts in the Eastern section where contractors are bidding against each other for labor so that, unfortunately, the prices paid are equal to the peak prices of 1920, the costs of buildings are not materially less than they were at that time and cannot be lessened except by other means of increasing the efficiency of the labor effect.

The same thing is likewise true all through the industrial system as the activity becomes greater or is maintained at its present pace. The reduction of costs is imperative, if industry is not to be limited in its advance by its own inefficiency. This reduction of costs must come from more effective ways of dealing with labor and not from the arbitrary fluctuations of the labor scale.

Reputation of American Automotive Products Makes for Sound Export Business

FAIR prospects of a steady growth of the motor trade in southern Rhodesia are reported by F. Fisher, British trade correspondent at Bulawayo. The American proportion of import trade is particularly large. In 1919 the value of American cars and parts imported amounted to $160,526, and in 1920 this was increased by $492,800. The value of American motorcycles imported in 1919 was $15,930, while in 1920 the value was only $11,670. England, however, increased her motorcycle trade in Rhodesia, for in 1919 her import amounted to but $10,730, and in 1920 it rose to $37,945.

Another item reflecting the prosperity of the province concerns farm implements, which in 1920 showed an 84 per cent. increase over 1919.

COMMERCIAL ATTACHÉ ARNOLD reports from Shanghai to the Bureau of Foreign and Domestic Commerce that motor car and tire dealers of China are showing a tendency to standardize on American sizes of tires, and that practically every dealer is instructing his manufacturers to equip any cars shipped to China with American sizes. At present European sizes, known as "millimeter clinchers," of every size are in use, as well as American types of both the clincher and straight side of inch sizes.

The Bureau also has received a report on the use of spark plugs at Tsingtau, where practically all cars are of American make. The plugs also are practically all of American manufacture, except for one British plug, the "Lodge."

THE rubber goods trade in Germany has flooded the markets of Switzerland, according to a report from Con-Willrick, St. Gall. During the period of the late war German goods grew scarce, British goods generally taking their place. Some American firms also were successful in introducing their products and even established agencies in Switzerland. Most of these have been closed again and those remaining specialize in automobile, motorcycle and bicycle tires. American tires, being considered at least as good as other makes, are in fair demand.

THE large proportion of American tractors now being used in Poland should be helpful in increasing the sales of American implements and tractors in that country, states a cable to the Agricultural Implement Division of the Department of Commerce.

A census of tractors in Poland, just made, shows that there are 1300 tractors in use, of which 1204 were imported. Of that number 1055 were imported from the United States and represent ten different American makes of machines. Practically all tractors imported have been shipped in within the past three years. All machinery of every type, during the war, was destroyed.

Next to the United States, Austria has supplied the largest number of tractors. Of the 45 originating in Austria 25 were Austrian built and mounted in Poland. Germany was third with 37 tractors, Finland fourth with 30. Czechoslovakia, Italy and England furnished a number of tractors equal to that from Germany. Some of the American tractors now in Poland are war-time stock, purchased from Italy and other allied countries. The type which seems to be in greatest demand is a wheel tractor of 10-25 hp. Of the 1300 machines in use, 1290 are wheel type machines, the other ten being track-laying types.

AUTOMOBILE and bicycle tires constitute the principal articles of rubber goods imported into the Aleppo district, though on account of the disturbed political conditions and the limited demand for transportation facilities, the market for tires is far from good. There are about 140 passenger cars and 55 trucks in the district. Seventy-five per cent of the tires in use are of the inch clincher type, the balance being metrics. Fabric tires are preferred because of the lower initial cost and represent 85 per cent of the tires used. American tires enjoy the greatest sale because of the high quality and low cost. The garages buy both direct and through commission agents. Terms are usually 25 per cent down, balance against documents. As the roads are very poor the annual tire consumption per car is much greater than in the United States. Red inner tubes are preferred.

THE extremely high cost of transportation of gasoline into the interior of the Belgian Congo, largely due to tsetse flies, which make it impracticable to use animals for transporting goods and necessitate the use of native porters, led the Belgian Colonial Ministry to organize a trial of road tractors using palm oil as fuel. The results of these trials gave full satisfaction. The semi-Diesel two and four-cycle engines ran normally on the palm oil, and the power developed was equal to if not greater than that obtained with kerosene. Nothing was noted that suggested possible difficulties in using palm oil in these engines. Starting up, without gasoline injection, was good, and there was no carbonization.

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That Luxury Argument

A PROMINENT banker and economist stated recently that he was much surprised at the rapid recovery of the automobile industry, for he did not think that it was justified by general business conditions. He had concluded that it was due to the fact that the automobile is now an accepted need in the daily life of Americans as is the telephone.

The bathtub and the telephone have been at certain times in the history of our country considered luxuries which should not be encouraged. Such an attitude is inconceivable now. It is probable that the automobile will soon be as readily accepted in the scheme of life as previous innovations. Indications are that it is very near that point. The argument that automobiles are a luxury is growing weaker.

Discussions about the future of the industry often revolve about the subject of the saturation point as if it meant disaster or a sudden slowing down in production. Probably it is not always realized that if such a point were possible to be reached that the industry would still be one of the biggest in the country.

When the industry approaches the point where further increase in production depends on an increase in population the automobile will be an accepted universal necessity and—well, automotive executives and engineers will still have their problems.

Mixed Fuels—Reasons for Their Popularity Abroad

IT will have been noticed that abroad, whenever the substitution of other fuels for gasoline has been proposed, the substitute usually has been a mixture of a number of simple compounds of entirely different derivation. For instance, the German standard fuel is a mixture of tetraline, alcohol and benzol.

The question naturally arises—if gasoline is to be done away with, why not adopt some other simple fuel, the one which possesses the most merit?

There are several reasons for the use of compounded fuels. The chief one undoubtedly is that none of the possible substitutes is available in sufficient quantity to meet the requirements. Alcohol could be produced in sufficient quantity if the matter of cost could be neglected, but this is not the case, as the very object in replacing gasoline is to cut down the expense. To supply pure alcohol for a portion of the automotive apparatus in the country, leaving the rest to be supplied with other fuel, would not be a practical plan, because it would greatly increase the difficulties of distribution. To take full advantage of the possibilities of alcohol it would be necessary to design the engines specially for this fuel, as a much higher compression is required and the conditions of vaporization also are different than with the present day gasoline.

In making any change in the fuel marketed, the limitations of the automotive equipment already in existence must be taken into account. Evidently it is this consideration which decided the French, in looking for a national fuel to limit the alcohol admixture to 10 per cent. The original plan, it seems, was to develop a mixture all of the components of which were of native production, and the use of a half mixture of benzol and alcohol was contemplated. But the conclusion seems to have been reached that it would be absolutely impossible to secure enough of this mixture at a price at which it could compete with gasoline to supply the needs of the automotive field. Gasoline, therefore, could not be dispensed with, at least not for the present. A limited quantity of alcohol can be produced comparatively cheaply, largely as a by-product of other industries, and to create a market for this by-product the 10 per cent mixture is proposed as a standard fuel and its compulsory use urged. It is evident that the properties of such a fuel cannot differ much from those of straight gasoline, and no difficulty need be anticipated in connection with its use in equipment designed for gasoline.

From the standpoint of the American automotive industry the adoption of substitute fuels in foreign countries is a fortunate thing, for it will relieve somewhat the competition for petroleum fuels.

Looking Ahead

BUSINESS conditions in general have accelerated considerably during the last month. All industry is not yet on a level with the automotive industry, but steady gains have been made all along the line. This generally increased activity of business will enable automobile manufacturers to keep their production schedules very near to capacity during the month of June.

Permanent prosperity in this country will depend largely upon the stabilization of European conditions. Europe is the normal consumer of our excess products, especially raw materials, and until it is able to buy in its usual volume our domestic market will not be thoroughly stabilized.

Foreign trade increased last month, however, while exchange has been strong, many of the important exchanges holding to high levels. The promise of an early settlement of the question of German reparations is having a steadying effect. The world winter wheat crop is in good condition. Reports from Central Europe are specially favorable but warmer weather is needed in France and Great Britain.

This definite trend toward increased foreign business and greater industrial stabilization in foreign countries indicates a sound basis for continued revival of business in America. The fundamental return of sound conditions, moreover, will have a particularly favorable effect on the truck market during the last months of this year, since the farmer, more than any other producer, is dependent upon European stability for continued prosperity.

The South is likely to be the weakest buyer of automotive products during the next month. Heavy floods and adverse planting conditions in the cotton belt indicate the possibility of a cotton crop below normal. Retail sales have been excellent in the West and conditions point to a continuance of favorable buying in that section.

The continuance or settlement of the coal strike will have considerable bearing upon conditions in certain sections and industries. Some of the larger manufacturing plants will undoubtedly begin to feel the pinch of lack of fuel within the next thirty days, unless the strike ends or current supplies are increased in some way. A continuance of the coal strike, however, is likely to affect automobile productions more seriously than automobile sales demand during the next quarter.

Unemployment has materially decreased and is a thing of the past so far as the automotive industry is concerned. In certain instances there is serious competition for labor already, and possibilities of rising wage rates are looming up because of this labor demand.

The money market is good. Comparatively easy rates prevail. No money stringency has yet developed, despite the greatly increased industrial and commercial activity. This is resulting in greater facility in financing automotive sales.

All previous building records were shattered during April, and activity was continued during May. Car loadings increased during May, while iron and steel output showed another gain.

There is a definite feeling evidenced by executives in every line of industry that business is now definitely on the upgrade. It was noticeable, however, that the executives gathered at the U. S. Chamber of Commerce meeting two weeks ago were saying that "Business has turned the corner," not that "We are back to capacity production," as the automotive industry has already been able to state.

Thus it appears that some hesitation in automobile and truck production is likely during the third quarter. Conditions at this time, however, indicate that the hesitation will be comparatively slight, far less than could have been predicted with confidence two months ago. The continuance of steady but conservative buying and sane production plans will insure the automotive industry against any shock.

Another Big Month Predicted for June

Orders Continue to Flow into Plants—Second Quarter May Set Record

By JAMES DALTON

NEW YORK, May 29—Most passenger car companies have endeavored to speed up operations in the final week of May in an attempt to establish new production marks and offset the loss of output on Memorial Day. June will bring no sharp slackening of activities for a flood of orders still is flowing into the plants. If the second quarter is not the largest ever recorded for passenger car production it will be close to it.

Less than a month ago it was generally expected that the third quarter would bring a decline in sales but the industry now is becoming confident that there will be only a seasonal falling off. Some makers feel that the third quarter will be about on a par with the second. The results will depend largely upon the farm market and conditions in the south. There are strong indications of large sales in the agricultural sections when the harvests begin and there already is considerable demand in these districts.

Truck Production Increasing

Truck production is increasing month by month although improvement has not been as spectacular as in the passenger car field. Sales are likely to increase steadily until November, at least. More farmers than ever before are considering the purchase of commercial vehicles and many of those now in operation will be replaced as soon as possible.

Practically all parts plants are operating at capacity and a considerable proportion are employing day and night shifts. Sales in April showed a gain of 20 per cent over March and May probably will record another equally large expansion in business. Some vehicle manufacturers still are handicapped by a shortage of essential parts and materials.

Closed Car Demand Grows

Nearly all large passenger car producers report a steadily increasing call for closed models. Several new models or additions to established lines have been brought out recently and more are in prospect. If there is any tendency for demand to slacken in the early fall, new models are expected to revivify it.

(*Continued on page* 1187)

Business in Brief

NEW YORK, May 29—Optimism in larger measure features reports of business and industrial conditions in all sections of the country. A survey of the Middle West shows that conditions are better than at any time in two years.

The improvement applies generally to trade, industry and crops. Improvement has not been uniform but it has been almost universal. Retail buying and jobbing distribution have shown most progress in the Western surplus grain producing states.

Perhaps the most encouraging reports relate to the crops. They show much lost time made up, especially in corn planting; further improvement in winter wheat; good reports from hay and pasture lands and a good if late start for spring wheat. Cotton is late getting started.

Steel mills are well filled with business for the next two or three months. Freight car orders now have reached a total of 75,000 for the year. A few plants plan to increase their capacity. Production of steel ingots is at the rate of about 38,000,000 gross tons a year compared with 35,000,000 tons on April 1 and 20,000,000 tons in December.

Freight car loadings have increased, great activity in building continues, and the strength of raw textiles continues to be a feature of interest.

Employment reports are favorable, although the coal trade and the cotton manufacturing industry in New England show little gain. Shoe factories are fairly active except in New England where there are labor troubles.

Stocks are irregular, bonds firm and sterling steady.

Bank clearings for the week ending May 25 aggregated $6,866,225,000, a loss of 1.6 per cent from the previous week but a gain of 21.7 per cent over the same week last year.

WINS LE MANS FUEL TRIAL

PARIS, May 29 (*By Cable*)—A new model overhead valve Citroen four passenger car won the LeMans fuel consumption trial, covering 100.5 miles with an allowance of 1.49 gallons of gasoline at a minimum speed of 25 m.p.h.

DIRECTS A. E. A. FOREIGN TRADE

CHICAGO, May 30—A foreign trade committee composed of the following has been appointed by the Automotive Equipment Association: S. D. Black of Black & Decker Co., Baltimore, chairman; N. H. Oliver of Metal Specialties Manufacturing Co., Chicago, vice chairman, and F. B. Caswell, Champion Spark Plug Co.

Wing Firm to Make Car Gunn Designed

Incorporated for $10,000,000—Product Now Known as "Canadian" in Canada

BINGHAMTON, N. Y., May 26—The Wing Motors Corp. is incorporated under the laws of Delaware for $10,000,000 to establish a plant in the city of Binghamton for the manufacture of the Wing automobile, the principal feature of which is the front spring suspension, two springs being placed transversely across instead of in line with chassis. A Continental six cylinder motor is used and other parts are standard.

The car is designed to sell for about $1,800. Two million shares of stock are preferred stock of $100 per share par value, and 800,000 shares common stock without par value. The officers are: William Lorimer of Binghamton, formerly of Detroit, president; Philip Hamlin of Binghamton, previously of Denver, Chicago and New York, and former executive of the American Telephone & Telegraph Co., senior vice-president; Albert E. Fowler of Binghamton, formerly of Detroit, secretary; Edward G. W. Ferguson, previously New York broker and formerly with the Harriman Bank, vice-president in charge of finance. Brown and Swartwood of Johnson City are the attorneys.

No Stock Yet Issued

Lorimer and Hamlin are to be directors, with Isaac F. Pearsil of Brownsville, Pa., and four Binghamton men to be chosen later. No stock has yet been issued, and the site of the plant has not been selected, although negotiations are pending for the $500,000 Hires tin can plant owned by the Nestles Food Co. in this city. The designer of the car is Earl G. Gunn, formerly chief engineer of the Packard Motor Car Co. A company already has been organized in Canada to manufacture the car under the name of the Canadian.

American Car Takes Over Carter Carbureter Plant

ST. LOUIS, May 29—The plant of the Carter Carbureter Co. in this city has been taken over by the American Car & Foundry Co. and will be operated as its carbureter division. Sales and service will be handled by a separate company known as the Carter Carbureter Corp., with headquarters at the factory.

Hugh H. C. Weed, who was in charge of the old company, will also be general manager of the Carter Carbureter Corp. and will have associated with him practically all the old Carter organization, including G. M. Bicknell as chief engineer, R. H. Herron as field engineer and H. S. Staton as sales manager. C. E. Burg will represent the company on the east coast, with headquarters in the offices of the American Car and Foundry Co. at New York and V. G. Lowenstein will cover the middle west.

Special Equipment Demand Increasing

Buses and Trucks Form Good Part of Business of Milwaukee Manufacturers

MILWAUKEE, May 29 — Pressure upon manufacturers of automotive parts and equipment by passenger car builders in all production centers continues to increase as the result of the intensive effort made by the industry to bring car output as close as possible to demand. The car factories in this center and vicinity are working hard in this direction, but unfilled orders have shown a further enlargement in the past week.

In the motor truck industry, manufacturers here have adopted a much more optimistic attitude than they have had for about two years, as the result of a better response to the merchandising efforts of truck dealers everywhere. The motor bus is taking a prominent place among the principal sources of demand, while the call for special equipment, such as trucks with dump bodies, hoists, etc., for purposes like highway construction, general building construction and fuel hauling is also reaching a high level. Some factories are doing more business in the more specialized equipment than in standard, commercial trucks for commodity transportation.

Tractor Situation Better

There have come to notice no particularly striking instances of marked development in tractor and power farm operating equipment manufacture, but the situation is steadily growing better. Jobbers and dealers are engaged in strong effort of a general sales promotion nature, in addition to current selling, the former having special reference to the time when the farmer will be better fortified in a financial way.

Manufacturers in all phases of the iron, steel and machinery industries are exercising rather unusual caution, especially in preventing inventories from becoming over-balanced, in order that they may avoid disastrous experience of the past. This has developed a situation in which production frequently is temporarily restricted by inadequate supplies of materials of all kinds, but usually it is possible to overcome this condition without serious interruption.

Local Sales Good

The month now ending takes rank as the most satisfactory in the last 18 to 24 months in respect to the volume of sales of passenger cars made by dealers in Milwaukee and generally throughout Wisconsin.

MOONEY MEETS PLANT HEADS

DETROIT, May 29—J. D. Mooney of New York, vice-president and general manager of the General Motors Export Co., conferred with plant managers in this district this week preliminary to his departure on a business trip to South America. Export business in the past five months has doubled that of the same period last year, he said. He noted that the tariff zone made up of countries of western continental Europe, including Scandinavia, which recently was at the bottom of the list in volume of sales, has advanced to a point where it now leads all the markets of the world with the exception of America.

Lower Freight Rates Will Help Business and So Benefit Truck Industry

By DON F. WHITTAKER,

Manager of the National Association of Motor Truck Industries

Detroit, May 29.

REDUCTION of freight rates by the railroads on July 1, as decreed by the Interstate Commerce Commission, should prove to be an important stimulus to general business, and as such will react favorably to the motor truck interests. A reduction has been expected for some time, and though somewhat smaller than expected, it is, nevertheless, important to general business.

Consideration of the effect that lower rates would have upon the motor truck business has led to the belief among truck makers that the change would be favorable. There will be some slight loss of business in some sections to motor truck operators, but this will be more than compensated for by the increased business that motor truck operators will get as railroad business revives.

The new railroad rates will be lower than the cost of hauling by motor truck only in some of the more congested manufacturing districts of the country, but even there the truck rates, including the door-to-door pick-ups and deliveries, should be lower on the whole than the rail cost. Then there is the time element to be considered, which is vastly in the favor of the truck.

The industry will be directly benefited by the savings on shipments of parts and material, and dealers will be able to offer trucks for sale at a price lower than present prices with war tax and freight included. All of these factors will make for increased business in the truck field. Manufacturing is continuing to gain steadily in volume and indications are that it will continue to do so.

Szarvasy Coming Here for Dunlop Financing

BUFFALO, May 29—F. A. Szarvasy, chairman of the board of the Dunlop Rubber Co., Ltd., is on his way from England to arrange new financing for the American Dunlop Rubber Co. Sir Eric Geddes, a brother of the British Ambassador, has been elected a director of the British company.

The statement is made by Samuel B. Botsford, a Buffalo attorney, who has just returned from England, that British officers of the Dunlop company are very optimistic regarding the future of the Buffalo plant. This tends to confirm reports recently received here that the new plant in this city may soon be in operation.

Botsford said that the new Dunlop tire plant at Birmingham, England, is producing on a large scale and that the company employs 15,000 workers in its English factories.

NO DUTIES TO HONDURAS

WASHINGTON, May 27—The tariff division of the Bureau of Foreign and Domestic Commerce has been notified that automobile and automotive equipment will continue to be admitted into Honduras without import duties.

Sales in Southeast Point to Normalcy

ATLANTA, May 29—Automotive sales conditions in the southeastern territory have improved so rapidly during the past six weeks that a majority of the dealers and distributors are of the opinion that the periods of business depression has now definitely become a thing of the past. All signs indicate returning normalcy, and with some dealers business now is even better than normal.

The Atlanta branch of the Ford Motor Co. reports the past two months the best in the history of the branch, and practically all of the Ford dealers in the larger cities of this section are from two to four weeks behind with their orders. The Atlanta branch of the company is now building an average of 100 cars daily but cannot keep up with demand. The larger Atlanta Ford dealers, A. L. Belle Isle, the Beaudry Motor Co. and David T. Bussey, all state that they are weeks behind in filling the orders now in hand.

In Florida practically all makes of cars are in excellent demand, with gross business appearing to be about 10 per cent better than it ever has been.

The Atlanta branch of the Buick company reports the sales volume having increased more than 200 per cent the past six months.

Registration figures for Atlanta alone, including new and used passenger cars and trucks, were 440 during the week ending Sunday, May 14, and 520 during the week ending Sunday, May 21. This is several hundred per cent better than registrations of five or six months ago, indicating a rapid and steady improvement in automotive sales in this section.

Territories Combed in New Sales Plans

Present Rush of Ford Business Due to Thorough Canvass of Country

DETROIT, May 25—Sales plans as being developed by leading companies in the Detroit district will result within the next year or two in the establishment of merchandising systems which will control very definitely the problem of reaching the prospective buyers of cars.

Such systems, though long regarded as necessary to insure the solidity of the industry as a whole, were compelled to await the arrival of a long period of depression before they could be worked out and tested at length. The recent period presented the opportunity, and the present season is witnessing their successful demonstration.

Ford at Highest Production

Ford Motor Co. officials, with the factory working at the highest production pitch it has ever known to keep pace with demand, ascribe the present rush of business to a thorough sales canvass made throughout the country in the dull period of last winter. At that time the sales force in every section was assigned the task of getting a definite idea of sales prospects, especially in the farming districts.

Sales to-day are said by officials to be really sales made during this canvass. Dealers were given exact knowledge as to where sales might be expected and were enabled to place their efforts where they would be most effective. There is nothing "chancy" about the business that has developed, though that it has been heavier than was expected even by the Ford interests is shown in the fact that the factory is working six full days weekly where it had been planned to adopt permanently the five day week.

Studebaker Has Similar Methods

Throughout its business career the Ford company has been benefited materially by the numerical strength of its dealerships and also by the extensive sales staffs that have always been maintained by its dealers. By the adoption of similar methods the Studebaker company has risen to a foremost place among the medium price car makers.

Though both the Ford and Studebaker distribution is handled through the branch system, those factories which depend on distribution for the turnover of their product are coming out for increased dealerships and more salesmen. Territories formerly held by one distributor are being divided into many smaller sales sections with a dealer on the spot to keep in immediate touch with the district.

Recently General Motors has gone in energetically for the subdivision of territories and the placing of dealers at points where the volume of sales was not considered up to possibilities. An intensive system of covering a territory is being developed by the advisory staff through the medium of one of its Detroit branches, which when perfected will be recommended for standard practice by all dealers handling General Motors lines.

Under this system every listing of residents compiled for any municipal, national, business or other reason will be consulted and analyzed for information which will be helpful in promoting sales. Dealers will be instructed in the lists to consult, how they may be obtained, the analysis of them, and how to use the information which they may be found to yield.

FARMER BIG FACTOR IN OVERLAND SALES

TOLEDO, May 29—Records of the Willys-Overland Co. show that purchases of Overland cars by farmers in April were almost double the purchases by any other vocation. Salesmen, laborers and merchants ranged next in order, each group taking approximately the same number of cars. Clerks followed in fifth place, with approximately one-quarter as many cars as were purchased by farmers.

Another fact brought out by the analysis of sales is that more than one-third of all Overland cars purchased this year were bought by persons who never owned a car before.

Former Cotta President Is Not Liable for Debts

ROCKFORD, ILL., May 31—T. D. Reber, former president of the Cotta Transmission Co., which failed, will not be liable for the debts of the corporation, according to a decision of Judge R. K. Welsh in the case of the Belvidere Screw & Machine Co. against him. The court held that Reber did not assent to the contracting of debts by the company over and above the capitalization, and, therefore, could not be held liable for debts in excess of the capital stock.

The court also ruled that Reber could retain the salary he drew in 1919 and the preceding years but must return the salary paid to him in 1920. He drew $5,000 per annum. This sum will be made part of the assets and will be distributed among the creditors.

MOSLER ASSETS TAKEN OVER

NEW YORK, May 29—The assets of A. R. Mosler & Co., which has been in the hands of receiver for a year and a half, have been taken over by a new organization. The plant at Mount Vernon will be operated hereafter as the Mosler Metal Products Corp. In addition to the line of spark plugs which the company always has made, several automobile accessories will be added as well as a full line of radio equipment.

Fisher Takes Over Old Cadillac Plant

Will Enter Field of Custom Body Building on Large Scale

DETROIT, May 29—Fisher Body Corp. has taken over the former Cadillac plant on Cass Avenue, where it will extend its present body manufacturing operations and enter, for the first time on a large scale, the field of custom body work. Offices for the sale of the custom work will be opened in New York and Chicago. The plant contains 650,000 sq. ft. of manufacturing space and will employ 2000 men.

The purchase of the plant also includes the section taken over by R. H. Collins, following his resignation as Cadillac president, which was intended to be the manufacturing site of the proposed Collins car. Following the purchase by Collins and associates of the Peerless company, Cleveland, the Detroit holdings were placed on the market. Collins still maintains, however, his home at Grosse Point.

In a statement indicating the proposed Fisher plans, Fred Fisher, president of the company, said a number of leading body designers had been engaged who will specialize on fine work. Workmen for the new plant will be selected from the 20,000 men now employed in the several Fisher plants in the city.

Recent Truck Executive Will Head Arrow Motors

SANDUSKY, OHIO, May 26—A. C. Burch, former president of the Signal Motor Truck Co. and later vice-president of the Clydesdale Motor Truck Co., will be president of the Arrow Motors Co., recently incorporated, which took over the assets of the Maibohm Motors Co. The other officers will be Sandusky business men. The directors will include R. E. Hayslett, treasurer of the Hydraulic Steel Co. of Cleveland; E. G. Kirby, vice-president of the Commerce-Guardian Trust & Savings Co. of Toledo, and N. T. Brotherton, president of the Brotherton Co., Detroit.

While creditors have a large interest in the new company, Sandusky stockholders retain important holdings and will have a majority on the board of directors. It is asserted that stockholders who did not go into the new company will lose their investment. More than 80 per cent of the creditors agreed to the reorganization plan, and the property was bid in by Kirby as the representative of a creditors' committee.

LOWER FEES HIS PLATFORM

DAVENPORT, IOWA, May 29—Walter C. Ramsay, secretary of state, candidate for re-election, is making his platform upon advocacy of a 33 1/3 per cent reduction in licensing motor vehicles.

Tire Makers "Wait" in Price Situation

Watch Each Other Following Moves Made by Seiberling and Goodyear

AKRON, May 27—Although tire manufacturers in Akron and vicinity are trying to minimize reports current for some time to the effect that a tire price war was impending, the introduction by the Goodyear Tire & Rubber Co. of a new cross-rib cord tire to sell at nearly 25 per cent below the standard cord tire market lists, and the announcement by the Seiberling Rubber Co. of a blanket 12½ per cent price slash on Portage and Seiberling straight side tires, on top of the price revisions made by Seiberling the first of May, admittedly have caused an upheaval of no small proportions among tire manufacturers and have upset carefully worked out programs for an anticipated upward revision of tire prices.

Regard New Tire as Price Cut

The new Goodyear line of tires was introduced at a psychological time to thwart the plans of competitive companies, for announcement of tire price increases about the first of May. Introduction of the new line is considered tantamount to a price cut, in view of the fact that the new cross-rib casings will sell at from 20 to 25 per cent below the standard lists of the Goodyear All-Weather tread cords and of most other standard cord tire makes.

Almost simultaneously with the Goodyear announcement, Frank A. Seiberling, who founded Goodyear 23 years ago in a dilapidated straw board box factory in East Akron, revised his prices on Seiberling cords down to the standard market lists, and put into effect a ten per cent cut on all Portage tires.

The combined action of Goodyear and Seiberling has forced a change in the plans of other rubber companies, which are known to have had new price lists drafted and ready for the printers. And these new price lists embodied substantial increases.

Abandoned New Tire

One Akron company feverishly developed a new tire to sell at prices competing with the new Goodyear tire. It was submitted to hurried tests and then it was discovered that the tire was too good to sell for so low a price, and that it could not be profitably marketed to compete with the lower priced casings. Realizing the futility of putting another high grade and high priced tire on the market, the company has about decided to abandon the new tire completely.

The Amazon Tire & Rubber Co. has put out a new cord tire to sell at fabric prices. Firestone has increased the dealers' marginal profit and has made a slight reduction to the consumer.

Officials of other companies here decline to comment upon the Seiberling price cuts or on the new Goodyear line. Yet each is watching the other—alert for new developments in the price war and waiting for the other fellow to make the first move. In other words it is the old "Watchful waiting" lid clamped down upon a situation that is liable to break forth with the rush of a volcano and to further disrupt the price situation.

Manufacturers last year took heavy inventory losses, slashed prices about 40 per cent and barely breezed through. Sales to-day are larger than a year ago, partly because prices were cut three and four times—approximately about 40 per cent in all. The sales in dollars are considerably lower, however, although the sales in units are larger.

Firestone Increases Wages

AKRON, May 29—The tire industry in Akron faced a new upheaval and a wage war, as well as a tire price war today, when the Firestone Tire & Rubber Co. announced a wage increase averaging 10 per cent, to become effective immediately for all its factory employees. Firestone is the first rubber company to increase wages following the comeback staged by the entire industry.

Officials of other rubber companies admit they are surprised by the Firestone action, but will make no comment as to the future action of their own companies. On good authority, however, it is learned that at least one more of the major plants will announce a wage increase on Saturday, and that another of the larger will take action tantamount to a wage increase by reducing the hours of factory shifts and continuing the same pay.

Firestone's action to-day was taken to avert labor trouble. There has been much dissension lately in the ranks of tire workers, and several minor walkouts over wage disputes have taken place in numerous factories. A few Firestone men to-day quit work, claiming the wage increase was not enough, but officials of the company expect them all to return to work within a few days.

BROADWAY ASKS BUSES TO REPLACE TROLLEYS

NEW YORK, May 29 — The Broadway Association, Inc., has filed with the Transit Commission a suggestion that surface cars be removed from that famous thoroughfare and buses substituted. The communication of the association states:

"The operation of surface cars not only works to the disadvantage of those with property and business on Broadway, but serves to retard and interfere with other modes of vehicular traffic on the street and to reduce the volume of such traffic to an extent which bears upon the general usefulness of the street and its value for business purposes."

Continental Awards Castings Contract

Ryan-Bohn Gets Order Incidental to Manufacture of Star Engines

DETROIT, May 26—Contracts to furnish castings for 100,000 engines has been awarded by the Continental Motor Corp. to the Ryan-Bohn Foundry Co. of Lansing. This contract is incidental to the manufacture by Continental of engines for the new Star car, work upon which will get under full headway at the Muskegon plant in June.

The Ryan-Bohn company will begin making deliveries under the contract the first week in June. Included in the castings will be cylinders, cylinder heads, pistons, fly-wheels and other smaller parts. The Muskegon plant of Continental has been completely equipped to handle the quantity production for the Star, and workmen forces are being assembled as rapidly as possible.

Big Body Contract

Hayes-Ionia Co., Grand Rapids, reports the closing of contracts for $15,000,000 worth of bodies to be completed by June 1, 1923, about $12,000,000 of which represents bodies to be furnished for the Durant Motor Co. The new orders will require the erection of two units to the present plant, work on which will be started at once.

The company is turning out 70 bodies a day at present, and it will be necessary to increase this capacity to 150. The present working force will be increased from 950 to 1500.

General Tire Declares Its Quarterly Dividend

AKRON, May 29—The General Tire & Rubber Co. of Akron, one of the few rubber companies that did not suspend dividend payments during the slump period, has declared its regular quarterly dividend of 1¾ per cent on preferred stock, payable July 1 to stock of record June 20. The company on May 1 paid a regular quarterly dividend of 2 per cent on common stock.

Production at the General plant in Akron is running in excess of 2500 tires a day, officials report, which is far above the company's peak record of output during the wave of prosperity experienced by the tire industry just before the slump came in May of 1920.

INSPECT FORD VIRGINIA SITE

NORFOLK, VA., May 29—A party of engineers representing Henry Ford and headed by Colonel Mayo has inspected the site which it is reported has been tentatively selected as the location for the principal Ford assembly plant on the Atlantic coast for export trade. Ford representatives had previously made careful survey and it is reported an option on the site has been obtained.

Export Sales Mount Toward 1919 Record

Efforts Being Made to Surpass Mark Established in Second Biggest Year

WASHINGTON, May 26—The international sales of American made automotive equipment are making as striking gains as those recorded in the domestic markets. A rate of overseas shipments has been reached indicating that 1922 will surpass all other years in the history of the industry, except 1920, when buying in the export markets was at feverish heights.

The totals for passenger cars during the first four months of the year are within 20 per cent of the shipments for all of 1921, and it is apparent that the exporters of American automotive equipment are out to surpass the 1919 record, second largest of the industry, and if the present rate is continued, the year will make a surprising comparison with the swollen total of 1920.

The automotive division of the Bureau of Foreign and Domestic Commerce has announced the export figures for April, following the receipt a few days ago of the Canadian totals for the same month. Shipments from the United States comprised 6438 passenger cars, 879 motor trucks and parts valued at $3,933,488. By adding the Canadian business (announced in the May 25 issue of AUTOMOTIVE INDUSTRIES), the April shipments of North American cars reached the surprising figure of 8750 passenger cars and 975 motor trucks.

Shipments Tripled

Details of the United States shipments, giving the various classifications of cars and trucks, with values, are shown in an adjoining table. Comparison with the preceding month of March and with April, 1921, are as follows:

	April 1922	March 1922	April 1921
U. S. shipments			
Passenger cars	6,438	4,471	2,311
Motor trucks	879	590	270
Canadian shipments			
Passenger cars	2,312	2,983	415
Motor trucks	96	172	63
Total Canadian and U. S. shipments			
Passenger cars	8,750	7,454	2,726
Motor trucks	975	762	333

Thus, both passenger cars and trucks are being sent forward to overseas territories at a rate three times that of the same month a year ago, and reports to Washington indicate that May will uphold or exceed the April totals. Other comparisons are fruitful in an understanding of the rapid expansion being made in our foreign trade on automotive equipment.

The following relates to passenger cars:

U. S. shipments twelve months, 1921	30 941
U. S. and Canadian shipments, January, February, March and April, 1922	25,770
Monthly average (6,442) if maintained, indicates 1922 shipments of	77,304
U. S. exports, 1919	67,144
U. S. exports, 1920	142,508

The comparison in regard to motor trucks is:

U. S. shipments motor trucks twelve months, 1921	7,402
U. S. and Canadian shipments, January, February, March and April, 1922	3,027
Monthly average (757) if maintained, indicates 1922 shipments of	9,084
U. S. truck exports, 1919	15,485
U. S. truck exports, 1920	29,126

The present volume of exports shows an increase of several hundred per cent over the low point made during 1921. For passenger cars, the June, 1921, totals for the United States and Canadian trade were down to 1967 vehicles, comparing with the April, 1922, volume of 8750. For trucks the low of 270 in August, 1921, has risen to 975 for April. Parts shipments have more than doubled in value, despite the decline in prices, and no month since January, 1921, has been comparable to April in this part of the overseas trade.

Exports, Imports and Reimports of Automotive Products for April, 1922, and for Ten Months That Preceded

	Month of April				Ten Months Ending April			
	1921		1922		1921		1922	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, including chassis (Total)	3,078	$3,743,074	7,337	$5,533,275	96,705	$126,942,168	35,331	$30,483,112
Electric trucks and passenger cars	....	....	20	35,791	....	....	97	148,642
Motor trucks and buses, except electric	609	811,841	....	....	16,718	28,186,022	2,727	2,851,223
Up to 1 ton	....	....	580	234,455	....	....	1,454	650,506
Over 1 and up to 2½ ton	....	....	226	273,907	....	....	760	1,020,507
Over 2½ ton	....	....	73	166,385	....	....	173	410,957
Total motor trucks and buses except electric	609	811,841	879	674,747	16,718	28,186,022	5,114	4,933,193
PASSENGER CARS								
Passenger cars, except electric	2,469	2,931,233	....	....	79,987	98,756,146	13,708	12,164,579
Value up to $800	....	....	4,023	1,670,297	....	....	9,816	4,747,013
Value over $800 and up to $2,000	....	....	2,211	2,506,904	....	....	6,033	6,682,368
Value over $2,000	....	....	204	645,536	....	....	563	1,807,317
Total passenger cars, except electric	2,469	2,931,233	6,438	4,822,737	79,987	98,756,146	30,120	25,401,277
PARTS, ETC.								
Parts, except engines and tires	....	3,195,698	15,588,304	3,933,488	....	64,993,319	....	26,671,452
Station and Warehouse motor trucks	58	18,469	5	2,339	511	291,445	99	120,876
Trailers	....	....	15	6,198	....	....	199	97,886
Airplanes & seaplanes	2	15,000	1	3,000	56	416,955	43	149,015
Parts of airplanes, except engines and tires	....	5,486	*2,305	1,412	....	148,930	....	72,246
BICYCLES, ETC.								
Bicycles and tricycles	....	75,816	1,066	16,172	....	3,305,498	....	454,644
Motorcycles	864	299,172	1,248	322,215	23,593	7,453,259	7,844	2,121,016
Parts, except tires	....	....	*351,245	158,587	....	....	*1,064,022	560,714
Gas Engines	127	22,687	597	71,231	2,857	560,576	2.590	369,779
Traction engines (steam) except agricultural	....	....	....	....	257	451,293	14	41,741
Automobile engines	1,108	223,311	7,132	773,315	12,429	2,288,174	19,160	2,508,040
Aircraft engines	....	....	8	9,125	....	....	35	21,117
Complete tractors, except agricultural	12	39,399	5	5,314	19,942	19,638,264	149	254,845
Other internal combustion engines	821	260,125	259	47,492	13,400	2,280,504	3,657	491,089
IMPORTS								
Automobiles and parts of automobiles	26	72,538	13	31,219	995	1,146,056	383	638,508
Parts, except tires	....	155.391	....	51,438	....	1,158,058	....	526.389
All other	....	10,318	....	8,459	....	426,754	....	211,604
REIMPORTS								
Automobiles (free of duty)	469	766,053	88	154,259	2,671	4,103,089	2,469	3,796,892

*Pounds

AVALON RUBBER CO. SOLD

AKRON, May 29—By order of Referee in Bankruptcy Harry L. Snyder of Akron, the Avalon Rubber Co. of Barberton today was sold for $28,500 cash to private interests represented by Fred Lahrmer, Akron attorney. The sale is subject to revision, and stockholders have served notice they will file a petition of revision within 10 days. The stockholders bid $30,000 for the plant offering $10,000 cash and the balance on time. The company's liabilities are about $35,000.

50 Per Cent Decline in British Exports

Imports of Cars and Chassis for First Quarter, 1922, Show Increase

WASHINGTON, May 27—Exports of British made motor vehicles and parts during the first three months of 1922 show a decrease of more than 50 per cent as compared to the exports during the same period last year and about 30 per cent as compared to the same period for 1920.

The exports of motor parts show the greatest decline, according to figures sent to the automotive division of the Department of Commerce by the foreign trade commissioner at London. Exports of parts, the figures show, were 33 1/3 per cent of the total for the corresponding quarter of last year and only slightly more than that for the same quarter of 1920.

The figures are as follows:

First Quarter, 1920	No.	Value
Phaetons and cabs	467	£317,991
Commercial vehicles	140	103,028
Chassis	357	257,060
Total	964	678,079
Parts of cars		406,152
Total value		1,084,231

First Quarter, 1921	No.	Value
Phaetons and cabs	840	£638,484
Commercial vehicles	238	213,113
Chassis	427	392,023
Total	1,505	1,243,620
Parts of cars		429,681
Total value		1,673,301

First Quarter, 1922	No.	Value
Phaetons and cabs	376	£255,317
Commercial vehicles	106	108,395
Chassis	287	206,473
Total	769	570,185
Parts of cars		187,102
Total value		757,287

British imports of motor cars and chassis show an increase in the first quarter of 1922, as compared to the same period in 1921, although far below those of the same period in 1920. The net imports for the first quarter of 1922 amounted to 4769 cars and chassis valued at £912,009, as compared to 3443 cars and chassis valued at £798,901 for the same period in 1921, and to 10,152 cars and chassis valued at £3,566,683 for the corresponding period in 1920.

April Figures Down

LONDON, May 16 (*by mail*)—April's Imports of cars and cabs were 1,105 (399), trucks 45 (209), chassis 614 (274) and motorcycle 59 (71). The value of imported parts for vehicles other than motorcycles was £222,695 (£203,440), and of motorcycle parts £5,088 (£12,604) and of tires £426,883 (£163,562). The figures in brackets are for the corresponding month, 1921.

The export of British automobiles in April was: Cars and cabs 142 (179), trucks 192 (267), chassis 45 (102), motorcycles 817 (1160), and the value of parts was: Vehicles, £68,560 (£124,-013), motorcycles, £23,322 (£26,785) and tires £239,652 (£185,997).

The comparative poor showing of British Exports reflects the engineer's trade lock-out.

The Chancellor of the Exchequer has refused to consider the repeal of the import duty on cars. From £5,000,000 the revenue from this duty has fallen to £763,000.

MEMBERS OF M. A. M. A. REPORT SALES IN APRIL TO BE $33,830,000, BIG INCREASE OVER MARCH

NEW YORK, May 29—The following table shows the sales by members of the Motor and Accessory Manufacturers Association, the total of past due accounts and the total of notes held, for all the months of 1921 and first four months of 1922.

Month	Total Sales	Per Cent Change	Total Past Due	Per Cent Change	Total Notes Outstanding	Per Cent Change
1921						
January	$6,264,587	.....	$8,099,727	.....	$4,359,871	.....
February	10,408,962	66.15 Inc.	6,717,165	17.07 Dec.	6,063,118	39.08 Inc.
March	20,120,386	93.30 Inc.	5,603,992	16.57 Dec.	5,069,877	16.38 Dec.
April	26,746,580	32.93 Inc.	5,352,271	4.49 Dec.	5,371,086	5.94 Inc.
May	26,781,350	.13 Inc.	4,505,176	15.64 Dec.	4,460,355	16.77 Dec.
June	22,703,414	15.19 Dec.	4,720,973	4.79 Inc.	4,012,670	10.37 Dec.
July	23,096,214	1.68 Inc.	5,242,046	10.79 Inc.	3,690,154	7.90 Dec.
August	23,397,640	1.31 Inc.	4,348,790	17.06 Dec.	3,494,510	5.30 Dec.
September	23,141,891	1.09 Inc.	4,358,545	.22 Inc.	3,677,500	5.24 Inc.
October	22,053,327	4.70 Dec.	4,512,680	3.54 Inc.	3,463,500	5.82 Dec.
November	18,998,490	13.85 Dec.	4,352,000	3.56 Dec.	3,661,900	5.73 Inc
December	14,349,750	24.47 Dec.	4,220,450	3.02 Dec.	3,384,250	7.58 Dec.
1922						
January	17,320,000	20.61 Inc.	4,450,000	5.45 Inc.	3,146,000	7.02 Dec.
February	22,720,000	31.17 Inc.	4,070,000	8.57 Dec.	3,483,000	10.74 Inc.
March	28,670,000	26.14 Inc.	2,890,000	28.86 Dec.	2,657,000	23.69 Dec.
April	33,830,000	18.07 Inc.	3,000,000	2.00 Inc	2,500,000	1.5 Dec.

Another Big Month Predicted for June

(*Continued from page* 1182)

The reduction in freight rates will result in important savings for automotive manufacturers on shipments of all materials except completed vehicles. The freight saving on these will be passed on to the consumer. The lower rates will tend to offset recent advances in the cost of supplies.

Virtually all tire factories are running full blast but there are many indications that a price war is imminent. Tires are being made at a much smaller margin of profit and if there is an era of intense price competition the results may be serious for some makers. Reductions averaging from 10 per cent to 15 per cent have been general in the last month. Some of them have been camouflaged but the result is the same so far as the consumer is concerned.

Maxwell to Operate in June at May Rate

DETROIT, May 29—Maxwell Motor Corp. will carry production through June at the high rate which has marked May, present orders already indicating that this will be necessary. President W. R. Wilson said a falling off in business is looked for during July and August, but he is convinced that fall business will be brisk and that sales through the winter will be steady. Important increases are looked for by him in 1923.

The company has been handicapped in its production during April and May through difficulty in getting materials and by labor scarcity, he said. In the Maxwell case this difficulty is with raw material and steel, as it is a company which builds practically every part of its product in its factories at Dayton, Newcastle and Detroit. Coal supply at its several plants is ample, Wilson said, but difficulty in obtaining steel is being attributed to the coal situation.

No action has been taken relative to the refinancing of the Chalmers subsidiary of the company, he said, owing to the failure of the bondholders to reach a decision. The company is being operated pending this action at a rate in keeping with its finances, and is producing between 500 and 750 cars at the present time. The demand for Chalmers cars would warrant a larger production, he declared, but until the financing is determined the schedule cannot be extended.

A. E. A. BOOK READY SOON

CHICAGO, May 31—The standardization handbook which the Standardization Committee of the Automotive Equipment Association is publishing, will be ready for distribution in advance of the convention of the association which meets at Colorado Springs, June 19, according to Charles Hughes, secretary of the committee.

Men of the Industry and What They Are Doing

H. H. Springford Resigns

H. H. Springford, special assistant to President E. G. Wilmer of the Goodyear Tire & Rubber Co. of Akron has resigned to accept the presidency of the Steel & Tube Co. of America at Chicago.

Springford representing New York, Chicago and Cleveland bankers, negotiating the Goodyear company's $85,000,000 refinancing and reorganization program a year ago, was elected treasurer of the company under the new financial control. Last December he was made assistant to the president and took active charge of the company during Wilmer's two months business trip to South America. P. H. Hart was elected to succeed him as treasurer.

Springford, a native of England, received practically all of his business training in Milwaukee in the steel and tube and gas, and the mining business.

No announcement has been made as to his successor at Goodyear.

Bacon Returns to Goodrich

H. M. Bacon, formerly vice-president of the McGraw Rubber Co. of East Liverpool, Ohio, has been named special tire sales representative for the B. F. Goodrich Co. of Akron. Bacon formerly was with Goodrich for a number of years. Two years ago he left the McGraw company and joined the Thomas Cusack Co. in Cleveland. He will assume executive direction of tire sales for Goodrich.

Heads Horseshoe Tire

J. C. Lawrence, Akron, has been elected president and general manager of the Racine Horseshoe Tire Co., Racine, Wis., which is the reorganization of the Racine Auto Tire Co., manufacturing Horseshoe tires, passing through the bankruptcy court. Lawrence was for many years associated with the Firestone Tire & Rubber Co. and was vice-president of the Rotary Club of Akron.

Hoesterman Joins Kickhaefer

Hugo F. Hoesterman has resigned as factory manager of the Stearns Motor Manufacturing Co., Ludington, Mich., to become vice-president of the Kickhaefer Manufacturing Co. of Milwaukee, manufacturer of dies and stampings used in the automotive industry. The Kickhaefer company has been in business since 1907.

McIntyre Leaves Finance Companies

Gecrge McIntyre has resigned as vice-president and director of the Metropolitan Finance Corp. and as vice-president and director of the Security Credit Corp., owned by the Metropolitan and previously engaged in the handling of automobile installment paper. McIntyre was one of the founders of the company which was started about four years ago. He was formerly connected with the Continental Guaranty Corp., Commonwealth Finance Corp. and Street & Finney Advertising Agency. McIntyre will announce his new connections at a later date, remaining at this time president and director of the Phoenix Finance Corp. of New York City, and the Ultimate Finance Corp. of Newark.

Durant Names Steigerwalt

A. K. Steigerwalt has been appointed manager of the new parts and service division of the Lansing plant of the Durant Motor Co. Steigerwalt had been connected with the Chevrolet organization since 1909, first serving with the Chevrolet Motor Co. of New York, then at the factory at Flint and recently at the Chevrolet headquarters in the General Motors building, Detroit.

Clayden Chief of Research

A. Ludlow Clayden is now chief engineer of gas engine research for the Sun Co. of Philadelphia. The company is equipping a laboratory at its research building at Norwood, Pa., and Clayden's first undertaking will be a rather elaborate study of factors which affect engine lubrication, with especial regard to piston friction.

Advertising Men to Hear Long

John C. Long, secretary of the educational department of the National Automobile Chamber of Commerce, will speak on "The Trade Association and Better Business" at the educational conference of the international convention of the Associated Advertising Clubs of the World in Milwaukee, June 12.

Carples Is General Manager

James M. Carples has become general manager of the Strut Rod Sales Co., New York City. Carples acted as manager of the automotive department of Flint & Co., Inc., bankers, during the war and in 1919 to 1920 organized the Detroit Motorbus Co.

Levick With Better Tires

J. N. Levick, formerly chief of the layout division of the advertising department of Sears, Roebuck & Co., has joined the Better Tires Co., Chicago, mail order jobbers of tires and accessories, to serve in a similar capacity.

Vansant Made Tire Sales Manager

G. E. Vansant, formerly identified with the Brunswick tire manufacturers, has been added to the executive staff of the F. G. Schenuit Rubber Co., Baltimore, and has been placed in sole control of the sales production department.

Grier and Hill Promoted

J. A. Grier has been made western district manager of the Cadillac Motor Car Co., and has been succeeded as specification manager in the sales department at the factory by Chester B. Hill. Grier began work for Cadillac on April 20, 1916, coming into the sales department. With the exception of the time he was in service during the war he has been connected with specification work and has been in charge of it for the last four years. Hill came to Cadillac in February, 1916, and after eight months in the engineering department changed to the sales. He has been there ever since excepting the thirteen months he served with the Marine Corps during the World War.

Jackson Succeeds Roberts

Ralph B. Jackson has been appointed western sales manager for Rolls-Royce, succeeding J. E. Roberts, resigned. Previous to his present connection Jackson was associated with the Pierce-Arrow Motor Car Co. as district representative for the sales department. During the war he was in the air service, commissioned as a pilot. Jackson will cover the western states from his headquarters located at the Rolls-Royce western branch, 980 Michigan Avenue, Chicago.

Couzens With Investment Company

St. Clair Couzens, formerly associated with the Olympian and Friend motors companies of Pontiac, Mich., is now with the Michigan agency of the Durant Investment Co. as a traveling representative, calling on county headquarters throughout the industrial section of the state.

Amazon Appoints Shea

Announcement is made by the Amazon Rubber Co. that William J. Shea, formerly district sales manager for the Portage Rubber Co., has been appointed head of the company's sales department. He is the first sales manager the Amazon Co. has had since the reorganization last year when the founder of the company, L. J. Schott, assumed direct charge of the business.

Britishers Visit Country

Oliver Stubbs, president of the Institution of British Foundrymen and managing director of Joseph Stubbs, Ltd., iron founders of Manchester, England, and Sir Henry Hollingdrake, managing director of the Hollingdrake Automobile Co. of Stockport and Manchester, have been visiting the principal American manufacturing centers with a view to studying modern American practice in foundry work, machinery design and manufacturing.

Plants Speeding Up in All Branches of the Industry

Big Westinghouse Orders

SPRINGFIELD, MASS., May 31—Westinghouse Electric & Manufacturing Co. has increased its operating force here to 2600, of which number 2000 have been taken on since the first of the year. The automotive equipment and radio departments are running at maximum, and the farm lighting department has shown a marked gain, indicative of the improved farm situation in the Central West.

New fuse box, ignition and cut-out devices are being made ready for production. It is stated that production of starting, lighting and ignition units during May will be triple that of April. Contracts have been closed for 20,000 sets for the Gray car, to be delivered at the rate of 1200 a month; 20,000 for the Gardner car, 15,000 for the Hupmobile, 15,000 for the Velie, and 2500 for the American motor truck. Continental Motors has placed an order with the company for $150,000 worth of Micarta gears.

Many other manufacturers' orders are being received, and a steadily increasing market demand for replacements is reported, so that the prospect for the balance of the year is very promising.

Standard Parts Business Gains

CLEVELAND, May 29—The Standard Welding Co., the rim and tube division of the Standard Parts Co., reports 36 new customers on its books and an expected increase in shipment for May of 100 per cent over March. The increase is not entirely automotive although there is a strengthening demand for the company's exhaust and windshield tubing and rims.

The Eaton Axle Co., axle division of Standard Parts, has received substantial orders from the Cadillac Motor Car Co. Shipments beginning in June are said to be scheduled at a rate greatly in excess of previous orders from this company. Production for C. H. Wills & Co. is also reported to have been materially increased.

The Perfection Spring Co., another division of Standard Parts, reports that its tonnage shipments for May will be the highest of any like period in the last 18 months. Recent releases to truck customers indicate a renewed activity in the commercial car field, while orders from passenger car manufacturers show a very marked increase.

Wilson Foundry Works Sundays

PONTIAC, MICH., May 29—Bending every effort to turn out enough Willys-Knight engines to meet the demand of the Willys-Overland plant in Toledo, which is now calling for 175 engines daily as a June schedule, the Wilson Foundry & Machine Co. here is keeping its plant working on Sundays and holidays.

The output had passed the hundred mark on May 25 after a steady development from the 25 a day which was reached shortly after the line was put in operation in March.

Bock Bearing Approaching Normal

TOLEDO, May 29—The Bock Bearing Co. reports its shipments 80 per cent or better of normal at the present time, and expects June to show practically a normal business. April was the biggest month for this plant since August, 1920. At the present rate, May will be twice as big as April. The roll department is operating overtime. The head grinding department is running a double shift while in certain other departments three shifts are working.

Farm Machinery Shipped

LA PORTE, IND., May 27.—The Advance Rumely Co., shipped 45 carloads of farm machinery from its factory here during the past week. It was the biggest week of the year for the company in farm machinery. The company is operating at about 70 per cent of normal.

Oneida Increasing Schedules

GREEN BAY, WIS., May 29—Excellent progress is being made by the Oneida Motor Truck Co. in booking new business, and plant schedules are steadily being increased to handle orders. Oneida trucks are experiencing a good call east to Pittsburgh and west to the Pacific coast, especially in communities where new building construction is active. Shipments are now being made daily.

Gardner Gain 220 Per Cent

ST. LOUIS, June 1—A statement from the Gardner Motor Co. says that for the five months' period ending to-day there was a gain of 220 per cent in cars shipped over the corresponding months of 1921.

May Best in Moon History

ST. LOUIS, June 1—The Moon Motor Car Co. reports that its sales in May were the largest for any single month in its history. The best previous month was June, 1920, and May exceeded that month by 64 per cent.

Jordan Breaks Record

CLEVELAND, June 1—The Jordan Motor Car Co. states that it broke all production records in May and that the indications are that June will show no slowing up in orders. Most of the demand this year has come from the states north of the Ohio river and east of the Mississippi and from California.

PERSONAL NOTES

Thomas H. Lavier Re-elected

Thomas H. Lavier, inventor of the Lavier formula plates used in Ray batteries, has been re-elected president of the Ray Battery Co., Ypsilanti; M. M. Read, vice-president; J. S. McDowell, secretary, and A. M. Colegrove, treasurer. E. E. Eastburn has been appointed sales manager. He formerly was western district manager of the Republic Rubber Co. with headquarters at Kansas City. Business is reported to be running heavy, and plans have been made for expansion in production. The company has improved its financial position through the addition of the several new officers and is prepared to enter business on a larger scale than formerly.

Young With Willys-Morrow

J. A. Young, formerly of the Sheldon Axle Co., has been appointed general manager in charge of sales of the Willys-Morrow Co. He will have charge of all sales of products which are supplied to other companies outside the Willys interests.

Bradley Leaves Commerce

F. A. Bradley has resigned as secretary and treasurer of the Commerce Motor Car Co. and has gone on a vacation trip to England which will take about six weeks. No announcement of his business plans for the future were outlined by Bradley.

Shaw Goes With Bank

James T. Shaw has resigned as secretary of the Automobile Crankshaft Corp. to become connected with the First National Bank of Detroit. The resignation is effective June 1, but Shaw will continue the secretarial duties for another month though actively connected with the bank.

Fox Appoints Hackethal

P. F. Hackethal has been appointed consulting and research engineer for the Fox Motor Car Co. of Philadelphia. For several years he has been connected with the Mercer and Templar organizations.

AUTOCAR NAME PROTECTED

PHILADELPHIA, June 1—The right of the Autocar Co., Ardmore, Pa., to the exclusive use of the word Autocar in the manufacture and sale of motor vehicles has been upheld by an injunction issued by the United States District Court for the eastern district of Pennsylvania against the Peters Autocar Co. of Bethlehem, Pa., and De Veillier & Co., who offered securities for sale in which they made use of the word Autocar.

Senators Question Need of Graham Bill

Committee Which Reported Reimportation Measure Also Doubts Present Necessity

WASHINGTON, May 26—Passage of the Graham resolution (HJ 183), introduced in the House at the instance of automobile dealers, to prevent the dumping of war trucks and passenger cars into the United States by imposing a 90 per cent re-import tax on all motor vehicles returned from France or any of the allied countries, has been characterized as doubtful.

This is the opinion of Senator McCumber, chairman of the Senate Finance Committee, who has already reported the bill out of committee. Despite the fact that the resolution has already been passed by the House, the opinion has been expressed by Senator McCumber that the measure will not pass the Senate, "for the reason," said Senator McCumber, **"that it is the opinion of the majority of senators that there is not any need for the measure."**

Survey Being Made

At the time the bill was introduced in the House by Congressman Graham, it was the expressed opinion of the automobile dealers that more than 5000 trucks were going to be reimported, thus destroying the present truck market in this country.

In order to determine just that status of the situation, the Department of Commerce has announced that it will make a survey of the trucks and passenger cars in Europe, available for reimport, and the automotive division of the department has already requested the United States trade commissioners in England and France to report as soon as possible.

The Department of Commerce, it is known, is strongly in favor of the Graham resolution, provided there is any real need for it. The only way that this can be determined, the department feels, is to make an actual survey of the number of vehicles subject to reimportation.

Senator McCumber, it is understood, has requested the department to report on the number of trucks that have already been re-imported from Europe during the past three years. Coupled with his request for the figures was the expressed opinion that in the belief of the majority members of Congress the automotive industry was a bit panicky over the situation.

Committee Gets Figures

That this is true, may or may not be borne out by the figures which have been submitted to the Senate finance committee, showing that as near as can be determined there are nearer 1800 trucks in Europe, subject to reimportation, than 5000, the number first stated. It is estimated that there are approximately 1000 trucks in England and 800 in France.

The actual figures on the number of passenger cars and trucks reimported from the two countries are as follows: From France, 1919, four, valued at $10,408; 1920, 35, valued at $168,996; 1921, 536 valued at $979,567; England, 1919, one, valued at $1,460; 1920, 52 valued at $149,645, and 1921, 1,748 valued at $2,668,525.

A report on 500 trucks recently reimported to the United States and shipped to California has been made to the automotive division of the department. The shipment, it is declared, was in very bad condition, and the trucks sold were worth hardly more than their freight from New York.

Aside from any bearing on the number of trucks or passenger cars which are likely to be re-imported, Senator McCumber has declared that there is considerable doubt in the minds of the committee, since reporting the resolution out favorably, that the number of trucks available for reimportation would be sufficient to influence the market. "Furthermore," said Senator McCumber, "these passenger cars and trucks were sold at a good price to the government, nothing was lost on them and the automotive industry having secured the cream of the business then must expect to take a little of the thin now with the thick had during the war."

No action on the bill is at all likely pending the survey which will be made immediately by the department, and whether or not the Senate will act then on the resolution is a matter of speculation, the sentiment now being, among the Senate Committee which has had a chance to study the measure, that the bill is useless legislation and that the time of the Senate can better be devoted to the consideration of more imperative measures.

Slough Trucks Hamper Sales

DETROIT, May 27—General increase in the motor truck field has been handicapped and delayed to a definite extent by the presence in the United States of a still unsold balance of the Slough trucks that were brought back to this country, declare motor truck makers in this district. Though business is now running at about 50 per cent of normal, it is declared an earlier return would have been certain without the Slough competition.

These makers declare that it is not so much because of actual sales made that the Slough influence has been harmful as because of the circularization that was carried out by the Slough group, which made it doubly hard for dealers in new-made American trucks to make sales. The Slough prices created an atmosphere of suspicion toward new truck prices.

This circularization still is being done, resulting in sales only at scattered points, but keeping the entire trade at a disadvantage. Apparently there is little desire on the part of operators to buy the war vehicles, makers declare, but they find it difficult to reconcile the wide divergence between the prices of trucks bought at forced war auctions and trucks made under current competitive conditions.

Overland to Build 785 Daily in July

Willys Says That Company Is Now 18,000 Cars Behind on Orders

TOLEDO, June 1—That the production schedule for the Willys-Overland plant here was gradually increasing and had passed the 500 a day mark on Friday was the statement made to members of the factory management class of Toledo University at their annual banquet at the Toledo Yacht Club on Friday evening by President John N. Willys.

Willys said that the production schedule for July called for 16,500 cars or an average of 785 a day for that month.

"We are 18,000 cars behind our orders now and must speed up considerably during June to make a gain on the sales," he declared.

He said his travels convinced him that next year would better 1922 because of the increased prosperity to come when farmers get in their crops and realize that better conditions are here.

Clifton Reeves, industrial engineer, and W. H. Kilpatrick, manager of manufacturers, of the Willys-Overland Co., were also speakers.

The class which numbers among its members a large percentage of the executives, foremen, and officials of factories in Toledo formed a mythical $25,000,000 automobile concern recently as a study in organization.

May One of Biggest Months in New York

NEW YORK, May 30—May has been one of the biggest sales and delivery months in the history of the automobile business in New York.

Actual comparison figures for the entire trade are not available but virtually in all branches and distributor establishments both wholesale and retail business ran ahead of March and April, which were strong business months, and representatives of several cars report the largest months they ever had.

With the more popular cars, inability to obtain prompt deliveries has held down both sales and deliveries but a good many of these orders have not been lost to the industry, having been turned toward cars of the prospects' second or third choice.

Compilers of registration figures while unable to furnish complete figures anticipate that registration of new passenger cars in ten counties in and around New York will exceed 10,000, as compared with approximately 9200 in April and 7000 in March.

Demand has held strong throughout the spring for closed cars, of which there has been a shortage in several lines.

Indications for June business are decidedly bright.

Murphy Takes Honors in Indianapolis Race

Victory Demonstrates Progress Made During Year by Refinements in Engine

HOW THEY FINISHED

Driver—Car	M.P.H.
Murphy—Murphy	94.48
Hartz—Duesenberg	93.54
Hearne—Ballot	93.04
De Palma—Duesenberg	90.61
Haibe—Duesenberg	90.56
Wonderlich—Duesenberg	88.79
Fetterman—Duesenberg	87.99
Vail—Duesenberg	85.69
Alley—Monroe	83.89
Thomas—Duesenberg	82.19

By J. EDWARD SCHIPPER

INDIANAPOLIS, May 30—Jimmy Murphy with his combination car, the Duesenberg grand prix chassis and Miller engine, which ran under the misleading name of Murphy special, demonstrated by winning the 500 mile speedway race to-day, from a field of 27 starters, what progress has been made in the past year by refining the 183 cubic inch engines.

His average of 94.48 miles per hour as compared with the record of 89.84 set by Ralph DePalma in a Mercedes in 1915, is a good indication of how speed can be increased by cylinder compression of 105 pounds, lighter reciprocating parts, improved lubrication, better engine balance, higher gas velocities and general chassis improvement.

Not only does Murphy's victory indicate progress, but this is accentuated by the fact that all of the first five cars to-day beat the DePalma record of seven years ago which he made in a 274 inch Mercedes.

Murphy Led from Start

Murphy led from start to finish. Hartz, who finished second in a Duesenberg, was never more than two laps behind but never fast enough to overtake Murphy. Murphy stopped three times to change plugs, tires and take on supplies. He carried off all but 45 of the lap prizes, as well as the $20,000 winner's prize. He turned laps at 100 miles per hour and drove as good a race as was ever seen on the speedway.

While the Duesenbergs did not win first place, they had a veritable field day. Seven of the 10 cars to finish in the money were Duesenbergs. To Duesenberg also goes a large share of Murphy's glory as his chassis was the Grand Prix Duesenberg.

It was a bad day for the Frontenacs, not a single one finishing among the first 10. Only one of the five starting, was running at the finish. Three were eliminated with rear axle trouble, one with a broken frame and the other with a broken valve action.

The Ballot entry of two cars had fair success. Hearne won third but his team mate, Goux, was eliminated with a broken axle at 62 miles. Hearne made only one stop, this being for tires and gas at 280 miles. This wa. one of the most consistent performances during the race.

Of the first 10 all had eight-in-line engines except the four cylinder Monroe which finished ninth. It made two stops for spark plug troubles and three others for fuel, oil and tires. The two

(*Continued on page* 1192)

Parish & Bingham Head Denies Merger Interest

CLEVELAND, May 29—Emphatic denial is made by Agnes D. Morse, president of the Parish & Bingham Corp., that the company of which she is the head has had any interest whatever in plans for a consolidation of the Grant Motor Car Corp., the H. J. Walker Co. and the Standard Equipment Co.

Mrs. Morse asserts that inasmuch as she is the largest individual stockholder of the Parish & Bingham Corp., she would have been consulted if any such plan had been under way. Her company, which is now doing a splendid business and is in a strong financial position, is not interested in mergers of any kind, Mrs. Morse declares, and is perfectly content to stand on its own feet.

Skilled Labor Scarce; Workmen "Shop Around"

NEW YORK, May 31—Difficulty in obtaining an adequate supply of skilled labor has become one of the most pressing problems of the automotive industry and the situation is becoming serious in the larger manufacturing centers, particularly Detroit. The trouble is fully as general in the parts field as in the vehicle branch.

In a good many cases automobile manufacturers are practically bidding against each other for labor. Inasmuch as the workers in automotive plants are not organized, there have been no threats of strikes, but the skilled employees not unnaturally are "shopping around" and taking the jobs which offer the best pay. This is resulting in a steadily mounting percentage of labor turnover.

Present indications are that whatever savings are effected in automotive plants by the reduction in freight rates will be more than offset by higher wage scales if production continues at its present pace.

FORCES INCREASE AT CORK

LONDON, May 16 (*By Mail*)—The number of men employed by Henry Ford & Son, Cork, has increased to about 1700 since the corporation decided to grant the fee-simple of the Marina site to the firm. They are employed at full time, the wages bill amounting to between £8,000 and £10.000 a week.

French Grand Prix Adopts Group Start

Change Is Result of Experience Drivers Gained on American Tracks

PARIS, May 12 (*By Mail*)—American track methods will be adopted in the start of the French Grand Prix road race for 122 cu. in. cars near Strasbourg on July 15. The triangular course being prepared for this race is 8.3 miles around; there will be 22 starters, and 60 laps will have to be covered, giving a total distance of 498 miles.

By an understanding with the drivers, many of whom have had experience at the Indianapolis track, the start will be made in a group, the cars being lined up in line of three according to positions decided by the drawing of lots. This will be the first time that a grouped start has been given in a European automobile road race, and the change has only been made possible by experience gained on American tracks.

Many Without Spare Wheels

Another feature of this race will be that many cars will start without a spare wheel, the drivers being prepared to run a lap on the rim if they burst or puncture just after passing the pits. This again is the result of American experience. In the past this has only been done with straight side tires, which have no tendency to leave the rim when deflated. This year clincher bead tires will be used in the same way.

Michelin has brought out a clincher bead racing type cord tire, which, as shown by tests, will not come off the rim when deflated. Convinced that it will stay on the rim as well as a straight side tire, European drivers are preparing to use the Michelin production because of its lower circumferential weight. Straight side tires were used last year in French and Italian road races, and although they proved to be perfectly safe they were found to set up excessive wear of the steering gear and to make the car hard to hold on an ordinary road.

Another Contest July 16

In addition to the 122 cu. in. race, there will be a speed contest over the same course on July 16 for four passenger cars given a limited amount of gasoline at the rate of 13.7 miles to the American gallon. This is not a stock car race, and while there are no restrictions concerning the engine, minimum body dimensions are indicated and there must be four seats of given dimensions.

Only the driver will be allowed aboard the car, but the equivalent weight of three other persons, at the rate of 154 lb. per passenger, must be carried in the form of ballast. No outside assistance of any kind must be given, nor can supplies of any kind be taken aboard during the race.

Murphy Takes Honors at Indianapolis Race

Victory Demonstrates Progress Made During Year by Refinements in Engine

(*Continued from page* 1191)

Fronty-Fords made a creditable showing, demonstrating their reliability. They made laps at the rate of from 80 to 84 miles per hour until one went out at 400 miles with a broken wheel and the other was running at the finish.

The British Bentley, a four cylinder stock car, gave a most satisfactory performance. This was the only car to go the distance without changing a tire. It averaged approximately 80 miles per hour.

The engineering development responsible for the higher speeds of this year is best illustrated by the fact that this is the first Indianapolis race in which not a single car was eliminated by broken connecting rods. There were no burned out bearings, no burned out valves, no clutch trouble and only one broken steering arm. Detail troubles such as clogged gas lines, leaky water manifolds, broken tank fastenings, loose pans and sticking throttles were still to be found. The fundamental troubles of a bigger nature were more in the axle and chassis parts than in the engines.

Thirty-five tires were changed but many of these changes were made while other troubles were being looked into. Twenty of the tires were right rears, eight were right fronts, six were left rears and only one left front. These changes were not all necessary but many were made on suspicion.

Although Hartz in his Duesenberg made four tire changes, more than anyone else, he still finished in second place. The Frontenacs made several tire changes. Mulford, Sarles and DePaolo each had three stops for tires.

Stops for Spark Plugs

There were 18 stops for spark plugs. The very qualities which made the cars of this year faster than ever before, made the stresses on the spark plugs higher than ever. This was fully shown in the stops at the pits which is not surprising in view of the prevalence of seven to one compression ratios and piston speeds of 26 hundred feet per minute. Magnesium and aluminum alloys of extremely light weight combined with highly efficient lubrication and complete absence of periodic vibration have permitted the high speeds, but the spark plug seems to be the limiting factor, if the records of the race may be interpreted.

The weights of the leading cars were closely grouped around 2000 pounds. The winner weighed 1970, the Hartz Duesenberg 2800, Hearne's Ballot 2600 and DePalma's Duesenberg 2000. The Fronty-Fords were the lightest cars in the race, weighing 1675 pounds.

DROPS LOCOMOTIVES

GLOVERSVILLE, N. Y., May 29—Announcement is made by the Fonda, Johnstown & Gloversville Railroad, which connects the New York Central lines with the southern part of the Adirondack region, that on July 1 it will discontinue the use of passenger locomotives on its steam division and substitute gasoline railroad cars for them.

The pace maintained throughout the 500 miles by the leader was wonderfully consistent. It fell belows 94 miles per hour only around the 200 mark when Murphy changed spark plugs. The average for any 25 mile distance never exceeded 96 miles per hour. The fastest 25 miles was the first at an average of 95.74.

Master Trucks Producing New Low Hung Bus Chassis

CHICAGO, May 29—A new low hung bus chassis is now being produced by Master Trucks, Inc. By underslinging the springs and using frame with pronounced kickup in the rear, the floor height is reduced to 26 in. The model JDB chassis has a 170 in. wheelbase with space for body measuring 192 x 84 in. and arranged to seat 22 passengers. Similar chassis for bodies to seat 26 to 34 passengers are shortly to be offered.

The components used include a Buda 3¾ x 5¼ in. engine, lighting system, Fuller clutch and gearset, Walker double reduction axle, 34 x 4 in. front and 36 x 4 in. dual tires, foot operated propeller shaft brake and bus-type front axle. The chassis is sold with or without body. The latter is of wood construction with plymetal side panels and is completely sealed inside.

Bethlehem Motors Starts with Three Truck Models

ALLENTOWN, PA., May 29—The Bethlehem Motors Corp., which recently was reorganized, will start production on three truck models with others to be added later. The first three will be a 1-ton, 2-ton and 3-ton. Bevel gear drive will be used on the smaller model and internal gear on the two others. The engine of the smaller model will be 3½ x 5 and on the largest models 4 x 5¼.

The prices for chassis are:

1-ton	$1,195
2-ton	1,595
3-ton	2,195

A. A. A. BOLTERS CHOOSE NAME

CHICAGO, May 31—The National Automobile Association is the name chosen by the former members of the American Automobile Association who bolted from the St. Louis convention, for the new organization of motorists which will be formed. The organization will be perfected at a national conference to be held at the Hotel Sherman June 19.

All Industry Active Through Northwest

Building Advances, Trade Thrives and Farmers Plant Diversified Crops

MINNEAPOLIS, May 29—Reports from the Ninth District Federal Reserve Bank in Minneapolis, from banks generally, labor employment bureaus, etc., are optimistic as bearing on business generally. Even in building this district leads the country for the quarter, showing a gain of 150 per cent as against an average of 83 per cent.

At the St. Paul Federal Land Bank applications for loans in April exceeded any previous month, approximating $5,000,000. Since the opening of the bank five years ago, the loans have reached 18,411, totaling $61,000,000. In fact, the assets have reached $69,000,000 against $3,315,535 capital stock. President E. Q. Quamme said, on the birthday of the bank, May 1, that conditions in the Northwest are greatly improved.

Eastern investors are finding farm mortgage loans in this territory attractive and rates have been reduced materially, approximating the 6 per cent rate of the Federal bank in many instances. Wheat acreage, he said, will be somewhat less this year in this section because planting was delayed by the late spring. He forecast good prices for farm products and a total acreage close to an average normal.

The Federal District report is to the effect that the agricultural outlook is good with winter sown crops better than the average throughout the country, and the knowledge that crops have been so much more diversified that even a poor crop year would not have the serious effects that it would have had heretofore. Western North Dakota and Montana are fortifying themselves by the introduction of the dairy cow, which is a further protection against the loss of any one crop through weather conditions.

March Sales Doubled

In the district business has increased month to month, until the volume is above that of a year ago. Implement sales were doubled in March over February preceding. Continued advances of prices in agricultural sections of farmers' products and the turn of the season into spring, has renewed among all classes a feeling of optimism, and it is assured the farmer is not down and out. Distribution of new trucks and agricultural machinery generally is another factor for rejoicing as indicating the farmer, the backbone of the district, has some money after all.

In the Twin Cities the unemployment situation is fading into conditions that indicate that for labor generally there are more jobs than applicants for work. In Minneapolis conditions generally are improving. Increased demand for farm labor and for workers in building is absorbing the bread line frequenters.

73 Makes Displayed At Barcelona Show

Both Former Enemy Nations and Allies Exhibit—Trade Revival Expected

BARCELONA, SPAIN, May 29 (*By Cable*)—This city is now holding the first international automobile exposition since the armistice in which the cars and trucks of both the allied and the ex-enemy countries are being shown in the same hall. The Barcelona show, undertaken with the expectation that it would revive trade after the depression of last year, is being held in a large modern art palace at Montjuich, in the suburbs of the city.

The show has brought together 73 makes of passenger cars and trucks, representing America, France, Italy, Belgium, England, Spain, Germany and Austria. The largest representation, as might have been expected and consistent with the world-wide development of automobile sales, is that from America, with 24 makes. A floor space of 150,000 sq. ft. is being used. This does not make it the largest exposition in Europe, but it is the most international, bringing together, as it does, the lines from all the automotive producing companies. The ex-enemy exhibits are side by side with those from the Allied countries.

Exposition Well Supported

Both manufacturers and local dealers and distributors are supporting the exposition, and these representatives are decidedly hopeful that it will furnish the impetus needed to get sales under way again in a much improved volume. The Spanish trade was decidedly hard hit last year, not only by the financial depression and the decline of the peseta, but as well by a stiff tariff that practically precluded any major importations.

The tariff regulations happily have been changed, although it cannot be said that dealers are overly pleased with the new provisions. The peseta has climbed materially from the low point of last year. Further improvement is to be hoped for, and if this comes about there should be a further betterment of the trade. In fact, quite an improvement already has taken place, and Spanish business is generally along much higher lines than it was only a few months ago.

America Holds Market

France formerly held the premier position in the Spanish market, but this has been lost to America, which now holds the leadership here by a long margin. The French makers are further hit by the fact that Spain and France are waging a private tariff war between themselves. Owing to it the French are practically unable to do business here. However, a commercial treaty is being prepared which will put France on the same footing with other nations, and it was expected that it would have been signed before the opening of the show. Owing to the failure to promulgate it, only 17 French makers have sent exhibits. These firms admit that they are doing business here now.

The Spanish automotive trade is further unsettled by the fear that automobile taxes may be raised considerably. Dealers, distributors and others in the trade are vigorously fighting the tax project, but the immediate effect is to hold up business.

Dealers representing the important American lines are optimistic over prospects for future sales and believe that the drawbacks will be overcome. They state that the present year has opened auspiciously and are hopeful that Spain stands on the threshold of an important automotive development.

W. F. BRADLEY.

American Made Cars Sold Best at Amsterdam Show

AMSTERDAM, The Netherlands, May 17 (by mail)—One hundred and fifty cars, representing 42 different makes, were exhibited at the annual exhibition of motor vehicles which has just closed here. Of the makes, 16 were American made cars, 12 French, 11 German, 2 Great Britain and 1 The Netherlands.

The medium and small types of car were the most popular, as prices are almost double those in effect in the United States. Dealers in the low-priced cars state that sales were above expectations, and it is estimated that 75 per cent of the cars sold during the show were of American make. Few American accessories were displayed.

Rupert B. Bramwell Dies Following Brief Illness

NEW BRUNSWICK, N. J., May 29—Rupert B. Bramwell, for the last 14 years advertising manager of the Michelin Tire Co., died of pneumonia at his home here last week after a brief illness. He was widely known in the automotive industry.

Bramwell was born in Terre Haute, Ind., in 1876, and entered the automotive industry in 1900 when he joined the DeDion Bouton Motorette Co. which sold the French DeDion car. While with this company Bramwell made the first long distance run on record, motoring from New York to Boston, which was considered a remarkable achievement.

Later he became advertising manager of the Pope Toledo car after which he devoted himself entirely to advertising. He was connected with the Cosmopolitan, the Scientific American and Leslies and was with the Class Journal organization for about four years.

Bramwell joined the Michelin Tire Co. in 1909 and played a prominent part in building up that organization. He not only directed the advertising of the company but spent some of his time calling on distributors in important centers and putting through big sales contracts.

Bramwell is survived by his widow and one son.

Pamphlet on Roads For High Schools

Booklet Prepared for Universities So Successful Use Will Be Extended

WASHINGTON, May 31—Prompted by the success of the educational outline on highway transport prepared for university use under their direction by Prof. Lewis McIntyre, the officials of the Highway and Highway Transport Education Committee have now turned to Professor Buckner of the School of Education of the University of Pittsburgh to translate the book into language designed for use by high school students.

The new pamphlet will be prepared in co-operation with officials of the U. S. Bureau of Public Roads, the United States Bureau of Education and other organizations represented on the committee, and will be the first comprehensive effort to place the subject of highway transport before the high school students of the country.

Officials of the educational committee plan a thorough revision of the text in the fall, at which time much new information, which is constantly being made available from the studies of the Bureau of Public Roads and other agencies, will be added.

Mrs. Florence Fox, specialist of educational systems in the Bureau of Education, has been working for several months in the preparation of an outline on highway transport for use by students in the fifth and sixth grades. This work has taken the form of project teaching, by means of which the pupil examines the relation of highway location, construction and use to the historical, civic, geographical and economic development of the community in which he lives.

Star Models to Be Shown at Exhibit in New York

NEW YORK, May 31—No official announcement has been made thus far of the merchandising plans for the Star car, designed to compete with Ford, which will be built by Durant Motors, Inc., under contract for the Star Motor Car Co., itself a subsidiary of Consolidated Motors.

Progress is being made in the development of models for display purposes and a show will be staged in New York within the next month. Various models, including the stripped chassis, the phaeton, coupe and sedan, together with the "station wagon," will be shown. Special passenger and commercial body models also may be brought out.

The personnel of the Star organization has not been completed, and no distributors have been appointed officially thus far. It is understood only distributors will be named, and that they will be given liberal territory with the right to appoint as many dealers as they see fit.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

In general call money was decidedly easy last week, loaning the greater part of the time as low as 3½ per cent. The advance on the afternoon of May 26 from 3½ to 5 per cent was attributed largely to the close approach of the June 1 interest and dividend disbursements. The range for the week was 3½ per cent to 5 per cent as compared with 3 per cent to 3¾ per cent in the previous week. For fixed date maturities little change was noted; in general, business was quiet and no large transactions in any maturities were recorded. The range for the week was 4 per cent for sixty days and 4 per cent to 4¼ per cent for maturities of from ninety days to six months, as compared with 4 per cent to 4¼ per cent for all maturities in the previous week. The prime commercial rate continued to be 4¼ per cent.

On May 25 Secretary Mellon announced an offering of $200,000,000 of Treasury Certificates of Indebtedness with interest at 3½ per cent. These Certificates will bear interest from June 1 and will be payable Dec. 15, 1922.

The Federal Reserve statement as of Feb. 24, 1922 showed the following increases: $4,128,000 in total reserves, $2,546,000 in gold reserves, $26,785,000 in total bills on hand, $28,021,000 in total earning assets and $31,131,000 in deposits. Federal Reserve notes in circulation registered a decline of $18,426,000. As a result of the foregoing changes the reserve ratio declined from 77.6 per cent to 77.5 per cent.

The New York Institution showed a decrease of $1,333,000 in gold reserves and of $1,779,000 in total reserves. Total bills on hand increased $25,907,000 and total earning assets $23,379,000. Total deposits showed an increase of $16,880,000, while Federal Reserve notes in circulation declined $2,517,000. The reserve ratio declined from 86.2 per cent to 85.2 per cent.

Weekly bank clearings at the leading cities of the United States for the week ending May 25 aggregated $6,886,225,000, a loss of 1.6 per cent from last week, but a gain of 21.7 per cent over the corresponding week of last year. Outside of New York the total was $2,539,825, a decrease of 4.5 per cent from last week, but an increase of 14.4 per cent over the corresponding week of 1921.

W. A. PHARES SENTENCED

BLOOMINGTON, ILL., May 31—W. A. Phares, former treasurer of the Pan-American Motors Corp., Decatur, Ill., pleaded guilty to the embezzlement of funds of that company and has been sentenced to the penitentiary for a term of years of not less than one and not more than fourteen.

G. M. C. EXPANDS AT DAYTON

DAYTON, OHIO, May 29—The General Motors Corp. has transferred several activities to the former Dayton-Wright airplane factory and the building now is fully occupied. Included in the work now being done in this plant is the making of parts for old type machines and service work for the Delco lights. The General Motors Corp. has leased the west side plant of the Dayton Products Co. in which it is making steering gears.

FINANCIAL NOTES

Kissel Motor Car Co. has sold an issue of $750,000 of its first mortgage 7½ per cent sinking fund 15-year gold bonds to A. C. Allyn & Co. of Chicago. The bonds are offered for subscription at par and interest. They are dated April 1, 1922, and secured by a closed first mortgage on all fixed assets of the company.

Maxwell Motor Corp. net profits for May are expected to run close to the $600,000 mark. The company now has a working capital of approximately $16,500,000, of which $5,000,000 is cash and securities. Current liabilities aggregate about $2,600,000. In the first quarter of the year earnings were around $30,000.

Republic Rubber Corp. has completed arrangements with banks for issuing $1,500,000 certificates of indebtedness. Proceeds will be used to retire $1,000,000 certificates issued in January and provide additional working capital to meet requirements of expanding sales.

Reynolds Spring Co. balance sheet as of April 30 shows cash, $107,787; accounts receivable, $132,199; notes receivable, $20,474; discounted notes receivable, $40,000; notes payable, $79,000; accounts payable, $126,536; and surplus, $183,708.

Rolls-Royce of America, Inc., reports net loss for 1921 of $796,402. The balance sheet as of Dec. 31, shows total current assets of $1,629,573 and total current liabilities of $284,878, leaving a net working capital of $1,344,095.

Lage Bros. & Co. announces that books have been closed on the offering of 60,000 shares of no par common stock of **Moon Motor Car Co.,** the issue having been oversubscribed.

MERGER TALK ENDS

CLEVELAND, May 29—Talk of a merger of the Grant Motor Car Corp., the H. J. Walker Co. and the Standard Equipment Co. has ceased, and the deal has been declared off by reason of the cancellation of an order for motors that has been given the Walker company by a large manufacturer of motor cars. A syndicate of local men had put forward the merger for the purpose of uniting factory units whose products would turn out a complete automobile.

NEW DATE FOR ALLEN SALE

COLUMBUS, May 29—Failing to sell on a previous date the assets, including the plant and good will of the Allen Motor Co., the receivers, W. C. Willard and George A. Archer, have secured another order from the United States District Court for the sale of the property at public auction June 27 at 9 a. m. at the Columbus plant on Dublin Avenue.

Asks Freight Data for Airplane Line

Government Wants to Know Volume Available in New York-Chicago Service

WASHINGTON, May 29—The War Department has begun the compilation of information as to the probable volume of freight traffic available for the support of a commercial airplane line between New York and Chicago. The Government desires to promote the commercial use of airplanes so that the development of aeronautics in this country may keep pace with the advance in other nations. In a letter to the heads of commercial organizations, asking them to collect the data required, Major General Patrick, chief of the air service says:

This office has under investigation the possibilities of civil aircraft operating as a transportation agent along organized routes. In particular, an organization to promote daily overnight transportation between the industrial communities of New York and Chicago is being considered.

It is of first importance to determine as accurately as possible what the average daily volume of traffic would be which would utilize overnight air transportation if it were so established that the reliability and safety of service were comparable to present-day railroad standard. Merchandise and express will probably be collected in the downtown districts of New York and Chicago between 6 and 7 p. m., with delivery the following morning in the opposite city between 7 and 8 o'clock. It will be necessary to charge probably between $1 and $2 a pound at least during the development period.

Emil Schwarzkopf, Unique Figure in Industry, Dead

NEW YORK, May 31—Emil Schwarzkopf, a widely known and unique figure in the automotive industry, died last week in Roosevelt Hospital after an illness of several months resulting from a general break-down. He was 70 years old.

Born in Austria, Schwarzkopf came to the United States in the 80's and not long after his arrival started a little automobile magazine. He later established Automobile Topics which he conducted for several years but finally sold. At one time he developed a four-cylinder motor car.

Schwarzkopf was a thorough student of the industry and voiced his opinions frankly. He had many friends, but his very bluntness made numerous enemies for him. He had written much about the industry and in 1909 published The Motor Cyclopedia. After he retired from the publishing field Schwarzkopf went into the accessory business in Detroit as a manufacturer's agent.

After his break-down in this city several months ago, Schwarzkopf was cared for by his friends in the industry and sent to the hospital, where determined efforts were made to restore his health.

Automotive Industry Big Reviving Factor

Federal Reserve Board Notes Part Played in General Stabilization

WASHINGTON, June 1—Increased production of automobiles during March and April has revived the demand for iron, steel and copper products and assisted in stabilizing other industries, according to a report issued by the Federal Reserve Board to-day in reviewing general business and financial conditions throughout the Federal Reserve districts during the month of May.

In the opinion of the board, the indicated yield of the principal agricultural products has been an outstanding feature in the developments of the past month. Quite significantly, the board says: "Business, in so far as dependent upon current agricultural prospects, shows steady improvement, notwithstanding diminished export shipments of agricultural products, particularly grains, as disclosed by the ten months' figures since the beginning of the fiscal year, and notwithstanding further a slackening of the demand for agricultural products for domestic use."

It is believed that the adjustment of prices among commodities and industries is approaching a more normal relationship. The heavy purchases of automobile manufacturers and railroads is one of the bright spots of the steel industry.

Discussing automobiles, the Board says in part: Exports have shown a considerable increase. A few popular medium and low priced makes have been selling in larger quantities than ever before, while many dealers are several weeks behind in their deliveries. Used cars are being accepted on a more equitable basis than heretofore, when concessions were made in order to stimulate business, and a larger percentage of sales now involves no trades.

The Department of Commerce in its review for April declares that one of the striking features of the month of April was the increase of some 30 per cent in the production of automobiles. It is declared that April was a month of assimilation and of the adjustments of conditions for progress in later months. It is very encouraging, the department says, that business for the most part is advancing in this less spectacular but more substantial manner.

CLOSED CARS MORE POPULAR

CLEVELAND, May 29—Another indication of the increasing popularity of closed cars is found in the report of the Peerless Motor Car Co. that it is several weeks behind in filling orders for its new 5-passenger sedan. There also has been a large increase in orders for the other closed models manufactured by the company.

FRANKLIN AWARDS PRIZES

SYRACUSE, May 29.—The Franklin Automobile Co. has distributed $4,000 in cash prizes to 226 employees in connection with its second "suggestion contest." The prizes were given in recognition of efforts made by Franklin men in the past six months to improve the quality of the Franklin car and cut down the cost of production without impairing quality. There were three prizes of $400 each, one of $300, three of $200, two of $100 and five of $50 in addition to a large number of smaller awards.

INDUSTRIAL NOTES

Western Vulcanizer Manufacturing Co. has removed its factory to Plymouth, Ind., which will give enlarged manufacturing facilities for its specialties. It will also enable the company to introduce a new item of vulcanizing equipment. The general and sales offices remain at 150 North Desplaines Street, Chicago, where H. K. Wheelock will continue to make his headquarters. The factory superintendent, I. W. Clark, will be in charge of the factory at Plymouth.

Rowe Motor Manufacturing Co. announces that it has decided to erect a new factory building 327 feet x 120 feet at Lancaster, Pa., which will be devoted to the production of the Anderson truck tire. The Rowe company recently took over the Hydraulic Devices Corp. and the Anderson Tire Manufacturing Co. Senator Owen of Oklahomo was one of the large stockholders in the tire company which has a factory in Washington, D. C.

Hercules Steel Casting Co. of Milwaukee has been successful in its defense to a suit brought by a stockholder for the appointment of a receiver and the issue of restraining injunctions. In dismissing the litigation, the Milwaukee Circuit court assessed costs of the action against the stockholder, Chris Thomsen. The defense was made by E. G. Gennrich, secretary-treasurer and manager of the company.

Zee Zee Rubber Co. plant at Yardville, N. J., has been sold at trustee's sale for $58,000 to a group of New York men represented by E. D. Newman, 29 Broadway, New York City. It is said that the group plans to organize a company to make automobile tires and tubes.

Earl Motors, Inc., has discontinued the use of the former Bohnet plant at Lansing, Mich., which was used for partial body production when the company was the Briscoe Motor Corp.

Receivers Postpone Sale of Auto-Lite to June 7

TOLEDO, May 29—No one appeared to bid for the Electric Auto-Lite division of the Willys Corp. at the sale scheduled at the County Court House to-day and the sale was postponed until June 7 by Receivers Frank P. Kennison and Francis G. Caffey, who were given power to postpone in the original order of the court.

Clement O. Miniger who is expected to acquire the property has resigned as a receiver for the Willys Corp. in anticipation of the sale. He was not ready to present his bid to-day but will do so next week, according to his attorney. The Fostoria Toledo plants are included in the offering at an upset price of $4,700,000.

METAL MARKETS

Automotive consumers continue to set the pace for steel buyers in other industries. Their leadership among buyers is all the more impressive as steel statisticians only a few days ago made their annually recurring discovery that the tonnage consumption of "the automobile industry" is relatively light. One of these statistical commentators said: "One cannot get far away from a factor of 5 per cent for the motor vehicle industry, despite its very large consumption of pickled sheets, blue annealed sheets, cold-finished steel bars, etc." In the first place this estimate of a 5 per cent consumption of the entire steel production by the automotive industries is utterly fallacious because it is computed on the basis of the weight of the finished vehicles, taking no account, whatsoever, of the steel that is used in the automotive industries and does not appear in the weight of the finished cars.

Take for instance the highest priced steel of which a pound sells for approximately 50 times the price of tonnage steel, i.e. high speed steel. This market had been dormant for months. Within the last few days it has undergone a revival as the result of automotive demand and 18 per cent tungsten steel now quoted at 75 @ 80c a lb. is destined for an early advance as the result of this demand. As an index to the important part which the automotive industries play in the steel market the only fair method of statistical presentation would be one showing in dollars and cents the amount of steel orders emanating from the automotive industries.

Pressure on the pickling capacity of sheet rolling mills, as the result of automotive demand, is such that they constitute the only division of the steel industry in which the daily output falls considerably short of the demand. And it is freely admitted by the tonnage critics that the automotive industries consume virtually all pickled sheets produced. Inability of the pickling departments to cope with the demand and insufficiency of the supply of sheet bars over the next month or two are the factors chiefly responsible for the worried look of automotive purchasing agents who are bending their every effort to insure a steady flow of material to their plants. The price situation is clarifying and greater stability is in sight.

Pig Iron.—Some Middle West automotive foundries needing early deliveries of foundry iron have been compelled to pay as high as $24, others enjoy protection at more favorable figures.

Steel.—Makers of cold-finished steel bars having automotive orders find difficulty in securing a sufficient supply of hot-rolled bars. There is much talk of the inadequacy of the prevailing spread between hot-rolled and cold-rolled bars and an advance in prices for the latter is not improbable. For strip steel some automotive consumers are reported to have offered premiums of $5 per ton for prompt shipment. In the Pittsburgh district automotive consumers appear to have the sheet market more to themselves as most of the other sheet consuming industries have temporarily withdrawn. Bolts and nuts are being contracted for freely by automotive consumers in spite of the recent advances.

Aluminum.—Some odd lots of imported ingots continue to be offered at concessions but on the whole the market is steady.

Copper.—Amid improving export demand copper prices have scored fractional advances.

Calendar

SHOWS

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiserdamm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

June 11-15—Milwaukee Annual International Convention of the Associated Advertising Clubs of the World.

June 19-20 — Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer Meeting of Society of Automotive Engineers.

Canadian Tax Law Will Boost Prices

Automobiles on Hand May 23 Subject to 5 to 10 Per Cent Levy

OTTAWA, ONT., May 26—Automobiles in the hands of agencies at midnight on May 23, on which bona fide sales had not been made, will be subject to the new tax of 5 or 10 per cent, according to the value, and also subject to the increase of 50 per cent in the sales tax, it was learned by inquiry at the Department of Finance yesterday.

The matter of administering the new taxes will be in the hands of the Department of Customs and Excise, the officers of which department will receive, it is expected, many requests for adjustments where sales had been partially completed before the new taxes became effective.

The budget provisions respecting automobiles read: "Schedule 1:—Automobile adapted or adaptable for passenger use, valued at not more than $1,200 each—5 per cent.

"Automobile adapted or adaptable for passenger use, valued at more than $1,200 each—10 per cent."

Canadian Made Cars Included

This tax applies on automobiles manufactured in Canada, as well as upon those imported into Canada after midnight of May 23.

George J. Pink of Pink & Blackburn stated in connection with the increased tax on motor cars:

This means that the price of all cars in Canada selling under $1,200 will increase about 6½ per cent and all cars selling over that price by about 11½ per cent. The increase will naturally go into effect at once.

It is the impression that the changes will give a shade of advantage to the sellers of Canadian made cars. The increase on Canadian made cars will be on the actual price to the dealer, while the increase in the American made cars will be their price to the dealer plus the duty.

Pink said that the increase will be passed along in every case to the buyer. In addition to the increase in cars specifically there is the increase in the sales tax. The present sales tax on cars was 3 per cent and the 50 per cent increase in the tax would mean that the sales tax in future would be 4½ per cent.

The chief selling American cars in Ottawa are the Hudson, Marmon, Maxwell, Chalmers, Nash, Moon, Studebaker, Cadillac, Packard and Dodge Brothers.

J. G. McGuire, of the J. G. McGuire Co., Ltd., stated that so far as the increase in the sales tax was concerned, his firm, which handles the Chevrolet, which is a Canadian made car, would absorb the increase. It was probable, however, that any increase in the internal taxes on Canadian made cars would be passed on in some degree at least to the purchaser.

Dodge Begins Shipping Its New Closed Models

NEW YORK, June 1—Dodge Brothers have begun shipments to dealers of their new closed models. Production of the old models was practically suspended several weeks ago and dealers have on hand a large number of orders for the closed cars.

The new sedan does not show a complete stream line design, but the radiator and hood are 3½ in. higher than in the old model, although a slight dip from the dash remains.

The rear axle is a new assembly, heavier than the old, of ¾ floating design instead of full floating.

Many minor changes have been made in the sedan body.

The new sedan is now on display at numerous showrooms and shipments of the phaeton will be made in the near future.

MUCH TIRE FABRIC USED

NEW YORK, May 29—Approximately 180,000,000 lb. of tire fabric are needed to meet the annual requirements of the automotive industry in this country, according to an estimate made by the American Wool and Cotton Reporter. This is at the rate of between 300,000 and 400,000 bales of cotton a year without any consideration of waste in manufacture. When this factor is figured the total used approximates 500,000 bales.

Colombia Opens Oil Fields; Prices Fall

Automotive Interests See Greater Opportunity for Sales Because of It

BARRANQUILLA, COLOMBIA, May 5 (*By Mail*)—An immediate result of the opening up of the Colombian oil fields is the radical reduction in fuel prices just announced by the Tropical Oil Co., which controls the Perdices field at Barranca Mermejes in the Department of Santander. Gasoline has been reduced in price from about $7 (Colombian gold) to $4.20 in ten-gallon lots and kerosene to $2.75 for the same amount.

Automotive representatives here look forward to larger sales as a result of this price change, as the cost of fuel has always been one of the drawbacks to extensive development. Raul H. Mendez y Cia., distributor for Ford and some of the General Motors lines, as well as tires and accessories, declares that the reductions will give a great impetus to the trade and predicts larger business during the coming months.

The exploitation of the Colombian oil fields is proceeding rapidly. Roads are being cut through the jungles to provide transportation and the activities are growing daily. Concessions in the fields stipulate that fuel must be sold in this country at prices comparable to those at New York, and gasoline and kerosene will fluctuate here in sympathy with New York.

At the present exchange rate, the gasoline prices here would be about $3.78 (U. S. gold) in the ten-gallon tins.

COMPLAIN OF TIRE COMPANY

WASHINGTON, May 29—Formal complaint against the Keaton Tire & Rubber Co. of San Francisco has been made by the Federal Trade Commission, in which it is charged that this company disparaged a competitor's name and goods. The company has been given 30 days in which to reply, after which the case will proceed on its merits.

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Research Essential to Industrial Progress

Opinions must yield to facts. Sound progress can be made only on basis of fundamental truths. Search for such data must be made in fields of marketing, engineering, production, and highway transport.

By David Beecroft

THERE are generally as many different conceptions of what constitutes research as there are people interested in research. One engineer has considered the development of a certain design or patent as research, and correctly so. For convenience, that might be called development research, the kind carried on in many industrial laboratories.

There are a few other industrial laboratories that conduct research of a different character, viz., for the purpose of discovering new facts in an uncharted field, and if possible, the writing down of principles relating to that field and the establishment of new laws.

Our universities and some industrial laboratories are engaged in a field of research which might be designated as intensive research, in that it has to do with the carrying out of very many experiments in given fields in order to determine the relationships existing within the field with the eventual object of discovering principles underlying such relationships followed by the possible formulation of laws applying to such.

Another aspect of a research and one that is preliminary to all research and also essential, is the collection of data relating to the subject in question. In many industries little has as yet been done in this collection of information from various sources. This work might be designated as the source from which research starts. This is the work which to some extent determines the line research is to follow. It gives a conception and a very definite one, of what has been accomplished by different investigators. These data furnish a record of the present accomplishment. They form a base line, so to speak, from which to carry on further researches. The purpose of this first annual research issue of AUTOMOTIVE INDUSTRIES is largely concerned with this collection of data, and the presentation of these, along organized lines, so that they may serve a purpose in facilitating research.

So little is research understood that too often those engaged in it are too frequently considered futurists and theorists and one of our leading research engineers has well expressed it by saying that the man who thinks of to-morrow is generally unpopular with those he is working with to-day. This well sums up the atmosphere in which the research man works. It expresses the estimation some manufacturing executives have of research.

The fact that during the last year or two many companies have dismissed some of the engineers connected with their laboratories and engaged in some form of development for research work, is largely an acknowledgment by such companies that they consider research work highly experimental and only

semi-practical in character. At no time has the discovery of facts, which is in short research, been more essential than at present. To take a leaf from financial practice, we consider first the necessity of budgeting our finances more in times of depression than in days of prosperity. And so in our engineering work, our needs for engineering facts are greater in days such as we are passing through than in times such as war days, when demand greatly exceeded supply.

Viewed psychologically, research is unpopular, as it generally implies an about face—a reversal of position. It means a discarding of old opinions which is a very difficult task, and substitution for these exploded but often long-cherished opinions of new, and sometimes very hard-to-get-acquainted-with facts.

The adoption of the fundamental principle of research implies the discovery and acceptance of facts, and the rejection of these long-held opinions which too often have become part and parcel of ourselves. There is nothing so difficult to rid ourselves of as opinions, perhaps largely personal, and which have consciously or unconsciously become part and parcel of our very existence. It is one of the most difficult tasks to separate ourselves from these opinions. It is akin to a medical operation in which we literally amputate what has become a corporate part of our daily existence.

This psychological aspect of research is more difficult because the examination of oneself is an unusually difficult problem—at times one that approaches the boundary of impossibility. It has been said that self is the most difficult object to analyze. We agree. Consequently, the discovery of the fact that we base so much on mere opinions, the origin of which we are not certain of, adds to the problem of analysis, and it is still harder to cast aside these cherished views that are a part of us, and to discover facts that will replace such faulty opinions. Research really becomes a work of upsetting your past life and building a new foundation on which to survey the future and build upon.

The discovery of new facts by research is long, laborious work, and too often the correct interpretation of these is not carried to its completion. This interpretation is perhaps the most difficult aspect of the work.

There is no royal road to research. He who would find this highway must search it out with the sweat of his brow. Following the thread of experiments, leading to discovery of facts very frequently leads through a labyrinth of years, not infrequently decades, and a lifetime may fleet away without the thread that the research student has been following having led him to the promised field.

Such long-deferred results demand a human tenacity all too rare in days like the present when the search after truth, call it the search after facts if such has a stronger appeal to you, is more needed than at any other time in the century. The too easy profits of the war years in many manufacturing industries had a diametrically opposite effect to what the needs of the present most demanded. It gave many manufacturers an unsound conception of their own importance and the real strength of their positions in industry. It gave a wrong conception of the value and soundness of certain designs, of certain policies, of certain methods, of certain processes. War always creates demand without due regard for the cost of obtaining the end; and too frequently the merchandising fact is eliminated. The problem is one of supplying a demand rather than marketing a product.

Witness our export trade, created during the war, a trade not secured by our own efforts, but rather thrust upon us by other nations not being able to secure merchandise in the markets of Europe where they had been accustomed to securing it. It is not surprising that our manufacturers devoted little effort and fewer dollars to securing facts on this foreign trade, and unfortunately too many in their own self opinion vainly imagined themselves almost super-human merchants in whose hands kind providence had placed some magic wand, the mere possession of which was an open sesame to the business doors of the nations of the world.

A rude awakening came in 1921, and is still with us. Each day impresses us with not only the greater importance, but the undeniable necessity of facts. Hard, cold truths as opposed to deceptively varnished opinions, that an always over-indulgent self is so proud to label its own.

No wonder we shrink from research and all it implies when so frequently our embracing it means a possible sacrifice of those opinions which may be quite a part of the warp and woof of all we are. It may often mean a veritable cutting of all bridges behind us.

The great necessity for all research is to establish the difference between opinions and facts. There is no more difficult line of demarcation to trace than that separating the zone of opinions from the zone of facts in our individual lives. So frequently the opinions have been held by us for so long that we have deposited them in our warehouse of experience as facts. We are very frequently ignorant of their origin and we hold them as facts rather than as opinions until they can be sanely established, a work too rarely done. Too frequently we are too proud to cast aside these opinions. We have had them for so many years, we have depended on them so frequently, they have been our standard in battle, that it is a large sacrifice to admit their error—to admit they do not rest on a sound foundation of facts, but are rather but part and parcel of a most uncertain structure.

When an engineer can classify his own knowledge and can consciously zone it into the two very different groups of opinions and facts, he has taken the first great step in his advancement in research. In research our aim is to work consistently to discover facts and establish principles. Research is concerned with searching after facts and the necessary organization and co-ordination of these facts as they represent principles. This development of facts and the culmination of the work in the establishment of principles is the end to keep in mind. Sometimes facts are as unusual strangers as opinions are highly unreliable friends. Ridding ourselves of these unsound opinions demands a sacrifice equal to that of getting on a speaking acquaintance with the few fundamental

RESEARCH takes the guess out of opinion. It substitutes "I know" for "I think." Sometimes it upsets opinions that have been held for many years. But it points the road to progress.

People that tell the whole truth with brutal frankness are not always popular. They sometimes arouse prejudice by turning the light of truth onto the shadows of opinion. Research is a good deal like these very candid people.

The need for research in every phase of the automotive industry, however, is great. Much has already been accomplished and many activities are now being carried on. This interesting article indicates the path of future development.

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THE FIELD OF AUTOMOTIVE RESEARCH AND DEVELOPMENT

MARKETING

1. Size of Market Numerically
- a. car
- b truck
- c tractor
- d. motorcycle
- e. other automotive vehicles
- f. parts, materials, accessories and equipment

2. Size of Market in Dollars.
(See sub-heads under 1.)

3. Factors Affecting Buying—Buying Values

4. Selling Costs

5. Methods of Distribution

6. Methods of Selling

7. Economic Influences Affecting Buying

8. Relation of Service to Sales

9. Effect of Advertising

10. Foreign Marketing
- a. location of markets
- b. factors affecting sales of given product in each given market
- c. type of selling organization
- d. methods of distribution
- e. methods of selling

THERMO-DYNAMICS

1. Cycles
- a. effect of variations in conventional constant volume type
- b. constant pressure type
- c. mixed steam and combustion cycles
- d. effect of variations in conventional two stroke cycle

2. Expansion and Compression Ratio
- a. means for increasing expansion ratio without excessive compression pressures

3. Heat Losses and Transfer
- a. rate of loss to jackets under various conditions
- b. rate of heat transfer with various surface and gas velocities

4. Effect of Cooling
- a. upon efficiency of engine
- b. upon temperature of wall surfaces
- c. upon maximum temperature and pressure of cycle

FUELS

1. Supply
- a. kinds of
- b. quantities available
- c. refining methods

2. Utilization
- a. requirements of service
- b. atomization
- c. vaporization
- d. chemical composition
- e. latent heat
- f. impurities
- g. corrosive action
- h. mixture proportions
- i. explosive range
- j. combustion
- k. detonation
- l. effect of diluents
- m. carbon deposits
- n. ignition
- o. blending
- p. diffusion
- q. distribution (in multi-cylinder engine)
- r. condensation and deposition
- s. absorption (in oil)
- t. effect of characteristics on economy

LUBRICANTS

1. Oils
- a. desirable characteristics
- b. lubricating value
- c. heat resisting qualities
- d. viscosity
- e. chemical structure
- f. volatility (fire and flash tests)
- g. deterioration
- h. oxidation
- i. carbonization
- j. emulsification
- k. gumming tendency
- l. effect of dilution
- m. blending
- n. effects of adulterants
- o. corrosive action
- p. laws of bearing lubrication
- q. effect upon wear and mechanical efficiency

2. Greases
- a. desirable characteristics
- b. lubricating value
- c. chemical composition
- d. heat resisting qualities
- e. deterioration
- f. corrosive action

TEST METHODS AND APPARATUS

1. Strain analysis

2. Development of better instruments

3. Development of better methods

HIGHWAY

1. Economics
- a. traffic studies
- b. community needs
- c. cost of transport
- d. economics of location
- e. financing
- f. highway valuation

2. Operation
- a. control of traffic
- b. accident insurance
- c. planning systems of transport
- d. financing
- e. distribution of costs
- f. maintenance systems
- g. maintenance machinery
- h. maintenance methods
- i. trail marking
- j. safety

3. Road Design
- a. subsoil studies
- b. base course
- c. surface
- d. cross section
- e. loads
- f. design of integral slab
- g. volume changes
- h. reinforcing

4. Road Design as Relating to the Vehicle
- a. design of vehicle
- b. effect of design on loads
- c. surface
- d. alignment
- e. cross section
- f. safety

5. Construction
- a. material
- b. mixing
- c. placing
- d. road testing methods
- e. design of experimental roads
- f. drainage
- g. impact on bridges
- h. reinforcing
- i. inspection
- j. plant design and control
- k. cost accounting
- l. construction contracts

LABOR

1. Stabilization of Employment
- a. general industrial stability
- b. study of business cycle
- c. possibilities of cooperative action by employes
- d. unemployment statistics (see Mitchell for Home Outline)

2. The Individual Plant
- a. influence of job type on individual efficiency
- b. relation of supervision costs to individual responsibility
- c. relation of physical fatigue to production efficiency
- d. relation of metal fatigue to production efficiency
- e. cost of labor turnover
- f. causes of labor turnover
- g. causes of lack of efficiency on part of worker
- h. methods of increasing efficiency
- i. relation of wages to production efficiency
- j. methods of wage payment
- k. bonus schemes
- l. employe stock owning

PRODUCTION

1. Relation of Worker to Production Efficiency
2. Cost Accounting
3. Machine Design
4. Departmental Layout
5. Machine Placement
6. Obsolete or semi-obsolete machinery
7. Relation of Parts Design to Production Efficiency.
8. Handling and Storage of Materials and Product
9. Machining and finishing methods
10. Effect of Methods on Quality and Rate of Production
11. Routing
12. Packing and Shipping Methods.

MATERIALS OF CONSTRUCTION

1. Steel and Iron
- a. requirements of service
- b. physical properties
- c. heat treatment
- d. means of preventing corrosion
- e. effect of impurities
- f. alloying methods and materials
- g. cause, location and effect of flaws
- h. microstructure
- i. factors affecting distortion
- j. electro-plating
- k. welding
- l. machining qualities and methods
- m. casting methods
- n. forging methods
- o. hardening and decarbonizing methods

2. Copper Alloys (Brass and Bronze)
- a. requirements of service
- b. physical properties
- c. heat treatment
- d. corrosion at various temperatures and means for its prevention
- e. effect of impurities
- f. alloying methods
- g. cause, location and effect of flaws
- h. microstructure
- i. welding and soldering
- j. casting methods
- k. electro-plating
- l. machining qualities and methods
- m. effect of cold working

3. Aluminum Alloys
- a. requirements of service
- b. physical properties
- c. heat treatment
- d. corrosion and its prevention
- e. cause, location and effect of impurities
- f. alloying methods
- g. microstructure
- h. welding and soldering
- i. casting methods
- j. machining qualities and methods

4. Bearing Materials
- a. requirements of service
- b. physical properties
- c. wearing qualities
- d. non-scoring qualities
- e. friction coefficient
- f. optimum alloys
- g. type requiring no lubricant
- h. optimum thickness
- i. microstructure
- j. corrosion

5. Wood
- a. supply
- b. requirements of the service
- c. physical properties
- d. effect of moisture content
- e. preservation
- f. fatigue
- g. causes of deterioration
- h. brashness
- i. shock absorbing qualities
- j. seasoning and drying methods
- k. kinds for different purposes
- l. laminated members
- m. moisture absorption through different protective coatings

6. Rubber
- a. requirements of service
- b. physical properties
- c. supply natural and synthetic
- d. effect of compound and curing on life or rate of wear
- e. aging
- f. effect of light and temperature on life
- g. internal power losses (hysteresis)
- h. cementing
- i. vulcanizing methods
- j. compounding
- k. optimum composition

7. Asbestos
- a. requirements of service
- b. physical properties including effect of temperature
- c. factors affecting durability
- d. abrasion
- e. friction qualities
- f. methods of compounding
- g. optimum composition

8. Leather
- a. requirements of service
- b. physical properties
- c. factors affecting durability

9. Fabric
- a. requirements of service
- b. physical properties
- c. holding finish coating
- d. durability of colors (fading)

10. Felt
- a. requirements of service
- b. physical properties
- c. factors affecting durability
- d. ability to exclude dirt
- e. oil retaining qualities

11. Glass
- a. requirements of service
- b. factors affecting friability
- c. color
- d. transparency
- e. surface regularity

12. Celluloid
- a. requirements of service
- b. factors affecting durability
- c. means for preventing scratching
- d. physical properties
- e. color
- f. transparency

13. Paints and Varnishes
- a. requirements of service
- b. factors affecting durability
- c. physical properties
- d. methods of application
- e. factors affecting drying

14. Glue (Celestin and Casein
- a. requirements of service
- b. optimum composition for various conditions
- c. factors affecting strength and durability
- d. methods of application

PERFORMANCE AND CHARACTER OF CONSTRUCTION

1. Complete Vehicles
- a. requirements of service
- b. factors affecting safety
- c. effect of various factors on fuel economy
- d. relation of service to life of vehicle and cost of operation—?
- e. economic size for various service
- f. factors affecting durability
- g. friction losses
- h. riding qualities
- i. factors affecting stability
- j. windage
- k. effect of vibration on life
- l. braking
- m. effect of vehicle on the road
- n. effect of the road on the vehicle
- o. optimum speed
- p. accelerating ability
- q. accessibility as affected by various types of construction
- r. relation of weight to economy and life of vehicle
- s. factors affecting skidding

2. Power Plant
- a. requirements of service
- b. optimum size, speed, No. of cylinders, type of construction, etc. for given performance
- c. factors affecting efficiency
- d. method of mounting
- e. balancing and other factors affecting vibration
- f. material for various parts
- g. design factors as affecting starting
- h. type of manifold, carburetor, etc., for maximum economy
- i. effect of design factors on combustion
- j. effect of piston and ring design on distortion power, friction and economy in oil and fuel
- k. effect of type and construction of ignition units on performance
- l. structural problems
- m. utilization of heavy fuels

3. Cooling System
- a. requirements of service
- b. heat transfer laws and their application
- c. relative advantages of air, oil, water and steam cooling
- d. optimum capacity, dimensions, and materials of radiating surface
- e. prevention of scale, clogging and corrosion
- f. relative advantage of forced and thermosyphon cooling
- g. factors affecting size, speed, efficiency and quietness of fan and its driving mechanism
- h. non-freeze solutions

4. Engine Lubrication System
- a. requirements of service
- b. factors affecting reliability
- c. effect of type on durability of engine
- d. optimum pressure
- e. means for preventing leakage
- f. methods of lubricating parts outside crankcase

5. Electrical System
- a. requirements of service
- b. type, timing and construction of ignition system
- c. study of factors causing trouble (reliability)
- d. type, location and mounting of generator and starter
- e. character of wiring and method of installing
- f. type of construction and carrying means for battery
- g. factors affecting suitability and durability of spark plugs
- h. factors affecting battery life
- i. contact materials

6. Power Transmitting Units
- a. requirements of service
- b. effect of gear tooth form on wear and efficiency
- c. other factors affecting efficiency
- d. gear design as affecting performance
- e. cause of noise and means for preventing it
- f. lubricating problems
- g. optimum type of construction for universal joints
- h. advantages of cushioning of driving members
- i. factors affecting ease of engagement in clutches
- j. factors affecting wear of clutch facings
- k. means for cooling clutch parts
- l. gearset location as affecting accessibility
- m. structural problems
- n. factors affecting efficiency
- o. possible improvements in type

7. Brakes
- a. requirements of service
- b. optimum type for safety
- c. cooling means
- d. factors affecting durability and freedom from noise
- e. effect of construction on braking effect and weight
- f. study of various factors affecting durability

8. Axles
- a. requirements of service
- b. relative advantages of various types of construction
- c. efficiency of various types of gearing with various lubricants
- d. optimum gear ratio for various conditions
- e. effect of weight on tire life and riding qualities
- f. effect of various factors on steering

9. Wheels
- a. requirements of service
- b. factors affecting durability
- c. effect of weight and material on tire wear
- d. relative shock absorbing ability
- e. optimum type for various applications
- f. type of rim construction

10. Tires
- a. requirements of service
- b. effect of loading on fuel economy
- c. factors affecting durability
- d. factors affecting frictional losses

11. Springs
- a. requirements of service
- b. optimum type for given conditions
- c. factors affecting weight—sprung and unsprung
- d. factors affecting durability
- e. means of lubrication
- f. factors affecting riding qualities
- g. effect of design on durability of vehicle

12. Frame
- a. requirements of service
- b. structural problems
- c. factors affecting strength and rigidity
- d. optimum method of riveting
- e. factors affecting selection of materials

13. Chassis Lubrication System
- a. requirements of service
- b. relative effectiveness of various types
- c. means for preventing waste of lubricant
- d. means for preventing damage due to dirt and moisture
- e. possibilities of bearings requiring no lubricant

14. Lights
- a. requirements of service
- b. means for preventing glare
- c. better distribution of light on road
- d. factors affecting durability (finish, filaments, etc.)
- e. optimum arrangement of lights and reflectors in buses

15. Steering Gear
- a. requirements of service
- b. factors affecting safety
- c. effect of various factors on ease of steering

16. Body
- a. requirements of service
- b. optimum character of construction for minimum weight and maximum durability
- c. type of construction to facilitate rapid and durable finish
- d. factors controlling heating and ventilation of closed bodies
- e. factors affecting wind resistance
- f. cause and elimination of noise

17. Trimming
- a. requirements of service
- b. finish as affecting ease of cleaning
- c. relative suitability of various fabrics for various uses
- d. type of upholstery for maximum comfort of passengers

18. Muffler
- a. requirements of service
- b. factors affecting silencing
- c. factors affecting back pressure
- d. structural problems

AERONAUTICS

1. Airplanes
- a. service needs
- b. resistance reduction
- c. stress analysis and structural refinement
- d. metal construction
- e. substitutes for fabric surfacing
- f. landing run and take-off
- g. wing arrangements and adjustable wings
- h. control and stability
- i. fire prevention and extinguishing
- j. weatherproofing

2. Airships
- a. service needs
- b. resistance reduction
- c. stress analysis and structural refinement
- d. propeller disposition and drives
- e. gas proofing of fabric and fabric substitutes
- f. hull ventilation and thermal insulation
- g. mooring methods and equipment
- h. control, stability and dynamic lift
- i. fire prevention and extinguishing
- j. weatherproofing
- k. gas purification and handling
- l. gas valves and controls

3. Helicopters
- a. service needs
- b. stability and control
- c. efficiency
- d. gliding ability

4. Gliders
- a. practical uses and service needs
- b. resistance reduction
- c. structural refinement
- d. stability and control

5. Hulls and Floats
- a. service needs
- b. structural refinement and weight reduction
- c. resistance reduction
- d. shock absorption and flexibility
- e. weathering qualities and seaworthiness
- f. metal construction

6. Propellers
- a. service needs
- b. efficiency
- c. weatherproofing and wood substitutes
- d. silencing
- e. pitch adjusting and reversing mechanisms

7. Instruments
- a. service needs and altitude effects
- b. engine instruments
- c. navigating and flying instruments
- d. ordnance instruments
- e. recording apparatus

8. Navigation
- a. methods
- b. observation and calculating apparatus

9. Landing Fields and Airways
- a. service needs, day and night
- b. economic hangar construction
- c. field arrangements and wind screening
- d. airplane and airship mooring
- e. drainage and runways
- f. fire prevention and extinguishing
- g. marking, color visibility and signalling
- h. wind direction and speed indicators
- i. launching and arresting mechanisms

10. Commercial Operations
- a. economic size and characteristics
- b. economic distances for operation
- c. operating cost reduction
- d. passenger facilities
- e. despatching
- f. operation with poor visibility
- g. Emergencies, life saving and salvage
- h. mail dropping and picking-up equipment
- i. business sources, new uses and extension
- j. regulation

11. Miscellaneous
- a. leakproof tanks, pipe and fittings
- b. automatic cameras and aerial surveying
- c. radio and direction finding
- d. radio antennae for use on surface
- e. parachutes and liferafts
- f. automatic pilots
- g. accidents
- h. new applications of constructional materials
- i. direct (jet) propulsion

12. Radiation
- a. service needs
- b. reduction of resistance of radiators
- c. Adjustment for temperature
- d. utilization of wing and body surfaces for radiation

13. Aerodynamics
- a. wing curves, military and commercial
- b. propeller model tests
- c. airship hull tests
- d. airplane bodies, military and commercial
- e. resistance of appendages
- f. wing arrangements
- g. tapered wings and slotted wings
- h. wing, body and propeller interference
- i. performance computations and corrections

14. Hydrodynamics
- a. resistance of hulls and pontoons
- b. planing of hulls and pontoons
- c. control of planing speeds

facts, or better still with well-established principles.

May we borrow an example from our highway situation of to-day.

We have nearly as many opinions as to what is the correct way to build a highway and the maximum load to carry thereon and the maximum permissible speed for travel, as we have highway engineers, motor truck engineers and transport engineers. But in the midst of all we have a famine of facts on highway design and highway transportation. No one engineer has yet measured and set down in figures, the facts on the transportation costs on a cement highway, a gravel highway, a brick or other form of highway. No one engineer has yet gotten the facts on the life of different kinds of highways for a given type of truck, or for the movement of a different quantity of commodity at different speeds and under varying conditions. We are short on highway, and highway transportation facts.

Unfortunately, we are very long on opinions. These opinions are the stumbling blocks to that rapidity of progress we desire. These opinions so often are of such long standing and so many reputations, be they big or small, are founded on these opinions, that it is a major operation in the life of the individual to change his opinion, and too frequently it is harder to get a research fact started than for the camel to pass through the eye of the needle. In no other sense is the fact that we are chained to tradition so true and so almost fatal to progress, as in this clinging to opinions and the lack of energy to see greater success in broadening our stock of facts than in clinging to our unreliable opinions.

The traditional adherence to opinions was well exemplified recently by a New England highway official, who expressed the opinion that the maximum gross motor truck load that should be permitted on the highways be ten tons. No reasons for such an opinion were given, the foundation for such being merely a hunch. The reason back of the hunch was largely based on a query as to where the money was to come from to build the future roads for his state. His suggested source of revenue was to tax the motor truck and make the vehicle that wears out the roads pay for their maintenance and construction—another opinion. He failed to appreciate the fundamental fact, or better still, the fundamental principle, that the community in which transportation is carried out, pays the cost, whether that cost is on highway construction, or highway maintenance, or high intitial price of motor truck, or high maintenance of truck, or high transportation cost, due to not using the most economic unit of transportation and employing this unit in the most economic manner. It is the citizen of the community who pays transportation bills. He may pay it in the form of a high state tax, or county tax, or a higher price for his milk for breakfast, or his loaf of bread, or every other commodity that enters into his business or domestic sustenance.

The illusive thread that will lead us out of the highway transportation dilemma, is the discovery of facts, and the recent research work of the Bureau of Public Roads, supplemented by work in some of our universities and state highway departments, will eventually bring to the surface the fundamental facts on highway transportation costs, and with these known the broad underlying principles can be discovered and the economic laws of highway transportation drafted. Throughout this work the struggle will be one of facts against well entrenched and traditional opinions.

Charles F. Kettering recently drew a practical analysis between research and finance which aids in clarifying our conception of the role that research should play in an industrial organization. He described research as the mechanical budgeting of our industries just as we budget our finances over a year or other period. What financial man, what president of a large factory, would base his year's program on a budget not based on facts, definite figures, expressed in dollars and cents?

What board of directors at an annual meeting would accept from the treasurer what was merely an opinion as to the assets and liabilities and which was not supplemented by specific figures to establish such opinions. The balance sheet of an organization must be accurate to the last cent. You never saw a statement that neglected the cents. There is no room for opinions on the financial balance sheet of a company. Its entire use is based on its adherence to facts. It is a reliable compilation of dollar-and-cent facts.

Research which results in the accumulation of facts accomplishes for engineering, just what facts do to the balance sheet. They take the guess out of opinion, if the opinion is not upset entirely. The manufacturer who hopes to make engineering progress by basing it on opinions is in a very precarious position and pursuing a highly uncertain and most improbable path to advancement. Here facts are merely accurate units for measurements of results as contrasted with estimates or opinions. These facts are, or should be, definite milestones by which to blaze out the trail of progress.

"RESEARCH gives to a man nothing that he cannot deduce himself, but it gives it to him easier and quicker."

One great need to-day is the training of men competent to carry out intensive research. Industries can profitably co-operate with the universities in the attempt to meet the demand for competent research workers.

What have our recent researches to motor fuels in the last eight years consisted of more than the discovery of facts and the interpretation of these so as to discover underlying principles? Different schools of fuel research have directed effort along certain lines so that each school seeks facts—not opinions. One school seeks facts in speed of flame travel, facts on speed of combustion, tries to measure and express in figures explosion pressures—in a word, to write down in indisputable figures, the explosion transaction, just as the business house writes down its profit or loss in a series of fundamental facts rather than in paragraphs of financial opinions.

Research work should never be confused as being a promotional department in an organization. Perhaps this statement is paradoxical in that the only progress that is enduring is that what is founded on facts. In this sense, research is heart and soul progressive, but a line must be drawn between the words progress and promotion. The ideal promotional work should be based on research, but this is not the generally accepted interpretation of the term. Insofar as promotional work is founded on facts, then research can be promotional, but too frequently promotional activities rest on opinions, in which facts unfortunately play too minor a rôle.

Research has not always to do with engineering problems and not infrequently what might be designated as psychological research has a more direct bearing on the development of an industry than any technical research might have. There are many examples in industry where a certain engineering design of apparatus has been

"RESEARCH is not going to deprive any engineer of his present work. It is going to enable him to obtain results which otherwise might not be possible. It is going to provide him with an arsenal well stocked with knowledge that will help speed his efforts to better work."

mechanically correct and has not employed any new engineering parts or relationships, but the success of which device has been poor. In short it has not had a psychological appeal. The success of the company is generally measured by its financial success and where the product may be correct from an engineering viewpoint, but does not appeal to the public, the end of that company is failure.

A psychological research may be necessary. Any piece of automotive or other apparatus to sell must have a human appeal—must coincide with the other standards of human development—must admit of application in accord with the present standards of life. For example: You might market an electric machine for the farm that involves nothing new in the electrical field, that is designed in accord with established facts, that has no unknown relationship existing among parts, but yet such machine might prove a failure if its application and operation are not attuned to the capacity of the farmer or not in sympathy more or less with his scheme of life.

Here the necessary research consists primarily in a search after psychological facts, rather than technical facts. The success of a company manufacturing the product is as dependent on the psychological facts as on the electrical facts, and here the business is but as strong as the weakest link. How often have you seen a product of accepted merit prove a failure due to its poor psychological appeal or because it is in violation of psychological principles and not resting on psychological facts.

The laws of the mind have not been nearly as definitely defined as the laws of nature, as the laws of mechanics but unfortunately there are manufacturers who have never heard of the science of psychology and they have constantly wondered why with all their engineering knowledge and all their manufacturing skill their efforts have not lead to success.

There are physiological researches that are as much needed as engineering and psychological researches are. The seat of a motor car and the general co-ordination of controls and measurements may be cited in explanation. To produce a comfortable seat, and it is agreed they should be comfortable, and admitted by others they can be, requires research of the human body, a study of the skeleton, muscles and tendons. A position of a muscle in repose as well as in tension should be known. A great portrait painter or any great animal artist must be as great a student in the proportions of anatomy and the relations of muscles to actions as in combinations of color or in the technique of pigments. The artist must discover the relationships of certain facial expressions with muscular tension, bone position, etc. He has the engineering of the physiological as well as the automotive engineer. So the motor car engineer should know the facts of the human body, the skeleton system, the muscular system and the physiological system in order to produce the best results. Our great musicians, both vocal and instrumental, have learned the necessity of physiological researches. There is not a great pianist but who performs in obedience to underlying principles governing movements of the human hand. The same applies to the great vocalist. Success in either is based upon facts—facts developed by research.

A factory research department because of the indefinite character of the work to be done, may prove to be a non-remunerative department if an effort is made to measure its value month by month. The fact that it is a research department too often presupposes that it is subject to no laws and requires no direction. There is no Blue Book that tells what corners to turn at as the engineer vainly endeavors to discover the route he is seeking across some uncharted plain. It may take years of continuous study to discover the direction in which to go and more years to chart with a degree of accuracy the route to that goal and still more years to discover what units of measurement are best applied to the work and what are the underlying principles and to write the specific laws that govern.

The presence of all these unknowns does not make impossible the pursuit of a definite program and the shutting out of irrelevant experimental work. The initiative of the research engineer must be conserved, in short, encouraged at every turn. But this encouragement can be accomplished none the less. If a gunner with a long distance piece, cannot see his target, even if he knows the position, he should, by application of the laws of ballistics definitely train his gun upon it. It profits little to merely shoot in the direction of the target. The explosive charge, the weight of projectile and characteristics of the gun, must all be brought into relationship before he hits the mark. He must correct for windage and take recognition of other interfering factors. Too many researches are merely firing in the direction of a possible target without bringing the facts of science constantly to bear on the task.

The origin of research is always found in a lack of satisfaction or lack of efficiency of some existing product, process, condition or state.

Our motor fuel may not burn in the combustion chamber to our satisfaction.

Our engine design may not give the amount of power per unit of fuel consumed we consider it capable of.

Our motor cars to hold the road as we think they should, have to weigh too much and we begin researching on roadability and unsprung weight.

Our commercial airplanes are not built with sufficient reliability, the public has opinions on accidents and we start to discover the facts that compose the alphabet in safety of commercial aviation.

Our engine manifolds do not distribute the mixture of air and liquid fuels of the different cylinders as they should and we start to write down the facts and aim to formulate the laws governing manifold design.

Our farmers do not purchase house lighting units in quantities as we think they should, and we institute a psychological research to discover reasons why and to find out what laws of psychology are directly concerned and wherein we violate them.

We are not certain of the wear of pneumatic tires upon heavy vehicles using our highways and we set out to measure the destruction and to write the facts.

We are not satisfied with the endurance of paint on wood surfaces and research to learn the reason why and possibly formulate a law.

Believing that the ability of a motor vehicle to hold the highway at speed, in other words to possess good roadability, is too low, we set out to study every detail in steering parts and if possible set down the mathe-

matics of every factor entering into roadability and to establish the relationships existing among these different factors.

Countless other examples might be cited. Each represents a research. Each is a definite target on which to concentrate. In each the problem can be fairly definitely specified.

Each research generally begins with the bringing together of all literature relating to the subject of the proposed research. This literature generally represents the sum total of existing information. This information has been studied, analyzed, arranged, rearranged and generally results in suggesting the many avenues or directions in which more information is necessary. It is a good chart by which to direct the work.

The research engineer should constantly have impressed upon him the fact that he is working on some definite problem that eventually will become an economic factor in industry.

He should always be conscious of the fact that he is not working on some problem, the solution of which may result in a process or device that will not prove an economic factor in the industry concerned. The keeping of this economic character of the process or the device is a safety valve in research work. It is a yard stick by which the progress of research can be gaged, when definite measurements of such progress may not be possible.

This definite factor in research work does not hint at putting blinders on the personal initiative of the research engineer. Some of our most useful research departments and most able research engineers are those who are required by their organizations to financially budget their different researches for a year and to periodically report progress of work. Research effort must be carried on with a definite objective of economic value constantly in mind. A new lubricant may have been discovered and definite laws for its manufacture written, but unless the machine equipment necessary to produce it is designed and built the research cannot be said to be complete. It then becomes incumbent on the research department to design a machine or a system of machines or processes that will commercially produce the lubricant or other product, and when this is done the work of the research engineer on that job is ended. The job is not complete if the necessary wherewithal to render the result of the research commercially successful has not been carried out.

This brings us to the state of transition between the research department and what might be designated as the commercial manufacturing department of the company. The research department develops the product to the commercial stage and produces the tools that may be necessary to manufacture it if necessary. The factory takes it and all problems relating to multiplication of production methods are factory problems and not research department problems.

Different companies in different industries vary widely in the practice of covering relations between the research department and commercial manufacture.

Some rather definite regulations have been laid down: One organization will not permit the factory manufacturing department to alter a fundamental of design which might not only interfere but quite upset a basic principle constituting the foundation on which the machine is designed. The manufacturing department is prone to see only the production phase of the job, and numerous examples could be cited of where a manufacturing organization has almost entirely destroyed the efficiency of the device. By alterations and design, intended to facilitate production, and perhaps reduce manufacturing cost, but at the expense of the engineering principle involved. This suggests the imperative need for close co-operation between the research and the manufacturing departments and vice versa. Not infrequently the great, if not the greatest problem, of the research department, is to upset the opinions and prejudices of the designing engineer. This is the oft referred to contest between facts and opinions. This close relationship between research and manufacture suggests what some term contact and others liaison work. The research engineer will generally find it desirable to keep in constant touch with the engineering, manufacturing and production departments long before he is ready to turn over a job he has been working upon. The oft heard remarks, that it will not work, it cannot be done, I know better, it never has been done that way, and others, suggest the task the research engineer has on his hands to convince the designing engineer. It is poor policy to try to do this conversion all at one time. Let us keep in mind that opinions are the most fatal enemies of research and that engineers are hugely human, much as we may think otherwise, and that their very education following channels of tradition, constitutes the bulwarks for the defense of these opinions.

> "MEN should gather the greatest satisfaction from the progress made in the search after truth. There is nothing so far removed from us as to be beyond our reach or so hidden that we cannot discover it, provided only that we abstain from accepting the false for the true and always preserve in our own thoughts the order necessary for the deduction of one truth from another."—Rene Descartes.

It is not surprising that in industries leading manufacturers with research departments insist on all modifications made for production or other reasons by the designing engineer be approved by the research engineer, solely to make sure that the underlying principles have not been disturbed.

The greater necessity for research in all departments of the automotive industry at this time is largely because of the greater demands from the public for more value per dollar expended. No one has yet weighed the effect of the great wave of economy that has been operating for upward of two years. No one has accurately measured the influence that it is going to exert on the products to be manufactured in the next few years. In no two previous years has the public studied prices and what is received for them so much as since the spring of 1920. The public has lived through a zone of price alteration, not local to the automotive industry but general to all industries. This has led the public to scrutinize values as never before. The uncertainty of the immediate future has introduced a thought of conservatism that formerly was not common with our buying public. The manufacturer finds himself faced with the problem of not only giving a better vehicle, if he is to build for the future, but also one at a fair price. The thought of merit in a product is more dominant with the buyer than formerly.

The second reason why research is so essential at the present time is that the great problem of production which absorbed the activities of manufacturers from 1912 up to 1920 has largely ceased. The question with the manufacturer is not how can I build more or in

greater numbers, but how can I build better and lower the manufacturing costs as well as the marketing and maintenance cost in every possible way. This situation has caused manufacturers to study markets as never before. The let-up in tractor sales led one of the best established tractor makers to institute a research on the buying capacity of different types of farming for his particular tractor. The study included an analysis of all crops and the zoning of the country into agricultural divisions that possessed similarity of climate, soil and cultivation characteristics. The facts developed by this research had a most important bearing on the manufacturer who made the surprising study that he was developing approximately 75 per cent of his manufacturing capacity to what constituted 15 per cent of the possible selling field for his product.

Merchandising Studies

Such a program was not an economic one, and the manufacturer by virtue of the facts developed, which contradicted long held opinions, was induced to program a new line of product, one that would better coincide with the status of the market. This simple example indicates how essential research is in the marketing field as well as in the field of design and how essential it is for any corporation to rest on a foundation of facts not only so far as the design of its product is concerned, but also so far as the possibilities of merchandising enter into it. This rounded-out character of research in any industry must constantly be kept in mind.

A motorcycle manufacturer, believing that the side delivery car offered one of the cheapest methods of light parcel delivery, looked with optimism on the future of such a field, but was surprised that the sales did not measure up with his conception of what they should be. A research carefully and broadly carried out disclosed the fact that while the side delivery car offered such possibilites for transportation, yet the driver was the obstructing factor. The driver could not be afforded necessary weather protection as in a conventional four-wheel type of vehicle. The research disclosed the fact that in the snow belt the side car encountered difficulties that the conventional four-wheel type did not have to cope with. In this case the fundamental research was a personal factor. It might be classified as a psychological one, and where the success of an industry is dependent on the strength of the weakest link, the psychological aspect may be of greater importance than the technical one.

The automotive industry faces to-day the necessity for a comprehensive research in transportation that will supplement the steam railroads and the electric railroads. The use of the internal combustion motor car on steam railroad lines is in its infancy in America, although cars of this type have been in use for many years. The movement has not been accepted and studied by the railroad people as it should have been. To-day there is grave possibility that this type of vehicle may be severely handicapped by restrictions of various characters considered necessary by the railroad interests. Only a co-operative research or study by the automotive industries and the railroad industries will evolve with the least expenditure of money and effort the most economic type of vehicle for this field. Individual researches conducted by each party will produce results that may not coincide, but by mutual effort better and speedier results will be obtained.

The past two years have witnessed factors injected into the controversy between electric railroad lines and motor buses that indicate how necessary sane researches after facts are in this field. The controversy has shown large corporations endeavoring to inject certain types into the field, largely because of vested interests and not because of the economic factors involved. In older established industries, such as the steam railroads and electric lines, opinions are naturally harder to remove than in newer fields of transportation. A recent example of this was when the American Engineering Standards Committee called a conference for the consideration of unifying colors in traffic signals, the railroad and electric railway interests immediately set about to make certain that their existing codes of colors were not altered but that all the alterations should be made in color signals as relating to the motor vehicle and the highway. There was no inclination on the part of either the steam or electric interests to enter on an even basis into the study, but rather hedged by traditional opinions that what they were using was right, they only saw one avenue of operation, namely, that all changes should be made in the newer forms of transportation. It is but natural to expect that such a stand should have been taken, and it is largely because of conditions such as this that researches or the establishment of facts as opposed to opinions are so necessary.

Examples as to why researches are necessary in so many fields of the industry could be cited ad infinitum. Accompanying this issue of AUTOMOTIVE INDUSTRIES is a supplement in the form of a chart that suggests the avenues along which researches should be carried out.

This chart was constructed with the thought that it should be comprehensive in character; that it should include all of the various lines of investigation from which the automotive industry will draw in determining its future practice. So far as we know, this is the first attempt of this kind that has been made. It is obvious that we have not accomplished our purpose in every detail. There may even be items of considerable importance missing from the tabulation.

Suggestions as to additions or corrections will be welcomed from representatives anywhere in the industry. Such criticism will aid in the development of a comprehensive picture of essential research activities and in bringing about a fuller recognition of their importance in maintaining the high standards of progress which have characterized the past growth of the automotive industry.

Highway Outline Good Example

For the outline of Highway Research we are indebted to the Advisory Board on Highway Research, from whose outline we have taken the highway part of the chart. This outline, prepared under the direction of Professor Hatt, director of the Advisory Board on Highway Research, presents an excellent example of the sort of basis needed throughout the field of automotive research. It comprises a thorough analysis of all the problems involved and a systematic classification of the various items in such a way as to give a vivid picture of the entire field.

The items listed in the chart are those which call for investigation, support and interest on the part of the industry.

The chief purpose of the chart is to visualize the vast extent of the research topics of direct or indirect interest to the automotive executive. In certain parts of this broad field the automotive industry must be the prime mover in the execution of the studies and investigations. In other instances responsibility for the actual work rests with allied industries. In these cases the automotive manufacturer is interested primarily in the results achieved and in the application of those results to automotive problems.

Market Research Activity Increasing in Passenger Car Field

Comprehensive outline of procedure needed. Research departments established in many factories. Retail sales laboratory is being operated by one large producer. General business surveys applied to current sales effort.

By Norman G. Shidle

SPORADIC effort and greatly increased interest during recent months have characterized market research in the passenger car field. Activities range from the collection and analysis of monthly registration figures to the operation by the manufacturer of a home retail branch as an experimental laboratory in retail automobile selling. Statistical departments are maintained in a number of factories, but few of these carry on what may properly be termed market research. Departments have been established in one or two cases which are given over to the collecting of various data affecting sales, to the analyzing, correlating and interpreting that data into terms of production schedules, distributor quotas and administrative claiming.

Comparative month to month examinations are usually made of sales figures as compared with competitive sales. One large manufacturer gets weekly telegrams from factory representatives in regard to the business and economic situation in nearly a hundred territories. Considerable study precedes the establishment of distributors' quotas in a few cases.

IN only one or two cases, however, has any definite continuing program of market research been laid out and followed through over a period of time. In most instances the object has not been to complete a research study to determine fundamental rules for permanent procedure, but rather to develop enough data to give the answer to a pressing immediate business problem.

Studies of this kind are included, to a large extent, in the field of competitive research, having to do with the development of a particular product rather than with the establishment of new principles of operation useful for promoting general progress.

Thus, it may be said that pure research in connection with passenger car marketing has been almost entirely lacking up to the present time. This is rather natural as there are many difficulties in the way of an individual company when it attempts alone to conduct research of a very broad character. Such general research is essential, however, as a basis for intelligent individual studies by single manufacturers.

More than a year ago one car manufacturer established a Commercial Research Department which had the following functions:

1. To lay out boundaries of dealers' territories along scientific lines and review contracts negotiated by the sales department.
2. To gather statistics bearing on the markets in which the company buys and sells.
3. To predetermine what the sales performance should be for the market as a whole and for each dealership.
4. To figure quotas and schedules for the market as a whole and for each dealership.
5. To keep statistical records of dealers, subdealers, and salesman's performance.
6. To analyze sales performance and point out faults and remedies.
7. To forecast economic conditions in markets in which the company buys and sells.
8. To analyze, construct, or carry out routines and sales promotion plans, investigate methods, practices, and policies.

This department carried out considerable research in all of the fields outlined, experimented with methods of establishing and varying quota, and fixed standards of performance for dealers upon the basis of economic studies. Much of the work done along these lines was, of necessity, fundamental in character, but a practical application of current results was necessary during the entire existence of the department. The work of this particular department has been greatly curtailed during recent months, but during the period of its chief activity a few sound major principles were established, which constitute probably the results of the most fundamental market research that has been done directly applied to passenger car marketing.

Territorial analysis has been attempted by a few companies, but the work has related to particular cars and to particular periods rather than to the establishment of and fundamental principles of general procedure. In many cases the study of markets is carried only far enough to permit the establishment of some sort of temporary working basis upon which to proceed for a few months to come.

Scientific studies of distribution costs have not played any important part in passenger car marketing studies thus far, while investigations concerning buying habits and buying characteristics have been sporadic and inconclusive in nature.

A brief survey of methods of setting quota in representative passenger car firms gives a clear picture of what studies are being conducted along these lines.

Very elaborate market analysis work precedes the establishing of quota in one or two cases. Comprehensive and accurate data are collected concerning a large number of factors affecting sales possibilities. These data

are listed, a certain weight is given to each of the factors and the factors are correlated to give the quota for the given territory.

One successful, conservative organization establishes distributor quota in this way:

THE percentage of registrations in a given territory to the total car registrations is first determined. The factory then determines the percentage of its own production absorbed by that territory during the previous year. When these percentages are about the same, as they are in many cases, the distributor is allotted that percentage of the year's production. When the two percentages do not agree, however, a compromise percentage is given, arbitrarily fixed with due regard to conditions within the territory, the number of cars that the distributor himself believes he can sell, road conditions and other factors.

In one factory quotas are established by taking the actual number of cars sold by a given distributor last year and adding to that number "as many more as the factory thinks he can handle in view of his selling ability and conditions within his territory." The number of cars to be produced by the factory, however, is determined before these quotas are established, so that the sum of the distributor's quota must arbitrarily be brought to that predetermined production total.

In another case, the distributor is expected to take a number of cars equal to a given percentage of sales of competitive makes to the total sales of the competitive group in his territory during the preceding year.

Another factory practically allows the distributor to say how many cars he will take.

Still another bases its quotas upon the number of cars taken last year by the given distributor, plus a certain number which is determined in conference with the distributor.

One company sets its production schedule and then gives to each distributor a proportion of that predetermined number based on the percentage of production absorbed by that distributor during the previous year.

One successful manufacturer likewise bases quota on the percentage of past production taken by the given distributor. Production is based upon "a number of factors compiled by the statistical department."

Another company relies very largely upon the intimate personal knowledge of the field possessed by a capable sales manager, correlated with the past performance of the distributor and the opinion of the district sales manager.

Still another method is found in basing quota upon the percentage of the given make of cars sold in the territory as related to total sales during the previous year plus a certain per cent.

AUTOMOTIVE INDUSTRIES has been conducting some general studies in connection with passenger car market limitations and probabilities, the results of which have been published in current issues. The whole field of research has not been adequately mapped out, however, nor has sufficient attention been given to correlating the various minor activities that are being carried on along this line.

The field of passenger car market research may be divided broadly into eight general divisions, as follows:

1. Size of market numerically.
2. Size of market in dollars.
3. Buying values—factors affecting buying.
4. Selling costs.
5. Selling methods.
6. Distribution methods.
7. Economic and human factors affecting buying.
8. Relation of service to sales.

Probably more effort has been made to determine the numerical size of the market than to analyze any of the other factors mentioned. Many of these studies have been static in nature, however, considering conditions only as of a given date. This has made it difficult to deduce from them any general principles. Research will seek to determine such principles so that methods of procedure for the future can be laid out on the same basis, even though current conditions fluctuate.

The numerical studies that have appeared in AUTOMOTIVE INDUSTRIES are good examples of the type of research activities needed along this line. These studies have viewed the numerical size of the market on a dynamic and constantly changing basis, seeking to establish methods and fundamentals which, through the interpretation of trends, will make it possible to determine the immediate future at any given time with a reasonable degree of accuracy.

Studies of this kind will first have to do with the prospective market for passenger cars in general. Then divisions into price classes and studies on the basis of price-class divisions will be necessary. For all work of this type, the free exchange of ideas and information among the various interested organizations is likely to prove of benefit to all concerned. So little has actually been done and so few fundamentals have been established that there is a rather strong necessity for an exchange of what data is available and a joint consideration of the factors involved.

Individual companies will later be able to analyze their own position and prospects in relation to others in their price group on the basis of the principles established through the more general studies just mentioned.

Research as regards the financial size of the market will naturally follow somewhat the same lines as those having to do with the numerical size, as one is dependent upon the other. The problem here is one of translation rather than of separate study.

THERE have been many statements made and many opinions expressed about buying values—about what the public wants. But there has been comparatively little investigation to find out. Buying values change, moreover, as do all the other factors affecting passenger car sales. New bases of comparisons arise and new influences determine in the mind of the purchaser the type and kind of car which he will buy. The continuous problem of every passenger car manufacturer is to correlate the design and equipment of his car with these comparatively unknown desires held by the public.

The abstract nature of this problem renders its solution doubly difficult and the necessity for pure research doubly urgent.

MARKET research in the passenger car field will accomplish many practical things for the manufacturers. Some of these are:

Predict with reasonable accuracy the probable market for cars.

Show the factors which influence buyers most strongly.

Bring to light inefficiencies in selling and distribution methods.

Stabilize production and reduce overhead.

Show in detail how service can be made a more effective aid to sales.

The cost of selling automotive products has constantly risen during the last ten years. This increased sales cost has been absorbed thus far by the increased efficiency of production processes. The relative efficiency of sales from a cost standpoint has decreased rather than increased. This process cannot go on indefinitely, and the period has arrived when a closer study of marketing costs is essential.

A high executive of one of the largest automobile companies is operating an important branch as an experimental laboratory for research in connection with retail selling methods. The results of the experimental work done in this branch is then correlated and transmitted in practical form for the use of all the distributors of the organization. This experimental work has been under way for some time. More studies of this type among manufacturers would be advantageous.

Selling methods may be considered largely a problem of the dealer, yet the manufacturer is so intimately dependent upon dealer efficiency that he must necessarily pay a certain amount of attention to selling methods. Certainly, the manufacturer will have to do whatever research work is accomplished along these lines.

MORE study has been given to distribution methods during the last twelve months than ever before in the automotive industry. The channels of distribution for passenger cars grew up like Topsy without any scientific analysis of the probable development nor the economic necessities of the situation. Only twenty years ago manufacturers were arguing as to whether or not "agents" would be necessary or whether the practice of buyers coming to the factory for cars could be continued indefinitely. To-day there are more than 30,000 dealers engaged in the business of selling passenger cars in the United States.

Between the manufacturer and the dealer the distributor or the factory branch has an economic function in the distribution system. The exact function and relationship of each of these distribution units has not yet been accurately defined, and readjustments are taking place all along the line. Considerable scientific study of the problems involved will be necessary before the most efficient system is determined.

The matter of storing cars, dealer inventories and the possible relation of the public warehouse to economic distribution all are a part of the factors concerning which further research is necessary.

FUNDAMENTALLY the human element is at the bottom of all car sales both from a selling and a buying standpoint. The variables affecting the human factor have been studied only superficially up to the present time and considerable effort will be necessary in this field of research. Effective work is already being done in a number of places as regards a study of business cycles and economic trends as affecting passenger car marketing.

The relation of sales to service is now generally recognized as important, but further study will determine more accurately the details of that relationship and thus enable manufacturers to better adapt design to the needs of the user and so order service methods that service will be a real asset to the sales department.

Magnesium Piston on New French Racer

FIRST of the new French 122-cu.-in. racing cars to get on the road are the Rolland-Pilains, built at Tours. These cars had been intended to start in the Indianapolis 500-mile race, but owing to delays at the factory they could not be completed in time for the trip across the Atlantic. They will appear in the French and Italian Grand Prix races.

The Rolland-Pilain engines have eight 2.32 x 3.54-in. cylinders in one aluminum casting, with a thin steel liner. Two valves per cylinder are used and they are mounted in the head, the angle between them being 160 deg. There is a separate camshaft for each line of valves, with front end drive by a train of spur pinions. A single spark plug is mounted in the head and receives its current from a Delco generator. Ball bearings are used for the crankshaft, camshafts and timing gear, and roller bearings for the connecting rods. By the use of magnesium the weight of the pistons has been got down to 0.22 lb., compared with 0.46 lb. for pistons of similar design in aluminum. The piston pin floats and has no bushings.

Experiments have been carried out with a mechanism for positively closing the valves by cam action, but it is not known whether this will be used in the race or not. At the present time both this system and the normal system of closing by valve springs are prepared, for two separate sets of cylinder heads have been constructed, and it will depend on the tests which type is finally retained.

The engine is combined with the gearbox, this latter providing four speeds ahead and reverse. Drive is transmitted through the springs, with torque reaction provided for through the gearbox; there is thus a single universal joint. The clutch is of the plate type and is fully enclosed.



The Rolland-Pilain racing car, the design of which is based on research work

In the chassis layout the features are the underslinging of all of the springs and of the frame at the rear. This gives the car a general slope rearward, and keeps the center of gravity down very low. As the French Grand Prix race is run on a course only 8 miles round, it has been decided to abandon the use of a spare wheel. This has enabled the body lines to be refined and has tended somewhat toward reduction of weight. With a track of 47 in. in front and 43 in. at the rear, and a wheelbase of 110 in., the total weight of the car is 1455 lb. This is 66 lb. above the minimum imposed under the French racing rules. The Rolland-Pilain cars are fitted with hydraulically operated front wheel brakes and hand-operated rear wheel brakes. The brake drums are in the axis of the wheel and steering pivots are straight.

Drivers of these cars in the European races will be Albert Guyot, Victor Hemey, Louis Wagner, and the aviator, Sadi-Lecointe.

Market Research Increases Motor Truck Sales

Past sales figures are carefully studied. Factors affecting demand constitute vital problems. Better correlation between production schedules and territorial quotas is sought. Sporadic sales analysis being done by almost all manufacturers.

By Philip H. Smith

MOTOR truck manufacturers are studying facts and figures concerning their actual sales far more thoroughly than they are analyzing market probabilities and demand and the factors affecting this demand.

A survey of the industry shows that market analysis is not playing an important part in the setting of production schedules.

Most frequently the method employed is for the sales manager and production manager or other executives to get together and set a production schedule based on their judgment of what they think they can dispose of through their selling organization. Territorial sales quotas must then conform to the factory schedule.

One concern sets production schedules by weighing the reports of the district managers. Another bases it on previous sales in the various localities using, to some extent, truck registration figures to determine strength of competition. In the case of bringing out a new model with no previous sales record to go by, they secure all possible production and sales figures of competing concerns and attempt to determine the actual demand for that particular model. Here again registration figures are employed. As a tempering factor the business conditions in the various territories are weighed against past sales performance. This latter concern has done rather exceptional analysis work.

The accuracy of the final conclusion as to actual demand depends chiefly on the ability of the branch manager or distributor to analyze his own specific territory.

Some study of markets is being carried on. Several concerns have carried investigation to great lengths and over a period of years, not always with satisfactory results. The method of adjusting territorial sales quotas is much the same as that used in setting production schedules. For the most part they are based on previous sales performance and to that is added what the sales managers think they can do in the coming months or year in the way of improvement. Often there must be more adjustment to fit a pre-determined production schedule. In short, the decision is left largely to the sales managers or manager and then adjustment is made with production.

Some of the results of this policy are: Overloading the selling organization because of the necessity of absorbing over-production; too many trucks in one territory and not enough in another with consequent losses and added expense from re-allocation.

Study to determine the best markets consists largely of analysis of past sales performance and conclusions drawn roughly that the best territory is necessarily that in which the most trucks have been sold. This method neglects the factor of actual demand and makes no allowance for the varying rate of growth in different territories.

Probably the strongest division in markets is that which exists between rural and urban. Manufacturers of heavy units have thus far found the urban markets to be the best for their product, while the manufacturer of light units finds the rural market a prolific one. The investment in the heavy duty truck is so large as a rule, as to necessitate maximum use to be profitable. This again makes evident the necessity of selling transportation rather than a particular type of truck.

The manufacturer of heavy duty trucks is beginning to concentrate on the branch form of selling organization with the object of controlling sales and service. The manufacturers of light trucks (which often use a passenger car engine) spread their selling effort over a wider territory and are not able to confine their selling to branches. We may say that the selling of light units is both intensive and extensive within an area, while the sales of heavy units is becoming increasingly intensive in the larger cities within the same area.

One concern states that they depend exclusively on branches for their business and have only a few dealers. The amount of business secured by the dealers is so small that they do not consider them in setting sales quotas. They maintain that they have found the giving of service so important that they cannot afford to let the responsibility rest outside the concern.

Manufacturers who distribute their product through a distributor-dealer organization find themselves handicapped in securing sales data in that the necessary cooperation in this matter is sometimes hard to obtain.

In the majority of cases the conclusions reached regarding the best form of organization and markets has been one of trial and error. Markets have been picked on the strength of past sales performance and very little by

"THE truck business is just beginning. The next five years after this should be the greatest period in the history of the industry.

"Our population is growing at the rate of 1,000,000 yearly. Our mode of living is constantly expanding, with the resultant increased demand for commodities of every description.

"We have 2,133,000 miles of highways and only 266,000 miles of railroads."



analysis of business conditions in the different districts.

With the exception of collecting data to assist the selling organization in studying a prospect's transportation needs, manufacturers have done comparatively little research work in connection with selling in the field and dealing with the ultimate sale to the consumer. Most companies leave this strictly to the direct representative.

There exists a wide divergence in the attitude of manufacturers toward this field of market analysis. One states that they are not opposed to it but just have not done any, believing that their business is so satisfactory that there is no particular need for study.

Another manufacturer believes that the added cost of employing people to carry on market analysis is not justified by the returns. In this case any analysis work that is carried on is done by the branches as they see fit and covers only the specific branch territories. The reason given is that it is difficult to convince a branch manager that the factory can know anything about his territory that he does not already know. It is assumed that a manager who is capable of appreciating the value of this kind of study is capable of carrying it on for himself.

Manufacturers have done, and are doing, a lot of valuable work in furnishing specific data to assist representatives in selling transportation to their prospects. Information is given regarding competitive trucks, the transportation needs of different industries, engineering features and principles as well as other material aimed to develop greater ability in the salesmen. Some factories have field representatives who are constantly giving assistance over the entire territory covered. Others utilize vocational files, field research and transportation engineering bulletins. Several concerns are training salesmen to become specialists in the transportation needs.

Territorial Sales Competition

In one instance a factory branch has done some very satisfactory work in determining the strength and nature of competition in its territory. This work has been carried along consistently for several years with increasing benefit. The factory is now undertaking a similar study of competition in all territories which will serve both factory and selling organization in helping to find the company's particular position in the industry.

Not the least benefit from this work is that of furnishing the means whereby the individual selling organizations may check up their own sales performance and the factory can check up on branches or distributors.

Used trucks have come to the fore as a problem. Many concerns have stated that it is the severest of all problems with which they have to contend. As yet very little study has been given to it and that of a widely divergent nature.

One factory which employs the policy of refusing to permit trade-ins of any trucks other than its own product has been able to avoid many of the troubles of over-allowances. This policy cuts down sales considerably and probably could not be carried on without there being a great number of existing owners, something a newer concern would not have. It is important to note that this concern rebuilds its "trade-ins" and wisely takes into account the number of rebuilt trucks on hand in a particular territory when setting sales quotas for that locality.

Another manufacturer has made a study of the potential replacement market for trucks by attempting to determine the average length of life of a truck. This has not proved very successful as yet, but he hopes by keeping at it to obtain concrete facts to work on.

Making Territorial Boundaries

The factor of the effect of distance in the cost of marketing has received very little attention. True, changes have been made which prove a recognition of the importance of this factor, but they have not, for the most part, been the results of any careful research.

The question of the maximum radius over which it pays to operate, which radius varies according to local territorial conditions and competition, resolves itself in the main into two parts:

1. The radius over which a branch or distributor may operate before increased economies would result from additional branches or distributors.
2. The most economical radius over which a dealer may operate. Whether additional dealers should be appointed or the number reduced.

"THE U. S. Committee on Reconstruction and Production has estimated this year's motor truck tonnage at 1,430,000,000 tons, and this is very likely to be more than one-half of the railway freight tonnage.

"So from this fact about the increased movement of goods, the prospects of the motor truck industry for the year are particularly bright."

Of the different factors bearing on the most efficient area to be covered by any one organization; actual demand within the territory, ability to make personal contacts, freight rates and ability to render proper service, the latter is now, perhaps, the most deciding factor in marketing motor trucks.

How to Analyze Markets

An efficient, accurate production program cannot be set without some knowledge of potential and actual demand. It can be approximated in many cases but no amount of confidence in the superiority of "our product" or the collective judgment of executives can take the place of a scientific study of actual demand.

Manufacturers should first sell transportation and evidence the rendering of real service before undertaking market analysis, because business which has been secured without consideration of fitting transportation needs is not a good criterion of future business.

A knowledge of business cycles is of primary importance. Market research will be incomplete and inaccurate unless the existing phase of the business cycle is known and applied to the data at hand. This means that we must know whether we are on the down grade or up grade of business activity.

The following steps are suggested for setting a scientifically determined production schedule:

1. Actual production figures of the specific concern taken over a period of years and the ratio of its production to the total production determined for each year. This will show what percentage of the total business has been secured and whether the percentage is normal, increasing or decreasing with relation to the total truck production.
2. Having determined the proportion of business which may logically be expected, the figure must be weighed against the existing phase of the general business cycle which will give the actual demand. The actual demand should be the production schedule.

The next steps in the procedure are:

3. An analysis of the nature of the transportation requirements of the concerns within a specific territory to determine the potential demand which the manufacturer's product is suited to fill.
   (a) An analysis of business conditions within the territory and application of this analysis to this demand. This will give the actual demand in the territory.
4. An analysis of past sales performance (over a period of years as in No. 1) of the specific manufacturer in that territory with relation to the performance of all competitors, in other words, the percentage of total business secured by the specific manufacturer. This will give the actual demand for that manufacturer's product (with seasonal variation) in the specific territory.

The production schedule is then determined by taking the sum of these actual demands in all territories covered.

The production schedule determined by No. 1 and No. 2 should be the same as that determined by No. 2 and No. 3. This serves as a check on the work done.

In two instances it was stated that past performance should be considered over a period of years rather than for just one year. This is essential because a manufacturer may be increasing the number of sales in a specific territory, or increasing production, and yet be falling behind with relation to his competitors and the industry as a whole. Territorial analysis and analysis of production figures will show up these facts. If sales are decreasing with respect to the whole industry they cannot be increased without a strengthening of the weak link, the selling organization, service or the product, other things being equal.

The boom year of 1920 made many manufacturers think that market research was unnecessary. The great falling off in production in 1921 and the very trying, bewildering times that the motor truck industry passed through, revived, to a certain degree, interest in market research but at the same time it was also necessary to curtail all expenditures which did not give immediate, profitable returns.

The concensus of opinion during the period of depression was that market research had not proved its worth, hence it was no time to give it a tryout. The study of markets has suffered from the idea that it is not needed in boom times and cannot be afforded in periods of depression.

Before undertaking any analytical work it is wise to make a complete survey of the organization and determine with what object analysis work is to be done and what facilities they have for doing it. A comprehensive plan must be laid out before work is started. This is often neglected. Data are collected before it is known to what use they are to be put. Sometimes the right material is secured, more often it is not right, or at best incomplete, and this prevents accuracy of the final result.

The laying down of a fundamental plan should be done by an executive in conjunction with the man who is to carry on the work. Such a plan should be as comprehensive and specific as possible and follow definite lines of procedure.

Trained Men Needed

Failure to achieve anything through market analysis and inaccuracy in such work as is done is due in a large measure to the lack of sufficient data to work with.

The desire to do research work has been promoted by necessity more often than foresight. Consequently data from previous years are not to be had and conclusions must be secured promptly, both of which spell a limitation in the value of the work done.

Data should be collected over a period of years. There are many variable factors, and the only way that the percentage of error can be reduced is to cover a long period of time. Analysis work cannot be promoted without the recording and analyzing of business experience and this cannot be done without recording it as it occurs.

Some difficulties have been experienced by manufacturers who produce both trucks and passenger cars in that they have not realized, in their research work, that the factors which govern the sale of trucks are totally different from those which govern the sale of passenger cars.

It is difficult to acquire men trained in the carrying on of market research because it is a comparatively new field of study. Statisticians or men with an analytical type of mind have been chosen in some cases. As a rule, anybody that liked to fool with figures has been eligible. A wide knowledge and grasp of general business principles, however, is essential.

The effectiveness of sales analysis depends on the ability with which the sales manager translates the information to the selling organization. The facts must be disseminated effectively. There exists a wide difference in the capabilities of sales managers to use the material which is furnished them.

The men who conduct and utilize market research must be granted the same status and consideration as is given to those engaged in engineering research, and if they are not worthy of this consideration then they are not the men to carry on successful market research for a concern.

The field of truck transportation is enlarging steadily, and with it come new needs for analysis. Bus transporta-

tion affords an outlet for truck production that is constantly growing in importance. The installation of bus lines on a sound financial basis requires a study of operating costs which the truck manufacturer can, and should, assist in. Manufacturers might well study the transportation needs of territories and be ready with assistance for those who undertake to install bus lines.

The larger conception of the economic value of highways will bring about many changes which must be foreseen. As one manufacturer puts it, "I expect to see a revolution of our conception of the highways, which in turn will change the character of the truck industry materially."

New legislation with regard to truck loads, sizes and widths means that the truck manufacturer must be constantly studying transportation requirements with relation to these laws of limitation, for such they are.

Already there exists divergence in opinion between truck manufacturers as to the type of transportation unit which will ultimately have to be used to carry the necessary loads and remain within the law's requirements. One says that it will force heavy loads to be carried on six wheels, another says that it will increase the number of smaller trucks and do away with the big units.

That railcars are yet in their infancy and research work will probably be limited to engineering for some time is the general opinion. Far-seeing manufacturers will begin to study the potential market for this type of vehicle before the necessity arises.

Co-operation with the railroads in the transportation of commodities has become extremely necessary. Some manufacturers have undertaken a study of this, but the majority consider it something to be done by truck operators and railroads and quite beyond their field of endeavor.

A survey of the industry shows several reasons why market research may have failed to give satisfactory results in the past. Some of the difficulties which almost all manufacturers have had to contend with can be listed in four groups as follows:

1. Lack of knowledge of what market research is and what it is capable of doing.
2. Absence of a fundamental, well thought-out plan of procedure.
3. Insufficient data with which to carry on work.
4. Lack of properly trained men to carry on research.

Reactions of Accelerators During Vulcanization

C. W. BEDFORD and L. B. Sibrell presented a paper on the above subject to the Rubber Division of the American Chemical Society at its Rochester (N. Y.) meeting in April last. The authors regret the lack of knowledge concerning the chemistry of sulphur reactions of organic nitrogen compounds. They attribute the curing power of nitroso accelerators first to their oxidizing power, which will greatly speed the reaction of the sulphur with the accelerator rubber resin or rubber protein, thereby bringing the nitrogen in the rubber into quicker action as an accelerator. In this sense, therefore, nitroso accelerators are, first of all, secondary accelerators acting in the same manner as litharge. Nitroso phenol has this type of accelerating power, and the fact that its reduction product is not a primary accelerator has no bearing on its action as a secondary accelerator.

The carbosulphydryl accelerators constitute the most important class of vulcanization aids known to-day. This carbonide is probably used in larger tonnage than the gross weight of all other accelerators together. Other than thio-urea derivatives, this class includes the thiuramins, dithiocarbonates, mercaptans, mercaptides, disulphides and all accelerators which produce these or similar compounds during the vulcanization process. In considering the class as a whole, one cannot overlook the great effect that zinc oxide has on the curing power of these accelerators, and it soon becomes evident that the action of the secondary accelerator must be known before much can be done to explain the action of the primary accelerator.

The question of the use of organic accelerators was discussed at a recent meeting of the Institution of the Rubber Industry at London, and considerable difference of opinion developed. Dr. Henry P. Stevens, the speaker of the meeting, favored the use of accelerators. He considered the use of a very slight proportion (about 1:800) of sodium bisulphide as quite harmless. The bisulphide is added to the rubber to prevent the development of an inorganic ferment which darkens the rubber and subsequently turns it streaky. The bisulphide is a preventative, not a cure, and if the darkening has once set in it cannot be cured even by concentrated solutions of bisulphide.

Reagents for Etching Alloy Steel

SOME experiments in the line of sequence etchings have been carried out at the Bureau of Standards at Washington on specimens of high speed steel in the condition as "received from the mill." Sequence etching means the etching with two or three reagents in successive order without any repolishing of the section between the etchings, and the taking of photomicrographs after each etching at the same spot in the microsection in order to note any changes in microstructure produced by the last etching as compared with that developed by the preceding etching reagent.

The reagents used in various combinations were: (1) Dilute ammonium hydroxide solution together with a weak electric current, the specimen being made positive pole; (2) two per cent alcoholic solution of nitric acid; (3) boiling sodium picrate, and (4) Murakami's reagent (solution of potassium ferricyanide and sodium hydroxide) at boiling temperature.

The results, as judged from the behavior toward the various etching reagents tried, appear to show that there are at least three different constituents present among the imbedded globules or particles in the specimen of high-speed steel, in the "as received from the mill condition," though any attempt to state the nature of these constituents would, in view of present developments, involve speculation.

Market Research Essential to Development of Tractor Design

Farming methods not likely to be changed to meet tractor requirements. Tractor must meet farm needs. It is essentially a power generator for soil preparation and belt work. Government and agricultural schools active in tractor research.

By E. A. White

THE year 1913 is generally regarded as a turning point in the tractor industry. It marks the time when manufacturers turned their attention to developing the types of machines which have constituted the large bulk of the sales during the past eight years. Now the question arises as to what ultimate market the types recognized as standard today will find, and whether or not it is necessary, to supplement these types with others in order to realize the maximum benefits of the internal combustion engine in agriculture and industry. The tractor manufacturer has or should have his eye on a world market. No matter by what means the directors of the industry's policies arrive at their conclusions they are certain to formulate plans in regard to the domestic and foreign market for the tractor. Whatever the policy, it will take into account both the active and potential markets. As so much depends upon the conclusions arrived at in regard to these matters it is important that the foundation upon which they are based should be as broad, deep and as substantial as possible. In the present state of tractor development and use we cannot know too much regarding the power requirements of agriculture and industry together with the results which have been attained with the present types of tractors in these fields.

At best it is a complicated problem involving many interrelated factors which must be differentiated, weighed and placed in proper relation to each other. In fact the problem is so complicated that most tractor manufacturers have used what might be called "a wholesale integration" method of arriving at conclusions. The sales department is consulted and the sales manager gets opinions and other information from the force in the field. Similar material is collected from the design and service departments and from this the policy is formulated. There is no denying that this system has its value and will always be used. The point is: Can it be supplemented by investigations and researches which will throw light on the problem yielding results commensurate with the expense involved?

As "the proof of the pudding is in the eating" this question can only be answered by finding out what light can be thrown on the market possibilities of the tractor from the investigations and researches which have been and are being conducted by various institutions and organizations. It is the purpose of this article to call attention to the more important sources of information and by means of a few examples show some of the possibilities in this direction.

In U. S. Department of Agriculture Circular 212 there is given tractor production statistics for the years 1909 to 1920, inclusive. The U. S. Department of Commerce, Bureau of Census is now collecting the production statistics for the year 1921, but the information is not yet available. The Statistical Number of AUTOMOTIVE INDUSTRIES estimated this at 50,000. Taking the information from the above sources it is found that 704,906 tractors have been produced in this country during the years 1909-1920, inclusive. During the years 1916-1920, inclusive, the tractor production was 592,906 or approximately 83 per cent of the total as given above. Of the 1916-1920 production 472,943, approximately 80 per cent, were sold in this country. It is too early to be able to report any figures regarding 1922 tractor business, but sufficient information is at hand to warrant the assertion that more tractors have already been sold this year than during the entire year of 1921.

The American farm has been the chief market for tractors and undoubtedly will continue to hold premier position in this regard. The 1920 census showed 246,083 tractors on farms. With this as a basis it is estimated that there were 396,071 tractors on American farms Jan. 1, 1922, according to the method shown in Table II. This gives an increase of 61 per cent in two years, a remarkable showing when the conditions prevailing during the last half of 1920 and during the year 1921 are taken into account.

Only 3.6 per cent of farms, however, reported tractors on Jan. 1, 1920. The sale of tractors during the past two years probably raises this figure to between 5 and 6 per cent. These figures leave no doubt that as far as number of farms is concerned there is a remarkably large potential market for tractors.

The problem is: What percentage of this potential market will become active and how fast will this transition take place? In this con-

TABLE 1

TRACTOR PRODUCTION BY YEARS

Data, except for 1921, from U. S. Department of Agriculture, circular 212.

Year	Tractor Production
1909	2,000
1910	4,000
1911	7,000
1912	11,000
1913	7,000
1914	10,000
1915	21,000
1916	29,670
1917	62,742
1918	132,697
1919	164,590
1920	203,207
1921	50,000
Total	704,906

nection it is well to look at the number of farms classified according to size. Of the total number of farms 4,428,107, approximately two-thirds, are between 20 and 174 acres in size. There are 1,223,701 farms over 175 acres in size. These larger farms constituting something less than one-third the total number of farms furnish a most attractive tractor market, but it is evident that if the possibilities of power farming are to be realized the other two-thirds must come in for careful consideration.

The tendency in tractor development today is to give more attention to the small farm on the hypothesis that it is easier to build a tractor to meet its power requirements than to attempt to change the system of farming to meet the power possibilities of the large tractor, which is much too expensive for the average farm.

For the past ten years the tendency has been to develop smaller and smaller tractors, and on the basis of the total number sold these smaller tractors have found a relatively large sale. In 1920 the last year for which definite information is available on this point 98,735 of the 162,988 sold to dealers in the United States had a rating of 18 horsepower or less on the belt, undoubtedly placing them in the 2-plow or smaller class.

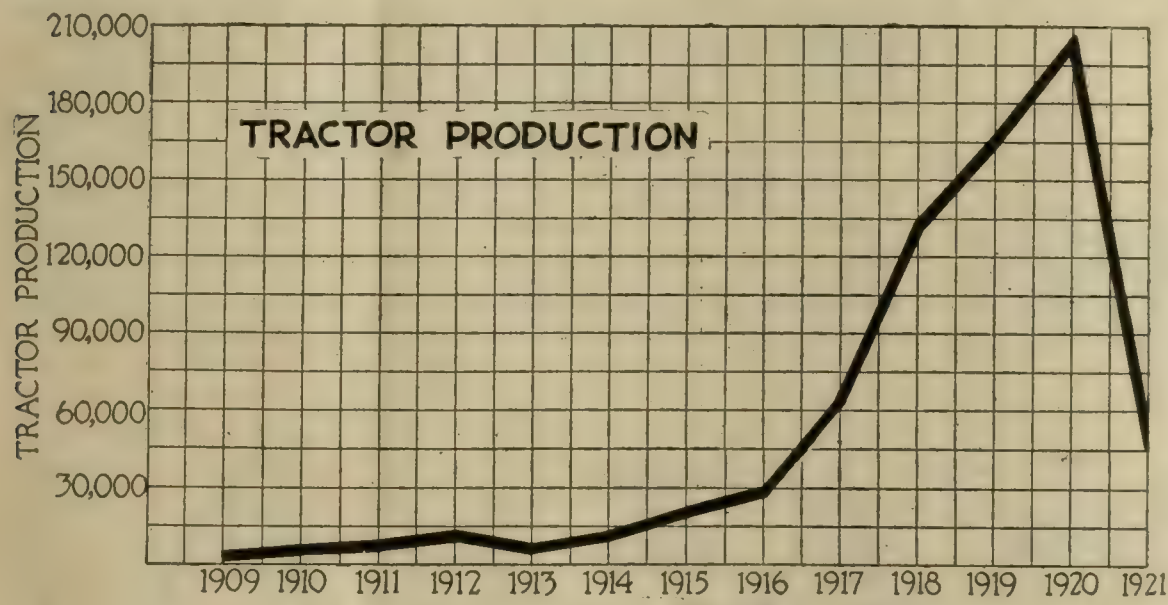


Fig. 1—Tractor production 1909-1921 inclusive

It would be of interest and value to know on what sizes of farms tractors have been placed. A company manufacturing a representative line of tractors, including 2- and 3-plow models, made a field survey in 1920 of a large number of the purchasers of these sizes of tractors and

TABLE 2

Method of estimating the number of tractors on American farms Jan 1, 1922; the number is 71 per cent greater than Jan. 1, 1920.

Tractors on farms, Jan. 1, 1920 (U. S. census)	246,083
Tractors sold to dealers, 1920 (U. S. D. A. manufacturers census)	162,988
Tractors manufactured 1921 (estimated)	50,000
	459,071
On hand, dealers and manufacturers, Jan. 1, 1922 (estimated)	40,000
Sold to others than farmers during 1920 and 1921, including 1921 exports (estimated)	15,000
Discarded (80% 1914 production)	8,000
	63,000
Tractors on farms, Jan. 1, 1922	396,071

the results showed that 80 per cent of them had gone to farms over 175 acres in size. In other words, on the basis of number of farms this company was selling over 80 per cent of its products to 20 per cent of the market. Unfortunately the Bureau of Census did not classify tractors on the basis of the sizes of farms. A number of surveys have been made, however, both by the U. S. Department of Agriculture and a number of agricultural colleges in which the sizes of farms on which tractors are used are given.

What these investigations show on this point is well illustrated by the results of three investigations conducted during the past year and one-half by the U. S. Department of Agriculture in three different sections of the country. H. R. Tolley, who had direct charge of the field work, expresses the belief that the results obtained are entirely typical of the distribution of tractors on the farms of the regions where the investigations were conducted.

The southern investigation covered 684 farms on which tractors are owned in the States of Alabama, Georgia, North Carolina, South Carolina and Tennessee; the corn belt investigations covered 286 farms in the States of

TABLE 3

Ford Tractor Sales by States, to Dealers

1917-18—Jan. 1, 1922

	Total		Total		Total
Alabama	945	Michigan	5,075	South Dakota	2,993
Arizona	523	Minnesota	6,838	Tennessee	2,072
Arkansas	1,663	Mississippi	868	Texas	9,909
California	9,008	Missouri	5,543	Utah	756
Colorado	2,681	Montana	1,356	Vermont	454
Connecticut	467	Nebraska	5,174	Virginia	2,724
Delaware	354	Nevada	40	Washington	2,388
Florida	1,166	New Hampshire	246	West Virginia	939
Georgia	2,852	New Jersey	1,768	Wisconsin	6,532
Idaho	1,000	New Mexico	367	Wyoming	589
Illinois	13,993	New York	6,306		
Indiana	8,081	North Carolina	3,246	Sub-total	162,296
Iowa	8,981	North Dakota	3,265		
Kansas	8,615	Ohio	10,585	Alaska	7
Kentucky	1,892	Oklahoma	4,827	District of Columbia	65
Louisiana	2,197	Oregon	2,385	Hawaiian Islands	49
Maine	675	Pennsylvania	6,036	Mexico	328
Maryland	1,431	Rhode Island	134		
Massachusetts	951	South Carolina	1,406	Grand total	162,745

TABLE 4

Showing the percentage of horse-hours for various operations according to investigations conducted by the U. S. Department of Agriculture and reported in 1919 year book.

Operation	Iowa grain and stock farm	Illinois corn and hog farm	Wisconsin dairy farm
Road hauling	26	20	13
Farm hauling	21	22	35
Plowing	3	16	11
Discing	8	12	8
Harrowing	6	4	5
Rolling	..	4	1
Cultivating corn	12	11	6
Cutting grain	2	1	2
Hauling manure	9	4	8
Other work	13	6	11
Per cent total work	..	..	..
Two-horse operations	65	57	58

TABLE 5

The total days which the tractor was used on the farm and the distribution of the work for which it was used.

	Southern	Corn Belt	Wheat Belt
Total days used per year	52.5	30.8	37.6
Per cent home work	93.0	85.0	87.4
Per cent custom work	7.0	15.0	12.6
Per cent home work plowing	44.0	47.5	....
Per cent home work other drawbar work	36.0	42.4	....
Per cent home work outwork	20.0	12.1	8.0

Illinois, Indiana and Ohio and the investigation in the spring wheat belt covered 354 farms in the States of Oklahoma, Kansas and Nebraska. In commenting on this Mr. Tolley said: "In any community you find relatively few tractors on farms under the average size of farms in that community."

The distribution of tractors by sizes of farms as found by these investigations and the distribution of farms by sizes in the states listed above are plotted in Figs. 2 to 7, inclusive. Unfortunately the reports of the investigations were not compiled according to the sizes of farms as reported by the Bureau of Census. These charts show that there is a distinct correlation between the larger farms and the number of tractors, and bear out the contention that the smaller farms have not yet been motorized to any appreciable extent. This would also lead to the conclusion that at present greater results can be secured by directing sales efforts towards the larger farms. The conclusions regarding future developments are left for the reader to formulate.

So far as is known there are no comprehensive investigations reported making an analysis of the horsepower hours required for various farm operations in different types of farming. Lacking specific information the best course is to make use of such material along this line as is available. In the 1919 yearbook of the U. S. Department of Agriculture there is a report of an investigation of the horse-hours required for various operations on three farms. A summary of this report is presented in Table IV which gives the percentage of horse-hours required for the more important operations. The percentage reported for plowing on the Iowa farm is low because the fall plowing was done with a tractor which had been purchased primarily for belt work. While the figures in this table do not represent accurately the relative amounts of power required for various operations they are accurate enough to indicate what problems must be met. Perhaps the most surprising fact is the large amount of 2-horse work due in no small measure to the large amount of farm and road hauling.

Such figures as these raise the question of how large a percentage of farm work can be economically done with a mechanical motor having a larger working capacity than a 2-horse team. Upon the answer to this question depends, in no small measure, the ultimate types of tractors. It should be pointed out that generating power for belt work was not taken into consideration in this investigation. Therefore the total farm power requirements are greater than indicated by the reports.

After studying the farm power requirements it is important to find out how completely farmers are using tractors. Some idea of this can be gathered from the results reported in Table V which are taken from the reports of the three investigations conducted by the U. S. Department of Agriculture previously referred to. In comparing this with the data in Table IV it is found that plowing which constitutes less than 20 per cent of the farm power requirements represents over 40 per cent of the tractor use and other soil preparation work makes up a large percentage of the balance exclusive of belt work. While the U. S. Department of Agriculture has reported some 17 drawbar and 15 belt operations for which the tractor has been used on the farm, all reports examined in the preparation of this article clearly indicate that in the field to-day the tractor is essentially a power

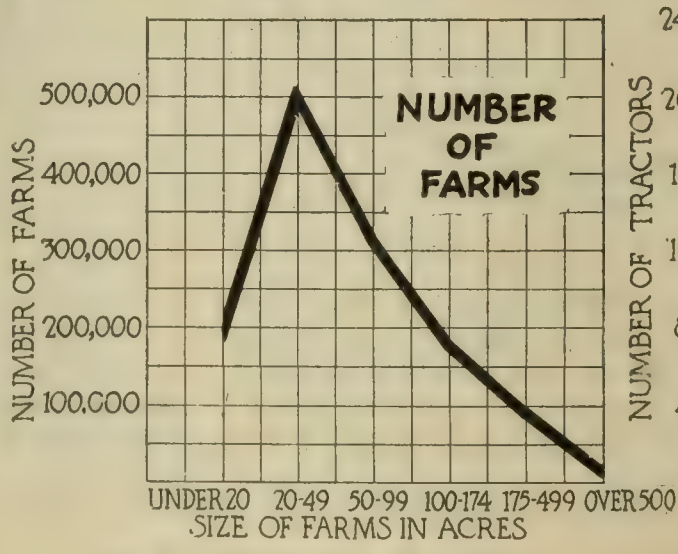


Fig. 2—Distribution of southern farms by size

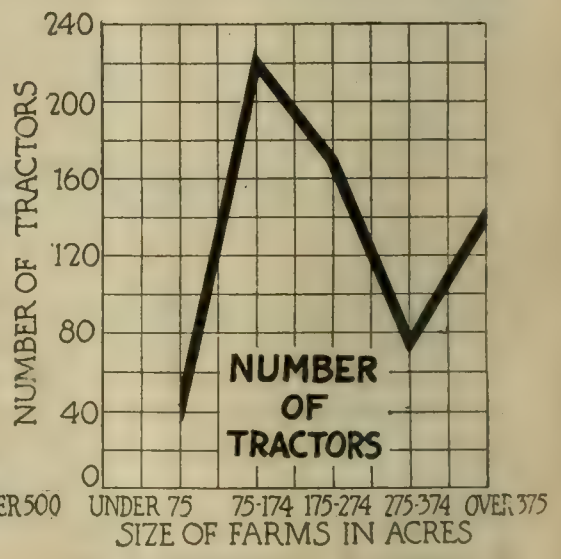


Fig. 3—Distribution of tractors on southern farms

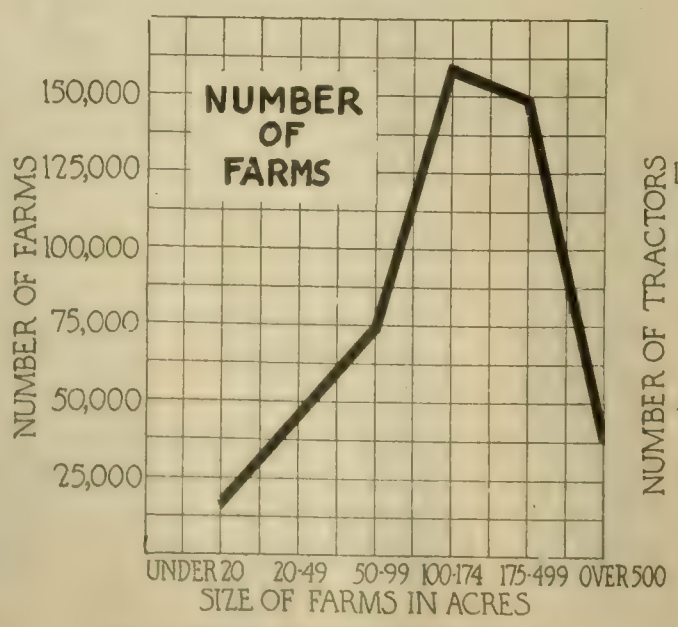


Fig. 4—Distribution of winter wheat belt farms by size

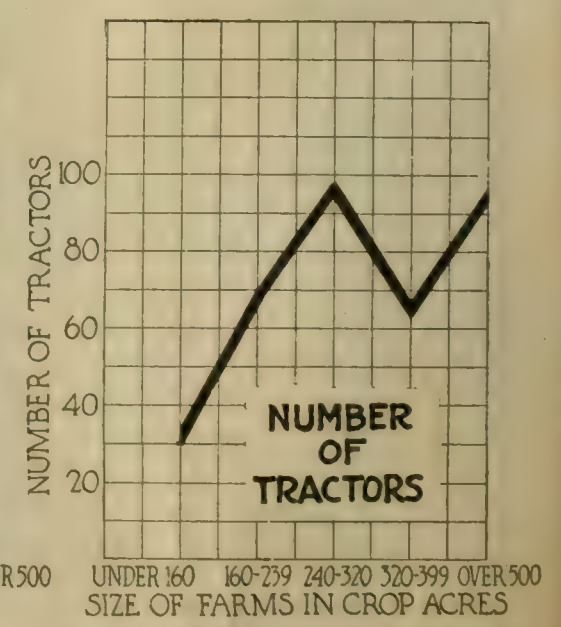


Fig. 5—Distribution of tractors on winter wheat belt farms by sizes of farms

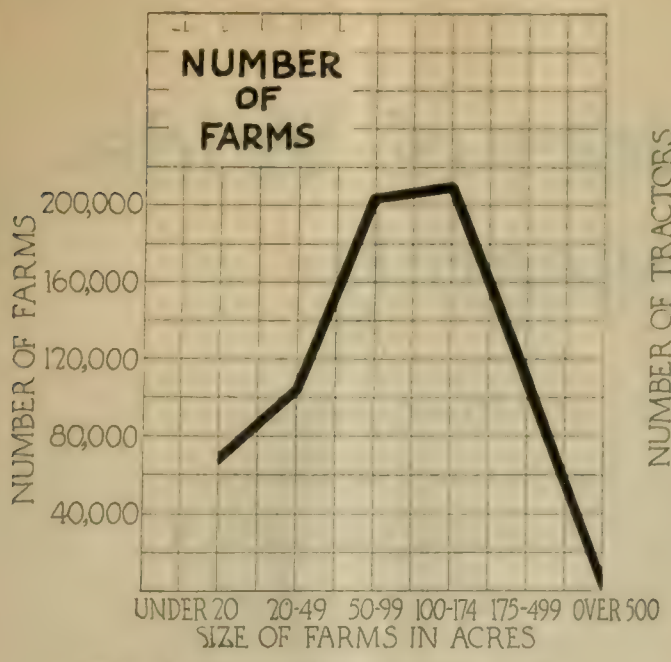


Fig. 6—Distribution of corn belt farms by sizes

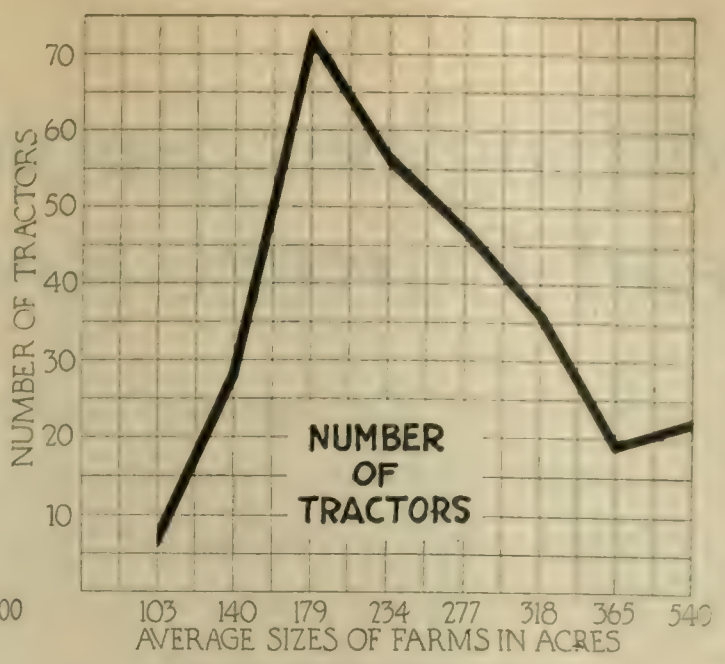


Fig. 7—Distribution of tractors on corn belt farms by sizes of farms

generator for soil preparation and belt work. This brings up a number of interesting questions including: How far can the present type of tractor go in meeting the farm power requirements? How much can farm practices be changed in order to make them better adapted to the present types of tractors? Can a combination of the motor cultivator and tractor as now built meet the farm power requirements? If so can the small farmer afford to purchase both machines? What field is there for the general purpose type of tractor?

This brief presentation of some of the results which can be secured from a formal analysis of the field for the tractor in American agriculture is simply an appetizer which, by no means, exhausts the possibilities. Numerous other reports are available, which have not even been referred to. Work of this character has never received the public support to which it is entitled. Our agricultural colleges and the U. S. Department of Agriculture could do more extensive work if the necessary funds were available, and making funds available for such work depends in no small measure upon popular support. Just think what it would mean if the $365,000 appropriated by the present Congress for free seeds had been appropriated for farm power investigations.

There is a growing belief among executives of the tractor industry that the possibilities for the use of the tractor in industry are much larger than have yet been realized. For example, it is reported that the Ford Motor Co. has instituted an intensive tractor drive in the industrial field. Unfortunately we have not been able to find even a trace of an extensive investigation of the possibilities for the use of the tractor in this important field.

In times past, which can easily be remembered, the export trade has taken an important part of American tractor production. Government export figures are as follows:

Year	Number of Tractors Exported	Per cent Total Production
1917	14,854	23.6
1918	36,351	26.7
1919	19,693	11.9
1920	29,143	14.4

This is an excellent showing when the unsettled condition of the exchange situation is taken into consideration. The officials in the Department of Commerce consider the export market for American tractors and other farm machinery of sufficient importance to appoint a man whose special duty is to collect and disseminate all possible information regarding export demands and markets. Reports are now coming through from this source. In addition to analyzing the foreign market the Department of Commerce has revised the export list so that complete information will be available in the future regarding tractor exports. There is no reason why this government department should not be of increasing value to the tractor manufacturer and render material assistance in opening up the foreign markets. Its work furnishes an excellent foundation for the individual manufacturer to build his investigations of the foreign market on.

Magnetic Tests of Chain

THE cross links of non-skid chains are case-hardened, so as to be able to withstand the wear of hard roads. If the case is of insufficient depth the link wears out quickly, whereas if it is too deep or if the chain has been quenched at too high a temperature the latter is too brittle and is liable to break. A test which gives a check on the surface hardness and brittleness is therefore required, but unfortunately the usual hardness tests, such as the scleroscope and the Brinell, are difficult to apply. At the plant of the American Chain Co. a magnetic method of testing the properties of case-hardened tire chain has been applied successfully, and an account of the method was given in a paper read by A. V. de Forest, research engineer of the company, before the New York Section of the American Society for Heat Treating.

Resistance to wear and resistance to shock are in general inversely proportional to each other, and the point of maximum usefulness is highly indeterminate. The final test, the mileage run on the road, is so subject to accidental variations that the average of a large number of records must be considered. If the depth of case is considered the only variable, if the chain is made from the same wire and carburized in the same compound at the same temperature for different lengths of time and is quenched from the same temperature, magnetic readings are obtained which are proportional to the depth of case. If a set of these chains, ranging from thin case to thick, are taken off after the first to break has worn through, it is found that the wear is very closely proportional to the magnetic reading.

When the chains are run until all are broken it is found that those showing the lowest and the highest magnetic readings give about the same mileage, while the highest mileage is obtained from chains giving an intermediate magnetic reading. The softer the road, the lighter the car and the lower the speed at which it is driven, the closer the maximum mileage chain will be to the deepest case or maximum magnetic reading chain. However, this hard chain is less reliable, and under severe conditions it may break after a few miles of running. The magnetic test, therefore, is used to determine when the chain has the most desirable hardness, as determined by experience.

Air-Cooled Engines Subject of Widespread Current Research

Automotive engineers seek most efficient method of direct cooling. Problem consists largely of locating hottest points on combustion chamber wall and providing effective cooling for them. Franklin has made careful studies. General Motors copper-cooled car nears production.

By J. Edward Schipper

WITHIN the last two years there has arisen a great deal of interest in air-cooled engines. This interest has not been confined to engineering circles alone, but has spread to all branches of the industry and also in some degree to the general public. With the exception of the motor boat and possibly also the tractor, there is not a branch of the automotive industry which has not felt in some degree the influence of air-cooling research.

The situation with respect to air-cooled engines to-day is rather indefinite. It is certain that we are on the eve of a period of air-cooled automobile manufacture to a degree which is far in excess of what would have been believed possible 5 years ago. We have among the foremost engineers of the country all shades of opinion regarding the subject, from one extreme where the belief exists that the air-cooled engine will eventually practically displace the water-cooled for automobile use, all the way down to the prediction of others that an attempt to use air-cooling for commercially manufactured automobiles will result in dismal failures. As in all such developments and as generally happens with such a wide range of opinion, the truth probably lies somewhere between these two extremes.

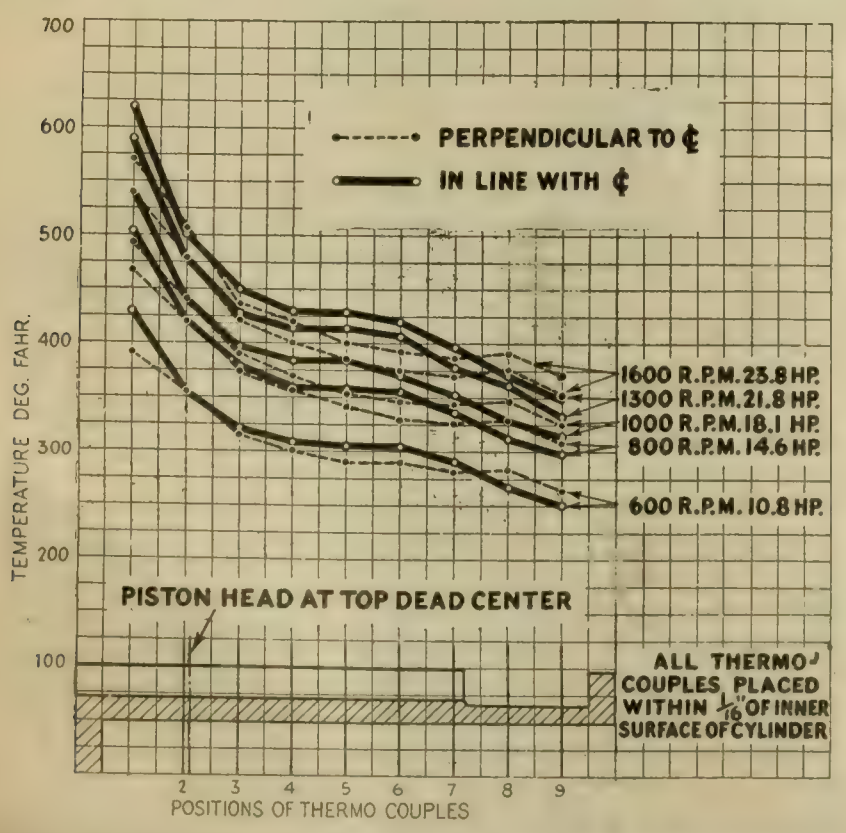


Fig. 1—Curves plotted as the result of temperature measurements on the Franklin engine, as described in text. These temperatures are taken down the side of the cylinder in nine positions

As regards small units, we have been successfully using air-cooled engines for stationary lighting plants and motorcycles. In large units, we have had successful airplanes which have operated with air-cooled engines with cylinder bores well above what would be required for automobile use. However, in aircraft work the tremendous air velocity is available for forced cooling, which somewhat modifies the conclusions which can be drawn from these successes insofar as applying them to automobile practice is concerned. We have one automobile engine which has been successfully air-cooled from the time of its inception and two or three other makes which have also been successfully air-cooled in this country, and some smaller air-cooled cars which have given good service abroad.

From an engineering standpoint, the prospect of the next three years in air-cooled development is entrancing. Regardless of the results accomplished and whether or not air-cooling comes into its own during the next few years, it is certain that it will leave its imprint on all engine designs, whether cooling is by air or water. As one engineer put it recently in a discussion of this subject at a meeting of the Society of Automotive Engineers, progress in air-cooling will probably result in better water-cooled engines.

Whether or not air-cooling is to be successful depends on whether it is possible to secure the same economy, quietness of operation and continuity of performance as with water-cooling. The power output per unit of displacement depends on compression ratio to a large degree. The allowable compression ratio depends very largely on the efficiency of cooling and the ability to eliminate hot spots in the combustion chamber. Consequently, with air-cooling, it is necessary that the hot points in the cylinder be located and dealt with in such a way that the temperatures of these points do not rise to a degree sufficient to reduce the allowable compression and, consequently, to correspondingly reduce the output.

In considering the power output of an air-cooled engine, it is necessary to consider the net output secured by deducting the power consumption of the cooling fan, and one of the objections generally offered against the air-cooled engine is the fact that this output runs up very fast with increase in speed.

Very extensive research work with a view of the further development of the air-cooling system has been done by the H. H. Franklin Mfg. Co. The Franklin engine is cooled by a positive current of air through a jacket sur-

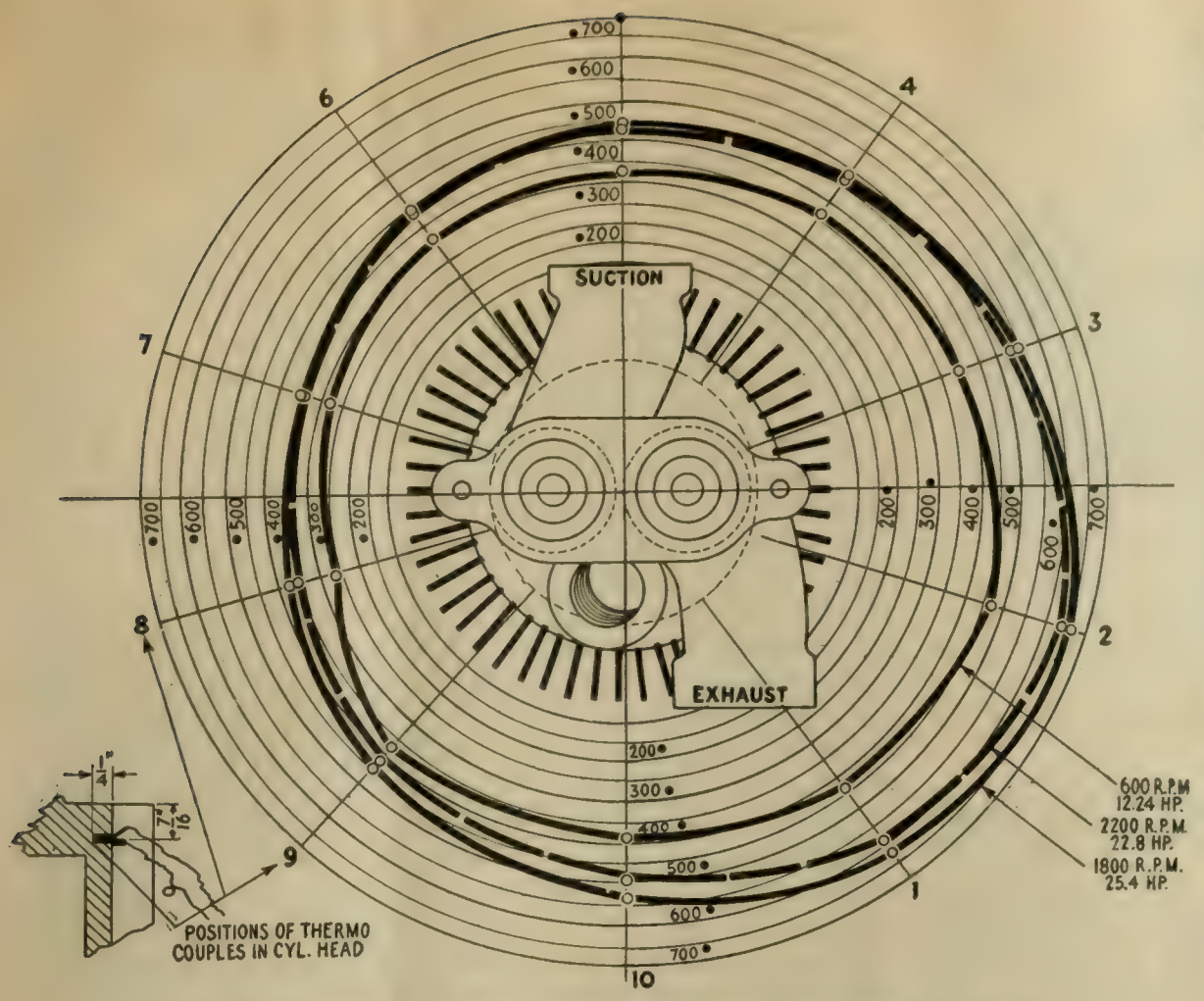


Fig. 2—Temperatures taken on Franklin cylinder head at equal distances of ¼ in. from the outside of the wall and 7/16 in. below the top of the cylinder head

rounding the cylinders. The cooling air comes in intimate contact with sheet metal fins cast into the cylinder wall. The valves and the spark plug boss are in the head, which has no cooling fins. Naturally, the cylinder head is the part which attains the highest temperature in operation, because it has only a comparatively small cooling area and is in contact with the burning gases throughout the power stroke.

In the research work carried out by the Franklin company, temperatures were measured at several points on the cylinder head, all around the circumference of the head and along the length of the cylinder casting both on the sides of the engine and between the cylinders, so that curves of temperature variation could be plotted for practically the whole cylinder. The temperature of any point in the cylinder wall varies with the conditions of operation of the engine; that is, with the crankshaft speed, the spark timing, the horsepower output, the richness of the charge, etc., of course, the highest temperatures occur under the condition of full throttle operation, and this is the condition under which the research work was carried out.

Temperature measurements were made by means of the Leeds & Northrup potentiometer system. This has been used extensively in the past for the measurement of temperatures in the heat treatment of steel. At first some difficulty was experienced in getting results to agree, but these were overcome and results can now be duplicated with only an insignificant error. In order to be able to accurately define the conditions of engine operation, it was necessary to provide means for measuring the air and fuel entering the engine.

For measuring the air use is made of a Venturi tube type of air meter. All of the air entering the engine is passed through a venturi tube of suitable size, the static and dynamic pressure of the air at the throat of the tube are measured by means of water columns, and from these pressures the speed of the air through the throat is calculated. In conjunction with the area of the throat, the temperature and the barometer reading, this gives the weight of air passing per unit time. This air meter is clearly seen in one of the illustrations herewith. An air meter of this type is quite simple to construct, and as it has no moving parts, it cannot get out of order.

Some of the curves plotted from the results of the temperature measurements are reproduced herewith, Fig. 1. One of the charts shows the variation of temperatures down the side of the cylinder in nine positions 1 in. apart, the first position being 1 in. below the top face of the cylinder head. There are two sets of curves, the full-lined curves giving the temperatures in line with the axis of the engine, or, in other words, between adjacent cylinders, whereas the dotted line curves give the temperatures at the side of the cylinder or perpendicular to the engine axis. In this case the temperatures were measured on cylinder No. 1 on the exhaust side and in the rear. All joints of thermo-couples were placed within 1/16 in. of the inner surface of the cylinder wall. It will be noted that all curves of the same kind follow some definite law. The highest temperature reached by any part of the cylinder wall with which the piston comes in contact is substantially 500 deg. Fahr. The temperature drops very rapidly from the top of the cylinder to a point about 1 in. below the beginning of the stroke, but there is comparatively little drop from this point down to the end of the stroke. That the temperature of the wall in the axis of the engine is slightly higher than at right angles thereto may be due either to

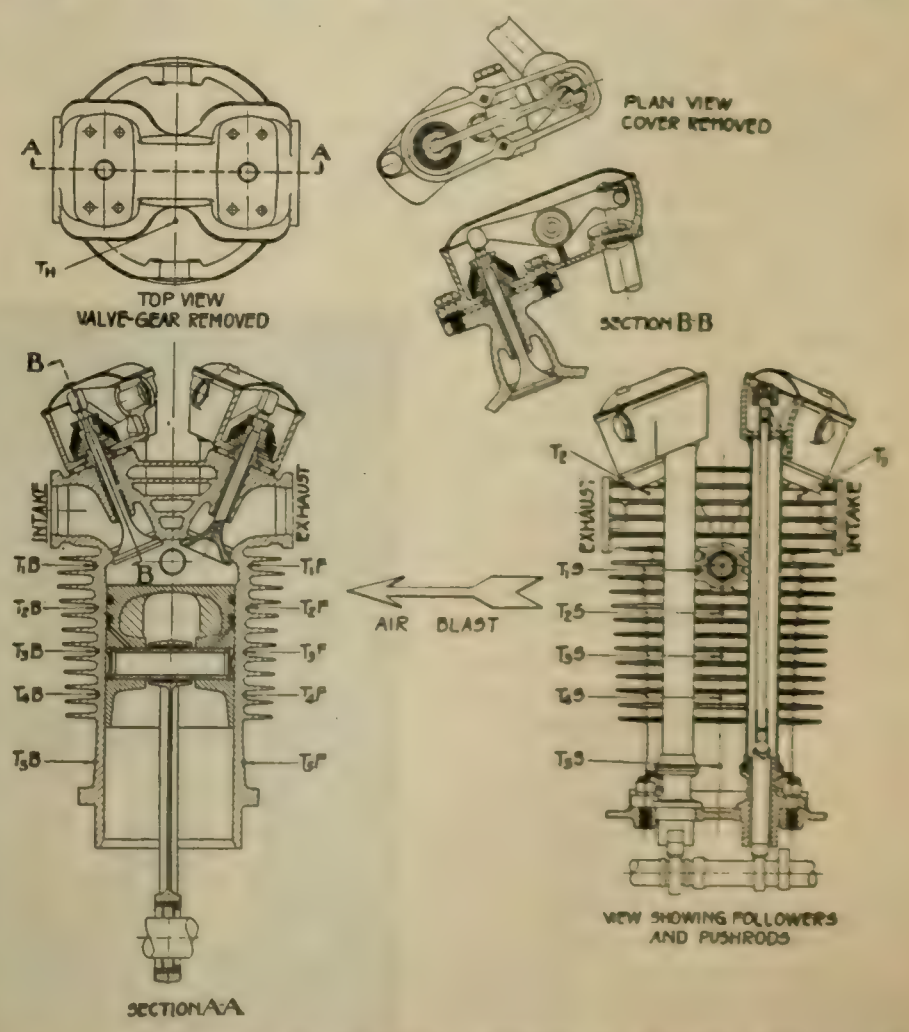


Fig. 3—Plan view and sectional elevation of cylinder used in the B. S. A. passenger car described in S. D. Heron's paper before the Society of Automotive Engineers

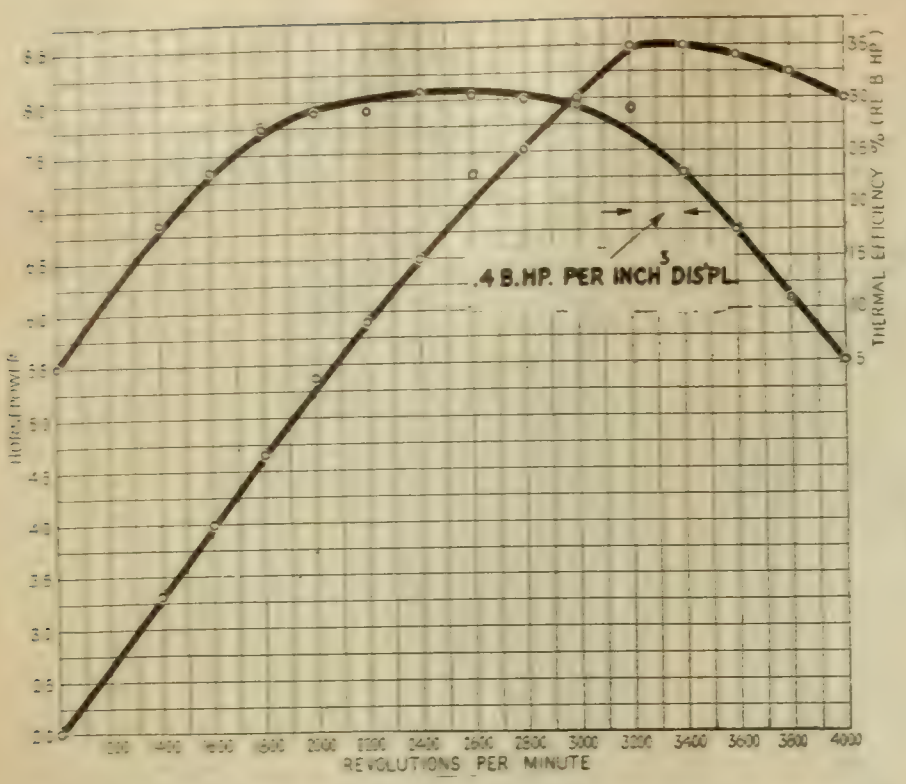


Fig. 4—Power curves showing the brake horsepower developed at various engine speeds up to 4,000 r.p.m. on the Barr & Stroud single sleeve valve, air-cooled engine

radiation effects from the adjacent cylinder or to the fact that the jacket space in the fore and aft direction is somewhat shallower than in the transverse direction.

It is quite obvious from this chart that the average wall temperature of an air-cooled engine is materially higher than that of a water-cooled engine, as the latter cannot be much above 212 deg. at 1/16 in. from the inner surface of the cylinder wall. The Franklin company made experiments with an engine in which the cooling wall temperature was gradually decreased to about 212 deg. by increasing the intensity of the cooling action, and found that the efficiency of the engine from the standpoint of fuel consumption decreased with the wall temperature from 400 deg. down.

The other chart, Fig. 2, shows the temperatures around the cylinder head, ten thermo-couples being inserted at equal angular intervals ¼ in. from the outside of the wall and 7/16 in. below the top of the cylinder head. As might be expected, the cylinder head is much hotter on the exhaust than on the inlet side. It will be noticed that the extreme temperature of the outer circumference of the head is about 65 deg. Fahr. Undoubtedly, some parts of the head get still hotter than this. The head, naturally, is the most difficult part to cool, owing to the fact that it is subjected to the action of the hot gases for the greatest length of time and that the amount of cooling surface in proportion to the area in contact with the hot gases is much smaller than for the side wall of the cylinder.

It was pointed out above that the working temperature of the air-cooled cylinder wall is materially higher than that of water-cooled cylinder walls, and this point is borne out by the fact that the Franklin company recommend the use of cylinder oil with a specially high fire test.

In all tests, it is endeavored to duplicate road cooling performance, which can be done by measuring the air pressure at the inlet and outlet of the jacket. The temperature of the cooling air is measured as it enters and leaves the cooling jacket with carefully calibrated long distance thermometers. It has been found that for full throttle conditions it is necessary to use 9/10 cu. ft. of air per sec. per brake horsepower, and the air then is raised in temperature about 100 deg. Fahr. With the aid of the venturi air meter and the calibrated fuel tank, it has been possible to measure the volumetric efficiency of the engine at various conditions of carbureter setting, suction yoke (inlet manifold) arrangement and camshaft setting. It has been possible to also study the effect of temperature changes on the volumetric efficiency.

It has been found that the maximum power is obtained with a mixture ratio of 12 to 1 and the maximum economy with a ratio of about 17 to 1, which results agree very closely with those obtained by others with water-cooled engines. In the temperature explorations thermo-couples have been placed even in the tip of the center electrode of the spark plug and in the inlet and exhaust valve heads. It has been found that the maximum economy is obtained from the engine with a maximum combustion chamber temperature of 550 deg. Fahr. and that the engine runs under these conditions without any signs of stress from either heat effects or mechanical loads. As a result of this research work, the Franklin company has been enabled to materially increase the compression ratio of its engines. In the words of Mr. Grimes, research engineer of the Franklin company: "Neither the compression ratio, volumetric efficiency nor cylinder head temperature can alone convey any definite meaning even to the engineer who must realize that the indicated horsepower is a function of the weight of the compressed volume and its pressure at the time of ignition."

The pressure alone is limited by the cylinder head temperature, whereas the compressed volume is limited by the ability of the cylinder to disperse the heat absorbed by its walls and thus remain at all times below the preignition point. The compromise of the three factors was decided upon a gasoline economy basis.

The preignition limit of cylinder head temperature must never be exceeded. The volumetric efficiency is then developed to the greatest value that will produce a uniform compression throughout the speed range of the engine.

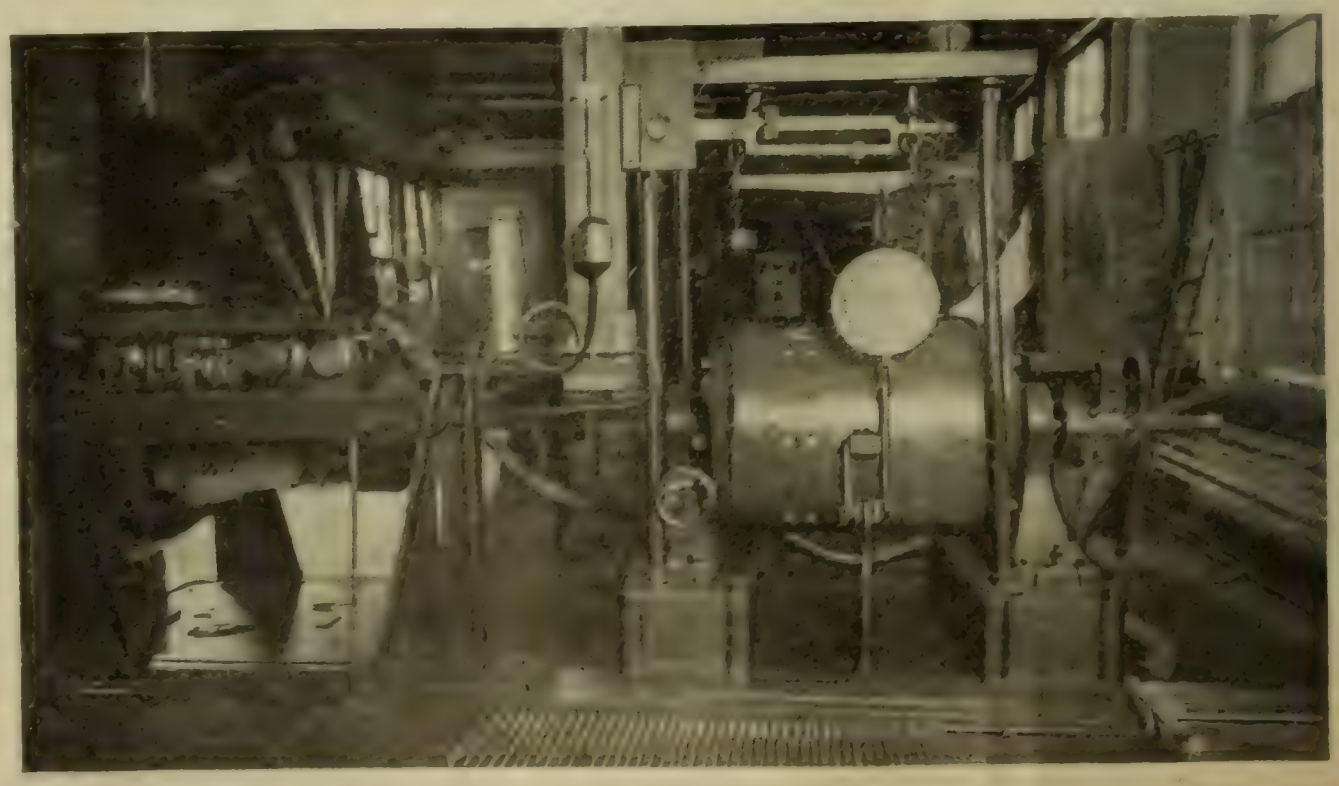


Fig. 5—Dynamometer stand used for tests on Franklin air-cooled engines

Should this uniform compression value cause preignition, the combustion space is then increased by the use of shims until preignition is eliminated. This procedure has invariably resulted in excellent economy, no small part of which is due to the use of a hot cylinder head which is of great assistance in burning the low grade fuels of to-day.

Little or nothing has as yet been disclosed by the General Motors Co. regarding research work on the copper-cooled car. In all probability, this car will find its way on the market during the fall of 1922. After that time, some very interesting facts will probably be brought to light on the development work behind this new air-cooled product. It is generally known, however, through the trade that the two big developments behind this project have been the discovery of means of amalgamating copper and iron in such a way that copper ribbing can be used for the cooling fins and the machine which has been developed for crimping the copper so that the ribs taper in depth in such a way that the cylinders can be brought very closely together without overlapping the cooling fins to any extent, if at all. The heat conductivity of rolled copper is approximately 2.35 times that of cast iron. Based on a figure of 1000 for silver, rolled copper has a conductivity of 845 as against 359 for cast iron (Kent). With the copper fins, therefore, a greater amount of heat will be conducted from the combustion chamber walls in a given amount of time for a given area of cooling surface. To put this in another way, if the cylinder size is fixed for cast iron by the ability to remove the requisite number of heat units per unit of time with cast iron, this cylinder size will not be as large as that which can be taken care of by the same proportionate heat removal with the copper fins.

S. D. Heron, in his paper on some aspects of air-cooled cylinder design and developments, presented before the Dayton Section of the Society of Automotive Engineers recently, stated that investigation has shown that for every brake horsepower developed, an average of approximately 0.6 hp. or 25 B.t.u. per min. has to be dissipated directly to the cooling air or the external surface of the cylinder. In addition, he states, 0.4 to 0.5 hp. has to be dissipated by the oil, by conduction to and radiation from the crankcase and similar means. The amount of heat absorbed by the oil will depend largely upon the amount reaching the cylinder and the piston walls and the facilities for cooling the oil. Power output, fuel consumption and

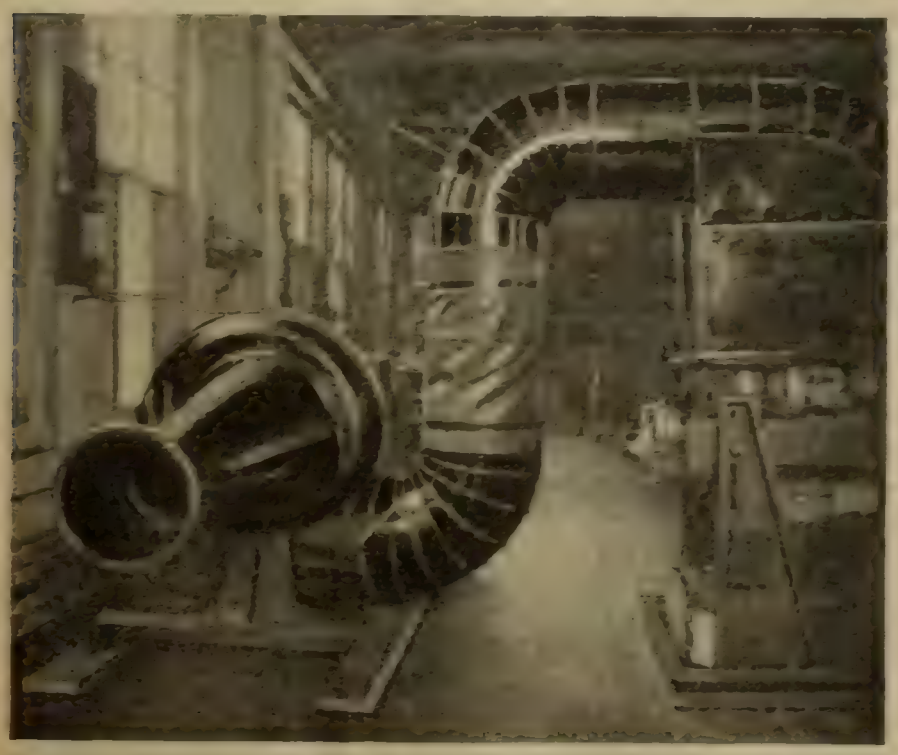


Fig. 6—Venturi measuring device used in tests on Franklin engines

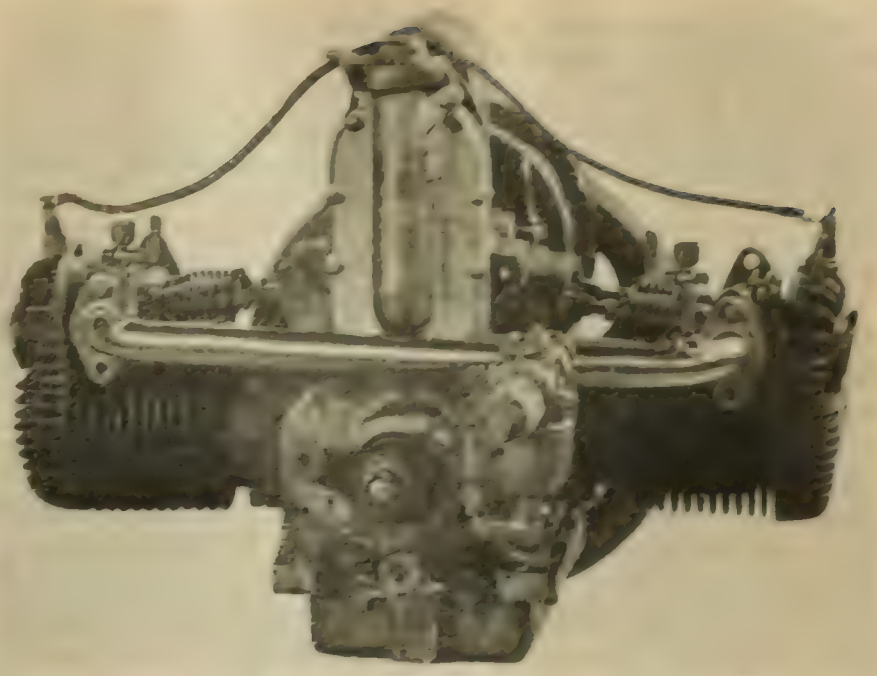


Fig. 7—Two-cylinder, horizontal opposed air-cooled engine used by Buda Co. for propelling its rail car

cylinder wall temperatures such as are quoted herein, are dependent upon liberal splash lubrication and the resultant oil cooling. This leads him to the following three conclusions, which are required for a design of a cylinder with high output (for aircraft work):

1—It must develop a volumetric efficiency of 80 to 85 per cent.

2—It must produce a brake mean effective pressure of at least 130 lb. per sq. in. at the normal speed on a maximum fuel consumption of .56 lb. per b. hp. hr.

3—It must dissipate 25 B.t.u. per min. per b. hp. from the external cooling surfaces of the cylinder, this heat to be dissipated so that the maximum temperature of any portion of the exterior of the cylinder wall does not exceed 550 deg. Fahr., and it is preferable that it be lower. In addition, the mean temperature of the exterior of the cylinder walls should not exceed 350 deg. Fahr. To produce a layout that fulfills the standard requirements, it is necessary that heat flow be the primary point in mind during design.

Mr. Heron, in his paper, is, of course, speaking largely of aircraft practice. Nevertheless, much of what he gives in his paper is applicable to automobile as well as airplane practice. He cites, as an example of what may be accomplished in the way of automobile engine cooling with small air supply, the British B. S. A. light car, the cylinder of which is illustrated in Fig. 3. This car has a 90-deg., two-cylinder V-engine of 66 cu. in. capacity and is cooled entirely by natural draft, no fan being employed. One of the early engines was fitted to a car weighing 1500 lb., including passengers and regular equipment, and road tests of the cylinder temperature under these conditions are interesting. Climbing a hill rising 1200 ft. in 2½ miles, the temperature at T-H, Fig 3, the hottest part of the hottest cylinder, was 310 deg. Fahr. above the air temperature at the start of the ascent and 495 deg. Fahr. at the finish. This ascent was taken on the run with the engine at normal temperature and was made in a following wind in 11 min. There is little question that the heat storage capacity of the cylinders is of considerable importance in preventing overheating under such conditions, as prevailed in this test.

The heat storage capacity of a water-cooled car engine having a large quantity of water in the jackets and the radiator, in this sense a heat accumulator, is known to be of advantage in preventing boiling in mountainous countries. This is a parallel tending to show the similar advantage of thick, heavy cylinders for air-cooled cars.

A great many lessons which have been learned in the motorcycle field where small bore engines are, of course, prevalent, and also the results of experiments in the stationary lighting plant field may be applied to larger cylinders. While it is true that in the automobile field metals other than cast iron have been experimented with extensively for air-cooling only lately, these experiments have been going on for some time in the motorcycle field.

William S. Harley, of the Harley-Davidson Motor Co. states that his concern has done experimental work with other metals than cast iron and in this connection has tried aluminum, brass and steel. In his experimental work with aluminum cylinders, he has made new patterns having cylinders with cast-in bronze valve seats. He has tried them both with and without sleeves and after experimental work covering a period of a couple of months, finally dropped the matter. He states that they did not have very satisfactory results with these cylinders, but realizes that there are many phases to the problem which they did not go into. The results he got from these tests were largely inconclusive, but from his experience with other metals he is inclined to think that cast iron is the best material for air-cooled cylinders.

A NUMBER of years ago motorcycle engines were built with copper cooling fins on cast iron cylinders. The Orient motor built at Waltham, Mass., was of this type. Harley-Davidson have built an experimental motor with 3-7/16 in. bore by 4 in. stroke. This engine, Mr. Harley states, is working very successfully and he believes that on automobiles, larger bores than this could be used as they have greater possibilites of more regular and more efficient cooling.

Barr & Stroud, Ltd., of Glasgow, are manufacturing a single cylinder, sleeve valve motorcycle with air-cooling which shows a great deal of promise and some extraordinary performance features. Fig. 4 is a horsepower curve of this engine. It is rated at 3 hp. and has a displacement of 350 cc. with 70 mm. bore and 90.5 mm. stroke. The compression ratio in this engine is four to one. This engine operates upon the same cycle as the well-known Argyle single sleeve, which is familiar to our readers.

Another interesting sidelight upon the compression ratio problem is furnished by N. J. Harkless, Engineer Railroad Dept., of the Buda Co. The Buda Co. has been building a two-cylinder, opposed air-cooled engine for a number of years. These engines are used in connection with railway motor cars for section gangs. In this engine, the compression ratio is 3½ to 1, which has been found most practical for this purpose. There is no cooling means other than a fan flywheel, which is not very effective in assisting in cooling. These engines are built in three sizes, a 4¾ by 4½ bore and stroke, 4 by 4 and 3½ by 3½ in. Although a heavy grade will overheat these engines when pulling heavy loads, in general the engines do not overheat. With these cars, runs of 200 and 250 miles per day with average speeds of 30 to 35 miles per hr. are common. In these runs, the only stops are at lunch time and to set off for trains. On this type of run, no overheating is experienced, as the load is very light, with 3 to 4 men, and the speed high enough for sufficient air draft for cooling.

A general survey of the present situation seems to indicate that the cast iron cylinder remains supreme in spite of the fact that experimenters have dabbled very heavily in aluminum, the copper alloys, etc. The possibilities of using metals of higher conductivity for cooling fins on cast iron cylinders have not been exhausted. This has been and is being done as, for instance, in the General Motors copper-cooled car.

Henry M. Crane, however, states that recent research on air-cooling seems to indicate that other design factors may be of such importance that the use of other metals than iron for ribs may not be necessary. Going further on this subject, Mr. Crane states that he doubts the economical value of air-cooling in automotive engines for anything but very moderate horsepower. The cost of operation and upkeep, he says, is high comparing these items to well-designed, water-cooled engines.

To look again at the negative side, the composite case against the air cooled engine for automobile work seems to be something along the following lines:

With water we have a fixed operating temperature. The temperature at which the engine operates can be predetermined. With air, many engineers claim it is not fixed, and may vary to a considerable range.

A practical objection which is often advanced against the air-cooled car is that it is difficult to make it quiet. It is claimed that the ribs on an air-cooled engine are conductors of both heat and sound. Because of the higher temperature of the air-cooled engine, greater clearances are necessary. With water-cooling, it is claimed that the clearances can be fixed more definitely because we can fix the operating temperatures of the water-cooled engine. This applies to valve mechanism as well as other parts. The greater difference in expansion due to the increased temperature of the air-cooled engine accounts for this.

In criticizing the air-cooled car, one prominent water-cooling advocate recently stated that improving road conditions throughout the country are forcing better performance and ability to run continuously at higher speeds, which is a difficult condition for the air-cooled car to meet. He states that it is only possible to remove a limited number of B.t.u. per min. from the combustion chamber walls. The distance through metal through which heat must be transferred on a water-cooled car is very slight. There are no cooling fins necessary and the thickness of the copper in the radiator is so slight that heat transfer is very rapid. On the other hand, he states that the cross-sectional area available to remove heat through the wall is greater in the water-cooled engine than in the air-cooled. In the water-cooled engine, there is 100 per cent cross-section, whereas with the cooling fins, part of this is lost.

REGARDING the weight situation, this same engineer states that it is doubtful whether the air-cooled car, in spite of its absence of radiator, saves any weight as compared with the water-cooled because of the weight of the air fan apparatus and also because of the necessity for leaving space for the cooling fans. He claims that this makes necessary a longer crankshaft and crankcase.

Regarding the efficiency of cooling, he states that the air-cooled engine is apt to be too cold in cold weather and too warm in warm weather. With water-cooled, it is possible to design the engine for 212 deg. Fahr. and keep it at that temperature regardless of atmospheric conditions. A further objection advanced is that the oil temperature is higher in the air-cooled engine.

With all of these objections, nevertheless, the air-cooled car is rapidly advancing to the point where we are going to see it marketed commercially through our automobile salesrooms, and there will shortly be numbers of them on the road. When the first of the production cars are out on the road, they are going to be scanned eagerly by engineers of both water-cooled and air-cooled leaning, and opportunity is going to be afforded for some very interesting and instructive debates on the subject. It is certain that the last three years have seen some material advances in air-cooled engines for all fields of automotive use and we are standing on the threshold of some of the industries' most interesting developments in this field.

Automotive Engineering Development Rests Largely on Fuel Research

Dependence upon foreign fuel supplies increases with decline of domestic reserves. Gasoline substitutes, especially alcohol, are already extensively used in other countries, but are not available in significant quantities in this country. Cracking processes being developed. Fuel volatility affects utility. Work of Ricardo and of Kettering and his associates is important.

By Herbert Chase

RESEARCH work pertaining to fuel suitable for automotive uses has brought into prominence many facts of far reaching import to the automotive industry. Among the important facts established in this connection the following need emphasis:

1. Conservation of motor fuel resources is necessary to prevent rapid depletion of the domestic reserve. This country is already dependent to a large degree upon imports of petroleum.

2. Gasoline substitutes are not available in significant quantities in this country, though the resource exists when conditions warrant its development on a large scale.

3. Alcohol is an excellent motor fuel. It can be produced in large quantities in competition with gasoline in many foreign markets, especially as a by-product of the sugar refining industry. Half the automotive vehicles in Cuba are reported to be using alcohol fuel at the present time. The Philippines can be easily made independent of motor fuel imports by developing potential alcohol reserves.

4. The use of fuel alcohol and blends containing it is of importance to American automotive manufacturers, especially exporters, because such fuels are now available in many parts of the world, even to some extent in this country.

5. Alcohol possesses many advantages as a fuel. Its disadvantages can be overcome or neutralized by its proper preparation and by adapting equipment to its use.

6. Cracking processes in which the yield of gasoline is very high are in process of development. Some of them give promise of materially increasing the available supply of gasoline from the crude, but none save the Burton process have yet been proven successful on a large commercial scale.

7. It has been proved that the tendency of a fuel to detonate is of great importance in respect to its suitability for automotive use. Thermal efficiency is largely dependent upon compression pressure, and increases with the pressure. Of the commoner fuels the paraffines detonate at the lowest pressures, while the alcohols withstand the highest pressures without detonation. The naphthenes and aromatic are between the two in this respect. Aromatics are next to alcohol in effectiveness.

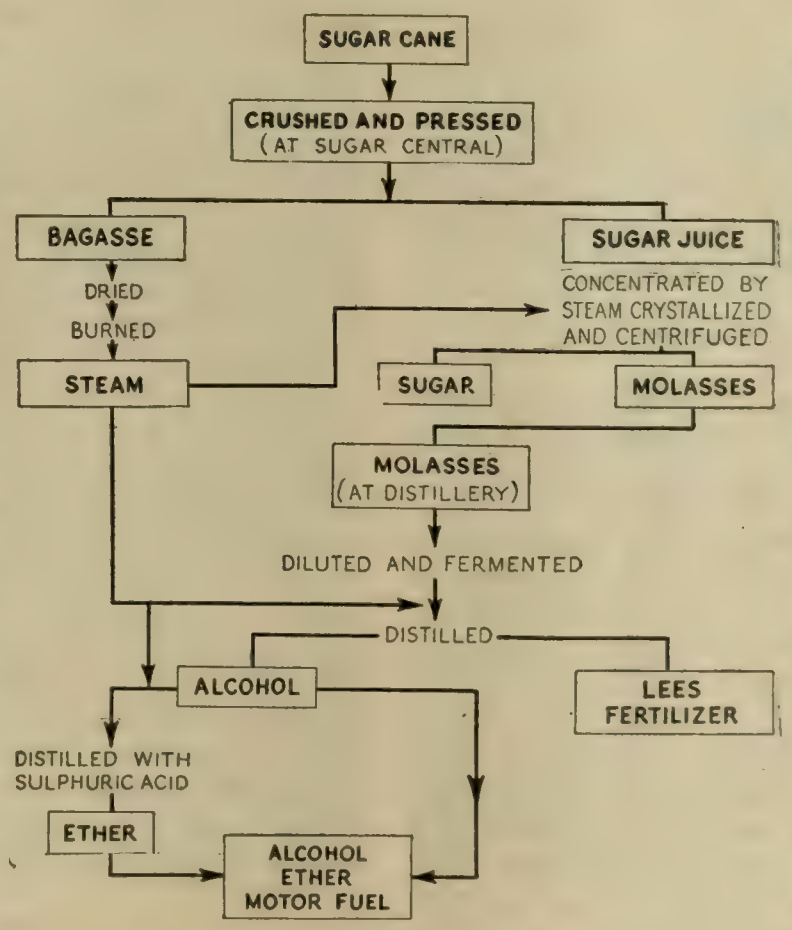


Fig. 1—Diagram of the process of manufacture of alcohol-ether motor fuel from by-products of the sugar industry, prepared by Dr. H. I. Cole

8. The volatility of a fuel is of great importance as affecting its utility. The readiness of a fuel to vaporize is being investigated, and some important findings in this respect are given in the following pages.

9. All fuels, when combined with air in proper proportions for complete combustion, give approximately the same power per unit of volume when used at the same compression pressure, providing detonation does not occur.

10. The fuel economy of automotive vehicles is dependent upon mixture proportions, uniformity of distribution, engine temperature, frictional losses and many other factors, several of which are discussed in the following pages.

Among the outstanding research activities within recent years there are none of more importance to the automotive industry than those relating to a study of motor fuel and its performance under conditions simulating those encountered in use in internal combustion engines. There are numerous experimenters in this field, but it is probably true that none have, so far as the public is informed, done more than Harry R. Ricardo and his associates. A record of this work has been published in these columns and elsewhere and has been the subject of much favorable comment, though some are disposed to criticize some of the methods followed and results obtained. The Bureau of Standards, General Motors Research Corporation and the International Harvester Co. among others, have done much commendable work, but few industrial organizations have been so

public spirited as the Asiatic Petroleum Co., for whom much of Ricardo's work was done, in permitting publication of comprehensive reports on the work done. A number of the oil companies in this country are known to be conducting research work on fuels and lubricants, but their work is, for the most part, held a strict trade secret, so that few but themselves benefit from whatever results are obtained.

Ricardo appears to have been one of the first European engineers to recognize the importance of the tendency of fuels to detonate in relation to the effect of this characteristic upon their suitability for use in internal combustion engines. C. F. Kettering and his associates had been giving this factor much study and had made reports in which various classes of fuels had been arranged in order in respect to their detonating tendency, but Ricardo's reports appear to have been the first published in which an effort was made to assign definite detonating values in terms of a fuel of known value. Ricardo demonstrated experimentally that thermal efficiency and the power available from unit volumes of liquid fuels combined with air in chemically correct proportions for complete combustion is, within 2 per cent, the same for all or nearly all fuels, when these fuels are used in a given engine with given expansion ratio, providing the compression is not high enough to cause detonation. Ricardo investigated numerous other fuel characteristics, as will be noted under various heads below. His published reports are among the most comprehensive which have come to our notice, and are worthy of careful study.

It is proposed in the following pages to review briefly under about a dozen different heads fuel research work which is now known to be in progress or which has been in progress or completed within about 18 months. We shall then consider the combustion of fuel under several headings and follow this by an outline of engine research and development in relation to fuel economy.

The Available Supply of Liquid Fuel

In spite of certain temporary quieting factors the need for conservation of the liquid fuel resources of the world becomes more and more apparent to those who give the subject study. There is no such thing as an "accurate" estimate of petroleum reserves, even in this country with its relatively excellent geological surveys—the very nature of petroleum occurrence makes exact estimates impossible—but the basis upon which resources in oil can be estimated are becoming more and more definite as a result of experience. Following the methods developed by the important oil companies of the country and with the full co-operation of these companies and independent geologists the U. S. Geological Survey completed this year a new survey which places our domestic reserve at nine billion barrels. This increases the previous estimate by nearly 70 per cent, but the total remaining supply is small in relation to the continually increasing annual demand which has reached a total of about a half billion barrels for this country alone. Already some 20 per cent of our domestic petroleum requirements are imported from failing sources in Mexico and there is reason to question whether this country will ever again be able to supply its need from domestic fields.

Investigations as to foreign supplies which may in time become available have progressed far enough to indicate promising possibilities, but reports on the quantity of petroleum available are highly speculative and it is certain that many years will elapse before reserves in this hemisphere, but outside this country, are developed sufficiently to have any marked effect on the domestic market. When and if available these supplies are certain to be far more expensive than those secured at present from domestic sources.

There is consequently need for much research to determine how great reserves of shale oil can be made available in place of petroleum. Work along this line is progressing slowly and on a totally inadequate scale. It is evident that shale oil cannot be recovered profitably in competition with petroleum until the price of the latter has reached a higher level than it has ever attained in this country, and then a mining industry comparable in extent to the coal mining industry of this country will be required to supply liquid fuel in adequate amount. Research work on shale oils has shown clearly that a usable motor fuel can be made from them, but much remains to be done in research and development work before such fuel is available in significant quantities.

Substitute Fuels

Aside from shale oil distillates, the possibilities of other substitutes for gasoline are not promising in this country, except in a decidedly limited way or as an auxiliary to supplement and improve gasoline. The advantages of benzol, toluol and other coal tar products as knock deterrents are becoming more generally appreciated, thanks to the work of Kettering and his associates, Ricardo and others, but the quantity of such products available, even if all the bituminous coal mined in this country were treated for their recovery, is extremely small as compared to the total demand for motor fuel. It is a physical possibility to produce alcohol in this country in quantities sufficient to at least help materially the supply of motor fuel, but the investment necessary in the way of distillation apparatus would be enormous and the production and accumulation of sufficient raw material to meet such a demand presents such a problem as to make its practical accomplishment in this country almost unthinkable on any scale comparable in respect to output with that of the present petroleum industry.

In countries such as Cuba, where alcohol can be made cheaply and in quantities sufficient to meet the national demand for motor fuel from by-products of the sugar industry and where gasoline is relatively expensive, the problem of using alcohol fuel is of immediate interest and importance even to American manufacturers, for it is to them that such countries look for automotive equipment. Blended fuels in which alcohol is one ingredient may also become an important factor in our domestic market, consequently an investigation of their performance is worthy of close study. Much experimental work is now being done along this line, as we shall shortly see, but before we examine the data concerning the use of alcohol a few items regarding substitute fuels in which alcohol is one component will be given.

Blended Fuels

In Germany, as in France and some other European countries, considerable quantities of alcohol are available for motor fuel, and the high price of gasoline as well as a desire to be independent of fuel imports has resulted in the governments encouraging or insisting upon the use of domestic products. Thus Germany has adopted a new standard fuel which consists of 50 parts benzol, 25 parts alcohol and 25 parts tetralene, $C_{10}H_{12}$. Tetralene is made by the hydrogenation of naphthelene, $C_{10}H_8$, a coal tar product which is a solid at ordinary temperatures. Tetralene has a low freezing point, a high boiling point and a heating value of 20,900 B.t.u. per lb. and the plant capacity for making it is said to be 30,000

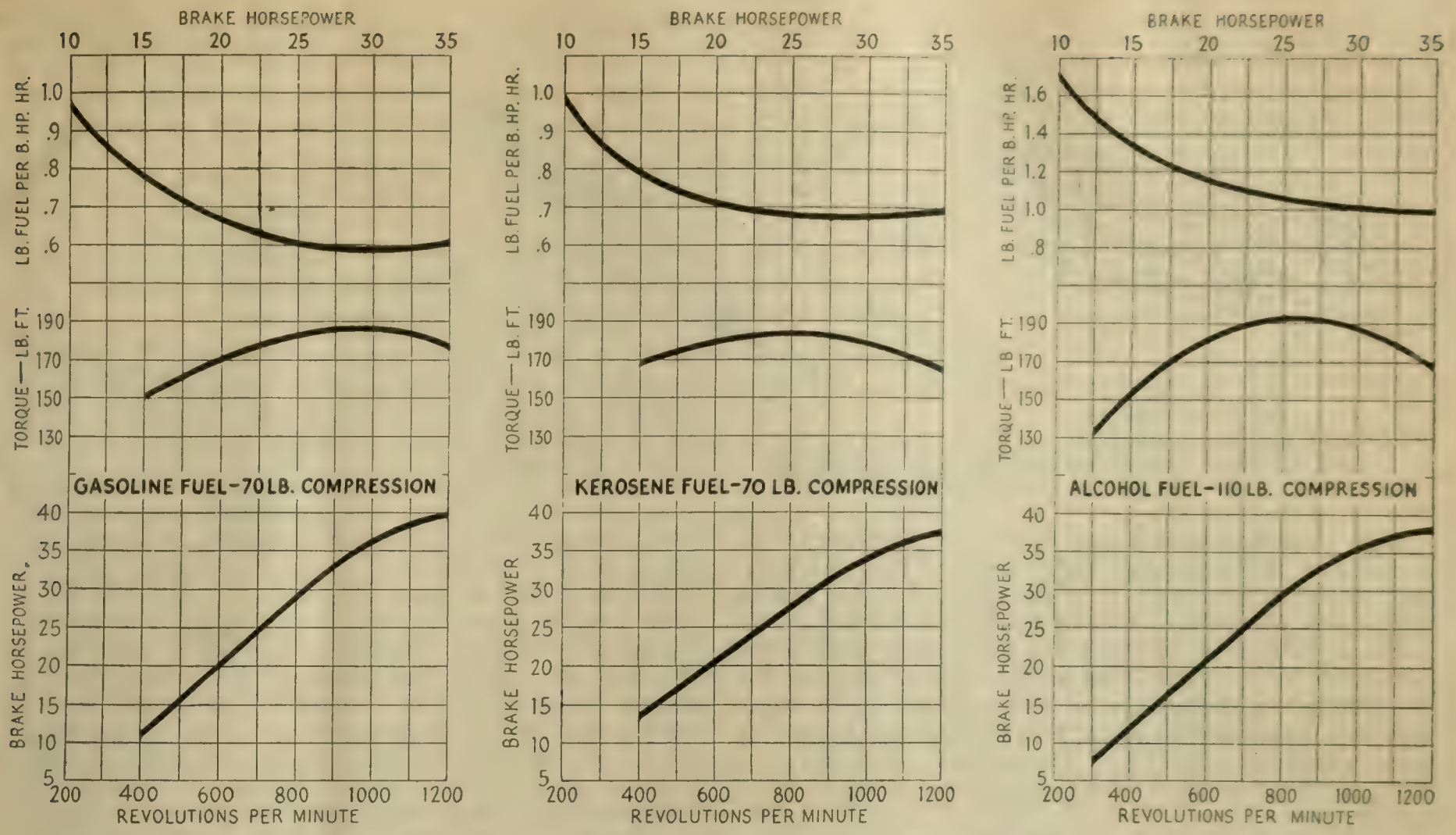


Fig. 2—Power, torque and economy curves of Twin-City tractor engine, showing performance on alcohol as compared to gasoline and kerosene

tons per year, or half the capacity for benzol production in Germany. Taking these two and adding to them 30,000 tons of alcohol makes an annual supply of 120,000 tons of motor fuel, which is said to be more than enough for Germany's domestic needs. The standard German fuel has a favorable distillation curve, a heating value of 17,200 B.t.u. per lb. and will withstand high compression pressures without trouble from detonation.

In France a so-called "national fuel," composed of alcohol and benzol in equal proportions, is being marketed under government auspices. The benzol is obtained from Germany, but alcohol is a native product which the government desires to see used in place of imported gasoline. Other experiments are being made to develop an acceptable fuel entirely from native sources.

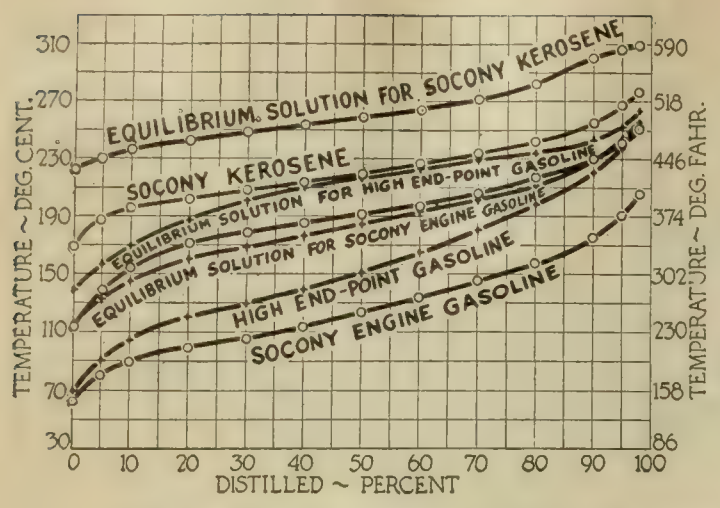
The British use alcohol-gasoline-benzol mixtures to some extent and are much interested in alcohol fuel and its economical production both for domestic and colonial use. The Empire Motor Fuels Committee is conducting tests upon engines using alcohol, alcohol-benzol and similar mixtures to ascertain which of these can be used to best economic advantage in engines of existing design and how present designs should be modified to use these fuels to best advantage. Tests are to be made first with 95 per cent alcohol and then with various mixtures containing alcohol, benzol and ether. These are to be made on engines running at various speeds, mixture ratios, compression ratios (up to 7:1) with throttle wide and partly closed and with varying amounts of heat added to the entering charge.

The London General Omnibus Co. has made extensive tests with mixtures of alcohol and benzol as well as with these two plus a small percentage of ether. In the case of mixture of 50 per cent alcohol and 50 per cent benzol a compression pressure of 123 lb. gave best results. It was found that the higher the percentage of alcohol the higher could be the compression ratio and consequently the higher the thermal efficiency obtained. With a compression of 160 lb. per sq. in. a mixture of 70 per cent alcohol and 30 per cent benzol gave the best all around results. In service tests, presumably with engines of normal compression for gasoline, it was found that a 50-50 alcohol-benzol mixture resulted in the least number of thermal units consumed per mile and consequently the highest thermal efficiency. The relative ease of starting, accelerating ability and flexibility were notably good, while fuel knock or pinking were non-existant. Use of sufficient heat to fully vaporize the mixture was found to be important.

Mixtures containing benzol and one or more of the following: gasoline, kerosene, alcohol and ether, have been marketed at various times in this country with more or less success even in competition with lower priced gasoline. Blends containing alcohol have, however, given some trouble as a result of corrosive action, a factor which will shortly be considered in detail, and some such have been withdrawn from the market on this account. Benzol-gasoline mixtures are extensively used for aviation engines in order to permit of the use of higher compressions.

Alcohol as Motor Fuel

Alcohol has long been used as a fuel for internal combustion engines, notably in Germany, and possesses many advantages as compared to present day gasoline, though it has also certain disadvantages. In many countries outside our own, in which petroleum products are imported at relatively high prices, alcohol is not only cheaper than gasoline, but is or can be made available in sufficient quantities to supply all automotive needs. Much research work looking toward its production from various raw materials has been done already and much more remains to be done. The factors affecting cost are so numerous and vary so much in different localities that each case must be considered on its own merits. The



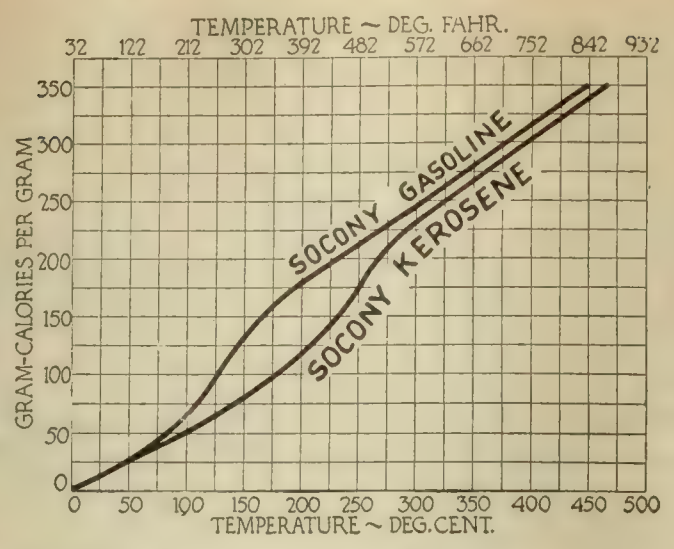


Fig. 3 (Left)—Distillation curves for various fuels and their equilibrium solutions.
Fig. 4 (Right)—Curves showing the total sensible heat of kerosene and gasoline at various temperatures

British Fuel Research Board recently completed an investigation of the subject and concluded that the prospect of adding materially to the supplies of motor fuel in England by the manufacture of alcohol from home grown materials is remote. Research work looking toward the perfection of a chemical or bacteriological process for the production of fuel alcohol commercially from waste vegetable materials is going forward and is thought to have promising possibilities for application in parts of the empire where such waste products are available in quantities.

In Cuba and other sugar producing communities alcohol is now made and used extensively as motor fuel, the source being low grade molasses, which is a sugar refinery by-product available in large quantities. Recent advice from Cuba is to the effect that about half the cars, trucks and tractors in operation there are now using alcohol successfully, although not designed for efficient operation on this fuel. In the Philippines the Nipa palm is the source of supply of industrial alcohol. It has been estimated that 100 sq. mi. planted to Nipa palm could produce sufficient alcohol to provide a substitute for gasoline in sufficient quantities to operate all the motor cars in Australia. This plant is said to have a life of 60 to 100 years and can be tapped periodically without injury throughout its life. According to Dr. Howard I. Cole, American chemist in the Philippine Bureau of Science, who has done considerable research work in connection with investigations regarding the possible establishment of an alcohol fuel industry, the islands could readily produce alcohol in sufficient quantity to become independent of any outside source of motor fuel and even produce fuel alcohol for export. He favors the use of a fuel similar to that produced in South Africa and called Natalite, which is said to contain 55 per cent rectified alcohol, 44.9 per cent ether and 0.1 per cent ammonia, to which is added some denaturant. The ether can be manufactured along with the alcohol.

It has been estimated that alcohol, which is already used to some extent in the Hawaiian Islands as one important constituent of motor fuel, can be produced there for about 10 cents per gallon, at the same time producing a valuable fertilizer. The appended diagram, prepared by Dr. Cole, is intended to visualize the process of manufacture of sugar with by-products in the form of alcohol-ether motor fuel and fertilizer. See Fig. 1.

Without going further into the matter of the possible alcohol supply it is apparent that it can and will be produced in considerable quantities for motor fuel and is, in fact, being so produced and used in large quantities where the raw material is at hand and the price of gasoline relatively high. There is reason to doubt whether alcohol will ever be widely used as motor fuel in this country so long as gasoline is plentiful and relatively cheap, except perhaps as one constituent of blended fuels, but its use in countries to which we export much automotive equipment makes it important to consider a number of problems which present themselves in connection with its use.

According to Ricardo's research work, ethyl alcohol (98 per cent) has a specific gravity of 0.798, a boiling point of 172 deg. Fahr., a latent heat of vaporization of 406 B.t.u. per lb. and a lower heating value of 11,465 B.t.u. per lb., or 76,250 B.t.u. per gallon. The latent heat of vaporization is about three times that of gasoline, hence, although the boiling point is lower than the average boiling point of gasoline, the quantity of heat required to vaporize a given weight is about three times that necessary to vaporize the same weight of gasoline. The heat content per pound is about 60 per cent of that of gasoline, but since alcohol weighs more per gallon than gasoline, the heat content per gallon is about two-thirds that of gasoline, instead of 60 per cent.

Commercial alcohol used for fuel purposes contains, as a rule, from 5 to 10 per cent of water, and "unless especially treated, possesses a slight acidity, owing no doubt to its oxidation through aldehyde to acetic acid. A certain degree of ionization is thus produced in any fuel in which aqueous alcohol is one of the ingredients. This will lead in the case of commercial metals immersed in the fuel to local pitting and corrosion owing to the presence of impurities in the metals setting up of a large number of electrolytic couples over its surface."*

Corrosive Action of Alcohol

Trouble from this corrosive action has occurred whenever commercial alcohol or fuels in which it is one constituent have been used, unless some steps have been taken to prevent it. Research work into the nature of this corrosive action is proceeding both in England and in this country. Analysis made at the Bureau of Standards of the deposit formed in a terne plate tank in which a blended fuel containing alcohol had been used showed that it consisted of 77 per cent lead, zinc and iron oxides, 20 per cent of moisture, combustible and silicious matter and the balance aluminum, tin and copper oxides. Later strips of copper, terne plate and steel were immersed in this fuel for periods up to six days. At the end of this time the copper and steel showed unmistakable signs of corrosion and the terne plate some slight corrosion, while the same metals immersed in gasoline showed no such signs.

The London General Omnibus Co. found that in the case of benzol-alcohol mixtures the fuel tank became porous and corroded in a month's use. Laboratory tests made by them showed that copper and iron are attacked badly, brass, tin, zinc and aluminum are slightly attacked, while lead proved to be immune. Iron coated with an alloy composed of 20 per cent tin and 80 per cent lead proved to be satisfactory, while brass carbureter parts proved to be only slightly affected. Ormandy and Craven* have since found that a small amount of alkali

*Physical Properties of Motor Fuels by W. R. Ormandy and E. C. Craven, a paper read before the (British) Institution of Automobile Engineers.

tends to prevent corrosive action of alcohol-benzol on iron. Pyridine, which is a powerful base, answers this purpose, and this substance is one of those used to denature alcohol used for power purposes in Great Britain, Cuba and elsewhere. Corrosion of brass in the vicinity of soldered joints is increased, but if the solder be made of two parts tin to one of lead, this action ceases.

Alcohol is often blended with sulphuric ether, which, if not carefully refined, may contain some sulphuric acid which will, of course, attack metal parts with which it comes in contact. This acidity can be neutralized by the use of pyridine or ammoniac, according to Cuba Fabril S. A., large producers of the motor spirit used in Cuba. The official formula for this fuel calls for the addition of 10 per cent of gasoline or sulphuric ether and about 1 per cent of other diluents, including pyridine, formol and coloring matter to alcohol containing 5 per cent of water. The concern mentioned states that no trouble from corrosive action has occurred in Cuba, presumably due to the use of pyridine, and similar reports have been received from tractor makers who have sold equipment there.

The incomplete combustion of alcohol results in the formation of acetic acid, which will, of course, cause corrosion if permitted to remain in the engine cylinder or exhaust system. Such corrosion can, according to John A. Secor, be prevented by washing the engine with kerosene while still hot, after running on alcohol, or by the use of alcohol and benzol in equal proportions, instead of straight alcohol. The tendency to incomplete combustion is naturally much less when the mixture is on the lean rather than on the rich side. Proper atomization and vaporization of the fuel also tend to prevent incomplete combustion.

The Vaporization of Alcohol

Several American manufacturers who have constructed alcohol burning engines have found that it requires considerable pre-heating to secure maximum power and economy, and some of them have found that the same heating devices used on kerosene burning tractor engines perform this function satisfactorily. Although alcohol distills completely at a temperature of about 172 deg. Fahr., except for its water content, as against a mean temperature of about 430 for a typical American kerosene whose end point is about 570 deg. Fahr., alcohol requires nearly four times the quantity of heat per pound to completely vaporize it. The figures given by Ricardo are 108 and 406 B.t.u. per lb. respectively for alcohol and kerosene. This heat must, of course, be added before the fuel can be burned, but there is difference of opinion as to whether enough can be added after the fuel has entered the cylinder. It is apparently possible to get all the heat required into alcohol in the case of single cylinder engines of low or medium speed and similar results are attained in the case of the Rumley two-cylinder tractor engines in which the manifold is very short. In any case such engines have good economy on both kerosene and alcohol. In the case of four-cylinder engines, however, at least when a single carbureter is used, the distribution problem becomes more difficult and the addition of considerable heat to the charge before it reaches the cylinder has been found necessary to secure good economy, as the following records of test will show:

A. W. Scarratt, of the Minneapolis Steel and Machinery Co., found in tests of a four-cylinder tractor engine that the carbureted mixture on entering the cylinder should have a temperature of approximately 100 deg. Fahr. While recognizing that this temperature can be obtained in various ways, Scarratt found that hot air supplied to the carbureter assisted materially in vaporizing the fuel, and in engines of his design operating on alcohol it is aimed to have the entering air heated to 150 deg. Fahr., after which the mixture is again heated by hot spot or other means on its way from carbureter to engine. When the fuel mixture was maintained at the temperature mentioned it was found to enter the cylinder in a colorless, dry condition and neither pre-ignition nor detonation ever occurred.

In tests made by the J. I. Case Co. on their 10-18 four-cylinder 3⅞ x 5-in. tractor engine it was found advisable, when burning alcohol, to use all the heat available from an exhaust jacket which completely surrounded the intake manifold, although the temperature of the mixture measured as close to the inlet valves as possible ranged from 185 to 200 deg. Fahr. This was with 90 per cent alcohol, that is, with alcohol containing 10 per cent of water. In spite of the high temperature of the charge, the engine ran much cooler than when either gasoline or kerosene is used, so much so that at all loads below maximum it was found necessary to cover a part of the radiator in order to maintain the desired temper-

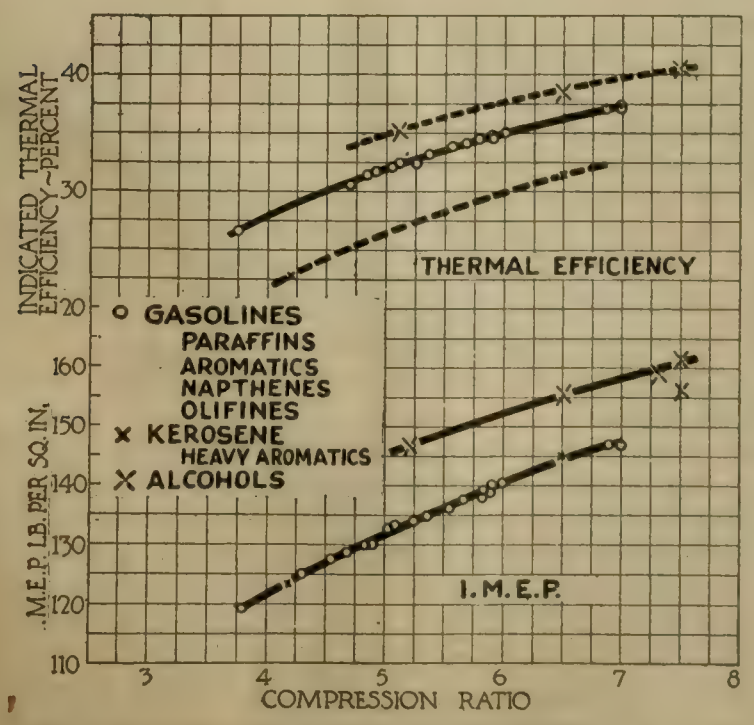


Fig. 5—Indicated M. E. P. and thermal efficiency of an engine operating on various fuels at various compression ratios, as determined by Ricardo

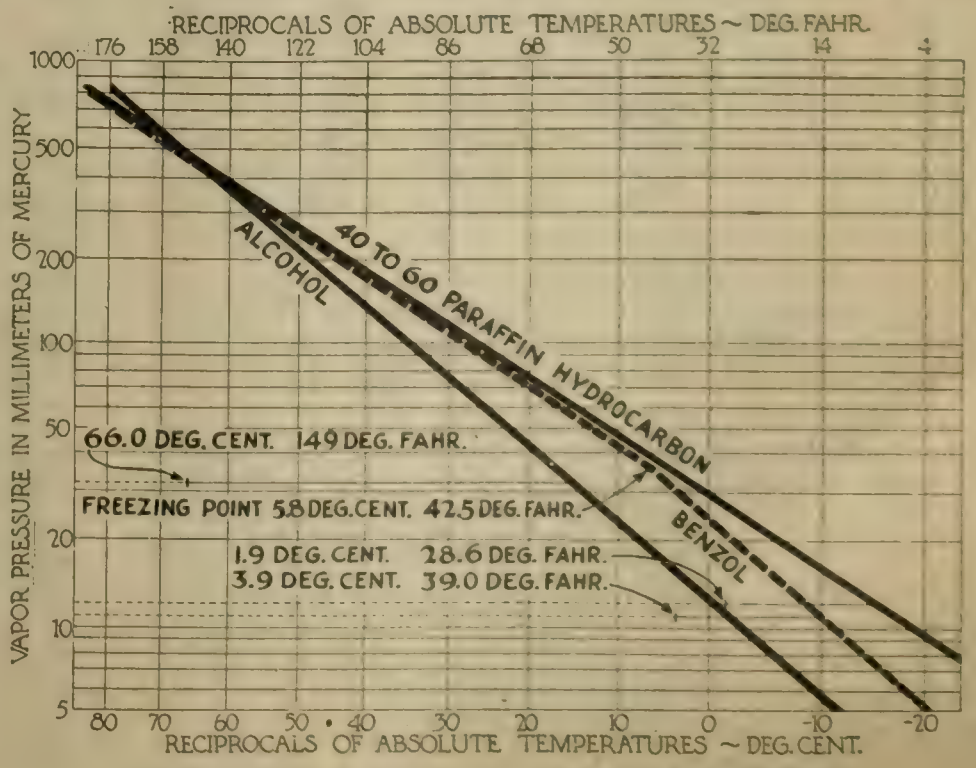


Fig. 6—Relation between vapor pressure and absolute temperature of alcohol, benzol and an imaginary hydrocarbon fuel

ature of the cooling water in the cylinder jacket.

Thomas Midgley, Jr., of the General Motors Research Corp., who has conducted much research work on alcohol fuel, also recommends the supply of considerable heat to the inlet manifold to facilitate vaporization.

Starting with Alcohol Fuel

Starting difficulties are sometimes encountered when alcohol alone is employed as fuel, although the large Rumely tractor engines are said to start easily on alcohol at temperatures of 70 deg. Fahr. or over. At lower temperatures starting is accomplished in the case of these engines by using gasoline. In most cases it is found possible to start readily with mixtures containing 10 per cent of gasoline or sulphuric ether, one of which constituents is used in the official motor spirit sold in Cuba. There is said to be no trouble encountered in starting there, though the warm climate is, of course, a favorable factor. One of the tractor companies supplies a longer starting crank to facilitate starting in engines designed for alcohol burning, but these engines have a much higher compression than gasoline and kerosene engines.

Compression Pressures with Alcohol

The power and fuel consumption of any engine depends to a considerable degree upon the compression pressure, and it is desirable from every standpoint to use as high a compression as can be employed without bringing about detonation which manifests itself in violent knocking, overheating, etc., and soon results, if allowed to continue, in pre-ignition.

Ricardo's research work in reference to the maximum compressions which various liquid fuels will stand without detonation shows that 98 per cent alcohol will stand well over 200 lb., equivalent to a ratio of 7.5 to 1, as compared to about 100 lb. for several samples of gasoline and 86 for one sample of kerosene. Ricardo appears to have established the fact that ethyl alcohol can be used with higher compression pressures than any other of the common liquid hydrocarbons, although acetone, benzol, toluol and xylene can all be used with compression pressures of about 180 lb., corresponding to a 7 to 1 ratio.

According to Secor, the German Deutz and other engines designed especially for use on alcohol fuel used compression pressures of about 193 lb. and had thermal efficiencies of between 31 and 32 per cent. The tractor engines built by the Rumely Co. with which Secor is connected, have a compression pressure of 90 lb., being intended primarily for burning gasoline and kerosene, although they burn alcohol efficiently considering the compression used. Secor states that this compression might well be doubled for alcohol burning.

H. L. Horning reports that the Waukesha Motor Co. has built over 2000 engines which are now being operated on alcohol fuel. Sixty per cent of these have a 4 to 1 compression ratio, some 38 per cent 4.5 to 1, and the balance a higher ratio. While Horning agrees that a 7 to 1 ratio can be used without detonation, he regards 110 lb. (about a 5 to 1 ratio) as the practical limit in truck and tractor engines of the conventional type, unless a special type of piston and rings be employed. Midgley states that a 7 to 1 ratio for alcohol burning is highly desirable. The Buda Co. use 90 to 100 lb. on engines intended for alcohol burning, the Avery Co. 100 to 110 lb., Minneapolis Steel and Machinery Co. 110 lb. and the Case Co. 125 lb.

In developing their alcohol burning engine, the Minneapolis Steel and Machinery Co. experimented with compression pressures varying from 70 to 127 lb. and finally chose 110 lb. as the compression which gave satisfactory operation and good economy. This engine is a four-cylinder, 4¼ x 6-in. type, has two inlet and two exhaust valves per cylinder and is built for 70 lb. compression when using gasoline and kerosene. The thermal efficiency, when operating on alcohol with 110 lb. compression, is equal to that obtained on gasoline at 70 lb. compression, while the maximum power developed is midway between that on gasoline and that developed on kerosene. Power, torque and fuel consumption curves for the three conditions are given in Fig. 2.

The Waterloo Gasoline Engine Co. build a line of small portable engines in which some tests in alcohol burning have been made. The standard compression ratio is 3.94 to 1. With this ratio the power fell off 5 to 10 per cent with alcohol as compared to kerosene and the consumption more than doubled. By raising the compression to a ratio of 4.95 to 1, the power increased 20 to 25 per cent over that on kerosene and the economy increased to about 1.25 lb. alcohol per b.hp.hr., as compared to 0.75 lb. of kerosene. The Case tractor engine uses 0.7 to 0.8 lb. kerosene per b.hp.hr. with 70 lb. compression and 1.12 lb. alcohol per b.hp.hr. with the compression raised to 125 lb.

Secor, giving figures for tests of the Rumely engine with 90 lb. compression, states that it used in tests made in Esthonia 0.784 lb. alcohol per b.hp.hr. as against 0.607 lb. per b.hp.hr., using kerosene, and the same compression pressure.

The Avery Co. report an increase of one-third in power in a tractor engine using alcohol as compared to gasoline, this increase presumably resulting in large part from increase in compression. The alcohol consumption is given at 1.6 lb. per hp. hr.

Horning states that engines built by the Waukesha Motor Co. develop 49 to 51 hp. on American gasoline, 44 hp. on American kerosene, 57 hp. on 93 per cent alcohol and 61 hp. on Borneo gasoline, the compression ratio used in each case not being stated.

Smooth Running with Alcohol Fuel

All authorities appear to agree that the use of alcohol fuel results in a much smoother operation of the engine than with gasoline and that detonation does not occur, as it often does with gasoline when the compression ratio is no higher than 4 to 1.

In reports from England recently received in this country, W. R. Ormandy, chairman of fuel committee of the Imperial Motor Transport Council (of Great Britain), states that detonation with alcohol does not occur with compression ratios up to 8 to 1, and pre-ignition does not occur with 6 to 1 ratios even when running for long periods with maximum power output of the engine. This agrees with findings of Ricardo, whose reports indicate that with alcohol pre-ignition occurs at lower compression pressures than detonation.

Other findings in Ormandy's recent report may be summarized as follows:

"There was no evidence whatever of corrosion in the engine. Power and efficiency are increased by the low temperature of the circulating water and supplying heat to the carbureter reduces power. Increase in water content of the alcohol up to 10 per cent by volume is an advantage especially in very high compression engines. Under all conditions of throttle or mixture alcohol requires the spark more advanced than with gasoline or benzol and much more advanced with weak mixtures."

Ricardo and others have noted that the range of com-

bustible mixtures is much greater with alcohol than with gasoline and other fuels. For this reason it is possible to vary the power of an engine through a considerable range by varying the mixture proportions. This can be done to some extent with gasoline, but to a much greater extent with alcohol. In the test with the Waterloo single cylinder engine, referred to above, it was found possible to decrease the power output 50 per cent by simply making the mixture leaner. When this is possible the use of the throttle can be avoided, within the range in question, and this permits of higher economy at part load than can be secured by the use of the throttle only, the mixture proportions remaining the same. Further information as to the mixture proportions which can be used with various compressions in alcohol engines is needed.

One of the marked advantages resulting from the use of alcohol as compared to gasoline is the absence of carbon deposit. Engines which carbonize badly in short periods when using gasoline have been run on alcohol for months without trouble from carbon deposit.

Cracking Processes

The process of cracking fuels which are not sufficiently volatile for use in automotive engines, and thus making them fit for such use, is used widely by the large refineries in this country, with the result that the available supply of motor fuel has been materially increased. According to the Bureau of Mines, practically all the cracked gasoline produced to date in this country has been made by the Burton process. On account of the desirability of having other processes available, the bureau has undertaken to obtain data regarding the more important chemical and physical factors controlling the formation of gasoline from less volatile fuels. The results of this investigation has been published in the form of Technical Paper No. 258, by E. W. Dean and W. A. Jacobs, entitled "Production of Gasoline by Cracking Heavier Oils," published by the Bureau of Mines. It is beyond the scope of this article to present in detail the results of this research work, these results being primarily of interest to the refiner rather than to the automotive industry. It may be pointed out, however, that some hundreds of patents have been taken out on various cracking processes and that the claims made for the bulk of these have yet to be proven by tests on a commercial scale. Furthermore, the few processes which have been tried in a relatively small commercial way, have yet to prove conclusively their merit over the Burton process in large scale operation. In some of them the yield of gasoline is admittedly very high, but other factors such as the renewal of the catalytic agent or of parts of the equipment employed, or the high fuel consumption, etc., are serious obstacles to be overcome.

On the other hand, there is sufficient evidence of success in some quarters to warrant the hope that new and improved processes will in time materially augment the gasoline supply, possibly making it of higher average grade than at present, so that the burden of more efficiently using our available supply of motor fuel may require less of a change in engine type than has been anticipated in some sources. Nevertheless, it must not be forgotten that any new process, however promising, is certain to require many years for its introduction on a scale sufficiently extensive to have any marked effect upon the motor fuel supply as a whole. Progress is being made and is certain to continue, especially in view of the fact that the demand for fuel promises to continue to increase at a higher rate than the supply increases, thus causing a rise in price and greater incentive to secure a higher yield of motor fuel from the crude.

Among the cracking processes now said to be under

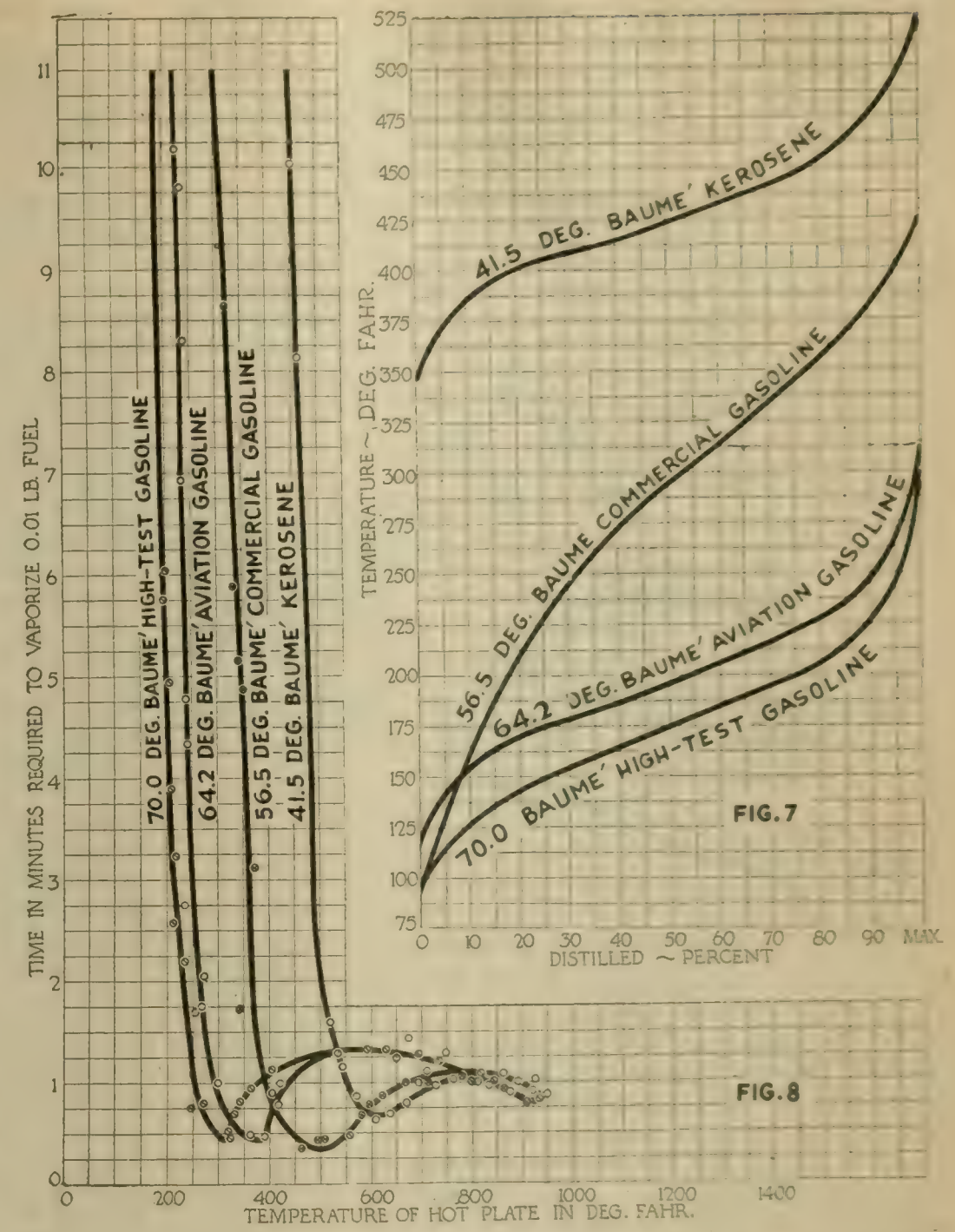


Fig. 7—Distillation curves of fuels tested by Berry and Kegerreis. Fig. 8—Curves showing time required for evaporation of 0.01 lb. of same fuels on a plate maintained at the temperature noted. Fig. 9—Effect of change in fuel-air ratio upon the temperature of the exhaust gases. Fig. 10—Relation between load and temperature of exhaust gas at different speeds

development or in limited use may be mentioned the following: Cross, Emerson, Greenstreet, Hewitt, Ramage, Dubbs, Coast, Jenkens, Isom, Adams, Flemming, Dewar and Redwood, Bacon and Clark, Parker, McAfee, Gray, Rittman and Weisgerber.

Chemical Composition of Fuels

One disadvantage of cracked fuels is the presence in them of considerable proportions of the unsaturated hydrocarbons. These olefins are characterized by their

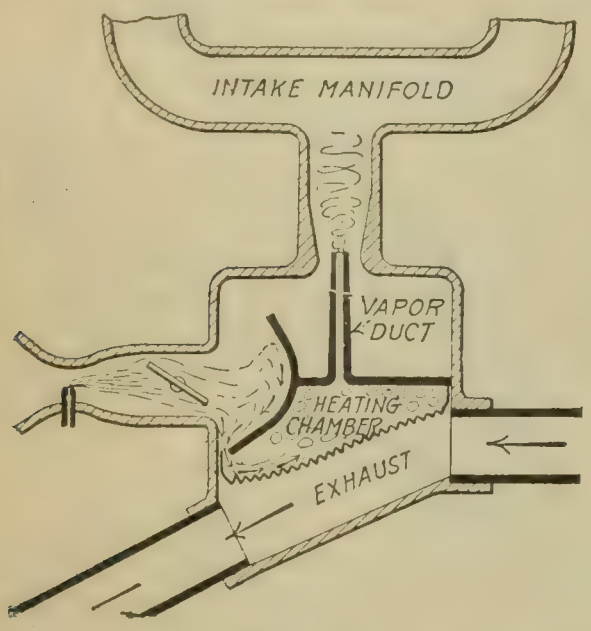


Fig. 11 — Diagrammatic sketch of type of inlet manifold suggested by Mock as a means for preparing fuels of low volatility for use in an engine without excessive heating of the air

tendency to polymerize or form larger molecules, some of which are gums or tars, which may be deposited on the inlet valves or other parts of induction system. Partly for this reason it is customary to blend cracked gasolines with straight run gasoline and thus keep the percentage of unsaturated compounds so low as to prevent trouble from this source.

The work of Kettering and Midgley has long since established the fact that hydrocarbons of the paraffin series, which have the chain type of molecular structure, and compose the bulk of the gasoline sold in this country east of the Rocky Mountains, are more prone to detonation, or detonate at lower pressures, than other hydrocarbons of the naphthene series which have the saturated ring structure and are present in considerable proportions in gasoline made from California crude. It has also been established that fuels of the aromatic series: benzol, toluol and xylene, will withstand still higher pressures without detonation, while the alcohols stand the highest of all. These findings have been verified by the work of Ricardo, whose reports were published under the heading, "The Influence of Various Fuels on Engine Performance," in these columns last year. The General Motors Research Corp. is continuing its investigations with a view to finding a so-called "dope," which when added to gasoline will decrease its detonating tendency. Many such substances have been found, but so far as the public is aware none of them are commercially producible in sufficient quantities to treat any large proportion of the gasoline sold in this country, even though the refiners were disposed to cooperate by adding them to the motor fuels which they produce.

Prof. Robert E. Wilson, director of the Research Laboratory of Applied Chemistry of the Massachusetts Institute of Technology, is conducting a series of investigations on motor fuels which deals chiefly with the effect of the chemical constitution of the various fuels upon their properties and behavior in internal combustion engines. This work is not to be carried out by studying actual combustion in engines, but will take the form of physio-chemical research into the effects accompanying the use of automotive fuels. The only results thus far made public will be treated under the head of volatility.

The Bureau of Mines is making an investigation with a view to learning what the gum-forming constituents in cracked gasoline are and how they can best be removed from commercial fuels.

Volatility and Vaporization of Fuels

It has long been known that the volatility of a fuel has considerable effect upon its suitability for use in automotive engines, but it has not been known definitely to what temperatures it is necessary to heat air-fuel mixtures to secure complete vaporization or prevent condensation once the fuel is vaporized. Professor Wilson has done some interesting and important work along this line, a complete report of which appears in the Journal of Industrial and Engineering Chemistry for October, 1921. By distilling gasoline and at the same time adding more fuel to maintain a constant level in the flask, it is possible after a time to arrive at an equilibrium temperature at which time the composition of the vapor leaving the flask is the same as that which enters. The liquid which then remains in the flask represents the liquid which is in equilibrium with the completely vaporized fuel, or that which would be condensed out first upon cooling the air mixture. Fig. 3 shows the distillation curves of three fuels and of their equilibrium solutions. The average boiling point of all the equilibrium solutions is about the same as the 85 per cent point on the distillation curve of the original fuel, and this temperature is of most importance in indicating the vaporization and distribution characteristics of the fuel. Prof. Wilson concludes that representative present-day gasoline has no inherent limitation to make it particularly difficult to obtain complete vaporization.

Prof. Wilson has also done important work in respect to the quantity of heat necessary to vaporize various fuels. Fig. 4, plotted as a result of this work, shows graphically the total heat required in the case of two fuels, gasoline and kerosene, sold under the trade name of Socony, to raise them to certain temperatures. It is interesting to note that, although the latent heat of vaporization of kerosene is lower than that for gasoline, the total heat required for making a combustible mixture is greater for kerosene on account of the fact that it must be raised to a higher temperature in order to get it into the air stream in truly vaporized form.

Ricardo, in the reports of research work already referred to, devotes considerable space to the subject of latent heat of vaporization and its effect upon engine performance, and gives tabular data concerning the latent heat of vaporization of various hydrocarbons. The following, among other conclusions, are drawn by Ricardo:

Latent Heat of Fuels

There is evidence that, except for fuels in the alcohol group, all fuels boiling below 392 deg. Fahr. are completely evaporated before the commencement of the compression stroke. Therefore the absolute temperature at the commencement of the compression stroke is dependent upon the amount of external heat applied and the latent heat of evaporation and almost independent of the temperature of the charge during its entry into the cylinder and the volatility of the fuel. From this it is concluded that, with any given amount of preheating, provided it is not excessive, the volumetric efficiency, and

therefore the power output, will vary directly with the latent heat of the fuel. Except for the alcohol group, the variation in latent heat is not large. In the case of alcohol, the higher latent heat and the larger proportion of fuel to air, as compared to gasoline and benzol for example, results in increased power. There was clear evidence that in the case of the alcohols, evaporation continued throughout the compression stroke, resulting in a nearly isothermal compression, a lower temperature of the cycle and a slightly higher thermal efficiency.

In this connection it is interesting to note the following comments made by a careful student of Ricardo's work and a man who has himself been closely identified with research along similar lines (see Fig. 5):

"We believe the result of greatest value from Ricardo's work has been the demonstration that the energy available from unit volumes of chemically combining mixtures of air and practically all liquid fuels are identical within about 2 per cent and that when these fuels are used in any given engine with a given expansion ratio, when the compression ratio is not high enough to produce detonation with any of the fuels, the power output and thermal efficiency are independent of the fuels used. The apparent exceptions to this conclusion are the two kerosenes and the alcohol group. Each of these, however, requires a different application of heat for proper operation. The kerosenes give identical M.E.P.'s with the lighter paraffins, aromatics and naphthenes, but lower thermal efficiency, thus indicating incomplete combustion either because of incomplete vaporization within the cylinders, which is unlikely, or because the maximum power mixture is considerably (15 per cent) richer than the maximum power mixture for the lighter fuels.

"In the case of the alcohols, although both the indicated thermal efficiency and mean effective pressure are higher than the paraffins, aromatics and naphthenes, the percentage increase in mean effective pressure is greater than the increase in thermal efficiency and therefore the combustion is probably incomplete, due to the use of maximum power mixtures which are considerably richer than the chemical combining mixtures. The increase in mean effective pressure is undoubtedly due to an increase in weight of air entering the cylinder and probably were the comparisons made on the basis of energy output per pound of air used, but little difference in the performance of the alcohols would be found."

It is generally recognized that ease of starting, especially in the case of a cold engine, depends to a considerable extent upon the presence of low boiling point fractions in the fuel, but, so far as we are aware, there is no definite data on the basis of which it is possible to predict with certainty either the proportion of volatile fractions needed to effect a start or the temperatures at which these fractions must distill off, although Professor Wilson has developed a means for comparative measurement of the effective starting volatility of different fuels.

In discussing factors which govern ease of starting before the American Petroleum Institute, Professor Wilson stated that starting volatility depends upon the lower part of the distillation curve, but not upon the initial *point*, and to illustrate this he compared three fuels which have almost the same boiling point: alcohol, benzol and a hypothetical fuel consisting of 60 per cent hexane (boiling point 154 deg. Fahr.) and 40 per cent heptane (boiling point 208 deg. Fahr.). By plotting the vapor pressures against the reciprocal of absolute temperatures of these three fuels on a logarithmic scale as in Fig. 6, substantially straight lines whose slopes are determined by the heat of vaporization of the fuels are obtained. Since the fuels have the same boiling point, the curves cross at a pressure of 760 mm., but the lower vapor pressures corresponding to the leanest mixture which will ignite are the more important, and it will be noted that the vapor pressure of alcohol drops off more rapidly than that of benzol and the paraffin in hydrocarbon fuel. To give vapor pressure of 11 mm. the alcohol must be 27 deg. Fahr. warmer than the paraffin hydrocarbon. This is one reason why it is more difficult to effect a start on alcohol.

Tne paraffin hydrocarbon and the benzol require about the same richness of mixture for ignition to become possible, but on account of its lower molecular weight the vapor pressure required for alcohol is about three times as great as for the other two fuels, and this again is unfavorable to ease of starting. A third reason for alcohol's poorer starting characteristics is the fact that, because of its higher latent heat of vaporization it causes a greater degree of cooling upon contact with the airstream. In the case of gasoline this cooling is said to amount to about 27 deg. Fahr. as against 122 deg. Fahr. for alcohol. The curves show, for example, that if the paraffin fuel in question has a given ease of starting 28 deg. Fahr., the benzol would have to be heated to 39 deg. Fahr., and the alcohol to 156 deg. Fahr. to give equal ease of starting. This illustrates the inadequacy of a specification which depends upon initial boiling point as a means of indicating ease of starting. Professor Wilson has succeeded in developing an apparatus intended to measure effective starting volatility of various fuels. It is described in the *S. A. E. Journal* for January, 1922, p. 20.

The light fractions in the gasolines Ricardo tested were found to consist of hexane, cyclohexane or benzine or mixtures of these hydrocarbons. He appears to have proved, however, that the "vapor pressure is indicative

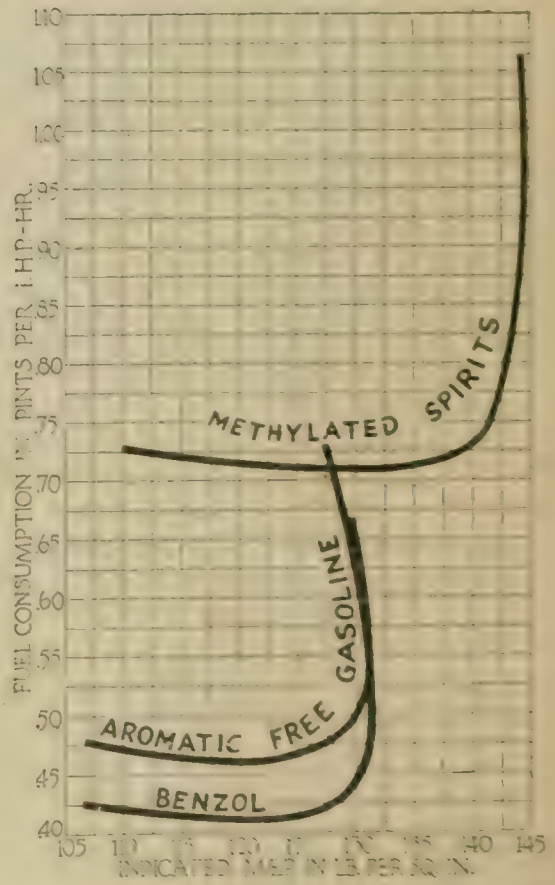


Fig. 12 — Relation between fuel consumption per i.hp. hr. and indicated M.E.P. for three fuels tested by Ricardo

of the readiness of the fuel to start from cold," a factor which has not escaped attention in other quarters.

The influence of heat added to the charge upon vaporization, starting and related phenomena has been the subject of much discussion and experimentation, but the fundamental factors involved have received far too little consideration. The quantity of heat required, the optimum temperature, location and area of heating surface and factors which control the rate of supply of heat to the heating surface are not well understood and but little reliable data appears to be available on these subjects.

O. C. Berry and C. S. Kegerreis have done some work

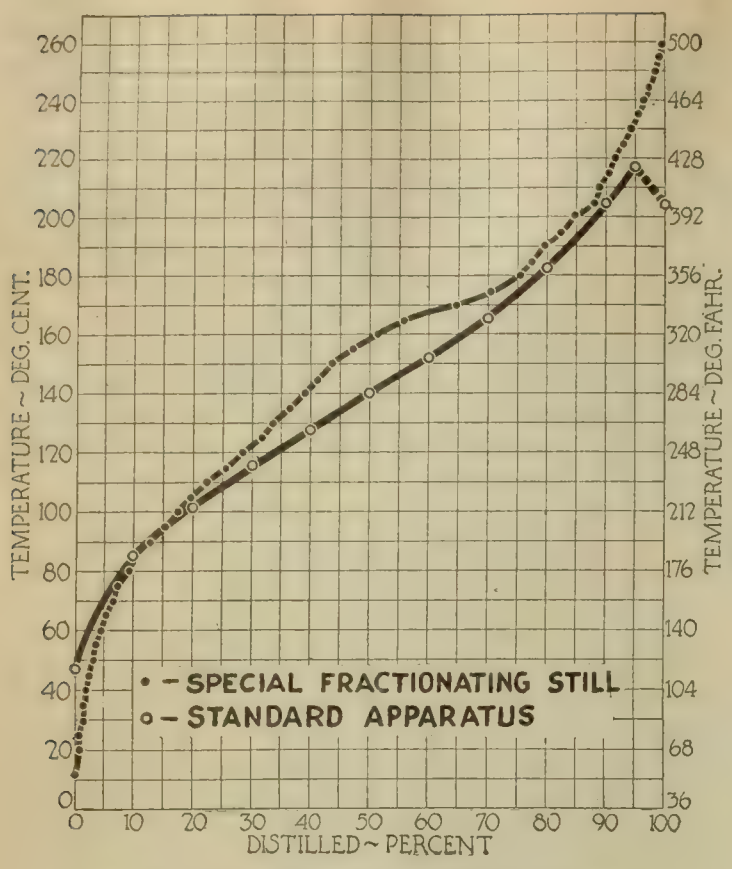


Fig. 13—Comparison of distillation curves of same fuel made respectively with the Tice fractionating still and the present standard apparatus. The differences are considerable and are said to be highly important

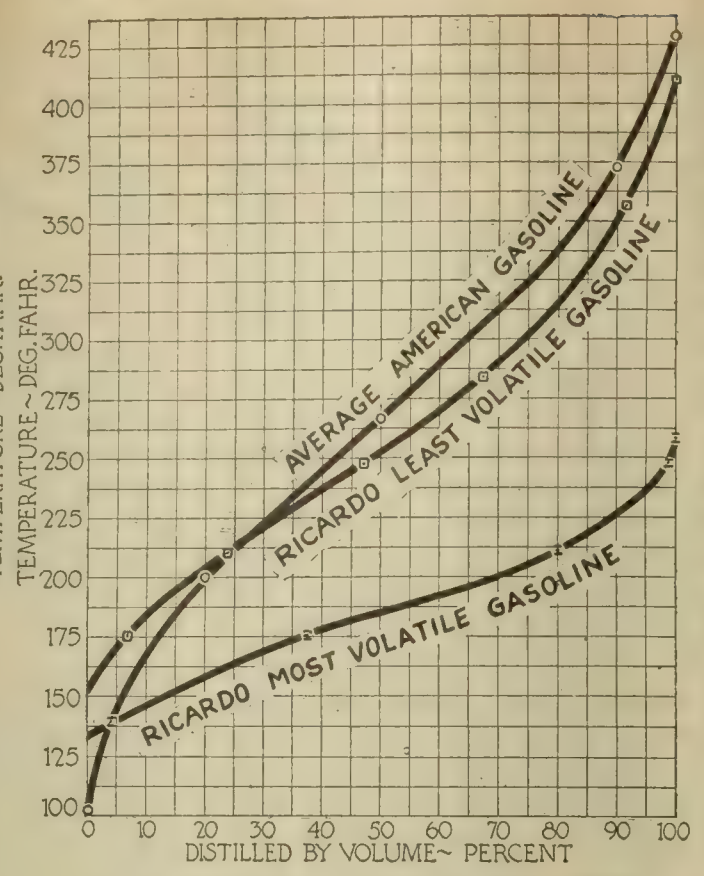


Fig. 15—Distillation curves of the average gasoline marketed in this country and the gasolines of highest and lowest volatility covered by reports of tests made by Ricardo

intended to determine the rate of fuel evaporation from a surface heated to various temperatures, and also the effect of various factors on the temperature of exhaust gases. The results of these tests were reported in a paper presented before the Society of Automotive Engineers and the more important ones are summarized below:

Three samples of gasoline and one of kerosene, the distillation curves of which are given in Fig. 7, were placed in a well formed on the surface of an electrically heated plate and the time required for complete vaporization of the fuel sample was noted together with the temperature indicated by a thermometer placed in a well adjacent to that containing the fuel. This temperature was held constant during the test. Fig. 8 gives the results of the test in graphical form. The fuel showed evidences of cracking during periods of rapid boiling and a deposit of solid matter was left on the wall of the well. When the liquid was boiling from a wetted surface, the vapor was wet and easily condensed. It appeared as a fog as it was carried off in a relatively cool atmosphere. When the spheroidal state was reached the deposition of solid matter ceased entirely, and the vapor was dry and almost invisible so that even after it had traveled a few feet in a cool pipe no appreciable condensation was apparent. The curves show the rate of vaporization. The highest rate recorded in each case is the one in which cracking and deposition of solid matter occur. It is consequently concluded that a higher temperature at which the rate of vaporization is slower but in which the spheroidal state is reached is the best.

Tests made in an engine running at 1000 r.p.m. and half load gave the following results in respect to the temperature of the exhaust gases as measured by a thermocouple placed near the outlet of the exhaust manifold.

Varying the temperature of the cooling water from 70 to 210 deg. Fahr., measured at the water outlet from the jacket, had but little effect upon the exhaust gas temperature, which remained almost constant at about 1250 deg. Fahr. The variation was less than 50 deg. Fahr. from this mean.

The variation in temperature of exhaust gas with change in mixture proportions is shown by the curve in Fig. 9. The effect of change in load at various speeds of the engine is shown by the curves in Fig. 10. The maximum difference in temperature between light and full load is 270 deg. Fahr. at 300 r.p.m., and this difference decreases at higher speed to only 110 deg. Fahr. The tests show a variation in temperature as between low and high speed which ranges from 300 to 1300 deg. Fahr. at low loads and from about 600 to nearly 1500 deg. Fahr. at full load, hence the difficulty in maintaining any desired temperature of an exhaust heated vaporizing surface.

F. C. Mock of the Stromberg Motor Devices Co. is conducting experiments for the purpose of determining the heating areas, temperatures and other conditions of vapor generation necessary for the use of fuels ranging from aviation gasoline to fuels of low volatility known as distillate, and also the common alcohols. Mock states that he has already demonstrated that it is possible to secure better operation with the heavier of these fuels than the average motor car shows with gasoline, except in the matter of detonation, which he concludes can be taken care of by the use of water or alcohol. These fuels are being used at temperatures lower than is commonly believed necessary for efficient use of gasoline. The detailed results of these tests have not yet been given out, but Mock has expressed the view that by developing means for separating liquid fuel from the airstream, passing it to an exhaust heated chamber, and after it is vaporized returning it to the charge entering the inlet manifold, after the manner shown diagrammatically in Fig. 11, it will be possible to overcome many difficulties now encountered in efforts to better utilize present-day fuels.

This method of handling relatively non-volatile fuels is not new. It is in fact being used, with many variations in mechanical arrangement and design in the case of several vaporizing systems marketed in this country, and further tests along similar lines are being made by various concerns, among them being the Autocar Co. The method does not necessarily involve, as so many, especially British investigators, appear to assume, a high temperature of the incoming charge, for only the fuel is heated, while the air, at least in many excellent systems, is heated in a secondary way by admixture with the fuel after the latter is vaporized. This may result in condensing the fuel, but the fog thus formed is composed of such fine particles as to handle much like a true gas, and because of the large surface presented by the fuel particles, they are readily vaporized prior to combustion by contact with the hot piston, cylinder walls and residual products of combustion in the cylinder.

Mixture Proportions

The proportions of fuel to air have a very marked effect upon the power and economy of an engine and much excellent work has been done with a view to determining the

optimum ratios both for maximum power and maximum economy. The work of P. S. Tice and O. C. Berry, records of which have appeared in these columns, and that of the Bureau of Mines contain some excellent data in this regard, and a review of these and other sources of information along this line is given in a paper by W. S. James of the Bureau of Standards, read at the summer meeting of the S. A. E. last year. Berry has since done additional work on behalf of the Wheeler-Schebler Carburetor Co. with a view to learning the mixture requirements of engines under various conditions of steady running, acceleration, temperature, manifolding and quality of fuel. These include a series of tests showing the relation between the content of CO_2 in exhaust gas and the power and efficiency of the engine under various speeds, loads and mixture proportions. Records of these tests have not yet been made public. The effect of the temperature of fuel and air on the mixture proportions has also been investigated and are said to have made it clear that thermostatic control of the carburetor can be made of great practical value.

P. S. Tice, in charge of the Carbureter Division of the Stewart-Warner Speedometer Corp., who has done much valuable work in connection with problems relating to fuel economy, has recently made a study of the effect of pulsating flow upon carbureter metering and upon the measurement of air consumption of engines, and is now preparing a report on this subject.

Ricardo has included in his research work record of some experiments which, he says, demonstrate that "maximum power is always developed (with fuels other than the alcohols) when the mixture strength is at or near that giving complete combustion, and points to the curves given in Fig. 12 as proof of this fact. Other investigators have reached different conclusions, but so far as we recall most if not all of them used multiple cylinder engines in their determinations, and it is possible that the imperfect distribution which it is difficult to avoid in such engines accounts to some extent for the difference in the conclusions arrived at. In the case of alcohol fuel, however, Ricardo finds that the power output "increases as the mixture is enriched, and continues to so increase until the mixture strength is at least 20 per cent more than that required for complete combustion." This he attributes to the high latent heat of vaporization of alcohol and the relatively large increase in specific volume resulting from combustion.

Distillation Tests of Fuel

The distillation test of various fuels has long since taken the place of hydrometer testing which at one time was supposed to give some indication as to the value of fuels for engine uses, but is now recognized as being of secondary importance except when considered in combination with other known characteristics.

It is generally understood that the lower the distillation curve of a fuel, the more readily it is vaporized, but certain points on the curve are of special significance, as has already been pointed out in connection with the work of Prof. Wilson. Distillation tests are, as a rule, made with an apparatus consisting of an engler flask, a heating element, condenser, thermometer, etc., set up and operated in accordance with specifications laid down by a Government Committee on Standardization of Petroleum Specifications and published in Bulletin 5 of the U. S. Bureau of Mines. According to P. S. Tice, who has made a close study of this apparatus and of tests made with it, the apparatus has the following undesirable characteristics: Lack of control of still head temperature, use of an unnecessarily rudimentary still head, too high rate of distillation, too large increments per cut and lack of provision for conserving earliest distillates. Because of the faulty apparatus and methods, Tice states that two men using the same apparatus cannot consistently check results. Furthermore, the initial boiling point indicated by it may be as much as 70 deg. Fahr. too high and the end point too low by as great an amount, while direct recognition of any one of the numerous substances of which the fuel is made up is difficult to recognize either as to character or amount.

As a result of experimental work with fuel fractionating apparatus and other experience in work of this character, Tice has developed a special fractionating still which is said to incorporate the following essentials of design: Close and consistent regulation of the temperature of the still head walls, intimate thermal contact between vapors

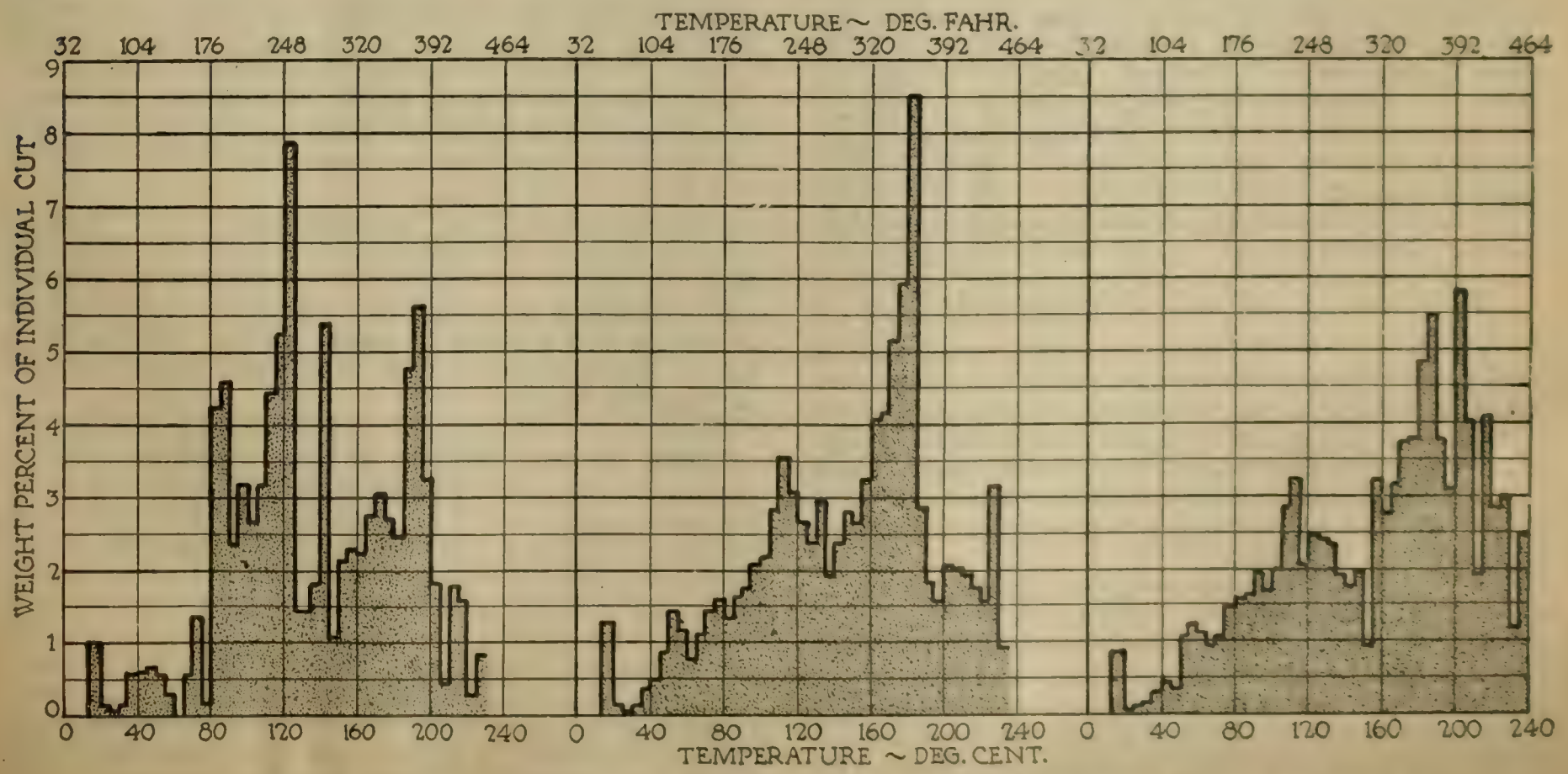


Fig. 14—Cumulative plotting of distillation data obtained by use of the Tice fractionating still on three brands of gasoline sold most extensively in and about Chicago

and condensate, minimum temperature gradient across still head section at any level, and sufficient space and time intervals between still and side tube. On account of limited space available here, it is planned to give a detailed description of the Tice distillation apparatus in a later issue of AUTOMOTIVE INDUSTRIES, but the appended distillation curves, Figs. 13 and 14, show clearly the advantage of this apparatus over the present standard type in more closely recording the distillation characteristics of the fuel. The conventional plotting used in Fig. 13 shows the boiling range of the fuel but gives little idea as to the substances contained or the quantities in which they occur. The differential plots in Fig. 14, in which the percentage of each cut is treated separately, shows the approximate number of fuel substances present, the approximate percentage and quantity in which they occur and the approximate boiling points of each substance. The data presented in Fig. 14 is representative of the three brands of gasoline sold most extensively in Chicago, the samples having been obtained at filling stations there on March 8, 1922. Fuel A is said to be a "straight run" gasoline.

The U. S. Bureau of Mines has, for some three years, been making a semi-annual gasoline survey. Representative samples of gasoline are collected in nine large cities in various parts of the country, and these are subjected to the tests required under the Government specifications. The latest survey, completed in March of this year, shows that the average quality of gasoline sold is almost identical with that sold a year earlier. The average initial boiling point is given as 102 deg. Fahr. and the average end point at 430 deg. Fahr. The average distillation curve is shown in Fig. 15 in comparison with similar curves for the gasolines of highest and lowest volatility tested by Ricardo as shown by his reports published in these columns last year. It is interesting to note that all except the initial part of the average curve of American gasolines is well above that for the least volatile gasoline tested by Ricardo, a fact which makes it more than ever apparent that gasoline used in the British Isles is much more readily volatilized than our own. This, of course, accounts to a considerable extent for the relative ease with which it is possible to efficiently utilize British as compared to American gasoline.

One of the interesting conclusions drawn by Ricardo as a result of his research work reads as follows: "There is considerable evidence to indicate that, in the case of most 'natural' gasolines, the more valuable constituents are those whose boiling points lie between the 176 and 356 deg. Fahr. It is, therefore, quite as undesirable to restrict the final boiling point of a fuel to 300 deg. Fahr. as it is to permit it to exceed 392 deg. Fahr. So much, however, depends upon the actual composition of the fuel, and so great are the variations in this respect that this conclusion must be regarded only as a broad generalization."

Fuel Distribution in Multi-cylinder Engines

On account of the problem of securing equal distribution of fuel in an engine with more than one cylinder much recent research work has been conducted on single-cylinder engines, thus quite properly eliminating one variable factor which has too frequently been overlooked in research work. The variables which control distribution are so numerous and complicated that little has been done to establish the laws which govern them.

Among the most informative pieces of research work in this field is that done by P. S. Tice and published in the *Journal of the Society of Automotive Engineers* for March, 1921, in which are given photographs showing the streamline characteristics for various types of manifold and various throttle positions. It was noted that the liquid filaments lie in and are forced to travel toward the areas of low pressure. Some work along similar lines has been done at the Bureau of Standards. Tests of this character are desirable as indicating the manifold areas to which heat can be applied to best advantage. O. C. Berry, among others, is collecting as much information as other work permits regarding the factors which control distribution, but so far as we are aware there is little if any basic work being done along this line. Prof. C. E. Lucke of Columbia University is studying the effect of manifold design and other factors on fuel utilization, but no results of this work have as yet come to our notice.

Ricardo states that "uniformity of mixture strength supplied to each individual cylinder of any group drawing from one source of supply depends primarily upon the design of the induction system generally and to a surprisingly small extent upon the nature of the fuel. A really well designed and efficient distribution system appears to maintain nearly the same uniformity of mixture strength on all fuels . . . though defects are more accentuated the lower the volatility of the fuel." He says further that distribution is the factor about which least is known to-day, while it exerts a more important influence than almost any other.

Effect of Fuel on Lubricant

The character of the fuel plays an important part upon the quantity of fuel which passes the pistons and is dissolved in the lubricant. Much fuel reaches the cylinder in a liquid state even when the induction system is highly heated, in some cases, and unless this fuel, which is usually composed of the less volatile ends is evaporated by contact with the hot piston, cylinder walls and residual gases in the cylinder, much of it finds its way into the crankcase and dilutes the lubricant.

Prof. Wilson, in connection with other research work already mentioned, is undertaking to measure the relative solubilities of various types of fuels in various lubricants, with a view to minimizing troubles from dilution. Work done by other investigators has shown that certain oils are affected less than others by contact with fuel which finds its way into the crankcase, but findings in this connection have not yet been made public.

Effect of Various Factors on Fuel Economy

Much research work has been done with a view to determining the numerous factors which affect the fuel economy of automotive engines and complete vehicles, but much remains to be done in this regard, both in respect to the factors themselves and in the application of existing information in designing new apparatus and in operating that now in existence.

Again we must refer to extensive research work of Ricardo. Some of his findings in this regard have already been referred to. Others may be summarized as follows:

For maximum economy, the compression ratio must be as high as it is possible to employ without inducing detonation. The tendency of fuels to detonate is the outstanding limiting factor.

The temperature of jacket water does not influence the indicated thermal efficiency to any significant extent. There was some slight gain in indicated thermal efficiency with lower jacket water temperatures, but the increase in mechanical efficiency due to higher wall temperatures and consequent lower viscosity of lubricant more than offset any gain from low jacket water temperatures in most cases.

In the case of fuels—except those in the alcohol group—with narrow boiling range, and boiling below 26 deg. Fahr., heating the charge has no effect on the thermal efficiency except as it reduces the maximum permissible compression pressure, but the power is decreased. The

thermal efficiency is somewhat increased by heat addition in the case of alcohol, but the power is decreased. This applies to single cylinder engines. In the case of multiple cylinder engines, where the question of distribution enters, heating the charge often increases thermal efficiency.

When the ignition is properly adjusted the indicated thermal efficiency remains nearly constant down to 40 per cent load, but if the ignition remains set at the same advance required for best performance at full load, the indicated efficiency falls off in substantially direct proportion to the decrease in load.

It is evident, of course, that fuel economy is affected by numerous other factors, some of which have already been mentioned in connection with the work of Ricardo, Berry, the Bureau of Standards, and others, but perhaps the most obvious loss is one that is preventable, or largely so, and yet so prevalent that it escapes attention in a vast majority of cars used, especially in this country. We refer to the loss incident to incomplete combustion, resulting in large part from the use of mixtures which are much too rich in fuel.

Experiments made by the writer and published in these columns several years ago, and many other experiments along similar lines made at earlier as well as more recent date, have shown that the exhaust gas from automotive engines contains large quantities of incompletely burned carbon. Among the most extensive of these tests are those reported by the Bureau of Mines which show that from 20 to 30 per cent of all the fuel used in the average American passenger car and truck passes out in the exhaust unburned. The reason why more efficacious steps are not taken to prevent this waste it is beyond the scope of this article to attempt to explain. The resultant loss is very great, though there is abundant data on the basis of which it can be minimized if not prevented.

Friction, of course, plays an important part in regard to fuel economy, and it need hardly be said that mechanical friction should be reduced to a minimum in the interest of lower fuel consumption. Engine friction is made up of mechanical and liquid friction and pumping losses. The largest item in mechanical friction is that of pistons and rings. This friction in turn is largely dependent upon the internal friction or viscosity of the lubricant. There is considerable research data on engine friction, some of which is contained in the paper by W. S. James and his associates on the staff of the Bureau of Standards, entitled "Elements of Automobile Economy" and published in the Journal of the Society of Automotive Engineers for June, 1921. It is there shown that engine friction increases at a somewhat higher rate than the speed and is materially affected by oil viscosity (see Fig. 16). Variations in friction with change in load (manifold depression) are also given. The losses increase slightly as the throttle is opened. For maximum fuel economy with a given engine the engine speed should be kept as low as possible, pointing to advantages from as small a reduction in gear as is practicable—and the oil used should have the lowest viscosity consistent with maintenance of an oil film where it is required.

Friction in gearset, axle and other parts of the transmission have a direct effect upon economy, as do also the rolling losses in tires and the wind resistance of the vehicle. These factors are treated in several pieces of research work, some of which have been recently printed in these columns and one of which is included in an article relating to tires which appears in this issue.

An article entitled "Relation Between Fluid Friction and Transmission Efficiency," by Neil MacCoul, presented at the last annual S. A. E. meeting, gives useful data on gearset losses under various conditions of oil viscosity, load, speed, etc. The article entitled "Rear Wheel Dynamometer Tests and Their Significance to the Engineer," based on tests made by Professor Lockwood of Yale University and printed in AUTOMOTIVE INDUSTRIES for April 20, 1922, gives much data on actual rolling resistance of various cars and trucks as well as their economy and power under conditions approximating road operation. The wide variations in friction losses and the decreased loss when using cord as compared to fabric tires is particularly noted.

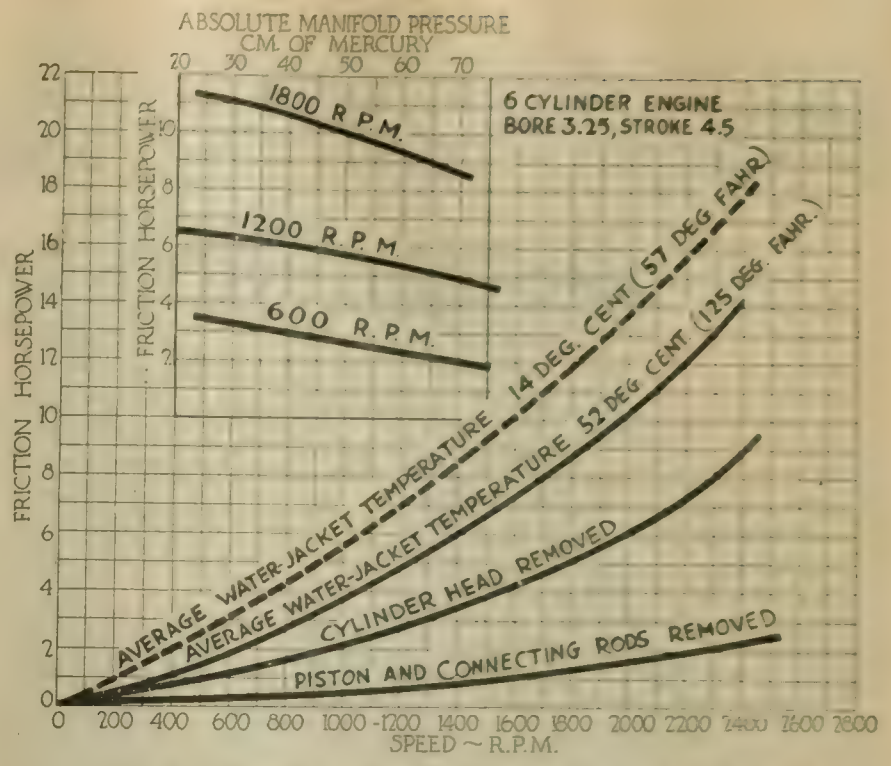


Fig. 16—Relation between friction hp. speed and load under various conditions, as given by W. S. James

Prof. W. E. Lay of the University of Michigan, and Prof. T. R Agg of Iowa State College, are investigating the rolling resistance and fuel consumption of trucks and cars on grades and level roads, while experiments made with a view to determining the actual wind resistance of vehicles are in progress at other universities. Professor Lay also has in progress some work intended to determine the effect of humidity on fuel economy.

The Bureau of Standards has had in hand for some time a series of tests the purpose of which is to measure graphically and with accuracy the performance of cars in operation on the road. Special apparatus has been designed for this purpose. It is so constructed as to give instantaneous values and to record them positively in order to minimize the number of observers required and eliminate the personal equation. The results of tests with this special equipment are to be reported at the semi-annual S. A. E. meeting next month. The apparatus includes a recording accelerometer of the liquid column type, a Republic flowmeter with special recording device, a vane anemometer with recording device arranged to measure air velocity and a Van Sicklen tachometer which is free from time lag. The temperature of the inlet and outlet cooling water, the fuel and air entering the carbureter, and the depression in the inlet manifold are measured and recorded on commercial instruments designed for this purpose. The quantity of air used is estimated by the use of a small venturi tube placed in the hot air pipe leading to the carbureter. By the use of this equipment it is hoped to secure much data which will be valuable in determining the factors which govern fuel consumption and related factors which determine car performance. While much is known regarding the performance of engines and complete chassis running under constant load in laboratory tests, there is much need for precise measurements on cars running under the actual conditions of service. Much useful data in this regard should be furnished by the Bureau of Standards tests.

Temperatures and Friction Losses Determined by Tire Research

Tire temperature increases as inflation pressure decreases. Rolling resistance of fabric tire fifty per cent greater than that of cord. Influence of wear on rolling resistance not proved.

THE manufacturers of rubber tires are confronted with technical problems of two kinds, one chemical, the other mechanical. The problems of compounding and curing rubber are essentially chemical in nature, while those relating to the building up of the carcass in such a manner as to minimize the work of flexing the walls, thereby reducing the friction loss in the tire and increasing the useful life of same, are essentially mechanical. The automotive engineer is directly interested only in the performance of tires; that is, their life under normal service conditions, their power absorption or frictional loss, and their rise in temperature in service. A good deal of research work bearing on questions such as these has been carried out during the past few years, and we are fortunate in being able to present in the following the results of two such series of researches.

Engineers as a rule do not realize what a large fraction of the power absorbed in the propulsion of an automobile is taken up in flexing the walls of the tires. This fraction of the energy of propulsion is converted into heat, and, in addition to being a direct loss, helps to cut down the useful life of the tires. It is evident, from the results of tests quoted further on, that a material increase in fuel mileage might be gained by keeping the tire inflation pressure always up to normal or even above normal. Of course, high inflation pressures are inimical to riding comfort and also to the endurance of some of the more delicate parts of the car, and what is the optimum inflation pressure in any particular case, all things considered, is certainly hard to determine.

The other class of problems coming up in connection with rubber tires is of a chemical nature, and its technicalities do not concern the automotive engineer directly, but any material progress in compounding or in methods of vulcanization of rubber which tends to either lower the cost of production or to increase the serviceability of tires should be called to his attention. Thus the automotive engineer certainly wants to know something about the organic accelerators of vulcanization which have come into use these last few years and which are the subject of a great deal of research work just now, both in Europe and in this country.

Temperatures of Pneumatic Truck Tires*

THE life of any pneumatic tire depends upon many factors. For large tires the operating temperature has become one of considerable importance, especially when they are used in hot climates. To obtain some information on this subject a series of experiments were conducted by the author for the Goodyear Tire & Rubber Co. The main purpose of these experiments was to determine:

1. The best means of measuring tire temperature.
2. The effect on temperature of inflation pressure, load, long runs, frequency of stops, rim size and tire size.
3. The temperature of various designs of tires.
4. Suitable means of reducing tire temperatures.

Heating of tires is due almost entirely to the flexing of the tire walls, or, in other words, it is due to hysteresis. The maximum temperature is reached when the rate of generation of heat is just balanced by the rate of its dissipation to the atmosphere. There are a great many factors which affect both of these rates, so that laboratory tests are essential if comparative temperatures are desired. These tests were all made in the laboratory at Akron with testing machines, each one comprising two 45-in. cast iron pulleys driven by an induction motor. A suitable framework allowed a known load to be supported by each tire. The pulleys drove the tires without any resistance except that due to their flexing and the slight loss due to bearing friction and air resistance.

To have a check upon the results, two different methods of measuring the temperatures were used simultaneously. One method consisted in measuring the increase in the pressure and in the volume of the air in the tire, from which the temperature may be calculated provided the initial temperature and pressure are accurately determined. The gages used to measure the air pressure were mounted on the hub of the wheel so that they rotated with the tire. They were checked daily and were also calibrated frequently by means of a dead weight tester.

Since all inner tubes have some leakage, it is necessary to determine its amount during a test and apply the proper correction to the pressure readings. The total leakage was determined for the twenty-four-hour period following the start of each run. This total leakage was then distributed on the assumption that the rate of leakage is proportional to the absolute temperature of the tube and to the square root of the pressure difference inside and outside of the tire. A special test in which the leakage was abnormally large showed that this was a reliable method of making the distribution. Suitable curves were prepared to facilitate the application of this method of correcting for leakage.

*From a paper presented before the S. A. E. Buffalo Section by Frank O. Ellenwood, Professor of Heat Power Engineering at Cornell University. This abstract of the paper was made by Prof. Ellenwood himself.

Several methods of measuring the increase in the volume of the air in the tire were tried, but it was found that the measurement of the longitudinal tread circumference was the most satisfactory. Knowing the cross sectional dimensions of a tire the relation between the volume of the air in the tube and the longitudinal tread circumference may be determined. With this information expressed in graphical form, the temperature of the air in the tube is readily calculated for any measured increase in volume and pressure, if the initial temperature and pressure are known.

A special tire thermometer designed by the Taylor Instrument Co. was used in many of the tests. On account of the vibration of a truck wheel it was necessary to have the space above the mercury filled with nitrogen. Because of the small clearance available the thermometer had to be bent at right angles and for protection each glass thermometer was inclosed in a metal case.

Before splicing the inner tube the metal thermometer well was placed on the inside of the tube, the stem passing out through a special valve patch, and this well was then clamped in place as is done with an ordinary valve stem. The well was partially filled with oil before inserting the thermometer. The union formed a tight covering for the well, so that no oil was lost when the wheel rotated.

After calibrating these thermometers carefully it was found that the readings obtained from them when inserted in a tube were very much lower than the true temperatures as obtained by the method previously described. This difference was at first believed to be due entirely to heat conducted away from the thermometer well by the cool part of the inner tube and by the atmosphere. By making several improved types of thermometer wells it was found that much better results could be obtained. The main feature of improvement was the addition of many thin fins to the wells, thus increasing very materially the rate at which heat is absorbed from the air inside of the tube. The rate of dissipation of heat from the wells could not be changed appreciably. It was not possible, therefore, to build a well which would enable the correct temperatures to be

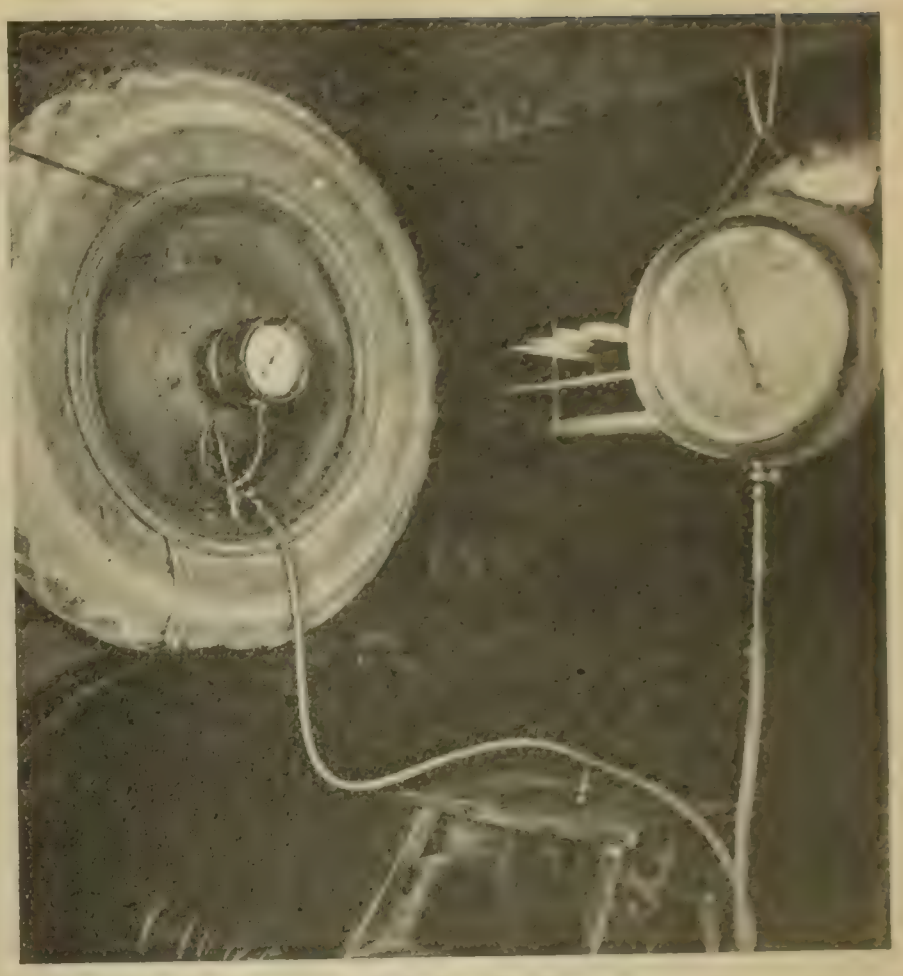


Fig. 1—General view of 40 x 8 tire mounted on testing machine. Pressure gage fastened to the hub of the wheel, and large standard test gage connected to tire for daily gage calibration

read by these mercury thermometers when using dry air in the tube.

Thermocouples placed inside of the tube were next tried. Much experimental work was done in the attempt to obtain a type which would be satisfactory mechanically, electrically and thermally. The temperatures obtained from the best types of tube thermocouples were materially lower than those obtained from the calculations based on the pressure and volume. This fact combined with the low readings from the tire thermometers made it imperative that extra precautions be taken to know whether the air inside of the tube was saturated

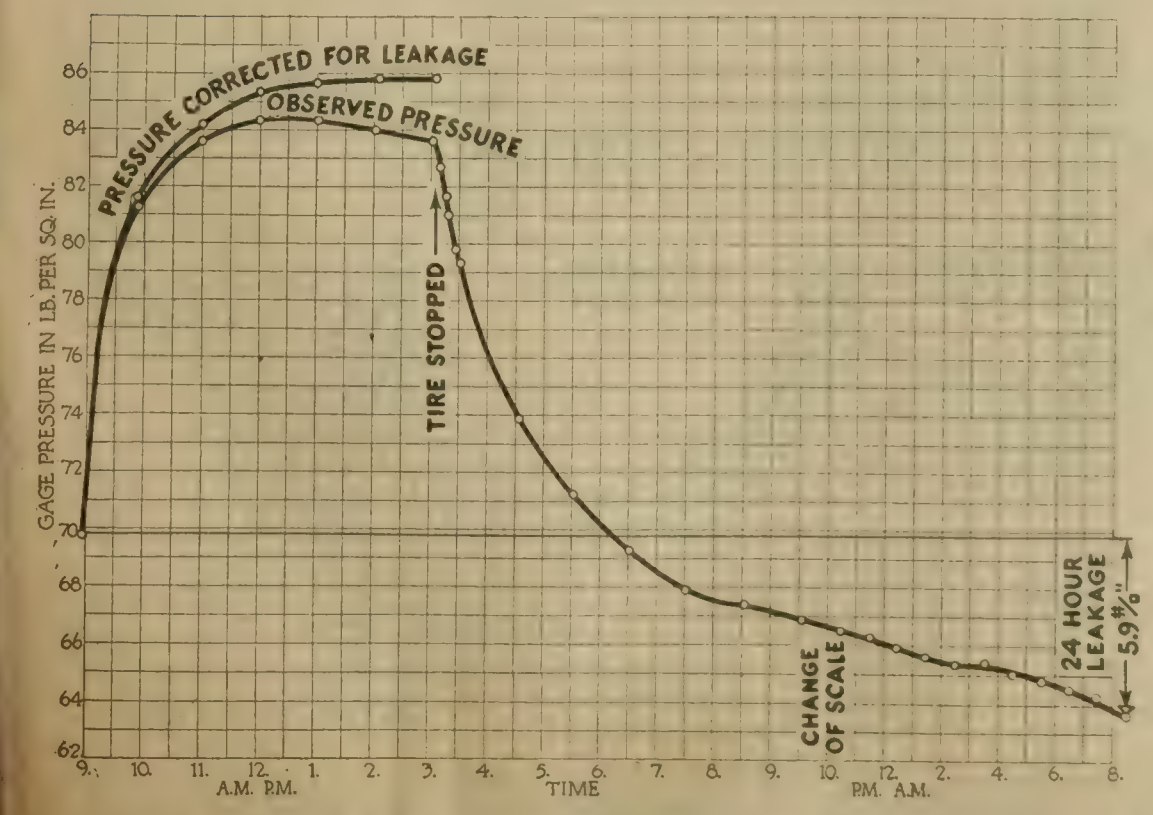


Fig. 2—Leakage data obtained from an old tube during 6 hrs of operation and the following 18 hrs. of cooling

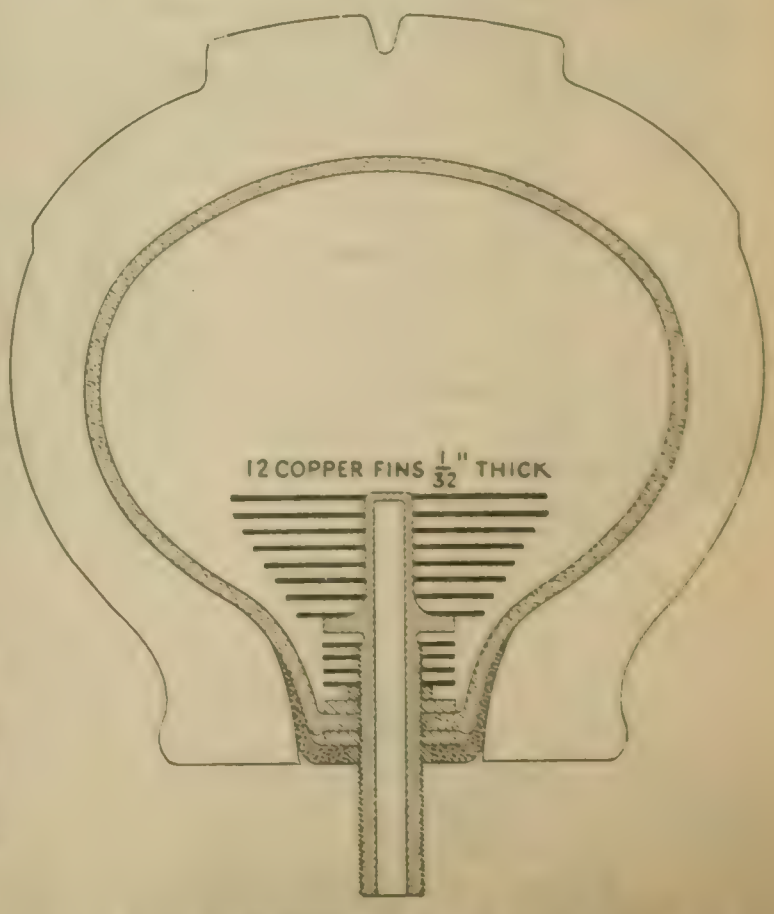


Fig. 3—Tire thermometer well, model G for 36 x 6 tires with head absorbing capacity increased by the attached fins

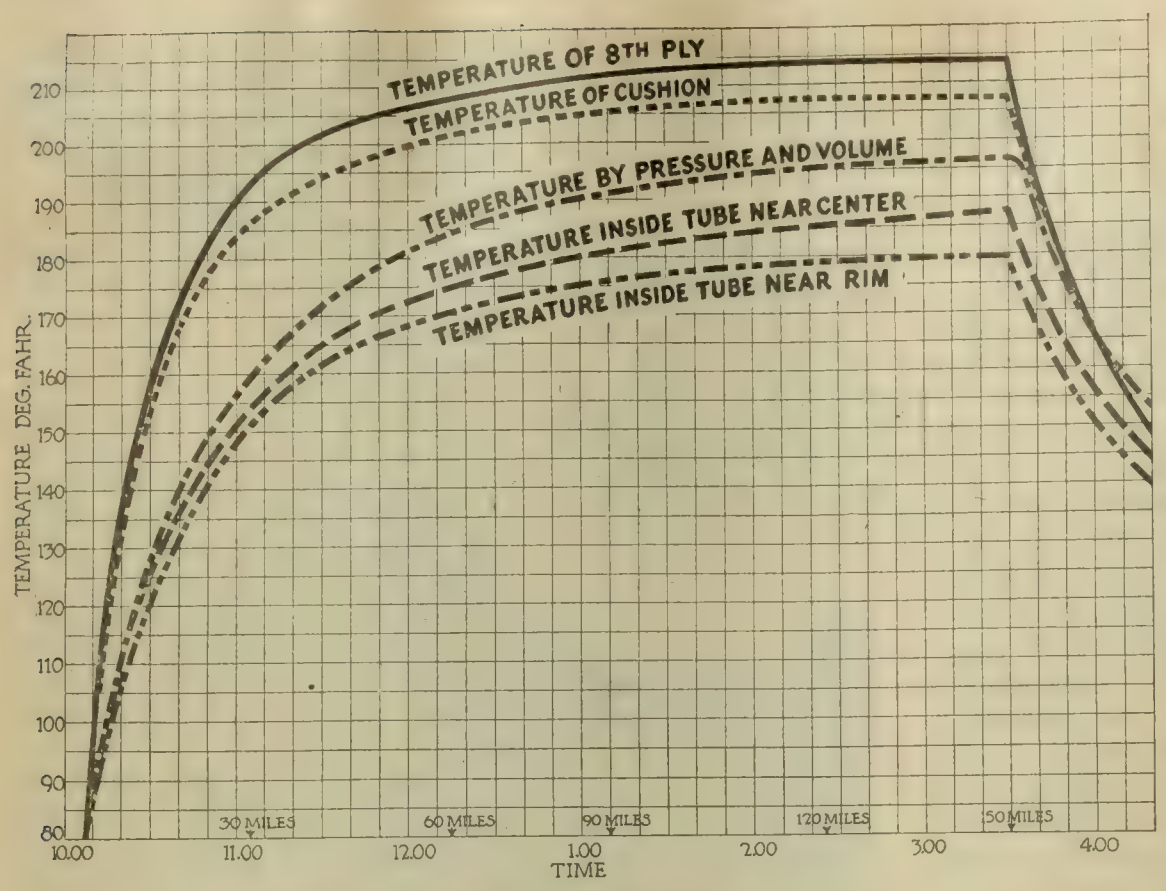


Fig. 6—Temperatures of various parts of a 40 x 8 tire as obtained by several methods. The room temperature during this test was 90 degrees F.

with moisture. To have enough moisture inside of the tube to cause saturation at all temperatures means that a different method of calculation must be used from that which is correct for dry air. That the air inside of the tube supposed to contain "dry air" did contain only a little moisture was made certain by inflating the tires with air which had been passed slowly through a special separator containing calcium chloride and also by the examination of samples drawn from the tube after inflation. Hence the temperatures as calculated for dry air were correct.

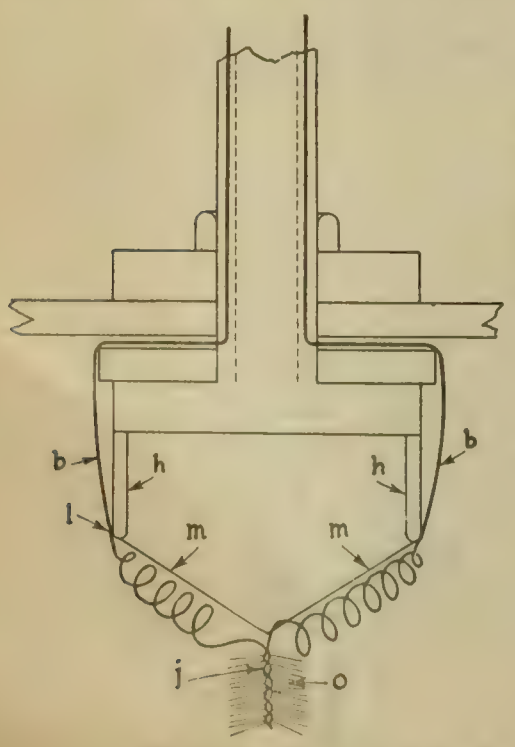
To account for the difference in temperatures as obtained from the different methods the effect of convection currents was next investigated. This was done by placing thermocouples in different places inside of the same tube and obtaining readings from each couple when the tire was stopped in different positions.

Readings were also obtained from these couples while the tire was running at full speed. These tests showed that convection currents would account for the discrepancy between the thermocouple readings and the average temperature of the air in the tube. They also explained why the tire thermometer used with the well having many fins on it still gave readings too low.

Tube thermocouples are troublesome in many ways, and, besides, it was desired to measure the temperature of the material in the hottest part of the tire. This led to the use of detachable thermocouples. They are made of very fine wire mounted on the end of a small hard rubber insulating plug, that is inserted immediately after stopping the tire, in a hole bored through the tread to the point at which it is desired to measure the temperature. The temperature indicated by the potentiometer will then rise quickly to its maximum, which is appreciably less than the temperature of the stock because of the heat conducted away from the couple. One of the greatest advantages of this method is that it enables the temperature of the stock itself to be determined. This temperature is very much higher than that of the air inside of the tube. The ease with which the couple may be renewed is another important advantage. The injury to the casing caused by the drilling of small holes is of no great importance in the case of laboratory test tires.

Before any comparative temperature tests were made the deflections of the tires under various inflation pressures were determined. The results of many different temperature tests were plotted, and in all cases it was found that it takes nearly six hours of operation for a 40 x 8 tire to reach its maximum temperature. The smaller sizes require less time.

For sections of the country having long periods of very hot weather it is desirable to have some simple means of cooling large truck tires. A very satisfactory cooling method was found to consist of putting a small amount of water inside of the tube before inflating with air. The theory which prompted trying this is as follows:



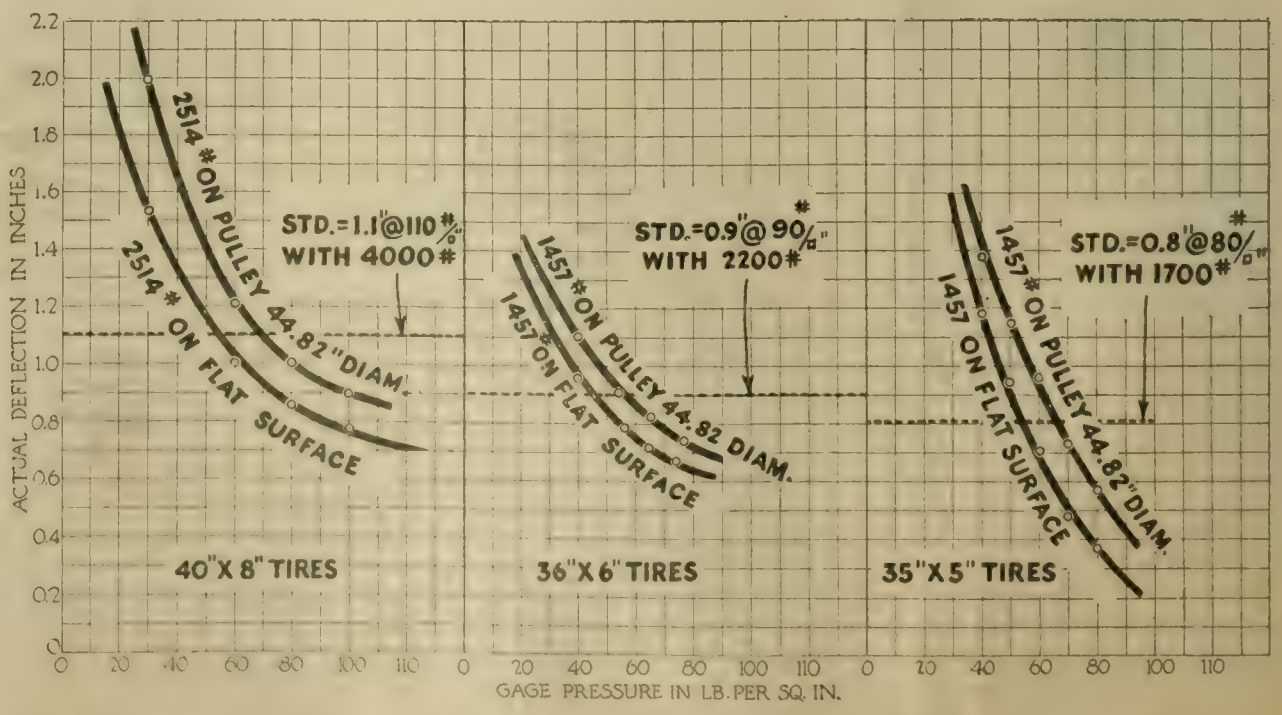


Fig. 4 (Left)—Model E. Couple at j with fine copper wires. o, soldered to it to increase heat absorbing capacity; b, coils of couple wire to reduce heat conduction from the couple; m, cotton cords supporting couple from anchor wires, l and h. Fig. 5 (Right)—Deflections of three sizes of tires having various inflation pressures when supported by flat and curved surfaces

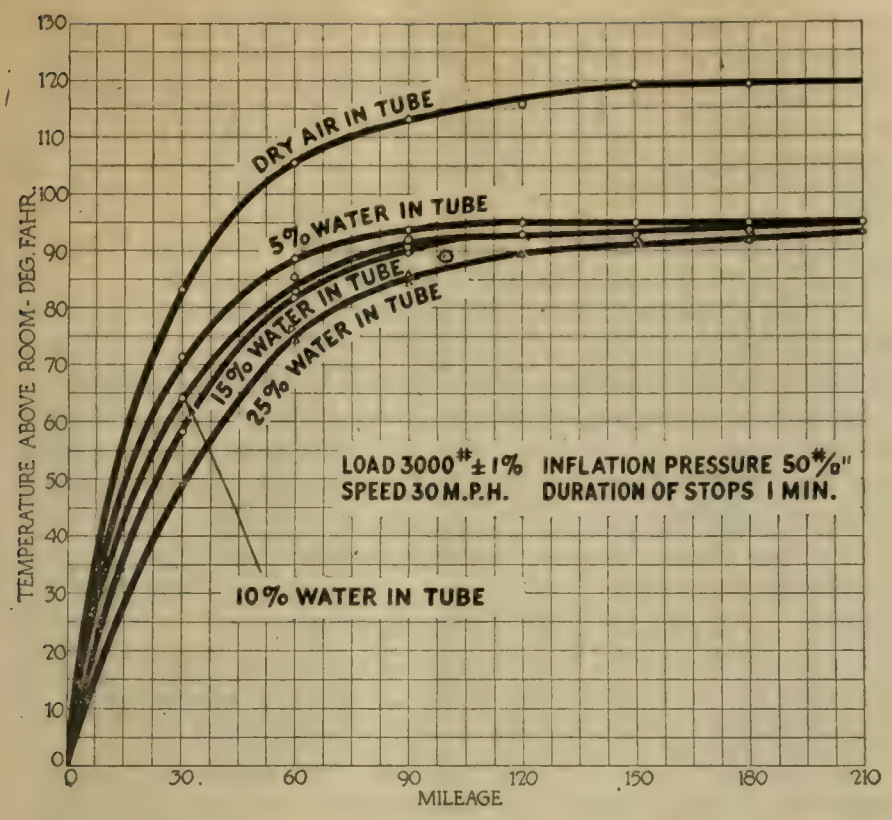


Fig. 7—Tube temperatures resulting when various amounts of water were used in the tube

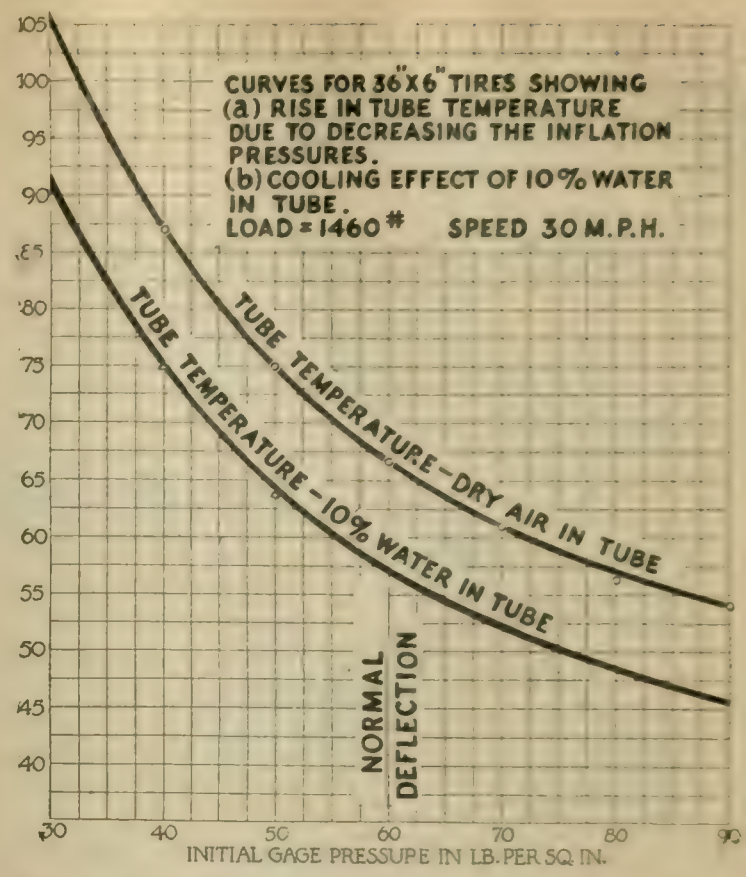


Fig. 8—Temperature effect of underinflation on small truck tire, "wet" and "dry"

First, a small decrease in the generation of heat may be expected because the vapor pressure will increase the total pressure inside of the tube so that the amount of flexing of the tire is reduced. This vapor pressure will be small, but it will act as a sort of safety valve because the hotter the tire the greater will be the vapor pressure. The vapor pressure increases more rapidly than does the air pressure for a given increase in temperature.

Second, the vapor may be expected to transfer heat very rapidly from the hottest parts of the tube to the cooler parts of it. As the tire rotates the water is kept in a thin band extending entirely around the tread portion of the tube. This is the hottest part of the tube and the cooling would be effected here by the evaporation of the liquid which would condense again on the cooler portions of the tube, lying next to the rim and the side walls. The very rapid circulation of the air and vapor in the transverse section of the tube is of material assistance in this transfer of heat.

Third, a cooling effect is produced on the tube by the absorption of heat by the liquid itself until it attains the same temperature as the tube. This effect depends upon the amount of liquid used, as may be seen in one of of the accompanying illustrations. It should be noted that in all cases the average temperature of the wet tube is materially lower than that of the dry tube and that the beneficial effects of the extra liquid is very small after the first three hours of the run.

The following general conclusions are drawn from these experiments:

1. The measurement of the increase in air pressure of a tire is a very accurate and reliable means of determining the average tube temperature providing proper precautions are taken to know whether the air is saturated and to have accurate measurements of pressure, volume changes, leakage and initial temperature.

2. Convection currents inside the hot tube are very large and may necessitate a large correction to any temperature measuring apparatus which records only the particular temperature at some definite region, which is small in comparison with the whole cross sectional area of the tube.

3. These convection currents are due to the variation in density of the air in contact with the hot and cool portions of the tube, combined with the forces of gravity and that due to the rotation of the wheel. The first of these forces causes the convection currents to flow in the longitudinal direction of the tube when the tire is standing still, and the second causes much stronger currents to be in a transverse section of the tube when running.

4. Tire thermometers of the type herewith described are not very well suited for any tube temperature measurements except the initial one, on account of the corrections due to the convection currents and the still greater correction due to the heat conduction to the cool part of the tube to which the well must be clamped.

5. Thermocouples placed inside the tube and mounted so that they will be held near the center of the tube are rather frail and are likely to be injured or misplaced during the splicing of the tube; they are also subject to corrections due to convection currents and require considerable care and patience to make and install.

6. Detachable thermocouples of the type herein described are easily made and used; they are quite reliable when carefully used, and they possess the very great advantage of giving fairly close to the correct temperatures of the various parts of the tire which are hottest and whose temperatures are often most desired.

7. The detachable thermocouple readings must be taken at very carefully measured intervals of time after stopping the tire as the hottest parts of the tire cool rapidly and appreciably immediately after stopping.

8. It appears likely that the detachable thermocouple should have a correction applied to its reading to compensate for the conduction of heat through the wires from the couple to the outside air. This correction has not been worked out completely as yet but will be greatest when used in holes of shallow depth.

9. The pressure in the tube does not begin to drop until a short time after stopping the tire, thus affording time to obtain accurate pressure and volume readings.

10. The pressure volume method combined with the detachable thermocouple one appears at the present time to be best suited for determining pneumatic tire temperatures, as the results are more accurate, more comprehensive and more easily obtained than those from any other methods thus far developed by the author.

11. For comparative tire temperature the results

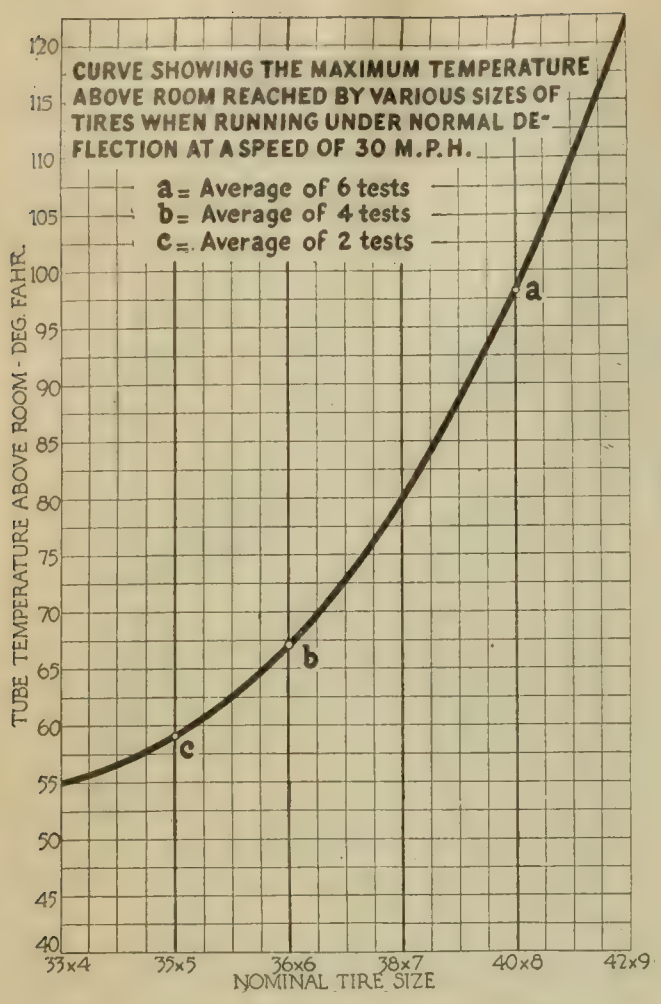


Fig. 9 — Variation of tire temperatures with tire sizes

should be given in terms of temperature above the atmosphere surrounding the tire, as this factor is so very important and so variable. It is also essential to have the same loads, inflation pressures, speeds, mileages, supporting surfaces and sunshine in order to use comparative temperatures of different designs of the same size of tires.

12. The temperature of a tire increases very rapidly with its size due to the thickness of its walls.

13. High temperatures are destructive to tires, but the relation between the life of a tire and its temperature for various compounds has not yet been established.

14. Small amounts of water (5 to 10 per cent of the air volume) used in the tube with the air result in a cooler tire, the difference in tube temperatures being very appreciable in the case of large hot truck tires.

15. The use of water in passenger car sizes is not recommended since such tire temperatures are not usually sufficiently high to justify it.

16. Care must be exercised when using water in the tube to drain the water from it before exposing it to temperatures much below the freezing point.

17. All users of tires should note the rapid increase in tire temperature with the decreased inflation pressure.

A more detailed survey of the results of these tests is not possible in the limited space available. The accompanying charts, however, bring out briefly the more important results.

Tire Friction Losses

CONSIDERABLE research work on the power losses in various kinds of tires has been done by Prof. E. H. Lockwood at the Mason Laboratory, Sheffield Scientific School, Yale University. The influence of load and inflation pressure on the friction losses was studied for both kinds of pneumatic tires, the fabric and the cord tire, while in the case of the solid rubber tire the variation of the tire losses with increasing wear or reduced thickness was investigated.

Tests of fabric tires were made on three different sizes of the same make, viz., 32 x 4 in., 33 x 4½ in., and 35 x 5 in. For each test load and inflation three different speeds were used, but it was found that changes due to speed were very slight and that speed could be eliminated as a factor. The rolling resistances of the three tires under different loads and with different inflation pressures are given in Table I.

From the data given in this table the conclusion may be drawn that the rolling resistance of a fabric tire may be increased more than 50 per cent by lowering the inflation pressure from 90 to 30 lb. per sq. in., and 25 per cent by lowering it to 50 lb. per sq. in. The total car resistance, of course, will not be increased in this same ratio. In Fig. 1 are shown rolling resistance-load curves for the three sizes of tire for different inflation pressures. It is noteworthy that the so-called "curves" are straight lines and also that for the same inflation the "curves" for the different tire sizes show the same relation between load and rolling resistance. Hence the rolling resistance depends solely on the load and not on the size of tire. The rolling resistance of fabric tires when fully inflated may be represented by the following formula—

$$R = 0.018\,L - 3.0,$$

where R is the rolling resistance in pounds and
L is the load on the tire in pounds.

A simplified way of giving the average rolling resistance of the tires tested is to say that it amounts to 15 lb. per thousand.

Dynamometer tests of cord tires show that their rolling resistance is approximately one-third less than that of fabric tires. The following figures, based on tests made on Fisk and Goodyear tires, are presented as typical of the test results.

TABLE I—ROLLING RESISTANCE OF FABRIC TIRES
(Speed, 20-40 m.p.h.)

32 x 4 in. non-skid; weight of tire, 19.5 lb.; outside dia., 32.8 in.

	Load 460		Load 700		Load 975	
Inf.	lb.	p.c.	lb.	p.c.	lb.	p.c.
30	8.03	186	14.45	165	22.3	163
55	5.35	124	10.6	121	16.8	121
80	4.33	100	8.78	100	13.7	100

33 x 4½ in. non-skid; weight of tire, 23.5 lb.; outside dia., 33.7 in.

	Load 585		Load 935		Load 1285	
Inf.	lb.	p.c.	lb.	p.c.	lb.	p.c.
30	9.05	124	18.4	152	27.7	145
45	8.65	118	15.6	130	23.0	121
65	8.65	118	14.2	118	21.2	111
90	7.32	100	12.03	100	19.1	100

35 x 5 in. non-skid; weight of tire, 33.5 lb. outside dia., 36.0 in.

	Load 750		Load 1050		Load 1650	
Inf.	lb.	p.c.	lb.	p.c.	lb.	p.c.
40	12.7	123	19.8	128	37.0	148
55	11.4	109	17.6	115	32.4	129
70	10.5	102	15.9	103	28.2	113
90	10.3	100	15.4	100	25.1	100

COMPARATIVE ROLLING FRICTION OF FABRIC AND CORD TIRES
(At speeds of 20-40 m.p.h.)

Tire size, 32 x 4 in.; inflation pressures, 30-80 lb. p. sq. in.; loads, 460-975 lb.

Average of 54 readings for fabric tires, 11.3 lb. = 100 per cent.

Average of 54 readings for cord tires, 7.6 lb. = 67 per cent.

Tire size, 33 x 4½ in.; inflation pressures, 30-90 lb. p. sq. in.; loads, 585-1285 lb.

Average of 72 readings for fabric tires, 15.2 lb. = 100 per cent.

Average of 72 readings for cord tires, 9.06 lb. = 60 per cent.

Tire size, 35 x 5 in.; inflation pressures, 40-90 lb. p. sq. in.; loads, 750-1650 lb.

Average of 32 readings for fabric tires, 21.1 lb. = 100 per cent.

Average of 32 readings for cord tires, 13.45 lb. = 64 per cent.

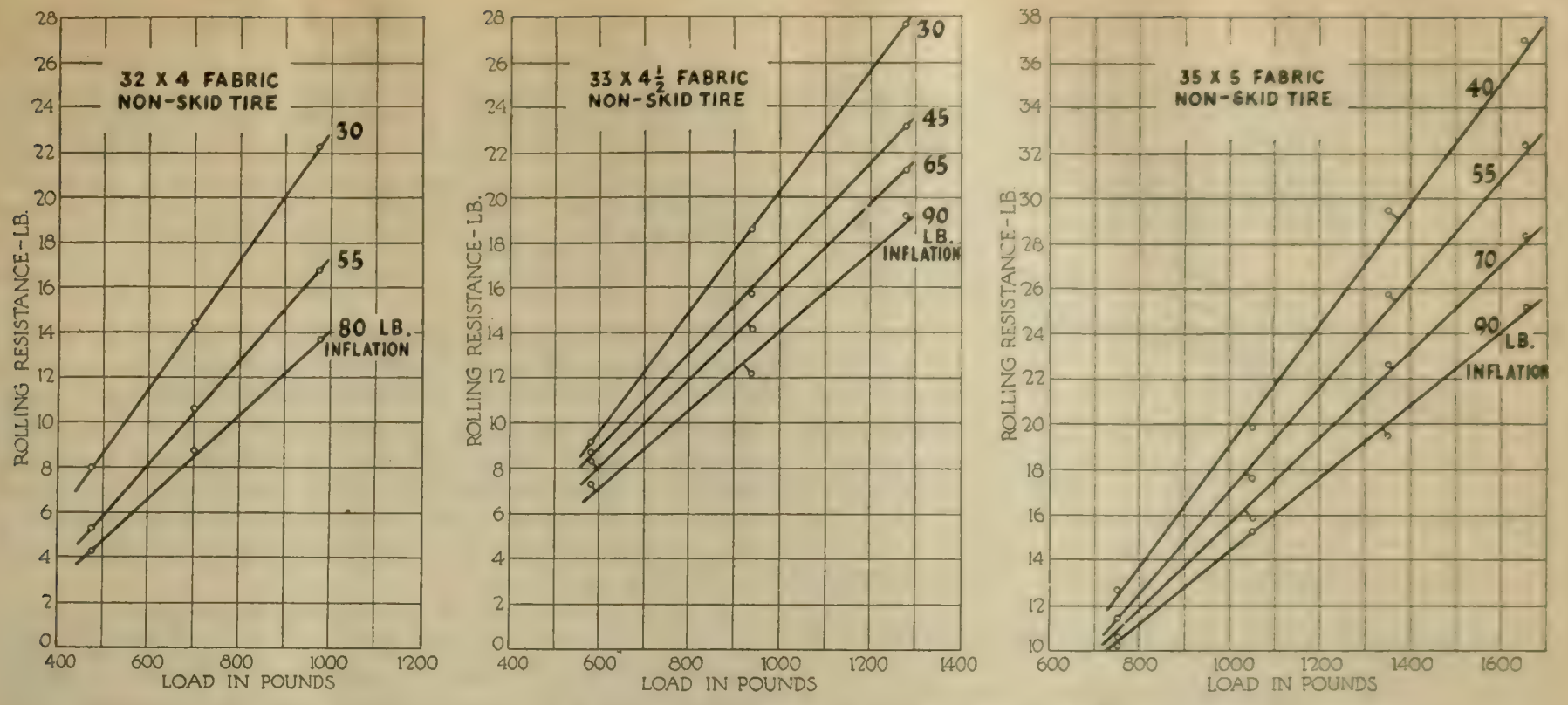


Fig. 1—Rolling resistance of fabric tires as affected by size, load and inflation pressure

By plotting curves of the test results it was found that the proportion of the rolling frictions is about the same for all inflations. A valuable feature of the cord tire is that the rolling resistance is low even for low inflations. For instance, with an inflation pressure of 65 lb. the rolling resistance is 11.5 lb. and for a pressure of 90 lb. it is 11 lb. In Table II are given the rolling resistances of 33 x 4½ in. cord tires for three speeds, three loads and four inflation pressures. It will be noticed that after the inflation reaches 60 lb. per sq. in. there is little further decrease in rolling resistance, and that high inflation pressure is not essential to efficient operation of cord tires. Within the limits covered by the experimental work the rolling resistance for any load and inflation pressure may be obtained from the following equation—

$$R = \left(\frac{L - 200}{100}\right) \times \left(1.06 + \frac{(90 - P)^2}{7000}\right)$$

R = rolling resistance; L = load; P = inflation pressure. Limits, load from 500 to 1300 lb.: Inflation, 30 to 90 lb.

For a normal inflation pressure of 60 lb. this equation simplifies to

$$R = 0.012\,L - 2.0,$$

in which, it will be noted, the constants are such as to give a result exactly 50 per cent greater than given by the equation for fabric tires.

Tests on solid rubber tires were made at intervals from 1919 to 1921 on ¾ to 2 ton trucks. It was found that solid tire resistance could be measured by the jacking-up method, and that in general the resistance was intermediate between the resistances of fabric and cord pneumatic tires under the same load. Later on tests on the chassis dynamometer at Mason Laboratory were made in co-operation with the Committee for Research on Trac-

TABLE I—TABLE OF FRICTIONAL DISTRIBUTION IN THE CHASSIS

Measured on the Mason Laboratory Dynamometer

Number of cylinders	4	4	6	6	6	8	8
Bore x stroke, in	4⅛ x 4½	3¾ x 6¾	3¼ x 4	3¼ x 4½	3½ x 5	2⅞ x 4½	3⅛ x 5⅛
Weight, front, lb	1,360	1,850	1,250	1,350	1,585	1,495	2,010
Weight, rear, lb	1,650	2,250	1,450	1,460	1,815	1,735	2,400
Weight, total lb	3,010	4,100	2,700	2,810	3,400	3,230	4,410
Tires, front, size	32 x 4	32 x 4½	32 x 4	32 x 4	33 x 4	32 x 4	35 x 5
Tires, front, kind	1 fab.-1 cord	cord	cord	1 fab.-1 cord	cord	cord	cord
Tires, rear, size	32 x 4	32 x 4½	32 x 4	32 x 4	33 x 4	32 x 4	35 x 5
Tires, rear, kind	cord	cord	cord	1 fab.-1 cord	cord	cord	cord
Rolling resistance, front tires	23.2	25.3	9.5	22.8	14.6	16.4	21.0
Rolling resistance, front bear.	4.4	2.4	7.4	3.2	3.9	4.0	6.2
Rolling resistance, front total	27.6	27.7	16.9	26.0	18.5	20.4	27.2
Rolling resistance, rear tires	19.0	30.0	16.0	20.3	22.8	25.2	23.5
Rolling resistance, rear bear-tr.	14.0	14.0	10.0	14.6	27.8	13.8	26.5
Rolling resistance, rear total	33.0	44.0	26.0	34.9	50.6	39.0	50.0
Rolling resistance, front and rear	60.6	71.7	42.9	60.9	69.1	59.4	77.2
Rolling resistance, tires only	42.2	55.3	25.5	43.1	37.4	41.6	44.5
Rolling resistance, bear. and trans	18.4	16.4	17.4	17.8	31.7	17.8	32.7
Rolling resistance, engine, 20 m.p.h.	47.5	69.0	34.0	27.4	74.4	88.0	47.5
Rolling resistance, total, including engine	108.1	140.7	76.9	88.3	143.5	147.4	124.7

TABLE II—ROLLING FRICTION OF 33 x 4½ CORD TIRES

Average Values for Seven Ribbed and Non-Skid Tires

Inflation	Load 585				935				1285							
	30	45	65	90	30	45	65	90	30	45	65	90	585	935	1,285	Av.
Speed, m.p.h. 20	6.03	5.16	4.68	4.17	10.99	9.04	8.21	7.49	17.39	14.06	12.16	10.87				
Speed, m.p.h. 30	6.33	4.98	4.70	4.29	11.75	9.76	8.34	8.01	18.17	14.71	12.32	11.30				
Speed, m.p.h. 40	6.91	5.26	4.65	4.54	12.37	10.01	8.43	8.22	19.01	14.89	12.64	11.70				
Speed, m.p.h., aver.	6.42	5.13	4.68	4.33	11.7	9.60	8.33	7.9	18.19	14.55	12.37	11.29	5.14	9.38	14.10	9.54

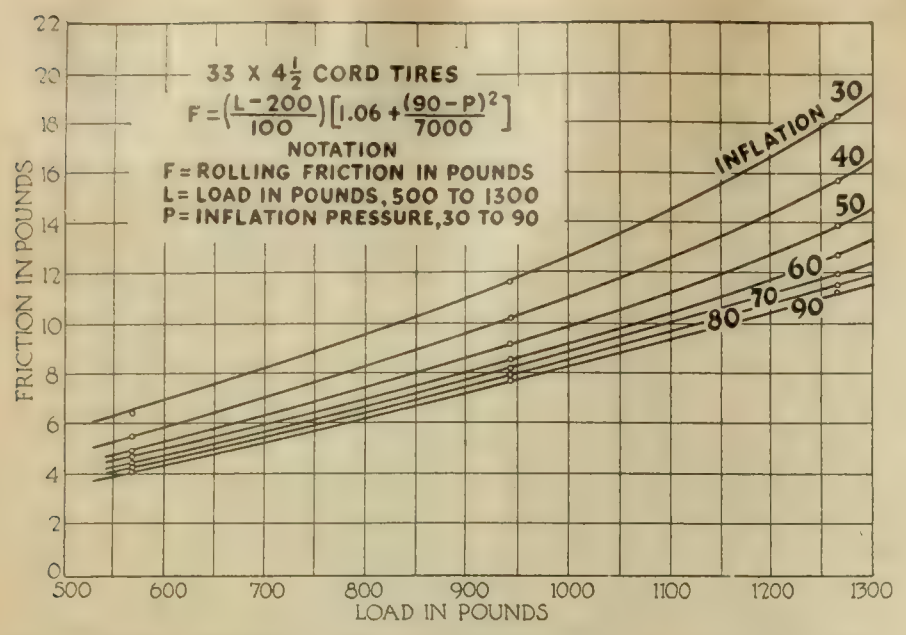


Fig. 2—Rolling friction of 33 x 4½ in. cord tires at various inflations

tive Resistance on Roads. The results are summarized in the following table:

FRONT TIRES, NEW

36 x 4	single	Load 583 per inch width	Resistance 21.7 lb. per 1000
36 x 5	single	Load 466 per inch width	Resistance 19.0 lb. per 1000
36 x 6	single	Load 375 per inch width	Resistance 20.2 lb. per 1000
36 x 7	single	Load 375 per inch width	Resistance 19.0 lb. per 1000
Average		Load 450 per inch width	Resistance 20.0 lb. per 1000

FRONT TIRES, WORN

36 x 5	single	Load 466 per inch width	Resistance 15.5 lb. per 1000
36 x 6	single	Load 375 per inch width	Resistance 16.5 lb. per 1000
36 x 7	single	Load 375 per inch width	Resistance 16.2 lb. per 1000
Average		Load 400 per inch width	Resistance 16.1 lb. per 1000

REAR TIRES, NEW

40 x 6	dual	Load 285 per inch width	Resistance 18.0 lb. per 1000
40 x 6	dual	Load 275 per inch width	Resistance 15.7 lb. per 1000
40 x 12	single	Load 275 per inch width	Resistance 14.0 lb. per 1000
40 x 12	single	Load 275 per inch width	Resistance 15.8 lb. per 1000
40 x 12	single	Load 275 per inch width	Resistance 19.0 lb. per 1000
Average		Load 275 per inch width	Resistance 16.5 lb. per 1000

REAR TIRES, WORN

40 x 6	dual	Load 285 per inch width	Resistance 12.5 lb. per 1000
40 x 6	dual	Load 255 per inch width	Resistance 11.0 lb. per 1000
Average		Load 270 per inch width	Resistance 11.8 lb. per 1000

Several conclusions are apparent from these figures: First, the partly worn tires roll with less friction than new and more resilient tires, the difference being from 20 to 25 per cent. Hence increased cushioning must be paid for by increased power. Second, front tires showed more friction than rear tires, both new and worn, undoubtedly because the load carried by the former was greater. The tests of the rear tires were made with the truck empty, hence the load per inch of tire width was considerably less than for the front wheels. Third, the rolling resistance of these solid rubber tires varied considerably, in accordance with wear, construction, etc., but the values obtained were all intermediate between those for cord and fabric tires and the general average figured out to 16.0 lb. per 1000.

Tire friction measurements by dynamometer were made at 20, 30 and 40 m.p.h., and over this range the readings were nearly constant. When the averages of many different readings are taken, a slight increase of the rolling resistance with speed is found, amounting to 6-8 per cent when the speed is doubled. This holds only for smooth, hard surfaces, and there is no doubt that on rough, uneven and soft roads the rolling resistance increases materially with the speed.

Thirty-six readings of the rolling resistance of 33 x 4½ in. cord tires with ribbed tread, of three different makes and for different speeds, loads and inflation pressures, gave an average value of 8.83 lb., while the same number of readings taken on non-skid tread tires of the same size under the same conditions showed an average of 9.58 lb., an increase of 8 per cent. This increase is probably caused by the greater compression of the rubber under the load, and undoubtedly varies with the shape of the non-skid formations. A so-called non-puncture type of thick-walled tube showed increased rolling resistance of 5 to 10 per cent, while a tube protector consisting of a thick endless pad lying between the tube and casing caused an increase in rolling resistance of 7 per cent in a 33 x 4½ in. casing.

Tests on giant pneumatic tires as used for trucks showed that their rolling resistance is somewhat greater than would be expected from the equations developed for the smaller sized cord tires.

As far as pneumatic tires are concerned, no influence of the state of wear and age on the rolling resistance could be proved. With solid tires the resistance decreases as the tire wears out. There seems to have been a general improvement of pneumatic tires as regards rolling resistance during the past four years, amounting in the case of cord tires to about 10 per cent.

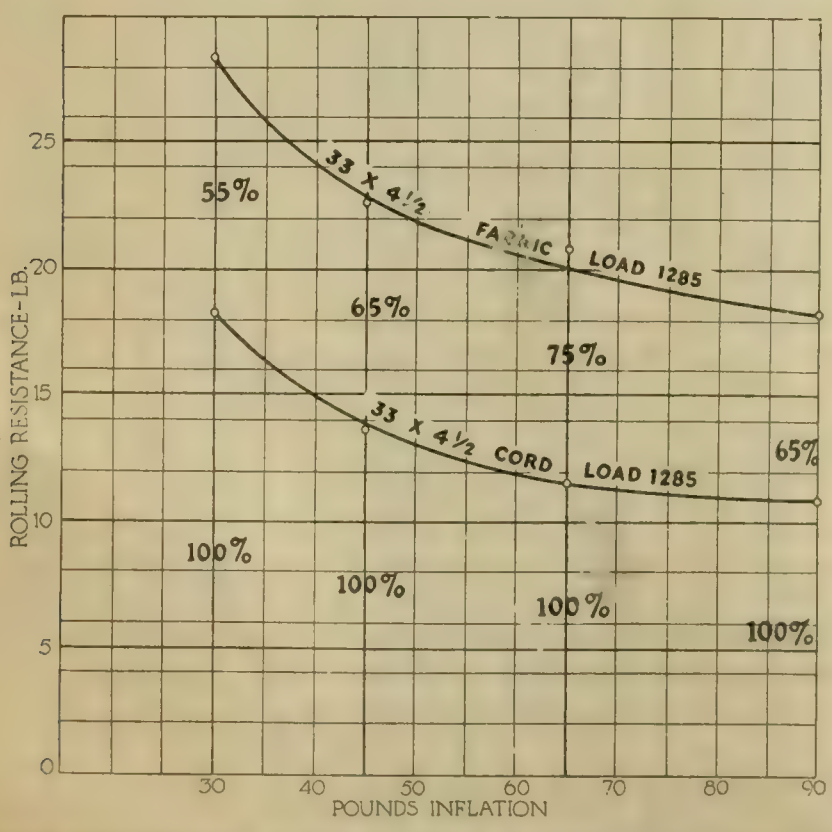


Fig. 3—Typical rolling resistance curves of cord and fabric tires under constant load and varying inflation

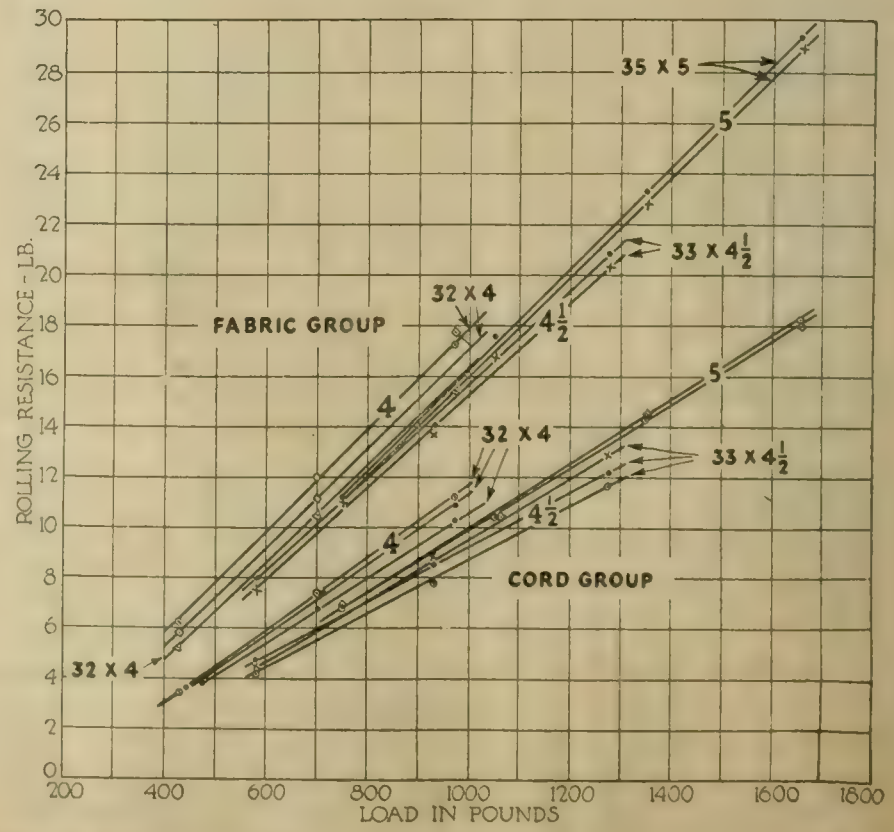


Fig. 4—Rolling resistance of cord and fabric tires compared, at 65 lb. inflation pressure

Highway Transport Research Is Foundation of Automotive Progress

Industry must form habit of thinking of highway vehicle always in relation to highway. Traffic surveys have been sporadic, but are being improved in character and usefulness. March and April months of average traffic. Trucks overloaded. Fuel consumption related to road design.

By H. S. Fairbank*

MOST of the problems of highway transport center about the motor truck. The question of its proper place is one of the most important questions to be answered. What are the clear fields of the truck, the railroads, the electric roads, the waterways; in what parts of the field are they competitors; where are they allies? Able investigators are working on the problems presented by the motor truck, but it must be admitted that, as yet, the vagueness of the results of their researches is more or less disappointing to the many people who are waiting for information of practical usefulness.

In the passenger-carrying field the automobile used to be accepted as largely a pleasure vehicle, the lineal descendant of the horse and carriage. But, of late, we have begun to see a commercialization of the passenger car in the form of the motor bus, and we shall now have to ask ourselves the same questions with regard to its relations to the other carriers as we do in the case of the truck and commodity haulage. The point is that we are not interested only in the motor vehicle and in highway transportation—that is, we should not be—but in transportation as a whole. All existing agencies—even the horse—have their proper field and we shall profit most by finding that field for each as quickly as possible. In attempting to do that we find ourselves in a maze of criss-cross relations which will take some of our best thought before they are untangled.

AT the outset it will be well to form the habit of thinking of the highway vehicle—motor truck, automobile or horse-drawn wagon—always with the highway. The two constitute highway transportation. They are as inseparable as the railroad train and its rails, the vessel and its stream. Each affects and limits the other and together they have their effect upon the other systems.

We must learn the relation of the road to the vehicle. And it is precisely in this field that the bulk of the investigation thus far centers. Highway engineers have been feeling for that relation for more than a decade. Forced by circumstances to build roads without a proper conception of all the factors involved, they have taken what time they could for a study of traffic by means of the traffic census.

Most of the early traffic counts were made in advance of the improvement of particular roads with the idea of determining the kind of road required. The fact that the traffic which used the road after it was completed was totally different from that revealed by the preliminary count and that some of the roads, in consequence, were pretty badly battered was a source of considerable annoyance to the highway engineers. But out of that experience has come a knowledge of one of the cardinal laws of highway traffic which was certainly not appreciated before if indeed it was understood at all. That law is that traffic flows to the better road.

One of the earliest States to set about the business of a traffic census in a systematic way was Maryland. The State Roads Commission began some five or six years ago the counting of traffic monthly on each completed contract section of the State highways. The counts were made by the maintenance patrolmen. They distinguished between several classes of horse-drawn vehicles and light and heavy motor vehicles. The data collected were put to no immediate use, but carefully were filed away, and those files have become a veritable mine of useful information.

BECAUSE the records cover the traffic on the whole State highway system Dean A. N. Johnson, of the Engineering College, University of Maryland, has been able, by plotting the averages for a year, to produce a traffic map of the State on which by varying the width of the lines representing the roads he pictures the varying intensity of traffic on all parts of the system.

Another fact of importance that is clearly brought out by the Maryland data is the seasonal variation of the traffic. Taking the Baltimore-Washington road as an example to show the usefulness of the data, the averages of the records for this road show that traffic is at a maximum each year from June to October, inclusive, with the peak in October. November, December, January and February are the months of light traffic, and March and April bring close to average volumes of traffic to the road. From the middle of June to the middle of October the daily traffic is about 135 per cent of the average daily traffic for the year on this particular road, and from November to February it is less than 75 per cent of the annual average.

Between these data for one particular road in Maryland and the statistics of all the railroads, as compiled by the American Railway Association it is possible to draw some interesting comparisons.

*Senior highway engineer, Bureau of Public Roads.

Both on the railroads and the highway the months of March and April stand out as the period of average traffic.

For our latitude it is safe to say that a single traffic census taken during these months, whether for a railroad or a highway will come as close as possible to indicating the average daily traffic for a year. Qualitatively, the periods of lean and heavy traffic on railroad and road coincide. October is the big month on each, and February is the month of lowest ebb.

Truck Traffic Variable

IT is when we come to compare the variation of traffic quantitatively that we find the one outstanding difference between the railroads and the road. The railroad has an almost uniform flow of traffic the year round. The peaks and valleys come along at the same seasons as on the road, but they are not nearly as high or as low. October's railroad traffic, for example, is only 116 per cent of the monthly average. On the road it is 140 per cent. In February traffic on the railroad drops only to 85 per cent of the monthly average, while on the road it falls to but little over 60 per cent. Traffic on the road the winter through, that is from November to February inclusive, is 73 per cent of the average for the year, and in the summer—from June to October inclusive—it is 135 per cent. For the same periods on the railroads the percentages are 95 and 106.

These facts should suggest a number of things to all who are trying to raise highway transportation to a higher level of efficiency.

Bear in mind that the road selected for the foregoing comparison is one of the most noted roads in the country, a road that is in shape for travel at all times of the year. Take the highways of the country as a whole, or even the principal highways, and the comparison would be decidedly more favorable to the railroad.

H. R. Tolley and L. M. Church of the Bureau of Public Roads, have thrown some light on the average passability of our roads for motor trucks by their researches conducted by means of farmer's questionnaires in the Eastern and Corn Belt States. Each farmer was asked to specify the kind of roads over which his truck traveled and the number of weeks during the year when the roads were in such condition on account of mud or snow that the truck could not be used. Twenty-nine per cent of the farmers in the Eastern States reported that their trucks ordinarily travel only on dirt roads, 46 per cent reported that the roads they use are part dirt and part improved, and the remainder said that the roads they operated over were all improved. On the average there were 10.7 weeks during the year when the men with all-dirt roads could not use their trucks at all, those with part-dirt roads managed to operate during all but 7.8 weeks and the men whose roads were wholly improved were entirely laid up only 3.8 weeks, probably by snow.

In the Corn Belt the record was less favorable. Eighty per cent of the farmers reported only dirt roads, 14 per cent said they had partly improved roads, and only 6 per cent had totally improved highways to operate over. So it is not surprising that the average number of weeks during which operation was impossible in this section was 8.4 as compared with 7.7 weeks in the Eastern States.

Tolley and Church uncovered some other facts of importance in their correspondence with farmers and we will come back to them later. For the present, since this is a story of research and only by way of example a record of the results of research, let us revert to the traffic census and see what has been done with that useful instrument.

Most of the traffic records have been made by the State highway departments, and most of the work has been sporadically done. With one or two exceptions it has not been done with any very definite purpose in view other than to record some information which might later prove interesting to examine. As a result not many of the numerous records that have been made offer an attractive field for the analyst.

The first traffic census taken in this country for any extended period was made in Illinois in 1906-7, where the traffic was counted at some seventy-odd stations continuously during a two-year period on an average of four times a month. The data collected are chiefly valuable from an historical standpoint.

The valuable work done by Maryland has already been noticed. The Iowa highway department has made a contribution along a slightly different line. At the time they made their study the purpose in mind was to settle the question, then a subject of considerable debate, as to whether the roads should be built principally to accommodate the so-called farm-to-market traffic or the through or tourist traffic. To answer this question Iowa made counts at 47 stations in 1917 and 87 in 1919 and their data are mainly useful for the classification of the traffic by source and origin.

The results for the two years expressed in the same terms are given in the following table:

Per Cent of Total Traffic

Year	Farm-to-town, Per cent	Interurban, Per cent	Interstate or tourist, Per cent
1917	46.6	46.9	6.5
1919	47.1	46.1	6.7

Before-and-after improvement counts made in other States have served principally to prove the utter valuelessness of traffic counts made before the improvement of a road to indicate the form the improvement should take, and to illustrate the principle of selection which runs through the whole fabric of our transportation system, according to which the traffic takes the easiest and best road from source to destination.

California Investigations

WITHIN the past two years, however, traffic censuses of a different order have been taken in several parts of the country, which have produced some really important data and which without question represent the highest development of the traffic census as a research instrument, lacking only the continuity of the Maryland records.

The first of these studies was made by the Bureau of Public Roads in California, in connection with an investigation of the accomplishments of the State highway commission made at the request of the commission in 1920.

One hundred and three stations were selected and counts were made at each for intervals varying from one to eleven days, and for 16 hours each day. The traffic classification distinguished between light and heavy automobiles, motor trucks of four capacity groups, passenger buses, horse-drawn vehicles and extra-heavy vehicles. The average of the counts for the whole State shows that in numbers of units the highway traffic of California is predominantly a passenger automobile traffic, vehicles of that description constituting nearly 83 per cent of the total. In point of tonnage the commodity traffic plays a more considerable part, but it is not to be compared to such traffic as some of the Eastern highways carried during the war years. Not more than one-third of the tonnage of traffic in California is in trucks, whereas during the war such roads as the Belair road in Mary-

land carried truck tonnage in excess of 50 per cent of the total.

SINCE the stations selected in California covered practically the whole road system of the State it was possible to plot the counts for each station in traffic diagrams which show the variation in traffic on the various parts of the system. The diagrams, like similar ones plotted in Maryland, bring out very clearly the influence of the cities and towns. The typical form is a series of peaks and valleys with a peak at each town depending in height upon the size and character of the town and a valley in between depending in depth upon the distance between towns, the character of the towns and the character of the intervening rural sections.

These traffic diagrams, or traffic profiles as they might be termed, have a meaning which has not been unriddled because no one, so far, has made a determined effort to obtain the collateral economic data with regard to the towns and the country traversed which is needed to show why one city causes a higher peak than another, or one rural section maintains a higher level than another. If traffic censuses are to be genuinely helpful it is the firm belief of the writer that sooner or later this effort will have to be made.

Until it is made the traffic census will give a fair picture of an existing condition, but it will be a practically useless instrument in the solution of the main question, which is always, what traffic can be expected, not what is the traffic now. The farmer's parallel problem—the productivity of soil — is never solved by a weighing of crops only, no matter how many yields are weighed. It is only when the yield is related to the analysis of the soil that scientific agriculture adds anything of value to almanac farming.

In addition to the character and volume of the traffic and an insight into the laws of local traffic variation, the California investigation produced interesting data with regard to the daily and hourly variations. Sunday was shown to be the day of greatest travel with an average traffic approximately 1.7 times the average week-day travel. Saturday came next and Friday's traffic was the lowest of the week. On the average day the traffic was found to be a minimum at 6 a. m. when the counts were begun with a subordinate peak at 11 a. m. and a maximum peak at 5 or 6 p. m. both on Sundays and week-days. Is this variation to any extent controllable, or is it the inevitable result of the individualistic character of highway traffic? Will it ever be practicable to spread highway traffic over the week and the day and the season to a degree approaching the constant and regular use of rails?

These are not academic questions. The efficiency of the highways is bound up in them. Such very practical considerations as the widening of roads are dependent upon the answers we find. And who is to say now that some such control may not be possible? In commodity haulage there is already an apparent trend from individualism to co-operation and specialized corporate transportation service. When we get right down to brass tacks, how many of us would care to say definitely that highway passenger transportation will remain indefinitely the unorganized affair it now is? These are some of the questions which remain to be answered. Shall we wait until they answer themselves, or shall we try to discover where we are going before we get there?

There is other food for thought in the California investigation—much of it—for the interested reader, but space will not permit a discussion of it here. The primary purpose of the investigation was to appraise the service value of the State road system, and there is much that is suggestive and a great deal that is definitely informative in the methods adopted by the investigators no less than in the valuable results of their investigations.

The Connecticut survey, another experiment of the Bureau of Public Roads, in which it co-operated with the State highway department, dealt solely with the traffic. Problems of the road as a structure had no place in it. It was strictly an analysis of traffic. The roads selected for the investigation were the Boston Post road, upon which the counts were made at Greenwich, and the Hartford-Springfield road, which was studied at a point near the Massachusetts line.

HERE is a comprehensive survey of all the significant studies that are being made in the field of highway transport. The activities are reviewed in an interesting, non-technical story that gives briefly a number of interesting facts about highway transport research that every automobile man will want to know.

The field covered includes traffic surveys, operating cost investigations, determination of relation between vehicle and highway design, store-door delivery and accident studies. The field of the motor truck as a transportation medium is being defined by the results of these investigations.

THE traffic passing these two points during fourteen-day periods was counted and weighed. The vehicles were measured, their tire equipment was noted, their speed was observed, the character of their cargo was recorded and their drivers were questioned as to the length of their trip.

Most striking among the results of this census is its revelation of the prevalence of overloading. Every third truck was found to be loaded beyond the rated capacity of the truck and tires, notwithstanding that less than 3 per cent of all the trucks observed exceeded the maximum weight allowance of the Connecticut law, which is 25,000 pounds. For seven-eighths of the violations of the maximum weight provision and three-quarters of the trucks loaded beyond their rated capacity the regular trucking companies were responsible. The practice was not confined to loads of heavy material such as sand, gravel and brick. Apples, beer, butter, eggs, drugs, fish, furniture, meat, vegetables and, in fact, nearly every commodity transported was represented in the records of overloads.

The significance of this observed fact will depend upon the relation which is found to exist between road strength, wheel load and tire width. Such investigations are in progress by the Bureau of Public Roads at the Arlington, Va., Experimental Farm. It goes without saying that roads must be designed to carry some given maximum load, and it is already clear that the imposition of a greater load after the road is constructed overtaxes the road. Repeated applications of such excessive loads or even occasional applications of greatly excessive loads are likely to damage the road far beyond the small gain in the operating cost which results from carrying the additional load, if, in truth, there is any gain. Certainly, therefore, those trucks which were found to be carrying total loads in excess of the legal maximum of 25,000 pounds were guilty of an offense against the road cal-

culated to cause loss to the community which was paying for the road and the transportation.

Overloading Is Common

THE effect of the overloading of smaller trucks when the greatest wheel load does not exceed the maximum used in design has not yet been determined beyond doubt. State laws prescribe a limit, generally 800 pounds per inch of tire width, which is intended to prevent excessive concentration of load on the road, and the trucks which were found in Connecticut to be loaded beyond the rated capacity of the trucks and tires were violating the State law. Investigations made thus far give some reason for the belief that such overloading, so long as the given maximum wheel load is not exceeded, may not be followed by serious consequences, but the point is not at all clear. It is possible that the effect upon some types of surface may be more serious than upon others. This much is certain, that the operators of those trucks were guilty of a practice which, for all they knew, might seriously damage the road, and which in the long run would certainly reduce the life of their trucks, and yet for the sake of small temporary gain they risked the consequences.

So long as there is such disregard of economic law, highway transport will never become the efficient link in our transportation service that we should hope to make of it. Again comes up the problem of individualism which the railroads do not have to face and another indication of the need for research looking to the establishment of uniform, just and reasonable traffic regulations and means for their enforcement.

In view of the fact that truck and railroad transportation are more seriously in conflict in New England than in other sections, certain comparisons developed by the Connecticut data are interesting and important. Classifying the commodities hauled by the trucks and comparing them with similar classifications of railroad tonnage results as follows:

Comparisons of Commodities Hauled by Motor Trucks and Railroads in New England

Class of Commodity	Truck	Hauled by N. Y., N. H. & H. Ry. (1918)	B. & M. Ry. (1920)
Products of agriculture	14.3	9.4	11.8
Products of animals	11.2	3.3	3.2
Products of mines	0.5	42.5	36.8
Products of forests	1.5	6.5	13.2
Manufactures and miscellaneous	72.5	38.3	35.0

Remember that the high-pay tonnage lies in the group of manufactured and miscellaneous commodities and that products of the mines and forests are low-class freight, and you will see from the table what the truck is doing to the railroads. It is invading their most lucrative field and taking a part of their business in that field, but it is not taking over any of the burden of carrying the bulky, low-class freight.

Now consider the further fact revealed by the Connecticut census: That the trucks are carrying some of those manufactured commodities for distances which exceed what is ordinarily understood as short-haul distances of more than 100 miles and as high as 150 miles. Consider further that the two competing railroad systems are short-haul systems, as railroad hauls are rated, and you will appreciate the situation in which the railroads find themselves.

The transportation conditions in New England are almost unparalleled in other sections. Perhaps the railroads have not adjusted their service as well as possible to the peculiar conditions. In some respects they certainly have not. The fact remains that, so far as we can see now, New England could not get along without its railroads, and their position must not be rendered impossible by ruinous motor truck competition. Bearing in mind that what we are after is not the improvement of highway transportation only, but of all transportation, it will be clear that there is need for research to define the proper fields of the two transportation systems in this area especially. A way must be found to make them aid each other and to put an end to expensive conflict.

An investigation similar to the Connecticut study has been made by the Massachusetts highway commission. The results have not been published, but it is understood that in many respects they verify the Connecticut findings and that they point toward the same general conclusions.

In Tennessee another survey has been under way which goes over much of the ground that has been covered by the former censuses and includes some important features that have not been accounted for in the others. This survey, the complete results of which have not yet been published, has been conducted by Prof. N. W. Dougherty, of the University of Tennessee, who has been appointed also a special assistant of the Bureau of Public Roads. The work has been done with the cooperation of the university, the State department of highways and the Federal Bureau.

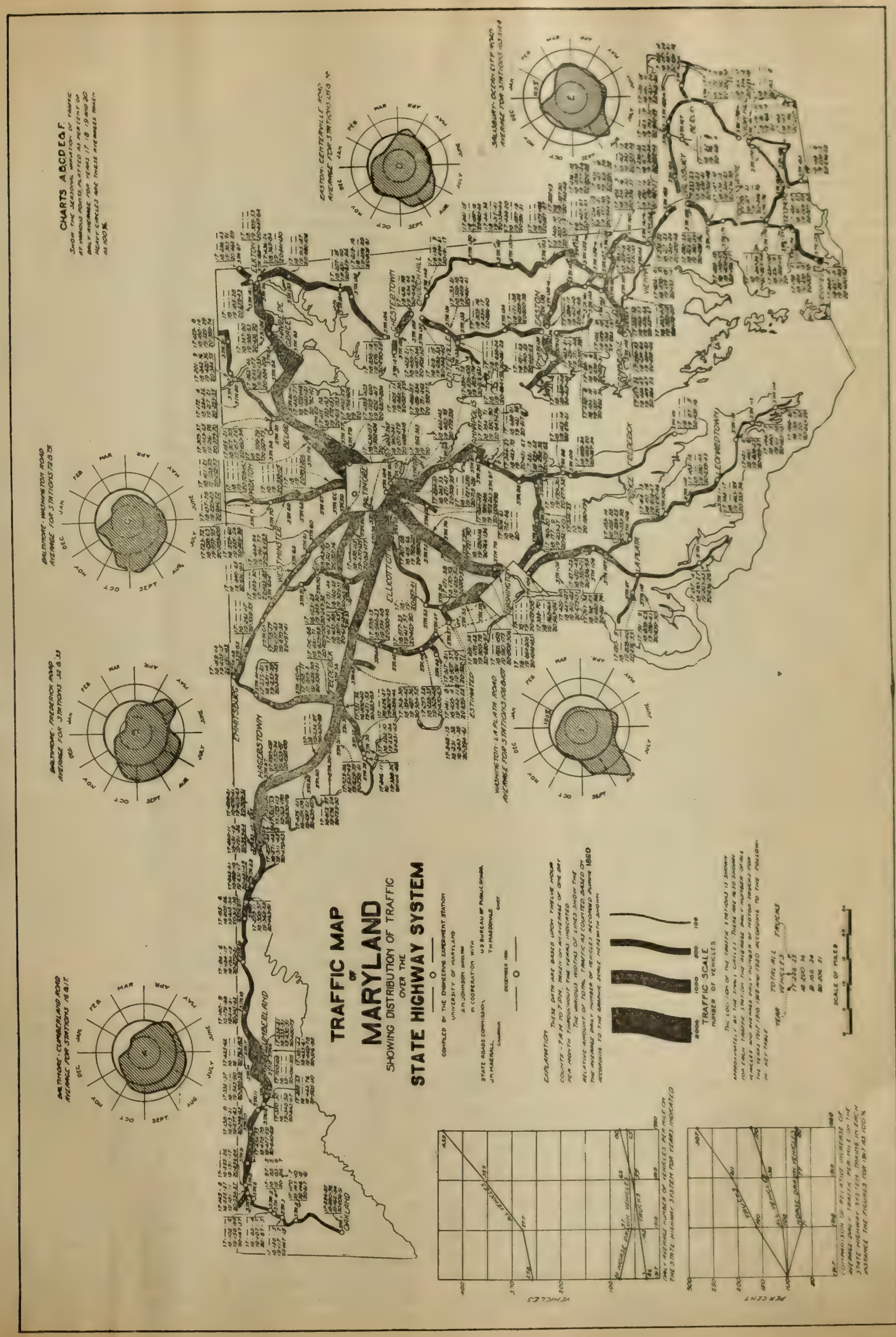
It has been the principal purpose of this investigation to determine the service value of the roads of several counties, of which Davidson County, with Nashville as a center, has received first consideration. The other counties included were Williamson, Maury, Cumberland and Knox in the order of mention.

Reviewing, briefly, the method adopted: The first step was to study the existing condition of the roads, their age and cost of construction, the existing grades, widths, drainage and climatic conditions and other factors which affect the use of the roads and their value as arteries of transportation. The next step was to review the maintenance methods adopted with respect to cost and adequacy.

Unit Transportation Costs

TYPE of surface, character of subgrade, grades, widths, etc., plus character and completeness of maintenance indicate service potentiality. Costs of construction plus maintenance constitute the roadway charges to be considered with the operating costs of the traffic in arriving at a combined roadway and operating cost which will be a measure of the efficiency of the transportation. The investigation proceeded to a count of the traffic by roads, classifying the vehicles as automobiles, motor trucks (roughly classified by capacity) and horse-drawn vehicles. So far in his investigation Prof. Dougherty found it possible to obtain representative, if not complete, data. With these data and the operating costs of vehicles related to the roads over which they are operated, he would be in a position to show with a fair degree of approximation what are the total and unit costs of transportation over the various roads. But it is right here that he has struck a snag, which has prevented him from carrying his analysis to its logical conclusion. He has not been able to secure accurate costs of operation—even average costs—and he needs something more than average costs. He needs detailed costs—detailed with respect to the highway surfaces and grades to which they relate. Such information is vital to a proper selection of surface types. Knowledge of traffic volume related to annual road charges will show from the viewpoint of the road, for example, at what stage of traffic development it

Results of a Traffic Census



is desirable to change the surface of any particular road from gravel to concrete.

When the traffic reaches some particular volume the cost of the gravel road, made up of cost of construction plus maintenance reduced to an annual basis, will pass the similar cost of a concrete road. At that stage, from the standpoint of the road, it is desirable to resurface with the more durable type. But the chances are that before that stage is reached the gravel road will already have become a relatively unprofitable investment viewed from the higher standpoint of total transportation cost, because the owner of every vehicle that passes over it is paying a higher price for his operation than he would be required to pay if the surface were concrete instead of gravel.

Individuals and groups of individuals, which is to say the community, have paid that higher cost of operation from the time the gravel road was built, but so long as the sum of the annual operating cost and the annual cost of the gravel road does not exceed the sum of the two costs for the concrete road the gravel road should remain. The more durable surface should be laid when the balance swings to the other side. It is this point which is not determined by Prof. Dougherty's data, because of the lack of relative operating costs.

He has, nevertheless, been able to bring out some interesting relations, and although his complete report has not yet been published, I think I may take the liberty of quoting briefly by way of illustration from a preliminary draft of the report for Davidson County. "For example, the Harding Pike has a total of 8775 vehicle-miles over a distance of 14.5 miles, giving an average intensity of 605, and the Charlotte Pike has a total volume of 2324 vehicle-miles over a distance of 8.75 miles, giving an average intensity of 255. These two pikes are of practically the same construction, requiring an annual expenditure of practically the same amount. The highway commission estimates that the annual expenditure for the main pike roads will not exceed $750 per mile per year, not counting interest on the original investment. Seven hundred and fifty dollars per mile per year would give a vehicle-mile cost of 0.34 cents for the Harding Pike and 0.8 cents for the Charlotte Pike.

What Do Roads Cost?

"IT is estimated that the district roads will cost about $500 per mile per year. The traffic will vary from a few vehicles per day to about 200 vehicles per day. . . . Twenty-five vehicles per day makes the vehicle-mile cost 6.23 cents (sic) if the annual expenditure is $500. It would seem, therefore, that there is a minimum traffic which will justify an expenditure of $500 per mile per year. If the same relation* be assumed for highway operation as for railway operation, the total cost per vehicle-mile would have to be 31.15 cents to justify an expenditure of 6.23 cents for maintenance and structures. Ordinarily 31 cents would be counted high for average vehicle-mile cost on a hard surface road. Assuming an average cost of 15 cents per vehicle-mile, the (proportionate cost of) maintenance and structures would be 3 cents per vehicle-mile. Three cents per vehicle-mile and an annual expenditure of $500 would require a traffic of 50 vehicles per day."

The Davidson County study aims also to find a basis for the estimation of future highway traffic using the rate of increase of population, motor vehicle registration and observed traffic as arguments to find a relation between roads and agricultural production; to determine the effect of roads upon the value of property and finally to find by the combination of the several factors a more adequate basis for the selection of roads of the county for improvement.

*In railroad operation the cost of maintenance of way and structures is approximately 20 per cent of the total cost of operation.

Vehicle Operation Relative to Road

WHAT the Tennessee studies have failed to reveal, namely, the cost of vehicle operation relative to the road over which the operation takes place is the subject of two investigations, one in Iowa, the other in Massachusetts and Connecticut. These experiments are being conducted by the committee on economic theory of highway improvement, a committee of the Advisory Board on Highway Research which is a division of the National Research Council. Prof. T. R. Agg of Iowa State College is the chairman of the committee, and the Iowa tests are being made under his personal direction. The Massachusetts tests which are being made at the Massachusetts Institute of Technology under Major Mark Ireland of the Quartermaster Corps, U. S. A., are known as the Quartermaster Research on Tractive Resistance. Correlated tests are being made at Yale University under the direction of Prof. E. H. Lockwood.

The Quartermaster Research aims to discover the total resistance to traction of motor vehicles, including the sum of all resistances within the vehicle itself and the resistance of the road. The concrete road will be used as a basis of comparison and most complete data will be secured for that type. Comparative data will be secured for other types. A measure of the roughness of the road surfaces tested forms a logical part of this research. At Yale, tests are being made to ascertain separately the magnitude of the various internal resistances, such as the inertia and frictional resistances of motor and transmission, and tire resistances. These resistances evaluated, they can be deducted from the total resistance as found by Major Ireland and the remainder will be the road surface resistance which correlated with the type of road and the measured roughness of the particular road section will furnish the means of predicting road surface resistance from the type of the road and the measurable roughness.

Out in Iowa Professor Agg hopes to convert the results of these two investigations into terms of gasoline consumption and hence, finally, into cost of vehicle operation for particular classes of roads of known roughness. By combination of the results of the three experiments it should finally become possible to predict from the type of road and its roughness the average cost of vehicle operation over it which is precisely what has been shown to be lacking in the Tennessee data.

Briefly, Professor Agg's method will be to operate three classes of vehicles—automobiles, trucks and trailers—over selected sections of concrete and bituminous concrete or brick roads. Special devices he has contrived will preserve a continuous record of gasoline consumption at every stage of the operation and a correlated record of the profile of the road showing grades and roughness, together with a record of the speed and air pressure front and back of the machine at each instant during the course of the tests. Samples of the gasoline will be taken and tests made upon them will show their fuel value in British thermal units.

The net result of these tests, it is hoped, will enable Professor Agg to determine the money cost to the traffic of grades and highway surfaces. Such results should be available at a not very distant date. No similar information has been available heretofore with the exception of the results of a few simple tests made several years ago by A. N. Johnson, then serving with the Portland Cement Association.

All the foregoing researches, the primary purpose of which is to provide a basis for determining the service value of roads and the actual cost of highway transportation must necessarily depend upon the various physical researches which are being made to determine the necessary constructural features of the roads and the vehicles to withstand the forces which react against each at the points of contact of wheels and road surface. Obviously changes in vehicle design which alter the concentration of load on the wheels, or the tire medium through which the load is transmitted will affect the construction of the road and the construction of the road will affect its cost. Improvements in vehicle efficiency will affect operating costs, so that it is clear that the economic and the physical researches must go hand in hand. The latter are another story which is told by Professor Hatt elsewhere in this number.

Naturally the design of the vehicle affects the cost and character of the service in many ways entirely aside from the road relation. The substitution of pneumatic for solid tires has its effect not only through its influence in reducing impact troubles of both the road and the vehicle, but directly, in the character of the transport service. Consider, for example, the difference between a motor bus on solid tires and on pneumatic tires. Body sizes, the relation of weight of cargo to volume of cargo, the field of the four-wheel-drive, these and numerous others are matters of vehicle design which directly affect service and which merit and are receiving careful study by many vehicle manufacturers and various users in the course of everyday business.

There remain to be discussed briefly a number of fields of study related to the use and service of vehicles, including the type and capacity of motor trucks for various industries and for short and long hauls, for intercity hauling and city delivery use; including terminal uses of motor trucks in connection with the railroads and the future terminal problems of the motor truck services themselves, if intercity passenger and commodity transportation is to continue to develop. There are problems associated with the use of trailers—when to use them and how best to operate them; what special loading and unloading requirements attach to their use? Is there hope of greater economy in specialized corporate control of highway transport than in the present prevailing practice according to which nearly every man is his own carter? What are the possibilities of co-operative operation? If, as is generally conceded, the highest development of the specialized trucking industry depends upon the adoption and maintenance of regular schedules, equitable classification of commodities and equal rates to all for equal service, how will such schedules be determined and such rates and classifications be established? What are the possibilities of establishing central warehouses by means of which trucks will be assured of return loads? These are some of the service problems; there are many more, and the indications are that they are to receive the study they deserve if the recommendations of Mr. Tom Snyder, secretary of the National Association of Commercial Haulers are widely carried out.

The research in this field has been carried on mainly by the questionnaire method and in connection with the daily business of vehicle manufacturers and motor trucking companies. H. R. Tolley and L. M. Church of the Bureau of Public Roads, as previously mentioned, have developed a great deal of important data with regard to farm uses of motor trucks by the questionnaire method. The reports of their work published as bulletins of the Department of Agriculture cover such matters as the size of trucks used by farmers engaged in truck farming, dairy farming, fruit, crop and general farming and the satisfaction or dissatisfaction of the various owners with the trucks of their choice. They have obtained the opinions of farmers on the question as to whether their trucks are profitable investments; they have compiled information with regard to the length of farm hauls, time saved by the use of trucks, the percentage of return loads, the extent to which the change from wagons to motor trucks has permitted the farmers to reach new and better markets, the number of days use per year, the life and depreciation of the trucks under farming conditions, the cost of repairs, the saving in hired help, the displacement of horses and approximate statements of the cost of operation. Such data have been compiled for the Eastern and Corn Belt sections, and they constitute a valuable contribution to the developing science of highway transport. Other industries should be studied in a similar manner.

"EXECUTIVES of car and truck companies will have to take a more active interest in highway research or they will wake up some morning and find that their sales cannot go on because there aren't proper road facilities for taking care of the manufactured vehicles. We can't go on producing cars without thinking seriously and scientifically about road problems."

This statement was made recently by one of the most prominent executives in the industry. And he was right.

Highway construction, finance and operation are going to be studied in the future more carefully and accurately than in the past.

The highway is a necessary economic unit. It must be made to pay its own way. Public funds will not always bear the burden. Research is essential to the attainment of this end.

As a result of the rapid increase in the traffic on the highways the prevention of accidents has become a matter of the first importance. State highway departments are giving more and more of their attention to this and the associated problem of the guidance of traffic. As yet there is an unfortunate lack of co-operation in the efforts that are being made by the various States. There is a wide variety of caution and directional signs which is in itself a source of confusion and positive danger.

One of the most interesting experiments in the field of accident prevention is that which is being conducted by the State Roads Commission of Maryland. It is not only an interesting experiment, it is also a valuable administrative measure, for its results are being applied directly by the Commission to the elimination of dangerous places on the State highways. By a system of reports the commission receives from its patrolmen an account of every accident which occurs at any point on the State roads immediately after the accident. Each accident is recorded on a map of the State system by the insertion of a pin with a colored head, yellow for a mishap involving no loss of life and red for fatal accidents. Whenever possible the cause of the accident is stated in the reports, and when there is indication that the road is at fault a special inspection is made of the site by an engineer and steps are taken at once to remedy the dangerous condition. The grouping of the pins on the map has brought out very clearly the most dangerous places on the system, and in many cases they are places which had previously been considered entirely safe.

As previously suggested the regulation of traffic is in a far from satisfactory condition, taking the country as a whole. Each of the States has adopted its own regulations without much regard for the regulations of adjoining States with the result that when a motorist passes from one State to another he must learn almost an entirely new code. One of the reasons for this lack of uniformity is the fact that there has been heretofore no very definite groundwork of experimental fact upon which to base the regulatory provisions.

A considerable amount of study has been applied to the problem of bringing the various regulations into uniformity and one of the notable results is the uniform motor vehicle law drafted by the Federal Highway Council. Most of the provisions of this model law appear to be so reasonable as to be worthy of immediate adoption by all States. A few, particularly the limits placed upon weight and speed of vehicles, will probably be affected by physical research now under way, and their adoption should await the conclusions to be drawn from these researches.

Store-Door Delivery

WHAT is popularly known as store-door delivery, by which is meant the plan of direct collection and delivery of freight by the rail carriers has been a subject of much interest in the cities for several years. It is not an untried experiment. In its major features it is really a successful institution of long standing, the Pennsylvania and Baltimore and Ohio railroads having practiced it in Baltimore and Washington for nearly half a century. As a result of decisions in cases before the Interstate Commerce Commission the practice was unwisely abandoned in these cities a year or so before the outbreak of the world war. Since the war it has attracted widespread attention and we are likely to see its adoption generally by all cities before many years have passed. It is almost a panacea for railroad terminal congestion. Such congestion results in large measure from the piling up of less than carload freight in the terminals, due, in the first instance to the delay in delivery which results from the necessity of mailing a notice of receipt to the consignee, and secondly, to the delay of the consignee himself in sending to the terminal for his freight. Under the system of store-door delivery the l. c. l. freight is not permitted to remain in the station but is unloaded directly from the cars into trucks which convey it directly to the consignee, the same trucks returning from their delivery trips with outbound freight for loading upon the cars.

As formerly practiced in Baltimore and Washington motor trucks were not considered to be as successful as the horse-drawn dray for this purpose on account of the numerous and lengthy stops for loading and unloading. This difficulty has been practically overcome by the development of demountable container bodies which can be quickly placed upon the trucks by travelling cranes at the terminals, and the principal obstacle that remains is the matter of unloading. In this respect there are still some problems to be worked out.

After a thorough investigation the principle of store-door delivery has been recommended by the Port of New York Authority for the present relief of congestion in our principal port. The proposal contemplates the use of motor trucks with demountable or container bodies to avoid all unnecessary handling and reduce to a minimum the loading and unloading time of the trucks leaving them free to perform the function for which they were designed—the rapid carrying of freight. For those merchants who do not desire direct delivery or whose business is not of such a character as to permit it the proposal of the Port Authority is to build centralized union freight stations located at such points as to minimize the truck mileage in delivery and collection, these stations to be erected inland from the waterfront in order to reduce the congestion at the piers.

Container Cars

A MODIFICATION of the system of store-door delivery has recently been successfully adopted by the railroads centering in Cincinnati for the transfer of freight between the several roads and between the main stations and substations. The method seems to be ideal for this purpose. Freight can be loaded and unloaded in container bodies by means of cranes and the trucks are practically assured of a full load both ways with negligible delays at the two ends of the trip. The experiment, known as the Cincinnati plan has resulted not only in a saving of time and the elimination of a great deal of rehandling, but has also released a great many freight cars from the interline transfer service for use on the main lines, has reduced the number of standing cars on the yard tracks, thereby improving the track service for carload freight unloading, and has made it possible to accommodate a much greater amount of l. c. l. freight on the available area of loading platform.

German Determinations of Road Adherence Coefficients

PROF. DR. BREDTSCHNEIDER of the Berlin Technical College publishes in the *Verkehrstechnik* the following road adherence constants obtained on the Avus automobile track near Berlin, with different types of tire and under different conditions of road surface. The tests were made on a level stretch with the dynamometer inserted between one car acting as a tractor and another acting as a load, the brakes on the latter being applied. The passenger cars were fitted with pneumatic tires, the left front and right rear wheel tires being of the steel studded anti-skid type, whereas the trucks had the usual solid rubber tires.

The figures show that the steel-studded pneumatic tire has only slightly more adherence than the smooth-tread pneumatic tire on wet wood block and asphalt pavement,

	Coefficients of Adhesion					
	Passenger Non-skid		Vehicles Smooth Tread		Trucks Solid Rubber	
	Condition of Road Surface					
Road Surface	Dry	Wet but Not Muddy	Dry	Wet but Not Muddy	Dry	Wet but Not Muddy
Tarred macadam..	0.50	0.45	0.56	0.50	0.62	0.57
Wood pavement...	0.44	0.34	0.60	0.30	0.62	0.22
Asphalt pavement.	0.39	0.32	0.53	0.27	0.60	0.25

and is inferior to it under other conditions. As the steel-studded tire also has other drawbacks it will be replaced in Germany before long by the rubber non-skid tread tire.

The Motor Bus—Today and Tomorrow

Cost studies help define proper field of bus transportation. Return on investment more important factor than operating cost. Experiments in design are widespread. Greater comfort for passengers sought. Limousine bus makes appearance. Better feeling between bus and railway interests.

By Walter Jackson

JUST enough has been learned as regards design, operating costs and possibilities of use of motor buses to indicate that a broad field of usefulness lies ahead and that further development is certain to take place. Numerous investigations are now being conducted.

A growing tendency toward co-operation between electric railway, railroad and bus interests is evidenced by studies in the commercial phase of motor bus problems. Analysis of bus operating costs under various conditions show that the ultimate field of this type of vehicle will depend upon many factors other than the mere operating cost of the vehicle. The bus often returns greater profit than the electric car, even though its vehicle operating cost is greater.

The general tendency in motor bus design is toward the one-man 25-seat vehicle, but standardization in body design is not likely, nor perhaps desirable, in the near future. Lower bodies and door steps are necessary, while other comforts and conveniences for bus riders are rapidly being developed. Experiments with lighter pressed steel frames are in progress. Six reflector units equipped with 21 cp. Mazda C to give about 6 ft.-candles on the reading plane are recommended for lighting a 20-ft. bus as the result of recent researches along this line. These are the chief features which stand out from a survey of bus research from a construction standpoint.

All the investigations and experiments now under way may properly be regarded as research activities so far as the motor bus is concerned. The comparative newness of the bus as a transportation medium makes it necessary to classify as research many items which would be little more than historical data if related to older units. The cost per passenger-mile of hauling passengers, for instance, has been so thoroughly studied in the railroad field that such data is scarcely in the realm of research at the present time. Yet these same data, gathered and interpreted in relation to motor bus transportation very definitely constitute research material because so little has already been done in this field.

Final results are not yet available from either the construction or operating research already completed or in process, but some very definite trends are already evidenced, as is shown from an examination of the various researches in progress throughout the country. This article contains a summary of those researches and the trends so far developed by them.

The commercial growth of the motor bus will be determined by its ability to provide efficient transportation. Consequently the studies of operating costs, service possibilities and transportation economies are important to bus manufacturers. The co-ordination of bus lines with existing transportation mediums is one of the major problems.

Every bus manufacturer who expressed himself on this subject said that traction men are rapidly losing the idea that there is nothing to the bus. Their inquiries from traction companies had, indeed, greatly increased within even the last twelve months. Those who attended the October, 1921, and February, 1922, sessions of the American Electric Railway Association sensed an appreciable turn for the better within the few months intervening. It is true that the embargo on bus company membership adopted in October was not revoked in February, but there is nothing to prevent a maker of buses from becoming a member and sitting on committees—a rather anomalous situation.

SOME of the motor bus installations made by electric railways within the past year tend to make the anti-bus element look foolish. One company has installed buses on a cross-town line because they are cheaper than rail renewal; a second, to make one good bus route of two bad rail routes; a third, to save the wages of flagmen compelled with car operation; a fourth, to get rid of some jitneys by running buses to a neglected area; a fifth, to protect itself against pirates on a cross-country line, etc. Every day sees some new situation where the bus is not a competitor but a money-saver and even a money-maker for the electric railway. However, it will take years before even the progressive electric railway man forgets the jitney's ravages, not to mention the considerable tribe who are still at gripes with it. Those who insist upon dying with their boots on will find themselves succeeded by bus companies—not individual jitneurs—with a better sense of responsibility to a public which will put up neither with antiquated vehicles nor antiquated management.

The over-enthusiastic bus advocate dislikes to learn how cheaply a truly modern electric railway can be operated. Perhaps it is because of this that we have seen such desperate skimpings in equipment and service to produce operating costs that would look better than the railway's, making no allowance for the burdens that eventually will fall upon a bus corporation as upon a railway corporation. The biggest field of the bus is in creative work. It can do ever so many things that the rail-bound vehicle cannot do at any price within reason. Therefore the bus manufacturer should cease worrying about attaining a seat cost of ½ to ¾ cents a mile.

The transportation man with business sense will not be interested so much in costs as in net revenue. Admit that for a given situation the bus does cost 50 per cent more to run than the car. It is probably possible then to go on to show why the bus will earn more net through higher schedule speed, greater attractiveness to the public, wider usefulness on holidays and at night. Up to the present time also almost all buses have been used in small, widely scattered lots. The cost of operation under such conditions is certainly not comparable to running 50 to 500 street cars from one shop and carhouse. While the operating costs of the big double-deck companies do not come into the reckoning, they are useful as proof of the reliability and flexibility of the motor bus.

MANY thousands of buses will be ordered within the next two or three years. But it is likely that the greater share will go for new business to meet the never-sated transportation appetite of the American people, rather than for supplanting any existing transportation business.

Various researches show that frequently the bus is preferable despite higher expenses. The following specific studies are typical and illustrate the point clearly:

No. 1 may well be taken from abroad because it offers direct proof of how traffic is created and greater net obtained when a superior form of service replaces an inferior.

The Edinburgh municipality took over a cable system which was to be partly electrified and partly bused. In the meantime the motor bus has been installed on quite a number of lines. Thus the Mound Tollcross cable cars, which made the run in twelve minutes, were replaced Oct. 3, 1920, by buses making the run in nine minutes. This gives a fair idea of the difference in the two services.

Although 46-seat double-deck cable cars were succeeded by 30 to 32-seat, single-deck buses, the receipts per mile increased on the Golden Acre-Mound route within six weeks by nearly 17 cents over cable—58 cents instead of 41 cents.

Now comes the point emphasized as most important—the question of net. The average operating cost of the cable system between January 1, 1919, and May 15, 1920, was only 36.8 cents per mile, whereas that of the buses was 40.8 cents per mile; but the balance to net in the case of the cables was only 5.4 cents, whereas in the case of the buses it was 15.6 cents. These comparisons were not substantially different in the summer of 1920. The buses ran over pretty severe grades and cobble-paved and granite-paved streets over almost the entire route.

The accompanying Table 1 is not given as an example of present costs, which are substantially lower in wages, fuel and first costs, but to show the way the accounts are kept.

Table 1—Typical Cost Set-Up of Edinburgh Municipal Bus Operation, Period July 1, 1919, to May 15, 1920

	In Cents per Bus Mile
Traffic Expenses—	
Superintendence	.032
Wages of drivers and conductors	12.874
Wages of inspectors	.124
Wages of other traffic employees	.076
Ticket check	.564
Uniforms (free to men)	.436
Licenses	.564
Cleaning, oiling and lighting	4.006
Miscellaneous	.277
General Expenses	
Salaries of staff	.368
Store expenses	.162
Office expenses	.078
Printing and stationery	.137
Fire insurance	.226
Accident insurance	.958
Employers liability insurance	.228
National health insurance	.066
Rent of garage	.954
Taxes	.200
Miscellaneous	.102
General proportionate expense of management.	.284
Repairs and Maintenance—	
Chassis	2.490
Bodies	1.600
Tires (solid)	.582
Plant, etc.	.284
Power Expenses—	
Gasoline	12.884
Total operating expenses	40.832
Total revenue	55.490
Carried to net revenue account	15.658

No. 2 is also taken from British practice. This case involved the operation of cross-country bus services over large areas under a single management instead of small services run by individuals, as is usual in America at the present time. The Birmingham & Midland Motor Omnibus Company operations are chosen as an example. Last summer this property had 209 buses and 9 char-a-bancs. The focal point of the business is Birmingham, from which there radiate scores of regular bus routes up to distances of 126 miles, aside from any combination that parties chartering buses may desire. Competition of the individual bus man with this efficient organization is quite out of the question. It has twelve inspection and repair garages along its main routes, so that the standard Tilling-Stevens gas-electric equipment can be kept in such fine shape as to average 40,000 miles per breakdown (May, 1921). The total expenses and earnings of this cross-country system with 32-seat buses happened to be remarkably close to that of Edinburgh, although the period taken was a year later. The earnings were practically 55 cents per mile, and the operating expenses about 41 cents per mile.

Although some of the buses had been on the job since 1911, the total maintenance staff numbered 261, or only 1¼ men per bus, despite the large number of garages and the inclusion of a body-building staff. Not more than two spare chassis frames and eighteen engines were on hand for a system operating in much rolling country. In fact, the spare parts reserve did not exceed 12 per cent.

No. 3 takes us to the United States. The San Francisco Municipal Railway as early as 1917 used buses instead of immediate tracking for extension services. It now has nine White chassis and eight bodies. The former three routes have been revised to two of somewhat different layout, another proof of easy adjustment to conditions as revealed by trial.

THE route across Golden Gate Park has a round-trip mileage of 4.16 miles and that along the beach 5.5 miles. The operating expenses have hung quite consistently around 26 cents a mile for these T. D. B. and 20/45 models. While this operation from the ends of trolley lines through thinly peopled areas has always shown a loss in itself, there is no doubt that it has helped to build up traffic on the connecting lines and improved realty values from which the city recoups its bus losses. The cheapest form of electric traction available would have cost far more and would not have been subject to instantaneous re-routing.

Even if the San Francisco style of bus operation does not throw off a direct profit, it is for all that an example of the most promising field for bus use by electric railways. Bus sales from this source should go into the thousands, for there is hardly a community which is not

growing beyond the terminals of its street railways. In the old days the roads in the outer sections were simply dirt highways, but in these times well-paved thoroughfares are already down. This means that the track extension would be in paving at prohibitive expense to the railway. Hence there is no way out but gas or trackless bus, with the gas bus winning out in most situations.

THROUGH services to the heart of the city are bound to evolve from such extensive shuttle services. This service, if handled at special fares with no intermediate pick-ups, will give genuine rapid transit to cities which are not large enough for subway and elevated lines and that means cities below 1,000,000 population. Many bus services of the British Electric Traction Company are conducted successfully on this principle. There are instances of it in this country, but we have started at the back door. Instead of specifically developing such a service from the center of the city outward, our non-stop services are generally given by unco-ordinated buses coming in from small or nearby cities or rural areas. Indeed, the non-stop, no pick-up plan is not so much the deliberate intent of the operator as it is of local ordinances intended to protect the urban transport company. In any event, the non-stop, extra-fare bus to suburban centers will also be responsible for the sale of thousands of buses in the future.

No. 4 may be offered as an example of short-cut advantages offered by the bus in cross-country service. The Connecticut Valley Street Railway has long had a trolley line between Greenfield and Turner's Falls, Mass., but the distance via the existing roundabout route was 4.8 miles, whereas rubber-tired vehicles could make the run via a short cut of only 3.14 miles. To protect its investment against jitneys and give the public more service, the company started bus operation in November, 1919, making the run in 15 minutes as against 20 minutes by trolley. Since March 15, 1920, also the company has been getting a somewhat higher fare (minimum of 10 cents for two zones and 15 cents for three) for the superior article. It did not simply superimpose the bus service on the trolley service, but cut enough of the trolley mileage to insure a profit. Co-ordination is obtained by having the trolley leave on the half-hour and the bus on the hour. The car schedule speed is 9.6 m.p.h. and that of the bus 12.5 m.p.h.

In this case also experience showed what parts of the route did not pay. These were abandoned later. The equipment in this installation comprises three 1919 Cadillac chassis, model 57-B, especially lengthened to carry a 19-seat body. A report for the year ended Dec. 31, 1920, reproduced as Table II, shows an operating expense of 33.67 cents per mile and a total overall expense of 35.38 cents per mile against revenues of 28.23 cents per mile. It has been stated, however, that reduction in trolley service offsets these losses. In jitney days the company lost one-third of its revenues to these interlopers, whereas now it is cock of the walk.

The motor bus was one thing ten years ago; it was something else a year or two ago and it will be something still different to-morrow. In what respects is it improving and in what respects can it be improved? This was one question that the editors of AUTOMOTIVE INDUSTRIES wanted answered in this "Research Number." The writer felt that the question was too big to be answered by any one person, so in setting forth the following statements on tendencies in the art of motor bus and motor coach development he has embodied therein the summarized experience of many makers of automotive passenger equipment.

It is easier to talk about body than chassis standardization. From the first, motor buses have been operated by one man, except the double-deck buses in New York, Chicago and Detroit. There are still plenty of 12 to 20-seat bodies mounted on the cheaper priced chassis. These are mostly in the hands of jitney men who do not hesitate to overload them and who otherwise operate under conditions that would not be tolerated in the case of a reliable company. The trend of the better class one-man buses is toward a standard seating capacity of 25, with some as high as 29. The seats are arranged according to the most approved street car plan of longitudinal benches at the entrance-exit and transverse seats wherever wheel housings do not interfere.

Table 2—Operating and Overall Charges, Connecticut Valley Street Railway, Year Ended December 31, 1920

	In Cents per Bus Mile
Maintenance—	
Inspection	2.48
Repairs to body and chassis	5.91
Tires	2.98
Depreciation	8.36
Transportation and Fuel—	
Platform labor, etc.	6.75
Gasoline	5.23
Oil	.22
General and Miscellaneous—	
Insurance, etc,.	1.95
Miscellaneous credits	.21
Total operating expenses	33.67
Taxes	.41
Interest on Investment	1.22
Total cost of service	35.38

In view of the absence on a bus of the electro-pneumatic door and step control now installed on many street cars, and in view of the usually higher step and less spacious entrance-exit facilities, a seating capacity of 25 is about as high as practicable if the bus is used in city service. From observation, a crowded 16 to 20-seat bus will not make a better schedule than a 32-seat one-man safety car because its greater flexibility is offset by its longer passenger-interchange time. On the other hand, the one-man bus has a big advantage in both speed and safety over the roundabout single-track cross-country trolley wherever the highways are well paved and straightaway.

The intense competition in the body-building field, from the humblest local carpenter to the experienced car builders, results in the paradox of high prices to the buyer and little profit to the builder. There is as yet no quantity production of one-man buses that would give a low price to the buyer and a satisfying profit to the builder.

UNDER the circumstances, the standardization of such items as seat dimensions, seat spacing, window spacing and sizes, body width and height are far from realization. It took the electric railway industry nearly thirty years to attain one standard car, namely, the one-man type; and hardly had it proved a success when the old game of variations from standard began again. Yet in the electric railway field there are less than half a dozen car builders and only two manufacturers of propulsion and control equipment. If electric railway experience is to be repeated, the only way to achieve even a partial standard will be for a group of powerful manufacturers to build something in quantity and offer it at a price that cannot be touched by the others.

Wise operators are no longer putting 20 to 25-passenger bodies on 1-ton and 1¼-ton chassis. In terms of chassis, 2½ tons capacity is the size best for say 3750 lb. live load (25 x 150 lb.) and for maximum life of equipment. This size is not too awkward for city streets

and it offers a good capacity for chartered parties. The true field of the smaller size is for hotel and other private service.

Lower Bodies

THE low-hung body is necessary for safety, riding comfort and ease of access. Side sway, tail whip and triple or even double steps are not good selling points for a discriminating public. One builder says: "A single-step body is, in our judgment, imperative. While we have built, and do build, bus bodies with two steps, we would not do it unless we had to." A low center of gravity in itself tends to easier riding, and to some degree this feature is practicable with smaller wheels. One chassis design has brought the floor only 26 in. above street level through the use of radical constructions, such as gooseneck frames. Further stability is obtained by using a wider wheel gage for the rear than for the front: one design uses 66½-in. front and 71-in. back.

Some bus operators and builders have considered the use of sliding rather than folding doors, but street railway experience indicates that a single doorway with collapsing leaf door is most desirable. The door may be so hung on the front jamb as to be practically automatic in closing through its own inertia. After the bus operator has reached driving speed he may reach over and turn the operating crank to the locked position. On approaching a stop, he moves the handle to the unlocked position, whereupon the door opens through its own inertia upon the application of the brakes. Proper handholds and also overhead or underfloor connections will prevent the passenger from closing the door on himself.

In some states a rear emergency door is required. Usually, this door is blocked by the cross-bus rear seat and is therefore of doubtful utility in case of panic.

In general, door and step devices on buses have a long way to travel before they can equal the modern electric car which has the convenient powers of electricity and compressed air at hand for such apparatus. In Great Britain, however, the writer ran across the first bus in which the door opening and closing were interlocked with the operations of the engine, just as in the case of the American safety car. So there is no reason for assuming that inventive ability will not find the way toward a higher plane of safety than is now the case.

The public utility automotive business in this country began with the converted second-hand passenger touring car in the East and with the body-carrying freight chassis in the West. Only now are East and West beginning to meet. People who have had no transit facilities at all may be willing to put up with makeshifts for a time, but with what success can uncomfortable accomodations be offered to communities that have had rattan, leather and plush-seated cars for decades and have more lately tested the still greater ease of the deep-cushioned well-sprung automobile?

The best makers in the motor-truck field have seriously turned their attention to a genuine passenger chassis. They are realizing that longer wheelbase and longer and more flexible springs than those suitable for a freight truck are a necessity. There are differences in opinion, however, as to the distribution of the pay load. One manufacturer believes that the accepted commercial practice of carrying 80 to 90 per cent of this load on the rear axle should be used on motor-buses, whereas another maker has cut this to 65 per cent and still another to 55 per cent.

One could write a book on the subject of springs alone. There was the courageous passenger car builder who said in plain print that he would not put his name on any bus body to be mounted on a freight chassis unless his ideas as to suspension were met—an attitude not of truculence, but of sound sense and long-headed honesty. The chassis builders have learned that while hundreds of such "freight-buses" are in use, their operators change springs frequently in addition to trying a variety of shock absorbers, snubbers, pneumatic tires, cushion wheels and cushion tires, etc. All these latter auxiliary devices are helpful. But the fundamental problem lies in eliminating the short, choppy spring with its rapid period of vibration. The 20-passenger bus of one manufacturer who is building a vehicle for human beings has such long alloy-steel springs as 42-in. front and 54-in. rear. Another maker is using chrome vanadium springs of special design to meet varying loads with comfort to the passenger.

A third design, which has attracted much favorable attention, combines long (3½ in. x 62 in.) flat rear springs with rubber shock insulators at the ends. These springs are dead flat under load, perched on top of the axle, with the frame swung between them at a height of about 30 in. when 34-in. cushion or caterpillar tires are used. The advantage of a low frame is preserved by placing the body floor on the frame channels without sills or bolsters.

The rubber shock insulators between the spring ends and the frame are intended to provide a vibration-damping cushion between the axles and the frame equal to pneumatic tires. The elimination of spring shackles and bushings by simple blocks good for a year's running (say 35,000 miles) are auxiliary advantages from the upkeep standpoint. The writer has ridden on this and other types of improved suspension. He believes that if they can be made as pleasant riding at the rear as in the rest of the vehicle, the problem of suitable suspension is a good way toward solution.

Improvements in wheelbase, lower body and in suspension should not be offset by hard seating, cramped seat aisle and low roof clearances. If there is anything that the street car rider despises it is the longitudinal seat upon which comfortable riding is almost impossible. The electric railway operator's excuse was: "We need more standing room," a sentiment that is dying out with the coming of the automobile and motor-bus. The bus maker should study the seating standards of electric railways and strive to improve upon them. A seat back of 18 in., a cross-seat (for two passengers) of 33 in., seat centering of 27½ in. for ample knee room and a clear aisle of 16½ in. to 17 in. are the standards of one wise maker.

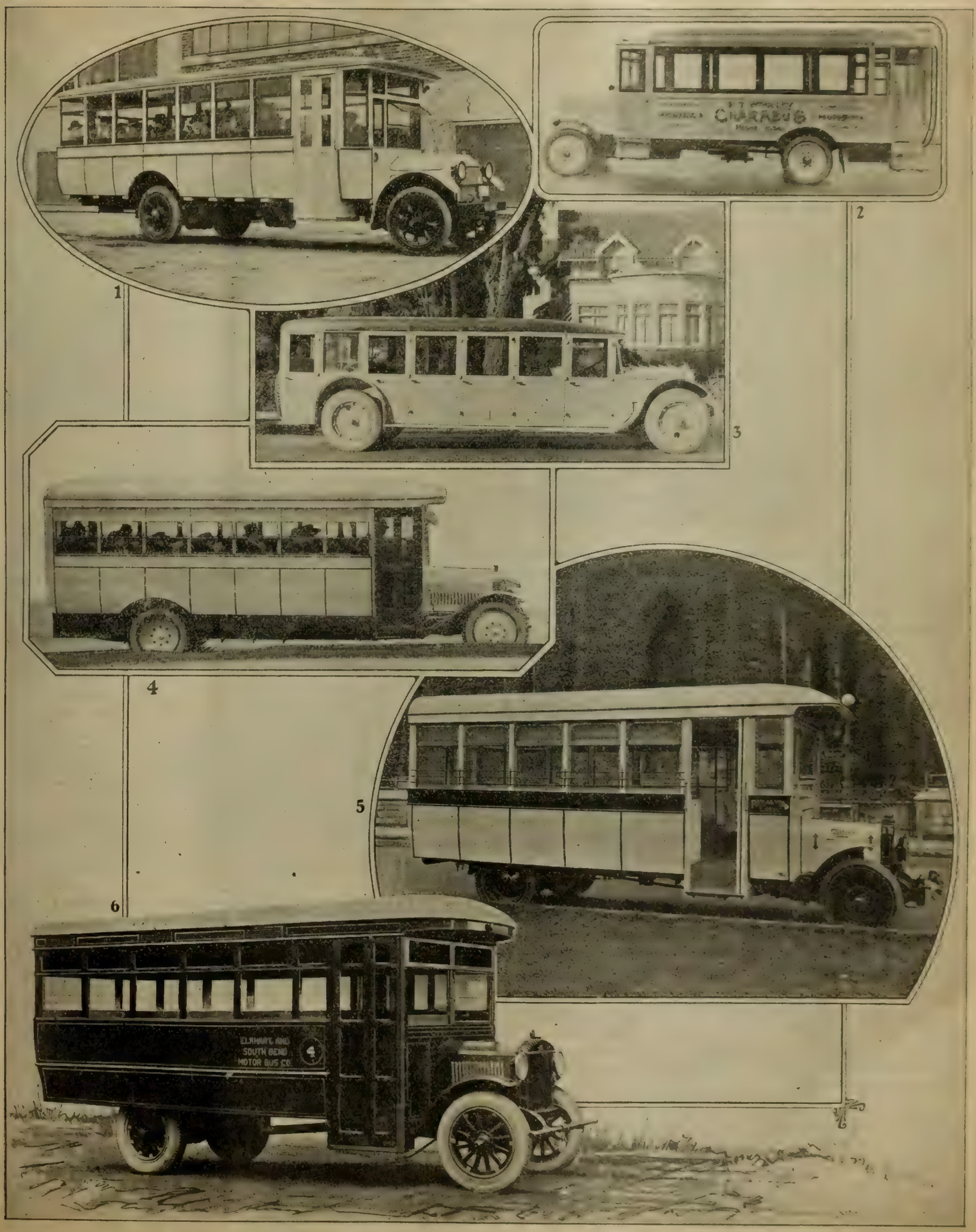
Riding Comfort Improved

SOME electric railways may cling, if they will, to the slat seat for long rides, but the progressive bus operator will not forget that there are some 10,000,000 automobiles in the United States to accustom the Americans to something better. One large builder summarizes his experience as follows:

"The trend is toward lighter, pressed-steel frames and decidedly backward tilt to the seats. The mistake has frequently been made of securing this slope by building up the cushion in front and tapering it down thin in back. This is bad because the cushion is too thin at the back where most of the weight is carried and because the seat back is not sufficiently slanted in these cases. On the other hand, very deep cushions are not desirable on account of excessive bounce, and, the springs for the same reason should be slightly stiffer than in touring car cushions. Where the buyer is willing to pay the price, compound cushions are a great advantage.

"As between rattan, leather and plush seating, rattan

The Modern Motor Bus



1—Garford. 2—Woolley Charabus (British). 3—Fageol. 4—White. 5—Masters. 6—Duplex

seems to have the preference for regular public bus service. Leather and plush are not easily cleaned and do not wear so well. Rattan—the street car favorite—is easily cleaned and is cooler in summer. Plush is universally condemned, though easiest on clothing, because it is almost impossible to keep clean and is hot in summer. Leather is in demand for de luxe buses, while long-run limousine buses are being upholstered in velour and whipcord. The latter can be covered with mohair slip covers in summer."

Better Lighting, Heating and Ventilation

THE foregoing not only expresses one maker's ideas, but those of practically all makers of the better grades of vehicles. These manufacturers report a call for better trim and finish, these demands showing the influence of the best electric railway and private automobile practices. The American public refuses to stay long without its comforts.

Aside from higher-fare bus operation, the standee must always appear during rush hours. Even the de luxe bus requires some support for the hand of the passenger walking through a moving vehicle. The street car strap, plain or celluloid, is not in such favor, however, as hand-holds on the seats and vertical enameled posts which can also serve as roof supports. The roof rails, so exasperating to the short-limbed patron, are going out.

A bus builder who has made thousands of electric cars notes that bus users are no longer satisfied with the first "scratch" schemes of lighting and heating, but want to know and follow the principles of the best electric railway practice. That isn't so easy with a self-contained vehicle as with one that has unlimited electricity at its elbow.

Almost all of the early buses were so dimly illuminated that fellow riders appeared in silhouette, and reading was out of the question. A recent study by illuminating specialists states that an intensity of 6 ft.-candles is necessary in a bus if passengers are to be able to read, the greater vibration of a bus causing eye strain, which imposes a higher intensity of light than in street cars. The minimum intensity of light acceptable is 1.5 ft.-candles. Specifically, their recommendation for a 20-ft. bus are six reflector units equipped with 21-cp. Mazdas C to give about 6 ft.-candles on the reading plane. If dome units are used in a bus of like size, eight 32 cp. lamps are suggested.

One builder (of a 23-passenger bus) provides the passenger compartment with four 32-cp. nitrogen lamps in Holophane domes plus one 32-cp. lamp in the operator's vestibule, together with step lights, dash lights and head and tail-lights.

Another builder has given up dome lights in favor of six special fixtures, each made up of a Holophane bulb and 21 cp. miniature Mazda lamp. The use of reflectors is increasing because they reduce glare and promote diffusion.

The Limousine Bus

ALTHOUGH builders may feel that they cannot yet obtain a sufficiently economical and practical lighting generator, they cannot continue the practice of having only enough battery-made light to keep the patron from dangerous stumbles. Buses that cost much less than street cars cannot attain to street car standards. In addition to body lights a real bus also will have illuminated destination signs and a safety lamp over the step.

Buses cannot use electric heating. Even an electric railway finds that too costly. Stoves are not to be thought of, but hot-water heating is a possibility. All that is available now is the direct use of the exhaust. Good results should be possible with this in a well-built bus. It would be unfair to judge exhaust heating by its alleged application in rattle-trap jitneys. As a number of companies are now making bus heaters and ventilators, which items should be considered together, we can consider the chilly and smelly bus as inexcusable as a horse-car floor littered with straw.

No matter how well constructed the motor bus may be, it can hardly be expected to give limousine comfort at bus fares. On the other hand, we have a public so well used to the luxury of the private car that we cannot lure them to long-haul rides on the highway unless we equal that luxury and go a step further by enabling people to get all the comfort of the automobile without any of the drawbacks of personal care and driving.

We are all familiar with the development of the fast road coach in California, encouraged largely by the high-grade tourist business available throughout the year. It is a different matter, however, to persuade people who own high-grade cars that they will find it preferable to make use of a public utility vehicle of equal luxury for neighborhood runs to and from town or for party excursions. Yet the time has undoubtedly come for what one correspondent has happily termed "the development of land yachts."

A specific case will bring out the writer's reason for prophesying big things in this particular part of the automotive field.

The Bus vs. the Private Car

A certain Eastern electric railway operates a number of lines usually termed inter-urban, but in this case little better than a single-track cross-country route due to the time lost in passing over the streets of intervening towns. Instead of a motor-bus operation, some independent operators conceived the idea of running an enlarged limousine at higher speed and higher prices. They built up a prosperous business. At first the electric railway thought that this traffic had been drawn from its interurban customers. Investigation disclosed the startling fact that almost all the clients of the limousine service were people who had but lately been driving into town in their own cars. The limousine service had appealed to them, especially the women, as being actually cheaper, free from parking and replenishment worries and more sociable inasmuch as they could arrange to go as a party of neighbors.

Consequently, the electric railway decided to install even finer coaches, give still better service and offer the patron the joint use of coach and car wherever each fitted best.

Now that touring in personal cars is no longer a novelty and main highways are often crowded to suffocation with private cars only partly occupied why should there not be a big field for vehicles of equal luxury, of less expense and with more efficient use of highway space?

This article would not be complete without an acknowledgment of thanks to the following firms who willingly set forth their experience to make this review of greater value than it could have been otherwise: The J. G. Brill Company, Philadelphia; Brown Body Corporation, Cleveland, Ohio; Bus Body Corporation, Evansville, Ind.; Duplex Truck Company, Lansing, Mich.; Garford Motor Truck Company, Lima, Ohio; General Motors Truck Company, Pontiac, Mich.; the James Holan Mfg. Company, Cleveland, Ohio; Hoover Body Company, York, Pa.; International Motor Company, New York; McKay Carriage Company, Grove City, Pa.; Republic Truck Sales Corporation, Alma, Mich., and The White Company, Cleveland, Ohio.

Combustion Research—An Aid to Better Performance

Detonation is the most important combustion phenomenon because of its marked effect upon engine performance, but it is not yet thoroughly understood. Factors affecting it are receiving much study. Flame propagation and related subjects are examined by various investigators.

By Herbert Chase

"IT has been proved that the tendency of a fuel to detonate is the one outstanding factor in determining its value for use in an internal combustion engine. Compared with this all other considerations are of secondary importance." This conclusion, reached by Ricardo as a result of his extensive research work for the Asiatic Petroleum Co., had been reached by C. F. Kettering and his associates at a much earlier date. It is significant, however, to have it confirmed by independent investigation, for its meaning is not even yet fully appreciated either by fuel producers and users or by the designers of apparatus, the functioning of which is greatly affected by this phenomenon.

Cylinder pressures approximating 1500 lb. per square inch have been found to result from detonation, even with moderate compression pressures. These peak pressures are thus three to four times the maximum resulting from "normal" combustion, and consequently have an important effect upon design as well as performance.

We know detonation by its effect, and several factors which control it are also known. A study of flame propagation is giving some further light on the subject, and work in this direction is proceeding in various quarters. In other places tests are in progress on explosion of gaseous mixtures and accompanying phenomena, cooling losses and heat transmission through walls of cylinders, and other factors relating to the process of combustion.

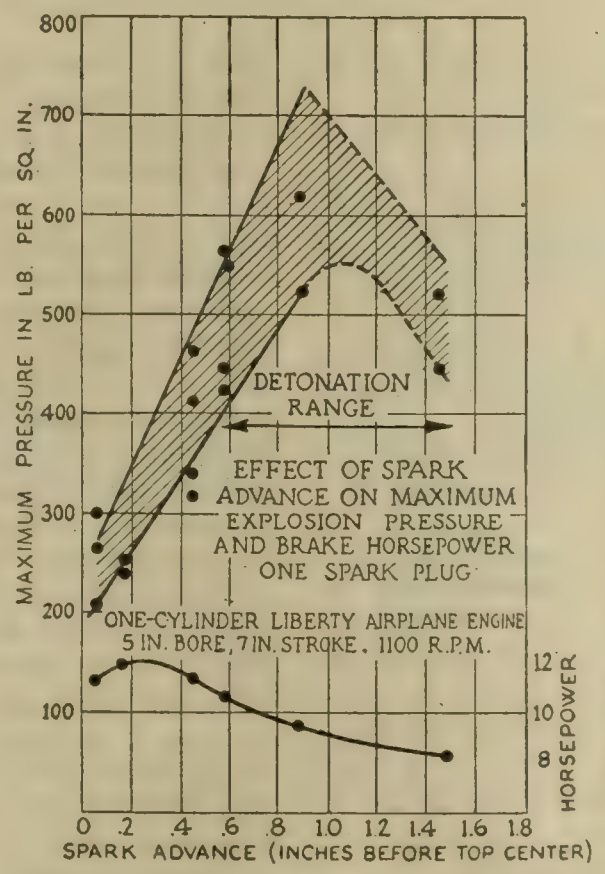


Fig. 2—Curves showing the relation between the spark timing, the maximum pressures reached in the cylinder and the power developed

We have yet to see a satisfactory definition of the term detonation as it is applied to the phenomenon otherwise known as fuel knock, pinking or pinging. We know, or think we know, a lot about this important phenomenon, but it appears to be true that its exact nature is not known. One of the best discussions of the subject is contained in an appendix to the paper on Elements of Automobile Fuel Economy, by W. S. James. The appendix was written by H. C. Dickinson, now manager of the Research Department of the Society of Automotive Engineers, and appears in the journal of the society for June, 1921.

Dickinson says that "the term detonation implies that something occurs in the cylinder which corresponds to the detonation of a high explosive. Such conditions are easily produced in explosive gas mixtures, but there is scant proof that the same thing occurs in an engine cylinder. In fact, some of the experimenters most familiar with the phenomena doubt the possibility of such occurrence.

"Fuel knock, as ordinarily understood, is characterized by the following phenomena:

1—Sharp metallic noise.
2—Bright yellow flame within the cylinder.
3—Decrease in power.
4—Increase in the heat rejected to the jacket water.
5—High instantaneous cylinder pressure.
6—Destructive mechanical effects.
7—Occurrence of smoke in the exhaust.
8—Preignition in most cases.

"Observations show that the occurrence and intensity of the knock are intimately related to the following factors: (1) Chemical composition of the fuel; (2) ignition timing; (3) compression pressures; (4) mixture ratio; (5) position and number of spark plugs; (6) shape of cylinder and piston head; (7) temperature of the charge; (8) cylinder temperatures."

Dickinson discusses the various theories advanced to explain the character of the knock phenomenon and cites experiments which show that:

1—The excess heating during knock is not localized.
2—Pressures in excess of 1300 lbs. per sq. in. were recorded in an engine with 5 to 1 compression ratio using kerosene fuel.
3—The cylinder head is distorted (in the case of a Liberty airplane engine) with sufficient velocity to cause the emission of sound.
4—Apparently fuel knock of itself does not reduce the power but rather the conditions at which the knock occurs are not those for maximum power.
5—There is strong evidence that no marked localization of pressure occurs which depends directly on spark plug location.
6—For the Liberty engine cylinder, the combustion flame must traverse the explosive mixture at a rate of at least 4500 ft. per second to produce the observed rise of pressure.

Dickinson says further, "It may be concluded that whatever the phenomenon of fuel knock may involve, the observed facts are in reasonably close agreement with the

theory that high pressures and attendant phenomena are the result of an abnormal type of combustion.

Ricardo states that the phenomenon of detonation appears to be the setting-up in the cylinder of an explosion wave that strikes the wall of the cylinder with a hammer-like blow.

Ricardo at one time believed that turbulence had an important influence upon the tendency to detonate, but has since learned, as a result of further research work, that he was mistaken in this belief. It was supposed, until recently, that detonation is dependent upon the temperature of compression. Ricardo, Sparrow and others have recently shown that detonation has little connection with the temperature of compression, but is closely dependent upon compression pressure.

Tizard, who has collaborated with Ricardo in his work, has reached the following significant conclusions regarding the detonation phenomenon:

1—It depends primarily upon the rate of burning of that portion of the charge first ignited.

2—The rate of burning increases rapidly with slight increase of flame temperature.

3—The rate of burning of the first portion of the charge depends, so far as practical engine conditions are concerned, upon neither the temperature nor the pressure of compression, but rather upon the flame temperature.

4—For any given mixture strength the maximum flame temperature depends primarily upon the proportion of diluent or exhaust products present.

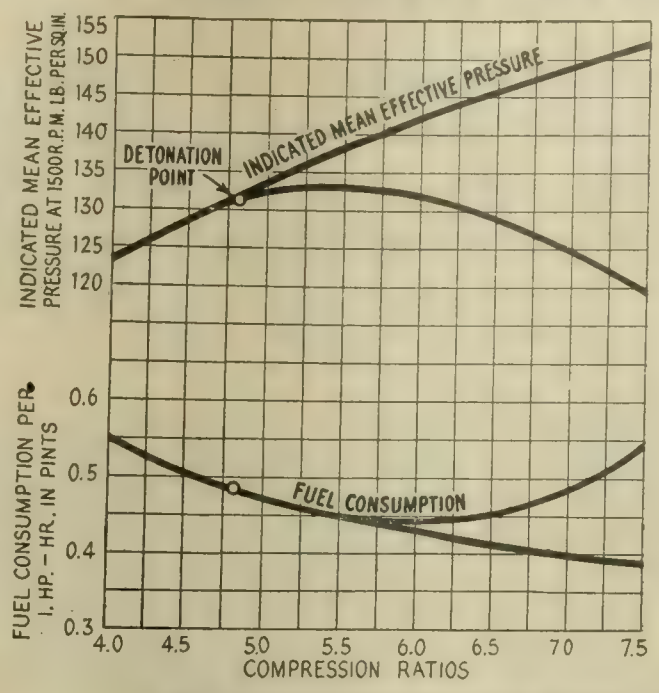
5—If the flame temperature be reduced by weakening the mixture strength a very much higher compression could be used.

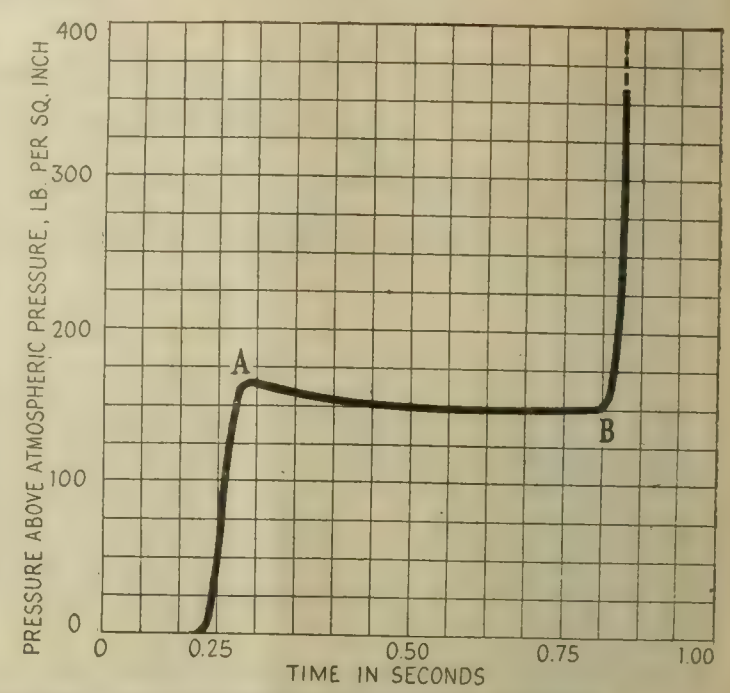
The foregoing statements of Ricardo and Tizard are taken from a paper entitled "Recent Research Work on the Internal Combustion Engine," presented by Ricardo at the last annual meeting of the S. A. E. In concluding his statements regarding detonation, Ricardo says, "Broadly speaking, it would appear from our experience that two factors determine whether or not a fuel will detonate. These are (a) the self-ignition temperature of the fuel-air mixture, and (b) the rate of acceleration of burning as the ignition temperature is exceeded.

"As a broad generalization, our experiments confirmed that, as regards groups, the paraffins are the worst offenders from the viewpoint of detonation, the naphthenes are better, the olefins better still, the aromatics next and the alcohols the best of all."

Effects of Diluents Upon Detonation

It has generally been believed that, in the conventional type of engine, the exhaust products remaining in the clearance space at the end of the exhaust stroke are a necessary evil. It was supposed that if these products could be replaced by air a much improved performance would result. Tests made by Ricardo indicate that quite the reverse is true. It was found that when residual exhaust products had been cleared away by scavenging with air, detonation became severe at once even with very low compression pressures. When additional exhaust products were added by way of the carbureter it was found that the compression could be raised to almost any degree, depending upon the quantity of exhaust gas admitted. "Other tests using nitrogen, steam and carbon dioxide gave similar results. The effectiveness of such inert gases appears to be closely proportional to their specific heats; that is, to their direct influence upon flame temperature." Fig. 1 shows the variation in compression ratios permissible when, to gasoline detonating normally at a compression ratio of 4.85 to 1, varying quantities additional exhaust products were added and the compression adjusted in each case until detonation just became apparent.





(Left) Fig. 1—Indicated mean effective pressure and fuel-consumption curves obtained by adding varying quantities of additional exhaust-products to the charge. (Right) Fig. 3—Curve showing rate of pressure variation following ignition at A

According to Woodbury, Lewis and Canby,* "there is a certain necessary distance of flame travel from ignition to the point at which detonation is set up, and that the distance is increased by the pressure of diluent gases, even excess oxygen. In the engine the explosion chamber is of very small dimensions and the atmosphere is air diluted with from 10 to 25 per cent of the products of combustion. The possibility of detonation under such conditions appears exceedingly remote."

Some work is in process at Ohio State University, under the supervision of Prof. C. A. Norman, with a view to determining the temperatures reached and the rapidity of combustion under knocking and non-knocking conditions in a single-cylinder engine. Indicator diagrams are taken with a Midgley indicator and these diagrams are replotted on an entropy chart. The results of this work have not yet been published.

S. W. Sparrow, who has been in immediate charge of investigations relating to detonation at the Bureau of Standards, has given considerable study to the cause of this phenomenon. Some conclusions which he has reached in this regard are given in a paper entitled "Detonation—A Consideration of Its Causes," published in these columns on May 4, 1922. For full particulars in this connection the reader should refer to the paper in question. It is interesting to note, however, that the degree of spark advance has a marked effect upon detonation. An engine which is detonating violently with a given spark advance ceases to detonate if the spark is either advanced or retarded a sufficient amount. This is made clear by reference to the diagram in Fig. 2, which is the result of work done by Sparrow.

Ricardo states that the spark plugs should be as near

*See paper entitled The Nature of Flame Movement in a Closed Cylinder, *S. A. E. Journal*, March, 1921.

as possible to the center of the combustion space in order to reduce as far as possible the distance the flame has to travel. If the gases must be ignited from one side of the combustion chamber, he says, the plug should be placed on the hottest side, or the side that is nearest the exhaust valve.

Detonation appears always to be accompanied by a high rate of combustion if, indeed, it is not the direct result of this rate. The velocity of the flame which accompanies combustion is known to accelerate rapidly during the early stages of combustion and finally to reach a very rapid but constant velocity, known as the detonation velocity. Ricardo reached the conclusion that a low rate of combustion is advantageous and that "detonation is less the lower the rate of burning of the fuel." "No fuel has yet been found," he says, "whose rate of burning was too low to permit of maximum efficiency being attained in the highest speed engine yet tested." His work also tended to show that the performance of any combination of hydrocarbons as regards detonation is the mean performance of each of the components.

A very recent report, prepared as a result of research work done on behalf of the (British) Empire Motor Fuels Committee, by W. R. Ormandy, states that there was no evidence that the rate of combustion of 95 per cent alcohol in the engine tested was too slow to obtain the maximum effect—meaning, presumably, maximum power and economy.

Concerning the Efficacy of Dopes

THE General Motors Research Laboratory has for several years been studying the effect of various diluents, often referred to as "dopes," which have a tendency to prevent detonation. Several such substances are understood to have been found, some of them being effective when added to the fuel in proportions 2 per cent or less. It has been the hope of those directly concerned in this work that some substance contained in or easily derivable from crude petroleum would be found which could be readily blended with all gasoline sold by refiners in this country, thus enabling the use of higher compression engines and much greater fuel economy than is now obtained in most automotive vehicles. Kettering and Midgley have discussed the subject in several talks presented before the Society of Automotive Engineers and other organizations. So far as we are aware, no substance commercially available or readily produceable in quantities sufficient to treat any considerable proportion of the fuel produced in this country has yet been found which meets the required conditions.

Ricardo says, summarizing the result of his work, that "no increase in power or efficiency has been found or need be expected from the use of 'dopes,'" a large number of which he tested, but he fails to define the term "dope." If any of the fuels he tested are to be regarded as dopes, it can be assumed by inference from his reports that they are effective only in proportion to their quantity and non-detonating value.

That the tendency of the fuel to detonate is of importance to the refiner as well as to the user of fuels is indicated by the fact that fuels with a less tendency to detonate have been successfully marketed in this country as well as abroad in competition with gasoline at a lower price. In other words, the difference is sufficiently great to be easily distinguished and appreciated by an intelligent user. As a direct result of Ricardo's work, the Shell Marketing Co. has determined to maintain in its fuel a certain anti-knocking standard. Because of the tendency of the aromatic series to prevent knocking, Ricardo concludes that any specifications for a motor fuel should be so drawn as to encourage the inclusion of as large a proportion of the aromatic series naturally present in the crude petroleum as possible.

Flame Propagation

THE subject of flame propagation may seem at first thought to be one of purely academic interest, but that it is a matter of great importance will become apparent to any engineer who gives it careful study. Much careful research work has already been done in this field, and other important work is continuing. Among those who have done important work in this connection may be mentioned Prof. Harold B. Dixon, H. R. Ricardo, various investigators at the Bureau of Standards* and Woodbury, Lewis and Canby of the E. I. duPont deNemours & Co., who have been co-operating with the General Motors Research Laboratory. Among the conclusions reached by the last-mentioned investigators are the following:

> It has been shown that in the case of acetylene-air mixtures ignited at atmospheric temperature and pressure the maximum volecity of flame movement is obtained with that mixture corresponding closely to the theoretical proportion for the formation of carbon monoxide.
>
> It has been substantiated that first record of pressure development occurs after an appreciable distance of flame travel, and that the instant of maximum pressure development coincides with that of total inflammation of the gas charge.
>
> A theory has been presented that the arrest occurring in mixtures fired without turbulence, and the consequent vibrations noted in the burning gases, are due essentially to the high density developed in the gases ahead of the flame front.
>
> It has been confirmed that turbulence greatly accelerates flame propagation, and it has been shown that turbulence changes the character of the flame travel by the elimination of sudden arrest and vibratory movement.
>
> Within the limits of the experiments carried out it was found that increased temperature and pressure have little effect upon the rate of flame propagation.
>
> The initiation of a detonation has been found possible at atmospheric conditions and in a closed cylinder of 12-in. length only by the use of relatively high concentrations of acetylene and a thorough enrichment of the atmosphere with oxygen.
>
> Preliminary results have been presented which indicate that high temperature inhibits the initiation of the detonation.
>
> It has been shown that autoignition of the high-density

*See AUTOMOTIVE INDUSTRIES for April 7, 1921, p. 754, for particulars as to methods followed in tests relating to flame propagation at the Bureau of Standards.

The Effect of Turbulence

IT appears now to be clearly established that the normal rate of burning of a fuel-air mixture is, at the start, far too slow to be of any value; however, its acceleration after a certain stage is extremely rapid.

It is probably in speeding-up the initial stages of combustion by spreading mechanically the pale and timid flame brought into life by the spark-plug, that turbulence plays its most important part, and this becomes most conspicuous when operating with weak mixtures.

H. R. RICARDO.

Mixture Ratio for Power and Economy

FOR present types of automobile engine the maximum power is obtained with air-fuel ratios of from 11 to 1 to 13 to 1 and the maximum efficiency at ratios in the neighborhood of 16 to 1, if the engine will operate regularly with such mixtures.

Where dilution by the products of combustion necessitates richer mixtures the maximum efficiency is attained with the leanest mixture at which the engine will operate regularly.

S. W. SPARROW.

gases ahead of the flame front occurs over a wide range of mixtures and conditions and that it is especially favored by high temperature and pressure.

A theory has been advanced that autoignition of the high-density gases ahead of the flame front is accountable for the fuel knock.

A record of some of Dixon's works appears in a paper entitled "Researches on Alcohol as a Fuel for Internal Combustion Engines," which was published in AUTOMOTIVE INDUSTRIES for Feb. 3, 1921. This paper is not confined to research on alcohol, but, under the heading "Movements of Flame Through Explosive Mixtures," gives a general treatment of that important subject. We shall not here attempt to summarize researches relating to flame propagation, but will mention certain items which appear of special importance to the automotive industry.

It appears to be practically a universal conclusion of investigators in this field that the ignition of a volume of gas at one point does not result in immediate combustion throughout the whole volume. The flame starts slowly at first, and the evolution of heat may at first be less rapid than its dissipation to the walls of the containing cylinder, with the result that the pressure may actually fall for a brief period while the flame is slowly spreading. A sudden increase in the rapidity of combustion is then noticed and this is accompanied by a sudden rise in pressure, which is readily recorded by an indicator.

Pressure Rise During Combustion

IN Ricardo's research work he built a machine for igniting air-fuel mixtures by adiabatic compression. This consisted of a piston arranged in a cylinder in such a way that the gases were rapidly compressed up to the temperature of ignition. At this point the piston was locked so that combustion proceeded at practically constant volume. The curve of pressure rise in one case is given in Fig. 3. It will be noted that combustion proceeds at almost constant pressure from A to B, but at B a very sudden rise in pressure occurs. This curve was made with a mixture of heptaine and air. It is interesting to note that in the particular case covered by Fig. 3 the combustion at constant pressure continues for a period of over one-half second. The interval of slow burning was found to depend to a considerable degree upon temperature. Raising the temperature even a few degrees would sometimes materially shorten the interval of combustion at constant pressure. Variation in the degree of turbulence also varied the period of burning at constant pressure.

Prof. C. A. Norman is engaged in making some determinations as to the rate of combustion and the temperature attained under knocking and non-knocking conditions. He is also investigating, by the use of indicator cards and the entropy diagram, the rate of combustion in Diesel engines with various types of injection. Reports of recent tests in this connection have not yet been published, but Norman states that he has not yet found a solid injection engine in which the combustion proceeds as rapidly as in engines using injection air. He says, "The temperatures in the solid injection engine do not attain the same peaks as with air injection, but are much more sustained. New systems of solid injection are, however, being constantly developed, and some show a more rapid combustion than others."

The Process of Combustion

THE National Advisory Committee for Aeronautics is having conducted at the Bureau of Standards an investigation, the purpose of which is to secure information regarding the process of combustion of various fuels. Three methods are being followed: (1) An investigation as to the rate of combustion of explosive mixtures of air and fuel in spherical constant pressure bombs (soap bubbles), long tubes or cylinders and constant volume bombs; (2) an investigation of the effect of substituting carbon dioxide and water vapor for nitrogen in the air, on the rates of combustion, in similar apparatus, the work to include investigation of the effect of dissociation of the products of combustion on the rates of combustion; (3) an investigation in similar apparatus of the effect of changes in the initial temperature and pressure of the explosive mixture on the rates of combustion.

Effect of Temperature

SEVERAL hundred observations have been made of flame velocity of mixtures of carbon monoxide and oxygen in ignitable proportions, using the Bunsen-Gouy method at temperatures from + 20 to + 100 deg. Cent. The results show that small changes in initial temperature do not greatly affect the flame velocity. It is planned to extend the temperature range from about — 20 to + 200 deg. Cent., and the pressure range from about three atmospheres to one-third atmosphere. The work will be continued with carbon monoxide because of the simplicity of its reaction and to make possible the interpretation of reactions of more complex substances.

The National Advisory Committee for Aeronautics also has in hand an investigation into the performance of gasoline, alcohol and benzol and mixtures of these fuels in an engine cylinder when various ratios of compression and expansion are used.

Prof. L. A. Leutwiler of the University of Illinois is engaged in making an investigation into the explosion of gaseous mixtures. This investigation includes a study of the phenomenon of the dissociation of gases during explosion and of the combustion of liquid fuels in a closed vessel. The methods being followed and the results obtained have not yet been made public.

Prof. C. E. Lucke of Columbia University has in hand an investigation of the subject of heat transmission through cylinder walls and its relation to air and water cooling. The General Motors Research Corp. is known to be conducting investigations along similar lines, but, as in the case with the work of Professor Lucke, results have not yet been published.

Ricardo states that the unavoidable losses due to dissociation and change of specific heat at high temperatures are substantially the same for all of the fuels which he tested.

America Makes Creditable Showing in Aircraft Research

Airplane speed and reliability increased. Development made in helicopters. Research with variable pitch propellers brings results. Europe leads in landing field development. Handley Page slotted wing important feature of aerodynamic research. Insurance and accident studies in progress.

By Archibald Black

INCREASED activity has been witnessed in aeronautical research and investigation during the past year or two, although military construction was greatly decreased. The United States made a very creditable showing in practically all branches of this work and took the lead in some. Airplane speeds of nearly 200 miles per hour, duration records of over 26 hours and altitudes of over 40,000 feet became facts during the past few months. The much heralded Handley Page wing has been built into some full-sized machines and is credited with a "take-off" run of as little as 30 ft.

Helicopters have been constructed which rose under their own power and remained in the air, under control, for periods of an hour, while flights of almost 22 minutes have been made with motorless gliders. The reliability of aircraft engines (from the viewpoint of mileage) has been increased beyond all comparison with other types of internal combustion engines and superchargers have passed the experimental stage. A recently developed system, the Loth cable, enables the aircraft pilot to determine not only his location, but also his height above the ground without visibility.

Commercial operation of airships has been at a standstill, but commercial aviation has obtained a footing in at least seven countries throughout the world.

IN a field of activity, such as that of aeronautics, which is yet in its embryo stages, it is difficult to differentiate sharply between research, investigation and general development. Broadly speaking, all commercial and some military aircraft activity may, as yet, be classed as research and investigation. Consequently the scope of this résumé includes references to activities which in another field would be classed as general development.

Airplanes

Development and refinement of airplanes has continued steadily and is reflected in the constant pushing up to higher notches of the various records. Speeds of close to 200 miles per hour have been attained both here and in Europe, England and France being slightly in the lead. Some speeds in excess of this have been claimed, but the performances have not been fully authenticated. A duration record of 26 hours, 19½ minutes was recently established in the United States by a German machine with American pilots. Through the use of superchargers the altitude record has been steadily raised until it now stands at 40,800 feet, the record established by an American pilot with American equipment. We may be proud of this achievement.

Work on metal construction has been continued, the United States showing considerable, though belated, activity in this field during the past couple of years. Both steel and duralumin are being used here and abroad. Zeppelin and Dornier in Germany produced some very notable developments in duralumin wings, fuselages and floats. A French firm, Wibault, produced a night bombing machine of very good performance, using duralumin construction in the wings and bringing the wing weight below the weight of wood construction. The construction of duralumin floats, which has been successful in Germany, is now being attempted here. The general lines of development have been in improving streamlining, decreasing the number of struts, the use of thick wing curves and increased use of metal construction. The carrying capacity of commercial airplanes per horsepower has steadily increased, thus decreasing their cost of operation. The latest commercial machines are designed to carry loads up to 4.45 pounds of freight per horsepower, or one passenger for each 45 horsepower, while attaining 105 to 110 miles per hour and 3½ to 4 hours' duration. The importance of this is better appreciated if it is considered that such loads are about **five times** the freight and **five to ten times** the passengers that can be carried by a converted military airplane.

Among the notable developments in and near this class were the DH-34, Bristol ten-seater, Handasyde monoplane, Handley Page 25-passenger, Wibault 2-BN-2, Bleriot-Spad, Dornier-Zeppelin, Fokker and Curtiss single engined "Eagle." As notable developments in speed machines there might be mentioned the Gloucestershire "Camel," Curtiss "Wildcat" and Navy Racer, Nieuport-Delage "Sesquiplane," Hanriot HD-22 and the Savoia, a seaplane for which a speed of 160 miles per hour has been claimed. Among machines of particular interest for other features were the Handley Page slotted wing machines; the Zeppelin-Staaken 1000 horsepower passenger airplane, an internally braced monoplane of duralumin, with four engines mounted in the



Fig. 1—Curtiss CT Torpedoplane

wings; the Dornier "Whale," a nine-passenger, all-metal, monoplane flying boat; the Dornier monoplane, cabin flying boat, which makes use of fins instead of wing floats for balancing on the surface of the water; the GAX triplane, an American machine with armored engines and fuselages; the Curtiss-Navy torpedoplane, an internally braced wood monoplane; the Tampier automobile-airplane, a machine equipped with an auxiliary 10-horsepower engine and which can be operated as an automobile by folding the wings and dropping its automobile running gear.

There might also be mentioned the Marcel Besson quadruplane, a four-plane flying boat with an unusual wing arrangement; the Loening boat, a novel type of flying boat with very good performance, and the dePischoff "Avionette," a small machine which flies with a 20-horsepower engine. The Burnelli "Airliner," while flown many times, has not yet proved its worth, but is of interest on account of the use of a very wide streamlined fuselage housing the two engines and a most commodious cabin. The Caproni 100-passenger triplane, while a failure, is interesting on account of its novel arrangement of three sets of triplane wings set behind each other and on slightly different levels. While the arrangement is inefficient, it is conceivable that some modification may be of value later in solving the problems of construction of very large machines.

The Handley Page torpedo-carrying machine may be rated as one of the most interesting developments of the year past. This is an experimental machine embodying the widely advertised Handley Page slotted wing. It showed in a startling manner what this wing can do in the way of lowering landing speeds.

While the machine is surrounded with considerable secrecy, presumably authentic reports state that it took off in a slight head wind (the velocity not stated) in a distance of about 30 feet and landed vertically in the same wind. The slots were, of course, open during take off and landing. The performance of this machine, assuming the report to be correct, certainly makes the value of the helicopter rather questionable.

Airships

Development in this branch of the aircraft industry has not been very active during the past year. The most notable advance is probably the Goodyear military airship, with its novel propelling mechanism (described elsewhere) and generally clean lines. Preliminary tests showed a high speed of 63 miles per hour, exceptionally good performance for a non-rigid airship. An American non-rigid, inflated with helium, is being experimented with. The U. S. Air Service has developed a portable mooring mast for small airships and the British conducted some experiments on the making of repairs to rigid airships while moored to a mast. These experiments have been very successful to date. In one of the British tests a rigid airship rode out a wind of forty-eight miles per hour. The Bureau of Standards is now conducting tests of wind screens for airship hangars with the object of reducing eddy currents.

Extensive plans for operation, with government support, of the British airships on commercial lines were made and one military rigid was converted to a passenger ship. Difficulty is being experienced in finding capital willing to assume the risk, but the indications are that the plans will eventually bear fruit. The accident to the R-38 last year showed the necessity of further investigation of stresses in rigid airships, and both the British and the U. S. Navy are giving consideration to this work.

Helicopters

The past few years have witnessed the return of attention to this type of aircraft and considerable activity existed throughout the world in the development of machines. A number of helicopters have been built which rose and remained in the air for short periods, some up to one hour, under control. Notable among the machines constructed and tested were the Pateras-Pescara, Karman, Damblanc, Oehmichen-Peugeot, Cooper-Hewitt, Brennan and the Berliner. The machines experimented with varied greatly in design, some being little more than propeller-type mechanisms, others had airplane fuselages with lifting screws mounted thereon, while still others were practically rotating wings. Up to date the work has been entirely on helicopters of possible military value. No promise of commercial uses has been noted.

Soaring Flight

Marked advances in soaring flight experiments have recently been made, activities in this field having been largely but not entirely confined to Germany. With development work on military types restricted by the terms of the peace treaty, German engineers gave considerable attention to experiments with man-carrying gliders.

Under the supervision of a central organization, and sponsored by many leading German aeronautical engineers, continued progress has been made in the length, duration and safety of flights. In September of 1921 Harth, a German experimenter, rose from a standstill and without assistance, in a motorless machine, flew and maneuvered under control for a period of 21 minutes and 37 seconds. During this flight he attained an altitude of about 200 feet above his starting point, finally landing at a point about 40 feet below the point of take-off.

Gliding, or soaring as they might be called, competi-

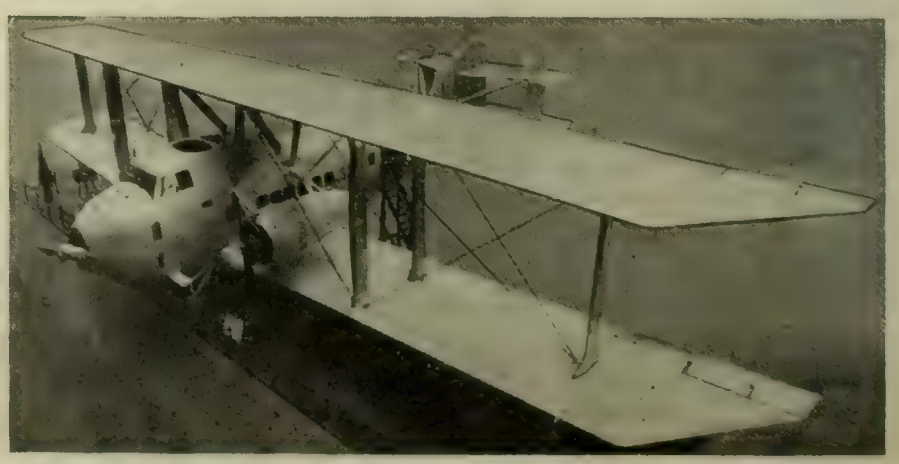


Fig. 2—Latecoere LAT4 commercial

tions have been held periodically. The interest taken in these is reflected by the numbers of machines entered, some forty types having been entered in the Rhoen competition of last year. The machines ranged from birdlike types of radical construction to those following conventional airplane design. The most successful machines have followed conventional lines, at least in their general appearance. The most striking feature in the construction of the successful machines is undoubtedly the extremely low weight of their structure. The "Aachen" soaring machine, a thick wing type suggestive of the Junker monoplane, has internally braced wings of plywood covered with fabric which weigh about one-third of a pound per square foot. This is about one-third to one-fourth of the weight of the wings of small airplanes.



Fig. 4—Dornier "Dolphin" 6-passenger. (Note the balancing fins)

Three of the most successful German soaring machines, the Aachen, Bavaria and Harth, show the following average characteristics: Span, 33.33 feet; area, 163.0 sq. ft.; weight, empty, 131 pounds; weight, per square foot fully loaded, about 1.85 pounds. The success of the German experiments has created interest in other countries and the near future may be expected to show further progress in this field.

Engines

Development of larger engines, both air and water-cooled, has been steadily carried on. Water-cooled engines developing over 1000 horsepower have been built and tested, while one air-cooled engine rated at 1000 horsepower is understood to have been built experimentally. A general tendency toward larger engines, both here and abroad, is very marked, the increase in horsepower of air-cooled engines being the more noticeable. Attention has been given to the dirigible engine problem, and one American firm, Wright Aeronautical Corporation, recently developed a 400-horsepower dirigible engine with the unusually large bore of 7 inches. One American manufacturer is experimenting with an engine of the barrel type, having the cylinders parallel to the shaft. Through careful redesigning and refinement the economy and reliability of engines has steadily been improved. One American engine, the Aeromarine U-8-D, recently passed a 300-hour test run for the Navy, six times the customary acceptance test.

The development of superchargers has also been steadily continued and these have been brought to the point where they have thoroughly demonstrated their value. Certain airplanes are now being designed around engines equipped with superchargers. The Moss supercharger is practically out of the experimental stage and was instrumental in establishing the world's altitude record of 40,800 feet during the past year.



Fig. 3—Aachen Glider

The National Advisory Committee for Aeronautics is now conducting a series of tests of two other types of supercharger compressors, a positive displacement and a fan type, with the object of obtaining further improvement in performance and reduction of weight. As this work stands at present, engine power can be maintained within about 11 per cent of sea level power up to an altitude of 16,000 feet. This compares with a loss of about 50 to 55 per cent for the engine without supercharger.

Work on supercharging engines has also been carried on in Europe, particularly in France and Germany, although the United States is in the lead if altitudes attained may be taken as a criterion. The Rateau, a turbine type, upon which work was started in 1916, has been in experimental operation for the past few years and three sizes have been developed. Several German makes of superchargers, notably the Brown, Boveri & Co.; A. E. G. and Siemens-Shuckert, have been developed and operated satisfactorily.

Fuel Utilization

The National Advisory Committee, in conjunction with the Bureau of Standards, conducted numerous studies of flame propagation from which much has been learned. This work is being continued and its field extended. Experiments have also been conducted by this committee on a single cylinder Liberty engine converted for operation on fuel oil by direct injection. Experimental fuel spray nozzles and photographic apparatus for studying the tests have been developed and some experimental runs made using different fuel pumps and pistons.

A single cylinder test engine, specially designed for direct injection, has recently been constructed and will be used for extensive tests at an early date. This special engine is provided with means for varying valve timing, compression ratio and valve lift during operation. The results of the tests up to date have been very promising but it is yet too early in the experiments to form any conclusions. Some similar experimental work on direct injection is also being carried out in England.

In the course of investigation of carburetion problems, at the Bureau of Standards, a discovery was made which threw some light on hitherto unexplained engine failures. It was noted that formation of snow took place in the intake manifold, under certain atmospheric conditions, resulting in erratic performance of the engine.

Studies of accessories have been carried on and some attention has been given to engine fuel pumps designed to feed directly to the carbureter without the use of a gravity tank. At least two types have been developed and are operating more or less satisfactorily. Very little has been



Fig. 5—Tampier automobile airplane. (Note the automobile running gear in rear)



Fig. 6—Wibault 2Bn2 all-metal night bomber

done on further development of engine starters in the past year, although considerable activity took place in the years preceding. Apparently the starter situation is considered to be sufficiently advanced for the time being and further work rather discouraged until the rapid development of larger engines slows up. In addition, the satisfactory performance of hand magneto starter systems also tends to discourage additional work on mechanical or electromechanical starters. Then in many cases hand cranks are all that is necessary. Flight and laboratory tests of radiators have been continued and the general fund of information increased thereby. This work has now advanced to the stage where radiator performance can be predicted with considerable accuracy.

The most important work in the propeller field can probably be said to be the recent developments in variable pitch propellers. This work has been carried on both here and abroad. Noteworthy developments are the Hart (American), Paragon (American), Chauviere (French), Levasseur (French), as well as some Italian and German developments. Each of these designs has been proven more or less satisfactory and the variable pitch propeller problem may be said to be very close to complete solution. Although wooden blades, set in metal sockets, were used in most cases, some of the variable pitch propellers developed were constructed wholly of metal.

Investigation of materials other than wood for propeller construction has been carried on to quite some extent both in this country and in Europe. Propellers built of Micarta have now been developed to the point where they are of practical value. Propellers of steel and other materials are also being experimented with here and abroad, but are still in the experimental stages, with the possible exception of the Haw, steel reinforced, propeller.

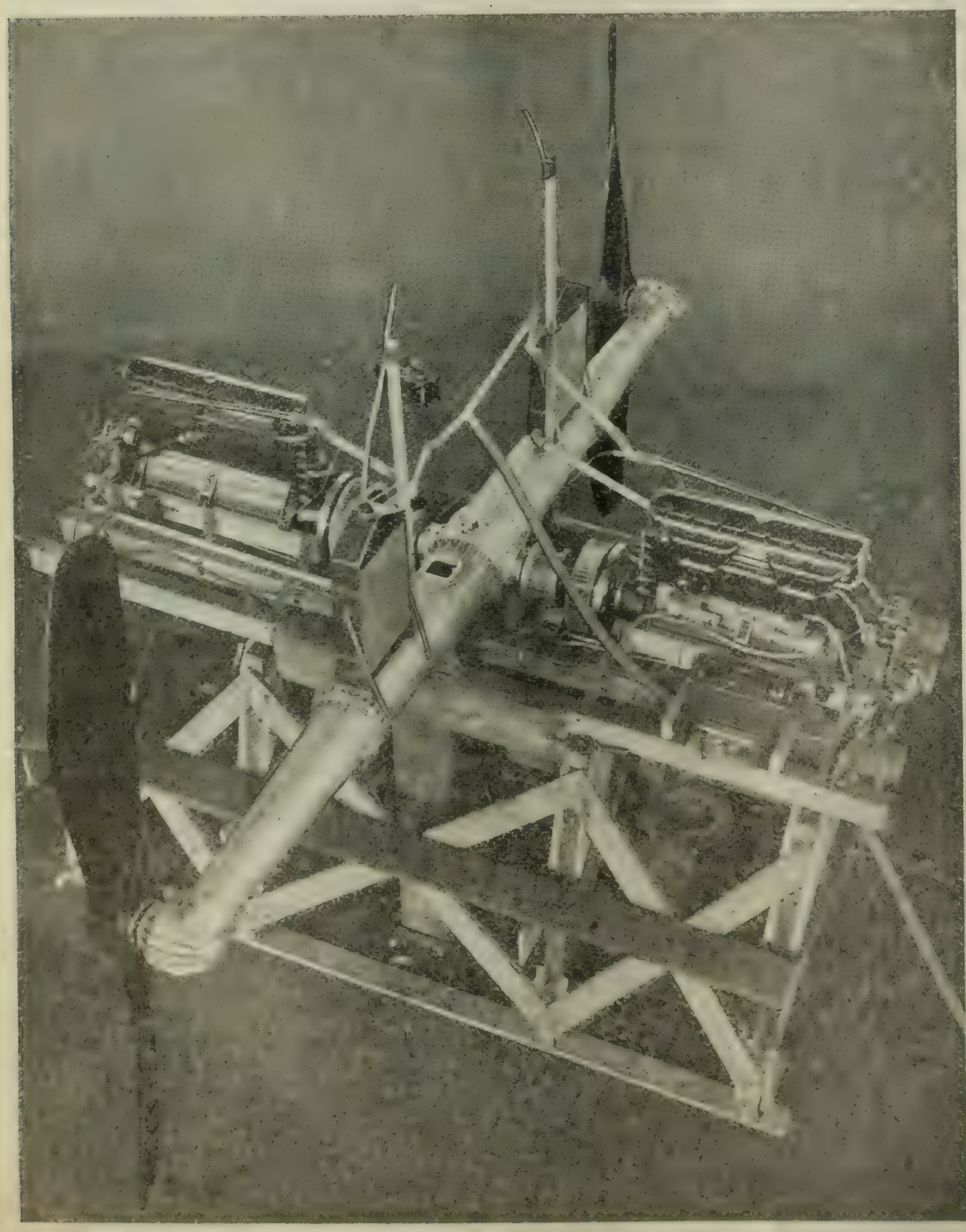


Fig. 7—Goodyear airship transmission

Instruments

Developments in the aircraft instrument field have chiefly been along the lines of refinement. Some new types and some important improvements in existing types have, however, been made. One American firm, Pioneer Instrument Company, placed on the market a novel type of gasoline gage, using a float and cord instead of the customary float and arm or screw. The dropping of the float, as the tank empties, unwinds the cord which, in turn, rotates the indicator needle. A new type of instrument, the "Flight indicator," consisting of a combined banking and turn indicator, was developed and marketed by two American and one French firms.

Air speed indicators of two new types have been developed, one for dirigible use, reading low speeds, the other for high-speed airplanes, reading up to 250 miles per hour. The Pioneer Company also developed a rate of climb indicator. A gyroscopic

sextant for aircraft use was developed in France, while the Bureau of Standards here developed a drift indicator of the optical type. The Bureau of Standards also developed an altimeter with automatic compensation for temperature changes, a rate of climb recorder and an angle of incidence recorder for test flight purposes. The National Advisory Committee for Aeronautics developed some special test apparatus for their free flight tests, notably a multiple recording manometer and a recording air speed indicator.

Aerial Cameras and Photography

Aerial photography has undergone great development recently, and this field of use for aircraft promises to expand rapidly. An American firm, the Fairchild Aerial Camera Corporation, contributed largely to this through the development of an advanced type of automatic camera, and there has also been considerable activity in France and Germany. The Fairchild camera is controlled by an electric timing device which regulates the interval between the exposures to accord with the speed of the airplane. The individual photographs are thus spaced equal distances apart along the line of flight. This greatly increases the accuracy of the mosaic map and simplifies the work of building it up from the separate prints.

The importance of recent developments in this art is evidenced by the photographic mapping of the City of New York, from the Battery to Van Cortlandt Park, in a single flight of 69 minutes. The Dayton Wright Company developed a special type of airplane for photographic work. This machine has a fuselage of the closed type with windows on all sides, top and bottom to facilitate photographing from any position. A dark room is also provided so that cameras or plate holders may be loaded during flight or plates developed from time to time to check the progress of the work.

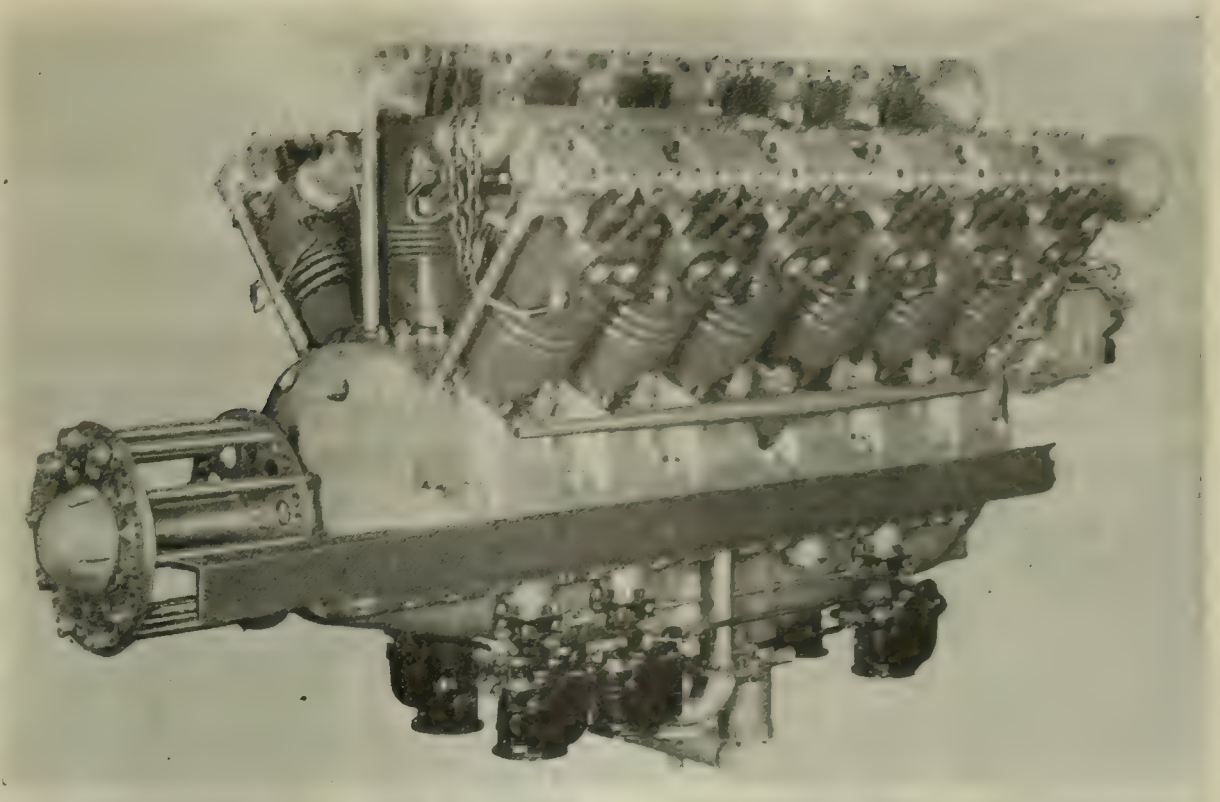


Fig. 8—U. S. Air Service Model "W" 700-hp. engine

Landing Fields and Airways

Landing field engineering and the development of airways has been given some attention of late, although this phase of activity still lags behind others of the industry. One of the constructive steps, in this country, has been the publication, starting November of 1920, by the Hydrographic Office of the Navy, of a "Notice to Aviators." This publication is issued monthly, widely distributed, and each issue contains descriptive matter, collected from various sources, regarding aircraft landing fields throughout the country. At the same time, the Air Service, continuing the work which it started at the close of the war, has been studying and mapping terrain and emergency landing conditions over the country.

As a result, a valuable fund of information on landing

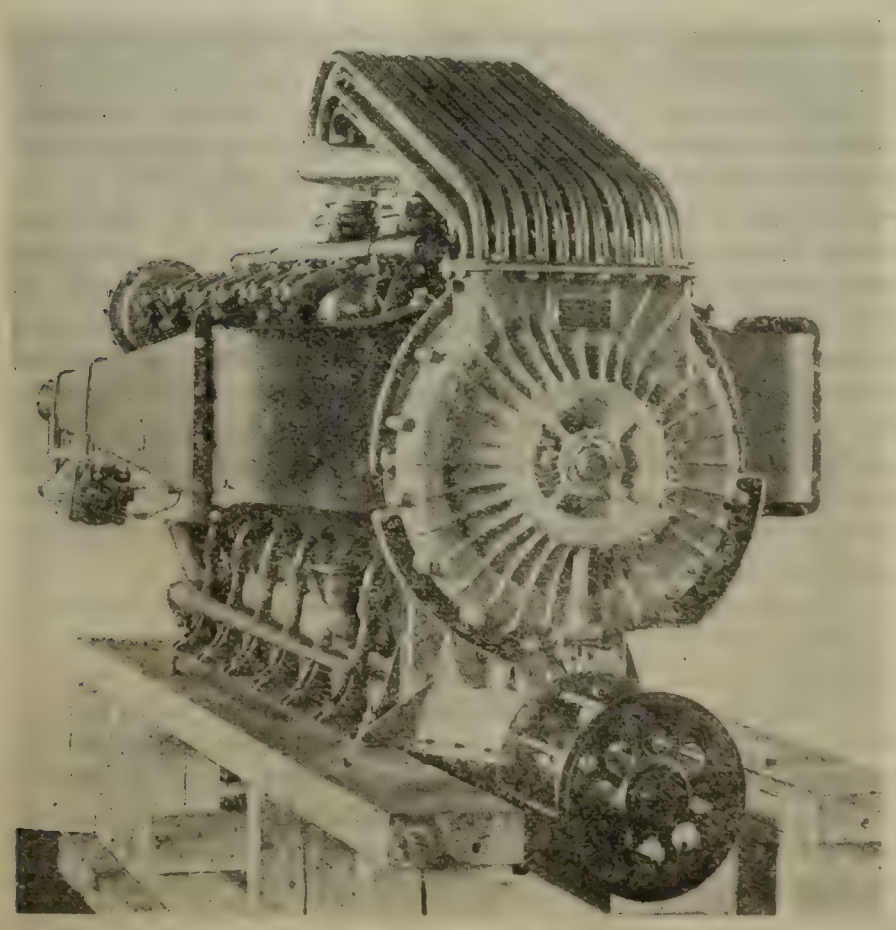


Fig. 9—Liberty-12 engine with G.E. (Moss) supercharger



Fig. 10—Gallaudet 1200-hp. drive, using three Liberty engines

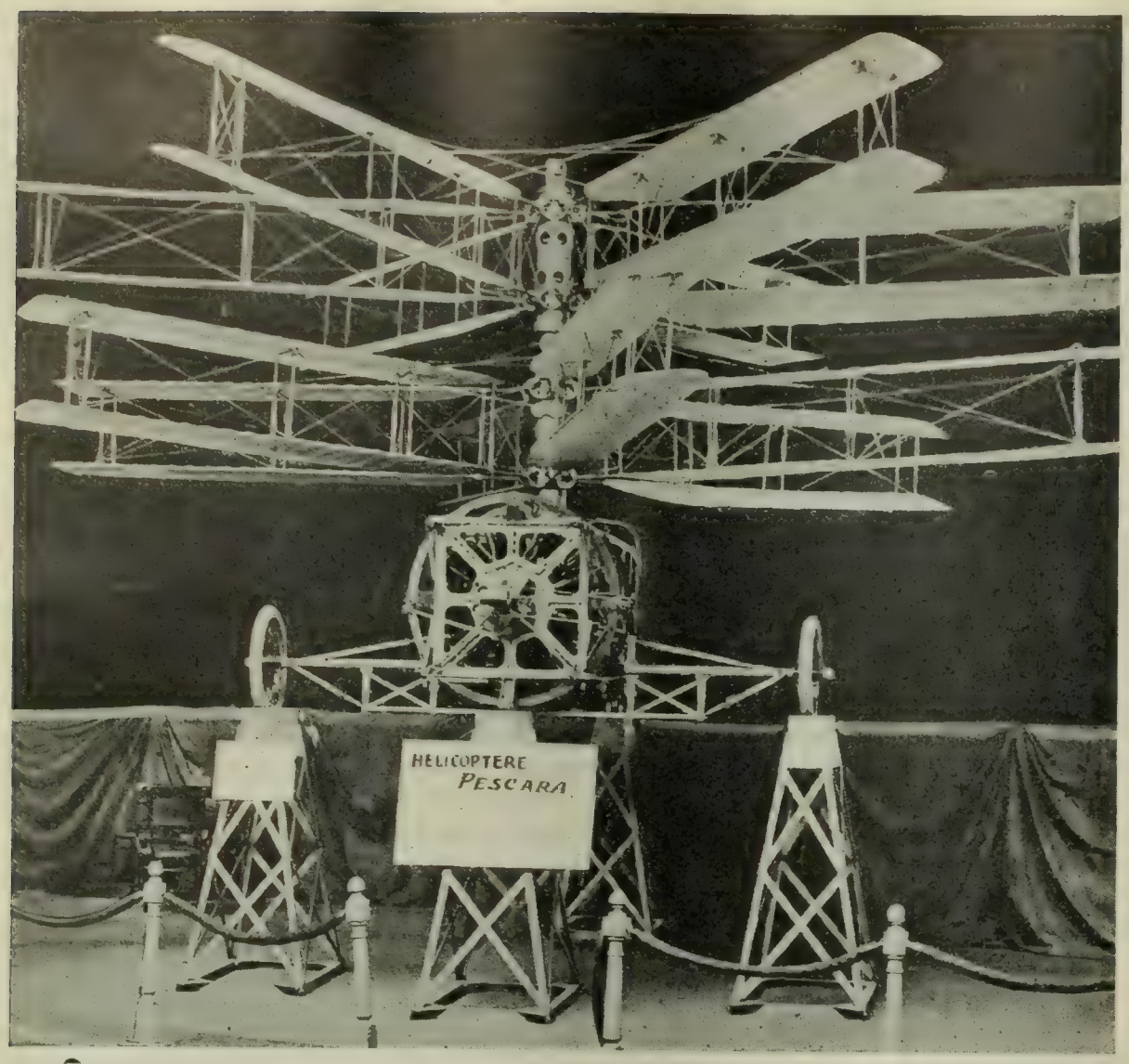


Fig. 12—Pateras-Pescara helicopter

places is steadily growing. Starting March of 1922, an arrangement was effected between the Weather Bureau and the Navy by which the latter daily broadcast, from Naval radio stations, complete weather reports and forecasts for the use of shipping and aircraft.

France and England have probably made the greatest advances in arrangement and equipment of landing fields. The French Government plans cover a comprehensive system of landing fields throughout that country. These range, through five classes, from a fully equipped field down to emergency landing places. The plans go into considerable detail and include the sizes and arrangement of buildings to be provided on each field.

The scale is so comprehensive that the scheme could, at this time, be carried out only through the government shouldering the major expenses. Consequently the French system would be capable of only limited application in countries, such as the United States, where the subsidizing of industries is less of an accepted practice. Even with the thoroughness of the French plans, however, it might be noted that the cost of construction per mile of airway is only a small fraction of the cost per mile of highway construction. Both the French and British plans provide for furnishing of service and supplies to machines, landing in Government fields, at fixed rates.

The increasing use of landing fields is bringing up new problems from time to time. One which has received some attention is the control of traffic at large terminals. At the Croydon field, near London, the system, which has been in satisfactory operation for some time, is very complete.

All machines leaving the field or alighting upon it are directed by a "traffic controller," stationed in a small house on an elevated platform giving full view of the field. Radio, Very's signal lights, megaphone or flashlights, as required, are used to communicate with machines in the air, and instructions are thus issued to the pilots desiring to land at the field. Field lights and signals are under the direction of the controller. the lights being operated directly from his office, while he is kept in touch with the radio operator by telephone. The system rather suggests that used at some of the large flying fields during the war, the chief difference being in the added facilities provided for issuing of instructions.

In both France and England, complete systems for communication between aircraft and the fields have been worked out and are now in experimental operation. Both visual and radio systems are being tried. Night landings are effected by the use of flare signals, all obstacles on the field being marked by lights, while wind direction is shown by an illuminated automatic Tee. Our own Air Mail Service and Air Service has also conducted some experiments along similar lines. The Air Service has been experimenting with a small searchlight, mounted on the airplane and controlled by the pilot, in place of parachute flares, for emergency landing use.

In hangars for landing fields, the Strauss (American) and the Service des Fabrications de l'Aeronautique (French) bascule door hangars are worthy of note. Each of these types makes use of a motor for operating the large hangar doors. The U. S. Navy constructed, at Lakehurst, N. J., the largest airship hangar in the world which is capable of housing two large rigids.

Navigation

The Loth cable, developed by Lieut. A. W. Loth of the French Navy, represents one of the most important of recent developments in aerial navigation. The fundamental principle of the Loth system is based upon detection of the magnetic field surrounding a cable transmitting high frequency current. The device follows along the lines of previous experiments in the directing of ships. In application of this system, a cable is carried on poles along the entire length of the airway from field to field. A flow of high frequency alternating current (600 cycles per second in the experiments) is maintained in the cable, using the ground for return. The airplanes are equipped with detecting mechanism consisting of three loops of insulated copper wire at right angles to each other, making a horizontal, longitudinal and a transverse loop. By means of a selector switch, these loops are connected to a telephone receiver, the switch being so arranged that the pilot can listen in on any loop. By listening in on the successive loops and estimating the relative intensity of the sounds, the pilot can determine his position *both horizontally and vertically* with relation to the cable.

Considerable trouble was at first encountered in overcoming interferences but the system is now developed to the point where these give little or no trouble.

As the work stands, the field of the cable can be detected up to an altitude of nearly 10,000 feet, and sufficient detection for complete control is possible up to altitudes of 6000 to 7000 feet. While at the latter altitudes, detection is possible for a distance on either side of the cable about equal to the altitude. As the ground is approached, the horizontal distance over which detection is possible increases until, close to the ground, the cable can be found

by the apparatus at a distance of about nine miles from either side of it. This system has been hailed by the French as mastering the problem of operating through fogs and it undoubtedly goes far toward this solution.

While the Loth system was being developed in France, attention was also being given to radio direction finding experiments, both here and in France, with much success. This system has the advantage, over the Loth cable, that it is not so expensive to install and can be used over large bodies of water where Loth cables are not practicable. On the other hand, the Loth system greatly simplifies the work of the pilot. With radio direction finding equipment, "beacon" stations, located at various points, transmit periodic signals. By taking bearings of each of two stations, the pilot is enabled to determine his position. Three "beacon" stations were in experimental operation last year, near the approaches to New York harbor, in addition to the numerous radio stations on both coasts which give bearings upon request. Some experimental "beacon" stations were also in use in England and France.

Another system, which is being experimented with in this country, England and France, makes use of beacon lights for navigation at night. Powerful lights are placed at landing fields and along the airway. These are arranged to either flash periodically, after the manner of lighthouses, or are pointed upward and kept in motion so that the beam of light describes an arc through the sky. Bearings are taken visually from the beacons by pilots.

Some very elaborate beacons of the lighthouse type were installed experimentally in France last year and some others have been installed experimentally here and in Great Britain. The lighthouse constructed at Dijon, France, is designed to be visible for a radius of 65 miles in normal weather, or 130 to 200 miles with very clear weather (at a height of about 6000 feet). This light is rated at 1000 million candlepower, the house being about 18 feet in diameter and about 30 feet high.

Considerable attention has been given, in Europe, to the collection and dissemination of meteorological information along the course of aircraft. Plans have been made, and are now being put into execution, in France and England, for the collection of this information and its transmission to aircraft en route by radio. Apparently all of the plans considered so far contemplate transmission of the digested reports to pilots. This brings to mind the question of whether it would not be more convenient for the pilot if a system of transmitting flying instructions could be used in place of the broadcast reports. The whole proposition is, however, in a more or less embryonic state at present.

Another necessity of aerial navigation which is now being taken up is the creation of maps suitable for this purpose. Conferences on aerial navigation, in Europe, have standardized three classes of maps as follows: *General maps*, Mercator's projection on scale of 3.cm per degree longitude; *Normal maps*, scale of 1 : 200,000; *Miscellaneous* maps and additional maps which navigators may desire to use, no scales or other standards yet fixed. Some progress has been made in the standardization of the symbols used. Tints, as against shading, have been selected to indicate altitudes.

Aerodynamic Research

The field of aerodynamic research has witnessed continued progress both here and abroad. In the United States particularly, activity in this work has increased since the end of the war instead of decreasing as in some other branches of the aircraft field. Work on tests of new wing curves has been continued and great improvement has been made, in gradual steps. Research has been extended well into the field of thick and semi-thick wing sections and tapered wings, showing these to be very promising. Full scale tests of airplanes and parts are being conducted here and in Europe, which will increase our knowledge of full size performance.

The Handley Page slotted wing and the German slotted wings may be numbered among the interesting developments of the past couple of years. From the purely military standpoint, the slotted wings have been rather disappointing up to date. While very high lift values have been obtained by the use of such wings, their application to military machines is being retarded by the fact that their properties at climbing angles did not permit substantial change in wing area. Remarkably low speeds have, however, been attained by the use of the Handley Page wing. The "Alula," a high lift wing of unusual shape, is being experimented with in England and has shown exceptionally high efficiency in preliminary tests.

Aerodynamic Theory

Important contributions to aerodynamic theory have been made by Prandl, Karman, Joukowski, De Bothezat and others. Recent papers showed marked advances in the reduction of the science of aerodynamics to a mathematical basis. Experimental investigation of ground interference with wings, conducted here, in England and in Germany, showed the resistance of wings to decrease and their lift to increase with proximity to the ground.

The National Advisory Committee for Aeronautics is now constructing, at Langley Field, a compressed air wind tunnel which will permit the making of tests under conditions dynamically similar to those of full size machines. The Committee also has started a comprehensive series of free flight tests on full scale airplanes and parts. Each of these plans promises to decrease the present errors in calculating full size performance from test results. Work

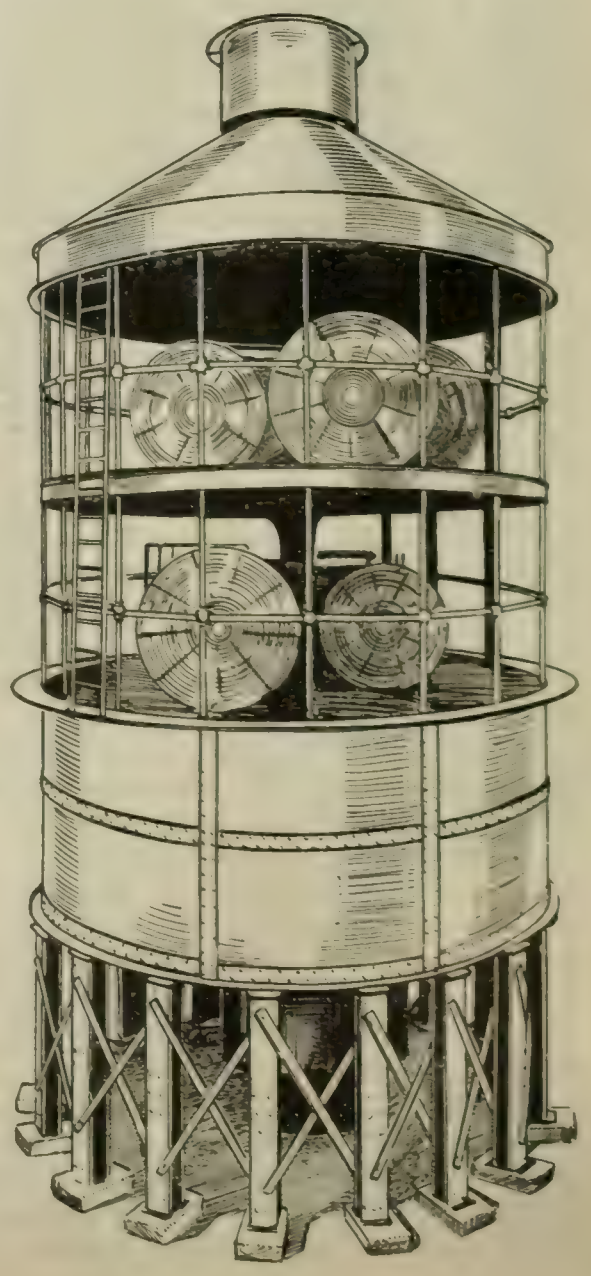


Fig. 11 — Dijon (France) aerial lighthouse

on the standardization of wind tunnels, by testing of standard cylinders, wing curves, etc., has also been started by this Committee. In addition to these activities, numerous tests of pressure distribution, over surfaces of wings, ailerons, etc., have been carried out. Some full scale tests have also been carried out in Europe. A new wind tunnel 10 ft. in diameter and equipped for speeds of up to 90 miles per hour, is now being constructed at the Bureau of Standards.

Wind tunnel tests of the characteristics of model propellers have been continued at the Leland Stanford University and much additional data obtained. These results are being published in convenient form for designers' use, by the National Advisory Committee as the work proceeds. The high speed wind tunnel of the Air Service, at McCook Field, Dayton, has furnished information on the characteristics of propeller sections at speeds up to 450 miles per hour, showing considerable movement of the "no lift angle" and other changes as the higher speeds were reached.

Within the past couple of years additional information on British and French tests of tandem propellers have been made available by their publication. Eiffel tests indicated the practicability of using two similar propellers in tandem, but showed that tandem propellers should be arranged to rotate in opposite directions.

Materials

Experimental work on practically all classes of aircraft materials has progressed steadily, but no particularly interesting results have been noted recently. Little, if any, has been added to our existing knowledge of duralumin, but the Germans have been working for some time on a magnesium alloy. Samples of this alloy, received in the United States, showed high strength for their weight, which is lower than that of duralumin. The National Advisory Committee and the Forest Products Laboratory, in continuance of their tests of glues, are now experimenting with animal glue and rubber in benzine, in an effort to obtain greater water resistance. Tests on the effect of varying the pressure used in glueing showed medium and high pressures to give the best results.

An American firm has placed on the market, under the trade name of "Plymetl," a material composed of a 5/16-in. core of wood faced, on each side, with No. 30 gage black sheet steel. The two materials are cemented together and sold in sheets free from any other means of fastening. The sheets resist damage and fire better than plywood.

The most notable recent work has probably been in the applications of materials rather than in the materials themselves. Among these new applications might be mentioned the experimental use of plywood in place of cloth for wing covering, the use of vulcanized fiber for fuselage construction, and some developments mentioned under other heads in this résumé.

Within the past year the Underwriters' Laboratories, at the request of the insurance companies, arranged to take up the work of inspecting and classifying aircraft and registering aircraft and pilots. Plans for the handling of this work have been worked out and were recently put into operation, but sufficient time has not yet elapsed to make available any substantial data on aircraft risks. Conditions abroad are somewhat similar and it will be a year or two before any trustworthy information on this subject is available.

Insurance premiums are accordingly high in most cases, with the notable exception of the French companies' premiums on merchandise carried by air. These rates are much lower than the corresponding rates for coverage of goods transported by other means.

As an example, for a given condition the premium of 1.50 francs per thousand charged for coverage of goods carried by air compares with the rate of 7.0 francs per thousand for goods carried by rail or boat. While the explanation of the difference is not given, it can probably be assumed as due to the greater care with which aircraft shipments are generally handled and to the elimination of pilfering.

Aircraft insurance pools have been organized in several countries and are now making studies of hazards. So far it has been learned that radial engines are poorer risks than other types, that water types of aircraft are better risks than land types and that much importance must be attached to the experience and record of the pilot. Differential rates are being worked out to apply to these conditions.

Operating Cost Studies

The first really reliable information on the cost of operating aircraft commercially became available with the publication of the monthly reports of the U. S. Air Mail Service. These have been continued and constitute to-day the most complete and reliable source of information on this subject. The consolidated report for the twelve months ending June, 1921, showed the following averages for the year: Total operating cost per hour of flight, $71.13; total cost per mile of flight, $0.8475. These costs were divided: overhead, 23.8 per cent; flying, 29.8 per cent; maintenance, 46.4 per cent. The more recent monthly reports show a tendency toward reduction of these figures, the cost dropping to $58.35 per hour and $0.64 per mile during March of this year. In considering these figures it should be remembered that the Air Mail machines are obsolete DH-4 Army types converted to mail carrying uses, entirely unsuited to their work, but the only craft available under the appropriations. The latest commercial airplanes are designed to carry about *five times* the capacity of these machines with practically the same horsepower.

The Aeromarine Airways, operating the largest fleet of commercial aircraft in this country, has now been in operation for about 19 or 20 months. This fleet has been added to until it now consists of 29 flying boats ranging from 5 to 14 passengers in capacity. Consequently, the following figures on operating costs, recently given publicity by this firm, are of particular interest: Total cost of operating converted Navy flying boats (exclusive of administration and advertising), five-passenger, $29.98 per hour; eleven-passenger, $71.12 per hour.

Late in 1920 the British Air Conference made a comprehensive study of operating costs of many types of airplanes. While this information is now old, it is worthy of mention on account of never having been published in this country. The figures gave the cost of operating *commercial* airplanes as 9.5 cents per passenger mile or .038 cents per pound mile. Using the Air Mail costs as a basis, the writer estimated that the latest types of commercial airplanes could be operated at a total cost of 6.5 cents per passenger mile or .030 to .032 cents per pound mile. Capt. de Haviland recently made a very complete study of this subject and stated that these figures are not only conservative, but on the high side. All of the latter figures assume fully loaded machines.

Commercial Operations

Although commercial operation of airships has been dormant during the past few years, commercial aviation has been slowly developing. This development has been slower than was generally anticipated by the industry, but some substantial progress has been made. The seven

countries on which figures are available show the following activity in this field during 1921:

Country	Number of flights	Total miles	Passengers carried	Pounds freight carried
*Belgium	1,224	161,800	2,199	28,000
Canada	10,386	294,449	9,153	79,850
France	6,221	1,457,437	10,336	396,000
Germany	....	1,029,000	6,820	67,700
*Great Britain ...	22,676	533,700	41,956	94,000
*Holland	1,000	289,000	1,511	68,100
†United States ...	130,736	2,907,245	122,512	123,227
Totals	....	6,672,631	194,487	856,877

*Incomplete figures.

†Unofficial estimate compiled by the Aero. Chamber of Commerce.

For a considerable period practically all operations of commercial airplanes, including those subsidized by government grants, were operated at a loss to the firms. These losses have gradually been decreased until, in many cases, the operators now show small profits. The largest American line, Aeromarine Airways, recently found it necessary to turn away some prospective passengers owing to the growth of their business exceeding that anticipated. Some curves, showing the growth of the French air lines, are reproduced here from a paper read (before the Premier Congres International de la Navigation Aerienne) by Albert Tete last year. British reports showed the monthly efficiency of air lines performance to range from 54 per cent to 100 per cent during a period of several months. The monthly performance of the U. S. Air Mail Service ranged from 77 per cent to 99.3 per cent efficient during the year 1921, while the Rumpler Air Lines, in Germany, showed efficiencies ranging from 91.6 per cent to 100 per cent during an eight months period. In general these figures seem to be gradually improving as experience is gained. Of all the lines the U. S. Air Mail Service is the most unique from point of mileage, regularity and varied weather conditions to be met.

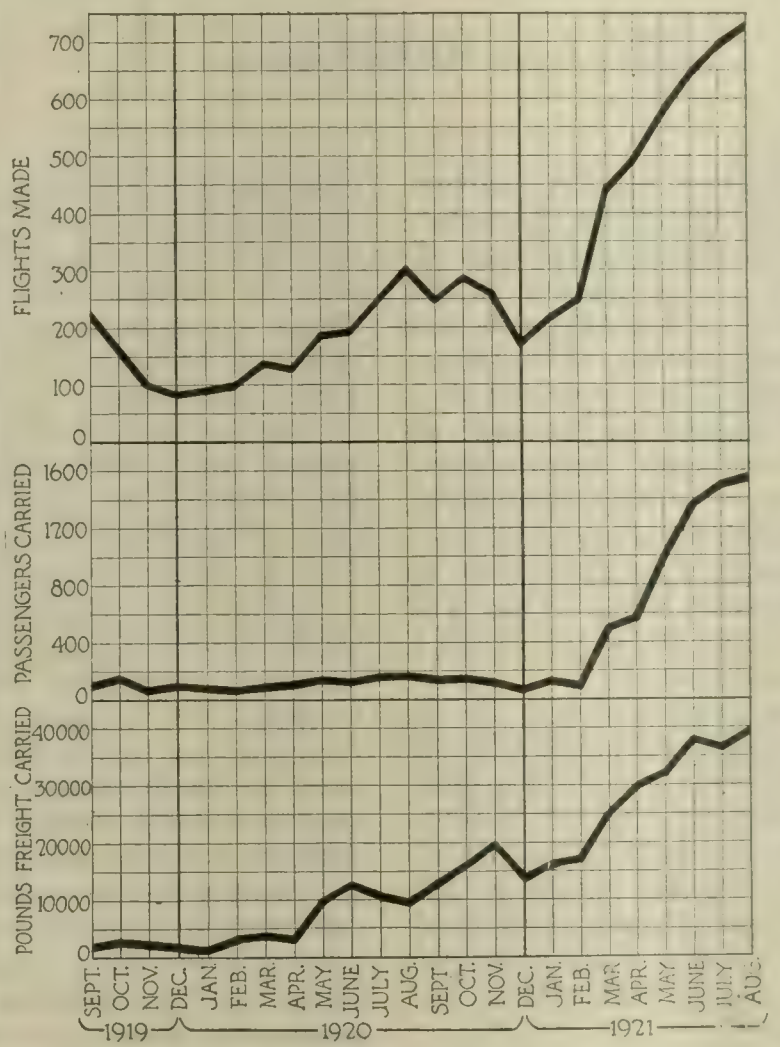


Fig. 13—Growth of the French Airlines

Last year witnessed 114 accidents to aircraft in the United States, resulting in 49 deaths and more or less serious injuries to 89. In 48 of these cases there were no casualties and only in 39 were there any fatalities. While no government body, charged with supervision of aircraft, exists in this country, the Aeronautical Chamber of Commerce in co-operation with the Army, Navy, Air Mail and others, tabulated the causes of each accident so far as they could be obtained. These were charged against chiefly, stunting; lack of supervision; lack of proper landing facilities; lack of weather reports; faults of engines and machines (many of which inspection would have avoided) and some appeared to have been unavoidable. During this period the 125 commercial aircraft operating firms flew 2,907,245 miles carrying 122,512 passengers without any fatal accidents. Two very serious airship accidents occurred during the past twelve months, the loss of the R-38 in England and of the "Roma" here. The first appears to have been clearly due to structural failure and suggests the necessity of further study of methods of stress analysis of rigids. The "Roma" disaster was probably due to an unfortunate combination of several circumstances rather than any one cause.

Between January 1 and September 15, 1921, French aerial navigation companies flew 1,003,000 miles during which 4 fatal accidents occurred and 8 accidents resulting in injuries to one or more persons. The report of the Canadian Air Board for 1921 showed a total of 479,929 miles of civilian and government civil flying during the year. In this period 18 accidents happened, of which 4 resulted in deaths, 3 in injuries and the remaining 11 did not involve either death or injury.

Last year the Gallaudet Company constructed, for the U. S. Navy, a power plant unit of particular interest. This unit, containing three Liberty engines and driving, through clutches, one 18-ft. propeller, has been tested out and performed very satisfactorily. It is entirely streamlined and will be used in the large flying boat which is being constructed at the Philadelphia Navy Yard. The Goodyear Tire & Rubber Company also developed a transmission mechanism, for dirigible use, in which the two engines were located inside of the car driving, through clutches, two propellers mounted on tubular arms projecting outside of the car.

The Avelene electro-mechanical airplane control, developed in France, makes use of a mercury type of balance and solenoid controlled compressed air motor for operating both ailerons and elevators. This device has gone through extensive tests and is understood to have performed very well. The U. S. Navy has developed a kite antenna, for the use of seaplanes while on the surface of the water, which was found to not only permit the use of radio under this condition, but to increase the range about 25 per cent over the normal range while in the air. This device is expected to be of great value to aircraft making forced landings on the surface of water.

The installation, in a number of Air Mail airplanes, of carbon tetrachloride spray systems is important from a safety standpoint. These are designed to permit the pilot to discharge this liquid over the engine in case of fire. No occasion has yet arisen to demonstrate the value of this device although some tests made by the Air Service indicated that it would be effective. The Foamite Firefoam Company is also experimenting with a system for spraying fire extinguishing foam over the engine in a similar manner.

New uses for aircraft continue to be found from time to time. The Department of Agriculture recently conducted some experiments using airplanes for spraying calcium arsenate over cotton fields. These were carried out as part of the work on the boll weevil scourge and were regarded as very successful.

Better Economy and Flexibility Are Chief Aims of Engine Development

Cars which will average forty miles per gallon of fuel may soon be the rule. Research and development work is tending in that direction. Lower average speed and higher torque desirable from economy standpoint. Development of non-throttling engines in process by several engineers.

By Herbert Chase

PRESENT day automotive engines of the conventional type lack certain highly desirable characteristics,—consequently there are afoot persistent efforts to bring about a change to a new type or to improve the present type with only such changes as are absolutely essential to better performance. The industry responds but little to those who urge reversion to a different type or types, but is lending an ear, at least, in the case of the more progressive elements, to promising improvements which involve less radical departures. Research and development is proceeding along both lines and should be followed and encouraged by executives as well as by engineers, for changes must come. They will be forced by change of conditions and those who anticipate these conditions will profit accordingly.

The chief drawback to the conventional type is its lack of high economy in fuel under the conditions of average use. Even when run under most favorable conditions of load and speed its consumption of fuel is higher than it need be if favorable conditions could be brought about, especially in respect to the nature of the fuel available. Some well informed engineers believe that the car which will average upward of 40 miles per gallon of fuel will be quite the average rather than the exception within a very few years.

Of scarcely less importance than fuel economy but frequently overlooked is the relatively low torque which the average engine exerts, especially at low speeds. It is in fact a comparative lack of flexibility in the internal combustion engine inherent in the steam engine which has enabled the latter type of prime mover to hold its own in heavy traction work, especially in railway locomotives, in spite of its relatively low fuel economy under the conditions of normal use.

Although some properly make a distinction between "pure" research and development work, the dividing line is not always well defined, consequently it is proposed to outline some promising development work which is now in hand or in contemplation, and in connection with this to consider several items of research of a closely related nature.

The Constant Compression Engine

WHAT many engineers regard as the most promising line of development of the near future in automotive engines is one which involves the abandonment of control by throttle and the use of constant compression, the power output being varied by control of the quantity of the fuel fed while the total cylinder charge remains substantially constant. The use of this type of engine involves localizing the fresh charge in a pocket adjacent to the spark plug at low loads. Operation at full load will be substantially the same as in present engines. There are several methods of accomplishing practically the same result in this type of engine, and some of them have been already described in these columns. Of particular interest in this connection are Ricardo's experiments, which were described in AUTOMOTIVE INDUSTRIES for February 24, and July 14, 1921, a sectional view of one of Ricardo's localized charge engines is given in Fig. 1. In the issue of June 16, 1921, was a brief description and diagramatic cut of the Newcomb two-stroke constant compression engine which performs substantially the same function as the Ricardo engine but by employing a quite different construction. It will be recalled that in the Ricardo engine the combustible mixture is taken into a chamber in the head through a separate valve while the main charge of air enters through a larger valve similar in size and arrangement to the ordinary inlet valve. The rich mixture is ignited in the chamber in the head and passes through a Venturi tube into the main combustion chamber where the additional air for complete combustion is present. In this engine the quantity of air taken in through the main inlet valve is nearly constant while the quantity of mixture taken in through the valve in the head compartment is varied in proportion to the load. In this engine the fuel consumption per i. hp. hr. was less than 00.4 lbs., while at full load it was approximately 0.5 lbs. With the same engine running under throttle in the normal way the consumption increased to 0.65 lbs. at low load. The difference on a basis of brake hp. was, of course, considerably greater, owing to the fact that engine friction and pumping losses are nearly constant at a given speed whether the load be light or heavy.

This is indicative of the chief advantages of the localized charge, constant compression, or non-throttling type of engine as it is variously called. In other words an engine of this type is much more efficient than the conventional type in which the economy at low loads is always much less than at full load, whereas the engine runs most of the time, especially in passenger car installations, under very low load conditions. Thus the advantages of high economy under practical operating conditions are much in favor of the non-throttling type.

The Newcomb engine, referred to above, possesses practically the same advantage although it is of quite different design. Like all two-stroke engines it is of the

constant compression type owing to the fact that exhaust products are expelled substantially in proportion to the new charge entering the cylinder so that the total weight of the charge at the beginning of compression is practically constant regardless of the load. In the Newcomb engine, however, the charge does not enter through the conventional inlet port near the base of the cylinder, but through a poppet valve in an L-head. At part loads the charge is localized in the L and is ignited by a spark plug at this point. The engine has other features (which we are not at liberty to describe at this time), the purpose of which is to minimize admixture of the fresh charge with residual productions of combustion in the cylinder, and prevent waste of the charge through the exhaust ports. We are not in possession of definite figures on performance of this engine, but understand that its economy at low loads is much superior to that of the ordinary throttling four stroke engine. The writer has ridden in a ½-ton truck chassis fitted with a single cylinder engine of the Newcomb type, and found it to show excellent performance on the road. It is said to be capable of running light from 70 to 80 miles per gallon of gasoline. This in indicative of the possibilities of a constant compression engine using a localized charge and explains the reason why several capable engineers are working upon the development of engines of that type.

A majority of the constant compression engines which have come to our notice are still in the development stage and particulars concerning them have not been released for publication. It may be said, however, that various methods are used to localize the charge. In at least one case this is accomplished by fuel injection in a very simple and effective manner, and by means of a system which can be easily applied to existing conventional engines, probably with the result of doubling the distance they will run per gallon of fuel consumed.

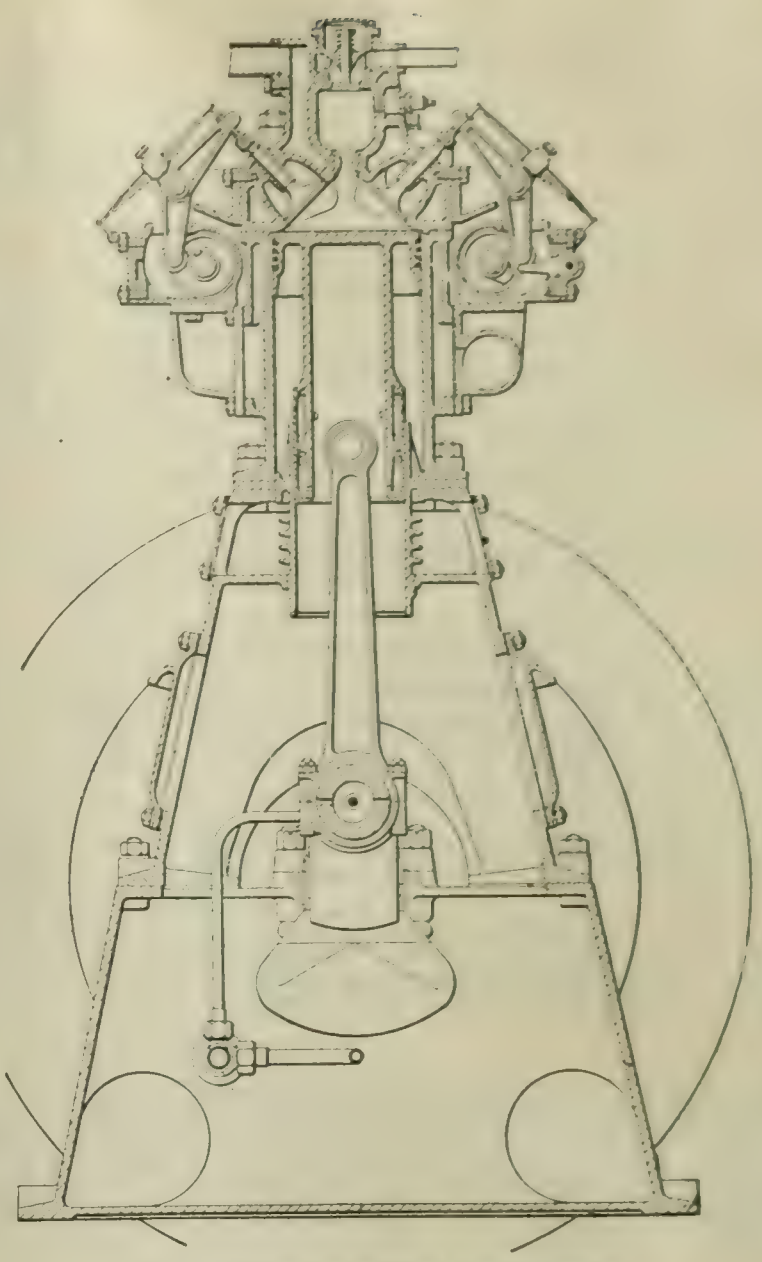


Fig. 1—Ricardo stratified charge engine

Supercharging Engines

THE question of supercharging engines has been considered chiefly from the standpoint of application to aircraft, and especially, in that case, for the purpose of maintaining at high altitudes the power which the engines are capable of developing at ground level. Considerable work has been done along this line by the National Advisory Committee for Aeronautics which has been engaged in the development of a Roots type positively driven displacement compressor. This supercharger has been operated as an experimental unit in connection with the Liberty engine and is now being installed in an airplane for free flight tests. It is reported to have shown promising results and to have an efficiency which is much higher than any other type of compressors used for the same purpose.

The N. A. C. A. is continuing the development of a positively driven fan-type supercharger having a fan construction with sufficiently low moment of inertia to permit of positive connection to the engine crankshaft. Changes are being made in this supercharger and it is expected that material improvements both in efficiency and capacity will make it suitable for application to the Liberty engine.

An interesting discussion of supercharging engines and their application to various forms of automotive vehicles is contained in a paper entitled Superchanging Engines by C. H. T. Alston,* from which the curves given in Fig. 2 are taken. The curves are intended to show the effect of operating the supercharged engine A in comparison with a normal type of engine B of a slightly larger cylinder capacity but developing the same maximum bhp. The maximum power with the supercharged engine is obtained with a much reduced speed or in other words the torque at low speeds is higher. Space here is not sufficient to discuss the advantages and disadvantages of the supercharging engine referred to by Alston, but certain of his conclusions will be given:

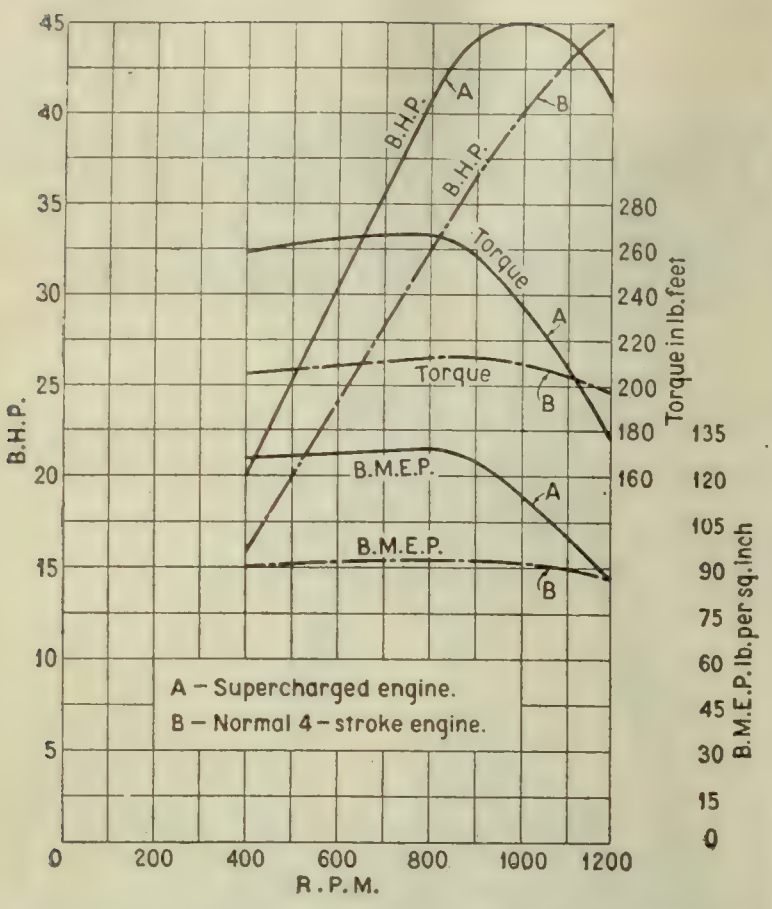
"For aircraft engines, intended for commercial aviation and flying at comparatively low altitudes for long distances, supercharging does not appear to offer any particular advantages, and will probably consume more fuel per mile flown and carry less cargo. It is quite a different proposition from that of the fighter type of machine for war purposes. In the latter case the larger hp. that could be exerted for climbing and attaining a very high 'ceiling' would be a great gain even if the fuel consumed should be more."

For road vehicles Alston concludes that supercharging offers great advantages providing the method and apparatus for carrying it out do not detract from it. Only a slight amount of extra weight is entailed while the torque is greatly increased, giving quick starting and acceleration and great hill climbing ability. He says further:

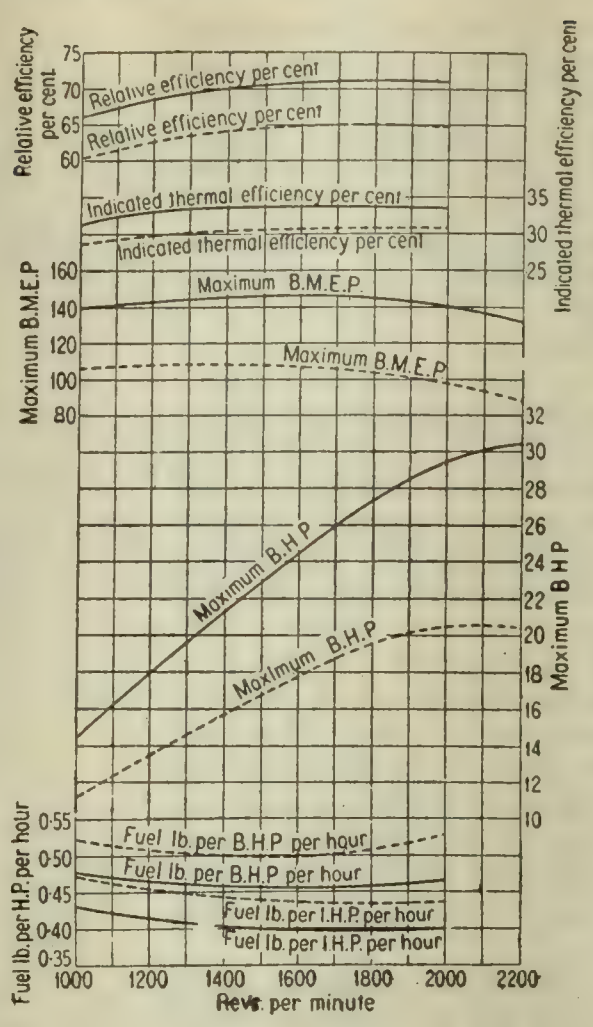
"There should be, moreover, a considerable increase in the ton mileage per gallon, as the conditions under which the engine is operating are, for the greater part of the time, more favorable to engine efficiency. It should render touring cars of moderate engine power pleasanter to drive, because more running can be accomplished on top gear without much loss of speed."

Ricardo has conducted numerous experiments with supercharging engines, and the results of some of his

The Automobile Engineer, October, 1921.



Above—Fig. 2—Relative performance of engines of equal power with and without supercharging. At right.—Fig. 3—Performance curves of Ricardo engine with and without supercharging



tests were printed in AUTOMOTIVE INDUSTRIES for July 14, 1921. Some of the results of these tests are given in the accompanying curves, Fig. 3. For details in this connection the reader should refer to the article in question.

Higher Compression Ratios

THE advantages of higher compression ratio in respect to power and thermal efficiency have been referred to many times in these columns in connection with the work of Ricardo and others. From the curves in Fig. 4 plotted from the results of Ricardo's work it will be seen that indicated mean pressure and thermal efficiency increase in almost direct proportion to the increase in compression ratio. The curves in question apply to 95 per cent ethyl alcohol which is capable of operation with compression ratios of nearly 8 to 1 without detonation. Similar results with other fuels are obtained up to the compression pressures at which detonation occurs.

As we have noted elsewhere in this issue in connection with our articles on the subjects of fuel and combustion phenomena, the tendency of the fuel to detonate is a limiting factor which cannot be controlled by the engine designer. It is possible, however, to decrease the tendency to detonation by diluting the charge with an inert gas such as the products of combustion, and the use of these products or of steam generated by the introduction of water with the fuel is worthy of careful consideration. In an engine of given size with a given compression ratio the maximum power may be reduced by the use of a diluent, but the thermal efficiency can be materially increased by this means. On the other hand the possible increase in compression pressures when diluents are used may more than offset any loss of power due to the decreased volume of air which is available to support combustion when the diluent is mixed with the incoming charge. This is a subject which requires further research work but has considerable promise of success.

The relative scarcity and consequent high cost of the more volatile fuels, especially gasoline, have led to considerable research and development work with a view to producing engines which will burn economically less volatile and much cheaper fuels which are often available in large quantities. Diesel engines and so-called semi-Diesel or surface ignition types have been successfully developed for marine use and for stationary or semi-portable applications, but few attempts have been made to adapt engines of this type to other automotive purposes. One French manufacturer has, however, developed an automobile engine intended particularly for colonial use in localities where gasoline is very expensive. This is the Peugeot-Tartrais engine which was described in AUTOMOTIVE INDUSTRIES for February 9, 1922. It operates on a two-stroke cycle and employs solid fuel injection. A separate pump is used for scavenging the cylinders and supplying the air for combustion of the fuel, which can be almost anything from kerosene to crude oil or various coal tar products, vegetable or animal oils. The head of this engine is made of a high grade heat resisting steel, and is not water jacketed. It is consequently maintained at a high temperature. The engine is apparently operated at fairly high compression pressures and is said to consume 0.397 lbs. of fuel per hp. hr. under full load and less than ½ lb. per hp. hr. at quarter load. One engine of this type is said to have been used successfully in a Paris bus chassis.

Another heavy fuel engine which is said to be capable of adaptation to automotive purposes is the compound expansion Sperry Diesel engine. This engine was described in AUTOMOTIVE INDUSTRIES for March 16, 1922. It employs solid injection. Precise data concerning its performance are lacking.

Aircraft Engine Development

ON account of the fire hazard which arises as a result of the use of highly volatile fuels for aircraft, much study has been given to the possible development of heavy oil engines for this class of service. The National Advisory Committee for Aeronautics has been working along this line for several years and has recently completed a single cylinder experimental engine with means for varying the compression ratio, valve timing and valve lift. This engine is so arranged as to be readily fitted with combustion chambers of varying shape. It is to be used in securing data on the basis of which a practical aircraft engine can be built.

The N. A. C. A. have for several months been operating a single cylinder Liberty engine arranged to operate with fuel injection. This engine is said to have given an indicated fuel economy which is reasonably satisfactory considering the unfavorable shape of the combustion chamber for an injection engine. The in-

dicated fuel economy is reported to be practically constant for all loads down to approximately ⅛ full load. The power output thus far obtained is about 70 per cent of the maximum possible with a carburetted mixture. This is attributed to the fact that the piston used extends so far into the combustion chamber as to prevent utilization of the whole air charge.

Solid Injection

ONE of the chief disadvantages with the earlier conventional type of Diesel engine is the very high air pressure required for injecting the fuel, and the consequent necessity for using a multiple stage air compressor which resulted in low mechanical efficiency of the complete engine, as well as in considerable complication. To avoid this disadvantage many solid injection Diesel engines have been developed in which the fuel is forced directly into the engine cylinder without the use of high pressure air. There is said to be difficulty in securing complete combustion with this type. Much depends upon the shape of the spray, and on this account the N. A. C. A. has been making experiments with liquid spray produced under various conditions corresponding to those in an injection engine. Apparatus for taking photographs of the spray at a rate of 1350 per second was first developed but was not found entirely satisfactory. It is being redesigned to increase the rate of photographing to 5000 per second. With this new apparatus it is expected that it will be possible to follow any individual particle of the spray from the instant it leaves the nozzle to the time it becomes invisible. This work is said to be proving its importance by results already obtained which show considerable variation in spray characteristics as affected by the density of the medium into which the spray is injected.

Other research and development work on heavy fuel engines is known to be in progress in various laboratories but the results of most of this work have not yet been made public.

A Brayton Cycle Engine

AT least one investigator, P. A. Lawrence, is experimenting with an engine operating on the constant pressure cycle in which the air is compressed and delivered from the working cylinder into an external air chamber after which it is readmitted to the cylinder. As it enters the cylinder fuel is injected into the air stream where it is ignited either by a spark plug or by the high temperature of the walls or the air itself. The operation of an engine of this type results in a card similar to that of a steam engine, and the cut-off can be varied as in the case of a steam engine, providing a suitable air reservoir is connected. The Brayton engine which operated on the constant pressure cycle was among the earliest gas engines to be used in this country. So far as we are aware the numerous inherent advantages of operation on this cycle have never been fully realized owing in part to difficulties which were encountered in the early engines of this type. It is believed that most of these can be overcome by the use of modern methods and materials. On this account much interest should attach to experiments along this line. Because of its steam-engine-like characteristics the constant pressure engine is unusually well suited for vehicle propulsion. It remains to be seen whether certain difficulties which are involved in a development along this line can be overcome. If so, and if the engine proves to be as economical under practical operating conditions as engines of the constant volume type, it should see wide application for automotive propulsion.

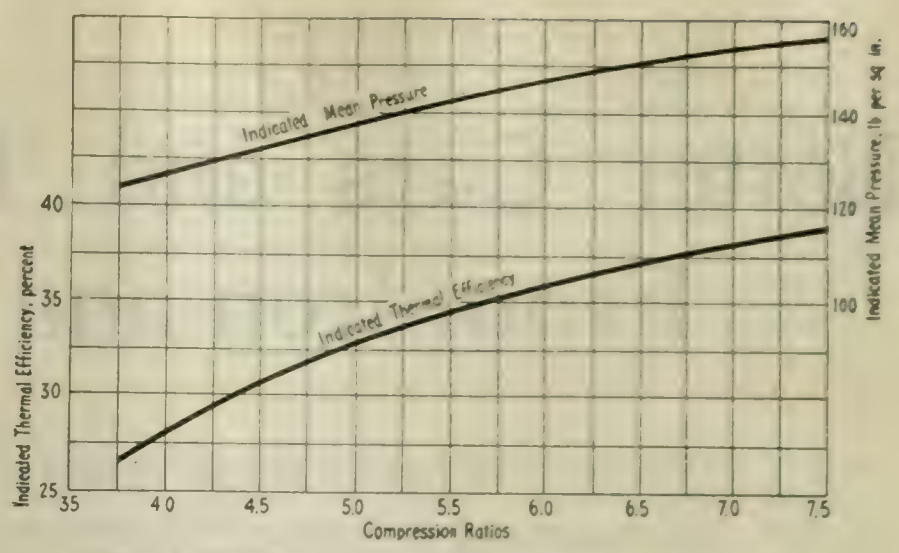


Fig. 4—Relation between compression ratio and indicated mean pressure and thermal efficiency

Steam Engine Developments

THE high torque, especially at starting and under heavy load conditions which the steam engine is capable of developing when used in connection with a well designed boiler, and its flexibility continue to make it an attractive subject for development work. Although its use involves certain drawbacks, it is, of course, capable of developing power on relatively low grade fuels without trouble from detonation and many other disadvantages of the internal combustion type. It is, therefore, not to be wondered at that work with it is progressing in several quarters looking to its use especially for heavy tractive work such as is involved in trucks and tractors. Much work is also going forward in the development of steam operated buses such as are already used extensively in England. Developments in the steam driven passenger car field are continuing, both among new and old manufacturers, but reliable data concerning the performance of the more promising of the vehicles recently constructed is lacking.

Research Work on Engine Performance

MUCH research work has been conducted during the past year into the performance of engines under various conditions of operation. Heat and frictional losses are being investigated in many quarters. Professor C. E. Lucke of Columbia University, is for example, making investigation into heat losses through engine walls in case of both water and air cooled types of cylinders, and much work in this direction has been done by the General Motors Research Laboratory. Tests involving a measurement of heat lost to the jacket water in truck engines are being made by the Autocar Co.

Ricardo in connection with his research work* had occasion to make a study of mechanical efficiency, the influence of cylinder size on engine performance, and of cylinder temperature on power output. He also determined the heat distribution in an engine using various fuels at various compression ratios, in addition to much other work along similar lines to which reference has already been made.

It will thus be seen that the subject of improved engine performance has not been overlooked in spite of the fact that much contemplated work along this line has necessarily been curtailed owing to the unsatisfactory business conditions of the past year.

*A series of Ricardo's reports were published last year in these columns under the heading Influence of Various Fuels on Engine Performance. A later report entitled Recent Research Work on the Internal Combustion Engine was presented by Ricardo before the Society of Automotive Engineers at its last annual meeting, and a summary thereof appeared in these columns, issue of Jan. 19, 1922. The report was published in full with appendices containing much useful data and discussion in the *Journal of the S. A. E.* for May, 1922.

Better Cars and Trucks May Result From Iron and Steel Research

Research in ferrous metals covers wide range. Automotive industry vitally concerned in results. Chrome molybdenum steels studied. High carbon steel brake drums developed. New facts determined in resistance-to-wear investigation. Further development in heat treatment likely.

By P. M. Heldt

PROBABLY in no line of industrial activity is research being carried on as extensively as in the iron and steel field. The ferrous metals not only have the most valuable mechanical properties but they are also very abundant, and on account of their cheapness, their high tensile strength, and their hardening and magnetic qualities they lend themselves excellently to a great variety of uses. The introduction of alloy steels during the latter part of the past century and of heat-treating processes has added greatly to the subjects calling for research. Much of the experimental work in connection with various methods of testing also is closely related to iron and steel, for, although hardness tests, shock tests, etc., are applicable to many other materials, they are used much more on ferrous materials than on any others.

Research on iron and steel is being carried on at industrial laboratories connected with the large steel works, at national metallurgical laboratories and at laboratories connected with universities and mining schools. Each of the great industrial countries has its technical organization of iron and steel metallurgists, of which the British Iron and Steel Institute is typical, at whose annual or semi-annual meetings many of the results of research work in this line are made public. The Society of Automotive Engineers has standardized steels for use in automobile construction, and recently the industries of several other countries have followed the lead, which might give the impression that a certain degree of stability must have been reached and that the chances for important advancements in metallurgical products and practices must have been greatly reduced, yet research in this line is being carried on more intensively than ever before. Only a small portion of this research work, of course, has a direct bearing on the automotive industry, but that part is very important. The development of alloy steels and of heat treatments is very closely bound up with this industry. The results of some recent research of interest to automotive producers are reviewed in the following.

New Tests in Fatigue of Metals

AT a meeting of the New England members of the American Society for Steel Treating and the Hartford Branch of the A. S. M. E. at the plant of the New Departure Mfg. Co. in Bristol, Conn., Prof. H. F. Moore of the University of Illinois gave some of the latest results of the research work on the fatigue of metals carried on at that institution with funds furnished by the Research Foundation and the General Electric Co. The interest of the General Electric Co. in the problem of fatigue is probably based on its work in the manufacture of steam turbines, and Prof. Moore mentioned the case of a turbine failure as a very impressive example illustrating the importance of the study of the fatigue problem.

When the problem was taken up, the first thing to do was to select or develop a suitable endurance machine. A slide was shown of the Upton-Lewis machine which is being used at Cornell University in work of this kind and is satisfactory under some conditions but has certain limitations. The machine now used at the University of Illinois is of a type which all experimenters on fatigue seem to come to in the end, Prof. Moore said. It is known as the Farmer rotating beam testing machine and consists of a base with two bearing pillars containing ball bearings in which the beam is supported. The middle section of the cylindrical beam is reduced in diameter and at both sides of this reduced section are mounted ball bearings from which, through an equalizing bar, the loading weights are supported. It was found that without a reduction in section at the center of the beam the beam would invariably fail at the inner edge of the stationary bearing, this being a point of stress concentration. This is not desirable, for one reason because it is difficult to accurately calculate the stress at this point due to any particular load.

An extended investigation was made with respect to the best form for the reduced section. At first the center portion was merely turned down to a smaller diameter.

the shoulders being rounded. The objection to this method was found to be that it is almost impossible to obtain a perfect joint or perfect continuity between the central cylindrical portion and the fillets. It was also found that nothing starts failure so easily as a sharp change in section. The form of the reduced portion of the cylindrical test beam is therefore made such that a longitudinal section of it is bounded by circular arcs of 9.85 in. radius. The stress in the beam at any section can be readily calculated from the loading weights and their position relative to the supports. The question then arose whether the stress so calculated was the actual stress. The results were checked up at the General Electric Co.'s Laboratory, which possesses one of Prof. Coker's optical stress measuring apparatus, and also by means of a very accurate extensometer, and the results in both cases checked to within 1 per cent.

It will be understood that in the tests the specimen is revolved by means of a driving shaft co-axial with the specimen, with pulley and universal coupling. The stress in the specimen is then reversed twice per revolution.

In the test it was found that up to a certain unit stress the strength of the metal in the specimen was not affected by fatigue, that is to say, with the maximum stress limited to these figures the load could be reversed indefinitely without failure occurring so far as could be determined. But beyond this limiting unit stress, which is called the endurance limit, the life or endurance of the specimen fell off with an increase in unit stress.

A considerable portion of the research work had to do with the exact nature of the failure under repeated reversal of stress, and what might be called animated micro-photographs of the specimen while approaching failure were shown. It was seen that under the reversal of stress slight cleavages occur near the outer surface where the tension is greatest and that these gradually increase until failure occurs. These cleavages are referred to as slip lines. At first there appears to be a very large number of these slip lines, but as the reversal of stress goes on some of the slip lines seem to develop faster than others.

The thought suggested itself that probably the endurance limit was identical with or had a close relation to the elastic limit. Prof. Moore said that there was no such thing as an elastic limit considered as an absolute measure of the limit of perfect elastic action. There were at least eight different definitions of this factor, he said, consequently no definite relation between it and the endurance limit could be established. On the other hand, it was found that there was a close correlation between the endurance limit and the ultimate strength, and also between the endurance limit and the Brinell hardness. Roughly speaking, 250 times the Brinell hardness was equal to the endurance limit. That the endurance limit should be proportional to the ultimate strength under tensile loads is not hard to understand when the way in which the failure under reversal of stress occurs is considered.

Prof. Moore said that results based upon the ordinary static tests of materials must be regarded in the nature of cartoons of the properties of these materials. They are based upon the assumption that metals were of homogeneous structure, and all micrographs showed that this was not the case. These tests brought out the outstanding characteristics, but left out many other features. Ductility, he said, was an insurance feature against occasional overloads. Most members of steel structures were loaded beyond their elastic limit in one point or another, but since this loading was not frequently repeated it had no effect on the safety of the members. Materials for members subjected to repeated stress should be as nearly uniform as possible.

Prof. Moore said that some years ago Mr. Stromeier, a British engineer, had suggested that the sliding of particles of the material over each other when subjected to reverse stresses generated heat, and that, consequently, impending failure of a test specimen would be indicated by a rise in temperature at the point where failure should occur. Accordingly, at the University of Illinois Experimental Station they had placed a thermocouple very close to the section of the specimen where the break would occur, directly against the steel, while the other joint of the dissimilar metals was located near one end of the test specimen and insulated from it by a layer of paper. A Leeds & Northrup galvanometer was inserted in circuit and differences in temperature as low as 0.003 deg. C. could be detected. Tests made by this method clearly showed the endurance limit with a fair degree of accuracy. The view was expressed that such a temperature measuring apparatus would prove useful in shortening the time required by the usual breakdown endurance tests.

Determining Resistance to Wear

J. A. BRINELL has developed a method for determining the resistance of metals to wear which is claimed to be an improvement on the methods of Felix Robin, Prof. A. Cary, Bauschinger, Aug. Roseval and Dr. F. Rogers. None of these methods has come into extensive use, probably because they are not practical.

Brinell's machine consists of a vertical disk 4 mm. thick and originally 100 mm. in diameter, of the softest, thoroughly annealed Martin steel. The disk is rotated at a speed of only 19 r.p.m. to prevent heating influencing the result. The test piece, which must have one flat side and at least one straight top edge, is pressed, by means of a holder, with the flat side against the top of the disk under a certain pressure. Over the point of contact between the disk and test piece is secured a glass funnel filled with pure quartz sand, from which a continuous stream of sand runs into the bevel space between the test piece and the disk. The disk turns between lateral guides so the sand cannot escape at the sides, and all of it becomes effective as an abrasive at the line of contact. The duration of the test and the pressure are so fixed for the different materials that the maximum depth of wear as a rule does not exceed 0.8 mm. For greater depths of wear the results become less accurate.

The depth of the segment worn into the test piece is measured by means of a depth gage or a micrometer. As a measure of the resistance to wear, N_w, Brinell takes 1000/A, where A represents the volume of wear in cu. mm. per millimeter width of disk. Brinell has compiled tables of values of A for segment depths of 0.01 to 2.7 mm. and disk diameters of 100 to 97.5 mm. The best material for the disk has been found to be annealed Swedish Martin steel with a carbon content of 0.010 per cent. It might be expected that the hardest materials would wear the longest, but that is by no means always the case. Resistance to wear depends not only upon the

hardness but also upon the elongation and probably also upon other qualities of the metal so far undetermined. Felix Robin, in a paper on The Wear of Steels, has shown that when a substance is being rubbed with an abrasive, the grains of abrasive first enter the material and cause a depression. The motion then converts this into a scratch or slot, whereby the displaced material is pushed aside. If the material is hard and has little elongation it becomes easily detached, whereas if it is soft and has high elongation it is not so easily detached. In the case of very hard steel with little elongation the resistance to wear is increased by the fact that the hardness prevents easy penetration, but this is counteracted by the easy detachability of the displaced particles. The relations are the exact opposite in vulcanized rubber, whose high elongation increases its resistance to wear while its softness increases it.

As accurate results are obtained only by keeping the depth of wear between 0.2 and 0.8 mm., it is necessary to use different pressures and continue the test for different lengths of time with different wear resistances. F. Robin has shown that the wear increases slightly with the velocity and materially with the pressure. Brinell made tests under conditions of varying pressure with both hardened and unhardened carbon steels, and also with alloy steels, and his results are summarized in the following table.

Wear in 1/100 Cu. Mm. per Mm. Disk Thickness

Grade of Steel	Unhardened Carbon Steel			Hardened Carbon Steel			Alloy Steel		
	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
No. 1010...	525	298	218	497	274	176	...	...	...
No. 1050...	468	240	166	348	218	166	...	...	...
No. 1130...	440	218	146	323	207	136	...	...	...
No. 4345...	...	...	...	...	...	...	400	240	166
No. 4337...	1,433	756	530	1,168	...	...	440	263	166
K	...	...	...	...	...	...	348	240	166
Total	1,433	756	530	1,168	699	478	1,188	743	498

Test No. 1—10 kg. pressure, 10 min. time.
Test No. 2—10 kg. pressure, 5 min. time.
Test No. 3—5 kg. pressure, 10 min. time.

It might have been expected that in test No. 2 the wear would have been twice as great as in test No. 1 as the time of the test was doubled. That this is not the case is due to the increase in contact surface as the test proceeds. Brinell suggests that the disadvantage due to the fact that the wearing surface at the beginning of the test = O may be overcome by causing the wear to take place on the end surface of a small test rod which has previously been given the proper radius by means of an emery wheel to fit the disk immediately. But such a test would be less convenient and more expensive.

It would be desirable to be able to place all materials in a series, if for all the same pressure were used and the test were discontinued as soon as the standard depth of wear had been reached. Brinell is going to conduct research along this line. In that case the depth of wear would be eliminated and only the wear distance would remain, that is, the distance covered by the disk circumference with any material in producing the standard depth of wear. The requirements made of a standard method of measuring wear are as follows:

1. It must give reliable results, be simple and be readily adaptable to practical conditions.
2. The preparation of the test pieces must be simple.
3. The method must be applicable to both hard and soft materials.

In this last respect Brinell considers his method unobjectionable. If it were possible to automatically indicate the time required to wear to a certain depth a simple method would be available.

Dependence of Brinell Hardness Upon Mass

In the tables of physical characteristics of steels issued by the S. A. E. it is stated that the figures given may be expected to be obtained from rolled bars up to 1½ in. diameter or square, whereby cognizance is taken of the fact that the effect of heat treatment varies with the mass of metal treated and particularly with the maximum distance of any portion from the surface of the treated piece. E. J. Janitzky, metallurgical engineer, Illinois Steel Co., has been investigating the effect of mass particularly upon the hardness test results and has discussed the matter in two papers presented to the American Society for Steel Treating.

As the section of the piece quenched is reduced, a greater Brinell hardness will be obtained, down to the diameter where the whole section on quenching attains a perfect martensitic structure. With this and all smaller sections the maximum hardness possible with the particular steel and quenching conditions is attained. With alloy steels of the structural type this section has a diameter somewhere between ½ and 1 in.

In the first paper referred to a formula is given for the Brinell hardness of any round section, based upon the normalized Brinell hardness of the steel, the diameter of the section and various constants. This applied to a 0.45 per cent carbon steel. The second paper, presented to the Sectional Meeting held at New York in March, had for its object to show that the same general formula could be applied to structural alloy steel and that the formula also holds good for points on cross sections of round parts half way between the center and circumference. The discussion given by Mr. Janitzky is not based upon the mean of a series of tests but upon a single test by a single experimenter and no doubt greater accuracy in the constants appearing in the formula could be attained if the experiments were repeated by others.

Brake Drums of High Carbon Steel

BRAKE drums, as well as other drawn parts of sheet steel, are usually made of low carbon or soft steel, because this steel is naturally more ductile than steel with a higher carbon content and is, therefore, not so easily injured in the cold working process. However, low carbon steel has certain disadvantages for this purpose, and for cars in which the brakes are subjected to severe usage, such as racing cars, the brake drums are often made from forgings of a higher carbon steel. Recently the Midvale Steel and Ordnance Co. has been making experiments in the manufacture of high carbon steel brake drums, the carbon content running from 0.35 to 0.90 per cent. The concern claims to have successfully produced drums that are now in operation on a number of cars and are giving very satisfactory results, a fact that should interest automobile engineers.

The development of high carbon steel brake drums is particularly interesting because a good many cars are being redesigned with a view to the use of transmission brakes, and the service is considerably more severe in the case of transmission brakes than in that of rear wheel brakes, as regards wear and grooving of the brake drum,

with consequent reduction in the life of lining. In installations of this kind the high carbon steel brake drum is said to be very desirable because it resists grooving and retains its polish, this being due to the greater hardness of the high carbon steel. The final result is an increase in the life of the brake lining.

Thermo-Electric Phenomena for Identifying Certain Steels

BY means of the Brinell test it is possible to identify carbon steels with sufficient accuracy for practical purposes, but this is not possible in the case of alloy steels. This led H. Le Chatelier to look for a method of classifying steels in a different order from that of hardness which would still be applicable to individual pieces. A note on Chatelier's results was presented to the French Academy of Sciences by M. Gallibourg some time ago.

The arrangement shown in Fig. 1, based on the use of the contact electromotive force, meets these requirements. A mercury bath is heated to 120 deg. C. by an electric heating element of nichrome. A wire of electrolytic iron inserted into the mercury is connected to one terminal of a milli-voltmeter. The other terminal is connected to a metal clamp cooled by water circulation, which holds the sample. The sample is held by the clamp at one end and is brought in contact with the mercury at the other. At the end of 4 or 5 minutes the hand of the milli-voltmeter remains stationary. The only object of the mercury is to close the circuit, by insuring a perfect electrical and thermal connection between the wire of standard metal and the sample.

A large number of tests were made to determine the electromotive force produced under these conditions by various ordinary and alloy steels for temperatures between 20 and 320 deg. C. For the highest temperatures the mercury is replaced by lead. The tests were made with the set-up shown in Fig. 2.

In the illustration the reactance coil with its movable core is incorporated in the circuit of the nichrome heater and serves to regulate the flow of current through same; it has otherwise nothing to do with the test.

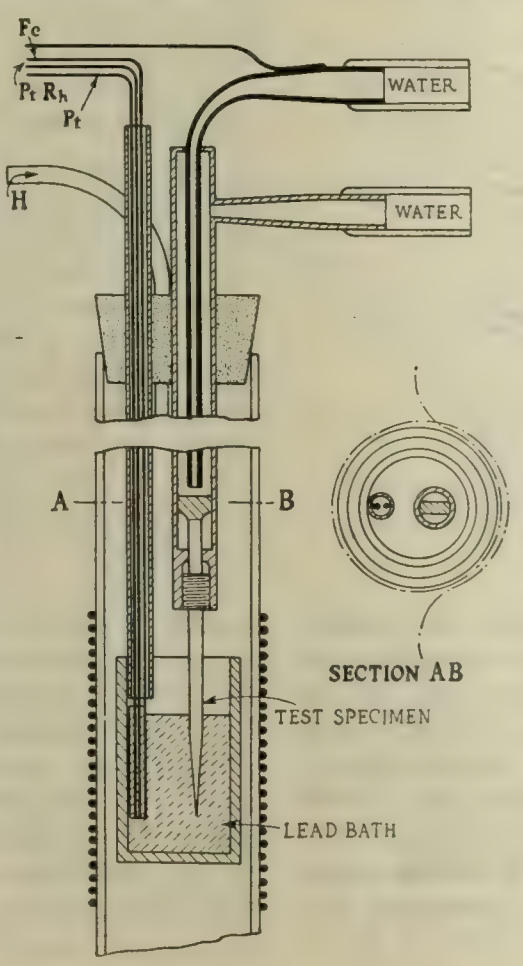


Fig. 1

Results Obtained With Nickel Steel

No.	C.	Mn.	Si.	Ni.	Thermo-electromotive force 120 deg. C.	200 deg. C.	300 deg. C.
1	0.08	0.34	0.13	2.15	0.8	1.25	1.70
2	0.12	0.01	0.05	5.23	1.8	2.80	3.85
3	0.12	0.12	0.05	7.13	2.1	3.40	4.80

Hardening has little influence on the form of the thermal electromotive force curve, as shown by the following tabulation:

	Annealed E.M.F. 120 deg.	300 deg.	Hardened E.M.F. 120 deg.	300 deg.
Carbon steel	0.50	0.95	0.55	1.15
Chrome-tungsten steel	0.25	0.25	0.25	0.35

The differences in the electromotive forces obtained with the different steels are sufficient in order that at the temperature chosen for the tests (120 deg.) the measurement of the electromotive force under the conditions indicated permits of classing both carbon and alloy steels in a different order from that obtained by the Brinell test, thus giving a second equation (the first being furnished by the hardness), to determine the character of a steel which cannot be subjected to an analysis.

In Fig. 3 the results obtained in the thermo-electric tests with nickel steels are shown graphically, the numbers of the curves corresponding to the numbers of the specimens in the table at the top of this column. It will be seen that the e.m.fs. increase with the nickel content. This is exactly what would be expected, as the thermo-electromotive force is taken relative to electrolytic or pure iron, and, nickel being the chief alloying component, the less the nickel content the more the composition approaches the standard metal. If both the standard wire and the sample have the same composition no electromotive force is set up.

Fig. 2

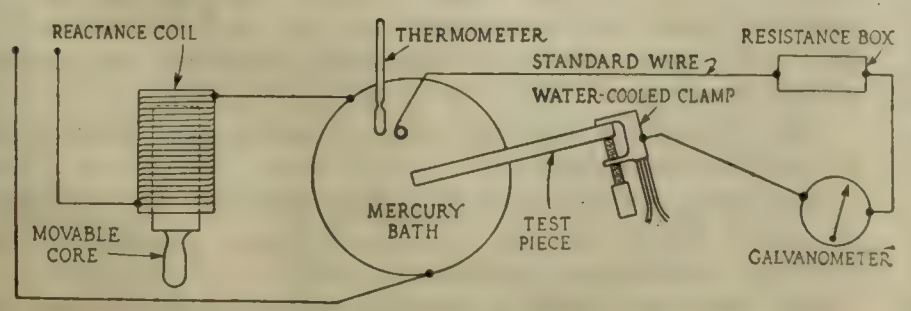
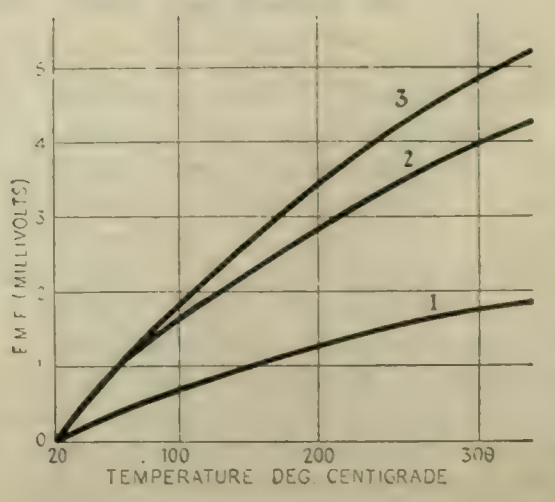
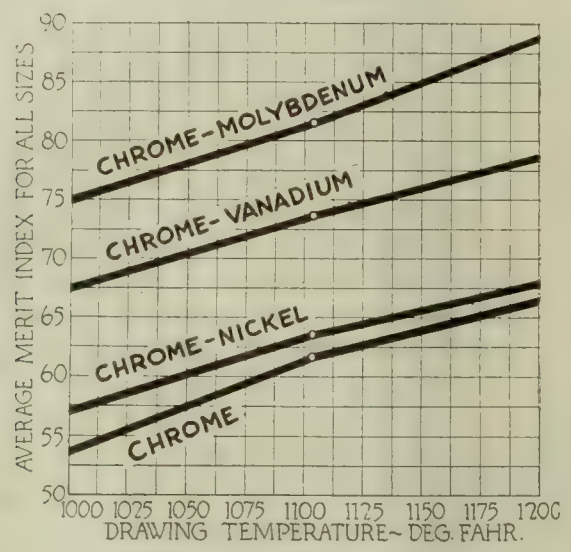


Fig. 3



Chrome Molybdenum Steels

MOLYBDENUM alloy steel is the latest structural steel to be introduced in automobile manufacture, being essentially a war product and in a certain measure, at least, the result of scarcity of other alloying elements during the war period. Naturally, a great deal of research work in connection with this new steel has been done during the past few years, partly by the steel makers and partly by users. At the last annual meeting of the S. A. E., a paper on "Chrome Molybdenum Steel Applications from the Consumer's Standpoint" was presented by C. N. Dawe, metallurgical engineer of the Studebaker Corporation. This concern is using chrome-molybdenum steel for rear axle shafts, transmission gears and shafts, steering knuckles and pins, ring gears and drive pinions, and already at that time had received delivery of upward of 2000 tons of this steel. It was found that for water-quenched parts the following composition gave good results: Carbon, above 0.23 and below 0.30 per cent; chromium, 0.70-0.90 per cent; molybdenum, 0.30-0.40 per cent.



Mr. Dawe points out that what consumers are specially interested in is the lowest quenching temperature which will give the maximum physical properties, and in comparative tests quenching temperatures of 1550-1650 deg. Fahr. were used for chrome vanadium, chrome molybdenum and chrome steels, and 1475 to 1575 deg. Fahr. for nickel steels. In making a comparison of the different steels, Mr. Dawe made use of a merit index given in a paper by John D. Cutter before the American Society for Steel Treating. This index is based on the tensile strength, elastic limit, elongation and reduction of area, and therefore takes in practically all the important physical properties.

In the tables given in the paper, containing the results of approximately 400 tests, this index is generally greater for chrome molybdenum steel than for any of the other alloy steels. With reference to the action of chrome molybdenum steel in various stages of production, Mr. Dawe states that it forges very satisfactorily, having the particular advantage that the scale formed breaks away from the forgings very easily. With proper composition and with sizes within ordinary limits it cold-shears as readily as the harder grades of alloy steels. It responds very readily to the heat treating operations, the percentage of forgings falling outside the required Brinell hardness being very small.

Chrome molybdenum steel has also been used for case hardened parts by the Studebaker Co., and some peculiar characteristics of the steel were noted in this connection. To get the best results, the piece to be heat treated had to be subjected to prolonged heating above the critical temperature of the core to bring about the proper condition for quenching, and the lower heat for hardening had to be applied as quickly as possible to prevent the core from being subjected to lengthy heating at the lower temperature.

To obtain the best possible results with the case-hardened parts, it was necessary, therefore, to quench from the carbonizing box into oil and follow this by the regular double heat-treatment and a final draw at 375 to 400 deg. Fahr., timing each operation as carefully as possible. There are two particular advantages that should be noted, however, in that chrome-molybdenum steel will take on a given case-depth in 10 per cent less time than chrome-nickel steel; also, there will be a resultant average increase in Shore hardness of from 5 to 7 points.

The Studebaker Corporation, however, has given up the use of case-hardening chrome molybdenum steels for highly stressed parts and Mr. Dawe concludes that chrome nickel steel is still the best commercial case-hardening steel for important parts, though chrome molybdenum steel is a serious contender. He believes that for parts where hardness alone is an important factor chrome molybdenum steel is entirely satisfactory.

Tests of Centrifugally Cast Steel

AT the Bureau of Standards tests have been made of hollow cylindrical steel castings with from ½ in. to 8½ in. wall thickness, made by the Millspaugh centrifugal process. Their composition ranged from two low-carbon steels, C = 0.17 and 0.23 per cent, to three nickel steels ranging in carbon from C = 0.33, 0.46 to 0.66 per cent, and in nickel from Ni = 2.69, 2.35 to 2.92 per cent. The wide range in carbon should be noted.

Segregation of the elements carbon, phosphorus, sulphur, nickel and copper appears to exist to a slight extent, but only radially, and is most marked next the inner surface in a narrow zone of about one-sixteenth inch depth. Manganese and silicon do not segregate in this type of casting. The greatest carbon segregation was 0.09 per cent in nickel steel (C = 0.66, Ni = 2.92 per cent) and the least was 0.02 per cent in another nickel steel (C = 0.33, Ni = 2.69 per cent).

The hardness (Brinell and scleroscope) practically follows the segregation.

The only evidence of unsoundness was the presence of small blowholes in the inner zone, usually within 1/16 in. below the surface.

The density across a section is practically constant; that is, to within 0.004 in 7.836.

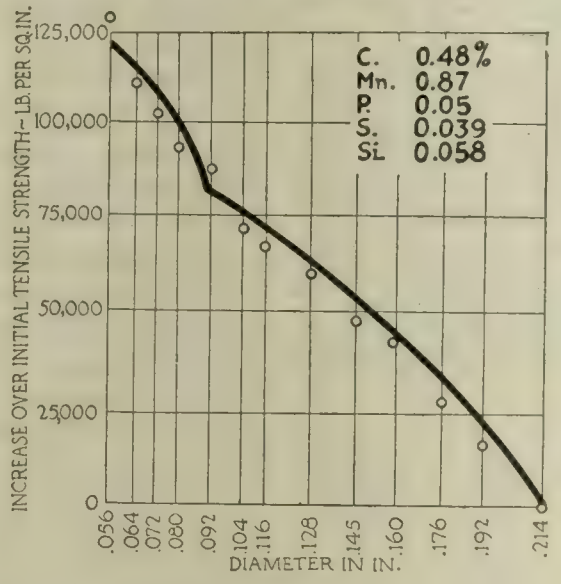
The mechanical properties show, in general, somewhat greater strength, elastic limit, and resistance to shock, but less ductility, in the tangential than in the longitudinal direction.

The internal stresses developed in the castings by this centrifugal process of manufacture, as determined from measurements on three rings from each of two castings, show values of the order of the elastic limit with the outer zones in compression.

The effect of heat treatment in improving the physical properties of the castings is very marked. The results suggest that the properties of such castings suitably treated may rival those of forgings of the same chemical composition.

Increase in Tensile Strength Due to Cold Drawing

IT is generally known that the strength of steel is increased by cold working, and especially by cold drawing. An attempt to establish the laws of increase in tensile strength in relation to the flow or deformation of the material in cold drawing has been made by E. J. Janitzky, metallurgical engineer of the Illinois Steel Co., who published an article on the subject in a recent issue of *Iron Age*. Janitzky bases his argument on the experimental work of Goerens (1911), Percy Longmuir (1913) and J. F. Tinsley (1914). All agree that cold drawing increases the tensile strength and reduces the elongation and contraction of area. Goerens drew the general conclusion that the tensile strength increases in proportion to the deformation of the metal; Longmuir stated that in no case was the increase in tensile strength exactly proportional to the amount of flow. Tinsley derived a formula according to which the increase in the tensile strength is equal to 1000 lb. p. sq. in. times the proportion of the decrease in section to the original section. Janitzky, by analyzing the experimental data published, came to the conclusion that this formula does not hold throughout the possible range of reduction. Curves are plotted showing the diameter of the wire as ordinates and the increase in tensile strength as abscissas. At a reduction of 90 per cent in a 0.10 per cent carbon steel there appears to be a break in the curve, and beyond this point the formula gives much too low values. A new curve starting from the breaking point also has a parabolic form, the same as the original portion of the curve, but is much steeper in slope. As the drawing is continued additional breaking points are found, the curve making a sudden change in direction at each of these points.



Janitzky reaches the conclusion that each portion of the complete curve can be determined by means of a formula very similar to that above stated, but using only one-half the proportional reduction in area and using the tensile strength and the area of the breaking point as a basis. Of course, instead of using one-half the proportional reduction and the constant 1000 he might just as well have used the proportional reduction and the constant 500. This leads to the following general equation for the strength after drawing:

$$T = \frac{A_n - a}{A_n} \times 100 \times 1000 + T_n,$$

where A_n is the area and T_n the tensile strength corresponding to any of the breaking points a the area after drawing and T the tensile strength after drawing.

The carbon content seems to influence the increase in tensile strength as drawing progresses only to the extent that the higher the carbon content the earlier will the first breaking point in the curve occur. Thus with a 0.10 per cent carbon steel the first breaking point occurs at a reduction of 90 per cent; with a 0.50 per cent carbon, at a reduction of 80 per cent and with a 70 per cent carbon steel at a reduction of 70 per cent. From the initial point to the first breaking point carbon has no influence on the rate of increase of tensile strength; beyond the first breaking point the increase is proportional to the reduction from the breaking point used as a base, the constant 500 being used for low and medium carbon steel and 1000 for high carbon steel.

The accompanying curve shows observed and calculated increases in tensile strength for a 0.48 per cent carbon steel. The close agreement between the curve and observed values will be noted.

Uranium as a Steel Alloying Element

URANIUM belongs to the group of metals that comprises tungsten, molybdenum and vanadium, which play such an important part as steel alloying elements. The ores of uranium are found in only a few parts of the world, including Joachimstal, Bohemia, Johanngeorgenstadt, Saxony, Paradox Valley and other places in Colorado and in Utah.

The separation of uranium from its ores is a costly and complicated process because of the refractory character of these ores. But the ores are seldom treated only for their uranium content. Indeed, this is more often a by-product of the recovery of radium or vanadium, or both, and thus the cost of treatment is shared between two or more products.

Uranium imparts remarkable physical properties to steels and alloys. When added to steels, it does not need to be augmented or intensified by the addition of other constituents, as is the case with some other steel-alloying elements. It increases the hardness and hardening power of steels by reason of its ability to emphasize the characteristics of cementite; the hardness imparted thereby is not accompanied by the brittleness that is character-

istic of other carbide-forming alloys. As a substitute for tungsten in special alloy steels it is claimed that a small proportion of uranium is equivalent to a relatively large proportion of tungsten.

Uranium steels are pre-eminently adapted for uses necessitating a low drawing temperature in that they possess under these conditions a remarkable combination of hardness, strength and durability.

The effect of the addition of small amounts of uranium on the physical properties of alloy steels is shown by the results (see Table I) reported by H. S. Foote in a recent issue of *Chemical and Metallurgical Engineering*, on different classes of alloy steel and compared on a like basis of ductility.

Table I.

Composition.	Elastic Limit	Tensile Strength	Elongation per cent.	Reduction in Area.
C, 0.32; Ur, 0.22	154,800	162,000	15.5	59.3
C, 0.30; Ni, 0.22	111,000	124,000	15.5	53.0
C, 0.31; Cr, 0.39; Va, 0.16	146,200	162,700	15.0	57.0
C, 0.28; Cr, 0.85; Mo, 0.37	154,000	165,000	15.0	58.3

These figures show that a small percentage of uranium increases the elastic limit and tensile strength to a point comparable with those of more complex alloy steels.

But while uranium alone in carbon steels produces results as shown, it also intensifies the desirable properties in the more complex steels. Foote supplies data of tests on uranium-nickel steels of the following percentage compositions which illustrate this fact: (*a*) C, 0.39; Ur, 0.22; Mn, 0.60; Si, 0.20; Ni, 3; quenched in oil from 1425 deg. F. (*b*) C, 0.45; Ur, 0.29; Mn, 0.48; Si, 0.53; Ni, 3; quenched in oil from 1475 deg. F. These tests are recorded in Table II, and it is interesting to note that the combination of small amounts of uranium with nickel produces a steel in which the desirable effects of both alloying elements are magnified. Many other examples might be supplied, but those given show that in alloy steels containing a little uranium, there is a material of extraordinary physical properties which for certain special purposes cannot be replaced by any other material equally suitable.

Table II.

Elastic Limit.	Tensile Strength.	Elongation per cent.	Reduction in Area.	Brinell Hardness.	Drawing Temperature.
(*a*) 206,400	248,600	13.0	47.7	512	400
(*b*) 244,500	290,100	10.0	29.1	555	—
(*a*) 199,200	231,100	13.5	51.1	477	500
(*b*) 238,900	271,100	10.5	35.5	512	—
(*a*) 183,300	202,100	13.5	54.1	418	600
(*b*) 212.000	228,000	11.0	39.0	464	—
(*a*) 164,100	177,200	15.0	56.0	387	700
(*b*) 185,000	198,200	12.0	45.0	415	—

(*a*) Charpy test, 156 ft.-lb. per square inch.
(*b*) Charpy test, 73.8 ft.-lb. per square inch.
(*a*) Alternating impact, 934 blows (⅜ in. throw).
(*b*) Alternating impact, 900 blows (⅜ in. throw.

As a constituent of high-speed tool steels, uranium has been found to be of great value. A metallographic study of high-speed steels indicates that the uranium tends to promote the formation of complex carbides upon which are dependent the cutting efficiency and the property of "red hardness." A complex uranium carbide is apparently more soluble in gamma iron than the carbides ordinarily found in high-speed tool steels, and it is reasonable to infer that uranium exerts an important influence on the property of "secondary hardness."

While the valuable properties of uranium steels have come to be widely appreciated, the relative scarcity of the ores of uranium limits the quantity of such steels that can be produced, and makes it improbable that the metal will ever be cheap enough to compete with other more abundant steel-alloying elements.

Effect of Uranium on Steel

IN the *Revue de Metallurgie* for June, 1920, E. Polushkin reports researches on uranium steel made in 1918 for an American company. He draws the following conclusions:

Uranium does not in the least affect the position of A_{c_1}, except when the uranium content is very high, about 7 per cent, when all critical points are suppressed. A_{r_1} is not noticeably lowered, except when the uranium content is above 2 per cent.

In steels with medium carbon content, 0.25-0.45 per cent, uranium raises the elastic limit and tensile strength, without affecting the ductility, or it may even raise the ductility, too. In steels with 0.60 per cent of carbon or more, uranium raises the tensile strength and elastic limit, but this steel has considerably less ductility. Uranium increases the hardness of steels. A melt of steel with uranium and steel gave very good results, the product being more ductile than ordinary nickel steel and chrome vanadium steel. Other melts, however, showed absolutely no favorable effect of uranium.

The comparative value of the good effects of the uranium outlined in the foregoing could not be determined exactly, by reason of the special conditions of fabrication and heat treatment, but in no case were any remarkable results obtained which could not be obtained with any other alloying elements. Uranium has absolutely no effect on the shock resistance or resistance to alternating stress.

Influence of Phosphorus on Low Carbon Steels

OPEN hearth low carbon steels are often used in the manufacture of products which require severe cold working in their fabrication. The Bureau of Standards therefore undertook an investigation to throw more light on the effect of different phosphorus contents upon the properties of such steels. No clear relationship could be established between the phosphorus content, varying between the limits 0.008 and 0.115 per cent (which marks the usual limits in plain carbon steels) and the microstructure and hardness as developed in two series of specimens, one of basic open hearth steel and the other of acid open hearth steel, by a series of different heat treatments, because of the marked irregularity in the distribution and grain size of the ferrite and pearlite grains found present in many of the specimens. This irregularity was traced, by means of the micro-structure as developed by etching, to the non-uniform distribution of the phosphorus. A cellularlike structure formed in conjunction with the micro-structure normal to these steels was studied and relationship between this unusual structure and the phosphorus distribution established.

Chromium Magnet Steels

OWING to the scarcity of tungsten in Germany during the war and the great demand for tungsten tool steels, it was found necessary to look for a substitute for the ordinary magnet steel which is a tungsten alloy steel. The Physikalisch-Technische Reichsanstalt then conducted a series of researches on the magnetic qualities of chromium steel for which samples in the form of rods of 6 mm. diameter and 22 cm. long were furnished by the Krupp Works. The results of this research were in the first place circulated confidentially. Recently this research work has been completed and a report on it was published by E. Grumlich in *Stahl und Eisen* of Jan. 12 and 19, 1922.

Samples with 3, 6 and 9 per cent of chromium were furnished by Krupps, and in the way of impurities these steels contained 0.03 per cent of silicon, 0.15 per cent of manganese and 0.08 per cent of copper. In the magnetic tests a maximum field strength of H=300 was worked with, and the remanence R and coercive force K for different quenching temperatures, as well as the product KR were determined. KR is a measure of the value of the steel for permanent magnets. It was found that, owing to the low value of this product, alloys with 1 and 9 per cent of chromium cannot be considered for use as magnet steel. With small chromium content the permanence of the magnets is not great, and these alloys are of little value for this reason.

With alloys of 2 to 6 per cent of chromium, remanence decreases with increasing hardening temperature, whereas the coercive force increases, at first rather fast and at higher temperatures more slowly. With increasing carbon content, the coercive force at first increases more rapidly than the remanence decreases, at least up to 1.1 per cent of carbon, so that the product RK first increases and then decreases with increasing hardening temperature and carbon content.

In general, with any particular carbon content the coercive force increases with the chromium content, at least up to 6 per cent chromium, the increase being more rapid with low than with high carbon. The remanence, on the other hand, generally shows a maximum value for as low as 3 per cent of chromium. The safest guide is again the RK value, which attains a maximum for both 850 and 900 deg. C, quenching temperature with about 1 per cent carbon and 3 to 5 per cent chromium, which seem to be the most promising alloys.

Oil quenching gave materially better results than water quenching, especially as regards the remanence. The comparison with tungsten steels in one of the tables herewith is based on the results obtained from samples submitted for test to the Reichsanstalt by different concerns. These therefore are representative of tungsten magnet steels used in practice. Oil-quenched chromium steels are somewhat better than tungsten steels.

The permanence of the magnets was tested by subjecting them to cyclic heating to 100 deg. C., to mechanical shock by dropping them from a height of 2.5 meters and to aging for successive periods aggregating one year. The loss of remanence through six cyclic heatings to 100 deg. C. was 3.42 per cent for steel with 1.04 per cent chromium, but only 1.15 per cent for steel with 8.05 per cent chromium.

As regards quenching temperatures, the loss of remanence was less for 850 and 900 deg. C. than for 800 and 950 deg. Loss of remanence through shock depends less on the chromium than on the carbon content. Loss with time was very slight (less than ½ per cent a year) and seems to decrease as the carbon content increases.

Table I—Influence of Hardening Temperature

Comp.		Remanence R			Coercive Force			Product RK		
Ch%	C%	R_{800}	R_{850}	R_{900}	K_{800}	K_{850}	K_{900}	$KR_{800}\times10^{-3}$	KR_{850}	KR_{900}
2.85	.88	11280	10900	9500	49.7	57.4	55.3	561	626	526
2.90	1.12	10630	10380	8560	56.1	59.2	63.1	596	615	540
5.84	1.13	....	9920	9200	49.3	64.6	72.5	...	641	666

Table II—Influence of Carbon Content

C%	Remanence R		Coercive Force K		RK	
	R_{850}	R_{900}	K_{850}	K_{900}	$RK\times10^{-3}_{850}$	$RK\times10^{-3}_{006}$
0.20	8660	8560	36.6	36.2	317	310
0.68	9500	9300	50.4	55.5	479	519
0.88	10060	10000	51.5	56.4	518	564
1.13	9920	9200	64.6	72.5	641	666
1.63	....	8040	....	60.2	...	484
1.82	....	7030	....	67.7	...	476

Table III—Comparison of Oil and Water-Hardened Chromium and Tungsten Steels

Chromium Steel Magnets											Tungsten		
Ch %	C %	Hard. Temp.	Rem. R	Coerc. Force K	RK $\times10^{-3}$	Ch %	C %	Rem. R	Coerc. Force K	RK $\times10^{-3}$	Rem. R	Coerc. Force K	RK $\times10^{-3}$
Quenched in Water.						Oil-Quenched					10200	58.1	593
2.85	0.88	850	10900	57.4	626	1.93	0.81	12660	56.8	720	9700	61.5	596
2.90	1.12	850	10380	59.2	615	2.97	1.12	10910	60.7	662	10250	63.0	646
6.24	1.14	850	9920	64.6	641	6.24	1.14	12270	66.3	814	10880	62.3	679
6.24	1.14	900	9200	72.5	666	....	....	.....	....	...	10880	66.4	723
Aver.	....	...	10100	63.4	637	....	....	11950	61.3	732	10380	62.3	647

Light Metal Research Will Affect Future Car and Truck Design

New all-aluminum car embodies results of aluminum research work. Rosenhain's studies determine best alloy for aluminum pistons. Germans experiment with light alloys in high speed engines. Progress made in forging aluminum parts. Aluminum solders developed more highly.

ECONOMY of operation is one of the chief aims of modern car and truck design. Low fuel consumption affects this factor strongly. Consequently, attempts to further reduce vehicle weight will probably continue.

Thus, the research work which is being carried on by various organizations in connection with the lighter metals probably reflects future design possibilities to a greater extent than does any other research as far removed from practice.

America, England, France and Germany are all playing their part in this important work. The accompanying article outlines briefly the various activities which are being conducted and tells something about the results expected or already obtained.

It gives the first public detailed information about the new all-aluminum car that has been developed experimentally in this country, and tells many other facts of interest to you.

ALUMINUM has been used for machinery casings almost from the beginning of the automobile industry, and it gradually came into use also for a number of minor parts not subjected to any severe stresses. The application of the light metal in this line of engineering was greatly extended when aluminum pistons were introduced, about 1914. Later came the aluminum engine, as exemplified in the Hispano-Suiza aircraft engine, and the Marmon, Napier, Austro-Daimler and Szawe automobile engines. A still more recent development is the aluminum connecting rod, which is made from a special forgable aluminum alloy named duralumin, and at the present time there is under development in this country a design of car in which all parts that can conceivably be made of light metal or alloy are made of aluminum alloy.

Aluminum in automobile parts has its drawbacks as well as its advantages, and both the aluminum piston and the aluminum cylinder block were discarded by several manufacturers who had adopted them. One failure, however, does not establish impracticability. In this case it tended to show that the aluminum piston and the aluminum cylinder had not been developed to a sufficiently high degree to meet the most exacting requirements of the automobile field. The aluminum interests were not discouraged by these temporary setbacks, but continued their research with rather encouraging results.

The practical results of the experiments carried on by the Aluminum Manufacturers, Inc., are nearly all embodied in the all-aluminum car which they may shortly market. It is expected that twelve more of these aluminum cars will be made and tested out exhaustively and that the car will then be put in production. The chassis weighs 1550 lb., which is claimed to be 1000 lb. lighter than a chassis of corresponding wheelbase made in the customary way with steel channel frame members, etc. The frame members, frame cross-members, front axle, rear axle housing, brake drum, all of the exterior fittings, such as running boards, etc., are made of aluminum. There are no splash aprons, the frame acting as such. The steering gear has an aluminum housing, and the engine is practically an all-aluminum unit with steel and iron employed only in the wearing parts. The cylinder blocks are aluminum with cast iron sleeves shrunk into place. In the original design the camshaft bearings were directly in the aluminum block, but undue wear developed at this point, and, in the new cars about to be made up, bushings will be used for the camshaft bearings.

The aluminum frame side rails used in this car are made up of three castings welded together. The axle housing is a casting and so is the front axle. The connecting rods and various fittings throughout the car are forgings.

Aluminum connecting rods have proved very successful in this car as well as in others. Several engines made by the Continental Motors Corp. have been fitted with them on trial. Many of the seven-passenger cars made by a prominent Cleveland concern now have aluminum connecting rods in their engines, and the manufacturer of a well-known air-cooled car is said to be another convert to this type of rod. Aluminum connecting rods are under test by quite a number of manufacturers and apparently are giving good results in every instance. But the change from steel to aluminum in this vital, highly stressed part marks such a radical step that many engineers hesitate to make it until the test engines have been in operation for a long period of time. Some are even concerned that, in regular production, the rods might not show the same high physical qualities as the test rods, as these qualities in aluminum are apt to be dependent upon careful manipulation in forging and upon accurate heat treatment, which

calls for the employment of high-class labor.

In connection with the manufacture of aluminum parts it is necessary to develop an entirely new technique, as the tools which are suitable for steel, bronze and iron parts are far from satisfactory for this purpose. With aluminum the cutting speeds should be almost half way between what is used for wood and steel respectively. No manufacturers at the present time are making tools suitable for this kind of work.

One of the reasons why the aluminum car is considered commercially practicable is the fact that all of the parts can be machined at such a rapid rate that a plant of a given size will turn out a far greater number of aluminum than of steel parts. Cutting speeds of 1000 ft. per minute are very practical with aluminum. These high cutting speeds reduce the cost of manufacture, and, although there is $200 worth more material in a chassis than in a corresponding size steel chassis, the manufacturing cost need not be more than $40 or $50 higher with a moderate production, and would be about equal with large production.

Probably the next development in connection with the application of light alloys in automobiles will be the use of magnesium. Several companies have been organized in this country for the commercial exploitation of metallic magnesium and considerable research work is under way, but most of it is as yet only in its early stages.

Research for Best Alloy for Pistons

AN investigation to determine the most suitable alloys of aluminum for internal combustion engine pistons was made at the National Physical Laboratory, England, during the war and the years following it, and the results of this research are embodied in the Eleventh Report of the Alloys Research Committee of the Institution of Mechanical Engineers, of which Walter Rosenhain, Sidney L. Archbutt and D. Hanson are the authors. This report was published in August, 1921, and embodies the results of research extending over a period of more than eight years.

It was found that for pistons, alloys containing a high percentage of zinc are not suitable, because of the rapid falling off in strength of such alloys at high temperatures. This rules out both the binary aluminum-zinc alloys and the ternary aluminum-copper-zinc alloys with a high zinc content. As an illustration of this property, it may be mentioned that aluminum-zinc alloys with either 12 or 14 per cent of zinc show a decrease in tensile strength from ten tons per sq. in. at 0 deg. C. to a little over three tons at 350 deg. C. As regards aluminum-copper alloys, it is an interesting fact that between 200 and 250 deg. C., all of the alloys with from 6 to 14 per cent of copper have substantially the same strength, but above 250 deg. the 12 and 14 per cent alloys are somewhat better than the others.

It had long been known that the addition of manganese has a tendency to stiffen materials at high temperatures, and manganese was therefore added in small quantities in order to study its effect on copper-aluminum alloys. With 12 and 14 per cent alloys an addition of 1 per cent manganese caused the tensile strength to increase up to 250 deg. C. From this temperature up the tensile strength decreased, but at 350 deg. it was still much better than without the manganese, especially with the higher copper content.

An exploration was undertaken with both smaller and larger manganese contents, but a 1 per cent content was found to give the most satisfactory results. It appeared that an alloy containing 14 per cent of copper and 1 per cent of manganese could not be produced in the foundry as readily as other well-known aluminum alloys, and alloys with iron, molybdenum, tungsten, chromium and vanadium were explored, these elements being substituted for the manganese. In this connection it was kept in mind that other properties besides high tensile strength at high temperatures, such as high thermal conductivity, are also desirable. However, in most cases these additions rendered the alloy very brittle. It was also found that in some instances the high melting point components on solidification tended to form a skeleton from which the more fusible alloy drained away, leaving a porous casting. The addition of iron to the usual aluminum alloys was found not to produce any improvement at high temperatures and increased the foundry difficulties.

The next step was to experiment with nickel additions to aluminum-copper alloys and with magnesium additions to these. It was found that in the presence of both nickel and magnesium the copper content could be safely reduced, which resulted in decreasing the specific gravity of the alloy and increasing its thermal conductivity.

What is referred to as Y alloy was finally developed as the most suitable for piston material. It contains 4 per cent of copper, 2 per cent of nickel and 1½ per cent of magnesium. At moderate temperatures this alloy is enormously better than the 14 per cent copper binary alloy as regards tensile strength, but at 350 deg. C. (662 deg. F.) the tensile strength of the two approach each other. At 0 deg. C. the quarternary alloy mentioned has a tensile strength of about 13.4 tons, as compared with 10 tons for the binary alloy, and at 200 deg. the strengths are still further apart.

An interesting and important feature of both sand and chill castings of the aluminum-copper-nickel-magnesium alloy is that test specimens show a really appreciable amount of elongation, and at high temperatures, above 300 deg., this increases very rapidly. This led the authors to try forging and rolling this material. A nickel content of 2 per cent and magnesium content of 1½ per cent was found to be the best by explorational experiments.

In preparing the Y alloy certain precautions are necessary. The magnesium must be added just before pouring, and it is best to add it in the form of fairly large pieces of pure metal which should be immediately pushed below the surface of the aluminum, so they can dissolve without coming in contact with the air. If added at an earlier stage of the melting operation, a considerable proportion of the magnesium is likely to be lost. Nickel is added as follows: A hardener or rich nickel alloy (about 20 per cent) is first prepared, and this is added in the proper proportion to the molten aluminum.

Castings of this alloy are likely to show a large number of so-called pinholes, but tests have shown that these do not materially weaken the material. Measurements of the contraction on cooling show that there is no great difference between the different alloys and that the more complicated alloys show less contraction than the binary zinc-aluminum alloys. Thermal conductivity is an important feature of an alloy intended for internal combustion engine pistons, and in this respect the Y alloy gave the following results:

Coefficients of Thermal Conductivity, Y Alloy
(Sand Castings)

As Cast	At 100 deg. C.	0.35
	At 300 deg. C.	0.37

Chill Cast

As Cast	At 100 deg. C.	0.37
	At 300 deg. C.	0.40
Annealed at 450 deg. C.	At 100 deg. C.	0.40
	At 300 deg. C.	0.41

This compares with the following values for cast iron (sand castings):

Coefficients of Thermal Conductivity of Cast Iron
(Sand Castings)

As cast	At 100 deg. C.	0.102
	At 300 deg. C.	0.099
Annealed at 450 deg. C.	At 100 deg. C.	0.121
	At 300 deg. C.	0.113

The cast iron on which the determinations were made, as cast had the following composition: Graphite, 2.64; combined carbon, 0.85; silicon, 1.84; sulphur, 0.078; phosphorus, 1.09; manganese, 0.82. After annealing the composition was as follows: Graphite, 3.34; combined carbon, 0.15; silicon, 1.94; sulphur, 0.070; phosphorus, 1.09; manganese, 0.85.

It was proved that material improvement in the physical characteristics of the castings could be obtained by suitable heat treatment of aluminum alloys, especially those containing magnesium. With chill bars of alloy containing 2, 3, 4 and 4½ per cent of copper, it was found that annealing for three days at between 450 and 520 deg. C. material improvements in both the tensile strength and the elongation were obtained. With 4 per cent copper, for instance, the tensile strength was raised by heat treatment from 9.5 to 15 tons per sq. in., and the elongation from 10 to 21 per cent. This is a rather remarkable result, but still more marked improvement by heat treatment was obtained with the Y alloy.

This alloy was first given a prolonged heating at 500 deg. C. to bring it to the same state as forged material. The temperature may be carried as high as 530 deg. without injuring the material. Next, the alloy was heat treated by heating to 480 deg. C. for six hours, either in an open muffle or in a salt bath, and then quenching in water. Still better results are obtained by quenching in boiling water or in oil.

Tensile Strength of Y Alloy, 1-Inch Diameter Chills

Treatment	Tensile Strength (Tons) At 15 deg. C.	At 250 deg. C.
As cast	12.6	10.5
Temp. 48 hrs. at 250 deg. C.	9.8	8.6
(1) Open muffle, 6 hrs. 480 deg. quenched and aged	14.9	11.3
6 hrs. 480 deg. and tempered 48 hrs. at 250 deg.	13.4	10.1
48 hrs. at 480 deg. quenched and aged	15.8	12.0
48 hrs. at 480 deg. and tempered 48 hrs. at 250 deg.	13.8	9.4†
(2) Nitrate bath, 6 hrs. 480 deg., quenched in oil and aged	14.6	12.8
6 hrs. at 480 deg. and tempered 48 hrs. at 250 deg.	13.2	11.0
48 hrs. at 480 deg., quenched and aged	16.0*	13.7
48 hrs. at 480 deg. and tempered 48 hrs. at 250 deg.	16.0	12.0
(3) Nitrate bath, 6 hrs. at 530 deg., quenched in boiling water and aged	21.0‡	

*Max. extension at 15 deg. C. 2.25 per cent in 2 in.
†Max. extension at 250 deg. C., 3.75 per cent in 2 in.
‡Extension at 15 deg. C., 6.5 per cent.

The marked improvement both at normal temperature and 250 deg. C. will be noticed. Prolonged heating has a very marked effect on the tensile strength of the material as cast, both at normal and high temperatures, but this effect is much reduced by heat treatment, which is important in a material intended for internal combustion engine pistons. The elongation is practically unaffected by the heat treatment. Heat treatment of the Y alloy is used at the Royal Airship Works at Cardington and it was there that a tensile strength of twenty tons was first obtained.

Progress Made in Forging Aluminum

IN the Eleventh Report of the Alloys Research Committee of the Institution of Mechanical Engineers, referred to in the earlier part of this article, extensive researches on wrought aluminum alloys are covered. The research work on which that report is based was done mainly with a view to developing alloys suitable for aircraft construction. Aluminum alloys that could be rolled into rods or sheets had been known for a long time, but these were all comparatively soft alloys of little strength, and the object of the researches was to develop alloys of greater strength that would lend themselves to rolling, drawing, extrusion, etc.

The first alloy experiment was with that known as Alloy A, consisting of aluminum 77, copper 3, zinc 20. It was found impossible to roll billets of this material without preliminary forging. Between 350 and 400 deg. C. the billets would stand a moderate amount of forging without cracking. At first the billet was rotated during the forging operation so as to distribute the blows evenly over the whole surface, but this was found invariably to result in cracking. The billet was then moved endwise so as to distribute the blows over the whole length, and was then rotated through an angle of 90 deg., after which an equal number of blows was given the billet on the side then up. By the method finally adopted the billet was reduced to an octagonal section, 5 to 10 per cent less in area, in two stages.

Much trouble was experienced from cracking during the breaking-down process in the rolls, and this was traced to surface defects in the cast billets. The trouble was finally overcome by tilting the billet molds at an angle of about 45 deg. to the horizontal and pouring the molten alloy in a slow stream. The object was to maintain in the mold at any time as shallow a layer of metal as possible, the rise in the liquid metal being arranged to keep pace with the rate of solidification of the alloy. This obviates all shrinkage cavities and largely avoids the necessity of "following up." This method of pouring, together with the plan of keeping the molds at a relatively low temperature (about 100 deg. C.) immediately improved the behavior of the billets in the rolls.

Annealing the billets at the maximum temperature short of incipient fusion did not improve the rolling qualities, nor did the use of lower breaking down temperature (300 deg. C.). Complete success was finally achieved by increasing the amount of forging and using a higher forging temperature (400 deg. C.). This was coupled with intermediate annealing between the first and second forg-

ing operations and a final annealing for one hour at 450 deg. C. before the rolling. It was also found necessary to keep the rolls well lubricated, as otherwise the billets would split in halves and curl around the rolls.

After billets had been broken down and rolled into rods of 1⅝ and 1¼ in. diameter, these rods could be readily rolled down further to ⅞ in. by reheating the rods as produced from the breaking down process to about 400 deg. C. The physical properties of the alloy vary slightly with the amount of rolling work done upon it, as may be seen from the following compilation.

Physical Properties of Alloy A (Rods)

Dia. of Rod Hot Rolled	Yield Point	Tens. Strength	Elongation
1⅝	17.8	25.4	16.5
	17.7	26.9	18.5
1¼	18.5	27.4	18.0
	16.2	26.1	19.0
⅞	16.5	26.1	22.0

The modulus of elasticity for this material was found to be 9,700,000 lb. per sq. in.

Experiments were also made in rolling this material into sheets, and in this connection it was found much better to use an annealing temperature of 250 deg. C. than 400-450 deg., which was the temperature range first tried. The advantage was especially great as regards the restoration of the ductility of the cold worked strip. Cold rolled and annealed material does not attain to the combination of tensile strength and elongation which can be readily obtained with hot rolled material that has never been cold worked. Cup-shaped spinnings were produced from alloy A with annealing at 250 deg. C., which proved entirely stable and remained sound for four years.

Annealing at lower temperatures than 250 deg. brought out the fact that cold rolled sheet after annealing for 30 minutes at 100 deg. C., shows a small amount of softening, while annealing at 180 deg. gives the maximum amount of softening, producing as much as 29 per cent elongation in 2 in. and a tensile strength as low as 19 tons.

Tests made on a specimen ½ in. in diameter by 2¾ in. long showed that when extruded and rolled, Alloy A (rolled to 1½ in. diameter from 2⅛ in. diameter) had an elastic limit of 10.4 tons, a buckling strength of 14.3 tons and a modulus of elasticity of 9,800,000. The proprietary alloy Duralumin, in specimens of the same form and treated in the same way, showed an elastic limit of 9.0 tons, a buckling strength of 13.7 tons and a modulus of elasticity of 10,100,000 lb. per sq. in. Tests gave a shearing strength for alloy A of 21.9 tons for sheet 0.048 in. thick and 23.3 tons for sheet 0.061 in. thick. Shear tests on rivets 0.063 in. in diameter gave a shearing strength of 15.8 tons for a single rivet joint and 17.3 tons for a double rivet joint. The reason for the lower shearing strength of the rivets, as compared with the sheet, is undoubtedly that the rivets were annealed. Yet the figures obtained with these rivets were much greater than those obtained with pure aluminum and soft alloys, which range between seven and eight tons.

Another composition experimented with is known as E alloy and consists of copper, 2.5; zinc, 20; magnesium, 0.5; manganese, 0.5; iron not to exceed 0.2; silicon not to exceed 0.2. After rolling billets of this alloy down to rods of ¾ in. diameter the following tensile properties were obtained:

Physical Properties of E Alloy

Primitive El. Limit	Yield Point	Tensile Strength	Elongation
22.1	32.9	37.8	12
18.9	32.1	36.8	11

This is claimed to constitute a considerable advance over any light alloy previously produced, so far as tensile properties are concerned, hence the committee devoted special attention to the development of alloys of this type and their production in the form of sheet by rolling.

In preparing alloys containing magnesium it was found that much better results were obtained by adding magnesium in the form of pure metal just before pouring than in the form of a high percentage magnesium (20 per cent) aluminum alloy, as the latter method produced unsound castings.

In working alloy E it was found that 300 deg. C. was the best forging temperature and that as much as 30 per cent reduction of area could be obtained without cracking. Results typical of tensile tests of alloy E after rolling to a thickness of 0.05 in. and after receiving the various forms of heat treatment indicated are given in the table below:

Tensile Tests of Alloy E in 18 Gage Sheet

Condition	Yield Point	Tensile Strength	Elongation
As hot rolled	26.3	31.4	15
	24.8	32.6	16
Ann. at 250 deg.	14.5	25.3	20
Quenched at 250 deg. and aged	13.7	23.3	22
Quenched at 350 deg. and aged	27.3	36.5	10
Quenched at 400 deg. and aged	27.8	38.7	9
	30.5	39.1	11

Production of alloy E was placed on an industrial scale at the Royal Airship Works at Cardington. Trouble occurred at first from excessive waste, due to edge cracking, but this was overcome by machining all billets before rolling and by a change in the composition. The conclusion was reached that the machining of slabs was cheaper than the rejection of all slabs showing surface defects. After the slabs are machined they are given a preliminary annealing before they are forged. This treatment permitted of a reduction in thickness of 30 per cent in the forging process, and after this the rolling process presented less difficulty. The addition of extra silicon, so as to bring the total amount up to 0.75 per cent, resulted in softening of the alloy, reducing the tensile strength from 39 to 35 tons and increasing the elongation from 15 to 18 per cent. With the additional amount of silicon the alloy is known as alloy F.

Alloy G is another modification of alloy E, in which the percentages of all alloying elements in the composition except copper are reduced to one half. The composition of alloy G, therefore, is as follows: Copper, 2.5; zinc, 1.8; magnesium, 0.35; manganese, 0.35; silicon, 0.80. This change in the composition produced very little diminution of the elastic limit but considerable increase in the elongation.

Alloy Y, originally developed for casting, had shown remarkable ductility within the temperature range 300-450 deg. C., which is usually employed for rolling, while alloys of the A and E type are remarkably deficient at these temperatures. For use in the connecting rods of internal combustion engines alloys containing a high percentage of zinc are useless. Type E also had shown certain limitations, due to the development of season cracking and corrosion. Alloy Y was studied particularly with a view to combining the high strength of zinc alloys with freedom from these defects. As regards tensile properties, on the whole, alloy Y gave the best results at both ordinary and high temperatures. At a temperature of 200 deg. C. alloy Y has a tensile strength of 19½ tons. This result was obtained in a test made on ⅞-in. diameter

rod previously heat treated by being quenched from 480 deg. C. in cold water and aged for four days. It appears that the hardening effect of heat treatment is removed by prolonged heating at 200 deg. C., as this tensile strength (19½ tons) is the same as that obtained from hot rolled rod. Temperatures up to 150 deg. C., however, do not seem to destroy the effects of heat treatment, as specimens held at this temperature for 100 hours showed only a negligible loss of strength. Comparison with alloys of the Duralumin type show alloy Y superior at 150 deg. in retaining hardness acquired by heat treatment. As alloy Y was intended for connecting rods, fatigue tests were made at 20-150 deg. C., and it was found that the safe ranges of alternating stress are ± 10.2 tons at 20 deg. and ± 8.4 tons at 150 deg. The range at 150 deg. was found to be higher than for any other alloy tested. It may be recalled that alloy Y contains 4 per cent of copper, 2 per cent of nickel and 1½ per cent of magnesium.

French Light Alloy Piston Work

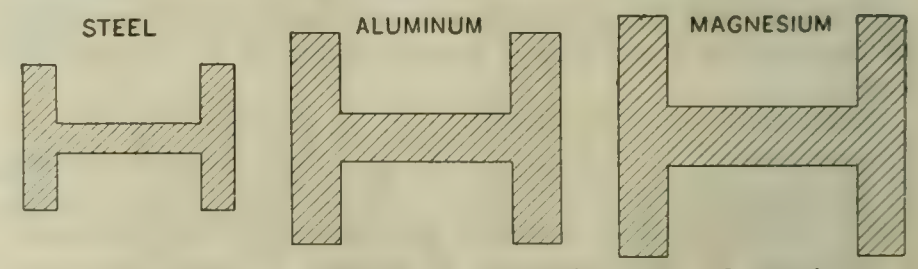
CAST magnesium pistons are being used this year for the first time on European racing cars and special speed productions. This type of piston was employed by Mercedes on the racing car which won the Targa Florio race, and cast magnesium pistons are being used on the French Rolland-Pilain two-litre racers built for the Grand Prix and other European contests. These pistons were cast by the Blanchaud Co. of Paris. The Fiat Co. of Italy also is experimenting with magnesium pistons. Other important uses of magnesium castings are to be found in the 500 hp. Bugatti-Breguet engines for the Breguet Leviathan plane. The crankcase of this 16-cylinder engine is a magnesium casting weighing only 99 lb., which is less by 55 lb. than the weight of the same casting in aluminum. This casting, which is one of the biggest and most important made in France up to this date, was produced by the Compagnie Parisienne de Fonderie with metal provided by the Societe de l'Electro-Chimie.

In Germany use is made of magnesium alloys described under the general title of Elektron, and produced by the Chemische Fabrik Griesheim-Elektron, near Frankfort. The most generally employed alloys appear to be magnesium and aluminum in the proportions of 90 and 10; magnesium, 85, and zinc, 15; or magnesium, 90, aluminum, 5, zinc, 5.

At the present time the greatest obstacle to the use of magnesium appears to be cost. Compared with aluminum there is a saving in weight of 33 per cent, but taking this into consideration the cost is double.

The Elektron Co. points out that this metal is inflammable if heated beyond its melting point, and that there is danger of fire if chips come in contact with water. The metal can only continue to burn, however, in thin sheets (sheet magnesium). As a proof that there is no danger of fire with magnesium alloy except when used in thin sheets, the following experiment was carried out in Germany. The engine was taken out of an old airplane and replaced by a gearbox in cast magnesium. The gasoline tank was filled and a light applied to the machine. In a few minutes the gasoline tank exploded and with the aid of a strong wind the entire plane was immediately in flames. After all the wood had been consumed parts of the magnesium casting fell to the ground, but they did not burn; the tail of the airplane dropped off, then the fuselage and the forward portion of the plane, which fell on the magnesium casting. The metal parts were only consumed slowly, and according to the official report the magnesium castings were the last portion of the plane to be burned.

Experiments have been carried out in France with both magnesium and aluminum connecting rods, but it appears that their use has been confined to experimental departments. M. De Fleury, head of a French aluminum foundry, has published particulars regarding aluminum and magnesium rods and pistons. While a steel rod and cast iron piston weighed 4.62 lb., the aluminum rod and piston weighed 3.08 lb. A magnesium connecting rod with two bolts and anti-friction bearing weighed 1.05 lb., compared with 1.38 lb. in aluminum. The sections of the three rods at the middle of their length were as shown in the sketch.



Diagrammatic sections of connecting rods of equal strength

These rods were for use in a cylinder having a bore of 3.38 in., with a compression ratio of 4.9. The three rods were of the same length, namely, 11 in. The explosion pressure per square centimeter was 347 lb. per sq. in. and the total pressure 3150 lb.

Aluminum Studies at Bureau of Mines

AN investigation is being made by Robert J. Anderson, metallurgist, at the Pittsburgh, Pa., Experiment Station of the Bureau of Mines of the effects of various metallurgical fluxes used in aluminum and aluminum-alloy melting practice. Worthless fluxes are to be given especial attention. Data have been obtained as to the different fluxes now used commercially and as to those suggested for use in melting. The effects of these are to be examined.

The Experiment Station is also conducting an investigation with the object of devising a rapid commercial method for the direct determination of metallic aluminum in aluminum, aluminum alloys, drosses, etc. A hydrogen evolution method has been developed for the direct determination of the metal. A complete account of the study is being prepared for issue as a technical paper.

A study is being made at Pittsburgh of the effects and interactions of the various gas constituents found in furnace atmospheres, e. g., carbon dioxide, carbon monoxide, oxygen, sulphur dioxide, water vapor, nitrogen, etc., upon aluminum at various temperatures. The available information, in the literature of the subject, has been col-

lected. Laboratory experiments are to be carried out.

The commercial use of pyrometry in aluminum and aluminum-alloy melting practice is being investigated. Data have been gathered as to the employment of pyrometric control of melting at commercial plants in the United States, and as to the types of pyrometers used.

A study is being made by the Bureau of Mines of the atmospheres in industrial furnaces used for melting aluminum and its light alloys. The purpose of the investigation was to ascertain the constitution of the atmospheres in contact with metal being melted in different furnaces by the analysis of gas samples taken from the furnaces. Samples of gas from practically all commercial types of industrial melting furnaces, both fuel-fired and electrically heated, have been taken and analyzed. A technical paper has been prepared, dealing with the sampling procedure and the results of the analysis, for publication by the Bureau.

The purpose of another investigation being made at Pittsburgh is to devise a rapid commercial method for the determination of aluminum oxide in aluminum and its light alloys, as well as to study the problem of aluminum oxidation in general. The methods suggested as suitable for this determination have been examined experimentally, and a number of new methods have been studied. The preliminary work done to date is being assembled in form for publication as a technical paper. It is intended that further study shall be made of this problem.

The effect of the quality of primary and secondary aluminum pig and aluminum-alloy pig in sand-casting practice as related to the quality of the resultant castings is being studied. Preliminary investigation, based on reports from foundries and other sources and on observation, has shown that difficulties are experienced in both foundry practice and in die-casting work, owing to variation in the quality of aluminum melting stock. This investigation may be regarded as continuous for the present. Some foundry experiments on the subject are under consideration.

A study has been made of the causes of, and methods for the prevention of, cracks in light aluminum-alloy castings. The investigation included also the determination of the contraction in volume and of the linear contraction of a series of commercial aluminum alloys, as well as an examination of the cracking tendency of the alloys when poured into different kinds of molds. In this connection an investigation was conducted with the purpose of measuring the total contraction in volume on freezing, and the linear contraction in different molds, of various light aluminum alloys. Measurements were made of the linear contraction in graphite molds of a series of commercial aluminum alloys and also of the total contraction in volume on freezing.

Investigations are also being made of the atmospheres in industrial furnaces used for melting aluminum and its light alloys. The purpose of the investigation is to ascertain the constitution of the atmospheres in contact with metal being melted in different furnaces by the analysis of gas samples taken from the furnaces. Samples of gas from practically all commercial types of industrial melting furnaces, both fuel-fired and electrically heated, have been taken and analyzed. A technical paper has been prepared, dealing with the sampling procedure and the results of the analysis for publication by the Bureau.

Thermal Expansion of Aluminum

SOME determinations of the coefficient of heat expansion of practically pure aluminum have recently been made at the Bureau of Standards. Pure aluminum has little use in automobiles, but presumably the coefficients of expansion for the ordinary alloys containing only small percentages of alloying elements are not very different. Two samples were cut from a bar of aluminum of high purity, prepared by the Aluminum Co. of America. The metal was melted in an Acheson graphite crucible at a temperature which at no time exceeded 1350 deg. Fahr. and was poured at 1300 deg. Fahr. in a green sand mold. The bar was taken directly from the mold and received no further heat treatment before the tests. The analysis of samples taken from the ends of the bar after it was cast was as follows:

	Per Cent
Silicon	0.12
Iron	0.13
Copper	0.006
Al. (by diff.)	99.744

The following table gives the results obtained for the average coefficient of expansion for various temperature ranges:

Coefficients of Expansion of Aluminum

Temperature range in degrees centigrade	Average coefficient Sample 1 (S613)	Average coefficient Sample 2 (S615)
20 to 100	23.7×10^{-6}	23.8×10^{-6}
100 to 200	25.4	26.1
200 to 300	27.3	27.0
300 to 400	29.8	30.2
400 to 500	32.3	32.9
500 to 600	35.9×10^{-6}	36.2×10^{-6}
20 to 300	25.6	25.7
300 to 600	32.7	33.1
20 to 600	29.3	29.5

The average equation

$$L_t = L_o[1 + (21.90\,t + 0.0120\,t^2)\ 10^{-6}]$$

is given as the most probable second-degree equation for the expansion of this aluminum (99.74 per cent) from room temperature to 600° C. The length at any temperature t as determined from this equation is accurate to $\pm$ 0.00004 per unit length.

The cooling curve was found to be slightly above the heating curve, and at the end of the test the specimen was about 0.01 per cent longer than before the test. The length of the other specimen was practically the same before and after the test.

A New Source of Aluminum

RECENTLY deposits of alunite, which contains 37 per cent of alumina, besides potassium sulphate, sulphuric acid and water, have been found in Tushar Mountains, Utah, and it is proposed to work these deposits for the manufacture of aluminum, potash and sulphuric acid. Although the alumina content of alunite is not as high as that of bauxite, it is believed that aluminum can be produced just as cheaply, if not more cheaply, from the former, on account of the valuable by-products, potash and sulphuric acid.

Potash is an important ingredient of fertilizers and sulphuric acid is widely used in the industries.

Research on Wood Products Aids Economical Automobile Production

Better bodies at a lower price depend largely upon fuller information about wood products. Forest Products Laboratory conducts practical research. Substitutes for ash determined. Preparing wood for bending studied. Moisture absorption through varnish is being investigated.

WOOD is extensively used in automobile and motor truck bodies and wheels, and to some extent in frames and minor parts. In aircraft construction it has so far been the chief material of construction, though attempts are now being made to replace it with light metal. The chief problems in connection with woods used in the automotive industry have to do with the procurement of sufficient stocks of faultless material; the substitution of other grades for the woods commonly used for certain purposes, in case of a shortage in the supply; seasoning or drying, storing, working, protecting against decay, etc. Most of the experimental or research work on wood is being done at the Forest Products Laboratory, Madison, Wis., an institution now in its twelfth year. The Laboratory did very effective work in connection with problems of aircraft construction during the war and has also published much material on the use of wood in automobiles.

One of the latest problems taken up by the Laboratory is that concerning the conditioning, finishing and protecting of wood. A preliminary meeting of representatives of interested organizations was held at Madison on May 3, at which it was decided to form a permanent organization by July 1 and to devise ways and means for carrying out the research. Although no automobile organization was represented at the preliminary meeting, it is believed that the automotive industry will be interested and will support the undertaking. A certain amount of work along the line indicated has already been done at the Laboratory, tests having been made of the rate of moisture absorption by wood when protected by different coatings. The research, when its results are published, no doubt will drive home the fact that the object in painting wooden structures and articles is to keep moisture out of the pores of the wood and thus prevent its decay.

A number of specific researches have been conducted which are of very direct importance to the automotive industry. A survey of the most important of these follows.

For use in automobile bodies ash has always been considered the most desirable wood. It combines the properties of moderate weight, easy workability, high degree of toughness, and comparative freedom from warping. On account of the high price of ash, however, other woods are replacing it in all but the most expensive cars.

The following description, prepared by the Forest Products Laboratory, gives some of the advantages and disadvantages of the substitute woods as compared with forest-grown ash for automobile construction:

Maple.—Hard maple is used for sills in many cars, and in some for the framework of the body and even the floor and running boards. Maple is fully as strong and stiff as a beam or post as white ash, but is not as shock-resistant. It is usually cheaper than ash and runs more uniform in strength. Maple warps very little, in this respect being superior to elm. On the other hand, maple is more difficult to season without checking than ash or elm, and it is said not to hold screws so well in motor car bodies. On account of the smooth, fine texture of maple, paint and enamel rub off it more easily, especially on curved surfaces which receive considerable wear, than off birch, which is slightly more porous. Because of its smooth wearing qualities and comparative freedom from slivers, maple is preferred to all other woods for the floors of delivery trucks.

Elm.—The principal use of elm is for frames, seat backs, and doors; very little, if any, is used for sills. White elm is preferred to rock elm, except for some of the bent parts, because it is more easily worked and is less subject to warping. For the same reasons lumber from old white elm trees, usually called "gray elm," is preferred to that from younger or vigorously growing trees. Old white elm is not so strong or tough as ash, on the average, but it varies less in strength than ash, especially that which comes from the southern swamps.

Birch.—Yellow birch is a close rival of maple. It is used for sills, framework and many minor parts. It is said to hold the paint better than maple on exposed parts.

Hickory.—The true hickories are used almost exclusively for spokes and felloes. The pecan hickories, which are somewhat inferior as a class to the true hickories, might be used in body construction, although their hardness and tendency to twist would perhaps prove a serious drawback.

Red Gum.—Red gum is too weak and soft for the sills and other major parts of the frame, but is used for floor boards, seat risers, and other minor parts. One of the principal drawbacks to the use of gum is its tendency to warp with changes in moisture content. Quarter-sawed gum gives less trouble in warping than plain-sawed gum.

Oak.—In automobile construction no distinction is made, as a rule, between the different species of oak or even between the red oak and white oak groups. In truck bodies, oak is one of the leading woods, being used for sills, cross sills, frames, floors, and stakes. In passenger cars oak is rarely used for the frame or sills. Wormy oak is used for running boards, floor boards, and seats, and some sound oak for instrument boards and battery boxes. Top bows are made almost exclusively of oak, second growth being preferred.

Southern Yellow Pine.—Under this heading are included longleaf, loblolly, shortleaf, and some of the minor southern pines. These have been found adaptable for running boards, floor boards, seat boards, and a number of small parts in the seats and frames.

Other Species.—Cottonwood is used for dashboards of passenger cars and the boxes or bodies of trucks. Sycamore, beech, basswood, yellow poplar, cucumber, tupelo, gum, chestnut, Douglas fir, and western yellow pine have also entered into car body construction to a small extent.

Seasoning by Means of Ozone

According to a recent issue of *Journée Industrielle,* Monsieur Otto, professor at the Sorbonne, has invented a process for seasoning timber by the use of ozone which accomplishes in twenty days what otherwise takes several years. The wood is subjected to the action of a current of air containing a certain percentage of ozone. A micrographic examination made by the laboratory of the Conservatoire des Arts et Métiers is reported to show that samples of oak and walnut which had been treated by the Otto process show the same characteristics as seasoned wood. The treatment does not change the color of the wood. The process is being worked by a French company, which has constructed works at Seregno, near Milan, and will shortly build new works in the neighborhood of Paris.

The comparative merits of the different species in the four properties most important in automobile construction are given in the following table, the strength of forest-grown white ash being taken as 100. Actual strength values of these species are to be found in Department of Agriculture Bulletin 556, "Mechanical Properties of Woods Grown in the United States":

STRENGTH OF WOODS USED IN AUTOMOBILE CONSTRUCTION IN PER CENT OF THE STRENGTH OF FOREST-GROWN WHITE ASH

Species	Strength as a beam or post	Stiffness	Shock resisting ability	Hardness
Hardwoods				
Ash, white, forest grown	100.0	100.0	100.0	100.0
Ash, black	71.3	79.3	90.1	62.3
Ash, white, second growth	122.5	117.6	119.6	118.9
Basswood	59.1	80.6	40.5	29.6
Beech	93.5	96.9	96.0	90.0
Birch, yellow	104.8	116.8	120.6	80.9
Chestnut	66.0	71.9	53.4	49.2
Cottonwood	60.6	79.0	54.3	35.3
Cucumber	85.4	112.4	76.7	54.9
Elm, rock or cork	98.8	92.9	140.5	101.6
Elm, white	79.2	79.5	89.5	57.1
Gum, red	80.7	91.5	75.5	59.0
Gum, tupelo or cotton	81.4	82.5	63.5	77.3
Hickories, pecan	103.5	103.8	119.7	139.6
Hickories, true	126.6	120.2	173.9	150.4
Maple, red	90.0	101.2	78.7	75.4
Maple, silver	66.9	68.5	71.7	64.3
Maple, sugar	104.7	105.9	90.5	103.0
Oaks, all kinds	92.6	101.3	94.9	104.5
Poplar, yellow	67.3	93.8	41.5	37.9
Conifers				
Fir, Douglas, Pac. Coast.	95.7	122.1	59.9	58.3
Pine, loblolly	93.7	105.6	71.0	60.0
Pine, long leaf	112.2	122.1	77.7	74.8
Pine, shortleaf	94.1	100.6	69.7	64.0
Pine, western white	75.5	99.7	53.8	37.0
Pine, western yellow	67.0	75.6	42.9	41.0
Spruce, Sitka	69.5	94.1	63.3	44.9

THE relative properties and performance of wood and metal wheels has been the subject of many tests. The growth in closed body production has made wood of growing importance. The researches which are being made in connection with wood products are of practical value to the automotive executive.

This article sums up the results of recent studies and shows their direct application to automotive practice. The facts are given in brief form, so that you can get a clear picture of the important developments in the study of wood as applied to automotive uses.

Bent wood is used in automobile construction in at least two forms—wood wheel felloes and steering wheel rims. To render wood pliable for bending requires both heat and moisture.

Experiments that were made at the Forest Products Laboratory indicate that enough moisture should be imparted to the wood to saturate the cell walls, which ordinarily means from 20 to 30 per cent moisture content. The pliability of wood apparently increases quite rapidly with increase of temperature. Very high temperatures, such as accompany steam under pressure, however, are not advisable, since they render the wood brash; in fact, boiling for any length of time permanently reduces the strength and toughness of wood to small fractions of their normal values.

Freshly cut stock is, of course, thoroughly saturated and needs no additional moisture. Only heat is required to produce flexibility. If the stock has dried for a long time, it will have a uniformly low moisture content throughout, probably 12 to 15 per cent. Such material requires the addition of a considerable amount of moisture before it is in proper condition for bending. If the stock has dried for a shorter period, the interior part may be at a high moisture content, while the exterior surfaces are quite dry. Such stock needs the addition of sufficient moisture to bring each part of it up to about 25 per cent.

Condensation of the steam may not furnish sufficient water if the stock is very dry; in this case the addition of a hot-water spray to play on the stock in the steam box would be advantageous. Admission of the steam through water will insure its being thoroughly wet. Pressure steam probably adds very little if any to the moisture content.

Steaming of Vehicle Stock During Kiln Drying

Saturated steam as a means of alleviating the tendencies of green lumber to honeycomb in the kiln has for some time been successfully applied in the commercial drying of heavy vehicle stock. So far the treatment has been confined to straight stock. The contention has always been that bent stock, such as rims, should not be steamed after removal from the form, experience indicating that stock so treated would tend to straighten out to its original shape. The kiln-drying of heavy, bent rims has been carried on, therefore, without resorting to steaming to remove case-hardening and other defects of drying.

Recent experiments conducted under the direction of the Forest Products Laboratory have shown that judicious steaming of heavy, bent vehicle stock results in a considerably improved product, and that the operation can be accomplished without serious effect upon the curvature. Careful judgment is necessary, however, as it is a very easy matter to ruin the entire charge by too severe treatment. This steaming has been done at high temperatures (150 deg. to 180 deg. Fahr.) and for short periods (one-half to three hours), the temperature and time varying according to the requirement of the case.

The method was given a rather severe test, being tried first on 56-in. oak rims and later on 60-in. artillery wheel stock. From kiln charges totaling about 2400 pieces, the losses attributable to kiln-drying were only 2 per cent.

Highway Research Brings Economical Transportation

Proper road location reduces construction and operating costs. Maintenance studies in progress. Knowledge of subsoils increasing. Test roads give help for future building. Construction economy through study of methods. Activities coordinated by Advisory Board on Highway Research.

By W. K. Hatt*

HIGHWAY research must be conducted in a somewhat critical mood. The impression prevails that a large part of our present data is unreliable partly because they have been obtained under conditions which no longer prevail, and partly because the data are misleading without the knowledge of underlying conditions. Hearsay evidence, rumors and propaganda are not wanting. Unproven statements should be eliminated. Mere argument, unsupported by facts, must be disregarded, and final decisions based upon authoritative and vital data.

THERE is an important service to be rendered by the highway engineer in so locating his road that the cost of operation will be reduced, these costs including fixed charges, depreciation, replacement, maintenance of vehicle and road, etc. Professor T. R. Agg of Iowa State College has accumulated a large amount of very carefully determined data in connection with the work of the Engineering Experiment Station of the College, and he is also directing work in New England in which Harvard University, Yale University, Massachusetts Institute of Technology, Bureau of Public Roads, United States Army, Society of Automotive Engineers and the highway commissions of Massachusetts and Connecticut are co-operating.

Maintenance

Maintenance costs, one of the most important elements entering into the economics of highway construction, have in the past not been properly determined and allocated. The choice of the type of road depends greatly upon such data. Something more is needed than a total cost of maintenance from fence-to-fence or from shoulder-to-shoulder. We should know the cost arising from the surface itself, and whether this was a replacement or the result of a misfit of the type to traffic conditions. The Bureau of Public Roads will require a report on maintenance costs on all federal aid projects according to a standardized system of accounting. In the course of time reliable maintenance data may be secured. In the meantime much can be learned from specific cases, particularly in those counties where foresighted individuals have properly analyzed maintenance costs.

Maintenance of roads must assume a larger importance as the construction program becomes more complete. A great deal of experimentation and research is needed to fix upon the correct theory of maintenance of the various classes of roads. An interesting experiment in the maintenance of a wide gravel road under the direction of Mr. A. R. Hirst of Wisconsin shows the possibility of useful research in this line. Here a layer of fine gravel is maintained on the surface by drags.

The Michigan State Highway Department has under way an interesting experiment to determine the efficiency of various dust preventives.

Dr. G. E. Ladd of the Bureau of Public Roads has completed a report upon its study of corrugations in gravel roads in eight different states. Contrary to the general impression of drivers, these waves which have been so expensive in the maintenance of roads and the maintenance of vehicles, are from 25 to 35 in. in length, crest to crest, and have a maximum height of 1½ in. unless pitting and ravelling have begun. These corrugations develop rapidly from the action of motor vehicles when the traffic reaches 400 cars per day. Generally in gravel roads they originate in the kick-back of surface materials arising from the spin of one or both of the rear wheels as they descend from a bounce over some obstacle or depression. Spring action has undoubtedly a contributing and modifying effect. Engineers are not agreed upon the most favorable materials or upon the effect of dust preventives to prevent corrugations. Planers, drags and scrapers are used to cut down and erase corrugations, with some success. Scarification and subsequent recompaction by traffic is a heroic treatment.

The problem of the sand-clay or top-soil road, which must furnish the main transportation for large regions of the South Atlantic states, is being studied in Georgia and North Carolina. Professor C. M. Strahan of the University of Georgia has developed data that serve to define the per cent of clay and coarse sand which will render these roads stable under a traffic which they can reasonably be expected to carry. The Bureau of Public Roads and the North Carolina Highway Commission are also investigating this type of road to determine the limit of traffic under which they may be maintained, and a means of improving and extending the life of the surface. In one experiment broken stone is rolled in the surface of a sand-clay road to serve as an anchor for a bituminous mat subsequently placed.

IN the fields of economics and operation but few references can be made to research activities, although it must be said that there is a live appreciation of the urgent necessity of early studies. In the field of design, however, the engineers are in a more favorable position, because

*Director, Advisory Board on Highway Research, National Research Council.

the fundamental mechanical principles of the operation of the various types of roads are being defined rapidly. Of course the problem is simple in statement. Given the maximum weight and volume of traffic; to provide a road of sufficient width and strength to carry this traffic over the existing or improved subgrade. The solution must depend upon the characteristics of the region, and will be different in Arizona and Massachusetts. Regional supplies of material and labor and climatic conditions certainly influence the result. The main problems of research lie in the load, the mechanical action of rigid and non-rigid slabs and the properties of the subgrade.

THE highway engineer must face all kinds of sub-soils, such as the adobe soil of California, which cracks and swells in a remarkable way, sufficiently at times to deform the green concrete of the road slab, the black soils of Illinois, plastic clays and gravel. The design of the road should be related in some manner to the supporting power of the soil. A large volume of research is directed to the study of sub-soils and particularly to determine that element of the soil which determines its properties and to the treatment of sub-soils by drainage and the admixture of chemical additions. The most important agencies in this field are the Bureau of Public Roads, the Sub-Soil Committee under the chairmanship of General T. Coleman Dupont, organized first as a committee of the now inactive Federal Highway Council, the work by Professor Eno of the Ohio State University, by Clifford Older of the Illinois State Highway Department, by the University of California and Dean Marston of Iowa. These researches include the mechanical and ultimate analysis of soils, instruments for determining bearing power and study of water movement and consequent volume changes. Studies are also under way in the Bureau of Public Roads for the protection of the shoulders and other means to preserve the moisture content of the sub-soil more uniform. In California the soil is improved by mixing in coarse aggregate. In some states a layer of tarred paper is placed in the sub-soil to prevent the entrance and egress of water which it is thought results in harmful volume changes of the concrete slab. When the studies under way are complete we should have within the year a fairly satisfactory account of the action of sub-soils, the means of testing them and the implication which the data carry into the field of design. It is Mr. Older's observation that in the case of the soils of Illinois there is practically no supporting power under expected conditions, and that therefore the concrete slab must be designed as an overhanging cantilever with the load at the corner of the slab. The Bureau of Public Roads has treated some sub-soils by the admixture of additional materials such as Portland cement which apparently renders a plastic clay granular in its nature and destroys the plasticity. Experiments are under way by the California State Commission on various methods of treating adobe sub-soils.

The Pittsburg, California, test road, including twelve different designs of concrete road slabs, has been interrupted, after carrying 3,500,000 tons, on account of the failure of some of the weaker sections. No substantial surface wear of the concrete is observed. Arrangements are made for replacing these and continuing the tests until the stronger sections, viz. those with inverted curb, are broken. This test has already decided the policy in choosing types of pavements in Arizona. The Pittsburg test road, which has cost in the neighborhood of $200,000, will repay many times the cost of its construction in the value of the information furnished. This test was originated by a private corporation but may be continued by the State of California and the U. S. Bureau of Public Roads.

The Bates test road in Illinois, after passing through almost two years of exposure to climatic changes, is now being loaded to destruction with motor trucks. In this road various types of pavement embodying weak and strong concrete, thick and thin sections, brick and bituminous covers, present a wide range of type.

The experiments of the Bureau of Public Roads at Washington wherein slabs of various design are subjected to impact tests, which have been connected up with the service blows from truck traffic, have disclosed some fundamental principles of subgrade and pavement resistance.

Results are now appearing from the experimental concrete highway 2 miles long constructed in Alexandria County, Virginia, under the direction of the U. S. Bureau of Public Roads. The road presents sections of various thicknesses and shapes, with various reinforcement.

The experimental road, circular track on concrete base with bituminous top, has been built by the U. S. Bureau of Public Roads at the Experimental Farm, Virginia. Various combinations of bituminous tops are to be tested under the action of a truck which is guided mechanically. A portion of this track 4 ft. wide will be surfaced with concrete containing various aggregates to determine their resistance to wear.

There are several roads built containing variations in aggregate or reinforcing as part of state systems, the data of which are at present being compiled.

THE Bureau of Public Roads is co-operating with the Asphalt Association in studying the causes of waving of asphalt pavements. A large number of samples have been secured from Washington, Baltimore, New York, Philadelphia and Detroit for laboratory study.

These researches in Washington, Illinois and California are surrounded with highly advanced technique and produce data which will be of general value in engineering design. When the results are gathered together and analyzed it is expected that engineers can intelligently design stiff slabs to carry a specified load over a determined subgrade. These researches alone probably involve an expenditure of three-quarters of a million dollars, a sum of minor importance in view of the hundreds of millions of dollars to be expended in the construction of such roads.

The last word has not yet been said on the policy of reinforcing concrete roads. One extreme is a thick, heavy

MOST discussions of highway construction are so highly technical that the automotive executive isn't much interested in them. They are of interest only to the expert engaged in road building work.

But future car and truck sales are so strongly dependent upon properly constructed and properly maintained highways that every executive in the automotive industry is really concerned very deeply in the progress of highway research studies.

Consequently we have asked Prof. W. K. Hatt, Director of the Advisory Board on Highway Research, to tell the story of highway research in a brief human way that will give you the essential information in interesting readable form. The accompanying article is the result of that request. Read it and see if you don't think Professor Hatt has accomplished just what was requested.

slab, massive enough to withstand such loads as are found in the state of Washington, viz. 20 tons of logs; the other extreme is a thin flexible slab which will deform under a load or under the action of frost and be brought back to its primitive shape by the elasticity of the reinforcing steel. No doubt the adjustment in this respect would be determined by the condition of supply of materials and by a comparison of the maintenance costs of heavy concrete roads and thinner reinforced roads. The amount of reinforcing now generally used is only sufficient to hold together the broken sections of the concrete slab. Research is needed to determine the amount of reinforcing which will be really effective under the various regional conditions of this country. The results of the Pittsburg tests point to the value of massive plain sections with stiffened edges under the conditions there obtaining.

It would seem that in the rapid development of other types of roads the experimental study of brick roads has been somewhat neglected, and we should welcome the efforts of the National Association of Paving Brick Manufacturers to promote research comparable to that now being applied to other types of construction. Favorable reports have been received from inspection of brick roads filled with bitumen and supported on a rolled stone base in Ohio. The limits of this paper will not permit the further discussion of types of roads.

Construction

A RESEARCH into the efficiency of the operations of concrete mixers is much needed and also a further study of the product of central mixing plants.

The field of research on the fundamental principles of materials and on standardization of tests has been occupied for a great many years. These researches are well fitted to the ordinary university laboratory and are numerous. It is not within the scope of this paper to mention them. Perhaps special mention may be made of the following without doing injustice to the large number of devoted and able experimenters.

The work of Prof. Duff A. Abrams of the Lewis Institute has made it now possible for expert testing engineers to duplicate tests of concrete cylinders in the laboratory with very close agreement. However, field tests of concrete cylinders scatter very widely even when they are made with great care by trained operators. At present it may be asked, if field tests of concrete cylinders in compression are indices of the concrete in the road? Are such tests a suitable basis for contractual relations? The practice of cutting cores from the hardened concrete roads is common, but the returns are not sufficient to allow judgment. The work of the Pennsylvania Highway Commission, the Illinois Highway Commission, the University of Illinois and the Maryland Highway Commission, when brought together, will throw light upon this question.

Survey of supplies of road materials by which bidders on highway construction may know the available sources of acceptable material, quarry condition and freight rates, such as are conducted by the Pennsylvania and North Carolina State Highway Commissions, result in an easily computable saving of money to the States. Mr. I. W. Crum, testing engineer of the Iowa Highway Commission, and Prof. M. O. Withey of the University of Wisconsin and the Purdue University Laboratory, have given special attention to the use of available aggregates. The Kansas State Agricultural College and the Texas Highway Commission are both active in the field of development of materials of construction.

Road Materials Survey

THE work of Mr. W. L. Schwalbe in the study of consistency, at the University of Illinois, is likely to prove of great value. At Purdue University a survey of road materials in the State is under way, and also studies of the test for surface hardness of concrete.

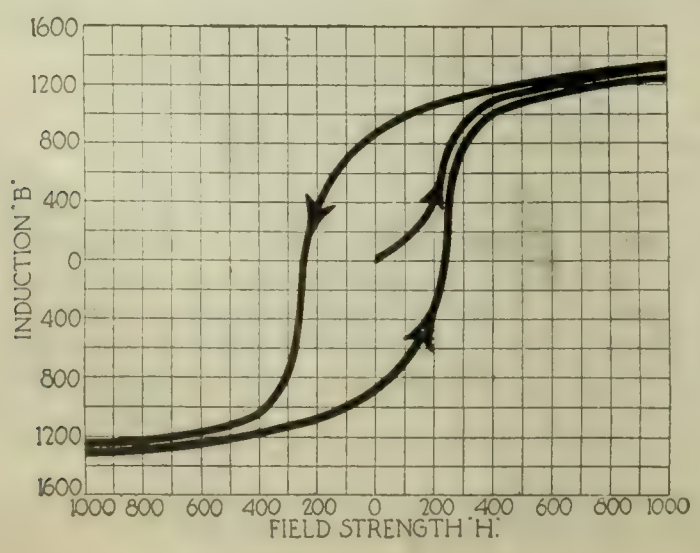
The ability of plain concrete to withstand reversed and repeated stresses is being investigated at the University of Maryland by Dean A. N. Johnson, who has devised a machine that will bend beams 2/100 of an inch at the rate of 200 times each minute. The Illinois Highway Commission and Purdue University are also experimenting in this field. Indications are that repeated loads below 50 per cent of the ultimate once-applied load can be applied hundreds of thousands of times without resultant failure of the concrete.

A little later the Research Council will expect to issue the results of a Census of Research in which the many valuable studies under way in the Experiment Stations of the various State universities will be listed and described. It is difficult to maintain a few of these investigations in a paper of this kind without doing injustice to the large number of devoted research workers.

Research upon structures such as highway bridges can only be mentioned because the limits of space have already been exceeded.

Cobalt Steel for Permanent Magnets

H. TAGAKI and K. Honda have made researches on alloy steels for permanent magnets. These are called K. S. steels and their composition varies between the following limits: Carbon, 0.4 and 0.8 per cent; cobalt, 30-40 per cent; tungsten, 5-9 per cent; chromium, 1.5 to 3 per cent. These steels are quenched at 950 deg. C. (1740 deg. Fahr.) in oil.



Samples of this steel were placed in a magnetic field having a strength of 1500 gausses; they showed a remanent magnetism varying between 920 and 620 c.g.s. units. Their coercive force varied between 226 and 257 gausses and is approximately thrice as great as that of the best tungsten steel. Fig. 1 shows the hysteresis curve of one of these samples which was in the form of a cylinder 20 cm. (8 in.) long and 5 mm. (0.2 in.) diameter. The energy absorbed by hysteresis in one cycle is approximately 909,000 ergs, while with the best tungsten steel it would have been 290,000 ergs. The experiments and their results are described in *The Physical Review* for December, 1920.

Non-Ferrous Metal Research Affects Design of Small Automotive Parts

New coefficient of expansion determined for nickel. Properties of monel metal examined. Research shows best flux for use in brazing with high-melting point brass. Bureau of Mines and Institute of Metals to collaborate for non-ferrous metal research. Bureau of Standards active.

FEW of the non-ferrous metals, other than the light metals and alloys, are used in the automotive industry to any great extent. Many automobile parts that were formerly made of brass and bronze are now made of steel, the development of metal pressing and forging and of rust-proofing processes having made the use of the cheaper metal practicable. Copper is used to a certain extent in tubing and in radiator cores and exclusively for the current-carrying parts of electrical equipment.

Brass is sometimes used for radiator cores and tanks, as well as for carbureter bodies, lubrication and other small fittings and for some brackets. Bronze is used for worm wheels and pump impellers, babbitt or white metal for all engine bearings, tungsten for vibrator contacts, nickel for spark plug electrodes and monel metal for float valves. Considerable research work has been carried on in connection with bearing metals, mainly with a view to the use of lead as an element of the alloy, but most of this seems to have been of a competitive nature and is not at present available for publication.

In addition to the non-ferrous alloys used as materials of construction in the automotive industry there are the heat resisting alloys which are largely used in crucibles for heat treatment and which have also been adapted to use in poppet valves. Research along this line is also going on constantly.

Thermal Expansion of Commercial Nickel

THE thermal expansion of nickel is of particular interest, for the reason that the electrodes of spark plugs are made frequently of almost pure nickel, and as the central electrode is embedded in the porcelain, the latter is apt to crack if there is too great a difference in the heat expansion of the nickel and the porcelain. In view of this fact the Bureau of Standards has recently made a redetermination of the coefficient of expansion of nickel. The results are embodied in Scientific Paper No. 426, of which Wilmer H. Souder and Peter Hidnert are the authors.

It appears that the first determination of the heat expansion coefficient of nickel was made by Fizeau in 1869 and yielded the value 0.00001279 at 40 deg. C. Thirty years later Tutton made nine individual determinations and found that between 6 and 121 deg. C. the expansion coefficient may be represented by the equation

$$0.00001248 - 0.0000000148\ t \text{ or } 10^{-5}\ (1248 - 1.48\ t)$$

Holborn and Day found that nickel undergoes a transformation at about 300 deg. C., and as a result the test bar, which at the beginning was 482.6 mm. long at 0 deg. C. was approximately 0.02 mm. shorter at the conclusion of the tests.

In the investigation at the Bureau of Standards determinations were made on the thermal expansions of ten different samples of commercial nickel from room temperature to about 600 deg. C. The nickel content varied from about 94 to 99 per cent. Five samples were hot rolled and the remaining samples were hot rolled and then annealed.

The results showed that annealing of hot rolled nickel generally increases the heat expansion coefficient. The average coefficients between 25 and 300 deg. C. for the samples containing 98.76 to 99.06 per cent of nickel are 14.4×10^{-6} for the hot rolled and 14.5×10^{-6} for the annealed specimens. For the range from 25 to 600 deg. C. the coefficients of the five hot rolled samples vary from 14.9×10^{-6} to 15.6×10^{-6} and for the five annealed specimens from 15.4 to 15.7×10^{-6}. These coefficients are considerably greater than those which the bureau has found to apply to porcelains used in spark plugs.

The average coefficient of expansion of the ten samples between 25 and 100 deg. C. varies between 12.9×10^{-6} and 13.5×10^{-6}. These coefficients are approximately 10 or 20 per cent greater than those of ordinary steel for the same range.

On cooling from the maximum temperature of 600 deg. C. to room temperature the observations were generally slightly below the heating curve, so that after the thermal expansion tests the specimens were generally

slightly shorter than before the tests. This corroborates the experiments of Holborn and Day, though the experiments of Harrison showed that nickel wire in each case returned to its original length after heating.

Heat Expansion of Monel Metal

MONEL metal is a natural alloy containing approximately 67 per cent nickel, 28 per cent copper and 5 per cent of other elements such as iron, manganese, silicon, etc. The Bureau of Standards has recently made determinations of the heat expansion coefficient of this alloy. Measurements were made on ten samples from room temperature to about 600 deg. C. Two samples were cast and three were hot rolled. The remaining five specimens, of the same compositions, were annealed in addition.

The expansion curves on heating were found to be fairly regular. On cooling, the observations were slightly below the heating curves in most cases. The average coefficients for the range from 25 to 300 deg. are all practically equal. Above 300 deg. there are some marked differences. For instance, one sample containing 2.22 per cent of lead has a coefficient of expansion of 20.6×10^{-6} between 500 and 600 deg. C., whereas another sample of the same composition but annealed at 1650 deg. F. for one hour had a coefficient of expansion of 18.3×10^{-6} for the same temperature range. In most cases the coefficients of the annealed and unannealed specimens were about equal.

Monel metal contains a large percentage of copper and the coefficients of expansion of this metal are greater than that of nickel but less than that of copper. The samples of monel metal containing lead showed the greatest coefficient of expansion. The coefficient for all specimens increase with the temperature, the most notable increase being observed in the case of the leaded monel metal, from 13.9×10^{-6} for 25 to 100 deg. C. to 20.6 for 500 to 600 deg. C. Between 200 and 300 deg. C. the coefficients of all the specimens are most nearly alike, the minimum being 15.5×10^{-6} and the maximum 15.9×10^{-6}.

Dip Brazing with High-Melting Point Brass

AN investigation of various factors in brazing has been made at McCook Field and the results so far obtained are published in a recent issue of the Air Service Information Circular. The particular object of this research is to determine the best flux for use in brazing with 80 copper-20 zinc brass, to determine the effect of heat treatment on brazed joints, to develop a satisfactory method of brazing with 80-20 brass, to ascertain the relative values of the 80-20 brass and an alloy consisting of 74 copper 20 zinc and 6 nickel for dip brazing, and to ascertain the proper brazing temperature and clearance for this method of brazing.

The round specimens which were to be used for making the butt brazed joints were cut in the middle and the ends faced off true in the lathe. These specimens were left approximately 0.08 in. oversize at the middle before brazing and no threads were cut on the ends until after the brazing operation. In order to hold the two parts of each butt specimen in place while brazing, two steel strips, or stays, were welded to opposite sides of the specimen by means of the acetylene torch, care being taken to align the two parts as nearly as possible. The heating of the specimen during the welding of the stays was confined as much as possible to the ends, and there it was very much localized. The middle part, where the braze was to be, never became hotter than 1000 or 1100 deg. F. during the welding of the stays. The temperature at that point was purposely kept low to prevent excessive oxidation on the surfaces to be brazed.

The specimens for the lap joints were held in place for brazing by means of two 1/16 in. rivets for each specimen inserted near the ends of the lap at such distance from each other that the required length of lap existed in the clear between the rivets. As in the case of the butt specimens, the lap specimens were left oversize to allow for cleaning up after brazing. In order that the joints might be firm after riveting and still leave a clearance to permit the brass to enter, the tip end of each piece was upset slightly with a hammer before riveting.

Then after the rivets had been inserted, they were drawn down with the hammer until only a perceptible gap was left. The surfaces of the steel were ground before assembling to remove all scale that might be present. To facilitate dipping of the sheet specimens, a ¼-in. hole was drilled in the end of each specimen through which a wire could be inserted to suspend the specimen when dipping in the brass. The round or butt specimens were suspended by inserting a wire under one of the stays that were welded along the sides.

Owing to the irregularity of the results obtained with the lapped tensile specimens just described, a shear specimen was designed and used on all the later work on brazing. The butt specimens, while giving fairly uniform results, were extremely difficult to manipulate and so were discarded.

The shear specimens were made of ¼-in. stock, lapped about ⅝ in. and riveted at each end, making a specimen approximately 1½ in. in length with a distance between the rivets slightly exceeding an inch. A hole was drilled in one corner through which a wire could be inserted for convenience in brazing. After the brazing had been completed both ends of the specimen were cut off, thus re-

SMALL improvements and minor refinements will play a part of increasing importance in automobile selling and designing as time goes on. The general principles have been well laid down and accepted. The difference between the gasoline engine of today and that of 1910 is largely one of minor improvements.

This tendency gives a special interest to the research work which is being conducted as regards non-ferrous metals. Such materials are used in limited quantities by the automotive industry, but the small parts for which they are used are important to future selling and manufacturing.

moving the rivets, and the area of the lap was reduced to exactly ½ sq. in.

The special strap specimens were made for the purpose of determining whether the length of the specimen influenced the results of heat treatment. They were made 6 in. long with a longitudinal lap about ¾ in. wide, and held together by spot welding with the oxygen-acetylene torch. They were designed to be broken apart with a hammer to ascertain the character of the braze after heat treatment.

The following conclusions were arrived at:

Conclusions

Preheating to a dull red heat just before brazing is found desirable, but a higher temperature or continued heating hould be avoided on account of oxidation of the surfaces to be brazed.

Borax gives the best joint when brazing with 80-20 brass, but should be used in connection with a cooling flux, preferably boric acid, in order to prevent surface oxidation of the specimen.

It is found advisable to coat the parts to be brazed with a borax-boric acid paste to prevent oxidation during preheating.

The proper brazing temperature is found to be 1850 deg. F.

The best joints are obtained when the surfaces to be brazed are fastened close to each other by any suitable means without the use of shims or spacers.

The strength in pure tension of joints made on carbon steel, untreated, is approximately equal to the strength of the brass in tension. That of the nickel-steel joints, heat treated, is nearly twice the strength of the brass. The strength of joints in pure shear is approximately equal to the shearing strength of the brass. This shearing strength is also approximately equal to the tensile strength of the brass.

Nickel-steel joints tested in shear give approximately the same results as carbon steel.

Heat treatment of brazed parts is shown to be successful on certain types of specimens brazed with 80-20 brass, but unsuccessful on one particular type.

Organization for Non-Ferrous Alloy Research Deferred

A CONFERENCE of the Advisory Committee on Non-Ferrous Alloys of the Institute of Metals Division of the American Mining and Metallurgical Engineers with representatives of the United States Bureau of Mines was held at the Bureau of Mines, Washington, D. C., April 25. This was the second meeting held for the purpose of developing a program of co-operation between the non-ferrous metal industries, as represented by the Institute of Metals Advisory Committee, and the Bureau of Mines, with especial reference to the non-ferrous work of the latter organization.

The conference discussed the question of the functions and possibility of development of the proposed Alloys Research Association, now known as the Alloys Research Information Service. As originally proposed, it was the idea to receive contributions of $250 each from firms in the non-ferrous metal industry for promoting a central information service. A fund of $40,000 was required for this work, which would begin as an information and abstracting service and later develop into a central research laboratory. The feeling was that, owing to the depressed industrial situation, it would not be a propitious time to push the matter. Members representing industrial concerns stated that their companies would be willing to enter such an association when conditions are better.

The Bureau of Standards has completed the examination of five bronzes for impurities, with the purpose of establishing the spectographic method for quantitative estimation of small amounts of aluminum and silicon, which are detrimental in bronze or brass castings. The method is simple, successful and sufficiently accurate. A report on this practical application of spectrum analysis was presented at the Non-Ferrous Metals Committee meeting on April 24.

Research Work at University of Illinois

FOLLOWING is an outline of the research work under way at the Engineering Experiment Station, University of Illinois, which should prove of interest to the automotive industry:

(1) *An investigation of the fatigue phenomena of metals.* This investigation is a co-operative one, a large grant of money having been made to the Station by the Engineering Foundation and the General Electric Company. One bulletin, No. 124, has already been distributed. This work will probably continue for several months until the funds provided have been exhausted. It is hoped that manufacturers of metal products will provide additional grants of money to continue this investigation until there seems to be little advantage in proceeding farther with it. It is the most elaborate study of the subject ever undertaken, and already many very important facts have been established.

(2) *Highway construction.* We have undertaken some work on certain phases of highway construction which may be of some interest. These include a study of the effects of temperature upon concrete road slabs; a study of the effects of moisture on such slabs; a study of the re-enforcing of concrete roads, and a study of oiled dirt roads.

(3) *A study of the explosion of gaseous mixtures,* which includes an elaborate investigation of the effects of the shape of the combustion chamber of an internal combustion engine, the effects of turbulence, of various fuel mixtures, etc.

THE decree permitting the free importation into Russia of motor cars for state and private use has, it is reported, brought many offers from foreign firms. The Foreign Trade Commissariat is negotiating with foreign motor car manufacturers to establish branches in Russia on a mixed corporation basis. German, American and Italian companies, according to the Russian Trade Delegation, propose to institute omnibus and motor truck services to link up with railway stations, and also to construct an interurban railway from Moscow.

AUTOMOTIVE INDUSTRIES
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The First Research Survey

WE have aimed to give a comprehensive picture in this issue of the various research activities from which the automotive industry will benefit. Every effort has been made to cover the field thoroughly.

The co-operation of many companies and individuals throughout the industry was essential to success in this attempt. The frankness with which many manufacturers told us about their research work has been gratifying and we take this opportunity to express our hearty appreciation to them.

A general spirit of openness and desire to exchange information has prevailed, although there are numerous instances of firms unwilling to exchange information freely with other manufacturers. This general frankness, however, is typical of the progressive spirit of the automotive industry which has been so largely responsible for its rapid growth. Through the frank exchange of ideas and results progress for everyone is facilitated and each company is benefited.

"When you shut the laboratory door you shut out more than you shut in," says Kettering. This is the spirit which has made possible this our research number and which will mean continued progress for our industry.

The very nature of the task made it impossible to paint a complete picture at this first attempt. Nothing of a similar nature has been done before, and there has been a necessity of explaining the idea to many people within a brief space of time.

Our purpose has been to give you both information and inspiration. We hope we have achieved our purpose, at least to some limited extent. How well we have succeeded in this attempt to show the importance and the results of automotive research will be judged by our readers.

Deprecating the Straight Side Tire

REFERENCE has been made in these columns previously to the propaganda of certain European tire manufacturers against the straight side tire. These same manufacturers have just discovered another disadvantage inherent in the straight side construction—that it renders steering more difficult. The argument is somewhat as follows: The straight side tire with its rim is heavier than the clincher tire and its rim, and in a modern racing car the difference amounts to as much as 16 to 20 lb. (which applies probably to all four wheels). Practically all of the additional weight is at the rim of the wheel. Now, a wheel rotating at high speed acts like a gyroscope, tending to resist any change in the plane of its rotation. Therefore, when the driver operates the steering hand wheel to turn a corner, he has to exert a greater effort with the heavier wheels, those with the straight side tires. The difference is said to be so great that experienced and well-trained men will find themselves tired out after four or five hundred miles with straight side tires.

Evidently this statement is meant to apply to racing conditions, as in touring it is very seldom that one wants to drive continuously for four or five hundred miles at high speed, and corners especially should be taken at low speed, for the sake of safety. Little objection can be found with the above statement *per se;* it would be a wonder if a driver after such a task were still fresh and without signs of fatigue. The trouble is not with the statement itself but with the obvious inference that with clincher tires the driver would not be tired out.

We fully realize that it is impossible to settle this matter by argument, because there are too many indeterminate factors involved, such as character of route, condition of road surface, sensitiveness of the steering mechanism, etc. Besides, fatigue is a rather indefinite thing itself, not subject to measurement, we believe.

There evidently has been considerable difficulty in getting race drivers to use clincher tires on the short, tortuous routes of European road races, on account of the danger involved in shedding a tire when going at high speed, and rather far-fetched arguments are

seized upon to bolster up the case of the clincher with the racing fraternity. This tendency of the clincher to leave the rim when deflated seems now to have been overcome, and while this improvement is to be welcomed, it does not affect the chief reason for preferring the straight side for general service, which is its comparative freedom from rim cutting.

Utilizing Existing Research Facilities

THERE are few if any better equipped laboratories for research work in this country than those at the Bureau of Standards in Washington. This applies to facilities for automotive research as well as to equipment for investigations in related and non-related fields. Funds for the conduct of research work at the Bureau are not solicited from the industries concerned or from any private source. They are appropriated by Congressional action from public funds, but Congress is largely influenced in making the appropriations by expressions as to the desire of the industries concerned. Any piece of research work which is urgently needed by a given industry will be undertaken by the Bureau, within the scope of its facilities, if the funds required are appropriated, but to bring this about the industry concerned must make it clear to Congress that the work is needed and is in the public interest. The Bureau can formulate a program and ask for the funds to carry it through, but these funds are seldom provided unless those who will benefit thereby have enough interest in the program to urge upon the Congressional appropriating committees the need for favorable action on the request for funds.

This year a constructive and highly important program was laid out by the Bureau, but the funds required were denied by a close vote in committee for lack of sufficient support on the part of the automotive industry. As a result the Bureau can do little of direct interest to the automotive industry with its excellent facilities aside from conducting tests for other Government departments whose appropriations happen to be devoted to such work. This is a reproach upon the automotive industry, for it must be evident to any who acquaint themselves with the need for research along many lines, as indicated by the articles on this subject on foregoing pages of this issue, that there is crying need for light on many important subjects which the Bureau is well equipped to handle. It is to be hoped that another year the industry will co-operate closely with the Bureau in formulating a program of research into the most pressing problems before the industry, and then see that Congress provides the funds necessary to carry it through.

Popularizing Air Travel

THE State, shipping and banking interests are lending powerful support to German aviation, but not content with these subsidies the air transport firms have decided to charge for a journey no more than that charged for first class passage on the railroads. This is being done with the idea of attracting as many people as possible to air routes during the summer.

This would seem to be a recognition that although subsidies were necessary they could not take the place of a universal public opinion favorable to this mode of travel.

Thanks to pioneering spirit and perseverance, progress in aviation is maintained in this country. But this progress might be more rapid if dormant public interest were aroused.

Popularizing air travel, by proof of its practicability and regularity of service, has value in awakening the public and securing the necessary financial backing.

Research, Pure and Impure

THERE is, especially in scientific circles, a distinction between so-called "pure" research and experimental work aiming at some specific development, sometimes termed commercial research. The scientist often pursues experimental work with a view to establishing basic facts regarding some natural phenomena, the governing laws of which have never been established or are not known within the desired limits of accuracy. Frequently such work is done for the mere love of adding new facts to the present sum of human knowledge and with no thought or desire for any pecuniary reward which may result from the commercial application of the information thus made available. The application of existing knowledge to the development of a commercial article often involves extensive tests and laborious investigation both in the laboratory and under service conditions. Such work is frequently referred to as research, but is not such in a narrow interpretation of the term, though it may be quite as commendable and perhaps even more useful to society as a whole.

Quite often commercial development requires careful and extensive research before the basic facts upon which success is dependent are obtained. The two are, in fact, so closely associated that it is not always easy to establish a line of demarcation, especially since the same methods and apparatus used in research work are often employed in commercial testing. This being the case, the Research Number of AUTOMOTIVE INDUSTRIES deals with both "pure" research and development work and has not sought to make a distinction between the two, although we appreciate that such a distinction can be properly made in some cases.

It is doubtless a good thing from many standpoints that passenger car development, in particular, and other lines of automotive development to a less degree are becoming more settled, that less radical changes are to be noted from year to year. It should not be thought, however, that we have approached, much less arrived, at perfection. Many improvements can and must be made. The industry should encourage them and give hearty support to the research work out of which they will come.

May Production Sets New Record!

252,000 Vehicles Output for Month

Exceeds Best Previous Month by 32,000 and May, 1921, by 53 Per Cent

By JAMES DALTON

NEW YORK, June 7.—May was the biggest production month in the history of the automotive industry.

The output of passenger cars and trucks, based upon reports to the National Automobile Chamber of Commerce, was 252,000.

The best previous month on record was March, 1920, when production is estimated to have been 220,000.

Production in April was 218,456.

While shipping figures supplied the N. A. C. C. are only about 90 per cent complete, the final total is likely to be larger than the estimate of 252,000 rather than smaller.

May production showed an increase of 53 per cent over May, 1921, and 15 per cent over April, 1922. Output in May, last year, increased 4 per cent over April.

Carload shipments for May were 33,810, as compared with 30,200 in April and 27,380 in March. The highest previous mark reached by carload shipments was March, 1920, with 29,236.

Cars driven away from the factory in May numbered 21,710, as compared with 22,500 in April and 15,800 in March. Driveaways in May, 1920, numbered 74,286, but carload shipments reached only 21,977.

Boat shipments in May, which numbered 7220, were the third largest on record, having been exceeded only by June and July, 1920, when they numbered 8350 and 8702, respectively.

June Opens Well

June opens with every promise of closely approaching the May mark. There is no noticeable diminution in the volume of orders. Sales at retail in virtually all parts of the country are gratifying alike to manufacturers and dealers. Rapidly improving conditions in the South and the prospect of an early opening of the real buying season in the agricultural sections of the Middle West offer much encouragement. These and

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Business in Brief

NEW YORK, June 5—Continued improvement in business and industry has been reported for the past week. Manufacturing in general is better than at any time since the fall of 1920. The words "poor" and "slow" have practically disappeared from trade and industrial reports.

Except for cotton, crop reports are good. Winter and spring wheat are leading. Better weather and crop reports are responsible for much of the improvement in trade in the West.

The iron and steel industry continues to gain, and operations for the industry as a whole are at about 75 per cent of capacity.

Record building operations are under way in Chicago and permits issued in May called for an expenditure of $27,000,000.

Leading mail order houses report that business in May increased 13.2 per cent over the same month in 1921, the first substantial gain in nearly two years.

A decided turn for the better in the St. Louis territory is reported by the Federal Reserve Bank. The grain areas appear to be making the most notable progress, although all sections of the district have participated in the improvement.

The report of the United States Employment Service for May "clearly emphasizes the fact that business depression is behind us," and that "June will accentuate the upward movement." May brought gains in employment in practically all industries.

Price strength in textiles apparently had aided jobbing distribution.

Stocks are irregular, bonds firm with all Liberty issues at par, and sterling has reached a new high mark.

Bank clearings for the week ending June 1 aggregated $5,980,599,000, a loss of 12.8 per cent from the previous week with a gain of 3.7 per cent over the same week last year.

114,325 PERSONS BUILD ROADS

WASHINGTON, June 3—Persons engaged in highway road building work in the United States now number 114,325, of which 10,483 are automotive and chemical engineers.

Plan Would Put Nash Closer to Lafayette

Latter Company to Be Reorganized with New Capital Exceeding Old

NEW YORK, June 5—A reorganization of the Lafayette Motors Co. under the direct control of the Nash Motors Co. will be voted upon by the stockholders of the former at a special meeting to be held at the Hotel Belmont in this city on June 20. This plan was decided upon soon after the abandonment of the contemplated merger with Pierce-Arrow.

Stockholders will be asked to authorize the sale of all property to the Lafayette Motors Corp., a Maryland corporation. The new company, which will be under the same management as the Lafayette Motors Co., will have a capital of $3,000,000 in 7 per cent first preferred stock of $100 par value; $4,000,000 in 7 per cent second preferred of $100 par value and 30,000 shares of common of no par value. This will exceed by $2,000,000 the capitalization of the old company, but the directors feel that the $2,000,000 additional capital is required.

Provides for Stock Purchase

Under the plan every holder of two shares of preferred stock and every holder of four shares of common stock of the old company may subscribe for a block of one share of first preferred and one share of common of the new corporation at $101 a block.

The Nash Motors Co. will subscribe for the full amount of both preferred and common of the new corporation, to which it is entitled as a stockholder in the Lafayette company. This amount will approximate 8500 shares of each. If the subscription for first preferred and common, including that of the Nash company, should aggregate less than 20,000 shares of each, the Nash company also will take at the subscription prices named such additional amounts of each as may be necessary to bring the total subscriptions up to 20,000 shares of each class.

Balance Sheet of March 31

The Nash company has advanced the Lafayette Motors Co. approximately $500,000 in addition to endorsing bank loans of about $1,000,000. Because of this assistance, about 80 per cent of the common stock of the original Lafayette company was transferred to Nash.

A Lafayette balance sheet as of March 31 last shows the following assets: cash, $206,350; accounts receivable, $82,578; merchandise, $612,808; prepaid expenses, $9,459; land, building and equipment, $1,558,967, making a total of $2,470,162.

(*Continued on page* 1301)

Plants Aim at May Marks for June

Demand by Dealers Forcing Big Output

Some Factories Placing Commitments for Parts 60 Days Ahead on May Basis

By D. M. McDONALD

DETROIT, June 6—June production in the Detroit district will continue at the same forced rate maintained in May which resulted in one of the largest months, if not the largest, the district ever has known. In practically every factory new daily high marks were set during the month and these marks have been fixed as the schedules at which the companies will aim in their production for June.

Executives in most plants declare that from a production standpoint, May has not been excelled by any month since the industry was established. Higher prices in the past, it is declared, may have brought the gross value of cars produced in other months higher and shipments may have been heavier in other months owing to the accumulation of cars in storage, but as a production month May, 1922, should take first rank.

Plants Absorbing Help

Days in which the high marks were fixed were largely the result of favorable manufacturing circumstances, but nevertheless they show the forced pace at which the factories are producing and will be repeated many times when the same favorable circumstances combine. June will be every bit as rushed as May, executives declare, and a number of companies are placing commitments for parts for two months ahead on the same basis as in May.

Factories are steadily absorbing help and companies which were considered fully staffed are making additions ranging as high as 20 daily, as skilled help arrives from other industrial centers. Material deliveries are far from regular, but better than in the early days of the rush. Scarcity of labor and difficulty in getting steel is blamed for failures in meeting requisitions.

There is no question that distributors and dealers are hounding factories for cars. There isn't a factory in the district that doesn't daily receive distributors from distant points, wires and telephone calls, seeking consideration in getting cars through. This has resulted in cancellation of some orders from buyers who would not wait, but what one company loses another gains.

HOW BIG PLANTS WERE WORKING AT END OF MAY

Ford on a 4300 daily basis.
Chevrolet, 1200 daily basis.
Dodge Brothers, 600 daily basis.
Maxwell, 400 daily basis.
Buick, 400 daily basis.
Durant (Lansing), 100 daily basis.
Studebaker (all plants), 440 daily basis.
Hudson-Essex (both makes), 275 daily basis.
Paige-Jewett (both makes), 160 daily basis.
Cadillac, 125 daily basis.

Factory executives declare that extreme delays in making deliveries is only true of certain models, and that with most models the delay is only from 10 to 15 days. This, however, shows that the factories are at least that far behind on shipments and is a clear indication that there is no stocking. Many leading executives, in one case the president of the company, have become stock chasers in order to get their material with the least possible delay.

Orders for Ford coupes are being taken on a six weeks' basis in Detroit. Closed cars in other lines are being bought, subject to from four to seven weeks' delay. Total Ford production is now on a basis of about 4300 daily. The June schedule calls for 135,000 cars, trucks and tractors, of which tractors and trucks will total about 20,000. May production approximated the 120,000 figure fixed, final figures not being complete. This, executives declared, was the best month the company has had.

Two Months' Schedule Arranged

Dodge Brothers' business continues on the 600 daily basis effective now for two months and the sales department anticipates this volume will be continued throughout the year. Maxwell has increased its daily schedule to 400 cars and now has two assembly lines in complete operation. Durant at Lansing has reached a volume of 100 daily and is working to increase this output.

Hupmobile built and shipped 3662 cars in May, a slight decrease in shipments under April but a larger production volume. June production will be increased. Hudson-Essex operated in May on a schedule of 275 daily and will continue this rate during June with increases if possible. Earl motors has reached a

(*Continued on page* 1305)

Conservatism Marks Wisconsin Activity

June, However, Will Show Schedules in Excess of Those for May

MILWAUKEE, June 5—Production of automotive parts and equipment in Milwaukee during May reached the highest point known since the early part of the summer of 1920, and June schedules will be even larger, since manufacturers and jobbers have increased their specifications of delivery since last month. It is interesting to note that while the call for car manufacturers' equipment was the first to reach large proportions, the demand for equipment marketed through the jobbing trade has risen rapidly.

Want Ads Show Conditions

Those who find it necessary to seek substantial evidence of the activity which the automotive industries here have reached need but scan the want ad columns of the daily papers. The A. O. Smith Corp. is advertising for men for night work for press and drill press operation, grinders, electric welders and laborers. The Milwaukee Ford plant wants top builders and upholsterers. Numerous other prominent concerns want men both for day and night shifts.

The majority of shops have now been able to bring forces to normal for day work. As yet many have not found it necessary to put on night shifts, although in some cases it is a fact that while orders might require the double-shift operations, conservatism is being exercised in production as well as purchase of materials lest an over-balance result.

Caution is discernable in all divisions of the industry, and this probably is one reason why the upward movement of automotive activity here and elsewhere has been substantial. It has been at the same time spectacular, yet not to the same degree that it might have been had there been no remembrance of the period which not long ago ended.

No Saturation Evident

Despite the fact that May sales, added to those of April, reached such proportions that some believe the sources of current demand must be near exhaustion, dealers say their prospect files indicate that the remarkable buying movement of the last ninety days is likely to be duplicated in the next three months.

One of the striking features of retail trade which has been present since the buying movement set in, is that dealers are meeting less pressure for price or equipment concessions than was the rule in former years.

Two Companies Join Truck Merger Plan

Selden and Atlas First to Become Members of Industrial Motors Corp.

NEW YORK, June 5—Another ambitious merger plan has been launched under the name of the Industrial Motors Corp. It will bring together at the beginning the Selden Truck Co. of Rochester and the Atlas Truck Co. of York, Pa., which is a subsidiary of the Martin-Parry Corp.

It is understood that this is merely a beginning and that the new corporation ultimately will control half a dozen or more truck and parts companies. One of these undoubtedly will be the Martin-Parry Corp. with plants at York, Pa., and Indianapolis, Ind., manufacturers and distributors of bodies for commercial vehicles.

Watson Heads Committee

The most prominent figure in the plan is John J. Watson, Jr., who is chairman of the committee working out the details. He is president of the Lee Tire & Rubber Corp. and of the Atlas Truck Corp., as well as one of the largest stockholders of the Martin-Parry Corp. Other members of the committee are George C. Gordon, president of the Selden; Frederick M. Small, president of the Martin-Parry Corp.; Robert H. Salmons and Reeve Schley, vice-presidents of the Chase National Bank.

No companies except those making gasoline trucks and accessories will be included in the merger, and no fancy prices will be paid to bring factories in. Reports that the Lee Tire & Rubber Co. will be one of the units have not been confirmed.

The present capitalization of the Selden Truck Co. is $1,000,000 in 8 per cent cumulative first preferred, $300,000 in 10 per cent cumulative second preferred, each of which has a par value of $100, and 30,000 shares of common of no par value.

The Atlas Truck Corp. took over the entire truck body business of the Martin-Parry Corp. in 1920 upon payment of 25,000 shares of its stock plus $250,000 in cash. It has outstanding also 35,000 shares which were sold at $15 a share with preferential subscription opportunity given the Martin-Parry stockholders.

Chase Prominent in Industry

Whether or not there is any special significance in the connection of the Chase bank with the merger, has not been disclosed. Representatives of the bank are included in the directorates of the Martin-Parry Corp. as well as of the Atlas company. The Chase bank also played an important part in the organization of the American Motor Body Co., which was organized in 1920 to take over the Hale & Kilburn Corp. and the Wadsworth Manufacturing Co. of Detroit. The American Motor Body Co. is controlled by the American Can Co. and the Hale & Kilburn Corp. Before its acquisition by the new company, A. J. Brosseau, president of Mack Trucks, Inc., was one of the directors of the Hale & Kilburn Corp. The Chase bank also is represented on the board of the White Co. of Cleveland and was interested in the reorganization of the Bethlehem Motors Corp.

The plan of the promoters is to put forward a specialized motor truck composed chiefly of standard parts now widely recognized. The grouping together of several manufacturers of trucks of this type will permit the greatest economy in the purchase of raw materials and supplies, lower the cost of production and greatly increase efficiency in merchandising and distribution, according to those backing the plan.

The Industrial Motors Corp., incorporated in Delaware, will have an authorized capital of 1,000,000 shares of no par value. Stockholders in the Selden and Atlas companies will get shares of the new company in exchange for those they now own on the following basis:

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DEALERS ANTICIPATE GOOD FARM BUSINESS

By WALTER L. DALY

Vice-President and Sales Manager, Columbia Motors Co.

DETROIT, June 6 — Though there is reason to expect that business will dip in the summer months, there is no reason to expect that it will fall off considerably at any time in the balance of the year. Dealers in the rural districts are confident of a large sale to farmers beginning in the next few months, and they have contracted for heavy shipments of cars.

This rural business will be important to the industry in that it will have a steadying effect upon the dealers in those sections who have already undergone two poor years. If this buying were not to materialize, there would be some forecast of it in the attitude of the dealers. They are sitting firm, however, and preparing to stage their comeback as soon as the crop conditions are safely established.

Closed cars are becoming more and more popular all the time with all classes of automobile owners. Even in the smaller villages and rural comunities the closed car is finding a steadily growing following, and this business will be increased as road improvements are carried out.

The closed car is most popular where driving conditions are best. The use of closed cars increases in every district as its highways are made better.

Legge Is Appointed New Harvester Head

Harold F. McCormick Steps Out and Becomes Chairman of Executive Committee

CHICAGO, June 3—Upon the retirement of Harold F. McCormick from the presidency of the International Harvester Co. yesterday, Alexander Legge, vice-president and general manager, was elected to the presidency by the board of directors. McCormick, whose retirement was voluntary, was elected chairman of a newly created executive committee of the board of directors.

Legge has been with the company for thirty years, having started as a collector for the Omaha branch of the old McCormick Harvester Co., which was later absorbed by the International. Later Legge became manager of the company's branch at Council Bluffs, Iowa, and when Harold F. McCormick as a young college graduate started out to learn the business he was sent to Council Bluffs. There he became closely associated with Legge. Shortly after McCormick returned to Chicago in 1897 Legge was brought here and made manager of the collection department.

Had Charge of Sales

For a number of years Legge has been in charge of the sales of the company, and probably will continue to exercise close supervision over that department. His election to the presidency does not mean any change in administrative policy, for he has been virtually the operating head of the company for a number of years. McCormick issued a statement saying that as chairman of the executive committee he did not contemplate any diminution in his interest in or service to the company.

The directors were given an encouraging report of the company's business. Nearly all of the tractors which have been an inventory burden for two years were reported sold, although at some loss. Prospects were said to indicate a large volume of business and satisfactory earnings for next year.

Other members of the new executive committee are: Cyrus H. McCormick, chairman of the board of directors; Alexander Legge, William D. McHugh, general counsel, and John P. Wilson, consulting counsel.

TAKING STEVENS INVENTORY

SPRINGFIELD, MASS., June 5—Receivers for Stevens-Duryea, Inc., will finish taking the inventory of the company's property in about a week, it was said to-day by Harry G. Fisk, who with Frank H. Shaw of Chicago was named receiver. Promptly thereafter, it was stated, a report of the state of the company's affairs will be made to the Superior Court. Orders at the factory are said to assure good business for the summer.

Overland Suit Filed by Willys Receivers

Claim of More Than $5,000,000 Met by Counter-Claim for $5,107,766

TOLEDO, June 5—Federal Judge Killits has set June 19 as the day for a conference here of all persons interested in the litigation by which the receivers for the Willys Corp. hope to establish claims for more than $5,000,000 against the Willys-Overland Co. as well as a counterclaim of the Overland company against the corporation for $5,107,766 for materials supplied the Electric Auto-Lite Corp.

Negotiations for a settlement out of court have been under way for some time, but were abandoned a few days ago. It is estimated that the claims of the corporation are considerably in excess of those filed by the Overland company. Judge Killits will attempt to bring about an amicable adjustment.

Counsel Outlines Claims

George T. Hahn, special counsel for Frank P. Kennison and Francis G. Caffey, receivers of the Willys Corp. has filed an intervening petition in the case of the Ohio Savings Bank & Trust Co. against the Willys Corp. In this petition he outlines the claims against the Willys-Overland Co.

When the capital of the Willys-Overland Co. was increased by $25,000,000 on May 6, 1920, it is claimed that Willys Corp. as a stockholder waived its right to subscribe to this new common stock. Later 329,866 shares of common stock were issued by the Willys-Overland Co. for the Willys Corp. in the name of "J. R. Harbeck, syndicate manager." At this time a majority of the directors of the Willys Corp. also were directors of the Overland Co. and for this reason a technical fraud in the procedure is claimed. The price paid was far in excess of market value, the petition alleges. Return of the subscription price of this stock is asked by the receivers.

Chrysler Six Mentioned

The other claim arises from a contract between the two companies whereby the Overland was to perfect a light six cylinder car to be known as the Chrysler six and the Willys Corp. was to manufacture and market the car.

The petition alleges the representations made by the Willys-Overland Co. were untrue and the car was unfit for manufacture or sale. The plant at Elizabeth was built for manufacture of this car and tools and equipment were bought for that purpose. The receivers want an accounting of damages thus incurred and judgment for them.

Judgment for $136,637.71 is also asked on account of indebtedness.

The petition states the corporation at one time offered to return its common stock shares for the return of the purchase price by the Overland company, but the latter refused.

Tracy, Chapman and Welles, attorneys for Clement O. Miniger, in the purchase of the Electric Auto-Lite division of the Willys Corp., have incorporated the Electric Auto-Lite Co. in Ohio with a capital of 500 shares of common stock of no par value. The attorneys said the incorporation was only nominal, but that it might be used in case the properties were sold at the sale set for next Wednesday. It was also said it might be a sales company. Delay in incorporating such a company may have been one of the causes for Miniger's unreadiness to bid last Monday.

CONGRESS MAY FATHER TRANSPORT INSTITUTE

WASHINGTON, June 5—Plans are under way to have Congress father a novel school of inquiry to be known as the National Transportation Institute, to deal primarily with transportation problems, but in an entirely different way from the methods pursued by any present Federal agency. It is to be conducted somewhat along the lines of the Rockefeller Foundation.

The Joint Commission of Agricultural Inquiry is sponsor for the school. It proposes the establishment of a private research and educational institution under disinterested auspices to promote education in the principles, operation and practices incident to transportation.

Stockholders Protesting Avalon Sale for $28,500

AKRON, June 5—Stockholders of the defunct Avalon Rubber Co. of Barberton have filed with Judge C. D. Westenhaver of the United States district court at Cleveland a petition protesting the order of Bankruptcy Referee Harry L. Snyder of Akron, in selling the Avalon plant to private Akron interests for $28,500, over the stockholders' joint bid of $30,000. The cash bid was made by a syndicate represented by Clyde Alvis, which has announced it will convert the Avalon plant into a factory for electrical devices and radiophone equipment.

The stockholders' bid was $10,000 cash and $20,000 in notes, but Snyder accepted the cash bid in preference. The company has been in receivership for several months with Ray F. Hamlin of Akron as receiver and trustee in bankruptcy. Its liabilities are about $35,000.

COMPLETING EXPORT MANUAL

WASHINGTON, June 5—The Foreign Trade Automobile Export manual, being prepared by the National Automobile Chamber of Commerce, through its special representative, L. E. Warford, is approximately three-fourths completed.

Harley Bankruptcy Receivers Named

Court Restrains Hendee from Foreclosing—Long Litigation Forecast

SPRINGFIELD, MASS., June 6—An involuntary petition in bankruptcy has been filed against the Harley Co. as the latest twist in the chain of entanglements begun after the purchase of this concern from the Hendee Manufacturing Co. for $1,100,000 several months ago.

Samuel M. Green and George A. Bacon, both of Springfield, have been appointed receivers in bankruptcy. At the same time the United States district court issued an order restraining the Hendee company from foreclosing on the Harley property because of an alleged default on the mortgage. The court denied a request that John D. Stephens, assistant treasurer of the Hendee company, be named as one of the receivers. It is expected that the receivers' investigation will be completed within two weeks.

Wished to Prevent Foreclosure

The bankruptcy petition followed upon a refusal of the United States District court on June 1 to grant a receivership for the company, sought by a group of stockholders as a means of preventing foreclosure by the Hendee company of its mortgage for $725,000.

It was alleged the concern was solvent but did not possess ready means with which to pay bills. The court denied the petition of Frank D. Zell of Pennsylvania for a receiver on a ruling that it could not legally be initiated by a stockholder, and further than this the merits of the sale were not considered. Bankruptcy proceedings are brought on petition of four creditors with claims totaling $1,917, most of which is itemized as wages due employees of the company.

Admits Inability to Pay

Attached to the petition when filed with the United States District Court in Boston was a statement by President A. W. Morris that at a stockholders' meeting June 1 the company admitted its inability to pay its debts and its willingness to be adjudged in bankruptcy. In answer to an inquiry, Morris said that he believed the Harley Co.'s affairs would be in litigation for some time.

MAY INVESTIGATE CURTIS

LITTLE ROCK, June 5—Suit has been filed in chancery court which opens the way to judicial investigation of the Curtis Motor Car Co., a concern which was organized and promoted locally in the autumn of 1919, and which went into the hands of a receiver last April, with reported assets of $87. Residents of Little Rock and other Arkansas communities are said to have invested more than $100,000 in stock in the concern.

Durant Would Build Star at Elizabeth

Likely to Get Plant for Approximately $3,000,000 at Receivers Sale

NEW YORK, June 8—Durant Motors, Inc., undoubtedly will purchase the huge new plant of the Willys Corp. at Elizabeth, N. J., when it is offered at receiver's sale to-morrow, June 9. Unless there are unexpected developments, Durant will be the only bidder. His offer will approximate $3,000,000, and he asserts positively that if anyone attempts to run up the price beyond the sum he has bid he will drop out. The construction of the plant cost about $10,000,000.

If Durant's bid is accepted and confirmed by the court, he will use the plant exclusively for the manufacture of the new Star car which was designed to compete with Ford. The Long Island City plant will continue in operation to turn out the Durant line.

The schedule for the various Durant cars for 1923 calls for a minimum of 120,000 and a maximum of 200,000. The Oakland, Cal., factory will be ready for production in 30 or 40 days. It will contain 300,000 sq. ft. of floor space and will have a capacity of 50,000 cars, of which 40,000 will be Stars.

If the demand for the Star develops as rapidly as is expected, most of the factory space in the Elizabeth plant, which covers 2,100,000 sq. ft., will be required for the assembling of the new line.

Must Deposit $200,000

The court has directed that $200,000 must be deposited before the bidding begins on parcel one, which includes the land, buildings and fixtures comprising the main plant. This is all of the property in which Durant is interested.

A separate bid will be asked for approximately $2,000,000 worth of machinery and tools which were installed in the factory before the Willys Corp. was thrown into a receivership.

So far as can be learned there is no basis for reports that Durant might ask the parts makers who will supply the essential units for the Star to establish branch plants in the Elizabeth factory in the interest of economy.

A. M. A. COMMITTEE PERSONNEL

CHICAGO, June 5—The committee representing the delegates who withdrew from the American Automobile Association at St. Louis, May 20, which has issued a call for all automobile clubs interested to meet at the Sherman Hotel here, June 19 and 20, to perfect an organization of the American Motorists' Association, is composed of Fred H. Caley of Cleveland, Charles C. Jones, Columbus; N. E. Noblet, Indianapolis; Richard H. Lee, Chicago; Henry Paulman, Chicago; B. H. Hagerman, Kansas City; Eugene Stuart, Louisville; H. R. Keltig, Louisville; Ewing S. Mosely, Dallas; G. E. Gillespie, Lincoln; W. Q. Winship, St. Paul; M. P. Lawler, St. Joseph, Mo.; A. G. Lupton, Hartford City, Ind., and Walter D. Meals, Cleveland.

MARYLAND COLLECTS CENT GASOLINE TAX

BALTIMORE, June 2 — The State of Maryland added to-day to the high cost of gasoline when it began collection of a tax of one cent a gallon on gasoline used in motor vehicles. The revenue will be used to reduce a long-standing deficit of $1,000,000 in the maintenance fund of the State Roads Commission.

The tax expires on Dec. 31, 1923, but on the day following another tax of two cents a gallon becomes effective, the proceeds to be applied to a reduction in the fees for the registration of automobiles.

Stewart Makes Changes in Its Capacity Ratings

BUFFALO, June 5—The Stewart Motor Corp. has changed the wheelbase on the Utility Wagon from 123 to 128 in. and the tire size all around has been increased from 32 x 4½ to 34 x 4½.

A slight change has been made in the capacity ratings on other Stewart trucks as follows:

Model	Capacity	Price
Utility Wagon	500 to 2,500 lbs.	$1,245
15	1¼ to 1½-ton	1,445
9	1½ to 2-ton	1,790
7	2 to 2½-ton	2,190
7X	2½ to 3-ton	2,390
10	3½ to 4-ton	3,190
10X	3½ to 4-ton	3,190

Trask Detroit Steamer Now Being Manufactured

DETROIT, June 6—Manufacture of the Trask Detroit Steamer has been started in the plant of the Schlieder Manufacturing Co., this city, manufacturer of valves.

The first of the product, a phaeton model, priced at $1,585, is now being exhibited in the lobby of the Detroit Board of Commerce. O. C. Trask, president of the Detroit Steam Motor Corp. is in charge of manufacturing at the Schlieder plant.

The car has a 115 in. wheelbase and weighs 2000 lbs. The two cylinder engine is directly connected with the rear axle. It is declared to develop the equivalent of 45-50 horsepower. Control of the car is by the throttle on the steering post. A distributor organization is being developed. Dominion Steam Motors has been formed in Windsor to handle the sale of the car in Canada.

Goodyear Makes Bus With Eight Wheels

Is Development of Present Six-Wheeled Vehicle—Same Chassis Used

AKRON, June 5—An eight wheel passenger bus—an entirely new departure in motor vehicle design—is being developed by the Goodyear Tire & Rubber Co. of Akron, which two years ago pioneered in the successful development and practical demonstration of the six wheel chassis for both truck and passenger buses.

The first six wheel passenger bus perfected by Goodyear engineers is being remodeled and made into an eight-wheeled bus, with four wheels in the rear and four in front. It will carry a street car body of the Peter Witt type, with pay-enter folding doors and collapsible steps, and seats and standing room for 55 passengers.

The new eight wheeler will have practically the same chassis and wheelbase as the six wheeled vehicle, with a wheelbase of 180 in. from the center between the front wheels to the center between the rear wheels.

Goodyear engineers have perfected a system whereby the big bus can be steered by all four front wheels operated with a single steering wheel. The front and rear wheels of the front truck have been arranged with different radius lengths so as to permit proper tracking when the vehicle is turned and the wheels are at an angle to the chassis.

Litchfield Worked Out Plan

His conviction that the ultimate motor vehicle would be multiple wheeled, taking the same evolution as the freight car, led to P. W. Litchfield's working out plans for the first six wheeled motor vehicles ever put into practical use in America several years ago. Litchfield is vice-president and factory manager of the Goodyear company.

Six wheeled trucks and buses now are being used regularly in Akron. They have proved to have easier riding qualities, a lower center of gravity and better traction, while tire equipment is less expensive than for a conventional four-wheeled truck with larger wheels. The new eight wheeler is expected to make its debut within a month or so.

PILOT HAS SPORTSTER

RICHMOND, IND., June 6—The Pilot Motor Car Co. has a sportster model, deliveries of which began on June 1. It is of the four-passenger type and carries barrel type headlamps, with cowl lamps to match. The runningboards are displaced by aluminum side steps with individual fenders, and there is an aluminum trunk rack with protecting bars on the back of the body and other specially built features not heretofore used by the Pilot organization.

Akron Stills Strife by Wage Adjustment

Labor Restless Under Improved Conditions—Makers Bid Against Each Other

AKRON, June 5—Labor strife, cropping out among rubber workers in the Akron tire factories and apparently conducted by the steady climb back to prosperity of the tire industry and the increasing heavy demand for labor upon the part of the larger tire concerns, has forced wage adjustments in most of Akron's factories within the past ten days.

The Firestone Tire & Rubber Co., on top of a wage increase for all factory employees ranging from 9 to 12 per cent, has increased the salaries of all office employees by 10 per cent. In the face of the Firestone wage revision, however, a small group of workmen walked out, contending that if any increase be made at all, it should be more than that given. The dissension was confined to a few minor departments, however, and the demand of the men remained unheeded. Some of those who walked out have resumed work, while others are seeking jobs in other factories.

Goodrich Reduces Shifts

The B. F. Goodrich Co., at least temporarily, has salved a feeling of dissension breaking through the service in several departments, and has made adjustments by reducing shifts from ten to eight hours each and giving the men nearly the equivalent of ten hours pay for eight hours work. The new scale at Goodrich under this arrangement is reported to be 77½ cents an hour for skilled tire builders. The company in the negotiations offered 71 cents, countering a demand from employees for 80 cents, the comprise being reached on 77½ cents.

The Miller Rubber Co. has quietly made adjustments of wages wherever necessary in its factory, without enforcing any set scale of increase or without making any public announcement of what revisions are known to have been made. The Mason Tire & Rubber Co. at Kent has had some trouble with a group of its men, but now reports labor conditions normal.

The Goodyear Tire & Rubber Co. so far seems to have been free from any serious dissension or wage strife, although it is a matter of conjecture in rubber circles that practically all the tire companies, both large and small, sooner or later will have to follow the Firestone lead of announcing flat increases to their men.

Faced with Labor Shortage

Where Akron a month ago had a labor surplus, the Rubber City to-day is faced by an absolute labor shortage along all lines. Common labor has become independent, in fact, and men are refusing work at 45 cents an hour, whereas a month ago they were glad to get it at 35 and 40 cents an hour.

Rubber companies have apparently revived the old tactics, laid upon the shelf by amicable agreement during the slump era, and are bidding against each other for men, advertising in other cities and painting jobs here as attractively as possible.

The mad pace in tire production continues unabated. Firestone is hitting 25,000 tires a day, Goodrich 16,000 and Goodyear is striving to get enough men to attain a production ticket calling for 26,000 casings daily. Goodyear is reported to have almost completely exhausted its finished goods inventories, in order to fill rush orders, and it is admitted that if enough men are available the company will jump to 29,000 or 30,000 tires a day, long enough to catch up with orders and to build up again a sufficient reserve for the future.

Timken Bearing Raises Wages

CANTON, OHIO, June 5—Wages of all shop employees of the Timken Roller Bearing Co. have been advanced 10 per cent. Salaries of other employees have been adjusted to make the pay the same as it was prior to Sept. 1, 1921, when wages were cut.

Stockholders Provide New Oshkosh Capital

OSHKOSH, WIS., June 5—By unanimous vote of stockholders, an amended plan for refinancing the Oshkosh Motor Truck Co., Oshkosh, Wis., has been put into effect. The sum of $76,000 has been provided which will make possible the liquidation of a considerable portion of the indebtedness and such an extension of time on the balance as will insure the safety of the company.

The amount of $43,000 has been subscribed by stockholders, and trucks on hand and in process when the business slump overtook the truck industry to the amount of $33,000 have been sold. The reorganization of the Oshkosh Motor Truck Sales Co. recently enabled the company to market considerable of the surplus, the remainder of which is steadily being absorbed, enabling the company to resume output on a fair scale, with prospects of a nearly normal schedule of production within a relatively short time.

Investment Company Holds Various Kelsey Interests

DETROIT, June 5—The John Kelsey Investment Co. has been formed in this city with a capitalization of $1,500,000, 15.000 shares at $100 a share, to consolidate the different business enterprises of John Kelsey under one head.

Stockholders in the new company are John Kelsey, 14,998 shares; George Kennedy one share and William Duncharme one share. Kelsey said it was not the intention of the investment companies to engage in any new businesses, but to simplify the management of the existing companies. The Kelsey Wheel Co., Inc., is the principal of the Kelsey holdings.

Detroit Employment 50,000 Above 1921

Complete Recovery of Industry Seen by Government in Survey for May

WASHINGTON, June 4—Measured in terms of employment, the automotive industry has completely recuperated, according to the industrial survey for the month of May conducted by the United States Employment Service.

The automotive industry again registered first in the percentage over employment in April as the gain for this industrial classification amounted to 11.2 per cent, with railroad repair shops the nearest competitor in employment gains, having an average of 4.6 per cent. The actual increase for fourteen industries showed 3.2 per cent in the number on their payrolls as compared with April. The increasing activity in the automotive industry has reflected itself in allied industries.

Activity in Indiana

In Indiana, representatives of the Labor Department report that the demand for skilled help in the automobile and accessory lines is so active that certain classes of workers can be supplied only with difficulty. An increased demand for bench men, cabinetmakers and all-around mechanics is apparent. The revival of business has brought an increased demand for office workers and sales people in Indiana.

In Indianapolis, the automotive plants particularly are running at top speed, and a shortage of skilled automotive labor exists. All motor and plow manufacturers are working overtime in South Bend.

Other Industries Stimulated

In its survey of Michigan, the Federal Employment Service says:

"This has been the biggest production month the automotive industry has ever had. The business in sight will keep the plants going at top speed until the middle of July. The automobile activity has also stimulated employment in other industries, such as steel, and including aluminum, cotton fabrics, oil, electrical manufacture, and the numerous parts and accessories."

It is significant to note that in Detroit there are now employed 50,000 more men than during the peak of 1921, and the output for May was even greater than the previous month's increased production. One high-priced motor car company is hiring men at the rate of 120 a day. A year ago this company was operating with a working force of approximately 3300, while to-day there are 7000 on the factory payroll.

At Flint there is a shortage of skilled help in the automotive industry. One motor company is making 100 cars a day, or more than double last year's rate of

(*Continued on page* 1304)

Canada Protesting Increased Taxation

Representatives of A. I. C. Will Make Direct Appeal to Government

TORONTO, June 2—The members of the automotive industry of the Dominion are a unit in protesting against the new ad valorem 5 per cent excise tax on cars priced to dealers at $1,200 and under, and 10 per cent on cars selling to the trade at a price in excess of $1,200.

The Canadian Automobile Association and Ontario Motor League argue that the singling out of the motor car for special imports places it in the same category with candies, intoxicating beverages and tobacco, and is inherently a tax on individual and national efficiency.

Manufacturers to Act

Representatives of the automotive industries of Canada (the N. A. C. C. of the Dominion) have convened in this city purposing to wait on Hon. W. S. Fielding in Ottawa to present their brief against the new excise imposts. To the credit of those whose position is relatively improved by the 5 per cent discrimination against the higher priced makes be it said that they all are joining in the opposition. It is declared generally that the special tax is a breach of the pre-election promise of the premier, Hon. W. L. McKenzie King, that no special taxes would be imposed on motor vehicles in the event of his party sitting in the driver's seat of government.

Budget proposals of automotive interest have been somewhat classified and deprived of much ambiguity. The general sales tax has been increased 50 per cent, or from 4 per cent to 6 per cent on imported cars and from 3 per cent to 4½ per cent on cars of domestic manufacture. The 5 per cent or 10 per cent excise tax, as the case may be, is added to the sales tax and computed on the manufacturers' list price or the duty paid value respectively of Canadian made or imported cars.

Settlers' Effects Free

Under a provision of the budget, tractors selling for $1,400 or less and parts thereof will enter Canada free hereafter by act of Parliament. For some years they have entered duty free by Order-in-Council. The budget also provides similarly that automobiles be permitted to enter duty free valued at $1,000 or under if settler's effects, and up to any value if farmer and settler's effects.

The import tax on gasoline over 0.725 and not exceeding 0.750 gravity has been reduced from 2½ cents to 1 cent a gallon under the general tariff.

The budget further provides that the legislation providing a fixed valuation on imports from countries with depreciated currencies be repealed. This provision will, of course, profit the countries with depreciated currencies, and especially Germany.

While the British preference has been somewhat increased in some textiles it does not affect automotives.

The special tax on motor cars, it should be added, is collected from the Canadian manufacturer or importer at time of shipment or importation and, of course, is passed on to the dealer and in turn to the consumer either as a stated tax or included in the selling price. Most quotations are now "plus tax."

Among the points the A. I. C. will stress are: that the tax is wrong in principle in that it discriminates against one essential industry, that the tax discriminated between members of that industry, and that it will retard the return of development, progress and prosperity at the same time resulting in unemployment.

Racine Horseshoe Tire Completes Organization

RACINE, WIS., June 5—Reorganization of the defunct Racine Auto Tire Co. of Racine, Wis., by a new corporation known as the Racine Horseshoe Tire Co., has been completed by Eastern financial interests which have a working arrangement with the stockholders and Racine and Milwaukee banks. The new officers and directors which have taken over the management are:

President, J. C. Lawrence of S. W. Straus & Co., Chicago; vice-president, O. D. Hollenbeck; secretary and sales manager, L. H. Shepherd; treasurer, Raymond H. Weins, Racine. Lawrence was for eleven years an officer of the B. F. Goodrich Rubber Co., Akron. Hollenbeck is a former Firestone official, and Shepherd is a former Goodrich man.

The board of directors, of which Lawrence is chairman, consists of the following: H. H. Whiteman, fabric manufacturer, Boston; H. J. Lyall, attorney, New York; N. Howard Green, fabric manufacturer, Boston; Francis J. Johnson, banker, Chicago; W. C. Crawford, banker, New York; John W. Bate, financier and manufacturer, Racine; Frederick L. Sivyer, steel foundry owner, Milwaukee; William O. Goodrich, capitalist, Milwaukee.

Ford Shifts Departments to Help Lincoln Factory

DETROIT, June 2—Sales and service offices of the Ford Motor Co. have been moved to the Lincoln Motor Co. plant, and the purchasing department of Lincoln has been moved to the Highland Park plant of the Ford company. The relocation of the departments is declared by executives to be of an experimental nature, and part of the plan is to familiarize the members of the Lincoln departments with Ford policies and methods.

There will be no consolidation of the departments of the two companies, it was declared, as it is the Ford plan to maintain them as two entirely separated divisions, each with its own operating and executive staff.

Boycott Against Bus and Truck Spreads

Starting at Roseville, Cal., Now Reaches to San Francisco—Dealers Aroused

LOS ANGELES, June 6—The activities of employees of the Southern Pacific Railroad in extending their attempts to curtail motor truck shipping are developing. Starting at Roseville, Cal., where the blacklist and "we don't patronize" embargo was placed on motor freight and bus lines, and merchants were petitioned to refuse to handle goods shipped by truck, the movement now has spread to San Francisco.

Under the supervision of the Southern Pacific Good Service League, the Chamber of Commerce and many other organizations have been sent copies of resolutions asking that they patronize the railroads rather than the bus and truck, and that these organizations use their influence to bring about heavier taxes for the highway carriers.

In the preamble to the resolution, the league sets up that the Southern Pacific Railroad is meeting severe competition under unjust conditions from commercial motor trucks and buses; that the railroad pays taxes which are used in part to maintain the highways over which this competition operates; that this continued competition will so impair the revenues of the railroad that its employment of working forces will be curtailed.

League Strikes Snag

The railroad's taxes, the purchases, expenditures, payroll, etc., are set up in detail, and attention is directed to the fact that San Francisco's merchants benefit from these expenditures.

The league struck a snag when these resolutions were addressed to the Motor Car Dealers Association. The association appointed a committee to consult with officials of the railroad to ascertain if they instigated or were a party to the circulation of the petitions. Pacific Coast automobile dealers pay to the railroads about $19,000,000 annually in freight bills, and there is some talk of a plan in retaliation whereby these shippers would discontinue their patronage of Southern Pacific lines.

OPTIMISM AT TRUCK MEETING

PONTIAC, MICH., June 6—Conditions were never so bright for truck business in the retail field, according to thirty sales managers and agents from Boston, Philadelphia, New York and Kansas City districts in convention at the General Motors truck plant here to-day. Universal optimism was revealed in the meeting. Two sales sessions were held. The conference closes to-night. Next Monday and Tuesday the fourth of the convention series will be held at the plant, with men from the South and Southwest, from Atlanta to El Paso in attendance.

Activity in Building Boosts Truck Sales

Passenger Car Business Also Continues Improvement in Southern California

LOS ANGELES, June 3—The rush of automotive buying in southern California continues. When it began in March there were many to predict it could not last long, but it is improving rather than diminishing. The splendid business is being enjoyed not only by the passenger car dealers but exclusive truck merchants are experiencing a big demand as well.

The truck business undoubtedly is based largely on the unprecedented building activity. Los Angeles has been ranking third among all the cities in the United States in building permits. There is not as much road building as in some previous years, but this line is constant on the average. The number of Government and state trucks in use makes comparatively few privately owned trucks in this work.

Statistics just compiled indicate that the number of new passenger cars sold in this part of the state the first four months of the year was 21,651 as compared to 13,843 during the same period in 1921. In Los Angeles alone there have been 10,024 new cars sold in the four months as compared to 5997 one year ago.

Slightly more than one-third of all the new cars sold are Fords. Chevrolet is getting about 15 per cent of the total business. Willys-Knight has shown a gain of 300 per cent. Six cars show fewer sales than last year. In some cases this can be attributed to the fact the factory's financial condition has hurt the confidence of the public in the car.

Plan Would Put Nash Closer to Lafayette

(*Continued from page* 1294)

The liabilities were: notes payable, $1,440,000; accounts payable, $29,191; dealers' deposits, $21,750; accrued liabilities, $56,388, making a total of $1,547,329, leaving the net worth of the company $922,831.

The new corporation has made an offer to purchase all the property and assets of the Lafayette company in consideration of the assumption of all its debts and liabilities and the issuance to the Lafayette company of 40,000 shares aggregating $4,000,000 par value of the second preferred stock of the new corporation. The stock will be distributed share for share to the holders of the preferred stock as a dividend in final liquidation.

The Lafayette Motors Co. was organized in 1919 and erected a modern plant at Mars Hill, a suburb of Indianapolis. It was unfortunate in getting under way just as the business depression began. It sold approximately 1000 cars, but general business conditions were such that its outlay far exceeded cash returns.

Charles W. Nash, president of Nash Motors, has been president of the Lafayette company and a majority of the members of the board of directors have been Nash directors. They included Nash, James J. Starrow of Boston, chairman of the Nash board, and Frederic W. Allen of New York.

Nash will continue to direct the affairs of both companies.

Republic Truck Operates at 50 Per Cent Capacity

DETROIT, June 3—Republic Truck Co. is now producing between 450 and 500 trucks monthly, or at a rate of approximately 50 per cent of the normal capacity of the plant, President F. E. Smith declares. There is little buying of a farmer nature at this time, he said, the bulk of the business being by industrial companies, and originating for the most part in the Eastern section of the country.

Farm buying is expected to start in July and reports from Middle Western sales territories indicate that this will be on a fairly large scale, President Smith said. Most of the Republic business is in the heavier vehicles, but light truck buying is developing. Buying is divided about equally as regards pneumatic and solid tired vehicles, most of the pneumatic being in short wheel-based models.

Output and Shipments of Casings Still Gain

NEW YORK, June 6—Statistics of the rubber industry for the first four months of the year, as compared with the same period in 1921, follow:

PNEUMATIC CASINGS

1921—	Inventory	Production	Shipments
Jan.	5,319,605	703,430	965,417
Feb.	5,193,018	819,892	1,073,756
March	4,597,103	1,163,314	1,614,651
April	4,527,445	1,651,418	1,785,951
1922—			
Jan.	4,174,000	2,055,000	1,597,000
Feb.	4,691,000	2,084,000	1,562,000
March	5,183,286	2,645,790	2,073,963
April	5,464,336	2,401,187	2,086,651

INNER TUBES

1921—	Inventory	Production	Shipments
Jan.	5,586,163	740,824	1,042,617
Feb.	5,415,464	916,627	1,129,881
March	5,044,861	1,346,483	1,643,690
April	4,916,772	1,762,122	1,983,571
1922—			
Jan.	5,247,000	2,343,000	1,890,000
Feb.	6,142,000	2,597,000	1,703,000
March	6,991,118	3,017,511	2,090,737
April	7,230,096	2,650,573	2,329,343

SOLID TIRES

1921—	Inventory	Production	Shipments
Jan.	303,753	21,220	29,116
Feb.	304,374	23,365	29,599
March	283,800	27,710	43,926
April	269,985	28,859	42,080
1922—			
Jan.	182,000	40,000	33,000
Feb.	183,000	39,000	37,000
March	182,197	49,433	48,350
April	173,748	46,664	52,309

"Production" and "Shipments" figures cover the entire month for which each report is made. "Inventory" is reported as of the last day of each month.

"Inventory" includes tires and tubes constituting domestic work in factory and in transit to, or at warehouses, branches (if any), or on possession of dealers on consignment basis, and as a total represents all tires and tube still owned by manufacturers as a domestic stock.

"Shipments" includes only stock forwarded to a purchaser and does not include stock forwarded to a warehouse, branch, or on a consignment basis, or abroad.

Two Companies Join Truck Merger Plan

Selden and Atlas First to Become Members of Industrial Motors Corp.

(*Continued from page* 1296)

One hundred and twenty thousand shares of new stock exchanged, two for one, for 60,000 shares of Atlas; 60,000 shares of new stock exchanged, two for one, for 30,000 common shares of Selden; 24,000 shares of new stock exchanged, eight for one, for 3000 shares of first preferred shares of Selden; 80,000 shares of new stock exchanged, eight for one, for 10,000 shares of second preferred shares of Selden. Of the balance, 20,000 shares are to be issued for promotion.

Spicer-Hydraulic Merger

NEW YORK, June 6—Official confirmation still is lacking of reports of an impending consolidation of the Hydraulic Steel Co. of Cleveland and the Spicer Manufacturing Co. with plants at South Plainfield, N. J., and Pottstown, Pa. J. H. Foster, president of Hydraulic, declared at Cleveland that he deemed it unwise to discuss the subject at this time. C. A. Dana, president of Spicer, has been out of the city, and it was impossible to obtain a statement from him.

A consolidation of the two companies would result in a strong combination. The Hydraulic Steel Co. has as subsidiaries the Cleveland Welding and Manufacturing Co. and the Hydraulic Steel Craft Co., both of Cleveland. Announcement was made last week that it had sold the Canton Sheet Steel Co. to the United Alloy Steel Corp.

The Spicer Manufacturing Co. owns the entire capital stock of the Sheldon Axle & Spring Co. of Wilkes-Barre, Pa., and the Parish Manufacturing Co. of Reading, Pa., and Detroit, as well as the common stock of the Salisbury Axle Co., Inc., with a plant at Jamestown, N. Y.

Capitalization of Companies

The Hydraulic Steel has an authorized capital stock of 500,000 shares of common of no par value and $6,000,000 in 7 per cent cumulative preferred. There are outstanding 225,849 shares of common and all the preferred. Application recently was made to list an additional 150,000 shares on the New York Stock Exchange. It also has outstanding $2,957,500 in 8 per cent 10 year gold notes.

The Spicer Manufacturing Co. has a capitalization of 600,000 shares of no par value common and $10,000,000 in cumulative preferred. It has outstanding 313,757 shares of common and $3,000,000 of preferred. It has a funded debt of $2,400,000 in 6 per cent serial gold notes which were issued to provide in part for the purchase of the Parish and Sheldon axle stock.

Reports that the Detroit Pressed Steel Co. also will consolidate with the Hydraulic have been revived.

Men of the Industry and What They Are Doing

Bartsch Back from Trip

Alfred H. Bartsch, general sales manager of the American Bosch Magneto Corp., has returned for a six weeks' circuit of the eastern and southern states, having visited 33 leading cities in that time. The trip was made for the purpose of investigating general conditions and studying their probable effect on automotive sales during the next six months.

Sam Miles Sails for Home

S. A. (Sam) Miles, show manager of the National Automobile Chamber of Commerce, sailed from Liverpool last Saturday on the Aquitania on his way home with Mrs. Miles after their annual visit to Europe.

Lauer to Run for Congress

Robert M. Lauer, comptroller of the Federal Rubber Co., Cudahy, suburb of Milwaukee, has consented to be a candidate for the Republican nomination for member of Congress from the Fifth Wisconsin district, now represented by W. H. Stafford. This district twice elected Victor L. Berger to a seat in the House which he was denied by a vote of that body.

Lee to Fly to Meeting

Gordon Lee, chief of the automotive division of the Department of Commerce, will fly to the meeting of the Foreign Trade Committee, which will be held in the headquarters of the Motor & Accessory Manufacturers' Association in New York on June 12. This has been made possible through the offer of Major Hickam, chief of the information section of the Air Service.

Hydro Tire Appoints Hedges

William F. Hedges has retired from the tire business in Fort Wayne, Ind., to assume the position of manager of the Middle West States' branch of the Hydro-United Tire Co., located in Chicago. He is well known in the tire world having been identified with the industry since 1913. He has served in all branches of tire sales, promotion and advertising for various rubber companies throughout the country. Associated with Hedges is D. H. Coan, formerly in business in Canton and Fort Wayne.

Figgie Joins Standard Spring

Harry Figgie, formerly in charge of sales for the Perfection Spring Co. of Cleveland, has become associated with the Standard Steel Spring Co., Coraopolis, Pa., in a similar capacity. He is a graduate of Case School of Applied Science and spent a number of years in the shop before taking up the sales end of the spring business. He is a member of the Society of Automotive Engineers, being attached to the Cleveland section.

Kryl and Eichleman Partners

J. M. Kryl, president of the Kryl Bridge & Crane Works of Chicago, and W. H. Eichleman, until recently the chief engineer of the Hamler Boiler & Tank Co. of Chicago, have formed a partnership as steel fabricators. Both men are graduate engineers, and they now have facilities for handling oil and wood tanks, process kettles, ornamental iron and structural steel.

Serra Lima Visiting U. S.

Among the passengers on the "American Legion" of the Munson line arriving in New York on May 29 was Frederico A. Serra Lima, South American automobile racer. Serra Lima holds the championship for 200 and 350 mile distances in South America, having won the former against 32 cars and the latter against 28. He represents the Hudson Motor Car Co. in Buenos Aires and also Buxton Guilayu & Co. of England.

Vacuumeter Appoints Stone

L. Z. Stone has been appointed director and sales promotion manager of the Vacuumeter Manufacturing Co., Cleveland. Stone has specialized in the automotive sales field, having been associated with the Diamond Rubber Co. and the Goodyear Tire & Rubber Co. Lately he has been connected with advertising agencies, in charge of automobile and accessory accounts.

Jaeger Recuperates in Florida

Harry S. Jaeger has given up active work for the time being and is recuperating at Fort Myers, Fla. He was at one time in the sales department of the old E. R. Thomas Motor Co., then in sales and purchase with the Thomas Motor Car Co. Later he became service manager of the Atterbury Motor Truck Co. and salesman for the Goodyear Tire & Rubber Co. Subsequently he was associated with J. W. Hobbs as metropolitan distributor of Lee tires. Recently he was connected with the Nassau Garage & Taxi Co., Rockville Center, L. I.

Changes with Mitchell

A. G. McMillan, who has been general manager of the New York branch of the Mitchell Motors Co., Inc., has been appointed director of sales at the factory in Racine. John Tainsh will continue as general sales manager under McMillan's direction. Paul C. Lott, connected with McMillan in New York, has been named sales promotion manager at the factory. G. N. Bliss will direct eastern sales, and Fred T. Yeager, western sales, for the company.

Schurch Directs Western Sales

John F. Schurch has been elected a vice-president of Manning, Maxwell & Moore, Inc., and has taken charge of its western sales, with headquarters at the company's Chicago office, 27 North Jefferson Street. Schurch was graduated from the University of Minnesota in 1893 and entered the service of the Minneapolis, St. Paul and Sault Ste. Marie Railroad, with which he was connected for several years, leaving that position to become associated with the Railway Materials Co. of Chicago. In 1914 he was elected vice-president of the T. H. Symington Co.

Hendee Promotes Whitney

P. B. Whitney, formerly manager of the Chicago branch of the Hendee Manufacturing Co., Springfield, Mass., has been appointed by the company as manager of the Southwestern district, which includes Texas, Oklahoma, Louisiana, Arkansas, Colorado and Wyoming. Whitney is a motorcycle engineer of many years' experience and has been through all the phases of the motorcycle since its inception, both in selling and manufacturing. His headquarters will be at Fort Worth.

Soglovitz in Canada

S. S. Soglovitz has been appointed sales supervisor in the Province of Quebec for the Maxwell Motor Co. of Canada, Ltd. Formerly he was associated with the Cleveland Tractor Co. as a sales supervisor in Europe, North Africa, Canada and the United States. Soglovitz was connected with the Ferro Motor Co. and the White and Peerless companies in the early days of the industry.

Rickenbacker Appoints Whitley

J. W. Whitley has been named southeastern supervisor for the Rickenbacker Motor Co., with headquarters at Atlanta. Whitley is well known in the southern automobile territory, having been operating there for the past twelve years, during the last nine of which he was associated with the Saxon Motor Car Corp.

Stephens Is District Manager

H. M. Stephens has been appointed district manager for the Cadillac Motor Car Co. in the eastern states, having been a special representative for the company during the past year. Stephens was construction engineer of the new Cadillac factory in Detroit.

McKeen Made Sales Head

C. H. McKeen has been appointed sales manager of the Apco Manufacturing Co., Providence. He has been covering the East for the company ever since he became associated with it, ten years ago.

Plants Speeding Up in All Branches of the Industry

G. M. Truck Shipments Increase

PONTIAC, MICH., June 5.—W. L. Day, general manager of the General Motors Truck Co., declares May was the biggest month in the plant's history since 1919, when it was exceeded by only one or two months. This summary is based on orders received. Special equipment orders have held back shipment somewhat, but there has also been a large increase in shipments over the April record and any previous month since 1919.

"We base our opinions of the market and the prospects for coming business," said Day, "on the dealers' weekly retail reports. These have been showing a steady improvement for a long time and we are consequently feeling confident in the future prospect. There doesn't appear to be any let-up ahead. Orders now in hand and commitments made point to a still stronger production month in June."

Gray & Davis Improving

BOSTON, June 3—The Cambridge factory of Gray & Davis, Inc., is turning out more motors on a 1200 daily schedule than it did for an entire month six months ago. The average daily output for a sustained period is reported to be the largest on record. Monthly shipments show a steady gain since the first of the year. April was the best month of the year in point of net, and its average is expected to be maintained for several more months. Its production was 20,000. May is expected to show an output of 25,000.

Ford Output at Atlanta Greater

ATLANTA, June 5—The local plant of the Ford Motor Co. increased its output to 150 cars a day beginning June 1, and employed 75 more men. The present force is 350 men. When the plant reopened a few weeks ago its output was 75 cars a day, this being increased subsequently to 100. Increased orders made a further expansion of the output schedule mandatory. The new schedule is the largest attempted at the plant.

Packard Exports Grow

DETROIT, June 5—Packard Motor Car Co. states that its export business in passenger cars is showing marked improvement, shipments for the first four months of the year being 50 per cent better than the corresponding period in 1921. Truck sales abroad also show some improvement, Japan, especially, making purchases in larger volume.

Franklin Plans Big June

SYRACUSE, N. Y., June 3—Franklin Automobile Co. reports orders for June shipment equal in number to total shipments for May. Last month broke all previous records in the matter of retail deliveries of new Franklin cars into the hands of purchasers for a period running back twenty years. The company states that production for June will aggregate 1520 cars. More than 700 new employees have been taken on since April 1.

May Biggest Peerless Month

CLEVELAND, June 6—May was the largest sales month in the twenty-one years' history of the Peerless Motor Car Co., and June will eclipse May, according to prospects based on a comparison of orders at the beginning of the two months. Last month surpassed the previous record month, March, 1920. While production facilities at the factory have been adequate to meet all requirements with only small oversold conditions, these are being expanded as fast as is feasible so that with the continuance of the demand deliveries will not be hampered to any great extent.

Hendee Continuing Full Time

SPRINGFIELD, MASS., June 5—The Hendee Manufacturing Co. continues to run full time and has orders that will keep the factory at normal production for the next month. A second large order for Indian Scout motorcycles has been received from Holland; also a substantial order from South Africa for cycles of the various models. Numerous orders have been filled recently for machines for police departments.

May Big with Standard Parts

PONTIAC, MICH., June 6—Twenty-five per cent increase in May business over the April record is the report of B. A. Litchfield, general manager of the Standard Parts' plant here, making springs and axles. This concern, Litchfield says, had a bigger volume of business in May than in any month since 1920. The outlook for June, he said, is for an increase of about 25 per cent over May figures.

Oakland Speeding Up

PONTIAC, MICH., June 6—May business with the Oakland Motor Car Co., in actual shipments of cars from the plant, exceeded April output by 50 per cent, according to W. R. Tracy, assistant sales manager. Tracy says that the business in May was 125 per cent greater than that in May, 1921, and was the largest single month since September, 1920.

During June, he said, prospects are that there will be at least a 50 per cent increase over May's record, as orders ahead promise necessity of speeding up the production.

Bushing Company Expands

PONTIAC, MICH., June 3—The Pontiac Jig Bushing Co. has announced an expansion plan that includes purchase of several acres of land on the Grand Trunk railway here for factory buildings. The plant now occupied has been outgrown, and part of the work is being placed with other machine shops. The first unit of the plant is now being erected. O. R. Briney, president, declared to-day the scope of operations would be broadened as soon as more room is available, a national sales campaign entered upon, and other machined specialties put on the market.

R. & V. Increased 37 Per Cent

EAST MOLINE, ILL., June 6—R. & V. Motor Co.'s business in April increased 37 per cent over March, according to D. M. Beal, sales manager, who adds that field reports indicate that June may surpass the May record, which was the largest in the history of the organization. This is the biggest selling season in the 18 years of the company's operation. Closed car business in April gained 42 per cent over March. Production schedules on the Knight Six are being increased. A shortage of cars has already developed, a situation which will not be relieved for several weeks.

14,000 Studebakers Sold in May

SOUTH BEND, IND., June 2—President A. R. Erskine of the Studebaker Corp. announces that the production, sales and financial departments of that company shattered all previous records in May. Sales were approximately 14,000 cars and production 10,853 cars. Sales for May, 1921, were 7383. Collections by the company aggregated $17,000,000. Erskine asserts that there is no slackening in demand for the Studebaker products.

Bigger Output by Republic Tire

YOUNGSTOWN, June 5—Due to sustained improvement in casing demands the Republic Rubber Corp. is resuming tire production here, where the capacity is more than 4000 casings daily. At Canton the company is making 1500 tires a day, the output having been pushed beyond normal. Inner tube production by the company is being increased to 100,000 monthly, with some departments operating on three shifts.

Good Business at Springfield

SPRINGFIELD, OHIO, June 6—Good business during the month of May is reported by the heads of the Kelly-Springfield Motor Truck Co., Victor Rubber Co. and the Springfield works of the International Harvester Co. Prospects are considered bright for this month. The Westcott Motor Car Co. has been doing a good business the last two months.

Ford Plans to Make Aluminums in South

Manufacture of Cheap Fertilizers at Muscle Shoals Would Be Incidental

WASHINGTON, June 5.—The Committee on Military Affairs of the House has decided, by a vote of 12 to 9, to accept the proposal of Henry Ford for the development of the Government's vast power and nitrate projects at Muscle Shoals, Ala.

In reaching its decision the committee decided to eliminate from the properties covered in the Ford offer the steam plant at Gorgas, Ala., and it agreed with representatives of Ford on new language relating to the manufacture of fertilizer. In all other respects the Ford offer was fully approved.

To Make Furnace Steels Also

Production of electric furnace steels and aluminums will be the chief object of Ford if Congress finally accepts his offer to complete and lease the hydro-electric power plants at Muscle Shoals and purchase the nitrate plants, the Waco quarry and the Warror River steam plant. Manufacture of cheap fertilizers for the farmers of the country will be a big part of the undertaking, but it really will be incidental.

There has been much speculation as to the real purpose of Ford in making his proposal, and the final testimony of his chief engineer, William B. Mayo, before the Senate Committee on Agriculture and Forestry gave the first real clue. Mayo began giving his testimony before the House Committee on Military Affairs in February and continued on the stand periodically for three or four weeks, but he always evaded the question gracefully when asked to detail what his chief had in mind. It was not until his final appearance before the Senate Committee that Mayo told the secret.

Has Secret Process

Following is a verbatim report of part of the dialogue between Mayo and Senator Norris, chairman of the committee:

The Chairman. I would like to know why Mr. Ford has obligated himself to extract nitrates from the air by the process that, from all we can find out now, from scientific men, is not as good as the one he will not operate or will not obligate himself to operate for nitrates?

Mr. Mayo. Maybe you are mistaken in what offers. He does not obligate himself to operate nitrate plant No. 2 under the cyanamid process. He merely agrees to operate that plant at a certain capacity.

The Chairman. What process is he going to use there if he does not use the cyanamid process?

Mr. Mayo. He is not prepared to say, but he will have to equip it for whatever process he uses.

The Chairman. Do you mean to say he has some secret method that he is concealing that he is going to use?

Mr. Mayo. Yes, sir. Surely.

The Chairman. Can you give the committee this much information, that Mr. Ford, under that provision of the contract, does have in mind some other secret process that he expects to use instead of the cyanamid process?

Mr. Mayo. Yes, sir; and the process, we think, will be much safer and fully as cheap, if not cheaper, than the Haber process.

The Chairman. You feel under the proposition that he is obligated to make, then, at least 110,000 tons of nitrate a year?

Mr. Mayo. Its nitrogen capacity is equal to 110,000 tons of ammonium nitrate, and he sets that up as the equivalent.

The Chairman. Will Mr. Ford's secret process require as much power as this does?

Dovetails with Other Plans

Mr. Mayo. I don't think as much; no, sir.

The Chairman. How much less?

Mr. Mayo. We are not sure yet. It is being worked out to dovetail in with other manufacturing processes that are to be used in our own business.

The Chairman. Can you give the committee any idea as to how much power, under this new or secret process that Mr. Ford has, will be required to make 110,000 tons a year?

Mr. Mayo. I could not say offhand. As I say, it dovetails into other manufacturing processes.

The Chairman. What do you mean by dovetailing in?

Mr. Mayo. I mean the by-product of the one is the product of the other.

The Chairman. Can you give the committee any information as to what the other products are, whether by-products or otherwise, that you expect to make in the process?

Mr. Mayo. They will be electric furnace steels and aluminums.

The Chairman. Aluminums?

Mr. Mayo. Yes.

There are large deposits of bauxite in Georgia and in the region adjacent to Muscle Shoals. Bauxite is one of the sources of aluminum. The deposits near Muscle Shoals were at one time the principal source of this ore in the United States. Later, deposits in Arkansas came into the market, and more recently the Aluminum Co. of America obtained large sources in British Guiana.

Deposits Not of High Grade

The Arkansas-Alabama deposits are not, on the average, of high grade, but aluminum can be made from them. It is generally conceded that Ford can produce aluminum in large quantities much more cheaply than it can be purchased at present. Bauxite is the nearest thing in nature to alumina, which is refined from alunite. Bauxite contains 50 per cent alumina, which in turn is 53 per cent aluminum. It has been reported that Ford was considering the purchase of a large tract containing heavy alunite deposits which will be refined at Muscle Shoals if his offer is accepted by the Government.

By-products of alunite are potash and sulphuric acid.

Detroit Employment 50,000 Above 1921

Complete Recovery of Industry Seen by Government in Survey for May

(*Continued from page* 1299)

output. Another company in this city is running day and night shifts.

One motor company at Lansing is operating to the limit of its capacity, while an automobile body company is working overtime, employing 600 men.

Increased sales of automobiles and trucks have brought about a pronounced increase of employment in the automobile parts and accessories plants of Wisconsin.

In Ohio the automotive industry is running at full time. A report from Dayton, Ohio, says "The automotive industry has completely recuperated."

Employment Gains in Toledo

TOLEDO, June 6—The larger industries of Toledo showed a gain of 2146 workers in May for a total of 20,894 in the 21 plants normally employing 500 or more men, in a report made to the government.

A great share of the gain is shown in the automotive plants. The vehicle factories gained 1361 employees in May. The Willys-Overland Co. is now working 8625 men, which is 764 more than last month. The Milburn Wagon Co. placed 157 more men at work during the month, and the Toledo Chevrolet plant more than doubled its force.

The Electric Auto-Lite Corp., which is classed in the miscellaneous group, added 371 employees in May and now has 2173 at work. Other allied industries in the metal trades showed gains.

Tariff Bill Unchanged in Automobile Section

WASHINGTON, June 8—When the section of the tariff bill relating to automobiles came up before the Senate finance committee last night, it provoked little discussion and no change was made by the committee in the House rate of 25 ad valorem.

At the request of Senator McCumber, the Senate deferred action on a committee amendment proposing to strike out a proviso carrying a countervailing duty against automobiles from countries which impose a rate above 25 per cent on American made vehicles.

Senator Townsend of Michigan said he was more interested in a countervailing duty than in the straight duties proposed, explaining that he favored the same tariff treatment as the other countries accorded the United States.

PREPARE FOR ROAD MEETING

WASHINGTON, June 5 — The bi-monthly meeting of the Highway and Highway Transportation Education Committee will be held here on June 9.

Demand by Dealers Forcing Big Output

Some Factories Placing Commitments for Parts 60 Days Ahead on Month's Basis

(*Continued from page* 1295)

production of 65 daily, which will be increased in June.

Studebaker is continuing production at the rate of 440 cars daily, the capacity of the several plants of the company. Paige reports that the 3800 production mark fixed for its Paige and Jewett models was exceeded in May and that further gains will be made in June. Columbia continues to be handicapped in the production of its light six through material shortages, but declares it will reach a production of 50 daily in June.

Other Schedules Increased

Other cars in the more popular price class are meeting with just as ready a sale as they can meet. Rickenbacker with 500 in May has outlined a schedule of 750 for June. Liberty is approximating 30 cars daily. Reo is building and shipping 130 cars and speed wagons daily on a five-day weekly basis. Saxon business is better, the schedule of 10 daily being exceeded in May, with good prospects of further gains in June.

In the higher priced group Cadillac is working steadily on a schedule in excess of 100 daily and reports a record day in May, in which 150 cars were produced and shipped. Packard declares its light six production to be on a schedule of 50 daily. Wills Sainte Claire, working two shifts, reports a record day in May, in which 80 cars were built and shipped, and declares its daily schedule to be 60 continuing into June.

In the General Motors group, Chevrolet production continues at the rate of about 1200 daily. Buick is building about 10,000 monthly. Oldsmobile has increased its schedule to 150 daily and is increasing its working force rapidly. Oakland is operating at a rate in excess of 100 cars daily.

Hampered by Material Shortage

Lincoln, handicapped by material shortages, operated at a rate of 30 cars daily. Handley-Knight and Roamer, Kalamazoo, report business in May better than April and indicating a continued growth in June.

Production on the Gray car was delayed owing to inability to get factory equipment installed and delay in material deliveries. Work on the factory addition is being rushed and will be completed June 15, officials said.

The new plant of the Durant company at Lansing, which will be devoted exclusively to the manufacture of the Star, will be completed in July and production will be started there in August.

Maxwell produced 6500 cars in the United States and Canada during May and shipped 6525, which are records with this company. In the week ended June 3, incoming business reached new high levels, with an average of 600 cars ordered daily.

Dort is working on a schedule of 80 to 90 daily, and reports itself 3000 behind on orders, which executives declare assures capacity production through June and into July.

MAY SHIPMENTS BY CARLOAD, DRIVEAWAY AND BOAT MADE IT HIGH RECORD MONTH

NEW YORK, June 7—The following table shows the factory shipment figures for the first five months of 1920, 1921 and 1922:

	Carloads			Driveaways			Boat		
	1920	1921	1922	1920	1921	1922	1920	1921	1922
January	20,057	6,485	15,241	29,283	3,185	7,397	....	93	154
February	25,505	9,986	19,600	43,719	1,507	9,950	....	99	169
March	29,236	16,287	27,380	57,273	9,939	15,800	....	75	264
April	17,147	20,187	30,200	64,634	14,197	22,500	....	1,619	3,200
May	21,977	18,608	33,810	74,286	15,193	28,710	....	2,381	7,220

Factory shipments for the other months of 1920 and 1921 follow:

	Carloads		Driveaways		Boat	
	1920	1921	1920	1921	1920	1921
June	22,516	20,269	60,746	18,384	8,350	3,947
July	23 082	19,470	52,342	15,320	8,702	3,725
August	23,386	20,350	34,060	14,290	7,095	3,565
September	20,804	20,150	24,431	13,550	5,469	3,580
October	17,209	17,323	14,127	11,257	2,519	2,300
November	13,253	14,061	9,497	10,509	659	1,385
December	11,802	12,100	6,469	7,500	89	134

252,000 Vehicles Output for Month

(*Continued from page* 1294)

other factors promise to prevent any sharp seasonal midsummer slump in sales.

Peak production and the avid demand for motor vehicles have brought manufacturing difficulties in their wake. Probably the most serious of these is labor. A shortage prevails in all branches of the industry and is responsible in large measure for the shortage of some essential parts. The companies hardest pressed to meet orders have been placed in the position of bidding against each other for help and this is forcing wage scales upward with a consequent increase in costs which will more than offset the prospective savings on freight rates. The situation in this respect appears most acute in the tire field, but parts makers are little better off.

Another factor which has increased production costs somewhat has been the willingness to pay premiums for immediate deliveries of some raw materials, especially malleables. This is the result of refusal to place commitments for more than one or two months ahead. There is no general disposition, however, to place orders for more than 60 days in advance for it is felt that it is wiser to pay small premiums than to pile up inventories.

Midwest Engine Plans Approved by Committee

INDIANAPOLIS, June 7—A reorganization committee has approved the plan under which the Midwest Engine Corp. will be organized to acquire the assets of the Midwest Engine Co. of Delaware and the Midwest Engine Co. of Indiana. The new company will have a capital of $5,000,000 in 7 per cent preferred stock, 125,000 shares of no par value common and $3,000,000 in 7 per cent 15 year mortgage bonds.

Under the plan creditors of the A and B classes will receive mortgage bonds in exchange for their claims, and creditors in the C class will receive preferred stock.

Preferred stockholders have been asked to subscribe to the new mortgage bonds to the extent of 35 per cent of the present holdings with the understanding that they will receive a bonus of 50 shares of common stock with each $1,000 worth of bonds purchased.

Expect Harding to Sign Post Office Road Bill

WASHINGTON, June 8—President Harding is expected to sign the Post Office appropriation bill which passed the House and Senate to-day. The bill is of importance to the automotive industry, as it authorizes the appropriation for a three year highway program. The report of the conferees recommending an authorization of $50,000,000 with certain contractural rights left to the states to protect their situations was accepted.

The conference report as approved by Congress provides for an authorization of an appropriation of $50,000,000 for the construction of post roads during the fiscal year 1923 and also carries authorizations but not actual appropriations for $65,000,000 in 1924 and $75,000,000 in 1925 and in addition $6,500,000 annually during these last two years for construction of forest roads.

Miniger Purchases Electric Auto-Lite

Pays Minimum Price of $4,700,000—Must Negotiate Contract with Overland

TOLEDO, June 8—The Electric Auto-Lite Corp., a division of the Willys Corp., was sold to Clement O. Miniger, at a special masters sale at the court house here to-day for the minimum price set by the Federal court of $4,700,000. The sale will be subject to the confirmation of the court, which will probably come on June 19. In the meantime, by the provision of the order of sale, Miniger will have to negotiate a satisfactory contract with the Willys-Overland Co. for manufacturing farm lighting outfits.

Miniger was the only bidder to qualify by the deposit of a certified check for $50,000. Special Masters Frank P. Kennison and Colonel Francis G. Caffey were present with their attorney, George P. Hahn, who immediately filed a report of the sale and a motion for its confirmation. Attorneys Thomas Tracy and Edward Marshal accompanied Miniger to the sale. No announcement was made as to the use of the newly incorporated Electric Auto-Lite Co. chartered last week.

Purchaser for New Process Gear

SYRACUSE, N. Y., June 8—A purchaser for the New Process Gear Co. of this city, a subsidiary of the Willys Corp., has been obtained, but George R. Lunn of Schenectady, receiver, refuses to reveal the name of the probable buyer. Lunn says that the local plant will not bring half as much as it is worth. The plant here is now employing 800 men, and night shifts are being operated. Enough orders have been received to keep the plant working during June and July.

M. A. M. A. Advertising Heads to Form Council

NEW YORK, June 7—Directors of the Motor and Accessory Manufacturers' Association at a meeting here today approved the organization of an advertising managers' council. One hundred companies which are members of the organization expressed a desire for the formation of such a division and pledged the interest of their advertising managers.

The first meeting of the council will be held in connection with the annual credit convention, which will be held Sept. 13, 14 and 15. The meeting place has not been decided. The convention this year will be of more general interest than it has been in the past with additional sessions devoted to exports, advertising, etc., as well as credit questions. There also will be departmental meetings.

The executive committee of the advertising managers' council will be headed by E. W. Clark of the Clark Equipment Co., Buchanan, Mich. The other members are S. E. Baldwin, advertising manager of the Willard Storage Battery Co., Cleveland; J. C. McQuiston, department of publicity of the Westinghouse Electric & Manufacturing Co.; Joseph S. Jacobs, advertising manager of the American Hammered Piston Ring Co., and M. Lincoln Schuster, manager of the educational department of the M. A. M. A., as secretary. The council will function through the educational department.

FINANCIAL NOTES

Wisconsin Motor Manufacturing Co., Milwaukee, manufacturer of the Wisconsin motor, is offering $1,240,000 of 8 per cent cumulative preferred stock, par value $100, and 12,400 shares of non-par valued common stock at a price of $101 per unit of one share of preferred and one of common. Upon completion of this financing, there will be $2,000,000 preferred authorized and outstanding, and 75,000 shares of no-par common authorized. The present financing is for the purpose of furnishing necessary working capital and placing the company in the proper financial position consistent with good business.

Mack Trucks, Inc., earnings in April were in excess of $400,000, an increase of more than $100,000 over March. Net profits totaled $255,197 after depreciation in the first quarter, compared to $4,395 in the corresponding quarter of 1921. March net earnings absorbed the slight customary seasonal loss in the first two months of the year leaving a profit for the quarter equal to the quarterly disbursements on the combined $16,252,891 7 per cent first and second preferred stock. March earnings alone were at a rate of more than three times in excess of the annual preferred dividend requirements.

Reynolds Spring Co. directors at a meeting this week will declare the 14 per cent accumulated preferred dividends on the Class B preferred stock as well as the regular quarterly dividend of 1¾ per cent on the cumulative preferred A stock. The annual rate of 7 per cent has been paid regularly on the preferred A stock since the organization of the company and 7 per cent has been paid regularly on the B stock through June 30, 1920.

Cole Motor Car Co. has paid the regular bi-annual dividend, amounting to 10 per cent, to all stockholders. For the last five years the stockholders have never been paid less than 20 per cent per annum.

Walden-Worcester, Inc., will make the first interest payment on its bonds delivered in December, 1921, under the reorganization agreement of August, 1921, on June 15 at Merchants National Bank, Worcester, Mass. These bonds which are temporary will be replaced by permanent bonds about that date.

Willys-Overland Co.'s arrangement with its bank creditors has become operative, according to Ralph Van Vechten, chairman of the bank creditors committee. Van Vechten states that all of 51 interested banks have deposited their notes for exchange into bonds to be issued under the arrangement.

Kelly-Springfield Tire Co. has declared the regular quarterly dividend of $1.50 a share on 6 per cent preferred stock, payable July 1 to stockholders of record June 16.

BANK CREDITS

Written exclusively for* AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.

Call loans last week covered a range of from 4 per cent to 5½ per cent, as compared with 3½ per cent to 5 per cent in the preceding week. Increased firmness developed during the latter part of the week. In time money a firmer tendency was also noted, which was attributed in some quarters to the June 1 interest and dividend payments. The range was 4¼ per cent for 60 and 90 days' maturities, and 4¼ per cent to 4½ per cent for 4, 5 and 6 months' as against a range of 4 per cent to 4¼ per cent for all maturities in the previous week. The market was dull and no important transactions were recorded. The prime commercial rate remained unchanged at 4½.

Since June 1, the rate for sterling exchange has advanced more than 5½ cents, and on June 6 a high of $4.51¼ was reached, which is the highest since the summer of 1919. The reports of satisfactory progress of the negotiations at the Conference of International Bankers at Paris, and the general belief that the German reparations question is on the road to settlement, are probable factors in the rise of sterling.

The total commercial failures reported for May were 1803, the smallest number since last September. This marks a reduction of 7.4 per cent from April and 33.7 per cent from the high record of January.

Weekly bank clearings at the leading cities of the United States for the week ended June 1 aggregated $5,980,599,000, a loss of 12.8 per cent from the previous week, but a gain of 3.7 per cent over the corresponding week of last year. Outside of New York the total was $2,201,899,000, a decrease of 13.2 per cent from last week.

Howard B. Hall Elected President of Bethlehem

NEW YORK, June 7—Howard B. Hall, former vice-president of the Bethlehem Motors Corp., has been elected president of the reorganized company, which is now understood to be amply financed so that it can immediately reenter the truck manufacturing field.

M. Herbert Beary has been appointed special representative of the new company.

Other officers of the new company are W. H. Rodgers, secretary and assistant treasurer; D. C. Smith, factory manager of the Allentown plant; Louis K. Gordon, former associate engineer of Mack Trucks, Inc., and designer of the original Bethlehem trucks, chief engineer and purchasing agent, and W. H. R. Sandalls, factory manager at Pottstown.

SMALL PARKER CAR

MONTREAL, QUE., May 29—The Parker Motor Car Co., Ltd., announces it is developing a small air-cooled car which will be a companion to the Parker Six.

N.A.C.C. Directors Discuss May Output

Believe Decline in Sales Inevitable Before Long—Consider Time Payments

NEW YORK, June 7—The astounding production of passenger cars and trucks in May was the subject uppermost in the minds of the directors of the National Automobile Chamber of Commerce at their meeting here to-day. The total ran far ahead of the most sanguine expectations.

While naturally gratified at the remarkable business they are enjoying, announcement of the total for May had something of a sobering effect. It was felt that the industry could not continue indefinitely to operate at top speed, and that some decline in sales is inevitable before long.

Reports from all sections of the country indicate, however, that there are as yet no signs of slowing up. Practically the only weak spots in the country are Maine and Georgia, and it was reported that sales in Maine were 50 per cent better than in April. Several states report sales 100 per cent better than a year ago. Included in this list were Michigan, Iowa, Nebraska and Virginia.

Dealers generally report that June prospects are bright. This applies not only to passenger cars but trucks. May sales of trucks were larger than in April.

One significant fact reported was that the number of sales made on time is decreasing, and that there was more cash business in May. The directors nevertheless gave considerable attention to the financing of time sales, and it was the general opinion that manufacturers must do more to assist their dealers in this respect in the future than they have in the past.

There has been a marked improvement in the trading situation, and the used car market is growing steadily better.

Exports are increasing steadily. Foreign sales of passenger cars in April were 49 per cent more than in March and sales of trucks were 44 per cent greater.

The directors expressed frank alarm because of what they considered unjust motor vehicle regulations proposed in various states. They felt that the time has come for dealer associations to make vigorous representation to their state legislatures against discriminatory laws.

Barnes to Address Members

NEW YORK, June 8—Julius H. Barnes, newly elected president of the Chamber of Commerce of the United States and head of the United States Grain Administration during the war, will address the members of the National Automobile Chamber of Commerce at their annual meeting to-day. The subject will be "Transport and Human Progress."

Members of the N. A. C. C. will meet at 10 a. m. The first business will be the election of five directors to take the places of those whose terms expire. Barnes' address will be followed by luncheon after which there will be a meeting of the committee headed by F. E. Moskovics to discuss simplification of manufacturing methods with representatives of the division of simplified practice of the Department of Commerce.

Motor truck members of the N. A. C. C. will meet in the afternoon. The chief topic to be discussed by the members will be the business outlook for the remainder of the year.

Truck registration figures will be one of the important topics discussed at this session. The data available from the various states on truck registrations are confused and unsatisfactory at the present time, so that careful market analysis is extremely difficult. The possibilities of remedying this condition will be considered by the truck members.

Other topics for discussion will include the reimportation of war trucks, advertising ethics, appraisal of used trucks, specifications in municipal truck bids and the Frelinghuysen bill now before the Senate, designed to bring back A. E. F. trucks from Germany for use in road building in this country. Standard caution plates for trucks in all states will also be discussed.

Truck Committee Meets

NEW YORK, June 6—Progress was made toward a coordination of ideas on truck regulations when a sub-committee of the N. A. C. C. truck committee met with a sub-committee of the Association of Motor Vehicle Administrators here yesterday. The latter association comprises the motor vehicle commissioners of the six New England states and the states of New York, New Jersey, Pennsylvania and Maryland.

The topics discussed included truck weights, capacities, speeds and dimensions. There was comparatively slight divergence of opinion on these subjects among the members of the two sub-committees. The recommendations resulting from the conference will be brought before the N. A. C. C. truck committee at the annual meeting in this city on Thursday.

INDUSTRIAL NOTES

Morse Chain Co. has completed plans for the erection of a factory on the Detroit Terminal Railroad which will give it 60,000 sq. ft. of manufacturing space and be ready for occupancy by Oct. 1. The branch factory located here for the past two years has become inadequate. The main plant will be continued at Ithaca, N. Y. The Detroit factory will specialize in the manufacture of sprockets and adjustments required for the operation of the chain on the various types of engines now employing them. In connection with its plans for increasing its production facilities, the company will broaden its engineering staff located in Detroit. F. C. Thompson is manager of the Detroit branch.

Smith-Springfield Body Corp. has had an attachment filed against it at the registry of deeds in Springfield, Mass., in an action on contract for $35,000 brought by A. Waxman & Co. of Philadelphia.

METAL MARKETS

Third quarter prices for steel products are in the formative stage with automotive demand furnishing the chief prop for arguments in support of price advances. Quite a few of the sheet mills expect to carry a considerable quota of unfilled orders over into the third quarter, and there are those who consider such a condition in itself justifying a higher range of prices. On the other hand, those producers who hold that if ever there was need of a conservative policy with reference to prices, it is the present with its many adverse currents and cross-currents, are standing on solid ground.

Among those who mould the steel industry's price policy responsibility for maintaining price levels on a sound basis is felt perhaps a trifle more keenly at this time than usually because the steel industry as a whole is once more under fire from legislative inquisitors. Runaway market conditions would only add fuel to the comments of sensational newspapers. Moreover, certain reductions in production costs are about to mature, and in the face of these too sharp price advances would appear indefensible. Iron ore for the 1922 season is certain to be at least 50 cents a ton lower than last year. The 10 per cent reduction in freight rates which goes into effect July 1 is also destined to lower costs, although perhaps not as much as some consumers imagine.

All in all, moderation in the matter of prices fits nicely into the program of those producers who oppose jeopardizing the permanent welfare of their industry by taking advantage of the high spots in the demand while it is still below normal on the whole. Meanwhile sight must not be lost of the influence which those automotive purchasing agents continue to exert on the market who offer premiums for quick deliveries of material which they should have provided for earlier in the season. Such an offer of $10 premium on 500 tons of No. 22 automobile body stock is reported to have been made to a Mahoning Valley rolling mill a few days ago and turned down. The effect of the report on the market was, however, not lost.

Pig Iron.—Most of the automotive foundries are waiting until July 1 when the 10 per cent reduction in freight rates goes into effect before placing new orders. Foundries making castings for the Ford Motor Co. are quietly sounding the market regarding the tonnages they will have to buy as the result of notice to them that they will receive no iron from the Ford Motor Co.'s blast furnaces over the next three months.

Steel.—Some makers of cold-drawn steel bars appear to be out of the market; at least they are quoting prices which discourage fresh buying and which are considerably higher than the nominal 2¢ market. The market for strip steel continues strong, especially so for the cold-rolled variety. Sheet bars continue to show a wide range. For bolts and nuts even higher prices than those established by the recent advance are predicted in the Pittsburgh market.

Aluminum.—In the matter of prices every importer appears to be a law unto himself with outside holders of speculative lots cutting a fraction under the prices asked by regular importers.

Copper.—Detroit continues to buy large tonnages of Lake copper. New England rolling mills are also taking on copper and much of their production is reshipped to Michigan automotive consumers. The market is fairly steady.

Calendar

SHOWS

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiserdamm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

June 11-15—Milwaukee Annual International Convention of the Associated Advertising Clubs of the World.

June 19-20 — Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer Meeting of Society of Automotive Engineers.

Rail Rates for Milk Popularizing Trucks

WASHINGTON, July 7—The adoption of automotive equipment for the 200,000 milk producers and shippers who are members of the National Milk Producers Federation and its twenty-six allied associations, will be taken up Friday at a conference of the national directors and members of the executive committee of that association, called to Washington for special consideration of the milk producers' transportation problem.

In an interview to-day with AUTOMOTIVE INDUSTRIES the possibilities of 100 per cent automotive transportation on short line milk hauls were outlined by Charles Holman, executive secretary of the association, who expressed the opinion, based on a survey of the situation, that within three to five years practically all of short haul milk transportation would be done by motor trucks.

"The recent 10 per cent reduction in freight rates did not benefit the milk producers," Holman said. "All milk or, at least, practically all milk and cream that is carried by rail is transported by passenger trains and carries a passenger rate. So high have become these rates that the milk producers can no longer bear the burden of railroad transportation and our solution seems to lie in automobile transportation."

Have Appealed to I. C. C.

While little hope is entertained for favorable action on it, the milk federation has filed a petition with the Interstate Commerce Commission setting forth that in justice to its industry the rates on milk and cream must be reduced.

The relative cost of automobile transportation vs. railroad transportation on short line hauls from actual figures based on a survey in Minneapolis has been cited before the I. C. C. The "milk sheds" of Minneapolis comprise a radius of approximately 30 miles. The motor truck rate into Minneapolis from this zone is 15 cents per hundred pounds. The rail rate is 28 cents per hundred. Added to the rail rate is a pick-up charge of 5 cents per hundred and a delivery charge, from depot to milk station of 5 cents, making a total of 38 cents per hundred pounds when shipped over the railroad, compared to 15 cents by truck.

As a result of this wide difference in freight rates practically all the milk and cream from the Minneapolis "milk sheds" is now being transported by automotive equipment. So developed has become the motor vehicle transportation system in that city that it has resulted in what is believed to be the initial appearance of glass lined trucks of similar construction to regular motor trucks, for hauling large quantities of milk.

In discussing the possibilities of automotive transportation for the 200,000 milk producers, Holman declared that in his belief the glass lined trucks would open up a new field for the manufacturer.

With possibly three exceptions, the opinion has been expressed that trucks may haul economically, admitting good roads are available, the entire production of milk consumed in the urban districts. These three exceptions are New York, Chicago and Philadelphia.

Hart-Parr Co. Model 30, $400 Below Past Lists

CHARLES CITY, IOWA, June 2—Slashing price reductions on its tractor models, effective June 1, are announced by the Hart-Parr Co. They are:

	Old Price	New Price
Model-20	$945	$765
Model-30	1,295	895

The new price of the model 30 is $700 below the peak of 1921 and $400 less than it ever has been listed before. The new price of the model 20 is $430 below the peak price of 1921.

NATIONAL REDUCES PRICES

INDIANAPOLIS, June 2—The National Motor Car & Vehicle Corp. announces a price cut on National cars effective June 1 with the 7-passenger phaeton at $2,375; 4-passenger phaeton and 3-passenger roadster, $2,475; close coupled 4-passenger sedan, $3,250; coupe, $3,725; 7-passenger sedan, $3,825; Newport 4-passenger phaeton, $3,025, and 7-passenger Newport with all season top, $3,150. On the 7-passenger phaeton this represents a price reduction of $375.

Women Make Charges on Page Stock Sale

NEW YORK, June 7—An investigation of the affairs of the Pagé Motors Corp. of 522 Fifth Avenue is being conducted by the District Attorney's office upon complaint by two women that stock in the company was sold them under misrepresentation. Nicholas Pullman, a former chauffeur for Otto H. Kahn, who is sales manager for the company, has been summoned to court for examination.

Assistant District Attorney Pecora asserts that he has in his possession a report alleged to have been issued by the Pagé corporation on March 11 last and signed by Thomas R. Mead, vice-president and treasurer, which declares the assets were $7,284,770 and the surplus $5,854,770. Pecora declares inspection of the report revealed that $5,000,000 of the surplus was set down to the use of the name of Victor W. Pagé, president and chief engineer of the company, which is a Delaware corporation. He was described in the report as an "internationally recognized automotive engineering authority."

The complainants against Pullman allege they were informed by him that the company had sold 40,000 engines in Mexico and that the company paid 10 per cent dividends the preceding year.

The Pagé Motors Corp. has 600 feet of floor space in the plant of the Raymond Engineering Co. at Farmingdale, L. I., and has purchased land for a plant at Stamford, Conn., on which one building has been erected at a cost of about $17,000.

JEWETT ROADSTER, $1,065

DETROIT, June 3—The Jewett roadster, the latest addition to the Jewett line, will start production about July 1. It has a single straight seat, wide enough for three passengers, and is featured by a large baggage compartment in the rear, and by curtains which open and close with the doors to give good vision and a weathertight fit. The upholstering, as in the phaeton, is of genuine cowhide. The roadster is mounted on a standard Jewett chassis.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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252,000 Record Production in May. What Next?

Factories swing into June at full speed. Prices firm. Inventories held at lowest point. Sales in last six months depend largely upon farmer. Coal strike and threatened rail walk-out unfavorable aspects.

By James Dalton

EVEN the leading factors in the production of automobiles have been astounded at the aggregate output of 252,000 passenger cars and trucks in May, which exceeded the highest previous mark by 32,000. This total may be enlarged when complete figures are available. All factories swung into June at full speed and are forcing production to keep pace with demand. It has been impossible to accumulate reserve stocks of passenger cars.

Although the industry naturally is gratified that it is operating at capacity, it is felt in the more conservative quarters that the pace is too swift. It has resulted in many manufacturing problems which would not have become important with a somewhat smaller output. These various factors, none of which is particularly serious in itself, have combined to increase costs considerably.

Stock chasers, shipments of parts by express, orders by telegraph and premiums for raw materials, all cost money and add to the expense of turning out motor vehicles on which the unit profit is much smaller than it was before the era of keen competition forced by business depression. Prices of parts are somewhat stronger because the parts manufacturer, lacking long term commitments, has to buy in comparatively small quantities and pay stiffer prices than otherwise would be required.

HERE is the 1922 car and truck production record which convinces even the pessimist that the automotive industry has come back. May was the biggest production month in the history of the industry.

January	**90,486**
February	**129,500**
March	**173,342**
April	**218,546**
May	**252,000**

While the cumulative effect undoubtedly has been to increase production costs, it has had a stabilizing effect on retail prices and few revisions are in prospect except perhaps in the truck field, where the return to normal conditions has not been completed. While there is no likelihood of further recessions in passenger car prices, it is equally unlikely that there will be any general increases. Whatever upward trend may become apparent will be caused by the necessity of returning a profit in the face of mounting manufacturing costs.

The most popular topic of discussion within the industry is the outlook for the remainder of the year. It is not to be denied that it is exceedingly bright at this time. There is not the slightest sign of a falling off in demand for June and it promises to be one of the big months of the year.

Parts makers report that commitments for July thus far received are only about 50 per cent of the total for June, but this is no barometer of the ultimate business they will get. Unless there is a radical change in the custom which has prevailed for the last year, fully half the total volume of July business will be booked between June 15 and 20.

Vehicle manufacturers are determined to keep their stocks down to the lowest possible point, which is a wise procedure. It has been largely responsible, however, for shortages of essential parts. It has been impossible for parts makers to make deliveries in the quantities desired because they have been unable to place raw material commitments far enough in advance to meet the last minute pressure.

Many automobiles are being shipped from Detroit lacking minor parts. When the parts are received at the factories from the makers, they are shipped by express to distributors and the cars are equipped in the service stations of dealers and distributors. By resorting to this plan shipping delays have been cut down.

July Prospects Bright

PARTS makers reports that commitments for July thus far received are only about 50 per cent of the total for June.

This is no barometer, however, of the total business they will get.

Unless there is a radical change in the custom which prevailed last year, fully half the total volume of July business will be booked between June 15 and June 20.

While it is the general expectation that July will bring a slowing up in sales, the volume of business will depend largely upon the farm market. There is every reason to believe there will be a heavy demand in the agricultural districts as soon as the harvest is well under way.

Records of one company making a low-priced car show that nearly 25 per cent of its sales already are being made to farmers. This undoubtedly is higher than the average, but it is certain that farm sales are larger even now than they have been at any time in two years. There appear to be only two states in which sales are slow. They are Maine and Georgia, and business is improving rapidly in the former.

Truck sales in the farm states promise to be relatively larger than those for passenger cars. There is a crying need for new equipment, and the market for motor vehicles in the agricultural districts scarcely has been touched thus far. This fact will become apparent when the farmers really begin to get their debts cleared away. They still are heavily obligated to their banks and a large proportion of the sales this year will be on an investment basis. The volume of sales will be dependent in large measure upon the farm market, not only in July but also in August and the later months of the year.

Up to this time the automotive industry has been far in advance of all other industries except building construction, iron and steel, in the process of recovery from the depression. Now other industries are swinging into line and the volume of business as a whole is expanding rapidly. The natural result is a material increase in purchasing power and this will be reflected to a considerable extent in purchases of motor vehicles.

There already is speculation concerning the probable total production of the year, but it is more or less idle. The total for the first five months was approximately 857,000. It is practically certain that the million mark will be passed before the end of June. The total for 1921 was 1,668,550. It will be necessary to average only about 100,000 a month for the remainder of the year to equal this mark. July and August were the biggest months last year, with 176,336 and 180,781, respectively. The totals for the other months were: September, 158,314; October, 147,544; November, 116,349; December, 78,995. It is perfectly logical to assume that the total for the last six months of 1922 will be as large as for the same period in 1921, and if it is no larger the output for the year will aggregate between 1,850,000 and 1,900,000. It may reach the 2,000,000 mark.

Even if 2,000,000 motor vehicles are turned out in 1922, it will exceed by only about 300,000 the total for 1921. This is rather remarkable, because few companies could be found which would admit last year that business was good, and this year all unite in declaring it wonderful. The difference probably won't average more than 25,000 cars a month.

While the industry is running at capacity, manufacturers will be wise if they consider some questions beyond the problems of immediate production. One of these is the coal strike. Up to this time it has had practically no effect upon industry, but unless it is settled soon it will begin to exert a most malign influence. Reserve stocks are rapidly dwindling and the output of non-union mines is only a drop in the bucket. Even if reserves last throughout the summer, a suspension of mine work for three or four months cannot fail to prove serious next winter.

There are rumblings of a strike among the railroad workers whose wages will be cut if the orders of the Railroad Labor Board are carried out. Strike ballots now are being prepared. It is generally considered improbable that there will be a walkout, but if there is it will have a disastrous effect with the country just recovering from a long period of depression. Coupled with a prolonged coal strike it would be little short of a calamity.

Regardless of the position taken in relation to strikes, it is scarcely to be wondered at that railroad workers do not exactly welcome a reduction in wages just at a time when the automotive and other industries are raising their wage scales because of a scarcity of labor. Commodity prices are strengthening and there are no indications of a further fall in the cost of living in the near future. It is more likely to advance.

There are reports from Detroit that some manufacturers contemplate keeping their plants running under heavy schedules late in the year to pile up stocks of cars in preparation for a 1923 demand which they expect will be larger than that of 1922. Long range predictions are dangerous, but there is absolutely no reason to expect that sales of motor vehicles next year will be any larger than this, except in the great agricultural districts. It is more reasonable to expect that they will be smaller.

Another dangerous expedient would be the building up of large inventories. Big supplies of materials, with a more or less uncertain market, are a distinct menace, and it is possible for them to eat up the profits of a year.

While the industry is running at capacity, with no sign of a diminution in demand, it will be unwise to cast caution to the winds and accept the theory that there is no bottom to the market.

Spanish Show Forecasts Early Trade Revival

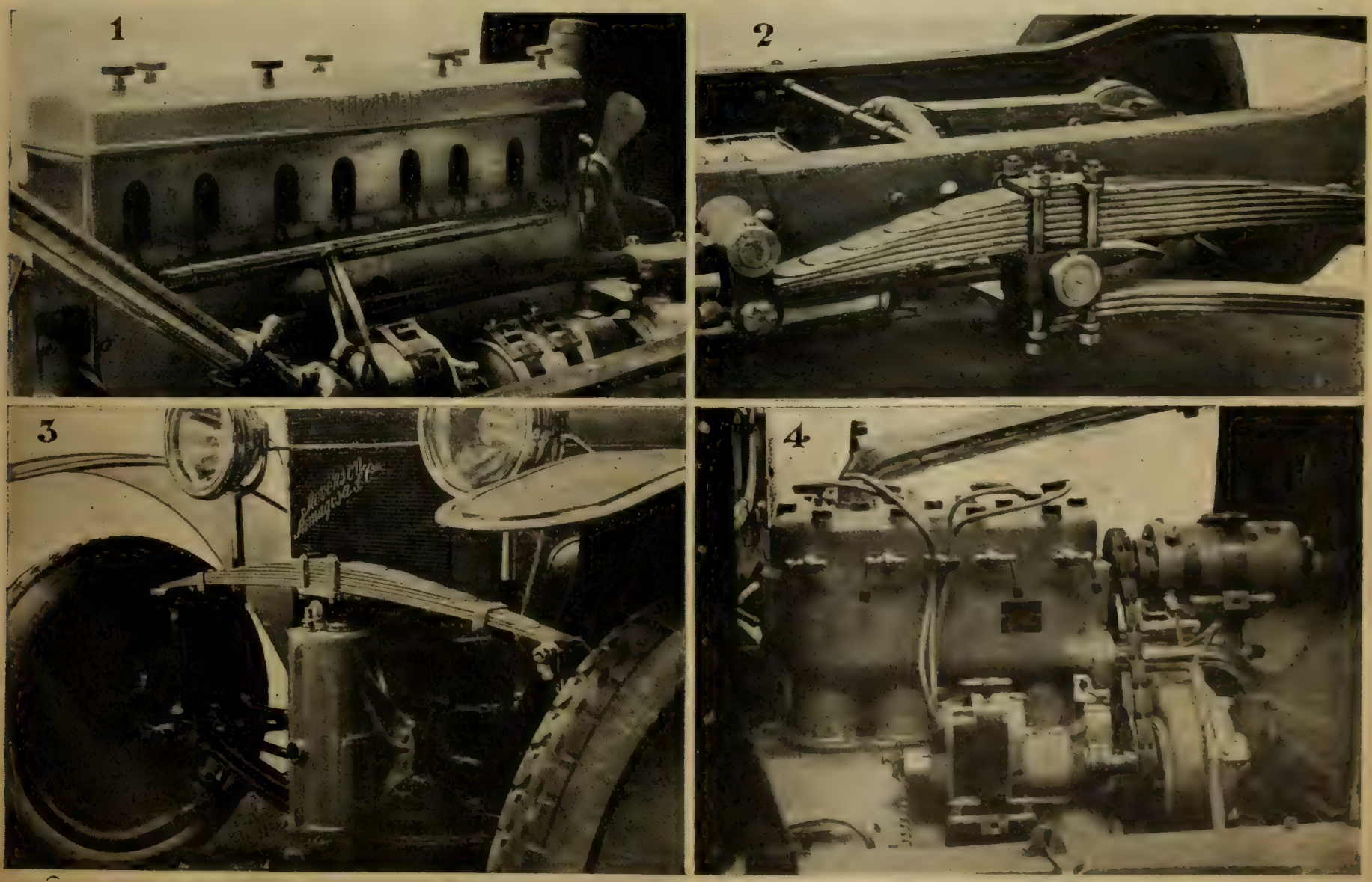
Last year was one of the worst in the Spanish automotive industry. 1922 marks business revival. Increased taxation threatened, but may not go through. Excess car stocks have been cleared out. Spanish dealers for American cars make many detail changes in equipment for local trade.

By W. F. Bradley

BARCELONA, SPAIN, June 1.

AMERICA, France, Italy, Germany, Austria, England, Belgium and Spain, represented by 73 different makers of passenger cars and trucks, are united in the first international automobile show to be held in Spain since the war. This is the only show in Europe open to all comers and having a really international character, for the Allies and their ex-enemies have not yet consented to exhibit under a common roof in their respective territories.

The show has been got together on the initiative of the Spanish dealers and traders as an aid to sales at a time when business conditions are not of the best. No single hall in Barcelona was big enough for an exhibition of this nature, but fortunately the Modern Art Palace, to form a part of the electrical exhibition of 1925, was sufficiently advanced for it to be completed in time for the automobile show. The floor space of this show is 150,000 sq. ft., the location is convenient and the approach imposing.



1—Elizalde 8 cylinder in line engine with detachable bronze head. 2—Entirely new type of rear spring suspension on Unic. 3—Front spring suspension on Stevenson. 4—New Unic engine with fan on generator shaft

America dominates the Spanish show, for of the 73 makes of automobiles on view 24 came from the United States, 17 from France, 10 from Germany, 7 were of Spanish origin, 4 each from Belgium and England, 6 from Italy and 1 from Austria. The accompanying list of exhibitors comprises only car-producing firms, and ignores accessory makers and dealers and tire firms.

THIS show is a direct appeal to the buying public, and not merely an effort to get dealers in touch with manufacturers; consequently it has been laid out to be as attractive as possible to potential purchasers. There is a light, gay note about it, not noticed elsewhere, created by festoons of flowers, plants, fountains with goldfish and thick beds of carnations around the cars. Never at any time during the first four days the show was opened could the same crowds be seen as at the London, Paris or Berlin shows, but probably this is merely due to natural temperament, for the Spaniard is, above all, an enemy of the strenuous life and cannot by any force on earth be induced to hustle or to forego his siesta.

Don Narciso Masferrer, general show manager, stated that this exhibition had been put on foot, at the tail end of a period of depression, in the belief that it would bring along an important revival of trade. Last year was one of the worst in the Spanish automotive industry, but there are indications that 1922 will mark a distinct revival and probably bring the total number of sales up as high as for the year 1920.

Before the war the best selling cars on the Spanish market were of French construction, the lead being held by Renault, followed by Panhard-Levassor. This year Panhard-Levassor has not even taken a stand, and although Renault is exhibiting, the amount of business done by him is very much less than that of several American makers. Just at the present time the situation is unsatisfactory and unsettled by reason of the high import duties and a threatened increase in the automobile taxes. Between France and Spain there is a tariff war which makes it practically impossible for French makers to sell on the Spanish market. This state of affairs cannot continue, and, indeed, there were strong hopes that an agreement would have been reached between the two Governments for the opening of the show whereby French automobiles would be admitted at the same rates as those of other nations. This hope was not fulfilled. Consequently the French are holding on to the market, in the hope of a settlement, but doing little or no business for the time being.

American automobiles imported into Spain pay an import duty of 25 to 30 per cent, in addition to a percentage for gold value. English makers, while paying the same duty, are making an effort to get the advantage of the most favored nation clause.

The Spanish market is the least developed of all in Europe, but one offering important potentialities and which will be the most keenly fought for by American and French firms when the latter can again enter on an equal footing. In the meantime American dealers are strengthening their position. General Motors products are generally well handled, and Buick is the best selling car on the Spanish market at the present time. Cadillac, being a more expensive model, cannot be sold in the same numbers, but has been well introduced by the James M. Nahon Co.

Cars are sold in Spain more as a luxury than because of their transportation value, and as a consequence the market has to be handled in quite a special manner. The use of automobiles is confined to cities and to individual regions possessing good roads. There is no use of automobiles for long distance traveling, such as is common in France, for while the roads may be good in spots these good places are divided off from one another by almost impassable stretches. Even in the cities automobiles are employed very considerably merely for parading and not for any real utility purpose. Because of this state of affairs a lot of attention has to be given to the individual requirements of clients. A realization of this fact is responsible, in a very large measure, for the success Buick has had on the Spanish market. Abaday, the Buick dealer, partially rebuilt the cars received from the factory and specialized in custom bodies. At first it was declared these Abadal-Buicks were not looked upon very favorably by the home factory, but when it was realized that this method of doing business was necessary in Spain, complete support was received from Michigan. In 1920 Buick sold 340 cars in Spain. The number dropped to 80 last year, but is expected to reach the 1920 figure this year.

As an indication of the lines on which the Buick dealer is working, the show contained a two-seater sporting type low-built six-cylinder, with external exhaust pipe, pointed cowl on the top of the radiator, wire wheels with clincher bead tires, the whole constituting a sporting proposition very attractive to Spanish speedsters.

ANOTHER example was a rebuilt six-cylinder Buick phaeton with changed radiator, hood and wheels, which was offered at 35,000 pesetas compared with only 18,000 for the stock job as received from the factory. The higher-priced car was a better seller than the stock model.

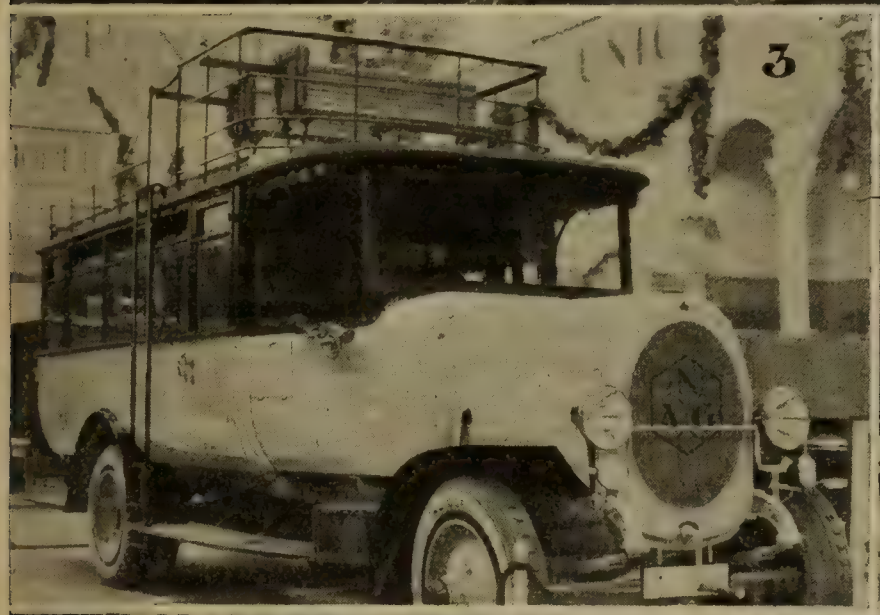
General Motors products are not all in the same hands. Thus the Cadillac is handled by the James M. Nahon Co. of Madrid, who are working on the same lines as Buick. Mr. Nahon told the same story as the Buick representative, namely, the necessity of giving individual attention to Spanish clients and making detail changes when-

EXHIBITS AT THE BARCELONA SHOW

America	France	Germany	Spanish
Chevrolet	Ariès	Benz	David
Stutz	Berliet	Bussing	Elfe
Mitchell	Bugatti	Daag	Elizalde
Cletrac	Chenard-Walcker	Krupp	Espana
Federal	Citroen	Loreley	Hispano-Suiza
Ford	De Dion Bouton	Mercedes	Landa
Buick	Delage	N. A. G.	Victoria
Cadillac	Lorraine-Dietrich	Opel	
Chandler	Peugeot	Stoewer	
Cleveland	Renault	Faun	
Cole	Rochet-Schneider		**England**
Dodge	Rolland-Pilain	**Italy**	Crossley
Essex	Salmson	Diatto	Lanchester
Harley-Davidson	Saurer	Fiat	Armstrong-Siddeley
Hudson	Turcat-Méry	Isotta-Fraschini	Austin
Hup	Unic	Lancia	
Indian	Vermorel	Itala	
Overland		Scat	
Packard			**Belgium**
Studebaker			Minerva
Templar		**Austria**	Excelsior
Maxwell		Steyr	Metallurgique
Mercer			
Apperson			













1. Stevenson with open phaeton body. 2. Four seater, sport type body on 10-15 h.p. Flat chassis. 3. N. A. G. bus. 4. Benz fire engine. 5. Krupp street sweeper and waterer. 6. Buick rebuilt to suit Spanish taste

ever necessary to effect sales. Mr. Nahon declared that the Cadillac Company had fully realized the importance of this line of action and gave him full support. Last year, during the slump, these dealers were overstocked with the old model. These stocks had been cleared out at cost price and the present year had begun with very good prospects. The Spanish Royal Court has 10 Cadillac cars purchased from American army stocks. These 10 cars are about to be traded in for the latest Cadillac model.

"Although the Spaniard realizes that he is never given delivery of a car with show finish," stated Mr. Nahon, "it pleases him to see such a car on the stand. For this show we took a standard Cadillac chassis and plated and polished every part of it; the job took a long time, and it cost money, but it certainly helps to bring business." The Cadillac dealers lay themselves out to make detail changes on their cars, such as fitting wire wheels, clincher bead tires, right-hand drive, special wheel carriers, etc. Low built, racy, sporting type bodies are in demand and are specialized in to meet the requirements of clients.

There is a threat at the present time of increased automobile taxation which is having a certain effect in restricting sales. The Government proposal is being fought by automobile interests, and there is hope that the increase will be staved off. Taxes are based on engine size, but there seems to be no real control, such as a sworn statement by the manufacturers or the lifting of the cylinders to measure bore and stroke, with the result that individuals often get cars accepted at very much less than their official horsepower. Merely as an indication of the rate of taxation, the 11 hp. Delage, which is a medium size car according to European standard, pays 280 pesetas a year. The 30-hp. six-cylinder Delage, a high grade full-sized car, pays 520 pesetas a year. The

local and state taxes paid on a Cadillac were declared to be equivalent to $320 per annum.

Conversation with dealers elicited the fact that German competition was not taken very seriously, for although there is the advantage of low exchange rates and the import duties are the same as for American cars, the German products do not appear to be handled on right lines. Italy is very well placed with advantageous exchange rates, good facilities for shipping and a type of car suitable for Spanish conditions. Fiat, among the Italians, has captured the great bulk of the Spanish business, the other Italian firms selling in limited numbers. The fact that Fiat has furnished motor transportation very considerably to the Spanish army helps in doing private business.

Some of the British dealers have been helped by their aviation connections, for English airplane firms are supplying machines to the Spanish Government and this connection helps to introduce automobiles. Armstrong-Siddeley, for instance, has secured an interesting connection on the Spanish automobile market by reason of the fact that its aviation engines are to be found on English planes sold to Spain. The same applies in a certain measure to Rolls-Royce.

Spanish automobile manufacturers are outnumbered on their own market by foreign makers as a group and by several individual nations. There are certainly many more French than Spanish cars in use in Spain, and doubtless a still greater number of American automobiles. Hispano-Suiza is the best known of the Spanish makes, but this reputation has been secured more by the work of the company in France than by the products of its Barcelona factory. Elizalde, although not as well known abroad, is just as important in the home country. This firm took advantage of the show to present an entirely new eight-cylinder in line automobile of exceedingly neat appearance, having as one of its outstanding features the use of a detachable bronze head carrying vertical valves. The size of the engine is 70 by 130 mm. Chassis features are four wheel brakes with a servo mechanism and cantilever springs front and rear.

ESPANA is another Spanish firm little known outside its own territory, producing a high grade car costly to build and having a certain general resemblance to the Hispano-Suiza. One of the mechanical novelties of the show was the Baradet-Esteve turbine engine, a Spanish invention, evidently of a somewhat experimental nature, but regarding the construction of which no details could be obtained.

Among the foreign cars the only entirely new model was a 10 hp. chassis from the French Unic Company. During the last three years this firm has specialized on a double cantilever rear spring which allows of the Hotchkiss drive being used. On the latest model there is a combination of the cantilever with the forward portion much shorter than the rear part, and below this a quarter elliptic spring with three leaves of equal thickness, the center one having a rolled eye. The engine is a unit construction job with detachable head, both of which features are new to Unic.

TRUCKS are not as well represented at Barcelona as are passenger cars, and in this section America has given way numerically to Germany. Packard has a pneumatic tired truck on exhibition, Ford shows one-tonners and Federal has a small exhibit. The French display in this section is rather meager, the British is non-existent, and the German is strong. There are important possibilities for trucks and for motor buses, but the Spaniard has not yet realized this. The easiest field to develop will be motor bus services both in the cities and in the country. Railroad service, on the whole, is poor, and in many of the mountain regions immense detours have to be made to link up important centers really only a short distance apart. It is here that the motor bus gets its advantage. On the day the Barcelona show was opened a Spanish-British company put into service a number of Tilling-Stevens London-type double decker motor buses, which were used for trips from the center of the city to the show. The intention is to put a fleet of 200 of these buses on the streets of Barcelona in order to supplement the now inadequate electric trolley car service.

Cletrac was the only American tractor to be seen at Barcelona. Although Ford has an assembly plant at Cadiz, and uses this as a distributing center for Spain, Portugal and Northern Africa, he evidently did not think it worth while to put his tractor on exhibition at the Barcelona show. Spanish farmers have yet to be converted to the value of the gasoline engine and any tractor firm coming into this market must be prepared to do a lot of pioneer work.

There is an indifference to the good road movement in Spain which stands out in sharp contrast to the progressive attitude of surrounding countries. On a road journey from Paris to Barcelona conditions on Spanish territory were reminiscent of those prevailing in the middle-west states of America fifteen or sixteen years ago. A few portions were good, but the majority of the road was bad and some stretches were in such a condition that even with a big, well-sprung car it was impossible to travel at more than six or seven miles an hour. In the villages conditions were worse than on the open road; in the towns good surfaces were encountered.

THERE are at least four ways in which buses may become a useful element in the transportation scheme of New York City:

1. They may be used to furnish special route service for segregated groups of patrons.
2. They can supplement existing lines by rendering cross-town or circumferential routes.
3. Accommodate short-haul traffic in congested centers in place of surface cars.
4. They can develop outlying areas of the city by furnishing transportation before rapid transit lines can be built with profit.

These suggestions were made by Daniel L. Turner, consulting engineer to the Transit Commission of New York City, in a paper recently read by him before the National Automobile Chamber of Commerce.

Mr. Turner showed that the transit problem of New York is one of mass transportation, illustrating it by the statement that the Fifth Avenue buses carry only 2 per cent of the total and that a complete substitution of buses for existing transit facilities would require approximately 47,000 buses of the Fifth Avenue type, a number which is twice as large as all the buses now in use in city transit service in the United States. Obviously the avenues could not possibly handle this number of buses.

While conditions in New York City are not representative of general conditions, Mr. Turner showed the necessity of close analysis of transit problems which is applicable to all cities.

1922 Will Surpass 1919 in American Export Trade

More automotive firms working with Automotive Division of Bureau of Foreign and Domestic Commerce. Organized efforts increase foreign business. Dealer associations in foreign countries ask Division Contact Committee for merchandising suggestions. Increased activities July 1.

By George E. Quisenberry*

SEVERAL hundred American companies manufacturing or distributing automotive products have been listed within the last few weeks as additions to the Exporters' Index, maintained by the Bureau of Foreign and Domestic Commerce, in connection with its efforts to foster export trade. This report was made by Gordon Lee, chief of the automotive division, at the meeting of the Foreign Trade Contact Committee, held in New York on June 12. This committee was organized in April at Washington, and composed of representatives of the foreign trade committees of the various associations and trade groups.

"The number of automotive firms now working with the division has been more than doubled," Lee stated. "This gives an indication of the increasing thought that is being given by the American companies to the necessities of international distribution and also is a measure of the improvement being recorded in our export trading. Despite the heavy demands of domestic markets, which necessitated record production during May, we are steadily increasing foreign shipments, this showing that the various companies are carefully alloting a percentage of output for their dealers in other countries. This tendency is more marked than ever before and is so encouraging that we can expect the year 1922 to be larger than 1919 so far as pertains to overseas trade."

The Contact Committee was formed for the purpose of bringing all branches of the automotive industry into co-operative effort for the furtherance of legitimate export aims and likewise to bring each of the associations and trade groups into closer contact with the division headed by Lee. A booklet, setting forth the development that is being gotten under way and detailing the work of the automotive division, has recently been published by the committee and circulated among all members of the National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers' Association, the Automotive Equipment Association, the Aeronautical Chamber of Commerce, the Motorcycle and Allied Trades Association, the National Association of Engine and Boat Manufacturers and the Association of Automotive Equipment Manufacturers and other trade groups which participate in the committee effort. In addition, all consular and trade representatives of the Department of Commerce, executive officers of the Department of State and many Congressmen have received copies of the publication, so that there may be the necessary co-ordination of work at home and abroad. A number of individual companies likewise have requested copies of the booklet, the contents of which were published in the April 27 issue of AUTOMOTIVE INDUSTRIES, to send to all foreign representatives, distributors and dealers.

FOREIGN business has steadily increased in the automotive field since the first months of 1922. Present indications are that this year will bring more profits from foreign business than did 1919.

More careful study of foreign markets will tend to stabilize international trade. Representation of American firms can be increased both in quality and quantity by better knowledge of necessities in foreign markets.

Co-operation with the Contact Committee of the Automotive Division of the Bureau of Foreign and Domestic Commerce offers an economical and effective means of bettering foreign merchandising policies. This committee is composed of representatives of the important trade associations of the automotive industry. Its function is one of service and co-operation.

Letters were read at today's meeting showing the interest that the effort has aroused in other territories. The automotive dealer associations at Havana, Cuba, and Sao Paulo, Brazil, both expressed their desire to cooperate with the committee, the Cuban association specifically asking for merchandising suggestions to enable the members to bolster up trade there.

Further progress was reported by Lee of the division's efforts to better its services. Several assistants will be added to the division on July 1, when the governmental fiscal year begins. This is deemed necessary to care for the enlarged work of the division. Cable reports from commercial attaches are now coming through regularly, setting forth conditions as to the automotive trade in the different centers and the division now has under way the publication of distribution and trade analyses of several important buying territories. A compilation of automotive tariff laws has been completed and information in regard to specific countries can be furnished.

*Managing editor, *El Automovil Americano.*

New European Taxicabs Are Designed for High Economy

Citroen with small four-cylinder engine, 111 in. wheelbase and 46 in. track and body seating only two passengers has proved highly successful. 3200 Renault cabs with larger engine, same wheelbase, 56 in. track, and four-passenger body are now competing. Relative merits still in doubt. Fords also used in Paris, are handicapped by higher fuel consumption.

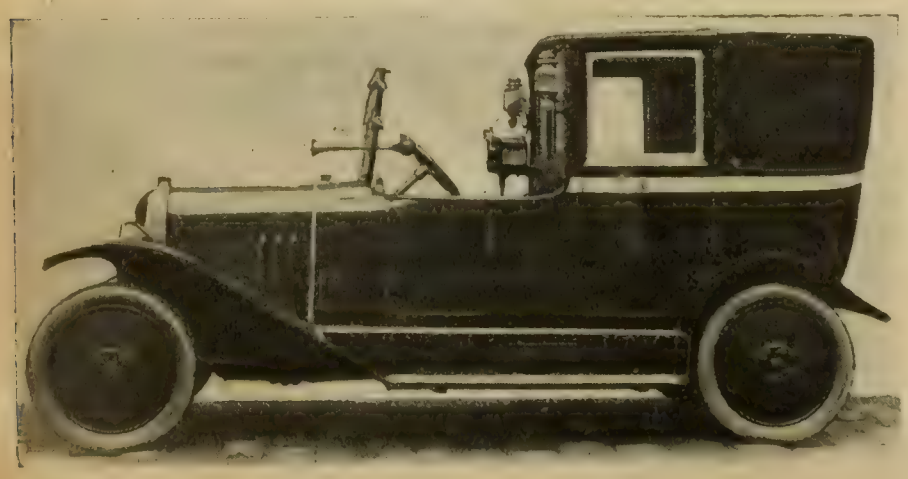
By W. F. Bradley

HIGH operating costs, traffic congestion and keen competition have necessitated a revision of taxicab design and construction. This is best exemplified in Paris, where gasoline costs are high, where labor charges have increased to almost the American scale, and where the special traffic conditions necessitate a type of cab carefully designed for city work.

Obviously the most suitable vehicle is the one capable of covering the greatest mileage in a given time at the lowest cost, but as to which type best meets these conditions even experts are divided, as is shown by experience in Paris and other European cities. Ignoring the old type pre-war cabs, which either will have to be modernized or submit to the process of elimination, there are two distinct classes in operation in the City of Paris.

Citroen broke into the field about two years ago with a two-passenger cab having a four-cylinder engine of 68 x 100 mm. bore and stroke, or 88 cu. in. piston displacement, a wheelbase of 111 in. and a track of 46 in. With a body width of 42 in. and an internal length of 41 in., the Citroen taxicab is only just large enough for two persons; it offers limited accommodation for baggage, and the preliminary objection raised against it was that it was too small to be successful.

The answer to these objections was that an average of 90 per cent of taxicab trips are made with only two persons aboard, and by ignoring the 10 per cent with more than two passengers or with heavy baggage a saving of more than 600 lb. in weight could be effected. By reason of this lower weight fuel consumption is decreased and tire cost is lessened, for 710 x 90 mm. size can be used, although an increase of the section to 105 mm. appears to give more economical results. With a track reduced to 46 in. and an overall width of 55 in., this type of taxicab will cover a greater mileage in a given time over city streets than a larger machine. This is a matter of particular importance in Paris and some other European cities having an irregular layout, where traffic cannot be regulated on a block system.



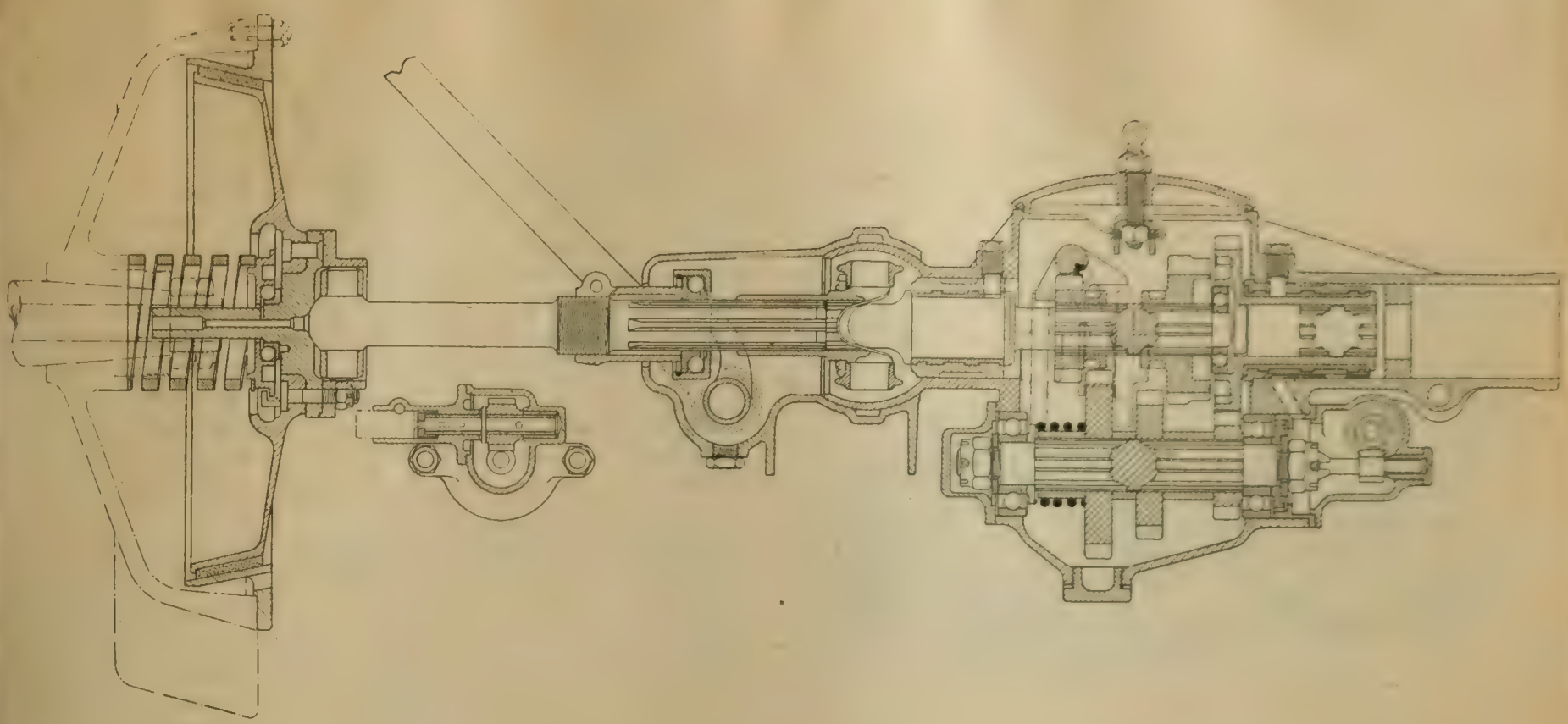
The Citroen taxicab, seating only two passengers, has narrow tread which facilitates operation in crowded traffic

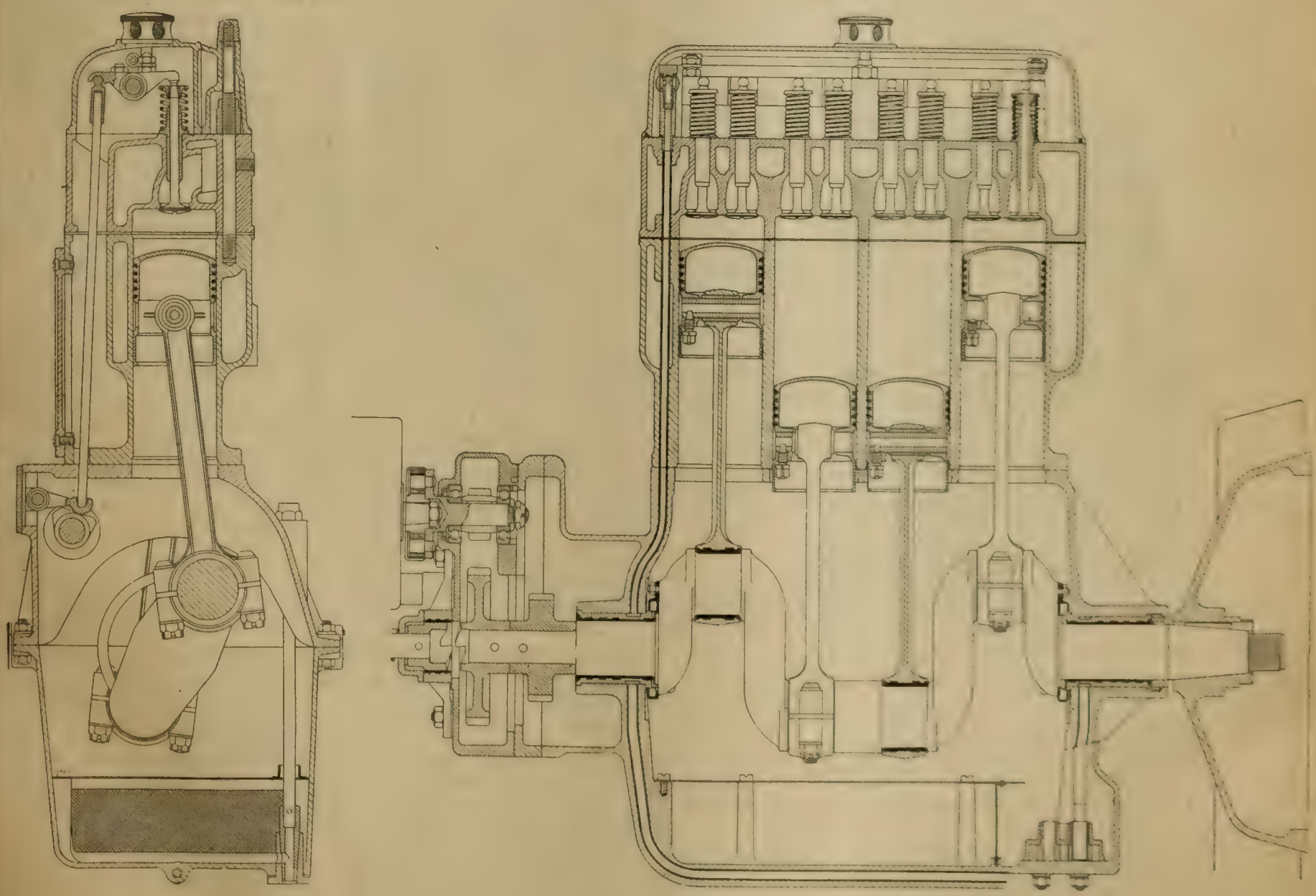
This reasoning appears to have been justified, for, after the public had become used to the small size of the Citroen taxicabs, it selected them in preference to others, and this choice was made very largely because of the time saved in congested traffic over other and larger vehicles. Doubtless, either consciously or unconsciously, this choice was influenced in some measure by the fact that the Citroens had four-cylinder engines compared with twin cylinders for most of the rivals, that they were equipped with electric lighting and were cleaned and better kept.

The Renault Taxicab

In direct competition to the small Citroens there is now being put on the streets of Paris a fleet of 3200 Renault taxicabs belonging to the Compagnie des Automobiles de Place, one of the most experienced concerns in the European taxicab field. In maximum speed, comfort, and appearance there is nothing to choose between the two. The Renaults have been designed, however, on the theory that for taxicab service a vehicle is required which can carry four passengers when necessary and which possesses adequate accommodation for baggage. Few cases are likely to arise when the Renault taxicab will be turned down because it is incapable of doing the work required of it; even at railroad depots, where the heaviest loads are picked up, it can meet requirements.

Expert critics maintain that this large capacity for service is the weak point of the Renault type cab, for the greater weight and the higher gas consumption compared with a light two-seater of the Citroen type will, it is contended, offset any extra earnings. It is argued, too, that the larger size cab will actually earn less than the small one, for, owing to the greater difficulty it will experience in getting through traffic, it will cover a smaller mileage. This applies particularly in Paris, where no speed limit is enforced, and where the man with the greatest skill and the most suitable type of vehicle maintains the highest average speed. Naturally, the company operating the

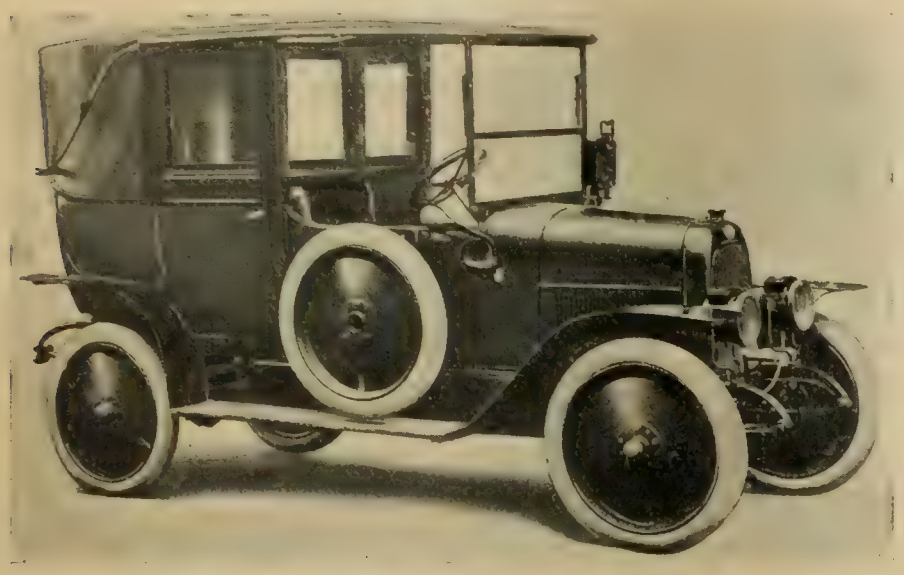




Above, sectional view of new Renault taxicab clutch and gearset. Below, transverse and longitudinal sections of the new Renault taxicab engine with demountable head, in which the valves are carried

Renault does not agree with these contentions, but maintains that a cab of its size is necessary. Only the state of the balance sheets of the two concerns at the end of a few years' operation will determine which view is the right one.

The Citroen type most generally employed in Paris and other European cities has a landaulet body with left hand steering and a door on the right side of the driver's cab; while the panel on the left side is fixed. A limited number



The Fiat taxicab, used extensively in Italian cities, seats four. It has 108 in. wheelbase and 55 in. tread

of high class taxis have coupé bodies. Overall body length is 97 in. and full width of body 47 in.; the height of the body is 51 in. With these general dimensions it is possible to use a rear cushion 41 in. long and 20 in. deep; the height from the middle of the cushion to the roof is 33 in., and from the floor to the roof 47 in. These dimensions are certainly a minimum for a two-passenger general service vehicle. While the wheelbase of 112 in. is normal, the reduction of the overall width to 55 in. gives a decided advantage under traffic conditions.

Mechanically the Citroen taxicab differs little from the normal type passenger car produced by this company. The frame members are heavier and tie rods are fitted to take care of the frame overhang occasioned by the double quarter elliptic spring construction. The engine is the normal type except that the bore is increased from 65 mm. to 68 mm. (3.07 in.). Timing is as follows: intake opens 5 deg. late and closes with a lag of 20 deg.; exhaust opens 30 deg. early and closes on center. Ignition advance is fixed and the compression is 106 lb. per sq. in. Average weight, with driver and two passengers aboard, is 2650 lb. Final gear ratio is 4.4 to 1, and tire size 710 x 90 mm.

Importance of Fuel Economy

While maximum speed is 34 m.p.h., the timing adopted has been such as to get maximum economy at 20 to 25 m.p.h., which is the speed at which the caps most generally run under city conditions. Very accurate figures are available on gas consumption. These show that for a fleet of one hundred cabs over a period of three months the total amount of gas consumed was at the rate of 22.4 miles per American gallon. These results were obtained with the Solex carbureter and straight gasoline and involved all kinds of drivers and various city conditions from the crowded center to the open suburbs. The maker's claim is a gas consumption at the rate of 31.3 m. p. g., and as a comparison with the average for a long period shows, this ought to be easily obtainable with a good driver and under normal street conditions. With benzol the fuel consumption can be cut 10 per cent, but this fuel is not obtainable on the French market at the present time, consequently straight gasoline is used.

The Renault cab has a wheelbase of 111 in., a track of 56 in., an overall width of 65 in., and a total length of 150 in. This allows of a body much more spacious than that on the Citroens. Not only is the rear seat wider and deeper, but two folding seats can be installed and there is room, by the side of the driver, for a large trunk.

Greater size and weight have increased cost, but every effort has been made to keep total weight down by as light a construction as is compatible with the rough service given a taxicab. A certain amount of weight has been saved by using minimum headroom. The height from the ground to the roof is 78½ in., and from the floor of the cab to the roof 55 in. The reduction of 4 or 5 in. in total height, as compared with the old cabs, has been obtained without changing inside height above the rear seat, by putting the body sills below the top of the frame members, so that the floor of the cab is flush with the top of the frame. Other savings are of a structural nature, involving, for example, the use of aluminum in place of iron or bronze for body fittings.

The Renault chassis has been designed throughout with economy in view by men who have had twenty years experience in taxicab operation. Renault makes practically all the parts, but the taxicab company does all its own assembly work. Compared with the usual French practice the engine is large. It has four cylinders of 2.95 x 4.72 in., giving a piston displacement of 129 cu. in. It has a detachable head, overhead valves, with push rods and rockers and a two-bearing crankshaft. Compression is rather high, being 85 lb. per sq. in., but the timing is laid out for high torque at low engine speeds. It is as follows: Intake opens 4 deg. late and closes 20 deg. late. Exhaust opens 30 deg. early and closes on center; this timing is practically identical with that of the Citroens.

Relative Operating Costs

This engine, fitted with the Zenith carbureter, has shown a gasoline consumption of 22.9 miles per American gal. on a five-hour run under representative Paris traffic conditions. This fuel consumption must be considered as the minimum obtainable by a skilled driver under these conditions, and is not comparable with the 22.4 miles average on the Citroens in the hands of all classes of drivers. With a driver and two passengers aboard, this cab certainly averages 3300 lb. In view of the frequent positive and negative acceleration imposed by traffic conditions, this additional weight entails at least 15 per cent increase in the gasoline consumption and increases tire cost in about the same proportion. Overloading, which is always a danger in a large size cab, may cause operating costs to go up without any corresponding return to the company.

Compared with the average cab running in American cities the little Citroen shows an improvement of 9 to 10 miles more to the gallon. This in itself is not a deduction of very great value, for it remains to be proved that the small type French cab would be successful under American conditions. It has been proved, however, that this two-seater cab can compete on equal terms with the larger Renault and run nearly 7 miles more to the gallon. Taking 60 miles as the average daily distance run by a cab, and estimating on 1000 cabs in service, the fleet of smaller cabs makes possible an economy of $304 per day in fuel costs. On the basis of 300 working days in the year the saving in the fuel bill is $91,200. This is sufficiently important to draw attention to the possibilities of a smaller type lightweight taxicab such as is used in France.

Paris has a certain number of Ford taxicabs in service, these being handled by small co-operative groups, in which the drivers are part owners. Generally the orig-

inal carbureter is replaced by a Solex, with which 19 miles per gal. can be averaged. Equally good results can be obtained with the Ford carbureter in the hands of a skilled driver, but the advantage of the French carbureter is that, when set, it is not liable to get out of adjustment. While the Fords consume more gas than the Citroens, the same carbureter being used on both, they are almost on a par in this respect with the Renaults. Generally the Fords are well handled by men who understand the city and who know where to pick up clients and how to avoid dead mileage. The inferiority of the Fords is most prominent when they have to operate in the heart of the city under very dense traffic conditions necessitating frequent and sometimes very steady use of the low gear.

Italian cities generally, as well as several of the European capitals with the exception of Paris, make an extensive use of the Fiat taxicab, which by reason of its power and dimensions is in the same class as the Renault. The Fiat has a four-cylinder, 2.7 x 4.7 in. engine (111 cu. in. piston displacement), a four-speed gearset, a track of 55 in., a wheelbase of 108 in., an overall length of 157 ir. and a total width of 65 in. These general dimensions allow of a rear seat 40 in. wide by 22 in. deep and also two folding seats facing forward. The body is landaulet type, with the whole of the space by the side of the driver available for baggage. It weighs 3300 lb. with driver and two passengers and its gasoline consumption averages 19 m. p. g.

High Tension Ignition for Ford Magneto

A HIGH tension ignition system employing four transformers of special design that utilize current from the Ford fly-wheel magneto has been designed recently by Richard Varley.

The principle of the transformer is best explained by reference to the diagram, from which it will be seen that the flux has two paths, one through the leg containing the secondary winding, the other through the horns, air gap and armature. Under the secondary there is another winding called a "choke" coil which, when its circuit is closed and the primary energized, restrains the flow of flux through the secondary and forces some of it through the armature; then, at a suitable point in the cycle, the magnetization of the horns overcoming the tension of the armature spring, separates the contacts, thus opening the choke coil circuit.

The resultant effect of increased flux density through the secondary coil, due in part to the fact that a large portion of the flux that previously took the upper path now passes through the secondary, accompanied by a high rate of change, sets up a voltage sufficient to jump the gap and deliver a current of high amperage, by reason of the small number of turns in the secondary.

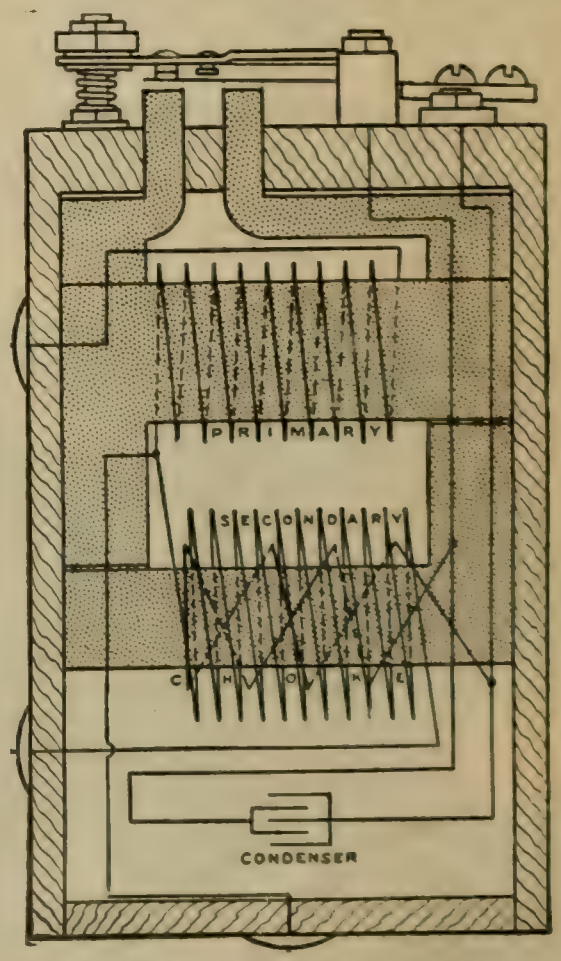
Without the choke coil, the voltage in the secondary would have the very low value determined by the turns, as in a simple two-coil transformer. To obtain a pressure of about 6000 volts, usually employed in ignition work, the secondary winding would require a very fine wire, the high resistance and excessively large number of turns of which would reduce the current to an amount too small to be of any practical use for the purpose of ignition.

It is said that the sparks obtained by the use of this new transformer have heat values greatly in excess of anything heretofore obtained from any coil using current from the same source.

The inventor has aimed to minimize ignition troubles common in coils of the Ruhmkorff type and has given particular attention to improvement in the trembler contacts in order to give greater reliability to the ignition system.

One of the troubles claimed to have been overcome is that of the burning and pitting of the contacts, which, although constantly going on in consequence of the main current from the generator being interrupted at the vibrator points, becomes very serious when the plugs get fouled by carbon or by reason of a cracked stone or porcelain. When a plug gets shorted, there is much flashing at the contacts of a Ruhmkorff coil, but the inventor claims there is no sparking whatever across the contacts of his new transformer when the plug is shorted, and no current direct from the generator passes through the contacts at any time. Only induced current passes through the contacts and this is so very small that pitting or burning is unappreciable.

For the installation of the new system on Ford cars advantage is taken of their present wiring, and to further simplify the application, the transformers are made



Varley Transformer. Diagram showing the magnetic and electrical circuits

to the dimensions of regular Ford units. It is claimed that the use of this system gives great improvement in the running of a Ford engine.

These transformers, for use with the flywheel magneto on Ford cars, trucks and tractors, will be manufactured under a license agreement with the Varley Duplex Magneto Co. and will be distributed by the sales department of the Autocoil Co.

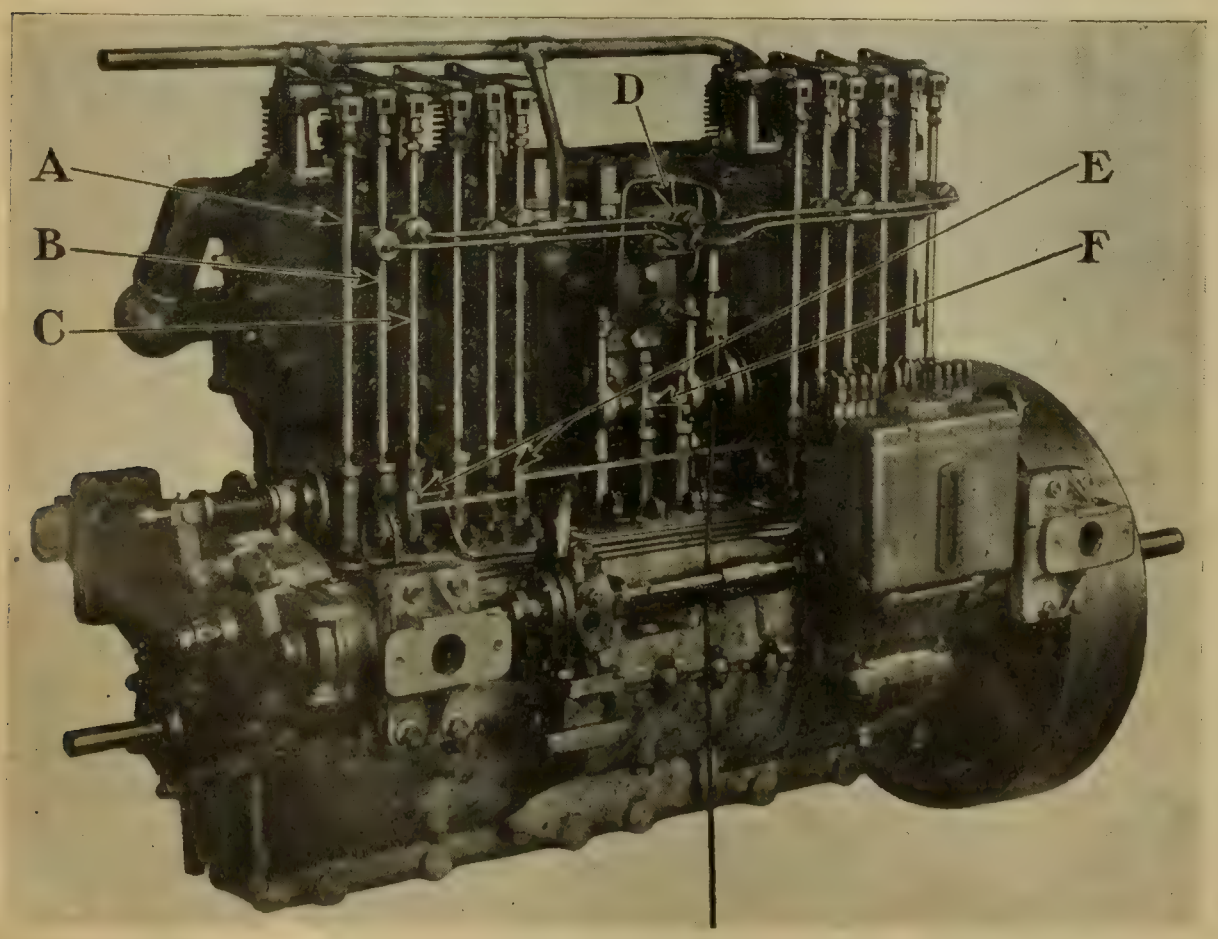
Small Diesel Type Automotive Engine Now in Production

A four-cylinder Austrian engine designed to avoid excessive compression and combustion pressures thus reducing strain on working parts. Auxiliary air compressor and air storage tank eliminated. The Hindl engine can be started by means of a hand crank and operates at a speed of 1150 r.p.m.

THERE are two difficulties which stand in the way of using the ordinary Diesel type engine for automotive purposes. One is the great weight of a multistage compressor required for compressing the air necessary for injecting the fuel under air pressure, and the other, the relative slowness of combustion, which makes the possibility of using high engine speeds seem very remote. The starting difficulties also cannot be neglected. In spite of these difficulties development work is constantly being done with a view to adapting the Diesel cycle to use in small units, for the advantages of its high thermal efficiency and its ability to utilize low priced fuels are fully appreciated.

A new design of four-cycle, Diesel type engine specially adapted for construction in small units has been brought out in Austria. It embodies a number of original features and represents the work of Joseph Hindlmeier, a former co-worker of Rudolf Diesel. At the present time the engine is being manufactured in three sizes of the stationary type, a 4½-hp. horizontal, a 7-hp. vertical and a 14-hp. twin vertical engine, at Mödling, near Vienna; a French company with a capital stock of 2,000,000 francs has been formed at Paris for the exploitation of the Hindlmeier French patent, and we understand that arrangements are being made for the manufacture of the engine in this country.

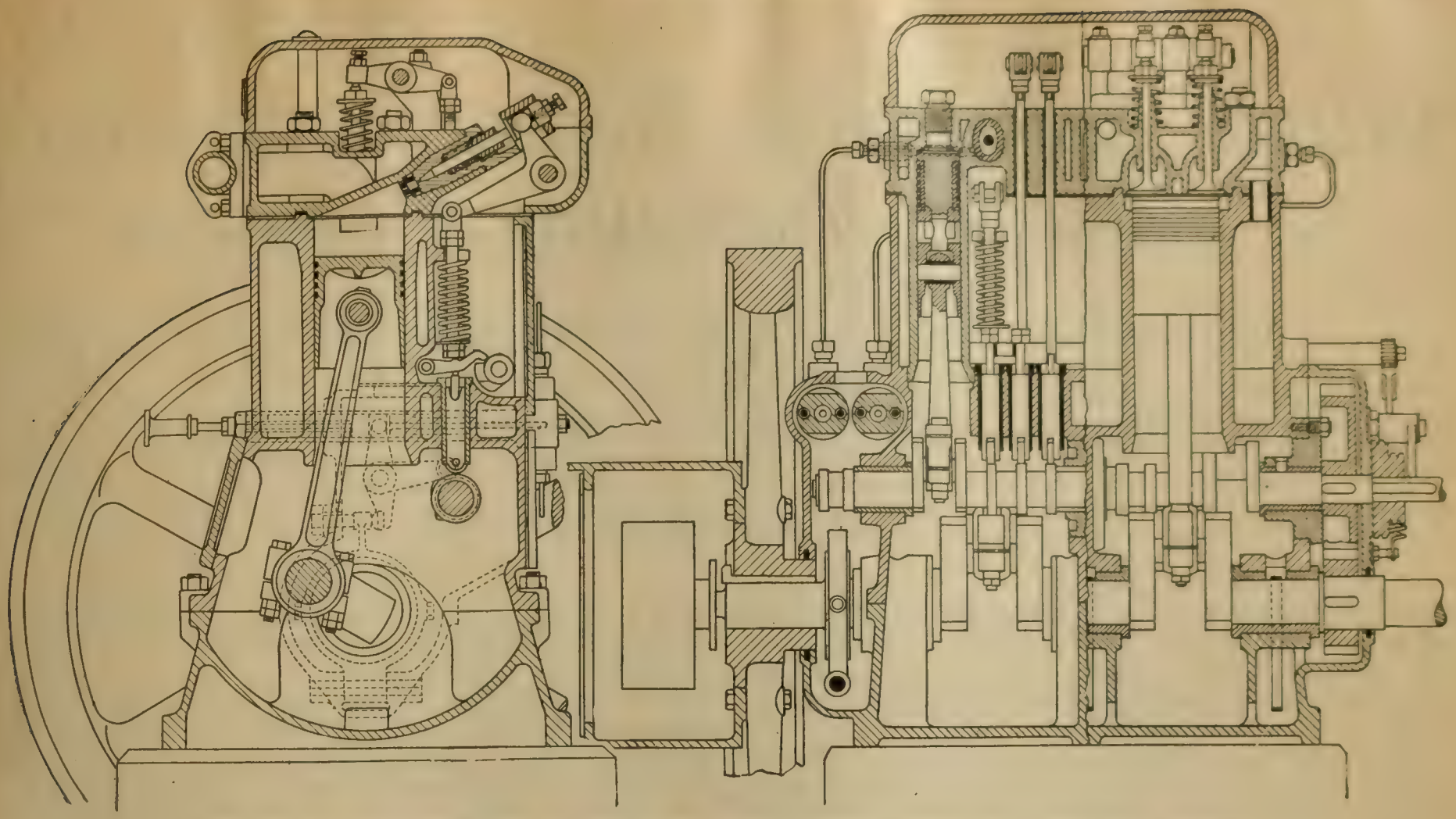
IT is claimed that from an engineering standpoint there is no reason why the Diesel engine cannot be built in any commercial size, however small, but in practice there is a limit in output below which the engine cannot be made practical. This is due to the fact that the Diesel is relatively expensive to manufacture. In large engines the extra cost of construction is warranted by the possible savings on fuel cost, but not so in small sizes. Another difficulty with the ordinary Diesel engine is that a good many breakages of parts are experienced, which are due to the high compression and working pressures. Lubricant from the compressor cylinders sometimes mixes with the air, passes over into the air storage tank, and in time accumulates in sufficient quantity to cause disastrous explosions.



Four-cylinder Diesel engine; A—exhaust valve, B—fuel inlet valve, C—air inlet valve, D—fuel distributor, E—variable lift on fuel inlet controlled by governor, F—fuel pump

Hindlmeier, in developing his engine, worked with two objects in view, viz., to do away with the excessive compression and combustion pressures and thus reduce the strains on the working parts, and to eliminate the auxiliary air compressor and air storage tank, which tend to complicate the engine.

To do away with the auxiliary compressor, the inventor conceived the plan of compressing a portion of the air of a charge only, rather than the whole amount, to a pressure sufficiently high to insure spontaneous ignition. The air thus compressed is not stored but immediately used in the cylinder, and the need for an air storage tank is thus done away with. This is accomplished by providing a small single-cylinder air pump or compressor integral with the engine camshaft, the compressor being so timed as to deliver a charge of highly compressed air into the main cylinder at the moment the fuel is injected. The fuel is both atomized and ignited by the air charge, and its combustion is completed as it mixes with the air in the main cylinder.



Sectional view of Diesel engine showing compressor cylinders mounted parallel to main cylinders

It is readily seen that this system somewhat eases the starting problem. Only a small part of the whole charge needs to be compressed to the high pressure necessary for incuring ignition, instead of the whole charge in the main cylinder, and by using a compression release on the main cylinder the Hindl engine can be started by means of a hand crank. Although the small compressor cylinder must deliver a very high compression, the flywheel weight is sufficient to carry it over dead center when the crank is being turned by hand.

The drawings reproduced herewith clearly show this construction. In the horizontal design the small compressor cylinder is located transversely across the head of the main cylinder, while in the twin and four-cylinder vertical engines the compressor cylinder is located parallel with the main cylinder. Each main cylinder must have a separate compressor cylinder.

Fuel is supplied under pressure by a plunger type fuel pump, from which it is conveyed by small tubing to the fuel admission valve in the cylinder head. This valve is operated from the camshaft in the same manner as the inlet and exhaust valves, but, unlike these, it is of the needle valve type. The engine is governed by a centrifugal governor controlling the amount of fuel allowed to pass on to the injector valve just mentioned. The engine, therefore, is not governed on the hit-and-miss principle, but is a throttling type.

THE compression pressure in the main cylinder is carried at about 400 lb. per sq. in., or at from 20 to 30 per cent less than in the regular Diesel engine. The pressure delivered by the small single-cylinder air compressor is 700 lb. per sq. in.

It is claimed that on account of the lower working pressure in the main cylinder it is permissible to use materially lighter working parts, and this permits of the use of higher speeds. This, therefore, eliminates the obstacle which hitherto has prevented the use of engines of the Diesel type for automotive purposes. The first Hindl engine of the automotive type, of which a photograph is shown herewith, is a four cylinder machine which, we are informed, operates at 1150 r.p.m. This is within the usual range of truck and tractor engine speeds and shows its field of application.

IT is obvious from the above description and an inspection of the drawings that high grade workmanship is required on the engine, especially on the compressor cylinder and piston and on the rings of the latter. The pressure required to cause ignition is produced in a single stage, which can be effected only if the workmanship is of the highest grade. Aside from the machining proper, care must be taken that there will be no distortion of the cylinders after completion, and to this end the cylinder castings must be properly annealed.

We have been informed that the parent works in Austria turn out about 300 engines of this type per month and that companies have been licensed to manufacture the engine in Bucharest, Cracow and Brunn. It is obvious that the most likely field of application of this engine in the automotive line is to tractors, railway motor cars, road tractors, road making machinery and motor boats.

Chain Type Non-Skid Device

AN automobile non-skid device in which the circumferential members of the ordinary tire chains are replaced by fabric bands and the cross members have circumferentially grooved cups inserted in three of their links has been invented by Ida V. Benoit. The cups, which in a sample cross member submitted to us are turned from the solid bar, are intended to increase the gripping power of the device, whereas the fabric circumferential members are intended to protect the sides of the tire against puncture and at the same time as an anchorage for the cross members.

The cups have a flat bottom resting against the tire case and the considerable area of contact should minimize wear of the tires.

British Automotive Research Devoted to Securing Operating Economy

Use of combined oil and air cooling for engines being studied by several parties. Experiments proceeding to further use of light alloys in chassis construction. Much study being given to reducing bus operating costs.

By M. W. Bourdon

IN conducting inquiries in Great Britain concerning the objects, progress and results of research in the automotive field—and in almost every other—one finds oneself in every direction up against the barriers of secrecy.

Except in regard to specialized work—such as fuel research—no government office or department makes a regular practice of initiating and conducting research for the general good and disseminating the information thus obtained. We have the National Physical Laboratory, which does not as a rule initiate researches and publish the results but primarily undertakes investigations at the request of other government departments or of private individuals or firms who are prepared to pay the cost—and an extremely high if not an almost prohibitive charge is made as a rule.

In place of initiating research and thus giving direct assistance, the Government prefers to subsidize research associations. However, one of the first stipulations is that the details of researches—their character, object and result—shall be confidential to the members of each association. The amount of the subsidy is to a large extent dependent upon the amount subscribed by members and as a rule represents approximately 50 per cent of the total expended.

UNDER this scheme there was formed in 1919 the Research Association of British Motor and Allied Manufacturers, the first of such associations from the engineering industry to receive official recognition and support.

But such is the seeming lack of interest in and enthusiasm for scientific research in the British Motor industry that even to-day there are in the membership less than 15 per cent of the manufacturing concerns.

The policy of secrecy insisted upon by the Government may to some extent be responsible for the apathy of the non-members.

The Association has a well-equipped laboratory and workshops in London, and a capable and enthusiastic staff, but its usefulness even to its membership would assuredly be increased if it embraced the whole or a far larger proportion of the British industry. Equipment for reseach is costly and, within limits, the larger the bank balance available the better equipped the workers will be and the deeper they can go into the problems which are submitted to them.

Practically all the fuel research work which has been carried on has been related to alcohol and the results of such study appeared in an article by Herbert Chase in AUTOMOTIVE INDUSTRIES, Research Number of June 8, so that repetition is unnecessary.

The commercial possibilities of gas producers to provide fuel for trucks and other heavy forms of motor vehicles have received a good deal of attention of recent years, and particulars of several British designs and results of working appeared in AUTOMOTIVE INDUSTRIES last year. Costs of running have certainly been shown lower than those with gasoline, but the need for carrying a somewhat involved plant in place of a mere gasoline tank seems likely to be a determining factor in preventing the system from becoming widely used.

It may be said, however, that it is advocated in this connection that the use of charcoal produced from vegetable waste and brushwood should be investigated, for it is said that in certain parts of the world—notably Egypt. Uganda and similar semi-tropical and tropical places—a fuel of this kind derived from local sources and used in a gas producing plant would open up fresh possibilities of transport owing to the abundance of raw material for the production of charcoal.

SO far as can be ascertained, no other investigators are endeavoring to carry Ricardo's experiments further in the matter of super-charging; at all events, no information concerning anything of the kind has been made known. Nor has research on the lines of improved vaporizing systems carried matters appreciably further in this direction; and in the better utilization of exhaust heat automobile manufacturers do not appear to be making any serious endeavors.

A possibility which does not seem to have been as carefully or closely considered as it justifies is that mentioned by Ricardo in connection with his super-charging experiments, viz., the cooling of a portion of the exhaust gases and their introduction into the cylinder with each fresh charge of mixture.

THE report of the Steel Research Committee, formed jointly by the Society of Motor Manufacturers and the Institution of Automobile Engineers, which was issued in October, 1920, still holds good in respect to the ten standardized steels recommended for adoption by British automobile designers. These steels comprise two main groups, the first including two carbon steels differing in carbon content, a 2 per cent nickel steel and a 5 per cent nickel steel, all of which are primarily intended to be used for case-hardened parts; the second group consists

of one plain nickel and two carbon steels and three different types of nickel chromium steel (one of the air-hardening type) which are intended to be used ordinarily either as normalized or after some form of hardening with or without subsequent tempering.

A member of the Committee (Mr. J. H. S. Dickenson) read a paper before the I. A. E. in November, 1920, on the subject of these ten steels in order to assist users to determine and compare the mechanical properties of the materials, to judge their possibilities and limitations under various conditions of treatment and to obtain by selection of material and suitable heat treatment the most advantageous combination of the properties sought in each case.

RECOMMENDATIONS of a similar nature to those just mentioned appear desirable in connection with aluminum and light alloys generally, for, though such matters as hardening and tempering do not enter into consideration, the selection of suitable light alloys for various purposes appears at present to be too haphazard, too dependent upon the imagination or crudely based ideas of the individual—that is, assuming, as more often is the case than not, that the individual concerned is not a member of the industry's research association or has not the facilities thus implied.

Experiments are proceeding in one or two quarters in regard to the more extensive use of light alloys in chassis construction, and the results may possibly be seen in chassis planned for production in 1923. But there is not much scope for extension. As material for back axle centers an aluminum alloy is quite ordinary, and there are already several British small cars said to have "all-aluminum" axle casings, though the description is not literally correct in view of the use of steel liners extended to support the wheel bearings. Aluminum cylinders with steel or cast-iron liners have also ceased to be noteworthy, and the same can, of course, be said in relation to aluminum pistons, water pumps, water pipes and other engine details, as well as clutch cones, and gearset casings.

But it has been suggested that there is scope for light alloys for hubs, rims and wheels; even aluminum or Duralumin frames, front axles and engine connecting rods have been proposed, but it is believed that no practical tests have been made of the use of light alloys for these parts, and it appears doubtful whether much, if any, weight would be saved if known alloys were utilized for such items, with design and dimensions rendering them capable of withstanding the stresses that would be imposed upon them.

The use of aluminum with air-cooling is believed to contain greater possibilities on account of its better heat conductivity as compared with cast-iron; but we have no example yet in automobile practice of cast-iron or steel liners in finned aluminum sleeves following occasional aero practice. But cast-iron finned cylinders with separate aluminum heads are being tried with seeming success on air-cooled cylinders.

Original research in connection with air-cooling has not proceeded far since the publication in AUTOMOTIVE INDUSTRIES of Dr. Gibson's paper, read before the I. A. E. in the session of 1920-21. Except in one or two directions it is difficult to hear of any impending development in automobile engine design as a result of the research carried out by that investigator. The exceptions are concerned with air-cum-oil cooling on the lines referred to by the present writer in AUTOMOTIVE INDUSTRIES of April 20th last. Although definite information received on this matter may not be divulged, having been imparted in confidence, it can be said that research and experiments relating to the principle of utilizing the crankcase lubricating oil for cooling the cylinders and pistons are proceeding apace and notable developments are probable.

One problem which had to be solved is how far the oil should be used for extracting the heat from points of high temperature and to what extent direct air-cooling should be depended upon. So far as investigations have proceeded at present it would appear that, contrary to first ideas on this point, it is neither needful nor desirable to carry the oil around the exhaust valve seating and port, and it will possibly be found that an overhead exhaust valve and a side inlet will give best results in ordinary use, and tend still further to keep down the temperature of the large volume of oil which is carried in the crankcase and circulated rapidly in these "oil-cooled" engines.

Research and development in connection with motor buses appear to be confined at the moment to ways and means of reducing operating costs, mainly by the improvement of vaporizing systems with gasoline as fuel and by applying, as far as possible, approved production methods to repairs and overhauling.

A great advance has recently occurred in the overhaul and maintenance departments of the London Bus Co. By improved organization no more than three or four days are occupied where previously two or three weeks were required to carry through a complete overhaul of chassis and body, including touching up and revarnishing the latter. It is not so much a matter of the direct costs of overhauling, though marked advantages are seen in this way; the important point is that buses are not kept idle for such a long while, which enables a greater proportion of the fleet to be in service at any one time—thus reducing capital charges.

NO avenue which might possibly lead to an improvement of a mile or two, or even far less, per gallon is being left unexplored, though no tangible results have become apparent of late. With a view, no doubt, to encouraging the imaginative and inducing those with ideas to come forward, an official of the London General Omnibus Co. recently expressed the view in a published interview that "a fortune" awaited the individual who could suggest a reasonable scheme whereby operating costs could be reduced, by improved fuel consumption, to the extent of one or two cents per mile.

This company, by the way, has not overlooked the possibilities of developments in air and oil cooling rendering this system feasible for buses and is known to be interesting itself in oil-cooling systems exemplified by those described in AUTOMOTIVE INDUSTRIES of April 20th last. The opening which oil-cooling may be found to provide leading towards a higher practicable m. e. p., better vaporization, and economy in oil and fuel consumption must obviously be attractive to bus operating companies.

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Even if water jackets are retained for the cylinder head and valve pockets there is the possibility of securing advantage in some of the named directions, as well as in others, by circulating a far larger volume of oil than now and arranging that it shall effectually extract heat from the cylinder walls and pistons.

In London services the 54-seated double-decker, known as the S type and described in detail in AUTOMOTIVE INDUSTRIES last year, appears likely to hold the field for awhile and it is unlikely that it will be superseded in the near future by a type with larger seating capacity. For provincial work and country services the single-decker with a seating capacity of 28 to 36 is also likely to remain the predominant type, but in view of its stuffiness in hot weather experiments are being made with a sliding roof and with a roof of the roller shutter pattern, though the difficulty so far has been to keep them waterproof after vibration, rain and sunlight have had their varying effects.

There are no signs of research or experiments having marked effect immediately or in the near future upon bus chassis design, with the possible exception that, as a result of the experience of the London Companies with the semi "over-type" (driver partly alongside and partly over the engine) this relative arrangement of engine and driving seat may be extensively adopted for provincial single-deckers, because of the additional passenger space it affords without increasing the wheelbase. It may here be mentioned that by far the biggest operating company outside of London (the Midland Bus Co.) runs gasoline-electric chassis exclusively and has no present intention of superseding this type.

Highway Transport

THE most important pending developments in connection with the transport of merchandise by road are (1) the probable entry of the railway companies into this field on a large scale and (2) the better organization of the clearing-house system among road transport undertakings to ensure certainty of return loads on inter-city trips. With regard to the former, the Bill which is now before Parliament authorizing the railways to organize road transport—either to supplement the railroads or independently of the latter—has been modified appreciably since it was first drafted owing to the opposition it originally encountered.

For the protection of truck makers and to conciliate the latter, a clause has been inserted with a view to preventing the railway companies from entering the manufacturing field, which was originally a possibility that caused the truck makers to be strenuous opponents of the Bill as a whole. Then, in an endeavor to cut the ground from under the feet of the road transport undertakings and allied interests, who protested that the railways wanted to run motor road transport merely to cut rates outrageously for awhile, secure a monopoly in road haulage and then divert freight back to the rails, a clause has been added which ostensibly will prevent anything of the kind by compelling the railway companies to charge minimum rates set by a special tribunal after investigation of complaints, if any, by the haulage companies.

The railways have agreed to keep separate accounts relating to motor transport, so that they can, if called upon, show figures proving their ability to make a profit at rates which they may ask the tribunal to authorize. Although originally the likelihood of the Bill being passed was more or less remote, it now has a good chance of doing so owing to the modifications and additions mentioned and others designed to prevent any possible unfair competition.

Railways as Highway Transport Operators

THE entry of the railways into the road transport business on a big scale should give a fillip to the truck industry, for while the companies now have fleets which they use for local deliveries they will obviously require large numbers of additional chassis for inter-city work and for transport over areas not now fed by the railroads. It is unlikely that they will confine themselves to one make of chassis, and doubtful whether they will specialize in British-made trucks. There may be an opening, therefore, for American truck makers.

Providing rates are not cut unreasonably, there is no valid reason why properly organized road transport undertakings pure and simple should not compete successfully with the railway companies for road traffic. But at present the majority are not properly organized by any means; there is a vast amount of waste of effort, time and money now going on, which necessarily has the effect of preventing rates from being as low or profits as high as they might be otherwise.

If the entry of the railway companies into this field serves to compel the motor haulage undertakings to set their houses in order, and organize and co-operate, it will do good all around—to the truck industry, owners of merchandise, and the general public.

The organization of the clearing-house system on a national basis will probably be the first outcome, and there is plenty of scope for development here; the sporadic and private efforts to provide return loads for trucks making inter-city journeys up to 150-200 miles in length have not been an unqualified success from several points of view. The railway companies will assuredly be able to avoid running their road vehicles empty or partially loaded on return trips, and the private enterprises will have to be placed, or place themselves, in a similar position if they are to live.

French Subsidized Motor Lines

ABOUT fourteen years ago, in France, the state was authorized to grant subsidies for country services of motor cars, and at the present moment the subsidies amount to nearly 6,000,000 francs annually for 119 services. A great many other lines are running without state aid, owing to the refusal of the proprietors to accept the conditions imposed, requiring that the vehicles should make a double journey each day and that the service should be completed with a 2-ton truck. It is now proposed to modify the conditions, and a bill is being introduced whereby the amount of subsidy will be adjusted to the character of the service.

In the preamble to the bill reference is made to the tendency to abandon local railways where the traffic is not sufficient to cover working expenses, and it is urged that these lines should be made the most of with the aid of gasoline rail cars, which could be run much more cheaply and are more adaptable to light traffic.

It is urged that as much as possible should be made of the local lines so as to relieve the roads, and that the motor car services should be regarded merely as an extension of the railway system and for reaching the most out-of-the-way villages. It is for this purpose that the motor car service is considered best suited.

Influence of Sales and Service Departments on Ignition Design

Correlation of ideas necessary to satisfactory design. Sales, service, engineering and production departments all have different sense of values. Design can give favorable appearance without sacrificing performance qualities

By A. H. Packer

WHEN a concern manufacturing automotive electrical equipment undertakes to design ignition apparatus, the exact type produced is naturally a compromise between the different points of view taken by the different departments. The concern is naturally interested in putting out a product which will enable it to pay dividends, so the ability to sell and make money on the article under consideration is of first importance. The best possible design in the world would be of no value from this standpoint if its appearance were such that it could not be sold. For this reason the sales department will naturally wish to present something which has a pleasing and symmetrical appearance and, if possible, incorporates unique features in design and construction. These will provide this department with talking points which can be used both in advertising and in personally presenting the product.

Members of the engineering department, on the other hand, while appreciating the value of the appearance of the equipment, will naturally be in favor of developing an outfit which is a credit to the skill and training they reflect. They will, therefore, appreciate the incorporation of unique electrical or mechanical features and will also wish to make the outfit superior in performance, if possible, to other similar equipment on the market. They will, therefore, have in mind the development of high voltage which will give a spark capable of jumping a long distance and will also seek to have this spark of maximum possible intensity or heat value. It will also be the endeavor of the engineering department, in case an automatic advance is contemplated, to have this operate as nearly as possible in accordance with the spark advance requirements of engines for which the outfit is being designed. The practical details of construction in the layout of spark advance, methods of assembly and facility for manufacturing will also be foremost in the attention of the engineering department.

During the process of negotiation the service department will usually be called in to see that the outfit is properly installed and that the operation is satisfactory to those in charge of the test for the prospective customers. From an application standpoint, the service department will then be interested in the facility with which the device can be timed; also the facility with which points can be adjusted and the possibility of the device being so constructed that a change from four to six or eight cylinders is not a serious matter, this being accomplished by changing the cam and distributor cap or something of this kind. Under such circumstances an engineer negotiating with a concern making a four-cylinder car could, by replacing, say, two parts, adapt sample equipment so that he could immediately go to another negotiation requiring six or eight cylinder samples. The service department will also be interested in the facility with which an ignition outfit can be adapted for either direction of rotation, for in addition to the possibility of a mistake in specifications there is always the chance that while negotiating with a concern requiring one rotation there may be received a telegram to get in touch with some other concern requiring the reversed rotation.

After the device in question has been on the market for some time and has been sold to a number of concerns, the service department will further be interested in the manner in which it gives satisfaction. Here the durability of the interrupter will have to be considered, both in regard to the way it stands the rapid mechanical vibration and the durability of the contacts as to whether they tend to come loose from the parts to which they are riveted and as to whether they develop electrical trouble and burning of the surface due to improper coordination of the electrical requirements and the ability of the contacts to handle the primary current.

The service department will also be vitally concerned with the design of the coil, and as all engineering is more or less a matter of compromise, they will tend to favor a coil which will be somewhat weaker in initial performance and where the intensity of spark may have been sacrificed somewhat for the purpose of strengthening the insulation so that the possibility of shorted coils may be reduced to a minimum. In the same way the service department will favor a condenser which is big enough so that it may not only have the required capacity but may have sufficient layers of paper between sheets of tinfoil so as to reduce danger of puncture as much as possible. The durability of the outfit in service will also depend on the efficiency of the lubrication.

In the case of the use of automatic advance the service department will be interested more in the general nature of its operation than its theoretical coincidence with the timing requirements of the engine. This will mean that its freedom of action and ability to return immediately with reduction in speed will be of vital importance, and here proper design and suitable lubrication will bear an important part. The design will also be of interest to the service man in regard to the way in which variation

in interrupter gaps affects timing of the device when installed on the engine, as this varies considerably with different types of cams. Freedom from missing will also be facilitated by the use of a flexible copper shunt connecting the ignition unit to the engine so that trouble will not be experienced due to the insulating qualities of the lubricating oil used where the ignition outfit is mounted in the engine.

The service department will also be interested in the degree in which the fiber bumper wears away, due to the rubbing action of the cam, as this will tend to close up the interrupter points, whereas if the points burned considerably the gap might gradually increase. A theoretically ideal condition would be such that the burning away of the interrupter points would be exactly compensated for by the wear on the fiber bumper. This is rarely encountered in practice, however, the usual condition being that the points gradually close up, due to fiber wear.

The design of the ignition outfit will also considerably affect the ease or difficulty with which new contacts and parts can be installed. Two general types are in use, one in which the assembly is mounted on a flat plate, which insures the maximum accessibility, the other with the interrupter parts mounted in a cup-shaped casting, which usually does not provide such accessibility. This, however, is not quite the case where the interrupter parts are mounted on a plate set in the bottom of the casting, which can easily be removed and replaced in its entirety.

HOW much importance does the sales department attach to service performance in the design of ignition apparatus? The writer thinks that the interest of the sales department in design is divided as follows:

Appearance, 50 per cent.
Performance, 30 per cent.
Application, 10 per cent.
Service Performance, 8 per cent.
Parts Accessibility, 2 per cent.

The article also analyzes the emphasis given to these various factors by the other departments.

The points of view of the various departments, as above indicated, have been tabulated below, these various percentage estimates being the writers' personal opinion, and, of course, each reader will have his own idea of the exact value placed on these various qualities by the different departments, but it will, no doubt, be admitted that the general nature of the analysis is substantially correct.

	Sales Dept. Per cent	Engineering Dept. Per cent	Service Dept. Per cent
Appearance	50	18	5
Performance	30	50	10
Application	10	15	10
Service performance	8	15	40
Parts accessibility	2	2	35

The view of the engineer for the automobile manufacturer contemplating the use of some ignition outfit, very often is likely to coincide with the view taken by the engineering department doing the designing so that he may place too much importance upon the initial performance and not enough on features of design which are hard to see and determine, but which eventually affect the satisfaction the outfit gives. The question of heat of spark comes up for prominent consideration, especially in view of the acknowledged fact that present day fuel vaporizes with difficulty, but whether additional heat beyond a certain amount will aid in firing the fuel after it has been vaporized is quite a different question.

For the sake of a home-made illustration we might consider lighting a bonfire with a match and see if the use of two matches at the same time and in the same place would be an appreciable advantage in rapidly spreading the flame through the combustible material. Under these circumstances there would apparently be no improvement. As to whether this illustration applies to the combustion chamber of a gasoline engine, research alone can determine, but the writer has during the last two winters had the opportunity of using on a Ford car an ignition coil which for heat of spark might not compare strongly with other ignition systems, yet this engine in a cold garage would invariably start after two revolutions of the flywheel. The Ford had standard manifold with no heater and nothing to aid starting but the regulation choker. It is accordingly the writer's opinion that excessive heat of spark would accomplish little, and that the main difficulty is in the driver's inability to control the gas mixture properly, either not choking the carbureter enough or else using the choker too much and flooding the engine.

In observing a spark it is seen to consist of a thin white or blue streak through the center surrounded by more or less reddish haze or flame, the volume of which is indicative of the amount of heat or amperage in the spark. If we now consider that this reddish flame when in the cylinder consists of a sphere of heat which in one case may be 1/16 in. in diameter and in another 3/32 or ⅛ in., it would appear that the start that we have given the flame is rather slight when compared to the distance it must travel from the spark plug to the farthest recess of the firing chamber. Assuming, then, that the smaller spark will fire the gap under the worst conditions, it would seem that an increase in the spark would be obtained merely at the expense of reduction in insulation, and, consequently, in the life of the ignition coil. The service department will, consequently, be in favor of constructing a coil in which space for the copper wire is sacrificed for the use of possibly three layers of insulating paper in place of two, and while this coil will not make as spectacular a test it will unquestionably stand up in service and give more ultimate satisfaction to the car user and therefore to the factory using such equipment.

In the design of the condenser the service man's point of view will also favor a liberal design to eliminate, if possible or at least reduce to a minimum, the possibility of punctures. Here the use of an additional sheet of paper in between the layers of tinfoil will reduce the capacity of the condenser, and hence its ability to absorb the arc at the contact, and in order to regain this loss in capacity it will be necessary to make the condenser larger, so as to get a greater area of surface.

Here, too, general designs must be considered. Two locations are commonly used. The condenser is either mounted in the coil or built into the interrupter. The mounting of the condenser in the interrupter has the obvious advantage that it is close to the points and consequently requires no outside connections. In this location, however, it is somewhat limited by lack of space, and the temptation will be to reduce the number of layers of insulating paper so that a condenser of the proper capacity can be put into the space available. This practice, while favoring the standpoint of the sales department for compact and neat appearance, may ultimately react in unfavorable operating characteristics.

The location of the condenser with the coil usually has the advantage that more space is available and the disadvantage that the inductance of the leads between the condenser and the interrupter tends to neutralize its ability to absorb the arc. This can be compensated for, however, by making the leads between the coil and interrupter as short as possible and by slightly increasing the size of the condenser. However, with the usual design of coil, in which the coil and condenser are surrounded with a compound of some sort, it is necessary to install a new coil whenever the condenser becomes defective, this being a rather serious disadvantage from the user's standpoint. In more recently designed coils, however, the use of the compound has been eliminated and the coil so constructed that it can be easily taken apart and a new condenser inserted. This construction is the best from the standpoint of the service department.

It is often observed that an automobile manufacturer employs one type of electrical equipment one year, manifesting much enthusiasm over its installation, but later in the year cools off somewhat as reports of various troubles start to come in, and a year later he turns to some other type of equipment. It is quite possible that this is due to the fact that the engineer for the automobile concern, while expert on the design of the chassis, engine, etc., is not as familiar with electrical principles as he should be and naturally judges the value of a device by its operating characteristics as brought out by the initial test. It is a well known fact that all engineering is more or less a matter of compromise and that no amount of cleverness will change fundamental engineering facts, so that if the various possibilities of ignition devices were frankly discussed between the representatives of the electrical concern and of the prospective purchaser it would no doubt result in more all-around satisfaction.

Up to this time the standpoint of the man in charge of production has been purposely omitted, but his attitude will be much the same as that of the service department in regard to ease of assembly, etc. In the matter of making the individual parts, however, he may have some ideas as to change in design to facilitate manufacture, and while all concerned should co-operate to reduce cost of production, care must be used to see that some change in design or material is not made that would detrimentally affect the performance or operating characteristics after the device had been placed in regular service.

The final word in regard to points in design should be left to a sales engineer having the authority of an officer in the company, who should possess the engineering ability and broad business experience to enable him to accurately weigh the points presented by the different departments.

Advertising Can Bring Government and Business Together

FOLLOW the "sign post" of sound advertising if you are seeking the highway of business success is the advice of F. M. Feiker, formerly personal assistant to Secretary of Commerce Hoover, and now special representative of the Department of Commerce.

Speaking at the First National Industrial Advertising Conference of the Associated Advertising Clubs of the World in Milwaukee, Mr. Feiker declared that his suggestion applies to government as well as business. He said: "Advertising can bring government and business together, because advertising brings business and the public together, and the government's relation to business is after all simply the public's relation to business."

The Commerce Department is a "regular treasure cave" of copy ideas. Every advertising man in a manufacturing establishment, every head of a copy plan board, should take a little box of note books and go to Washington for new ideas, in Mr. Feiker's opinion. He said that the whole program for a better understanding of statistics in industry, the advancement of our foreign trade and its long-time and vital relation to our domestic trade, the elimination of millions of dollars of industrial waste through simplified practice, all are full of copy ideas for advertising both in the field of industrial advertising and in the field of general advertising.

"If twenty of our largest advertisers would approach their business from the point of view of eliminating waste along the line of simplifying sizes and eliminating excess varieties and then advertise their programs of simplification to the buying public, one of the greatest forces for public education and more intelligent buying would be started. And more intelligent buying will make possible more regular production, cut out seasonal variation and unemployment."

"Let industry police itself," is the new policy of the Department of Commerce in the opinion of Mr. Feiker. In carrying out this policy over one hundred and fifty foreign trade committees from different business associations are working through fifteen or twenty special commodity experts of the Department of Commerce in the extension of foreign trade in different fields of activity, and as a result of this helpful service to industry the inquiries from business men per day at the Department have jumped from two or three hundred to over one thousand.

He referred to the accomplishments of the new Division of Simplified Practice, established less than a year ago as part of the Bureau of Standards. "This Division does not tell industry what it must do to be saved, but reverses the operation and acts as a center point to which committees of industry representing all branches, buyers and sellers and specifiers, may come to discuss the opportunity for the simplification of dimensions and the elimination of excess varieties." He added that after less than a year's work this division has already concrete evidence of accomplishment. The paving brick manufacturers have reduced the number of paving bricks by mutual consent between themselves and their buyers from 66 to 5. The metal beds, wooden beds, and spring and mattress manufacturers meeting together at the Department decided on a few standard sizes instead of scores and odd sizes. "This squeezing the waste out of industry by way of industry is proceeding along many other lines with excellent results assured."

CONSUL LEE, at Porto Allegre, reports that there are about 360 tractors in Brazil, ten of the track-laying type and 350 wheel type. Most of these tractors were received at the ports of Rio de Janeiro, Santos and Porto Allegre and very few were imported into the northern parts of Brazil. The state of Rio Grande do Sul has 143 tractors, all but three being of the wheel type. No figures are available at present showing the distribution of these tractors throughout the other states of Brazil.

New S. A. E. Standards Report of Interest to Many Manufacturers

Recommendations covering bumper mountings, oil drain plugs, spring steel, truck axle parts, electrical equipment, tractor drawbar adjustment, bronze and aluminum sheet, bearing metals, ball studs, screw threads and serrated fittings are important to vehicle as well as to parts makers.

STANDARDIZATION furnishes no thrills. It's just common sense boiled down and made available for the mutual benefit of manufacturers and users. That standards work is of great importance to the automotive industry has long been evident to all who are not blind, and the recent work of the Standards Committee of the Society of Automotive Engineers is no exception to this rule. The semi-annual report of this Committee is to be presented at the Summer Meeting of the Society to be held at White Sulphur Springs, W. Va., June 20 to 24. The report contains many items which are or should be of great interest to nearly all automotive manufacturers, whether they build complete vehicles, parts or equipment. The meeting affords an opportunity to discuss the recommendations which should not be overlooked.

Among the more important recommendations may be mentioned that covering bumper mounting. This, of course, avoids patented methods of attachment. It involves a standard punching or drilling of the front horn of frame members, making it possible to readily attach the bumper or a bracket to carry it without further drilling. It should prove a boon to bumper makers, as well as to car manufacturers, a large percentage of whom are said to be willing to follow the standard if it is adopted.

Another important recommendation is that of the Engine Division, providing for the use of an oil drain plug with a minimum opening of ¾ in. to be located at the lowest point of the oil pan and operable from the engine hood. This will facilitate the draining of old oil from the crankcase and flushing out the latter—an operation which is now frequently neglected because of the relative inaccessibility and small size of drain openings, with consequent more rapid deterioration of the engine through the use of dirty or fuel-diluted lubricant.

The proposal of the Iron and Steel Division, covering specifications for rolling tolerances for concave spring steel will facilitate both the manufacture and purchase of such steel and influence its suitability for conversion into leaf springs.

Many of the standards thus far adopted by the Society have a decided influence in the way of facilitating service operations as well as convenience in the manufacture of parts. The recommendation for a standard hexagon head for breaker contacts and check nuts is in this class. If this recommendation is approved and followed by manufacturers, it will eliminate the need for special wrenches now frequently required in ignition repair work.

The Axle and Wheels Division is recommending the extension of certain standards already adopted covering dimensions for motor truck front axle spindles. The proposals include standard dimensions for the threaded spindle end, including size and length of thread, diameter and location of cotter pin hole, and width of groove at back end of the thread.

One of the most important standards relating to isolated plant lighting equipment ever adopted is that providing for standard magneto mountings for engines in this class. Heretofore, there has never been any standard for such mountings, and the probable adoption at the coming meeting of the proposed recommendation will be of great advantage both to manufacturers of isolated electric plants and to magneto manufacturers.

Several new specifications for non-ferrous metals are proposed by the Non-Ferrous Metals Division. These include phosphor bronze strips for flat springs, aluminum sheet and strip of varying temper, brass wire for brazing, annealed copper wire and several additional specifications for bearing metals.

The Parts and Fittings Division, which has from time to time been concerned with the preparation of standard specifications for numerous miscellaneous parts and fittings, is again submitting an extensive report on a number of items of considerable importance. These include the bumper mounting specifications already referred to, and extension of the existing standard for adjustable yokes, providing for a light and heavy series, a table of specifications for plain steel washers for bolt diameters of from ¼ to 1½-in., a table of specifications for ball studs of nominal diameter varying from ½ to 3 in., and a table of specifications for straight and tapered serrated shaft fittings.

This work, thus briefly summarized in a paragraph, has required many months for its completion. It has involved the preparation of questionnaires sent to the various and numerous manufacturers interested in production of the parts involved, the digesting and reconciling of views held by the various manufacturers, and the preparation of tabular matter covering the controlling dimensions of the parts standardized. For example, a questionnaire sent to some 75 companies was the basis of the recommendation in connection with serrated shaft fittings. Most of these companies submitted data which indicated that these fittings are extensively used and should be standardized. The recommendations covering ball studs involved a revision of similar specifications submitted by the Division at the last summer meeting of the Society.

Perhaps no standards are more important or more extensively used throughout the automotive and related industries than those referring to screw threads. The sub-

ject, therefore, merits careful study and has received consideration by numerous committees. During the war, the National Screw Thread Commission was created by act of Congress. It has since made extensive and important recommendations in reference to screw threads. This Commission includes in its membership two members nominated by the Society, and is, consequently, in close touch with the S.A.E. Standards Committee. The Screw Threads Division has been reviewing portions of the Screw Thread Commission's work which are of interest to the automotive industry, and has recommended the adoption, as an S.A.E. standard, of certain tables prepared by the Commission and covering sizes, tolerances, allowances, etc., for screw threads of medium fit and free fit. The Division also makes some minor recommendations in reference to present S.A.E. standard bolts, cotter pin locations, etc.

In the following pages are printed, practically in full, the detail recommendations of the various divisions scheduled to present reports at the S.A.E. summer meeting.

The Axle and Wheels Division recommends that the accompanying tables be approved for adoption as an extension of the present S.A.E. recommended practice for motor truck front axle hubs.

Dimensions of Motor Truck Front Axle Spindle Ends

Spindle No	5	6	7	8	9
Thread, U.S.S.	1⅛-7	1⅛-7	1½-6	1½-6	1½-6
Length of threaded end	1 9/16	1 9/16	1 13/16	1 13/16	1 13/16
Height from center line of spindle to flat milled on threaded end	7/16	7/16	9/16	9/16	9/16
Center of cotter-pin hole to end of thread	3/16	3/16	3/16	3/16	3/16
Diam. of cotter-pin hole	7/32	7/32	7/32	7/32	7/32
Width of groove at back end of thread	⅛	⅛	⅛	⅛	⅛

General Information for Motor Truck Front Axle Hubs

Spindle No.	5	6	7	8	9
Spindle load rating in lb. on solid tire at ground	1250	1625	2125	2750	3500
Solid tire size	34x3½	36x4	36x5	36x6	36x7
Solid tire load rating, lb	1300	1700	2500	3300	4200

The Electrical Equipment Division makes the following recommendations: That the present S.A.E. standard for ignition distributor mountings be revised by

(1) Specifying a dimension of 27/32 in. for the distance from the bottom of the distributor mounting barrel to the bottom of the tongue on the distributor half of the driving coupling of the Type B ignition distributor.

(2) Changing the limits for the bore in the coupling from 0.4930 in. maximum and 0.4920 in. minimum to 0.4915 in. maximum and 0.4905 in. minimum.

That the magneto dimensions given in the accompanying illustration be given as S.A.E. recommended practice, as an addition to the present S.A.E. standard for magneto mountings.

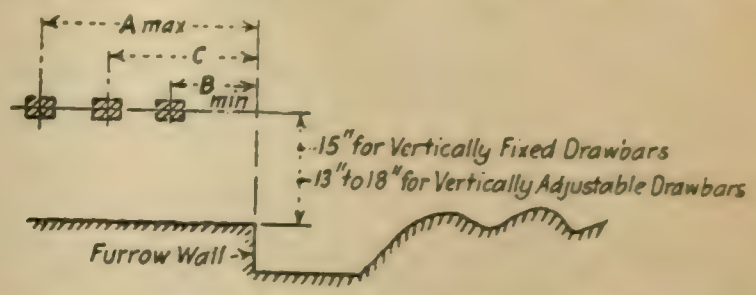
That the hexagon head of breaker contacts and check nuts shall be ¼ in. across flats and that the threads shall be No. 10-40 or No. 8-40.

That the diameter of the bolt holes for sizes Nos. 1 and 2 of the S.A.E. standard for starting motor flange mountings be changed from 7/16 to 13/32 in.

The Agricultural Power Equipment Division recommends that the present S.A.E. standard for tractor drawbar adjustments be revised to conform with the limits specified in the accompanying table:

Tractor Drawbar Adjustments

Plow	Two-bottom 12-In.	Two-bottom 14-In.	Three-bottom 12-In.	Three-bottom 14-In.	Four-bottom 12-In.	Four-bottom 14-In.
A—Max.	30	30	30	32	35	40
B—Min.	13	15	18	20	22	24
C—Best average	17	20	22	26	27	32



A—Maximum hitching position from the furrow wall, very often necessary when the tractor operates on the land.
B—Minimum hitching position from the furrow wall when the tractor operates in the furrow.
C—Best average hitching position from the furrow wall.

The Engine Division recommends for S. A. E. recommended practice that crankcase drain plugs shall have a minimum opening of ¾ in., be located at the lowest point of the oil pan and be operable from under the engine hood.

The Iron and Steel Division recommends the adoption of the accompanying specification for leaf spring steel tolerances as S.A.E. recommended practice.

Rolling Tolerances for Concave Spring Steel

The finished bars shall be of double concave section with round edges. The radii of the arcs of the two concave surfaces shall be of equal length.

Rolls to produce the round edges shall be turned to a radius equal to two-thirds the thickness of the bar.

All bars ordered to gage shall be rolled to the Birmingham wire gage.

All bars must meet the width and thickness tolerances specified in the following table:

Width and Thickness Tolerances

Width of Flat, in. Over	To, Inclusive	Width, in. Plus	Width, in. Minus	Thickness,[1] in. Plus	Thickness,[1] in. Minus
0	2¼	1/32	0	0.005	0.005
2¼	3	3/64	0	0.006	0.006
3	5	1/16	0	0.007	0.007

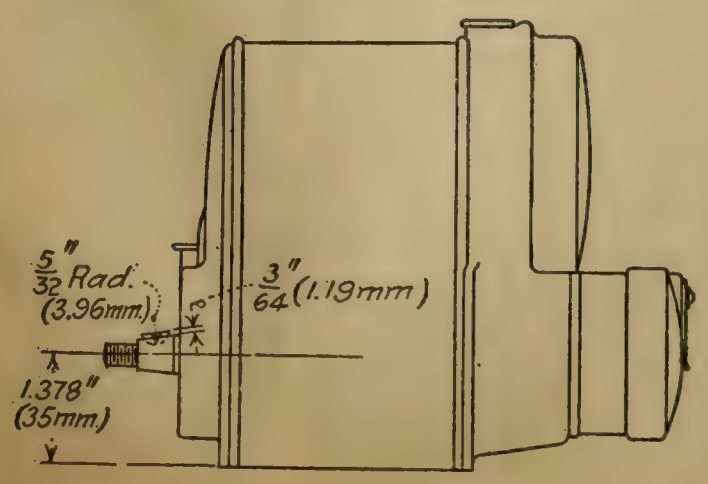
[1]Thickness measurement to be taken at edge of bar where concave surface intersects round edge.

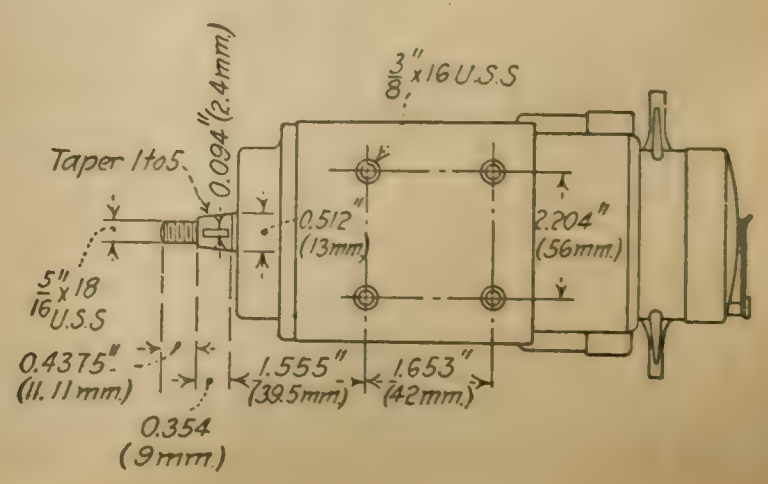
The difference in thickness between the two edges of each bar shall not be greater than those given in the following table:

Differences in Thickness

Width of Flat, in. Over	To, Inclusive	Difference in Thickness, in.
0	2	0.002
2	3	0.003
3	5	0.004

Spring steel bars shall not have more than 1 in. curvature in 20 ft., or 1¼ in. in 25 ft., or 1½ in. in 30 ft.





The concavity, or difference between the thickness at the edges and at the center of the bar, shall be as specified in the following table:

Allowable Variations in Concavity

Width, in.	Nominal Concavity, in.	Maximum Concavity, in.	Minimum Concavity, in.
1½	0.007	0.009	0.004
1¾	0.008	0.010	0.005
2	0.010	0.012	0.006
2¼	0.011	0.013	0.007
2½	0.013	0.015	0.009
3	0.016	0.018	0.012
3½	0.018	0.020	0.013
4	0.021	0.023	0.016
5	0.029	0.031	0.023

The Lighting Division recommends that the present S. A. E. recommended practice for head lamps be revised as indicated below:

(1) Change the second sentence in the paragraph under the sub-heading "Mounting," which now reads, "Means for adjusting the head lamps shall be provided so as to permit a change in the vertical as well as in the horizontal angle of the head lamps, * * *" to read "For adjustable types of head lamp mountings means shall be provided, * * *"

(2) Under the sub-heading "Brackets" insert the following: "*Adjustable Type.*—The adjustable type of mounting bracket for head lamps mounted on fenders, radiator shells, frame pillars, tie rods and similar constructions, is recommended."

The Lighting Division also recommends:

That the G10, G12 and G16½ lamps be omitted from the S.A.E. standard for electric incandescent lamps.

That the present S.A.E. standard for electric incandescent lamp voltages be revised by omitting the 8 to 10 and the 18 to 24 voltage ranges and the reference to four and nine battery cell arrangements.

That the following report be adopted as S.A.E. recommended practice:

(1) For motorboats and small cruisers having combined starting and lighting equipment, it is recommended that nominal 6-volt (6 to 8 volts) or nominal 12-volt (12 to 16 volts) systems be used.

(2) For larger cruisers having separate lighting equipment, it is recommended that the 32 or 110-volt system be used.

Non-Ferrous Metal Specifications

The Non-Ferrous Metals Division recommends that Specifications Nos. 77, 78, 82 and 83 be adopted as S.A.E. standard.

Specification No. 77, Phosphor Bronze Strip for Flat Springs

This specification covers bronze strips up to 0.080 in. gage for flat springs and includes a variety of tempers in two alloys, from which a suitable quality can be chosen for any ordinary purpose.

Composition in percentage:

	Grade A	Grade B
Tin	4.00 to 6.00	7.00 to 9.00
Phosphorus	0.03 to 0.40	0.03 to 0.20
Zinc, max.	0.20	0.20
Iron, max.	0.10	0.10
Lead, max.	0.10	0.10
Copper	Remainder	Remainder

Temper Designation.—The temper of strip phosphor bronze shall be designated as follows:

Temper	Reduction, B. & S., Nos.
Half Hard	2
Hard	4
Extra Hard	6
Spring	8

Physical Properties.—The average tension test of two samples of sheet thinner than 0.080 in. should conform to the minimum requirements specified in the accompanying table. In very thin strips, on account of difficulties in testing, the elongation may be considerably less than the values given.

Minimum Physical Properties

Temper	GRADE A Minimum Tensile Strength, Lb. Per Sq. In.	GRADE A Minimum Elongation in 2 In., Per Cent	GRADE B Minimum Tensile Strength, Lb. Per Sq. In.	GRADE B Minimum Elongation in 2 In., Per Cent
Half Hard	55,000	15.0	65,000	20.0
Hard	75,000	5.0	85,000	7.5
Extra Hard	85,000	2.0	100,000	1.0
Spring	90,000	1.0	.....	....

Dimensional Tolerances.—The width of the strip shall not vary more than 0.01 in. from the size specified in the order.

General Information.—These should be considered as general specifications. Phosphor bronze strip is used for various kinds of springs where the manufacturing requirements and the uses to which the springs are put are too particular to be specified by ordinary physical tests. It is advisable to submit samples or drawings to the manufacturer and secure an adjustment of temper to suit the manufacturing and service requirements of the article.

Flat springs formed with easy bends across the grain are usually made of the Grade A alloy, "Spring" temper.

Flat springs with easy bends either across or with the grain are usually made of the Grade B alloy, "Extra Hard" temper.

Clips or contact springs with most difficult bends are usually made of the Grade B alloy, "Hard" temper.

Thickness Tolerances for Phosphor Bronze Strips

Thickness: B. & S. Gage No. From	Thickness: B. & S. Gage No. To, Incl.	Thickness: Decimal From	Thickness: Decimal To, Incl.	Width, In.: Up to 5 Incl.	Over 5 to 8 Incl.	Over 8 to 11 Incl.	Over 11 to 14 Incl.
0000	0	0.4600	0.3248	0.0044	0.0048	0.0051	0.0055
0	4	0.3248	0.2043	0.0039	0.0043	0.0046	0.0050
4	8	0.2043	0.1284	0.0034	0.0038	0.0041	0.0045
8	14	0.1284	0.0640	0.0029	0.0033	0.0036	0.0040
14	18	0.0640	0.0403	0.0025	0.0029	0.0033	0.0037
18	24	0.0403	0.0201	0.0020	0.0024	0.0028	0.0032
24	28	0.0201	0.0126	0.0016	0.0020	0.0024	0.0028
28	32	0.0126	0.0079	0.0013	0.0017	0.0020	0.0024
32	35	0.0079	0.0056	0.0010	0.0014	0.0017	0.0022
35	38	0.0056	0.0039	0.0008	0.0012	0.0015	0.0019

All tolerances plus or minus.

Specification No. 78, Aluminum Sheet and Strip

Composition in percentage:

Aluminum, min.	99.00

Physical Properties.—Aluminum sheet and strip are furnished in several tempers or degrees of hardness. The mechanical properties of aluminum sheet or strip conforming to Tempers, No. 1, Soft Annealed; No. 2, Half Hard, and No. 3, Hard, are given in Table 1.

The tension test specimen is taken parallel to the direction of cold rolling. Sheet or strip of Temper No. 1 should withstand being bent double in any direction and hammered flat. Sheet or strip of Temper No. 2 should withstand being bent around a pin of radius equal to the thickness of the sheet,

Table 1—Mechanical Properties for Tempers No. 1 to 3

Temper No.	B. & S. Gage No. From	B. & S. Gage No. To, Incl.	Thickness, In— From	Thickness, In— To, Incl.	Minimum Tensile Strength, Lb. Per Sq. In.	Minimum Elongation in 2 In. Per Cent
1	12	16	0.0808	0.0509	12,500	30
1	17	22	0.0508	0.0227	12,500	20
1	23	26	0.0226	0.0159	12,500	10
2	12	16	0.0808	0.0509	18,000	7
2	17	22	0.0508	0.0227	18,000	5
2	23	26	0.0226	0.0159	18,000	5
3	12	16	0.0808	0.0509	22,000	4
3	17	22	0.0508	0.0227	25,000	2
3	23	26	0.0226	0.0159	30,000	2

without cracking. Sheet or strip of Temper No. 3 will not endure any considerable bending without cracking.

The usual variations in the thickness of sheet or strip are shown in Table 2.

General Information.—The specific gravity is about 2.70. Young's modulus of elasticity is about 10,000,000 lb. per sq. in.

Aluminum sheet and strip are used for many purposes where the requirements, either because of the service or the forming operations, are too specific to be covered in any general specification. It is usually advisable, therefore, to submit samples or drawings to the manufacturer to assist in the selection of the proper anneal or temper to suit the service or forming operations.

Aluminum sheet or strip is used for automobile bodies, hoods (special flat sheet), fenders, housing covers, floor covering, molding, instrument parts, instrument boards, hubcaps, wire wheel disks, brake-drum covers, miscellaneous pressed parts and for many parts in aircraft construction.

Table 2—Permissible Variations

B. & S. Gage No. From	B. & S. Gage No. To, Incl.	Thickness, In. From	Thickness, In. To, Incl.	Permissible Variations, In.
10	17	0.1019	0.0404	0.003
18	26	0.0403	0.0159	0.002

Specification No. 82, Brass Wire for Brazing

Composition in percentage:

Copper	59.00 to 62.00
Lead, max.	0.30
Iron, max.	0.06
Aluminum	None
Zinc	Remainder

This wire should be finished soft annealed. The surface should be clean and free from scale or other foreign materials.

General Information.—Wire in accordance with this specification is suitable for torch welding.

Specification No. 83, Soft or Annealed Copper Wire

Composition.—The copper shall be of such quality and purity that, when drawn and annealed, it shall have the properties and characteristics herein required.

Shapes.—These specifications cover untinned drawn and annealed round wire.

Finish.—The wire must be free from all imperfections not consistent with the best commercial practice.

Necessary brazes in soft or annealed wire must be made in accordance with the best commercial practice.

Specific Gravity.—For the purpose of calculating weights, cross-sections, and other purposes, the specific gravity of copper shall be taken as 8.89 at 20 deg. Cent. (68 deg. Fahr.).

Dimensions and Permissible Variations.—The size shall be expressed as the diameter of the wire in decimal fractions on an inch.

Wire shall conform to the following permissible variations in nominal diameter:

Mechanical Requirements for Soft Copper Wire

Diameter or Thickness, In. Over	Diameter or Thickness, In. To, Incl.	Tensile Strength Lb. Per Sq. In.	Elongation in 10 In., Per Cent
0.460	0.290	36,000	35
0.289	0.103	37,000	30
0.102	0.021	38,500	25
0.020	0.003	40,000	20

Wire 0.010 in. diameter and larger, 1 per cent over or under.
Wire less than 0.010 in. diameter, 0.1 mil (0.0001 in.) over or under.

Mechanical Requirements.—Wire shall be so drawn and annealed that its tensile strength and elongation shall not be greater nor less respectively than the values specified in the accompanying table. For wire whose nominal diameter is between the given sizes, the requirements shall be those of the next larger size included in the table.

Copper wire is usually purchased in B. & S. Gage.

Electrical Resistivity.—Electrical resistivity shall be determined upon fair samples by resistance measurements at a temperature of 20 deg. Cent. (68 deg. Fahr.), and it shall not exceed 891.58 lb. per mile-ohm.

General Information.—As soft or annealed copper wire is so soft and ductile that it is easily marred by careless handling in the operation of winding or cabling, all testing and inspection must be done at the manufacturer's plant.

White Bearing Metals

The Non-Ferrous Metals Division recommends the adoption of the extended specifications for White Bearing Metals Nos. 10, 11, 12, 13 and 14.

Specification No. 10, Babbitt

When finished bronze-backed bearings are purchased a maximum of 0.6 per cent lead is permissible in scraped samples provided a lead-tin solder has been used in bonding the bronze and the babbitt.

Composition in percentage:

	No. 10 Cast Products	No. 10A Ingots
Tin	90 to 92	90.75 to 91.25
Copper	4 to 5	4.25 to 4.75
Antimony	4 to 5	4.25 to 4.75
Lead, max.	0.35	0.35
Iron, max.	0.08	0.08
Arsenic, max.	0.10	0.10
Bismuth, max.	0.08	0.08
Zinc and aluminum	None	None

General Information.—No. 10 babbitt is very fluid and may be used for bronze-backed bearings, particularly for thin linings such as are used in aircraft engines. It is also suitable for die castings.

Specification No. 11, Babbitt

Composition in percentage:

	No. 11 Cast Products	No. 11A Ingots
Tin	86.00 to 89.00	87.25 to 87.75
Copper	5.00 to 6.50	5.50 to 6.00
Antimony	6.00 to 7.50	6.50 to 7.00

General Information.—This is a rather hard babbitt which may be used for lining connecting-rod and shaft bearings which are subjected to heavy pressures; its "wiping" tendency is very slight. It is also suitable for die castings.

Specification No. 12, Babbitt

Composition in percentage:

	No. 12 Cast Products	No. 12A Ingots
Antimony	9.50 to 11.50	10.25 to 10.75
Copper	2.25 to 3.75	2.75 to 3.25
Lead	24.00 to 26.00	24.75 to 25.25

General Information.—This is a relatively cheap babbitt and is intended for bearings subjected to moderate pressures. It is also suitable for die castings.

Specification No. 13, Babbitt

Composition in percentage:

	No. 13 Cast Products	No. 13A Ingots
Tin	9.25 to 10.75	9.75 to 10.25
Antimony	14.00 to 16.00	14.75 to 15.25
Lead	74.00 to 76.00	74.75 to 75.25

General Information.—This is a cheap babbitt and serves successfully where the bearings are large and the service light. It should not be used as a substitute for a babbitt with a high tin content. It is also suitable for die castings.

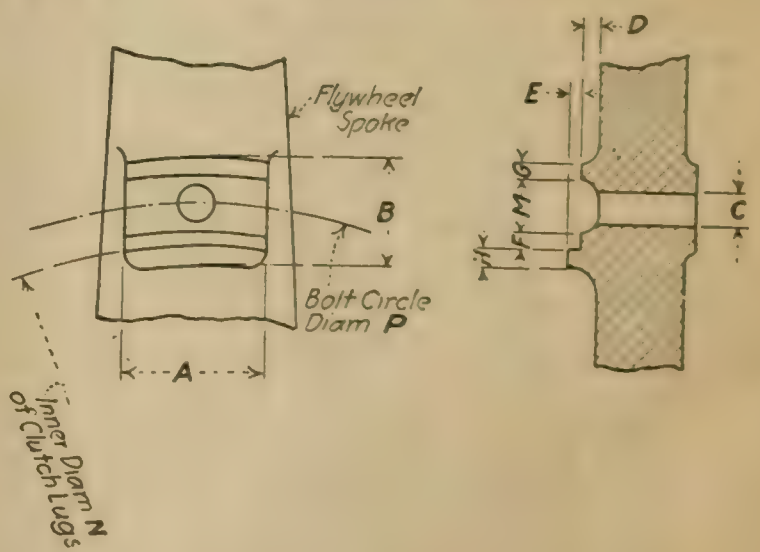
Specification No. 14, Babbitt

Composition in percentage:

	No. 14 Cast Products	No. 14A Ingots
Tin	9.25 to 10.75	9.75 to 10.25
Antimony	14.00 to 16.00	14.75 to 15.25
Lead	74.00 to 76.00	74.75 to 75.25

General Information.—This is a cheap babbitt and serves successfully where the bearings are large and the service light. It should not be used as a substitute for a babbitt with a high tin content. It is suitable for die castings.

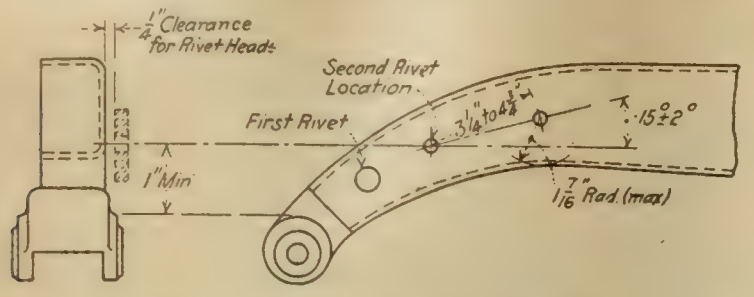
The Stationary Engine Division recommends that the flywheel pulley lug dimensions given in the accompanying table be adopted as S.A.E. recommended practice.



Pulley and Friction Clutch Fastening Lugs

A	B	C	D	E	F	G	H	M	N	P	Number of Lugs to Pulley or Clutch
1½	1¼	5/16	¼	3/16	¼	¼	¼	¾	8½	9¾	6
1¾	1½	5/16	¼	3/16	¼	¼	¼	¾	14	15¼	6
2	2¼	5/16	¼	3/16	¼	¼	⅜	1⅜	16¼	17¾	6
2¼	2¼	5/16	¼	3/16	¼	¼	⅜	1⅜	18¼	19¾	6

The Parts and Fittings Division recommends that the passenger car front bumper mounting shown in the accompanying illustration be adopted as an extension of the present S.A.E. recommended practice for passenger car front bumpers.



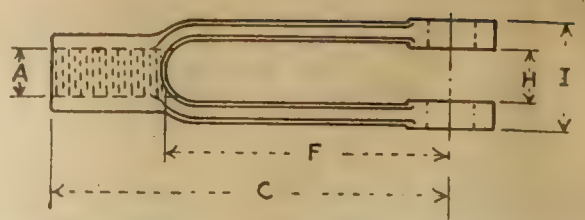
Two $\frac{33}{64}$-in. diameter bolt holes shall be located on or near the neutral axis of the frame section.

The first bolt-hole back from the spring eye may coincide with the first or second rivet hole.

In cases where the second bolt hole is to be used for mounting a shock absorbing device, the hole shall be located not more than $1\frac{7}{16}$ in. from the bottom of the frame channel at the nearest point.

The present S.A.E. standard for automobile bumper mountings specifies that the distance from the center of the bumper face to the ground shall be 21 in. for front bumpers and 22 in. for rear bumpers, the width of the bumper face, which shall be flat, to be 2 in. for front bumpers and 2½ in. for rear bumpers. The overall length of the bumper specified in both cases is from 59 to 60 in.

The Parts and Fittings Division recommends that the present S. A. E. standard for adjustable yokes be extended by the addition of a ½-in. adjustable yoke with a length of 3 in., the sizes to be classified as in the accompanying table.



Light Series Adjustable Yoke			Heavy Series Adjustable Yoke		
A	C	F	A	C	F
3/16—32	1 9/16	1	½—20	4 3/16	3 1/16
¼—28	2	1¼	⅝—18	4 15/16	3 11/16
5/16—24	2¼	1 7/16	¾—16	6⅛	4 9/16
⅜—24	2½	1⅝	⅞—14	7⅛	5¼
7/16—20	2⅞	1⅞	1 —14	8	6
½—20	3	1⅞			

Note: All other dimensions are the same as given in the table on page C9 of the S.A.E. HANDBOOK.

The Parts and Fittings Division recommends the accompanying table of plain steel washer size for adoption as S.A.E. standard:

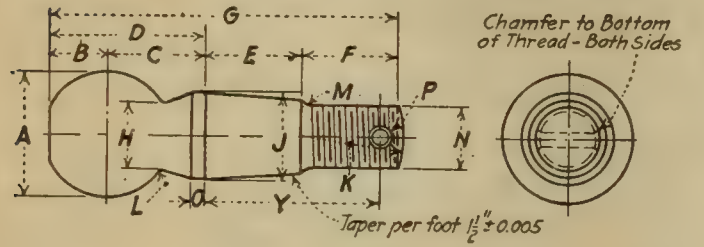
Plain Steel Washers

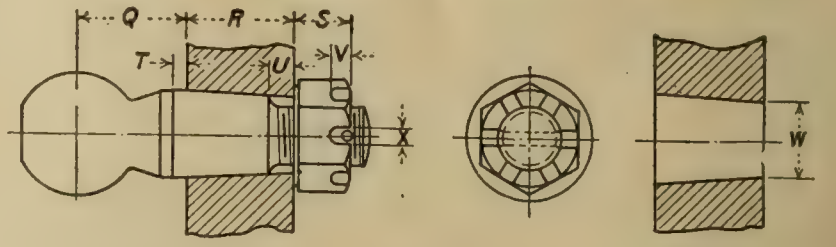
Bolt Diam.	Inside Diam.	Outside Diam.	Thickness ∓ 0.010	Bolt Diam.	Inside Diam.	Outside Diam.	Thickness ∓ 0.010
¼	9/32	5/8	1/16	¾	13/16	1½	⅛
5/16	11/32	11/16	1/16	⅞	15/16	1¾	⅛
⅜	13/32	13/16	1/16	1	1 1/16	2	⅛
7/16	15/32	15/16	1/16	1⅛	1 3/16	2¼	⅛
½	17/32	1 1/16	3/32	1¼	1 5/16	2½	3/32
9/16	19/32	1 3/16	3/32	1⅜	1 7/16	2¾	5/32
⅝	21/32	1 5/16	3/32	1½	1 9/16	3	5/32
11/16	23/32	1⅜	3/32				

[3] This dimension permits use of scrap stock. Washers shall be flat and free from burrs.

The Parts and Fittings Division recommends that the dimensions for ball studs specified in the accompanying table be adopted as S.A.E. recommended practice.

Table of Recommended Standard Dimensions for Ball Studs



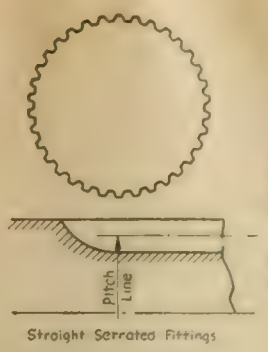


A Nom.	A Actual	B	C	D	E	F	G	H	J	K	L	M	N S.A.E. Thr'd.	O	P Drill No.	Q	R max.	R min.	S	T	U	V	W	X	Y
½	31/64 ±0.005	7/32	7/16	21/32	7/16	½	1 19/32	9/32	13/32 ±0.002	⅜	1/32	1/32	5/16—24	3/32	48	+0 9/16—3/64	19/32	33/64	17/64	+0 1/8—3/64	+0 13/64—3/64	3/32	0.329 ±0.001	3/64	23/32
⅝	39/64 ±0.005	9/32	9/16	27/32	9/16	½	1 29/32	11/32	15/32 ±0.002	½	3/64	1/32	5/16—24	3/32	48	+0 11/16—3/64	23/32	41/64	17/64	+0 1/8—3/64	+0 13/64—3/64	1/32	0.376 ±0.001	3/64	3 1/32
¾	47/64 ±0.005	5/16	⅝	15/16	⅝	9/16	2⅛	13/32	35/64 ±0.002	⅝	3/64	1/32	⅜—24	7/64	36	+0 25/32—3/64	25/32	43/64	21/64	+0 5/32—3/64	+0 13/64—3/64	1/8	0.446 ±0.001	1/8	1 3/64
⅞	55/64 ±0.005	⅜	11/16	1 1/16	11/16	¾	2	15/32	⅝ ±0.002	⅝	1/16	1/16	½—20	1/8	36	+0 55/64—3/64	29/32	25/32	7/16	+0 11/64—3/64	+0 17/64—3/64	9/64	0.509 ±0.001	1/8	1 5/16
1	31/32 ±0.010	7/16	¾	1 3/16	¾	¾	2 11/16	9/16	45/64 ±0.002	¾	1/16	1/16	½—20	1/8	36	+0 15/16—1/16	31/32	27/32	7/16	+0 3/16—1/16	+0 9/32—1/16	9/64	0.578 ±0.002	1/8	1 3/8
1⅛	1 3/32 ±0.010	½	27/32	1 11/32	27/32	29/32	3 3/32	⅝	25/32 ±0.002	1	1/16	1/16	⅝—18	5/32	28	+0 1 3/64—1/16	1 5/64	15/16	35/64	+0 13/64—1/16	+0 19/64—1/16	3/16	0.642 ±0.002	5/32	1 19/32
1¼	1 7/32 ±0.010	9/16	15/16	1½	15/16	29/32	3 11/32	11/16	⅞ ±0.002	1	3/32	1/16	⅝—18	5/32	28	+0 1⅛—1/16	1 11/64	1 3/64	35/64	+0 13/64—1/16	+0 19/64—1/16	3/16	0.725 ±0.002	5/32	1 11/16
1½	1 15/32 ±0.010	⅝	1⅛	1¾	1⅛	1 1/16	3 15/16	13/16	1 1/32 ±0.002	1¼	3/32	1/16	¾—16	3/16	28	+0 1 11/32—1/16	1 3/8	1 7/32	21/32	+0 7/32—1/16	+0 5/16—1/16	7/32	0.855 ±0.002	5/32	2
1¾	1 23/32 ±0.010	¾	1⅜	2⅛	1⅜	1 7/32	4 23/32	15/16	1 7/16 ±0.002	1¼	⅛	1/16	⅞—14	13/64	28	+0 1⅝—1/16	1 21/32	1 15/32	49/64	+0 ¼—1/16	+0 11/32—1/16	¼	1.039 ±0.002	5/32	2 25/64
2	1 15/16 ±0.015	⅞	1½	2⅜	1½	1 11/32	5 7/32	1⅛	1⅜ ±0.003	1½	⅛	1/16	1 —14	7/32	28	+0 1 25/32—5/64	1 25/32	1 27/64	⅞	+0 9/32—5/64	+0 23/64—5/64	¼	1.147 ±0.002	5/32	2 5/8
2¼	2 3/16 ±0.015	1	1 11/16	2 11/16	1 11/16	1½	5 7/8	1¼	1 9/16 ±0.003	2	⅛	3/32	1⅛—12	¼	11	+0 1 53/64—5/64	2 1/32	1 13/16	63/64	+0 19/64—5/64	+0 27/64—5/64	5/16	1.304 ±0.002	7/32	2 13/16
2½	2 7/16 ±0.015	1⅛	1⅞	3	1⅞	1⅝	6½	1⅜	1¾ ±0.003	2	3/16	3/32	1¼—12	11/64	11	+0 2 11/64—5/64	2 7/32	2	1 3/32	+0 19/64—5/64	+0 27/64—5/64	5/16	1.468 ±0.002	7/32	3 1/64
3	2 15/16 ±0.015	1¼	2¼	3½	2¼	1⅞	7⅝	1⅝	2 1/16 ±0.003	2½	3/16	3/32	1½—12	13/64	2	+0 2 37/64—5/64	2 19/32	2 13/32	1 5/16	+0 11/64—5/64	+0 27/64—5/64	3/8	1.733 ±0.002	1/4	3 13/64

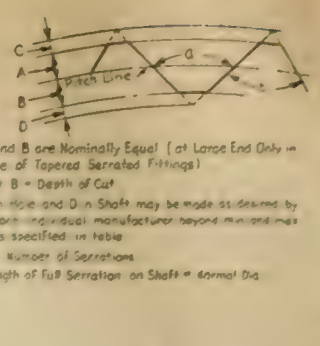
The Parts and Fittings Division recommends that the straight and taper shaft serrations shown in the accompanying illustrations and tables be adopted as S.A.E. recommended practice for serrated shaft fittings.

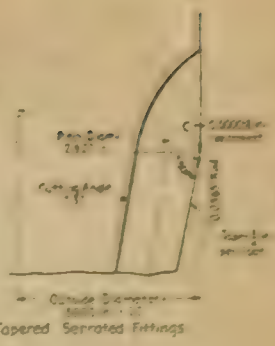
The Parts and Fittings Division recommends further:

That the present S.A.E. recommended practice for tank and radiator caps be extended by adding the note, "It is recom-



Straight Serrated Fittings




Tapered Serrated Fittings

STRAIGHT SERRATED FITTINGS

Nominal Diam.	Pitch Diam.		N	a^1 deg.	b^1 deg.	HOLE			SHAFT		
						Large Diam. Min.	Small Diam.		Outside Diam.		Inside Diam. Max.
	Max.	Min.					Max.	Min.	Max.	Min.	
⅛	0.122	0.120	36	90	80	0.125	0.118	0.117	0.124	0.123	0.116
3/16	0.182	0.180	36	90	80	0.187	0.176	0.175	0.186	0.185	0.174
¼	0.243	0.241	36	90	80	0.250	0.235	0.234	0.249	0.248	0.233
5/16	0.303	0.301	36	90	80	0.312	0.293	0.292	0.311	0.310	0.291
⅜	0.363	0.361	36	90	80	0.375	0.352	0.351	0.374	0.373	0.350
½	0.485	0.483	36	90	80	0.500	0.469	0.468	0.499	0.498	0.467
⅝	0.605	0.603	36	90	80	0.625	0.584	0.583	0.624	0.623	0.582
¾	0.733	0.731	48	90	82½	0.750	0.716	0.714	0.749	0.747	0.713
⅞	0.855	0.853	48	90	82½	0.875	0.835	0.833	0.874	0.872	0.832
1	0.977	0.975	48	90	82½	1.000	0.954	0.952	0.999	0.997	0.951
1⅛	1.098	1.096	48	90	82½	1.125	1.071	1.069	1.124	1.122	1.068
1¼	1.220	1.218	48	90	82½	1.250	1.190	1.188	1.249	1.247	1.187
1⅜	1.342	1.340	48	90	82½	1.375	1.309	1.307	1.374	1.372	1.306
1½	1.464	1.462	48	90	82½	1.500	1.428	1.426	1.499	1.497	1.425
1¾	1.708	1.706	48	90	82½	1.750	1.666	1.664	1.749	1.747	1.663
2	1.952	1.949	48	90	82½	2.000	1.904	1.902	1.999	1.997	1.901
2¼	2.196	2.193	48	90	82½	2.250	2.142	2.140	2.249	2.247	2.139
2½	2.440	2.437	48	90	82½	2.500	2.380	2.378	2.499	2.497	2.377
2¾	2.684	2.681	48	90	82½	2.750	2.618	2.616	2.749	2.747	2.615
3	2.928	2.925	48	90	82½	3.000	2.856	2.854	2.999	2.997	2.853

All dimensions in inches.

TAPERED SERRATED FITTINGS

Nominal Diam.	Pitch Diam.		N	a, deg.	b, deg.	HOLE			SHAFT		
						Large Diam. Min.	Small Diam.		Outside Diam.		Inside Diam. Max.
	Max.	Min.					Max.	Min.	Max.	Min.	
½	0.485	0.483	36	90	80	0.500	0.469	0.468	0.499	0.498	0.467
⅝	0.605	0.603	36	90	80	0.625	0.584	0.583	0.624	0.623	0.582
¾	0.733	0.731	36	90	80	0.750	0.716	0.714	0.749	0.747	0.713
⅞	0.855	0.853	36	90	80	0.875	0.835	0.833	0.874	0.872	0.832
1	0.977	0.975	36	90	80	1.000	0.954	0.952	0.999	0.997	0.951
1⅛	1.098	1.096	36	90	80	1.125	1.071	1.069	1.124	1.122	1.068
1¼	1.220	1.218	36	90	80	1.250	1.190	1.188	1.249	1.247	1.187
1⅜	1.342	1.340	36	90	80	1.375	1.309	1.307	1.374	1.372	1.306
1½	1.464	1.462	36	90	80	1.500	1.428	1.426	1.499	1.497	1.425
1¾	1.708	1.706	36	90	80	1.750	1.666	1.664	1.749	1.747	1.663
2	1.952	1.949	48	90	82½	2.000	1.904	1.902	1.999	1.997	1.901
2¼	2.196	2.193	48	90	82½	2.250	2.142	2.140	2.249	2.247	2.139
2½	2.440	2.437	48	90	82½	2.500	2.380	2.378	2.499	2.497	2.377
2¾	2.684	2.681	48	90	82½	2.750	2.618	2.616	2.749	2.747	2.615
3	2.928	2.925	48	90	82½	3.000	2.856	2.854	2.999	2.997	2.853

All dimensions in inches and apply to large end of taper only.
Taper ¾ in. per ft. on outside diameter.
Cutting Angle 1 deg. 37 min.

TABLE 1—ALLOWANCES AND TOLERANCES FOR SCREWS AND NUTS, CLASS IIA, FREE FIT

Threads Per In.	Allowance, In.	Pitch-Diameter Tolerances, In.	Lead,[1] In.	Half Angle, min. sec.
80	0.0000	0.0017	0.0005	2—50
72	0.0000	0.0018	0.0005	2—41
64	0.0000	0.0019	0.0005	2—23
56	0.0000	0.0020	0.0006	2—11
48	0.0000	0.0022	0.0006	2—04
44	0.0000	0.0023	0.0007	2—03
40	0.0000	0.0024	0.0007	1—52
36	0.0000	0.0025	0.0007	1—49
32	0.0000	0.0027	0.0008	1—41
28	0.0000	0.0031	0.0009	1—45
24	0.0000	0.0033	0.0009	1—32
20	0.0000	0.0036	0.0010	1—24
18	0.0000	0.0041	0.0012	1—26
16	0.0000	0.0045	0.0013	1—24
14	0.0000	0.0049	0.0014	1—20
13	0.0000	0.0052	0.0015	1—19
12	0.0000	0.0056	00.016	1—18
11	0.0000	0.0059	0.0017	1—15
10	0.0000	0.0064	0.0018	1—14
9	0.0000	0.0070	0.0020	1—13
8	0.0000	0.0076	0.0022	1—11
7	0.0000	0.0085	0.0024	1—09
6	0.0000	0.0101	0.0029	1—10
5	0.0000	0.0116	0.0033	1—07
4½	0.0000	0.0127	0.0037	1—06
4	0.0000	0.0140	0.0040	1—05

TABLE 2—ALLOWANCES AND TOLERANCES FOR SCREWS AND NUTS CLASS IIB, MEDIUM FIT

Threads Per In.	Allowance, In.	Pitch-Diameter Tolerances, In	Lead,[1] In.	Half Angle, min. sec.
80	0.0000	0.0013	0.0004	2—07
72	0.0000	0.0013	0.0004	1—54
64	0.0000	0.0014	0.0004	1—49
56	0.0000	0.0015	0.0004	1—41
48	0.0000	0.0016	0.0005	1—32
44	0.0000	0.0016	0.0005	1—24
40	0.0000	0.0017	0.0005	1—21
36	0.0000	0.0018	0.0005	1—17
32	0.0000	0.0019	0.0005	1—12
28	0.0000	0.0022	0.0006	1—13
24	0.0000	0.0024	0.0007	1—08
20	0.0000	0.0026	0.0008	1—02
18	0.0000	0.0030	0.0009	1—04
16	0.0000	0.0032	0.0009	1—01
14	0.0000	0.0036	0.0010	1—00
13	0.0000	0.0037	0.0011	0—57
12	0.0000	0.0040	0.0012	0—57
11	0.0000	0.0042	0.0012	0—55
10	0.0000	0.0045	0.0013	0—54
9	0.0000	0.0049	0.0014	0—52
8	0.0000	0.0054	0.0016	0—51
7	0.0000	0.0059	0.0017	0—49
6	0.0000	0.0071	0.0020	0—50
5	0.0000	0.0082	0.0024	0—48
4½	0.0000	0.0089	0.0026	0—47
4	0.0000	0.0097	0.0028	0—46

[1] Variation in lead between any two threads not farther apart than the length of engagement.

The tolerances specified for the pitch diameters are cumulative and include all errors of lead and angle. The full tolerance on the pitch diameter is therefore not available unless the lead and the angle of the thread are perfect. The last two columns give as general information the error in lead, per length of thread engaged, and in angle respectively that can each be compensated for by half the tolerance of the pitch diameter. If the lead and the angle error both exist to the amount tabulated, the pitch diameter of a bolt, for exampie, must be reduced by the full tolerance or it will not enter a basic nut or gage. If no lead error existed on such a bolt, the angle error could be twice that given, and conversely; but these extreme conditions are not contemplated as being desirable.

TABLE 3—CLASS IIA, FREE FIT, FOR SCREWS OF THE COARSE THREAD SERIES

Size	Threads Per Inch	Major Diameter			Pitch Diameter			Minor Diameter		
		Max.[1]	Tolerance	Min.	Max.[1]	Tolerance[2]	Min.	Max.[1]	Tolerance	Min.
1	64	0.0730	0.0038	0.0692	0.0629	0.0019	0.0610	0.0538	0.0030	0.0508
2	56	0.0860	0.0040	0.0820	0.0744	0.0020	0.0724	0.0641	0.0033	0.0608
3	48	0.0990	0.0044	0.0946	0.0855	0.0022	0.0833	0.0754	0.0037	0.0697
4	40	0.1120	0.0048	0.1072	0.0958	0.0024	0.0934	0.0813	0.0042	0.0771
5	40	0.1250	0.0048	0.1202	0.1088	0.0024	0.1064	0.0943	0.0042	0.0901
6	32	0.1380	0.0054	0.1326	0.1177	0.0027	0.1150	0.0997	0.0050	0.0947
8	32	0.1640	0.0054	0.1586	0.1437	0.0027	0.1410	0.1257	0.0050	0.1207
10	24	0.1900	0.0066	0.1834	0.1629	0.0033	0.1596	0.1389	0.0063	0.1326
12	24	0.2160	0.0066	0.2094	0.1889	0.0033	0.1856	0.1649	0.0063	0.1586
¼	20	0.2500	0.0072	0.2428	0.2175	0.0036	0.2139	0.1887	0.0073	0.1814
5/16	18	0.3125	0.0082	0.3043	0.2764	0.0041	0.2723	0.2443	0.0081	0.2362
3/8	16	0.3750	0.0090	0.3660	0.3344	0.0045	0.3299	0.2983	0.0090	0.2893
7/16	14	0.4375	0.0098	0.4277	0.3911	0.0049	0.3862	0.3499	0.0101	0.3398
½	13	0.5000	0.0104	0.4896	0.4500	0.0052	0.4448	0.4056	0.0107	0.3949
9/16	12	0.5625	0.0112	0.5513	0.5084	0.0056	0.5028	0.4603	0.0117	0.4486
5/8	11	0.6250	0.0118	0.6132	0.5660	0.0059	0.5601	0.5135	0.0125	0.5010
¾	10	0.7500	0.0128	0.7372	0.6850	0.0064	0.6786	0.6273	0.0136	0.6137
7/8	9	0.8750	0.0140	0.8610	0.8028	0.0070	0.7958	0.7387	0.0150	0.7237
1	8	1.0000	0.0152	0.9848	0.9188	0.0076	0.9112	0.8466	0.0166	0.8300
1⅛	7	1.1250	0.0170	1.1080	1.0322	0.0085	1.0287	0.9497	0.0188	0.9309
1¼		1.2500	0.0170	1.2330	1.1572	0.0085	1.1487	1.0747	0.0188	1.0559
1⅜	6	1.5000	0.0202	1.4798	1.3917	0.0101	1.3816	1.2955	0.0219	1.2734
1¾	5	1.7500	0.0232	1.7268	1.6201	0.0116	1.6085	1.5046	0.0260	1.4786
2	4½	2.0000	0.0254	1.9746	1.8557	0.0127	1.8430	1.7274	0.0288	1.6986
2¼	4½	2.2500	0.0254	2.2246	2.1057	0.0127	2.0930	1.9774	0.0288	1.9486
2½	4	2.5000	0.0280	2.4720	2.3376	0.0140	2.3236	2.1933	0.0321	2.1612
2¾	4	2.7500	0.0280	2.7220	2.5876	0.0140	2.5736	2.4433	0.0321	2.4112
3	4	3.0000	0.0280	2.9720	2.8376	0.0140	2.8236	2.6933	0.0321	2.6612

TABLE 4—CLASS IIA, FREE FIT, FOR NUTS OF THE COARSE THREAD SERIES

Size	Threads Per Inch	Major Diameter			Pitch Diameter			Minor Diameter		
		Min.[2]	Tolerance	Max.	Min.[1]	Tolerance[3]	Max.	Min.	Tolerance	Max.
1	64	0.0741	0.0031	0.0772	0.0629	0.0019	0.0648	0.0561	0.0017	0.0578
2	56	0.0873	0.0033	0.0906	0.0744	0.0020	0.0764	0.0667	0.0019	0.0686
3	48	0.1005	0.0037	0.1042	0.0855	0.0022	0.0877	0.0764	0.0023	0.0787
4	40	0.1138	0.0042	0.1180	0.0958	0.0024	0.0982	0.0849	0.0027	0.0876
5	40	0.1268	0.0042	0.1310	0.1088	0.0024	0.1112	0.0979	0.0027	0.1006
6	32	0.1403	0.0049	0.1452	0.1177	0.0027	0.1204	0.1042	0.0034	0.1076
8	32	0.1663	0.0049	0.1712	0.1437	0.0027	0.1464	0.1302	0.0034	0.1336
10	24	0.1930	0.0063	0.1993	0.1629	0.0033	0.1662	0.1449	0.0045	0.1494
12	24	0.2190	0.0063	0.2253	0.1889	0.0033	0.1922	0.1709	0.0045	0.1754
¼	20	0.2536	0.0072	0.2608	0.2175	0.0036	0.2211	0.1959	0.0054	0.2013
5/16	18	0.3165	0.0081	0.3246	0.2764	0.0041	0.2805	0.2524	0.0060	0.2584
3/8	16	0.3795	0.0090	0.3885	0.3344	0.0045	0.3389	0.3073	0.0068	0.3141
7/16	14	0.4427	0.0100	0.4527	0.3911	0.0049	0.3960	0.3602	0.0077	0.3679
½	13	0.5056	0.0107	0.5163	0.4500	0.0052	0.4552	0.4167	0.0084	0.4251
9/16	12	0.5685	0.0116	0.5801	0.5084	0.0056	0.5140	0.4723	0.0090	0.4813
5/8	11	0.6316	0.0124	0.6440	0.5660	0.0059	0.5719	0.5266	0.0098	0.5364
¾	10	0.7572	0.0136	0.7708	0.6850	0.0064	0.6914	0.6417	0.0109	0.6526
7/8	9	0.8830	0.0150	0.8980	0.8028	0.0070	0.8098	0.7547	0.0120	0.7667
1	8	1.0090	0.0166	1.0256	0.9188	0.0076	0.9264	0.8647	0.0135	0.8782
1⅛	7	1.1353	0.0188	1.1541	1.0322	0.0085	1.0407	0.9704	0.0154	0.9858
1¼	7	1.2603	0.0188	1.2791	1.1572	0.0085	1.1657	1.0954	0.0154	1.1108
1⅜	6	1.5120	0.0222	1.5342	1.3917	0.0101	1.4018	1.3196	0.0180	1.3376
1¾	5	1.7644	0.0261	1.7905	1.6201	0.0116	1.6317	1.5335	0.0216	1.5551
2	4½	2.0160	0.0288	2.0448	1.8557	0.0127	1.8684	1.7594	0.0241	1.7835
2¼	4½	2.2660	0.0288	2.2948	2.1057	0.0127	2.1184	2.0094	0.0241	2.0335
2½	4	2.5180	0.0321	2.5501	2.3376	0.0140	2.3516	2.2294	0.0270	2.2564
2¾	4	2.7680	0.0321	2.8001	2.5876	0.0140	2.6016	2.4794	0.0270	2.5064
3	4	3.0180	0.0321	3.0501	2.8376	0.0140	2.8516	2.7294	0.0270	2.7564

TABLE 5—CLASS IIB, MEDIUM FIT, FOR SCREWS OF THE COARSE THREAD SERIES

Size	Threads Per Inch	Major Diameter, in.			Pitch Diameter, in.			Minor Diameter, in.		
		Max.[1]	Tolerance	Min.	Max.[1]	Tolerance[3]	Min.	Max.[2]	Tolerance	Min.
1	64	0.0730	0.0028	0.0702	0.0629	0.0014	0.0615	0.0538	0.0025	0.0513
2	56	0.0860	0.0030	0.0830	0.0744	0.0015	0.0729	0.0641	0.0028	0.0613
3	48	0.0990	0.0032	0.0958	0.0855	0.0016	0.0839	0.0734	0.0031	0.0703
4	40	0.1120	0.0034	0.1086	0.0958	0.0017	0.0941	0.0813	0.0035	0.0778
5	40	0.1250	0.0034	0.1216	0.1088	0.0017	0.1071	0.0943	0.0035	0.0908
6	32	0.1380	0.0038	0.1342	0.1177	0.0019	0.1158	0.0997	0.0042	0.0955
8	32	0.1640	0.0038	0.1602	0.1437	0.0019	0.1418	0.1257	0.0042	0.1215
10	24	0.1900	0.0048	0.1852	0.1629	0.0024	0.1605	0.1389	0.0054	0.1335
12	24	0.2160	0.0048	0.2112	0.1889	0.0024	0.1865	0.1649	0.0054	0.1595
¼	20	0.2500	0.0052	0.2448	0.2175	0.0026	0.2149	0.1887	0.0063	0.1824
5/16	18	0.3125	0.0060	0.3065	0.2764	0.0030	0.2734	0.2443	0.0070	0.2373
3/8	16	0.3750	0.0064	0.3686	0.3344	0.0032	0.3312	0.2983	0.0076	0.2906
7/16	14	0.4375	0.0072	0.4303	0.3911	0.0036	0.3875	0.3499	0.0088	0.3411
½	13	0.5000	0.0074	0.4926	0.4500	0.0037	0.4463	0.4056	0.0092	0.3964
9/16	12	0.5625	0.0080	0.5545	0.5084	0.0040	0.5044	0.4603	0.0101	0.4502
5/8	11	0.6250	0.0084	0.6166	0.5660	0.0042	0.5618	0.5135	0.0108	0.5027
¾	10	0.7500	0.0090	0.7410	0.6850	0.0045	0.6805	0.6273	0.0117	0.6156
7/8	9	0.8750	0.0098	0.8652	0.8028	0.0049	0.7979	0.7387	0.0129	0.7258
1	8	1.0000	0.0108	0.9892	0.9188	0.0054	0.9134	0.8466	0.0144	0.8322
1⅛	7	1.1250	0.0118	1.1132	1.0322	0.0059	1.0263	0.9497	0.0162	0.9335
1¼	7	1.2500	0.0118	1.2382	1.1572	0.0059	1.1513	1.0747	0.0162	1.0585
1⅜	6	1.5000	0.0142	1.4858	1.3917	0.0071	1.3846	1.2955	0.0191	1.2764
1¾	5	1.7500	0.0164	1.7336	1.6201	0.0082	1.6119	1.5056	0.0216	1.4820
2	4½	2.0000	0.0178	1.9822	1.8557	0.0089	1.8468	1.7274	0.0250	1.7024
2¼	4½	2.2500	0.0178	2.2322	2.1057	0.0089	2.0968	1.9774	0.0250	1.9524
2½	4	2.5000	0.0194	2.4806	2.3376	0.0097	2.3279	2.1933	0.0278	2.1655
2¾	4	2.7500	0.0194	2.7306	2.5876	0.0097	2.5779	2.4433	0.0278	2.4155
3	4	3.0000	0.0194	2.9806	2.8376	0.0097	2.8279	2.6933	0.0278	2.6655

TABLE 6—CLASS IIB, MEDIUM FIT, FOR NUTS OF THE COARSE THREAD SERIES

Size	Threads Per Inch	Major Diameter			Pitch Diameter			Minor Diameter		
		Min.[2]	Tolerance	Max.	Min.[1]	Tolerance[3]	Max.	Min.	Tolerance	Max.
1	64	0.0741	0.0026	0.0767	0.0629	0.0014	0.0643	0.0561	0.0017	0.0578
2	56	0.0873	0.0028	0.0901	0.0744	0.0015	0.0759	0.0667	0.0019	0.0686
3	48	0.1005	0.0031	0.1036	0.0855	0.0016	0.0871	0.0764	0.0023	0.0787
4	40	0.1138	0.0035	0.1173	0.0958	0.0017	0.0975	0.0949	0.0027	0.0876
5	40	0.1268	0.0035	0.1303	0.1088	0.0017	0.1105	0.0979	0.0027	0.1006
6	32	0.1403	0.0041	0.1444	0.1177	0.0019	0.1196	0.1042	0.0034	0.1076
8	32	0.1663	0.0041	0.1704	0.1437	0.0019	0.1456	0.1302	0.0034	0.1336
10	24	0.1930	0.0054	0.1984	0.1629	0.0024	0.1653	0.1449	0.0045	0.1494
12	24	0.2190	0.0054	0.2244	0.1889	0.0024	0.1913	0.1709	0.0045	0.1754
¼	20	0.2536	0.0062	0.2598	0.2175	0.0026	0.2201	0.1959	0.0054	0.2013
5/16	18	0.3165	0.0070	0.3235	0.2764	0.0030	0.2794	0.2524	0.0060	0.2584
3/8	16	0.3795	0.0077	0.3872	0.3344	0.0032	0.3376	0.3073	0.0068	0.3141
7/16	14	0.4427	0.0087	0.4514	0.3911	0.0036	0.3947	0.3602	0.0077	0.3679
½	13	0.5056	0.0092	0.5148	0.4500	0.0037	0.4537	0.4167	0.0084	0.4251
9/16	12	0.5685	0.0100	0.5785	0.5084	0.0040	0.5124	0.4723	0.0090	0.4813
5/8	11	0.6316	0.0107	0.6423	0.5660	0.0042	0.5702	0.5266	0.0098	0.5364
¾	10	0.7572	0.0117	0.7689	0.6850	0.0045	0.6895	0.6417	0.0109	0.6526
7/8	9	0.8830	0.0129	0.8959	0.8028	0.0049	0.8077	0.7547	0.0120	0.7667
1	8	1.0090	0.0144	1.0234	0.9188	0.0054	0.9242	0.8647	0.0135	0.8782
1⅛	7	1.1353	0.0162	1.1515	1.0322	0.0059	1.0381	0.9704	0.0154	0.9858
1¼	7	1.2603	0.0162	1.2765	1.1572	0.0059	1.1631	1.0954	0.0154	1.1108
1⅜	6	1.5120	0.0192	1.5312	1.3917	0.0071	1.3988	1.3196	0.0180	1.3376
1¾	5	1.7644	0.0227	1.7871	1.6201	0.0082	1.6283	1.5335	0.0216	1.5551
2	4½	2.0160	0.0250	2.0410	1.8557	0.0089	1.8646	1.7594	0.0241	1.7835
2¼	4½	2.2660	0.0250	2.2910	2.1057	0.0089	2.1146	2.0094	0.0241	2.0335
2½	4	2.5180	0.0278	2.5458	2.3376	0.0097	2.3473	2.2294	0.0270	2.2564
2¾	4	2.7680	0.0278	2.7958	2.5876	0.0097	2.5973	2.4794	0.0270	2.5064
3	4	3.0180	0.0278	3.0458	2.8376	0.0097	2.8473	2.7294	0.0270	2.7564

[1]Basic diameters. [2]Dimensions given are figured to the intersection of the worn tool arc with a centerline through crest and root.
[3]The tolerances specified for the pitch diameter are cumulative and include all errors of lead and angle

mended that on passenger cars, motor trucks and tractors gasoline tank filler pipes have a minimum clear opening of 2 in. in diameter."

That the present S.A.E. standard be extended to include the accompanying temper and toughness tests.

Temper Test. — After compressing the lock washer to flat, the reaction shall be sufficient to indicate necessary spring power, and on a subsequent compression to flat the lock washer shall manifest no appreciable loss in reaction.

Toughness Test.—Forty-five per cent of the lock washer, including one end, shall be secured firmly in a vise, and 45 per cent, including the other end, shall be secured firmly between parallel jaws of a wrench. Movement of wrench at right angles to the helical curve shall twist the lock washer through 45 deg. without it showing signs of fracturing, and shall twist the lock washer entirely apart within 135 deg.

The Screw Threads Division recommends that the present S.A.E. standard for screw threads be extended to include the accompanying Tables Nos. 1 to 7 inclusive, together with the following definitions.

Class II B—Medium Fit.—This class of screw threads shall be defined and specified as follows:

(1) Minimum nut is basic.
(2) Maximum screw is basic.
(3) Direction of tolerance on nut. The tolerance on the nut shall be plus.
(4) Direction of tolerance on screw. The tolerance on the screw shall be minus.
(5) Zero allowance. The allowance between the pitch diameter of the maximum screw and the minimum nut shall be zero for all pitches and all diameters.
(6) Tolerance values. The tolerances for a screw or nut of a given pitch shall be as specified in Table 3.

Class II A—Free Fit.—This class of screw threads shall be defined and specified as follows:

(1) Minimum nut is basic.
(2) Maximum screw is basic.
(3) Direction of tolerance on nut. The tolerance on the nut shall be plus.
(4) Direction of tolerance on screw. The tolerance on the screw shall be minus.
(5) Zero allowance. The allowance between the pitch diameter of the maximum screw and the minimum nut shall be zero for all pitches and all diameters.
(6) Tolerance values. The tolerances for a screw or nut of a given pitch shall be specified in Table 2.

TABLE 7—CLASS IIA, FREE FIT, FOR SCREWS OF THE FINE THREAD SERIES

Size	Threads Per Inch	Major Diameter			Pitch Diameter			Minor Diameter		
		Max.[1]	Tolerance	Min.	Max.[1]	Tolerance[3]	Min.	Max.[2]	Tolerance	Min.
0	80	0.0600	0.0034	0.0566	0.0519	0.0017	0.0502	0.0447	0.0026	0.0421
1	72	0.0730	0.0036	0.0694	0.0640	0.0018	0.0622	0.0560	0.0028	0.0532
2	64	0.0860	0.0038	0.0822	0.0759	0.0019	0.0740	0.0668	0.0030	0.0638
3	56	0.0990	0.0040	0.0950	0.0874	0.0020	0.0854	0.0771	0.0033	0.0738
4	48	0.1120	0.0044	0.1076	0.0985	0.0022	0.0963	0.0864	0.0037	0.0827
5	44	0.1250	0.0046	0.1204	0.1102	0.0023	0.1079	0.0971	0.0039	0.0932
6	40	0.1380	0.0048	0.1332	0.1218	0.0024	0.1194	0.1073	0.0042	0.1031
8	36	0.1640	0.0050	0.1590	0.1460	0.0025	0.1435	0.1299	0.0045	0.1254
10	32	0.1900	0.0054	0.1846	0.1697	0.0027	0.1670	0.1517	0.0050	0.1467
12	28	0.2160	0.0062	0.2098	0.1928	0.0031	0.1897	0.1722	0.0057	0.1665
¼	28	0.2500	0.0062	0.2438	0.2268	0.0031	0.2237	0.2062	0.0057	0.2005
5/16	24	0.3125	0.0066	0.3059	0.2854	0.0033	0.2821	0.2614	0.0063	0.2551
⅜	24	0.3750	0.0066	0.3684	0.3479	0.0033	0.3446	0.3239	0.0063	0.3176
7/16	20	0.4375	0.0072	0.4303	0.4050	0.0036	0.4014	0.3762	0.0073	0.3689
½	20	0.5000	0.0072	0.4928	0.4675	0.0036	0.4639	0.4387	0.0073	0.4314
9/16	18	0.5625	0.0082	0.5543	0.5264	0.0041	0.5243	0.4943	0.0081	0.4862
⅝	18	0.6250	0.0082	0.6168	0.5889	0.0041	0.5848	0.5568	0.0081	0.5487
¾	16	0.7500	0.0090	0.7410	0.7094	0.0045	0.7049	0.6733	0.0090	0.6643
⅞	14	0.8750	0.0098	0.8652	0.8286	0.0049	0.8237	0.7874	0.0101	0.7733
1	14	1.0000	0.0098	0.9902	0.9536	0.0049	0.9487	0.9124	0.0101	0.9023
1⅛	12	1.1250	0.0112	1.1138	1.0709	0.0056	1.0653	1.0228	0.0117	1.0111
1¼	12	1.2500	0.0112	1.2388	1.1959	0.0056	1.1903	1.1478	0.0117	1.1361
1½	12	1.5000	0.0112	1.4888	1.4459	0.0056	1.4403	1.3978	0.0117	1.3861

[1] Basic diameters.
[2] Dimensions given are figured to the intersection of the worn tool arc with a centerline through crest and root.
[3] The tolerances specified for the pitch diameter are cumulative and include all errors of lead and angle.

TABLE 8—CLASS IIA FREE FIT FOR NUTS OF THE FINE THREAD SERIES

Size	Threads Per Inch	Major Diameter			Pitch Diameter			Minor Diameter		
		Min.[2]	Tolerance	Max.	Min.[1]	Tolerance[3]	Max.	Min.	Tolerance	Max.
0	80	0.0609	0.0024	0.0635	0.0519	0.0017	0.0536	0.0465	0.0013	0.0478
1	72	0.0740	0.0028	0.0768	0.0640	0.0018	0.0658	0.0580	0.0015	0.0595
2	64	0.0871	0.0031	0.0902	0.0759	0.0019	0.0778	0.0691	0.0017	0.0708
3	56	0.1003	0.0033	0.1036	0.0874	0.0020	0.0894	0.0797	0.0019	0.0816
4	48	0.1135	0.0037	0.1172	0.0985	0.0022	0.1007	0.0894	0.0023	0.0917
5	44	0.1266	0.0040	0.1306	0.1102	0.0023	0.1125	0.1004	0.0025	0.1029
6	40	0.1398	0.0042	0.1440	0.1218	0.0024	0.1242	0.1109	0.0027	0.1136
8	36	0.1660	0.0045	0.1705	0.1460	0.0025	0.1485	0.1339	0.0030	0.1369
10	32	0.1923	0.0049	0.1972	0.1697	0.0027	0.1724	0.1562	0.0034	0.1596
12	28	0.2186	0.0057	0.2243	0.1928	0.0031	0.1959	0.1773	0.0039	0.1812
¼	28	0.2526	0.0057	0.2583	0.2268	0.0031	0.2299	0.2113	0.0039	0.2152
5/16	24	0.3155	0.0063	0.3218	0.2854	0.0033	0.2887	0.2674	0.0045	0.2719
⅜	24	0.3780	0.0063	0.3843	0.3479	0.0033	0.3512	0.3299	0.0045	0.3344
7/16	20	0.4411	0.0072	0.4483	0.4050	0.0036	0.4086	0.3834	0.0054	0.3888
½	20	0.5036	0.0072	0.5108	0.4675	0.0036	0.4711	0.4459	0.0054	0.4513
9/16	18	0.5665	0.0081	0.5746	0.5264	0.0041	0.5305	0.5024	0.0060	0.5084
⅝	18	0.6290	0.0081	0.6371	0.5889	0.0041	0.5930	0.5649	0.0060	0.5709
¾	16	0.7545	0.0090	0.7635	0.7094	0.0045	0.7139	0.6823	0.0068	0.6891
⅞	14	0.8802	0.0100	0.8902	0.8286	0.0049	0.8335	0.7977	0.0077	0.8054
1	14	1.0052	0.0100	1.0152	0.9536	0.0049	0.9585	0.9227	0.0077	0.9304
1⅛	12	1.1310	0.0116	1.1426	1.0709	0.0056	1.0765	1.0348	0.0090	1.0438
1¼	12	1.2560	0.0116	1.2676	1.1959	0.0056	1.2015	1.1598	0.0090	1.1688
1½	12	1.5060	0.0116	1.5176	1.4453	0.0056	1.4515	1.4098	0.0090	1.4188

[1] Basic diameters.
[2] Dimensions given are figured to the intersection of the worn tool arc with a centerline through crest and root.
[3] The tolerances specified for the pitch diameter are cumulative and include all errors of lead and angle.

TABLE 9—CLASS IIB MEDIUM FIT FOR SCREWS OF THE FINE THREAD SERIES

Size	Threads Per Inch	Major Diameter			Pitch Diameter			Minor Diameter		
		Max.[1]	Tolerance	Min.	Max.[1]	Tolerance[3]	Min	Max.[2]	Tolerance	Min.
0	80	0.0600	0.0026	0.0574	0.0519	0.0013	0.0506	0.0447	0.0022	0.0425
1	72	0.0730	0.0026	0.0704	0.0640	0.0013	0.0627	0.0580	0.0022	0.0537
2	64	0.0860	0.0028	0.0832	0.0759	0.0014	0.0745	0.0668	0.0022	0.0643
3	56	0.0990	0.0030	0.0960	0.0874	0.0015	0.0859	0.0771	0.0022	0.0743
4	48	0.1120	0.0032	0.1088	0.0985	0.0016	0.0969	0.0864	0.0031	0.0833
5	44	0.1250	0.0032	0.1218	0.1102	0.0016	0.1086	0.0971	0.0032	0.0939
6	40	0.1380	0.0034	0.1346	0.1218	0.0017	0.1201	0.1073	0.0035	0.1038
8	36	0.1640	0.0036	0.1604	0.1460	0.0018	0.1442	0.1299	0.0038	0.1261
10	32	0.1900	0.0038	0.1862	0.1697	0.0019	0.1678	0.1517	0.0042	0.1475
12	28	0.2160	0.0044	0.2116	0.1928	0.0022	0.1906	0.1722	0.0048	0.1674
¼	28	0.2500	0.0044	0.2456	0.2268	0.0022	0.2246	0.2062	0.0048	0.2014
5/16	24	0.3125	0.0048	0.3077	0.2854	0.0024	0.2830	0.2614	0.0054	0.2560
⅜	24	0.3750	0.0048	0.3702	0.3479	0.0024	0.3455	0.3239	0.0054	0.3185
7/16	20	0.4375	0.0052	0.4323	0.4050	0.0026	0.4024	0.3762	0.0063	0.3699
½	20	0.5000	0.0052	0.4948	0.4675	0.0026	0.4649	0.4387	0.0063	0.4324
9/16	18	0.5625	0.0060	0.5565	0.5264	0.0030	0.5234	0.4943	0.0070	0.4873
⅝	18	0.6250	0.0060	0.6190	0.5889	0.0030	0.5859	0.5568	0.0070	0.5498
¾	16	0.7500	0.0064	0.7436	0.7094	0.0032	0.7062	0.6733	0.0077	0.6656
⅞	14	0.8750	0.0072	0.8678	0.8286	0.0036	0.8250	0.7874	0.0088	0.7786
1	14	1.0000	0.0072	0.9928	0.9536	0.0036	0.9500	0.9124	0.0088	0.9036
1⅛	12	1.1250	0.0080	1.1170	1.0709	0.0040	1.0669	1.0228	0.0101	1.0127
1¼	12	1.2500	0.0080	1.2420	1.1959	0.0040	1.1919	1.1478	0.0101	1.1377
1½	12	1.5000	0.0080	1.4920	1.4459	0.0040	1.4419	1.3978	0.0101	1.3877

[1] Basic diameters.
[2] Dimensions given are figured to the intersection of the worn tool arc with a centerline through crest and root.
[3] The tolerances specified for the pitch diameter are cumulative and include all errors of lead and angle.

TABLE 10—CLASS IIB MEDIUM FIT FOR NUTS OF THE FINE THREAD SERIES

Size	Threads Per Inch	Major Diameter			Pitch Diameter			Minor Diameter		
		Min.[2]	Tolerance	Max.	Min.[1]	Tolerance[3]	Max.	Min.	Tolerance	Max
0	80	0.0609	0.0022	0.0631	0.0519	0.0013	0.0532	0.0465	0.0013	0.0478
1	72	0.0740	0.0023	0.0763	0.0640	0.0013	0.0653	0.0580	0.0015	0.0595
2	64	0.0871	0.0026	0.0897	0.0759	0.0014	0.0773	0.0691	0.0017	0.0708
3	56	0.1003	0.0028	0.1031	0.0874	0.0015	0.0889	0.0797	0.0019	0.0816
4	48	0.1135	0.0031	0.1166	0.0985	0.0016	0.1001	0.0894	0.0023	0.0917
5	44	0.1266	0.0033	0.1299	0.1102	0.0016	0.1118	0.1004	0.0025	0.1029
6	40	0.1398	0.0035	0.1433	0.1218	0.0017	0.1235	0.1109	0.0027	0.1136
8	36	0.1660	0.0038	0.1698	0.1460	0.0018	0.1478	0.1339	0.0030	0.1369
10	32	0.1923	0.0041	0.1961	0.1697	0.0019	0.1716	0.1562	0.0034	0.1596
12	28	0.2186	0.0048	0.2234	0.1928	0.0022	0.1950	0.1773	0.0029	0.1812
¼	28	0.2526	0.0048	0.2574	0.2268	0.0022	0.2290	0.2113	0.0039	0.2152
5/16	24	0.3155	0.0054	0.3209	0.2854	0.0024	0.2878	0.2674	0.0045	0.2719
⅜	24	0.3780	0.0054	0.3834	0.3479	0.0024	0.3503	0.3299	0.0045	0.3344
7/16	20	0.4411	0.0062	0.4473	0.4050	0.0026	0.4076	0.3834	0.0054	0.3888
½	20	0.5036	0.0062	0.5098	0.4675	0.0026	0.4701	0.4459	0.0054	0.4513
9/16	18	0.5665	0.0070	0.5735	0.5264	0.0030	0.5294	0.5024	0.0060	0.5084
⅝	18	0.6290	0.0070	0.6360	0.5889	0.0030	0.5919	0.5649	0.0060	0.5709
¾	16	0.7545	0.0077	0.7622	0.7094	0.0032	0.7126	0.6823	0.0068	0.6891
⅞	14	0.8802	0.0087	0.8889	0.8286	0.0036	0.8322	0.7977	0.0077	0.8054
1	14	1.0052	0.0087	1.0139	0.9536	0.0036	0.9572	0.9227	0.0077	0.9304
1⅛	12	1.1310	0.0100	1.1410	1.0709	0.0040	1.0749	1.0348	0.0090	1.0438
1¼	12	1.2560	0.0100	1.2660	1.1959	0.0040	1.1999	1.1598	0.0090	1.1688
1½	12	1.5060	0.0100	1.5160	1.4459	0.0040	1.4499	1.4098	0.0090	1.4188

[1] Basic diameters.
[2] Dimensions given are figured to the intersection of the worn tool arc with a centerline through crest and root.
[3] The tolerances specified for the pitch diameter are cumulative and include all errors of lead and angle.

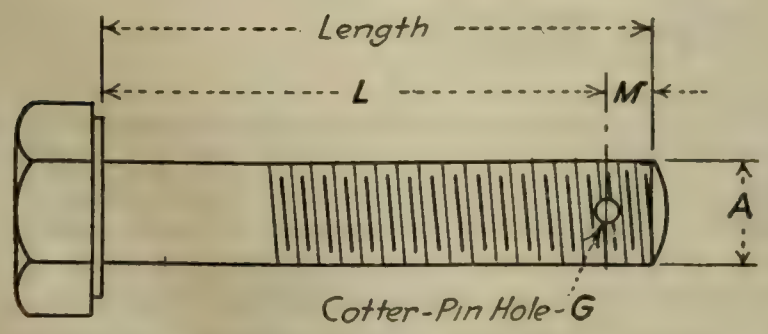
The Screw Threads Division recommends that the explanatory text in the S.A.E. standard for screws, bolts and nuts be revised and extended to read:

The length of the effective thread of screws and bolts shall be: $D \times 1.5 + \frac{1}{4}$ in. As bolts and screws conforming to these specifications are primarily intended for use with nuts, the oval end is not included in the nominal length.

All heads and nuts shall be semi-finished. All screws and nuts shall be made of steel.

Unless otherwise specified, S.A.E. standard screws, bolts and nuts will be made to Class II A (free fits) as specified in the (proposed) S.A.E. standard for screw threads.

S.A.E. standard bolts without slots or cotter pin holes are obtainable in stock. If slots, cotter pin holes or case hardening are desired, these should be specified by the purchaser.



Cotter-pin holes shall be located by dimension *L*

A†	*G*†	*M*	*A*†	*G*†	*M*	*A*†	*G*†	*M*
¼–28	5/64	3/32	9/16–18	5/32	9/64	1 –14	5/32	3/16
5/16–24	5/64	3/32	⅝–18	5/32	5/32	1⅛–12	7/32	7/32
⅜–24	⅛	7/64	11/16–16	5/32	5/32	1¼–12	7/32	7/32
7/16–20	⅛	7/64	¾–16	5/32	3/16	1⅜–12	¼	¼
½–20	5/32	⅛	⅞–16	5/32	3/16	1½–12	¼	¼

The Screw Threads Division recommends that the accompanying table indicating cotter pin locations be added to the present S. A. E. standard of screws, bolts and nuts.

The Springs Division recommends that the present S. A. E. recommended practice for spring eye bushing and bolt tolerances be revised by the elimination of the bolt tolerances, the title of the recommended practice to be changed to "spring eye bushings."

The Division also recommends the adoption of the following definitions as S.A.E. standard:

Definitions

Deflection.—The amount of travel of a spring under the application of a specified load, expressed as inches per pound.

Flexibility.—The flexing characteristics of a spring, determined by the weight which will deflect it 1 in. expressed as pounds per inch.

Composite Springs.—Springs made of leaves (or plates), one or more of which are of alloy steel and the rest of carbon steel.

Unsprung Weight.—The total weight of all parts not supported on the springs, including axles, wheels, rims and tires complete.

Rated Load.—The load which the vehicle manufacturer specifies shall be carried by the springs at a given spring height.

Load Clearance.—The maximum distance through which a spring can travel beyond its rated load position, before striking.

Load Height.—The distance from a line through the center of the spring eyes to the face of the axle pad, when the spring is deflected to rated load.

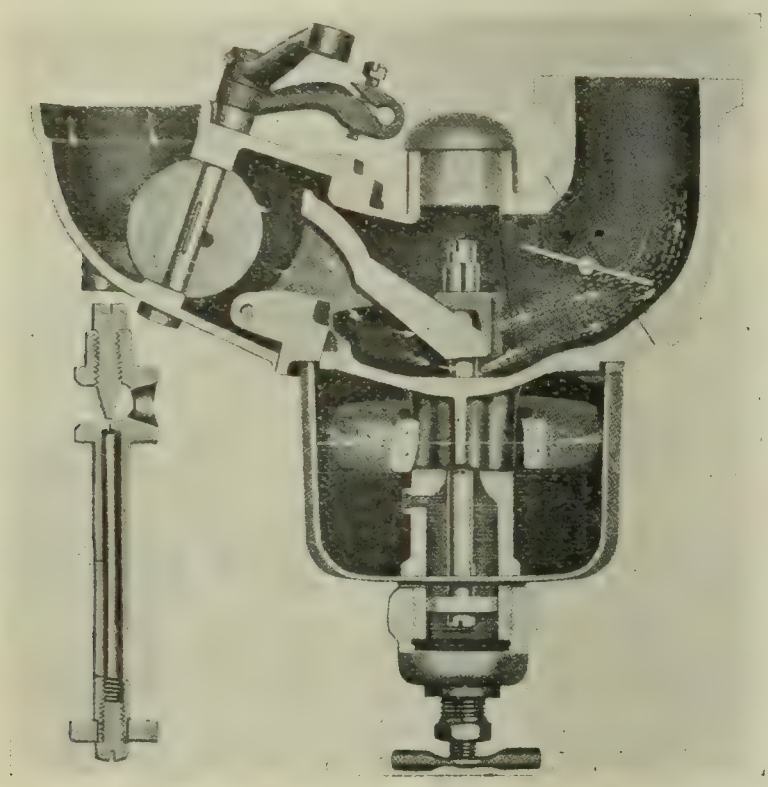
Load Length.—The distance between the centers of the spring eyes when the spring is deflected to rated load.

Free Height.—The distance from a line through the center of the spring eyes to the face of the axle pad, when the spring is in a free, unloaded position.

The Division recommends further that the present S.A.E. recommended practice for frame brackets for springs be cancelled.

An Air-Shutter Type Carbureter

A SIMPLE type of carbureter which varies from certain more or less conventional types chiefly in the use of an interconnected air shutter and tapered metering pin is being produced by the Briscoe Devices Corp. under the name of Scoe.



Sectional views of Scoe carbureter showing detail of metering pin

The body of the carbureter is diecast and contains the shutter and metering device as well as the throttle and choke. The passage between the shutter and the lower wall of the air passage forms an approximation to a venturi with its throat variable at a point adjacent to the nozzle, where the high velocity promotes atomization of the fuel. As the shutter rises, with increase in the quantity of air passing, the shutter opens and in so doing raises the tapered metering pin, thereby increasing the area of one fuel jet.

The metering pin is hollow and has near its upper end an orifice which can be partly covered by the flat end of a screw which controls the idling adjustment. Fuel which issues from this orifice enters the hollow stem of the pin through two small passages which are submerged in the fuel in the float chamber at light loads and idling. At higher speeds the lower hole is covered by the guide as the pin rises. The holes are of such size that the idling jet furnishes less and less fuel as the pin rises and the air flow increases, while the reverse is true of the jet, the size of which is controlled by the taper milled on the side of the metering pin. The latter can be given any desired slope, so that the mixture proportions for any given position of the pin can be varied as desired.

The carbureter is usually supplied with a metering pin, so shaped as to give a rich mixture for idling, a still richer mixture for low speed heavy pulling and acceleration, a lean mixture for the light load conditions of average running and a fairly rich mixture for maximum power at high speeds.

From the accompanying cut it will be noted that the metering pin is fitted at its lower end with a submerged disk, giving a dashpot action to prevent sudden change in position. The float is of laminated cork, coated with collodion and fitted with a valve of Monel metal. The metering pin is said to be the only element which requires close limits in machining, so that the cost of production is relatively low.

Stanley Producing New Model

THE Stanley Motor Carriage Co. is now in production on a new model, to be known as Model 740, which embodies a number of changes in body and chassis and an increase of $100 in the price of both open and closed types. Among the more important chassis changes may be mentioned an increase in boiler height of 4 in. with a consequent increase of 30 per cent in heating surface and 50 per cent in power storage capacity. The water level regulator is so set as to increase the normal height of water from 8 to 12 in. The rear axle is provided with a larger drive shaft and bearings and the wheels are secured with keys in place of the taper square formerly used. The area of braking surface has been increased 60 per cent, and condenser capacity about 8 per cent.

The throttle is now mounted so that it can be removed without disturbing the boiler cover and is operated by a lever arranged to give a more gradual opening than formerly. A number of improvements in the lubricating system have been made and a basket-type filter is now used in the fuel line. The main burner pressure system now includes but one tank, and its capacity is doubled.

Body lines are more pleasing and the car is lower hung, due to the use of 32 x 4½-in. tires, while the lower set top adds to the appearance. The new instrument board provides for a more compact location of the instruments and the barrel type head lamps are more rigidly mounted. Body models include 5 and 7-passenger phaetons, 2-passenger roadster, 7-passenger sedan and 4-passenger brougham.

Truck Market in Brazil Expanding Rapidly

The vast natural resources as well as the leading products of the country need transportation to be utilized. Lack of transportation facilities has focused attention on the motor truck. More bus lines needed to supplement the street railways. Various projects are now under consideration.

By Floriano P. Santos*

THE difficulties that were encountered a few years ago in introducing and fostering the motor truck in Brazil is now a thing of the past. The motor truck business has entered a new phase of development with brilliant prospects for its success. The factors most propitious to furthering the use of motor trucks are the increasing volume of Brazilian commerce and the general advancement of our industrial and commercial activities during the past few years.

The enormous riches, still untouched, that exist in the central part of western Brazil are known to most persons visiting our country. These resources cannot be exploited unless means of communication are established so that there may be suitable outlets to the east and west coasts of South America.

The mining industry demands better and more abundant means of transportation, to move the coal, manganese, gold and other minerals. The backbone of the Brazilian economic body, represented by the leading product, coffee, is handicapped, according to authoritative reports, to the extent of 40,000,000 pounds yearly, chiefly because of the lack of proper means of transport. This loss is reckoned at about 1,000,000 contos.

Our farmers and mining and business men, whether their holdings be large or small, are beginning to understand that railroads, as the only means of transportation, are insufficient. They are beginning to appreciate the efficiency of motor trucks as a modern substitute to the old-fashioned beasts of burden and wooden carts. The modern motor truck represents economical operation. It does not destroy the roads and it transports a larger volume of freight.

The great lack of transportation is a fact becoming known to all and it is realized more and more that the solution of the problem lies in the use of motor trucks, which are useful on the farms, in the rural districts, cities and almost everywhere. In Sao Paulo and Rio de Janeiro, the use of motor trucks has become generalized to such an extent that scarcely a commercial firm is found without one or more of these vehicles. They are used for delivery purposes as well as for general transportation, being mostly three-quarter or one-ton size.

The sale of small trucks of light weight is quite considerable. They operate at a smaller cost and comply with requirements for small loads. In the principal cities moving companies are using motor vans and there are numerous other uses to which they are being put.

In the interior several companies are engaged in the transportation of passengers and freight by means of motor buses. Among the leading companies so engaged are the Barretos, Cantanduva, Rio Claro and Limeira companies in the state of Sao Paulo and the Cia. Auto Viacao Intermunicipal de Sul of Minas Geraes. In Santos, state of Sao Paulo, there is also a motor bus line, using 1-ton trucks, for the transportation of passengers from Ponte-Pencil to Forte da Praia Grande.

Notwithstanding the developments outlined, the motor truck business is now in its stage of evolution. It is being studied in all directions. Its outlook is promising and we are confident that its brilliant prospects will be materialized in the near future. The need of better and more abundant transportation is of utmost importance throughout the Republic and the answer is to use motor trucks.

At present there is under consideration a project to enlarge the city of Sao Paulo by utilizing vast stretches of land in the outskirts. These lands will be utilized for home building and the project should solve the housing shortage with which the city has been contending for the past few years. House construction on these properties would, of course, greatly increase the value of the real estate and the various towns which can be built within a short distance of the city would become prosperous if transportation were provided.

The street railway company cannot extend lines to the proposed towns, because of certain privileges already granted to some railroad companies, such as the Sao Paulo Railway Company, Estrada de Ferro Central do Brazil and Estrada de Ferro Sorocabana. Because of the fact that some of the best municipal highways and some fine private roads cut through the sites of these projected suburbs, the opportunity for using motorbuses is readily apparent. Several companies are organizing a project to institute the required bus lines.

It is probably advisable to organize several transportation lines. The first one probably should be that of Sao Bernardo, to cover the road from Sao Paulo to Alto da Serra, on the Sao Paulo-Santos highway. The initial capital required for the Sao Bernardo plan was estimated at Rs. 100,000,000 (about $14,000 at current exchange), so as to provide the proper equipment, and reports on the proposal have been made to the interested persons. Offers have been made of free land for the installation of the company's establishment at Villa de Sao Bernardo and the proposal has aroused great enthusiasm among all persons interested in the development of these towns. It is confidently felt that the proposition will materialize soon and here there will be a great field for the application of motor trucks.

*Sales manager of Dias, Carneiro & Cia, representatives for several American automotive lines at Sao Paulo, Brazil.



Research Necessary to Automotive Development

THE different types of research may be summarized as:

(1) Scientific research.
(2) Technical research.
(3) Developmental research.

Any attempt to classify types of research reveals the fact that one merges into the other, and any division is a more or less arbitrary one. Nevertheless, there are distinct differences between the three types of research I have just mentioned. Scientific research in general deals with the search for knowledge for its own sake. The scientist likes to call it *pure* research. It is undertaken and carried on best by those whose only aim is the pursuit of knowledge without any hampering demand for its application, commercial or otherwise. It requires unlimited time and patience, and the spirit of the research worker.

Material rewards and physical comfort are usually of secondary importance to the man who accomplishes results in this line. He seldom cares to know whether his results are of direct material benefit to the race or not, being satisfied if the range of human knowledge is increased. Such men are the early discoverers and explorers of research; without them there could be no scientific progress, and the progress of industry would be confined to hopelessly narrow limits. Years or decades may elapse between the discoveries of Faraday, Maxwell and Hertz, and the commercial development of important processes, such as radio telephony, for instance, which would have been impossible without these discoveries. In fact, it is not always possible to discover who was the remote and obscure researcher whose diligent search for knowledge made possible some of our most important achievements.

It is not fair to say that scientific research alone is responsible for the difference between life in America to-day and in 1492, but it is fair to say that without scientific research this difference could not have been brought about. I particularly wish to emphasize this part of my subject because the importance, the necessity, for *scientific* research is not so readily appreciated as other lines. It is hard, sometimes, to see the forest for trees. It is easy for a business to stagnate and go bankrupt if the management confines its attention alone to the details of production and distribution, without developing its product or adopting new lines to meet changing conditions of trade; in fact, stagnation is the certain result of lack of progressive thought, though the result may be long delayed.

Some few private institutions have had the courage to give generous support to purely scientific research, with the expectation of a return in dollars and cents. The investment in pure research has, however, been very amply justified in these cases; in fact, it has probably paid as well as any investment that the firms have made. Success of private companies in the research field requires the broad free policy which has been adopted by such firms as the General Electric in connection with its work. The main general research laboratory at Schenectady has had the wisdom to allow freedom to the individual worker, to encourage him, and to avert discouragement.

It is true that, in conducting scientific research, the large companies have a very great advantage due to the fact that they are large. They can carry on a number of separate research problems with the expectation that some of them will yield results which will pay the cost of all. Such companies also have men and facilities which could not be assembled by the smaller companies. And perhaps even more important than this, they have the means for using a very wide variety of results.

Technical research, as differentiated from pure research, is responsible for the great mass of information, technical and scientific, on which we have to rely for most of the answers to technical questions. It is this type of research which most directly concerns the engineer and the industrial plant. It requires men and facilities much the same as those for pure scientific research, but it has the added attraction, for some workers, of being directed toward some known and specific end. Technical research is a survey of the field of science and engineering. It affords a map of the territory, by which development can follow. The research laboratories of the various industries have been developed mainly for the purpose of covering this field, though there has been much confusion of ideas as to what constitutes technical research, and what developmental work.

In using the term research, I wish to limit it to the first two of the three types mentioned, viz.: scientific and technical. Developmental work is usually of an entirely different character; it demands men of a different type.

DR. H. C. DICKINSON is probably better qualified than anyone else to discuss the matter of research from the standpoint of the automotive executive. He is now Director of Research for the Society of Automotive Engineers and was formerly Assistant Director of the Bureau of Standards. He has studied automotive research activities carefully both from the standpoint of the scientist and that of the business executive.

In this commentary on our recent Research Number, Dr. Dickinson describes in a brief, interesting manner, the relation of the various types of automotive research to business progress and profits. He has discussed this broad topic so definitely and concisely that every executive in the industry will want to read what he has to say.

What is here termed research, scientific and technical, as distinguished from developmental work, implies a search for fundamental information of a more or less general character. The results can nearly always be expressed in equations or curves, and can be applied to conditions other than those under which they were obtained. For instance, the testing of an individual engine, a new design of manifold, or the trial of a new kind of fuel, without reference to the specific characteristics of them, would not constitute research in this sense, since the results would only be applicable under the original arbitrary conditions. On the other hand, tests of a series of manifolds differing in area or diameter or temperature, or tests of a series of fuels differing by definite amounts in some particular such as volatility, would constitute technical research because the results would be capable of showing, more or less accurately, a general relation, as for instance, the effect of fuel volatility on fuel consumption, a result of general applicability.

The distinction drawn here is a very important one, notwithstanding the fact that the two fields overlap to some extent, and as this distinction is very often missed in the discussion of research matters, I shall ask your patience while I attempt to make it clear.

Men and the lower animals share in common the ability to try things, and the process of trial and error has led to vastly the greater amount of our mechanical and social development. It is the time-honored process of evolution, which, if we accept Darwin rather than Bryan, has produced life on the earth as it exists to-day. Given infinite time and material and no cost of production, it is the surest process. It is an essential factor in all industrial developments and it has led, unaided, to many of the revolutionary discoveries in science. But it is not technical research. In fact, it has more place in scientific than in technical research. It is, however, the process which must be followed to a considerable extent in development work and invention. After having made use of the already known facts which have come through research, the only alternative is to try out something or turn to further technical research for fuller information.

What technical research has done for the engineer can perhaps be appreciated by simply considering what it would mean to design from the beginning almost any simple machine, without previous experience, or access to the published results of research, viz., the handbooks and tables. So much of this information is a heritage of the past that it is not always easy to realize how much technical research has given us in the ability to meet new engineering problems which would be hopelessly impossible otherwise. Technical research has given us what we have of available information.

But how far can we go in any line to-day without finding a serious gap in our information? I therefore wish to urge upon you the necessity for supporting and extending technical research laboratories of the various industrial plants and in the universities and technical schools as well. It is the main source of power to progress.

Any discussion of research must include the research worker. The two main incentives that actuate the research worker are a thirst for knowledge and the hope of economic progress. So far as the research worker himself is concerned, one can almost neglect the second incentive. A desire for knowledge for its own sake is almost the sole incentive of the individual who will devote his life to fundamental research. If the appeal of commercial success is strong, he will usually drift into invention or development where his research training will make for greater returns in money.

However, the most common incentive for the organization and continued support of research laboratories or of any systematic research program is necessarily the commercial. In fact, this is almost the only one if we except some of the educational laboratories that have been endowed purely for the advancement of science. Thus, almost every research laboratory, particularly the industrial ones, presents a constant conflict between two viewpoints that are somewhat incompatible.

The true research worker is interested in securing facts and will not be satisfied until his results are complete. Moreover, every problem he undertakes presents to him numerous sidelines that are of absorbing interest. If given his own way, he will either carry through his problem to a final conclusion, or switch to some side line of greater interest, according to his temperament, unless he is endowed with unusual self-control.

On the other hand, the director of the laboratory or the capitalist who finances it will, as soon as some fact of apparent commercial value is developed, recommend dropping the research and developing something useful, unless endowed with unusual patience and foresight.

A happy medium between the two viewpoints is difficult to obtain, but a real compromise is necessary, since both viewpoints are important and neither side can be neglected.

I believe that the financial manager is coming more and more to realize that the search for knowledge affords the basis for all fundamental developments in the long run.

DR. H. C. DICKINSON.

Dependence of Valve Stem Clearance on Cylinder Temperature

Editor, AUTOMOTIVE INDUSTRIES:

In reading Mr. Heldt's interesting article in your issue of May 25, it has occurred to me that there is an error in that part relating to valve clearances in air-cooled engines having relatively cool push rods. In such engines, as also in water-cooled engines with overhead valves and exposed push rods, the effect on valve clearance is actually opposite to that set forth in the article.

It appears that Mr. Heldt lost sight of the fact that the rocker arm pivot is raised an amount at least equal to the movement of the valve seat, so that the push rod end of the rocker arm is also raised and the clearance correspondingly increased.

It has been my experience, more especially with the Oakland and Buick, that the clearance increased with rise of engine temperature. ROBERT F. KOHR.

The expansion of the cylinder alone, raising the valve seats and the valve rocker bracket, would produce an increase in the clearance equal to that expansion. This is reduced, however, by the expansion of the valve stem and the expansion of the tappet rod.

Inasmuch as the temperature of the tappet rod does not increase as much as the temperature of the cylinder walls —and the valve stem, although a part of it attains a higher temperature than the cylinder barrel, is comparatively short—the increase in the clearance due to the cylinder expansion is undoubtedly greater than the decrease in the clearance due to the expansion of the valve stem and tappet rod, so that the net clearance will actually increase with the cylinder temperature. In view of this fact it is rather surprising that the makers of a well known air-cooled engine recommend a valve clearance of 0.010 in. when the engine is cold.

For a very accurate determination the expansion of the rocker arm bracket also should be taken into account, which further increases the clearance, though very slightly only. —*Editor.*

Indirect Sales Costs Grow More Rapidly Than Volume of Business

Many factory activities are made necessary by the requirements of selling. Marketing expense should be charged with these costs. Because they are indirect, they tend to increase more rapidly than is justified by their usefulness. Unit selling costs should be determined from direct and indirect costs.

By Harry Tipper

THE president of a large corporation holding a number of factories and distributing a great many products, was talking over his business problems the other evening. The burden of his conversation was the cost of distributing products and the difficulty of determining the validity of these costs.

It has been fairly easy to determine the validity of the manufacturing costs, although there is much confusion in the production end of the business as to the methods by which cost analysis shall be made.

Sales costs, however, have been determined in a very arbitrary way so that the practice does not agree between the different organizations in the same line of industry, and it is indeed a difficult matter to determine the validity of all the operations undertaken for the purpose of making and maintaining sales. This is true of the automobile business as of other lines. The problem is slightly more difficult in the automotive field because of the rapidity with which the business has grown and the difficulty of preparing a flexible system of analysis so that the costs can be determined and be properly placed in the departments of operation as they are required in the growth of the business. This lack of any basis for analysis of sales cost makes necessary a definition of "sales cost" before it is possible to examine those operations which enter into the maintenance and improvement of sales and the relative importance from a cost standpoint.

In preparing material for the New York University in the study of marketing costs, we laid down the general principle that manufacturing costs were completed when the goods were ready for shipment at the factory on railroad cars, and that all other costs accrued to the business from that point on, as costs involved in the marketing of the goods, the distribution of the product to the market, and the maintenance of the sales. This would provide three general departments of cost relating to the business:

1. **General Costs.** Those costs relating to overhead organization devoted to the business; not specifically devoted either to manufacturing or marketing.
2. **Manufacturing Costs.** Those costs entering into the production and fabrication of the product.
3. **Marketing Costs.** Those costs entering into the distribution and sale of the product.

For the purpose of this article, the consideration is limited to the third item. The distribution costs need not be considered at this time. The discussion will be devoted to the operations entering into the sale of the product; the promotion of that sale; or the maintenance of the sale. These costs divide themselves into the direct costs of sale and the indirect costs.

CAREFUL analysis of indirect marketing costs offer an excellent opportunity for increased efficiency and reduced selling expense. The fact that such costs are frequently carried under a general head makes it difficult to evaluate the activities which they represent.

Proper analysis of marketing costs requires that all activities made necessary by the requirements of sales effort be applied to distribution expense and that a unit selling cost be established for each vehicle which will take into consideration these indirect as well as the direct costs.

The direct costs include the following general items of operation:

Salesmen, Time and Expenses
Branch Sales Office Expense
Advertising Expense
Sales Administration
Service Organization Expense
Office Departments of Sales and Sales Development

The indirect costs are:

Office Operations Due to Sales
Fixed Charges Required for Sales Organization Work
Percentage of General Charges Due to Sales Organization Requirements

The direct charges have been more or less effectively determined with most establishments within the field. The relation between the salesmen's time and expense and the amount of business he does, is known effectively and the value of his operations is judged pretty carefully upon this relation. The branch sales office expense is determined in many organizations in relation to the total product activity of the territory covered by the branch, so that there is some fair knowledge of the value of the branch office in its operations in connection with the company.

In many cases, however, the branch sales office expense is not charged entirely to the sales work, because the necessary accounting, order department, shipping and

other departments not directly concerned with the sales, are frequently charged to the general departments in the main office governing those activities.

For instance, it has been customary in many firms to charge the branch office accounting to the general accounting department. This is not desirable because the branch office accounting expense is directly caused by the necessity for maintaining a contact with the immediate market and conducting the sales operations from a convenient central location. The accounting operations performed do not remove the work from the general accounting of the company. They simply add detail to that work for the purposes of sales operation. The advertising expense is known, of course, but it is frequently set up as a separate activity of the company, although the entire object of the advertising is to promote sales, stabilize the sales and develop the future of the market in connection with the product or the organization.

In the automotive field, particularly with the automobile or the truck which are transportation equipment—and useful, therefore, only as they are kept in operating shape—it has been necessary to devote a considerable amount of time and attention to the development of the proper service among retailers who are selling the cars. For this purpose separate departments of service have been erected at the factory with their constant touch with the distributors and retailers and their constant attempt to develop a higher type of service in contact with the user.

FOR the most part, these departments are charged to general administration or to some other general account of the company, although they are required because of the sales necessities and the effect upon the future market. Properly, the service organization expense should be considered as a part of the sales expense, as it is operated for the benefit of the future sales of the company, the stability of the market, and the development of it.

In order that the sales work may be conducted without confusion and with the necessary pressure upon the retailers and users, a great many additional operations are required within the branch and main offices of the company. These operations are necessary because of the sales, and they are valuable only as they permit the sales organization to function more accurately, more definitely, and with more speed in its development of the market.

In addition to these departments directly devoted to sales work, there are operations required in connection with the general departments of the company which are directly due to the activity and necessities of the sales organization. These operations should be carefully segregated and their costs charged to sales so that the sales burden may be definitely established in connection with the organization requirements.

Finally, there are, of course, fixed charges due to the space occupied by the sales organization, the capital involved in preparing the equipment and space for them, and a percentage of the general charges necessitated by the organization of the company, which must be distributed according to the activities of the organization.

THE indirect costs of selling, due to the activities within the offices of the organization, the extension of its fixed charges, the development of its routing, etc., have a tendency to grow more rapidly as the area of the market increases and the pressure upon the market develops. They have a tendency to grow more rapidly than the volume of business because they have only an indirect bearing upon the actual volume, and their value is more difficult to determine, while the departmental system of routine develops almost without respect to the volume of operations.

Furthermore, these indirect costs have not been studied in their relation to the sales effect, and they are usually classified under numerous headings so that they do not come before the executives of the company in their proper position and with their proper analysis. A study of the methods used in various organizations shows that very few of them have assembled all the expenses involved in sales under such a classification of accounts, and that very rarely, indeed, are the indirect costs, or even the direct organization costs, analyzed in connection with their effect upon the sales and their influence upon the sales development.

In many cases the direct cost of selling is only one-third, or less than one-half of the total cost of selling, while in some cases it is only one-fourth—the rest of the area being taken up with the indirect costs of organization due to the sales necessity. Engineers have understood for some time that the indirect costs of manufacturing were responsible for a larger expense than the direct labor costs, and were capable of a greater degree of improvement by analysis. The same thing is true in sales work. The direct costs should be thoroughly analyzed; but because they have been regularly analyzed they are usually more efficient and of less effect in connection with the total sales expense than the indirect costs which have been arbitrarily divided according to custom, without any real analysis.

The indirect costs offer an opportunity for improvement in efficiency, the elimination of a lot of useless system and motions, and the development of a better relation when they are so classified that they can be examined in their true relation to the sales development and their value in connection with such development.

Tests Prove Tractor Suitable for Winter Mail Delivery in Finland

TRACTORS and automobiles for the use of transportation of mail in Finland have been recognized by the government, and mail routes are now being established in remote sections of the country which have heretofore been almost entirely isolated. Automobiles are used in good weather, but a great deal of the winter weather makes the roads impassable and tractors have been resorted to, says a report to the Bureau of Foreign and Domestic Commerce.

A recent tractor-mail carrying test was made with a tank-model, track-laying tractor on the road between Rovaniemi and Ivalo, a distance of 300 kilometers. Sleds laden with 11,000 kilos of mail and two sleds with official passengers were attached to the tractor. The tractor, it is stated, proved suitable for the purpose and surpassed expectations in spite of deep snow drifts, high hills and 40 degrees of cold. The trip consumed 4½ days.

Postal officials of Finland plan to establish several of these mail-tractor routes throughout the provinces of the country, and mail and passengers will both be transported.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE
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Speed Limits

ATTENTION should be given to the absurd confusion of legislative restrictions hedging the operation of automotive apparatus in various states.

Wise regulation is necessary and has been fostered by the industry at all times. With the increased traffic on the highways these regulations should be stringent against offenders so that automotive travel is conducted with proper regard to safety of passengers and public. The present confusion in regulations does not make for safety. Many of them are so absurd that they are broken by nine-tenths of the drivers of vehicles.

These laws cannot be enforced regularly and are subject to sporadic attempts at regulation, working an injustice to the public and the drivers. Speed laws vary over ranges of limitation utterly absurd in the space of a single day's run. Village, town and city traffic rules change every few miles in many states. Cities with their converging traffic, insufficient street space and cross streets require regulations and rules more restrictive than smaller centers. These again demand a greater degree of constant attention on the part of the driver and consequently a fair definition of rules. County districts do not need the same details of regulation nor the same limitation.

It should be possible to develop an orderly definition of the necessary regulations so that they would apply generally to the requirements of city, town and country travels. The increased simplicity would permit an orderly enforcement, and a full comprehension by the driver of his responsibilities in the case.

Wages and Unit Costs

WE want to call special attention to the following statement received the other day from an important manufacturer.

"Wages in Detroit for automobile factory labor are up 10 to 15 per cent compared with three or four months ago. The costs of certain materials also show increases, while deliveries of materials in many instances are not as prompt as formerly.

"On its face it would seem that these developments would cut down the profits of automobile companies for the current period. This will not be true, however, except in a few cases, since these increases have been more than offset by the economy of augmented volume and improved productivity of labor.

"In the case of the Packard Motor Car Company, the costs of materials purchased represents almost half the price of a Packard product, but the reductions in unit costs attained in the items making up the other half have resulted in total unit costs remaining practically the same as before the rising material markets."

This statement of an actual condition within an automotive factory furnishes an excellent example of how an intelligent analysis can give a proper perspective in viewing manufacturing and price problems. The fluctuation in wages is only one phase of manufacturing cost, often a comparatively small one.

The important figure is not the actual wage scale, but the unit production cost. If increased wages were found to result in decreased unit costs, the increase of wage scales would be an economical action to take.

A more careful consideration of the relative value of the factors affecting unit costs is needed. A general view of the situation frequently fails to give the proper weight to the various factors. Some managements have even been known to insist that if wages went up 10 per cent the cost of the product would naturally have to go up 10 per cent.

The individual performance of the workmen in a factory has a strong bearing upon the unit production cost. Comparatively little is known at the present time about the relative effect of wages, working conditions, monotony jobs, promotion possibilities, etc., upon the efficiency and stability of the individual.

As illustrated by the manufacturers' statement given here, the apparently obvious conclusion that might be drawn from a superficial consideration of the matter very rarely coincides with the actual facts

as developed from a closer investigation and analysis of methods and production costs.

Productivity, the Measure

RELATIONSHIP between factory and selling organizations is a difficult thing to maintain properly. Close supervision through a personal contact is often expensive for a factory and onerous to the supervised. The goal to strive for is maximum co-operation with minimum actual supervision.

One of the reasons given by passenger car manufacturers for abandoning branches in favor of other forms of organization is that there is a tendency for the branch to rely on the factory to make good its losses, to use a slang phrase, "to pass the buck to the factory." This attitude does not make for maximum initiative on the part of the branches.

Most manufacturers who operate branches have avoided this by putting the responsibility up to the branches to stand on their own feet and at the same time create feeling that the factory and branches are one. This is done by giving the maximum of responsibility, and the profit to the individuals in the branch is dependent on their performance.

One of the difficulties in determining the measure of success of a branch or other form of selling organization is that the standard of performance is set arbitrarily which permits question as to its accuracy.

Market analysis can assist in setting a standard which leaves little question of accuracy. If actual demand is known and recognized, it remains for the branch to produce and the amount of individual responsibility granted by the factory can be indefinite if based on this standard.

New Ways to Finance Highways

HIGHWAY construction is going to be put on a business basis. Leaders in the automotive industry are already taking an active part in the effort to find out how much highways really cost, what returns they give to users and to the public, and how the cost of construction and maintenance can fairly and economically be distributed among the various interested parties.

The time has passed when highway construction was chiefly a concern of politicians. "Highways must be made self-supporting," said Chief MacDonald of the Bureau of Public Roads, recently.

Many factors must be investigated to achieve this end. Transportation costs will have to be studied further, the relation of various kinds of vehicles to various types of road will have to be determined, and the type of highway needed for the economic purposes of a given community will have to be examined more carefully. Highway construction will go forward in the meantime. Highway financing will continue. The best methods available must be used.

Robert M. Haig has recently put forward a logical economic argument for the financing of highways by means of long term bonds. Quoting Chief MacDonald, Haig shows that the foundation of a highway can be made permanent; can be so constructed that it will improve with age. Thus a part of this foundation cost can be passed on to the next generation.

Maintenance will have to be re-defined, however, if this method is used. Maintenance will have to include not merely day-to-day expense of keeping the highway in serviceable condition, but also the replacing of the surface when needed.

Representatives of the American Association of State Highway Officials, the National Automobile Chamber of Commerce and the Bureau of Public Roads met in Washington at the Federal Bureau May 24 to discuss important matters relating to highways and highway transport. The meeting was the first of a series which, it is expected, will eventually lead to conclusions which will have an important bearing on legislation relative to these subjects.

Far-sighted executives throughout the automotive industry are keenly aware of the practical importance of a scientific and proper solution of the growing highway problem. Trouble may not accrue immediately to the industry from a failure to solve highway problems effectively, but the effect upon motor car and truck sales will be very great in the future. The efforts of those representatives of the industry who are applying themselves to a solution of highway problems should have the support of other executives.

A Truck Load Capacity Rating Formula

THERE are evidences that the possibility of establishing a standard truck formula are being discussed again. From an engineering standpoint there are many difficulties involved but the advantages to be derived from a marketing and taxation standpoint make it worth while to spend the time necessary to overcome the obstacles.

Recent surveys have proved the prevalence of overloading trucks, a practice which in the long run redounds to the detriment of truck sales. Overloading is partly done with a full knowledge of the circumstances, but variation in meaning of truck ratings tends to encourage rather than discourage the practice.

Nearly every state in the Union is studying the matter of regulation and taxation of trucks. Some rules are necessary, but they should be such as to encourage transportation in its most economical form. To attain such regulations, the truck manufacturer should co-operate with state officials in every possible way, that the problems of truck transportation may be worked out in the way that will be mutually beneficial to all concerned. The determination of a standard method of truck rating is one effective means of effecting such co-operation.

The engineering difficulties on the way of determining a standard truck rating formula should not be allowed to prevent the adoption of some standard. The chief need is for a uniformity in method of rating, whether that uniformity be entirely in accord with scientific engineering or not. The N. A. C. C. horsepower rating is a useful tool, but it does not conform to the requirements of technical and refined engineering terminology.

Durant's Bid Gets Elizabeth Plant

$5,525,000 Offered in Field of Three

Maxwell Motors Drops Out at $5,500,000—Star to be Made There

NEW YORK, June 12—Durant Motors, Inc., bid in the huge new plant of the Willys Corp. at Elizabeth, N. J., for $5,525,000 when it was offered at receivers' sale last Friday. James Smith, Jr., representing Walter P. Chrysler and the Maxwell Motor Corp., dropped out at $5,500,000.

Dramatic scenes attended the auction, which had been expected to be a perfunctory affair. Durant had announced previously that he would not bid a nickel more than he had previously offered the receivers for the property, which was approximately $3,000,000, and it had been expected there would be no other bidders.

Before the sale opened, however, certified checks for $200,000, a prerequisite to making bids, had been filed by Joseph P. Day, a New York real estate expert, representing Durant, by Smith and by J. Clarence Davies, a New York auctioneer, who declared he represented no one but himself. It was reported that he represented Studebaker interests. Davies dropped out at $4,000,000.

The property was offered first in four parcels. One of them included the plant equipment and machinery and another the land and buildings. When it was found that the highest bids for the four parcels aggregated only $3,030,000, it was decided to offer the property as a whole.

Offers Rise Steadily

It was then that the excitement began. The first bid was $4,000,000 under this plan. As the offers rose steadily higher, from $5,000 to $100,000 at a time, excitement became intense among the 500 or 600 spectators. Each new bid was received with cheers. Many of those who attended the auction held mechanics' liens on the property, and they realized that the higher the bid the more they would receive for their claims.

Smith finally raised his offer to $5,500,000. When Day raised him $25,000, Smith bowed, smiled and retired. There were no more offers, and the property was declared sold to Durant. Frank P. Kennison and Francis G. Caffey, receivers, attended the sale, which is subject to confirmation by the Federal court. It is considered improbable that there will be any objections to accepting the bid of Durant, which was more than had been expected, and it approximates 50 per cent of the cost of the property.

(*Continued on page* 1351)

Business in Brief

NEW YORK, June 12—Continued gains by trade and industry have been reported in the last week.

Orders now on the books of steel companies indicate that operations will be continued at the present rate for at least three months. This will carry them over the dull season. Some western mills are not disposed to book freely for deferred delivery.

Building construction has taken another surge forward.

Factory activities in shoe and leather making have been increased in the East and some western plants are working at capacity.

Crop reports have improved, especially those relating to the big surplus food staples.

Retail trade is better, and there is a greater disposition to buy for the future.

For each of the four weeks ending with May 21, the number of freight cars loaded with commodities other than coal was larger than for the corresponding week of any other year since car loading statistics have been compiled.

Up to June 3 the railroads of the country had ordered approximately 80,000 new freight cars, or about three times the total purchased in all of 1921. It is expected that by the end of June the total will have reached 95,000.

Stocks are less active, bonds generally firm, money easier and sterling at a new high.

Bank clearings for the week ending June 8 aggregated $7,304,687,000, a gain of 22.1 per cent over the previous week, which included a holiday, and of 18.7 per cent over the same week last year.

The coal strike, a threatened rail strike and other labor difficulties constitute the only important unfavorable factors in the industrial situation.

COLLECT PRIVILEGE RESTORED

NEW YORK, June 12—The American Railway Express will rescind on June 15 its rule requiring the prepayment on charges of shipments to Canada and restore the collect privilege. After that date shippers can send their goods prepaid or collect, as they prefer. The rule was put into effect because of the high rate of exchange between the United States and Canada, but improved financial conditions have brought the discount rate to approximately 1½ per cent.

Maxwell Had Plans for Chrysler Six

Rights to Design of Car Pass to Durant as Result of Sale Plant Built for It

NEW YORK, June 13—If the Maxwell Motor Corp. had been successful in its bid for the Elizabeth plant of the Willys Corp., for which it offered $5,500,000, it would have used the factory for the production of the Chrysler six, the purpose for which it was built.

Failing to get the property for what it considered a fair price, the corporation is not likely to take up any new building projects for several months at least, although it is probable it ultimately will establish a plant on the Eastern seaboard. Nothing will be done in this direction, however, until the return from Europe of Walter P. Chrysler, chairman of the board, the middle of September.

The Maxwell company is in an unexpectedly strong cash position, and Chrysler believed it would have been profitable to take on the Chrysler six, with which he is thoroughly familiar, in addition to the Maxwell and Chalmers lines. Rights to the designs for the Chrysler six went to W. C. Durant when he made the highest bid for the entire property. Lacking a suitable factory, it is said to be unlikely that the Maxwell interests will offer to buy these rights from Durant.

The Elizabeth plant was built under the direction of Chrysler while he was executive vice-president of the Willys enterprises, and the bankers who have lent their support to Maxwell were willing to back him in a new enterprise because they have a very deep regard for his ability as a production man and executive.

Chrysler Sails for Europe

NEW YORK, June 14—Walter P. Chrysler, chairman of the board of the Maxwell Motor Corp., sailed yesterday on the Aquitania for a three months' tour of Europe. He was accompanied by Mrs. Chrysler and their two daughters. His trip abroad will be devoted almost entirely to pleasure and it will constitute the much needed and long deferred vacation which he promised himself when he retired from the Willys enterprises.

The Chryslers will visit France, Switzerland, Italy, Austria, Czecho-Slovakia, Germany, Belgium, Holland, Paris and London, sailing for home September 9. While in Germany they will go to Oberamergau to witness the Passion Play.

Chrysler deferred his vacation until after the graduation of his elder daughter

(*Continued on page* 1351)

Lelands Quit Lincoln Organization

Company Operating as Ford Subsidiary

New Production Methods at Factory Said to Have Caused Disagreement

DETROIT, June 13—The retirement of the Lelands, Henry M. and Wilfred C., as president and vice-president and general manager of the Lincoln Motor Co., with the complete assimilation of that company as a Ford subsidiary, were considered accomplished facts in Detroit to-day. While no authoritative statement on the situation was obtainable either from Ford or Leland sources, when Henry M. Leland was questioned at his home as to the reported retirement of himself and his son he made this enigmatic statement:

"Something along that line is pending and it will be consummated within 24 hours."

Emmons Makes Statement

Harold H. Emmons, the attorney who represented the Fords in the purchase of the Lincoln plant at receivers sale, and who also has been personal counsel for the Lelands and for the Lincoln Motor Co., issued a statement relative to the situation, which he said he made as an attorney in Lincoln matters. The statement said:

Following its purchase in February by the Ford Motor Co., the Lincoln Motor Co. entered into a period of great activity during which the demand for the Lincoln car has been unprecedented. Its performance, together with assistance of continued and increased production, has resulted in an overwhelming demand for this automobile which has grown to such proportions that it is entirely beyond the production capacity of the present plant.

A readjustment of manufacturing facilities and relationship thereupon has become necessary in order to secure to this enterprise the complete assistance of the enormous Ford resources. To accomplish this result a combination of the executive administrative and manufacturing departments is in process out of which there will be a realignment of relationships. The management and conduct of the business will be transferred from Henry M. and Wilfred C. Leland to the combined Ford and Lincoln organization and under the control of Ford executives.

Disagree with Methods

While nothing official has been said, it is understood that the Lelands' retirement is due largely to their unwillingness to conform to Ford production methods. Although nominally vested with the control of the plant following the Ford purchase, there has been much realignment of facilities and methods, which did not meet their approval.

Two weeks ago, with the removal of the Lincoln purchasing department to the Ford Highland Park plant and the changing of the Ford sales department to the Lincoln plant, there was threatened a severance of relations. Edsel Ford is said at that time to have removed the Lelands from authority, but reinstated them almost immediately.

In the four months that the Lelands have conducted the plant under Ford ownership, there has been great difficulty in reaching a production basis that would be at all proportionate to the orders that the company received. At present, production is about 30 daily, having reached that point from an output of about 15 daily at the time of the sale. The company has claimed that it was handicapped through shortage of materials, but it is known that production methods were un-

(*Continued on page* 1353)

Most Important Result of Renewed Buying Is Change in Attitude of Banker

By ALVAN MACAULEY
President of the Packard Motor Car Co.

Detroit, June 12.

BUSINESS in the automotive industry gives every indication of carrying through the summer months on a scale closely approximating the present large demand, and in my estimation will be good right up to the winter season. Though the business for the year thus far has been much heavier than it was possible for manufacturers to estimate, it is most likely due to the fact that there has been a stemmed-up buying tendency for some time past and owners have now come to the conclusion that this is the time to buy new cars.

The old car was compelled to give service beyond the time that would have been expected of it had business conditions been improved during the past two years. Business is now better and will get better as the year advances. This will all be favorable to a continuation of the present buying movement that the industry is enjoying.

I believe that the most important result that the automobile buying of this year has accomplished is to change the attitude of the banker toward the industry.

There has long been a tendency by bankers to consider the automotive industry as a game rather than as a stabilized, essential business. The demand this year has shown the banker that the automobile is an essential, and the success of the industry has been mainly important in reviving business in what have been considered the basic industries.

The steel mills to-day are receiving a large volume of their business from automobile manufacturers. There is some delay in getting steel shipments but there is no shortage, nor is there any shortage in other commodities necessary to the manufacture of cars, except that time is required in getting them. This is all due to the fact that automobile buying has been beyond expectations and it has been impossible to prepare for it on a scale that later conditions justified.

There is a growing tendency toward the use of closed cars, Packard business at the present time in these models exceeding open model business. I believe that this condition will be true generally in the automobile business within a short time, and is now largely the case in better class cars. Buyers with $2,500 to $3,000 to spend are taking a closed car in a lower class car rather than an open model in a better grade. Touring models will wane until they will be confined largely to suburban use and for traveling. There is a waning desire for seven passenger touring models and those being bought now are for the extra room afforded rather than for the actual accommodation of seven passengers.

Texas Plans Prohibitive Taxes on Bus and Truck

FORT WORTH, TEX., June 9—A keen fight is in prospect, before the forthcoming session of the Texas Legislature, over a tax on motor trucks engaged in commercial traffic, and on buses operated for profit.

Legislation, levying almost a prohibitive tax on these two classes of vehicles, has been drafted, it is reported, and will be offered to the lawmaking body.

Steam transportation lines are said to be behind the move, which, if successful, will stop the use of the trucks for freight carrying between towns and drive out the buses, insofar as passenger travel is concerned.

In the last year, each of these has gained in popularity and in general use in Texas.

Factories Forcing Big June Schedule

Operating at Full Speed to Meet Demand—No Reserve Stocks Accumulated

By JAMES DALTON

NEW YORK, June 9—Even the leading factors in the production of automobiles have been astounded at the aggregate output of 252,000 passenger cars and trucks in May, which exceeded the highest previous mark by 32,000. This total may be enlarged when complete figures are available. All factories have swung into June at full speed and are forcing production to keep pace with demand. It has been impossible to accumulate reserve stocks of passenger cars.

Many Manufacturing Problems

Although the industry naturally is gratified that it is operating at capacity, the pace is so swift that it has resulted in many manufacturing problems which would not have become important with a somewhat smaller output. These various factors, none of which is particularly serious in itself, have combined to increase costs considerably.

Stock chasers, shipments of parts by express, orders by telegraph and premiums for raw materials, all cost money and add to the expense of turning out motor vehicles on which the profit is much smaller than it was before the era of keen competition forced by business depression. Prices of parts are somewhat stronger because the parts manufacturer, lacking long term commitments, has to buy in comparatively small quantities and pay stiffer prices than otherwise would be required.

Many automobiles are being shipped from Detroit lacking minor parts. When the parts are received at the factories from the makers, they are shipped by express to distributors and the cars are equipped in the service stations of dealers and distributors. By resorting to this plan shipping delays have been cut down.

Has Price Stabilization Effect

While the cumulative effect undoubtedly has been to increase production costs, it has had a stabilizing effect on retail prices and few revisions are in prospect except perhaps in the truck field where the return to normal conditions has not been completed. While there is no likelihood of further recessions in passenger car prices it is equally unlikely that there will be any general increases. Whatever upward trend may become apparent will be caused by the necessity of returning a profit in the face of mounting manufacturing costs.

The most popular topic of discussion within the industry is the outlook for the remainder of the year. It is not to be denied that it is exceedingly bright at this time. There is not the slightest sign of a falling off in demand for June and it promises to be one of the big months of the year.

While it is the general expectation that July will bring a slowing up in sales, the volume of business will depend largely upon the farm market. There is every reason to believe there will be a heavy demand in the agricultural districts as soon as the harvest is well under way, which will be not later than July 15 in most sections.

"FLIVVERBOOB" WINS IN A. A. A. CONTEST

WASHINGTON, June 12—Reckless and careless drivers of automobiles are to be known as "flivverboobs," according to the decision reached by the judges deciding the American Automobile Association's contest to pick a name describing the reckless driver in the same manner that "jay-walker" describes the careless pedestrian.

The name was suggested by F. B. Simpson, of Cedar Rapids, Iowa, who will receive the $25 in gold offered as a prize by the A. A. A. More than 10,000 names were submitted in this contest, and the suggestions came from all parts of the United States.

Ford Buys New Orleans Site for Assembly Plant

DETROIT, June 10—Ford Motor Co. has closed a deal for ten acres of land on the Mississippi river, on the outskirts of New Orleans, where an assembly plant to build 150 cars daily will be erected. The plant will serve the southern half of Louisiana, Texas and a part of Mississippi. It is planned later to develop the plant to take care of shipments to Mexico and some South American countries.

Edsel Ford, president of the company, said the total outlay on the new plant will be $400,000, including the land, which represents a valuation of $80,000. Four hundred men will be employed at the outset.

Freight rates have an important part in determining the field to be covered by each assembly branch, Edsel Ford said, and will be studied thoroughly before the final territorial limits of the new assembly plant are established. In addition to the river frontage of the plant, it is served by the Illinois Central railroad.

Bumper Patent Suit Decision Given Cox

Pancoast and Grotenhuis Infringement Charged by American Chain Co.

CLEVELAND, June 12—Judge D. C. Westenhaver has handed down a decision in the Federal district court dismissing the complaint in the suit brought by the American Chain Co. against the Cox Brass Manufacturing Co. of Albany, N. Y., alleging infringement of the Pancoast and Grotenhuis bumper patent No. 1,374,893.

The chain company announced that an appeal would be carried as rapidly as possible to the United States Circuit Court of Appeals at Cincinnati.

The plaintiff asked for an injunction, contending that the Pancoast and Grotenhuis bumper made by the defendant under its patent No. 1,371,605 was an infringement of the Bi-Flex bumper controlled by the chain company and under which licenses had been issued by that company to several manufacturers.

The defense of the Cox company was based upon the ground that the Pancoast and Grotenhuis patent was invalid for want of an invention; that it was invalid because it contained a needless multiplicity of nebulous and indefinite claims calculated to mislead and deceive the public and that the invention was sole and not joint.

This contention was upheld in part by Judge Westenhaver, but the chain company contends that inasmuch as there existed for many years a widely recognized need for a device performing the functions and giving the protection of a centrally broadened bumper and engineers and manufacturers tried unsuccessfully to solve the problem, the working out of a practical device like the Bi-Flex bumper, which was widely adopted by licensees and competitors was not an obvious slip, but involved study, experiment, intuition and genius, which amounts to invention.

Goodyear Workers Ask for Increased Wages

AKRON, June 12—Following voluntary 10 per cent wage and salary increases granted to employees of the Firestone Tire & Rubber Co., the house and senate of the Goodyear industrial assembly, composed of men elected from the ranks of labor by their fellow workers under the Goodyear plan of democratizing industry, have unanimously adopted resolutions asking the company to grant a 12½ per cent salary increase and 10 per cent wage increase, effective June 15.

So far the company has taken no official cognizance of the resolution presented by the industrial legislators to Vice-President and Factory Manager Paul W. Litchfield, and no announcement has been made as to whether the company contemplates any wage adjustments.

Lists 8 Companies in Plan for Merger

Two Not Heretofore Mentioned Are Announced by Associated Motor Industries

LOUISVILLE, KY., June 12—Plans for an annual manufacture of 15,000 automobiles and 40,000 wagons at the Kentucky Wagon Manufacturing Co.'s plant were disclosed Saturday when James R. Duffin, attorney for the company, asked until June 26 to file a response to bankruptcy proceedings against the company instituted in the Federal district court.

The Kentucky Wagon company is one of the eight concerns which will become a part of the Associated Motor Industries, it was stated.

Helm Bruce, attorney for L. B. Lewis, who holds a claim in the state court for $55,000 against the company, objected to the continuance which was sought from Judge Walter Evans pending a reorganization of the company's affairs. Bruce stated that his client did not wish to enter the consolidation.

Injunction Previously Sought

Several weeks ago the Federal court was asked for an injunction against the state court, asking that further action against the Kentucky Wagon company be deferred until it had time to formulate plans. No objection to the continuance was made by D. A. Sachs, Jr., or Emile Steinfield, attorneys for the petitioning creditors.

Details of the Associated Motor Industries financing are contained in a circular issued by the Union Trust Co. of Chicago, to advertise a $6,000,000 issue of the company's bonds. The bond issue is to be of first mortgage 10 year gold bonds, paying 7½ per cent to be retired from a sinking fund for which provision is made.

The companies named as having been consolidated, in addition to the Kentucky Wagon Manufacturing Co., are the National Motor Car & Vehicle Corp. of Indianapolis, the Traffic Motor Truck Corp. of St. Louis, the Recording & Computing Machines Co. of Dayton, the Covert Gear Co. of Lockport, N. Y.; the Jackson Motor Corp. of Jackson, Mich.; the Saginaw Sheet Metal Works of Saginaw, Mich., and the M & T Corp of Boston. The Associated Motor Industries was incorporated in September, 1921, in Delaware.

"National" to Be Used for Cars

The consolidated company will manufacture a line of passenger automobiles, it is stated, consisting of "fours, sixes and de luxe sixes" under the trade name "National" and the production of trucks, ranging from one to three and one-half tons capacity, under the trade name "Traffic trucks."

The various properties consolidated to form the company, it is pointed out, permit economy of production and insure a uniform quality in workmanship and material. The issue of bonds, it is declared, is for the sole purpose of providing additional working capital for extensions and betterments.

The bond issue is to be secured by a direct closed first mortgage on the fixed assets of the company. These, according to the circular, amount to $19,816,448.46 or $2,970.61 for each $1,000 bond to be issued. This includes current assets of $1,682.26 for each $1,000 bond, it is said, and land, buildings and machinery of $1,288.35 for each $1,000 bond.

Provision is made for the retirement of the bonds by a clause in the trust deed stipulating that there must be an annual sinking fund of not less than $500,000 a year, which must be applied solely to the redemption of the first mortgage bonds. The issue is to be dated June 15, 1922, and is expected to be ready for delivery June 20.

Jackson and Traffic Assets Transferred

NEW YORK, June 12—Announcement at Louisville of the companies which are to be included in Associated Motors occasioned little surprise here. Only two of them have not been previously mentioned in this connection. They are the Saginaw Metal Works and the M & T Corp. of Boston.

The only corporations whose assets have been actually transferred up to this time are the Jackson Motor Corp. and the Traffic Motor Truck Corp.

Stockholders of the National Motor Car & Vehicle Corp. will hold a special meeting in this city next week to determine whether to accept the offer of Associated Motor Industries.

It has been understood that several other companies would be taken into the merger, and a large number have been mentioned in this connection.

PAPERS SEEK TO KEEP LABOR IN OWN CITIES

PITTSBURGH, June 12—As an indication of the present shortage of skilled labor, the Standard Motor Car Co. reports that newspapers in several cities, which were requested to run advertisements calling for high class workmen who specialize in automobile body and engine work, declined the copy on the ground that manufacturers in their own towns were so severely pressed for workers that it would be against the best interests of their city to run the advertising and manifestly unfair to local industry.

The Standard company is working overtime in an attempt to meet the demand for its line.

10 PER CENT NEW OWNERS

SYRACUSE, June 12—The Franklin Automobile Co. reports that a notable feature of its business is the number of cars being delivered to persons who are buying a car for the first time. The proportion runs as high as 10 per cent.

Fisher Body to Pay $1,000,000 Dividends

Payment Includes 8 Per Cent Accrued in Addition to Regular Quarterly 2 Per Cent

CLEVELAND, June 12—With business transacted in the first year of operations exceeding the predictions of officers of the corporation, the Fisher Body Ohio Co. is about to forward to preferred stockholders dividends aggregating $1,000,000.

The big distribution is to be made July 1 as a result of the action of directors in declaring an 8 per cent back dividend in addition to the regular dividend of 2 per cent for the quarter ending June 30.

The fiscal year of the company ended May 1, and the annual earnings are now running at the rate of $22,000,000 to $24,000,000.

The company is now delivering from the plant 320 bodies a day, and of these 270 are closed.

The dividend that is going to preferred stockholders on July 1 is in accordance with the promise of the parent company to clean up the dividends that accrued pending the time the Cleveland plant was getting under way.

Good Chandler Reports

F. C. Chandler, president of the Chandler Motor Car Co., after directors of the corporation had met in quarterly session, stated that business for the five months ending May 31, indicates that the full year's dividend requirements of $6 a share will be covered by the first half's earnings.

At the White Co. plant more than 3000 men are employed, compared to 2000 at the beginning of the year. Walter C. White, president, stated that orders in May exceeded the one thousand mark, and deliveries showed a substantial increase over April, with every indication of a total business for the year of approximately 9000 trucks.

The earnings for the past two months has been at a rate more than sufficient to meet the regular dividend requirements. Loans have been cut down to $1,700,000, with no customers' notes discounted, as against $3,600,000 on Dec. 31, 1921, and cash has increased in the same period over $1,250,000.

The company has declared the regular quarterly dividend of $1 per share payable June 20 to stockholders of record at the close of business June 20.

CONSIDER BUYING PARENTI

YOUNGSTOWN, OHIO, June 12—Western Pennsylvania stockholders of Parenti Motor Co. at an initial meeting at Sharon, Pa., gathered the nucleus of a fund to be used to buy and operate the company's Buffalo plant. The Parenti Motor Co. is in receivership. A further meeting of stockholders to promote the purchase project will be called for Buffalo.

Conservatism Urged At N. A. C. C. Meeting

Colonel Clifton, Re-elected President, Sounds Note of Warning to Members

NEW YORK, June 12—A note of warning that this is a time for conservative thinking and planning in the automotive industry was sounded by Colonel Charles Clifton, president of the National Automobile Chamber of Commerce, at the annual members' meeting held last week. His address made a deep impression on the 100 or more manufacturers who heard him, and many of them declared their views coincided with those of Colonel Clifton.

In his address, Colonel Clifton called attention to production figures covering a 10 year period and used them to demonstrate there has been a very definite trend in production and sales in certain quarters of the year. He showed that the present unprecedented production merely is taking care of the demand which was dammed up during the depression of last year, together with the normal return this year. He called attention to the statement made recently in AUTOMOTIVE INDUSTRIES that sales at this time are no larger than they would have been if there had been no war.

Sees Normal Curve Rest of Year

If this contention is true, Colonel Clifton said, there should be a normal sales curve for the remainder of this year with the usual seasonal decline beginning about July 1. Business is so good that it preaches conservatism, he declared. Retail demand rises from three to six months in advance of production, and the curve of retail sales declines about the same length of time ahead of production.

Colonel Clifton said that the last six months of the year probably would be better than the seasonal curve might indicate because of increasing demand for closed jobs which is heavier in the fall than at any other time of the year.

Asserting that he would not sell the automotive industry short at any time or under any circumstances, Colonel Clifton said he believed this was a time for conservative planning and thinking so that the manufacturers might not get into a position which would be harmful to themselves, their suppliers and their dealers.

Members Enthusiastic

The members who attended the meeting were enthusiastic about business conditions and were virtually unanimous in asserting that their factories were operating at capacity. There was considerable discussion concerning the outlook for the remainder of the year, and it was generally believed that, while a seasonal mid-summer decline is probable, there will be nothing in the nature of a slump and that the last half of the year will be considerably better than the same period of 1921, when production aggregated about 850,000.

Considerable attention was given to reports on retail sales of automotive products in practically all sections of the country, and much gratification was expressed over the fact that reports from North Dakota and South Dakota were optimistic for the first time in 20 months.

Julius H. Barnes, president of the Chamber of Commerce of the United States, who also spoke, predicted prompt revival of business with a resulting increase in motor transport. He cited as one reason why the United States can invest so heavily in motor vehicles the fact that the average American family has to pay out only 40 per cent of its income for food, as compared with 60 per cent paid by the average European.

He Spoke of Conditions in Russia

"If in America the otherwise necessary expansion of railroads has been checked and replaced by the development of motor transport, and if in the test of competition motor transport justifies itself against the steam railroad in new areas," he declared, "then Russia with its 200,000,000 people and its vast distances and its scanty railroad lines, offers a great field for motor development."

The members voted for a continuance of all the activities which the N. A. C. C. has carried on, notwithstanding the fact that it may mean further inroads upon the surplus in the treasury of the organization. There was a heavy deficit last year.

The following directors, whose turns had expired, were re-elected: Roy D. Chapin (Hudson), C. C. Hanch (Lexington), J. Walter Drake (Hupp), H. H. Rice (Cadillac) and John N. Willys (Willys-Overland).

Clifton Re-elected President

At the subsequent organization meeting of the directors, Colonel Clifton was unanimously re-elected for another term as president. Other officers elected were: vice-president, Roy D. Chapin; second vice-president for passenger car division, C. C. Hanch; second vice-president for motor truck division, Windsor T. White; secretary, A. J. Brosseau; treasurer, H. H. Rice; general manager, Alfred Reeves.

The motor truck members held a meeting of their own in the afternoon at which they listened to a discussion of problems peculiar to their own field. The principal speaker was Daniel L. Turner, consulting engineer of the Transit Commission of New York City, who discussed "The Auto Bus in the New York Transit Plan."

GOODYEAR ABSORBS WAR TAX

NEW YORK, June 9—Goodyear Tire & Rubber Co. announces a reduction of 5 per cent on tires to its dealers. While prices hereafter will be quoted to the consumer at net, the dealer will continue to pay the old 5 per cent war tax, but this will be offset by the reduction of that amount allowed by the company. This means virtually that the company is absorbing the tax.

Tire Surplus Danger Seen by Firestone

Executive Declares That Schedules Now Maintained Indicate Over-Production

AKRON, June 12—Despite the fact that the current demand for automobile tires is unprecedented in the history of the automotive industry, tire companies in Akron have surged ahead to production records which forbode another tire surplus and which indicate an actual present over-production, according to President Harvey S. Firestone of the Firestone Tire & Rubber Co.

In reviewing the present tire situation, Firestone says:

Our information shows that there is a large overproduction in tires now in many sizes and types. In fact the demand all along the line has hardly kept pace with production, and as a consequence a surplus has been piling up.

It is expected that the usual increase in trade sales during the coming summer months will absorb this surplus, and I hope this will enable the rubber industry to maintain its present production schedule late into the autumn months.

We have no plans at present for a Firestone increase in production and therefore we are not hiring additional help. The demand for original equipment from automobile manufacturers is the chief cause of the present high point of tire production in Akron. Whether this demand will be maintained is uncertain. As far as I can see there is nothing in sight to warrant the belief that the tire industry will go much beyond its present production this year.

Has Been One of Greatest Years

Firestone's warning comes in the face of one of the greatest booms the tire industry has known, not even excepting the then unprecedented spurt of early 1920. Every tire company in the city is producing to its limit and is crying for more men, advertising for them in other cities and boosting wages as an added attraction.

Tire output has been over 85,000 a day now for more than six weeks and is steadily increasing. Firestone is running between 24,000 and 25,000 a day, and Goodyear has climbed to 26,000 a day. Unofficially it is said that Goodyear is considering a temporary production of nearly 30,000 a day, provided men are available, in order to catch up with orders and to replenish its exhausted finished goods inventory.

There are several manufacturers, however, who agree with Firestone that the possibilities of another huge tire surplus are increasing.

AMERICAN BOSCH SALES DRIVE

SPRINGFIELD, MASS., June 12—Branch managers of the American Bosch Magneto Corp. decided at a convention at the factory that with business conditions rapidly improving a vigorous and intensified sales drive should be made immediately with the idea of taking full advantage of increasing sales possibilities.

Finance Companies Take Up Zone Plan

Plan Discussed at Convention to Have Eight Sections Throughout Country

INDIANAPOLIS, June 9—Among the projects discussed at the morning session of the National Association of Automobile Finance Companies, which has been in convention here, was the districting of the country into eight sections and the holding of sectional meetings to take up matters affecting the districts and the national association. At present the organization membership is confined to state and local associations, with headquarters in the principal cities. The plan for the district division went over to be acted upon at subsequent meetings and for consideration by the board of directors at conferences, the first of which will be held in Pittsburgh in October.

First Convention Held

The convention, which was the first held by the organization, brought together 150 representatives whose companies in 1921 carried on a billion dollars' worth of automobile financing. The attendance did not represent the total strength of the organization, for several of the largest companies which are members had no delegations, and their business was not accounted for in the statistics gathered.

According to President Fred A. Weber, Jr., the national character of the automobile necessitated the organization of the association last fall. It was found necessary to have at some central point a medium for gathering complete reports of every financing negotiation of automobiles and motor trucks in order to offer fullest protection to the companies issuing finance paper, and for the advancement of the interests of the men in the automotive industry who look to such financing from these companies.

A movement toward educational campaigns and active work to show the need of more uniform state laws governing finance operations was considered favorably by the convention in its endeavor to provide in the future the most dependable sort of service to the automotive industry, and to simplify the business of companies which are operating over wide areas.

Safeguarding Business

Reports and statistics show that from 50 per cent to 75 per cent of the overhead of all the finance companies in the association is devoted to the credit and collections department in the effort to throw the strongest safeguards around the business. Because of this active effort to establish the business more soundly and to show its solidity, the finance companies have been able to show banks that there is no longer undue risk from such automobile paper when issued by reputable finance houses that follow the tenets of the association.

At the close of the afternoon session C. A. Vane, general manager of the National Automobile Dealers Association, told of the active interest of the dealers in the future welfare of the finance companies and the desire of his organization to co-operate to the fullest degree possible for the best interests of both the organizations and their members.

During the day the Indiana Finance Association, which acted as host, held its meeting and elected the following officers for the year President, Frank A. Fisher, Indianapolis; vice-president, C. H. Stratton, Sullivan; Roy Myers, Evansville; F. A. Shively, Lafayette; Edmund Bittler, Fort Wayne; secretary, Joe Twitty, Indianapolis, and treasurer, Ben Sagalowsky, Indianapolis.

The banquet in the evening was addressed by Weber, Walter E. Heller, first vice-president, of Chicago; S. S. Stratton, president of the Commercial Acceptance Trust; Henry Warrum, president, National Auto Insurance, and ex-Mayor Charles A. Bookwalter.

May Lose Dealers' Plates as Result of Speed Trip

NEW YORK, June 12—A new obstacle for motor car manufacturers who seek to establish endurance and speed records in this state has arisen as the result of the announcement by the Wills-Sainte Clair Co. that one of its cars had been driven to Montreal and back, a distance of 804 miles, in 19 hours and 50 minutes, an average of slightly more than 40 miles an hour.

Bert Lord, director of the New York State Motor Vehicle Bureau, has sent a letter to the Wills-Sainte Clair Co. asking it to show cause why its right to operate cars under dealers' plates should not be revoked. He pointed out that the state's motor vehicle law stated that "a rate of speed in excess of 30 miles an hour for a distance of one quarter of a mile shall be presumptive evidence of driving at a rate of speed which is not careful and prudent." Lord's letter declares the Wills-Sainte Clair test "a flagrant violation of the state law."

The car was driven on this trip to Montreal and back by B. E. Smith, who is connected with the Fisk Tire Co. in this city.

PACKARD IGNITION ENJOINED

NEW YORK, June 12—Judge Hough in the Federal District Court, with the consent of the Packard Ignition & Electric Co., Inc., defendants in a suit instituted by the Connecticut Telephone & Electric Co., granted the plaintiff a perpetual injunction restraining the defendant corporation from further selling Breaker plate. It was contended in the complaint originally filed by the plaintiff that the sale of this material by the plaintiff was an infringement on the patent.

8,770 Trucks Ready To Be Dumped Here

Pending Legislation Halts Shipments of American-Made Vehicles from Europe

PARIS, June 10 (By cable):—There is a total of approximately 7000 American made army trucks in France, which will be dumped on the American market, at prices far under the regular list, as soon as they can be reconditioned and shipped back to the United States. Of this number approximately 50 per cent are now serviceable and will need no reconditioning.

In addition to the 7000 in France there are 1770 trucks in the hands of dealers in England according to the British Liquidation and Disposal Board, which still remain to be sold, and which it is expected will be returned to the United States to compete with new trucks.

Because of the pending legislation in Congress at Washington, shippers are withholding immediate shipment for fear that the 90 per cent re-import tax might be imposed before the shipments can reach the United States.

Expect Facts to Aid Graham Bill

WASHINGTON, June 12—The announcement that there is a total of approximately 8770 trucks in Europe available for re-import to the United States, it is expected, will effect the needed passage of the Graham resolution (HJ 183), introduced in Congress at the request of automobile dealers, and which will, it is declared, prevent the dumping of war trucks and passenger cars into the United States by imposing a 90 per cent reimport tax on all automotive vehicles returned to this country.

Opinion has been expressed by members of the Senate finance committee who must pass on the measure that there is no real need for the passage of the Graham anti-dumping bill. The statement was made before the House Committee by the automobile dealers that there were approximately 5000 trucks abroad which could be brought back into this country and sold, even with the return freight added, at considerably under the market, thus demoralizing the United States trade.

BIG INCREASE BY BUDA

CHICAGO, June 13—The Buda Co. reports that since last December its increase in business has been over 700 per cent, covering the matter of releases secured for engines for truck service. Within the last 60 days there has been a great volume of releases of engines for the larger capacity trucks, an indication of improvement in general business conditions. The releases are coming from all parts of the country.

Covers 67.38 Miles on Gallon of Benzol

Citroen Successful Competitor in Le Mans Test—Breaks All Previous Records

PARIS, May 30 (*By Mail*)—All fuel consumption records were broken at the Le Mans trials when a four-cylinder four-passenger Citroen, weighing complete 2485 lb., covered a distance of 100.4 miles on an allowance of 1.49 gallons of fuel, this being at the rate of 67.38 miles to the American gallon. During this performance the speed never fell below 25 miles an hour. A similar Citroen got second prize by covering 99.9 miles on the same quantity of gasoline, or at the rate of 67.04 miles to the gallon. Both cars used straight benzol and were equipped with the Solex carbureter.

The severity of the trials at Le Mans reduced the number of competitors, only twelve cars facing the starter. Unlike previous years, a minimum average speed had to be maintained throughout the competition and the amount of oil consumed had not to exceed 7 per cent of the gasoline allowance expressed in cubic centimeters. This was done in order to prevent competitors getting a low gasoline consumption at the expense of their oil supply, which was a feature of last year's trials.

Little Oil Used

The winning Citroen used only three ounces of oil to cover a distance of 65 miles, while on several cars the amount of oil used was so low that it was difficult to measure it.

For this competition Citroen presented a new sports type car with an overhead valve, four-cylinder engine of 2.67 by 3.93 in. bore and stroke, having a compression of about 85 lb. to the sq. in. The valves are operated by pushrods from a camshaft in the crankcase. So far as chassis features are concerned, this new model is practically identical with the standard production of the Citroen chassis, and even some parts of the engine are similar on the two models.

RADIO USED TO CARRY MESSAGE OF N. A. C. C.

NEW YORK, June 12—Radio telephony was the means of carrying a story of the progress of the automobile industry to thousands in the radio audience when Alfred Reeves, general manager of the National Automobile Chamber of Commerce, spoke from the broadcasting station WJZ at Newark, N. J.

He briefly reviewed the history of the automobile industry, spoke of the early trials of manufacturers and owners and contrasted these with the comparative perfection of the car of to-day. He also called attention to the growing use of radio among automobile owners, both for commercial purposes and for amusement.

It is intended to get into production with this overhead valve model at an early date.

A 91 cu. in., four-cylinder Mathis captured third place on the general list with a consumption equal to 65.09 miles to the gallon. This car was handicapped by the accidental loss of a small amount of gas at the start. A couple of Chenard-Walcker cars, with 183 cu. in. overhead valve engines, averaged respectively 42.23 miles and 40.59 miles to the gallon.

The biggest car in the competition was a sports type Voisin of 274 cu. in. piston displacement, which came to a stop after covering 62.2 miles on an allowance of 2.49 gallons. This car, which is equipped with a Knight type sleeve valve engine, averaged 47½ m.p.h. and consumed 22 ounces of lubricating oil before the engine stopped.

Considered on a basis of miles per gallon, without any consideration of fuel allowance a two-seater 67 cu. in. Mathis made the best showing by averaging 99.11 miles to the gallon. On the basis of fuel cost per passenger, the winning Citroen driven by Poulain was the best, for the cost of fuel worked out at 1 fr. 61 cent per 100 kilometers.

RESULTS OF FUEL CONSUMPTION TEST

	Piston displacement	Weight pounds,	Fuel allowance, gallons	Distance covered, miles	Miles per gallon	Minimum speed, miles
1. Citroen, Poulain	91 in.	2,486	1.49	100.4	67.38	25
2. Citroen, Barbier	91 in.	2,488	1.49	99.9	67.04	25
3. Mathis, Lahms	91 in.	2,535	1.51	98.3	65.09	25
4. Chenard, L. Chenard	183 in.	4,207	2.18	92.07	42.23	21
5. Citroen, Labaume	91 in.	2,844	1.49	89.5	60.06	25
6. Chenard, Leonard	183 in.	4,166	2.18	88.5	40.50	31
7. Mathis, Bocchi	67 in.	1,560	0.79	78.3	99.11	22
8. Bignan, Gros	122 in.	2,863	1.58	67.02	42.41	28
9. Voisin, Gauderman	274 in.	4,651	2.49	62.2	24.98	37
10. Mathis, Colliere	91 in.	2,122	1.27	55.56	43.74	25
11. Mathis, Milsant	45 in.	1,199	0.72	53.26	73.97	18

Use Up Inventories on Passing Models

Heavy Buying Presages Discontinuance of Some Lines Earlier Than Anticipated

DETROIT, June 12—One important effect of the heavy buying in the early part of the year is that it has given manufacturers an opportunity to use up inventories on models which they had planned to discontinue with far greater rapidity than had been anticipated. As a result of this buying it is certain that the next three months will find announcements from at least four important companies that they have discontinued manufacturing certain models in their lines.

Two models have already practically been taken from the market, the Scripps-Booth by General Motors and the Briscoe by the now Earl Motors, Inc. In the latter there are only a few in the roadster and the coupe now unsold, the phaeton and sedan having found ready sale under the impetus of reduced prices and being now entirely sold. In both of these makes the service will be continued indefinitely.

Other models which will be taken from the market when the stock of material is exhausted will also be serviced indefinitely by the makers, who will concentrate their manufacturing facilities on other models in their lines.

The fall season will also witness the appearance of new models in several other lines; in one of these it will be a complete new line, and in others, the presentation of new closed models. There are likely to be manufacturing economies emphasized in some of the closed car bodies making their appearance, which will probably result in closed car prices more closely approximating those on open models.

Large Absorption of Labor

There has been a large absorption of labor in the Detroit district since April 1, every factory having added heavily to the working forces employed at that time. In addition to taking up all the unemployment that existed in the city, many hundreds of men have been brought in from outside districts, among these being large number of striking coal miners and farm laborers, as well as many skilled mechanics from other industrial centers.

AUTOCAR OPENS NEW BRANCH

NEWARK, N. J., June 12—The Autocar Co. has opened its new factory branch building in this city. It is one of the largest service stations of its kind in the country, with 77,000 feet of floor space on the street level. In addition to sales and service facilities, it will provide warehousing space and a reconditioning department for the entire Greater New York district. The new building, which is located on Frelinghuysen Avenue, covers a city block with entrances on four streets.

Steel Is Big Factor in Parts Shortage

Manufacturers Keep After Producers—Plants Expanding to Meet Demand

DETROIT, June 12—Timken-Detroit Axle Co. has succeeded in setting up most of the equipment without which it has been handicapped in meeting the heavy pressure of business, and will be in a position to meet deliveries in full within the month. Night and day forces will be continued to meet commitments, and in the meanwhile the company will continue to apportion its product so that all customers will be cared for.

The company reports difficulty in obtaining steel in the quantities needed, but is enabled to meet its requirements by keeping vigorously after the steel producers. There is no anxiety over the company's coal situation, but it reports that steel men ascribe shortages in that market to the inability to get coke.

Continental Makes Additions

Continental Motors Corp., with additional factory space at its Muskegon plant and most of its new equipment now set up, is about ready to enter large production on its single six engines and the several special models, which it is to make for other customers, notably Durant. Quantity production on the six will start late in June. The Star engine will be in large production in August. On its other models the company has been meeting commitments on a fairly even basis, having been handicapped by labor shortage temporarily.

Aside from these two companies, deliveries of parts have been commensurate with the early commitments placed by companies. There is a great deal of difficulty in obtaining deliveries of parts and materials ordered at short notice, but this is not due to any shortage. The failure to anticipate requirements in actual quantities is making last minute shortages, but the only real shortage is steel.

There is no disposition to make commitments over longer periods, parts makers report, the car and truck makers holding their buying for the most part to thirty day periods, though there are a number of companies which are buying on a wider time margin.

Commitments Run Lighter

Commitments at this time for July are running considerably lighter than for June, parts makers report, but this is only a repetition of a buying condition which has manifested itself all year. Early commitments for any month this year have been much lighter than the quantities that manufacturers afterward sought. It may be possible that July manufacturing will drop to a point where the early commitments will be sufficient. They have not been for any other month to date.

Some body makers are complaining of a shortage of plate glass, others declare their supply ample. The situation in this market is declared to be similar to that in other supply markets, a matter of getting commitments in early and in ample quantities. Plate glass deliveries are now on about a two months basis.

LIQUIDATION OF WILLYS CORP. ASSETS MEANS GOOD FIRST PREFERRED RETURN

New York, June 12.

HOLDERS of the $15,000,000 in 8 per cent cumulative converted first preferred stock of the Willys Corp. are likely to realize a substantial amount through the liquidation of the corporation's holdings. This stock has preference as to assets over both the second preferred and the common stock and in the case of voluntary liquidation or dissolution the holders are entitled to 110 and accrued dividends.

When the petition for a receivership was filed the liabilities were estimated at from $10,000,000 to $14,000,000. Supplemental claims will increase them to about $19,000,000.

The sale of the corporation's assets promises to net approximately $25,000,000. It owns 730,000 shares of common stock of the Willys-Overland Co. which now is quoted around nine on the stock exchange. This gives a book value of $6,570,000. The Electric Auto-Lite division was sold for $4,700,000 and the plant at Elizabeth, N. J., for $5,525,000. This makes a total of $16,795,000.

The book value of the New Process Gear division at Syracuse is $2,650,000 and it is expected to bring at least $1,500,000 when it is sold. Other assets include $1,000,000 par value in Fisk rubber common stock, $1,000,000 par value in Federal rubber stock and other securities with a par value of about $3,000,000. The total book value is about $3,000,000. The corporation has on hand about $1,000,000 in cash and approximately $4,000,000 in notes and accounts receivable.

Estimating the liabilities at $19,000,000 it will be seen that the dividend on the first preferred would approximate around 40 per cent.

Maxwell Had Plans for Chrysler Six

(*Continued from page* 1344)

from the National Park Seminary, as he had promised he would take her abroad as soon as her course was over.

Directors of the Maxwell corporation gave Chrysler a dinner at the Metropolitan Club last night in recognition of his achievement in putting Maxwell back on its feet in so short a time. E. R. Tinker, president of the Chase Securities Corp., presided and announced that Chrysler would be the only speaker.

Chrysler outlined briefly his connection with the Maxwell company since he became chairman of the reorganization committee while still vice-president of the Willys corporation. He said he had promised the directors that he would put out a new model on which the profits would be from $5 to $15 per car. He was somewhat proud, he said, of the fact that 40,000 of these new models already had been sold. The output in May was 6527 on which the profit was something more than $100 each. The June production will be not less than 6400, and the output for 1923 will be at least 100,000.

Chrysler said he had been asked frequently whether he would remain with the Maxwell company. He answered it by declaring that the Maxwell directors had stood by him and that he would stand by them.

Durant High Bidder For Elizabeth Plant

(*Continued from page* 1344)

Whether or not the sale is to be confirmed will be determined in Federal court at Trenton, Monday. If it is confirmed and the property goes to Durant, he will sell a considerable portion of it including 24 lots of machinery inventoried at $2,340,000, a baseball park valued at $72,719 and a garage with book value of $50,000.

If this property brings its inventoried value, the plant will actually cost Durant only $3,062,281, which was less than he offered for it at private sale. It can be said that Durant proposes to make no use of the rights and designs for the Chrysler six, which was to have been built in the Elizabeth factory.

If the sale is confirmed, the plant will be equipped as rapidly as possible for the assembling of 500 Star cars a day. This will not take more than 60 days and every effort will be made to shorten this period. The factory was designed in 14 units, each of which will provide an assembly chain. These assembling facilities will be installed in units as speedily as possible.

F. W. Hohensee, president of the Durant Motor Car Co. of New York and chief engineer for the Durant plants at Long Island City, Lansing and Toronto-will be in charge of Star production. It is probable the Elizabeth plant will be operated by a new subsidiary to be known as the Durant Motor Car Co. of New Jersey. This company has not yet been incorporated. Star Motors, Inc., will be solely a sales company to which Durant Motors has contracted to deliver the complete Star car.

Men of the Industry and What They Are Doing

McConnell Touring Country

D. A. McConnell, president of the Klaxon Co., Newark, is making an extensive trip through the country, calling on Klaxon distributors in the South, Middle West and on the Pacific Coast. He is not expected to return to the factory until about July 1.

Dumaine, Mack Trucks Director

F. C. Dumaine, treasurer of the Amoskeag Manufacturing Co., has been elected a director of Mack Trucks, Inc., succeeding E. R. Hewitt, resigned.

Peck Directs Traffic Sales

Charles C. Peck, Jr., has been appointed general sales manager of the Traffic Motor Truck Corp. He has been with the Traffic organization for over three years, first acting as manager of the New Business Department, then as assistant general sales manager.

A. M. Dean Joins Rubay Co.

A. M. Dean, connected with the Templar Motors Co. as chief engineer since its inception, has become associated with the Rubay Co., Cleveland, in the same capacity in the production of a chassis for town cars exclusively. No phaeton models are contemplated by the company.

Kiefer Service Manager of Buda

W. C. Kiefer has been promoted to the office of service manager of the engine division of the Buda Co., succeeding R. A. Kiken, who has resigned to join the Motive Parts Co. of America, Inc., Chicago, as sales manager. Kiefer has been with the Buda company for seven years, and for some time has been acting as assistant service manager.

C. L. Heyniger Transferred

C. L. Heyniger, formerly an assistant to Alfred Sloan, Jr., vice-president of the General Motors Corp., in charge of production, has been promoted and transferred to the sales department of the Chevrolet Motor Co. at Tarrytown.

Awarded Medal of Merit

J. F. Keller, vice-president of the Keller Mechanical Engraving Co., Brooklyn, has been awarded the Edward Longstreth Medal of Merit by the Franklin Institute for his automotive die cutting machine of the reproducing type.

Whiting with Greenfield Corporation

W. E. Whiting is now associated with the Greenfield Tap & Die Corp. and will be located in Detroit. Whiting has been connected with the grinding industry for 14 years. From 1909 to 1916 he was with the Heald Machine Co. of Worcester, Mass., as apprentice, journeyman grinder, demonstrator and finally as superintendent of the grinding department. In 1916 he went to the Norton Co., where he did laboratory and demonstration work for a short time. He is well known in Michigan, where for the last four years he has handled sales for the Grinding Wheel Division of the Norton company. Whiting will represent the machine tool division of the Greenfield corporation.

Promotion for W. P. Loveless

W. P. Loveless, who for the last three years has been alternately assistant sales manager and sales manager of the William R. Johnston Manufacturing Co., has been promoted to the position of assistant to the president. William R. Johnston, president and general manager, will devote the greater portion of his time to production and development of new lines. Sales work and advertising will be directly under the supervision of Loveless. R. W. Keyt, formerly sales promotion manager of the I. J. Cooper Rubber Co. of Cincinnati, has become identified with the Johnston company, in charge of the sales promotion department, covering directly the Johnston jobber end of the business.

Ralph Templeton Promoted

Ralph Templeton, for several years manager of the Whitman & Barnes Manufacturing Co.'s New York office and store, will assume an important position in the company's executive offices in Akron, July 1. Templeton first entered the employ of the Whitman & Barnes organization in 1898 and has served it in various capacities continuously since then. After serving in the Akron office and as Detroit representative, he was appointed manager of the New York store in 1910.

A. H. Frost with Cox Brass

A. H. Frost, formerly chief engineer of the Van Blerck Motor Co., for which he designed a 4-cycle engine, and more recently vice-president and sales manager of the J. V. B. Engine Co. of Akron, has joined the Cox Brass Manufacturing Co. of Albany, which he will represent in its relation with the engineering departments of motor car manufacturers.

J. W. Meely Resigns

J. W. Meely, Detroit branch manager of the Studebaker Corp., has resigned, effective at once. Meely has held the position one year. Before joining the Studebaker Corp., he was sales manager of the Barley Motor Car Co. at Kalamazoo for two years. His plans for the future have not been announced.

Zimmerman Visits Plants

H. G. Zimmerman, manager of the Australasian division of General Motors Export, spent a week visiting the Oakland plant at Pontiac, the Buick plant at Flint, the Chevrolet central offices at Detroit, the plant of Canadian Products, Ltd., at Walkerville, Ont., and General Motors of Canada, Ltd., at Oshawa. The main object of his trip was to complete arrangement for the manufacture in the United States of Oakland and Chevrolet right hand drive chassis for the Australian market. On his visits to Flint and Oshawa, Zimmerman was accompanied by W. H. Morris of Morris & Morris, Queenstown, South Africa, Buick and G. M. C. distributor.

Carmody Representing Weaver

John D. Carmody has joined the sales force of the Weaver Manufacturing Co., Springfield, Ill., his territory including Michigan, Indiana, Ohio and Kentucky as well as Buffalo, N. Y., and important cities in Pennsylvania and West Virginia. Carmody is well known in the industry, having been connected with the Champion Spark Plug Co. for a number of years and being associated with the Wainright Piston Ring Co. until its consolidation with the McQuay Norris Manufacturing Co.

Jack Cooper Expands Activities

Jack Cooper, in addition to representing the Walker Manufacturing Co., has become sales director of the E. A. Laboratories, Brooklyn, to succeed William Von Elm, who has resigned after three years service as vice president and sales manager.

Tire Dealers Threaten to "Shop" for Stocks

CLEVELAND, June 13—"Instability of prices for tires and uncertainty of adjustments is forcing many automobile owners to take chances on the less known makes of tires," reads a report of the special committee of the Cleveland Tire Dealers Association, which was appointed some time ago to make an investigation of the subject and to report.

The report concludes with the warning: "Unless adjustment of tire prices is made quickly, the tire dealer will follow the lead of the tire-buying public and will go shopping."

The committee states in its report that if the tire industry is to hold its place among the leading industries of the country and those engaged in the manufacture and sale of the product are to realize any measure of prosperity within the next few years, a complete revision of policies and practices, as well as adjustment of prices, must be made immediately.

Lelands Quit Lincoln; Ford Operates Plant

Severance of Relations Said to Be Due to Disagreement Over Methods

(*Continued from page* 1345)

satisfactory to Henry Ford, who spent much of his time at the plant with his engineers seeking increased efficiency in connection with the attempts to increase production.

Some of the work of manufacturing has been transferred to the Ford plants at Highland Park and River Rouge. This has resulted in the close connection of the Lincoln and Ford companies in manufacturing. This was one of the points that the Lelands had always been most desirous of keeping entirely separated. To them it seemed that the linking of the high class car with the inexpensive one would have a bad influence on Lincoln business. With an amalgamation of the two companies, all of the departments will come under the direction of Ford executives.

The Lelands own no stock in the new Lincoln company. It was understood that when the property was taken over by Ford, he paid the Lelands the full amount of their actual investment in the original Lincoln company. It is reported that Ford will pay each of them an additional $250,000 to cancel their contracts.

Rate of Output Ascribed as Reason

In the absence of an authoritative statement on the cause of the break between the Lelands and Fords, automotive circles generally have accepted the report that the break was due to incompatibility on manufacturing policies. Persons close to Ford, however, declare this not to be the case and ascribe it to a failure of the plant under Leland guidance to make satisfactory returns on the investment.

Prices fixed following the sale in February were based upon the ability to speed up production to a point approximating 50 to 60 cars daily. To date the best production reached has been about 30, whereas the orders on hand and obtainable would warrant a production double and treble the present rate. There has been no opportunity for the Ford sales organization to function with a low production rate, and orders booked by the former Lincoln organization could not be met.

With the company completely under Ford control, it is said much of the parts manufacturing will be transferred over to Ford plants, so that it may be turned out in a more economical and efficient manner.

1800, HENDEE JUNE PROGRAM

SPRINGFIELD, MASS., June 13—The Hendee Manufacturing Co. has given no sign of slackening production. About 1800 cycles will be built this month, and the July prospect is favorable. Export orders call for the early shipment of 800 cycles to England, Holland, Belgium, Sweden, Czechoslovakia, Italy, Australia and South Africa. It is stated that during the past four months the company has filled orders from American police departments for 560 motorcycles and 240 sidecars.

Pietsch Named Manager of Kelly-Springfield

SPRINGFIELD, OHIO, June 13—E. O. McDonnell, has resigned as general manager and vice-president of the Kelly-Springfield Motor Truck Co. Frank H. Pietsch succeeds him. Pearl A. Lewis has been named assistant general manager. He has been associated with the company for years. Pietsch, formerly of Chicago, joined the Kelly force here several months ago as general sales manager.

McDonnell announced his resignation upon his return from New York City. The resignation was accepted by President Charles W. Young, whose headquarters are in New York. Inasmuch as there are a number of important matters unfinished of which McDonnell has special knowledge, he will continue as vice-president until Aug. 1. While relations with the company are most cordial, McDonnell says that his personal affairs make it necessary for him to return to New York, where he expects to be associated with the same interests with which he was connected before coming to Springfield.

May Urge Endorsement of Motor Vehicle Law

NEW YORK, June 13—A committee representing the highway departments of 10 eastern states, which conferred here last week with committees from the National Automobile Chamber of Commerce and the Society of Automotive Engineers, probably will recommend endorsement of the uniform motor vehicle law at a general meeting of the highway departments at Baltimore, July 17. If the recommendation is adopted, it will carry considerable weight with the legislatures of the 10 states. If the uniform law were adopted by most of these states, it undoubtedly would be only a comparatively short time before the rest of the country swung into line.

Another question to be considered at Baltimore will be a uniform formula for rating trucks in these states.

FIAT PLANT SOLD

POUGHKEEPSIE, N. Y., June 15—The factory in this city of the Electric Auto-Lite Corp., which was formerly the Fiat assembling plant, was bid in at receivers sale yesterday by C. O. Miniger of Toledo for $300,000. Miniger, who already has bid in the Auto-Lite plants at Toledo and Fostoria, said he expected to open the local plant in the near future.

Long Tells Ad Men of Trade Body Aims

Every Industry Must Build Itself in Line with Public Policy, He Says

MILWAUKEE, June 12—"Building collective good-will is the chief aim of trade associations and trade advertising," said John C. Long of the National Automobile Chamber of Commerce, speaking before the educational conference of the Associated Advertising Clubs of the World here to-day.

"Selling more goods, reducing cost of manufacture and exchanging trade information may be the more immediate activities," he said, "but fundamentally every industry must aim first to build itself in line with public policy."

He continued with saying:—

Upholding the honor of the business family means that one must destroy or reform the enemy within the gates. The "shady" dealer, the "fly-by-night," the out and out swindler must go. In the realm of advertising, the trade association finds the A. A. C. of W. a shining sword of defense. The trade group needs but to make complaint against the unscrupulous, contribute funds in accord with its ability to pay, and the forces of Truth-in-Advertising are put into action.

The trade association can take a further constructive part in building goodwill by telling the public about the traditions and activities of its industry.

It can relate, for instance, how cooperation is saving the cost of production. The members of the National Automobile Chamber of Commerce, for example, exchange patent rights of over 500 patents without payment of money, thereby saving the high cost of litigations and royalties. The Society of Automotive Engineers has developed 245 standard parts which has meant a saving of $124 per car and $171 per truck annually in manufacture. In a competitive industry such as this the lower costs are immediately reflected in lower prices.

N. A. C. C. Meeting at Chicago

CHICAGO, ILL., June 13—Thirty automotive manufacturers were represented at the meeting of the National Automobile Chamber of Commerce advertising managers' meeting at the University Club here to-day. Edward S. Jordan presided and John C. Long represented the chamber. The discussions of the day were varied, but there was evidence that practically all of the advertising men and the firms they represented are taking the question of dealer selection and dealer importance in the sales plan more seriously than ever before.

C. G. BARLEY DIES

MARION, IND., June 12—C. G. Barley, president of the Indiana Truck Corp., died at his home here yesterday, following an illness of several months. His association with the industry covered a long period. He was identified with many local enterprises, and at one time was interested in the Rutenber Motor Co.

New York Is Shown Five Models of Star

Line Includes Phaeton, Roadster, Sedan, Coupe and Delivery Bodies

NEW YORK, June 14—The first showing of the Star car in New York was given to-day at the salesrooms of the Poertner Motor Car Co. Five models were displayed at the following prices: phaeton, $348 or $443, with starter and demountable rims; roadster, $319 or $414, with starter and demountable rims; sedan with starter and demountable rims, $645; coupe with starter and demountable rims, $580. All prices are f.o.b. Detroit. Delivery bodies were also exhibited. The phaeton is the only one which had previously been shown.

After the phaeton was exhibited at Washington, March 9, and at the Boston show, it was withdrawn until the Durant factories were prepared to meet the demands with quantity production. Notwithstanding this fact, Star Motors, Inc., has on hand orders for several thousand cars.

The roadster and phaeton bodies are largely of metal and are conventional in lines and most other particulars. These bodies are to be assembled at the various plants where the cars are assembled, while the closed bodies will be purchased outside.

Construction of Car

A substantial tire carrier has been added to the rear of the chassis frame, and conventional running board brackets are to be used without the angle iron brace between them under the gearset, which was shown on the first chassis. The worm-and-worm-wheel type of steering gear is to be furnished by the Warner Gear Co., which also supplies the gearset. The lower end of the worm wheel spindle is bent forward below its guide, thus forming an integral steering arm. The rear end of the gearset is supported on the two brake shafts which are pivoted at each end in the main frame. Brake rods are of flat steel with forged ends welded on. The battery box is formed from flat strip stock bent to shape and hooked over the cross member to which the gearset is bolted.

The Morse chain used in the engine can be adjusted by rocking the generator outward. The water pump is driven off the rear of the generator unit through a flexible hose-type coupling, which takes care of the change in alignment when the generator is moved. The starting motor, when furnished, is strapped to a bracket cast on the crankcase on the right side below the water pump and is provided with Bendix drive. It can be easily attached if purchased separately.

MORE HUPP DEALERS

DETROIT, June 13—Hupp Motor Car Co. is encouraging its distributors in all cities to open up their territories to additional dealers in such number as the size of the territory warrants. Although the appointment of the subdealers is left to the discretion of the distributor, the company has adopted the policy of seeking the most intensive means of covering its entire territory that may be employed successfully.

New York has witnessed the opening of another Hupp dealership in the past 10 days, but there are already 16 Hupp dealers in Chicago and a number in most other important cities.

Davis Building Phaeton Smaller Than Old Model

RICHMOND, IND., June 13—The Davis Model 71 phaeton is a lighter, smaller six than the series 61 models, which have been in production for some time. Model 71 phaetons are now in production and deliveries are being made to distributors and dealers. So far only one body model is being placed on this chassis, this being the phaeton at $1,195. The engine, which is a Continental, 3⅛ x 4¼, is slightly smaller than that used on the larger model, and the wheelbase is 114 in., 6 in. less than the other model. The regular equipment is Disteel wheels and 31 x 4 in. cord tires. The road weight is 2645 lbs.

The other units of the car are the same as the previous model, namely Timken, Delco, Borg & Beck, Warner, etc. The upholstery is long grain, genuine leather, French pleated over curled hair and coil springs. The top is from double texture fabric and is hand-tailored to each individual body.

Rear vision is provided for by a large rectangular plate glass window. The finish is in dark blue for the body, hood and wheels, the fenders and chassis being black enamel. The headlamps are drum type, finished in nickel and black enamel.

American Steam Truck Co. Produces First Phaeton

CHICAGO, June 10—The American Steam Truck Co. this week turned out from the factory its first steam 5-passenger phaeton, which the company plans to sell at $1,650. Four more of the cars are being assembled in the plant here and will be on the streets within a few days, according to R. R. Howard, president of the company.

A production schedule has been arranged for 100 cars to be turned out as soon as possible after the first five have been completed, Howard said. The company's first steam truck was produced about six weeks ago.

FRANK G. CARRIE DIES

NEW YORK, June 12—Frank G. Carrie, until recently vice-president of the Marmon Automobile Co. of New York, died at his home on Gerber's Island Saturday. He was 57 years old and was well known as one of New York's pioneer automobile tradesmen.

Government to Make New Tractor Survey

Proposed Campaign for Farmer Will Be Tabled Pending Its Completion

WASHINGTON, June 13—A comprehensive survey of the relative cost of tractors, as compared with horse power for use on farms, will be undertaken by the Department of Agriculture, in order to determine definitely the value of tractors on farms.

A recent report made by that department based on a survey of 1500 farms, showed that, in the main, farmers were partial to tractors, but had to depend on horses to a great extent. The survey, it is maintained by tractor manufacturers, who immediately sought a conference with the department officials, was not "fair" to the tractor industry in that it did not take into consideration various phases favorable to the tractor, such as feeding stock, cost and time of raising food and fodder for plow horses, rest for horses and cost and care of harness, etc.

A protest, at the same time, was received from horse breeders by the Bureau of Animal Husbandry, also a branch of the Department of Agriculture, that they would strenuously object to the tractor industry being favored in a survey, detrimental to the horse breeder.

No Favor Shown

Because of the protests made by the horse breeders and by the tractor manufacturers, the survey by the department will be made and the facts published, regardless as to whether the results favor the tractor or the horse as a more economical factor in farming.

At the final conference on the question, the tractor manufacturers, through their spokesman, J. B. Bartholomew of the Avery Co., Peoria, Ill., acquiesced in the department's plan to make a national survey, and consented to the "tabling" of a proposed educational campaign of farmers to the use of tractors, pending the report of the survey.

Moon Develops Sedan For Its 6-40 Model

ST. LOUIS, June 12—The Moon Motor Car Co. has developed a new 5-passenger 4-door sedan, fitted to the 6-40 Moon chassis, priced at $1,695. Previously only the phaeton has been put out on this chassis. The price of the sedan is only $400 higher than the phaeton. The body super-structure is built of hard wood, with all joints screwed and glued. The body panels are of 20 gage steel and are flanged by mechanical means, eliminating the use of solder. The mouldings are rolled around the door and belt to prevent cracking of paint. The roof is made of light bows and slats covered with wadding and waterproof top material.

Tractors Play Part in Buying Movement

Sales Made in Ohio Territory Are Four Times Those of Year Ago —Show Better Conditions

COLUMBUS, June 12—Distributors and dealers in this territory report an unexpectedly large volume of tractor and power equipment sales during the first five months of the year. Total business done by some tractor distributors and branches is more than four times that done in the same period of last year.

A part of this demand for tractors can be traced to the unusually wet weather experienced during the past spring. Frequent rains interfered with soil preparation and planting. A farmer would disk-harrow a field but before he could plant it rain would come, and the harrowing operation would have to be repeated.

The tractor-drawn plows and harrows offered the only solution. Their superior speed enabled the farmers to prepare the bed and plant the seed between rains. And many farmers in this territory have bought tractors this spring because of this time advantage.

But this reason does not account for all the buying. Had similar weather conditions prevailed a year ago, little buying would have resulted. At that time the farmer's resources were too limited to permit of his buying.

Farmers Recovering

The comparatively large volume of sales this year indicates that the farmers in this territory are rapidly recovering from the recent depression. They are making giant strides in their climb back to prosperity. They are adjusting themselves to the new conditions and are buying tractors to help them in that adjustment.

The farmers are paying for their tractors for the most part with notes. In some cases no cash is involved in the transaction.

Such paper is not readily salable to the bankers in this territory. The dealers must either be in a position to finance these sales or must have the assistance of the factory. A dealer representing a line which is not factory-financed consequently is under a prohibitive handicap unless he can finance the sales himself.

The banks have not adopted any rule against tractor paper. Some paper maturing next fall has been discounted. But, in general, paper maturing next year is not acceptable.

The farmers are on the whole satisfied with present tractor prices. They feel that the factories have done their share in getting back to pre-war levels.

Backward Season Benefits

CHICAGO, June 12—Manufacturers reporting to the National Association of Farm Equipment Manufacturers state that in most cases their production and sales are now from 50 to 60 per cent of normal. Summarizing the reports received, the association says

Improvement is noted in the sale of tractors and threshers, the backward season having reacted to the benefit of the tractor manufacturer because of the necessity on the part of the farmer for greater speed in preparing the soil for crops. Tractor stocks are moving out of the hands of dealers and jobbers and several factories are now shipping direct. Collections are reported better and an improved business tone is generally noted.

U. S. Senate Advancing Gasoline Price Probe

WASHINGTON, June 14—Employment of counsel for the Senate Manufacturers Committee was authorized to-day in a Senate amendment to the LaFollette measure introduced last week for an investigation of the increasing cost of gasoline.

The amendment authorizes the subpoenaing of witnesses and provides a penalty for refusal of any witness to answer questions pertinent to the investigation.

According to figures made public today by the Bureau of Mines, gasoline production for April was 472,920,182 gallons, compared with 472,277,870 gallons during the preceding month and 426,000,000 in April last year. Stocks on hand May 1 were 892,267,766 gallons, compared to stocks on hand the same day last year of 747,000,000 gallons.

John J. Watson, Jr., Heads New Industrial Motors Corp.

NEW YORK, June 14—Organization of the Industrial Motors Corp., a combination of the Selden Truck Corp. and the Atlas Truck Corp., has been completed. The new corporation is understood to be negotiating for the acquisition of several other truck and accessory companies.

John J. Watson, Jr., president of the Lee Tire & Rubber Co. and chairman of the board of the Martin-Parry Corp., has been elected president of Industrial Motors. The vice-presidents are George C. Gordon, Robert H. Salmons, Allan R. Cosgrove and James R. Floyd. Henry Hopkins, Jr., an attorney, has been elected secretary and treasurer.

TARIFF SCHEDULE PASSED

WASHINGTON, June 15—The Senate has passed the automobile schedule in the tariff bill providing for a duty of 25 per cent as proposed in the House bill. The Senate finance committee has not yet determined what it will do in regard to a countervailing duty. This has been passed over at the request of Senator Townsend of Michigan.

WILLIAM G. GRIEB DIES

NEW YORK, June 15—William G. Grieb, formerly president and one of the founders of the Ajax Rubber Co., died yesterday at his home at Scarsdale. He retired as head of the Ajax company about two years ago.

Output Is Exceeded by Fordson Demand

Remote Parts of Northwest Only Section Not Calling for Tractors

DETROIT, June 13 — Demand for Fordson tractors is reported by the company to be running far ahead of production, some of its branches having in excess of 1000 orders ahead. The tractor delivery situation has been very tight for the last 60 days, and the company reports the demand coming from all parts of the country except remote districts in the northwest.

Reports from its representatives in the field indicate an entire absence of stocked tractors even in eastern cities, where last year considerable difficulty was experienced in finding markets. Shipments now are confined only to those branches where the demand is pressing, and for the present there will be no shipments of machines for display or demonstration purposes. The tractor demand is expected to continue until the latter part of July, when a temporary lull is expected preliminary to the opening of the harvesting season.

A large fall business in tractors is looked for from the farming districts, and an important winter manufacturing schedule will be outlined in anticipation of heavy business in the spring. Business in tractors for industrial uses is reported by the company to have shown remarkable increases since the inauguration of its campaign, designed to show the usefulness of the tractor in an industrial way. This campaign will be pushed vigorously, as the company plans to develop an industrial tractor business which will be commensurate with its farm business and thereby furnish an all season outlet.

May Enter Trailer Field

Although there has been no official word as to the company's plans for production of heavy duty trucks, there are indications that these will be abandoned in favor of the plan to promote the tractor used with a trailer for industrial hauling. To further this plan there is a likelihood that Ford will enter the trailer manufacturing field, so that the vehicle may be sold as a unit.

SUES INTERNATIONAL DRIVE

CINCINNATI, June 12—Seeking the rescinding of a partnership agreement by which the International Auto Drive Co. was formed and asking judgment for $45,240, James A. Weaver has filed suit in Common Pleas court of Cincinnati against William M. Harris and George W. Martin, of this city, and the Dayton Securities Co. and Dayton Metal Products Co. of Dayton, declaring that he was fraudulently induced to enter into a partnership with the parties he names. The court granted temporary injunctions.

FINANCIAL NOTES

Ford Motor Co. will pay a semi-annual disbursement of 3 per cent and an extra 3 per cent July 1 to approximately 18,000 employee holders of Ford investment certificates. With a similar disbursement at the end of the year the 1922 return will be 12 per cent, the same as in 1921. Sixteen per cent was paid in 1920, the first year of employee participation in earnings. Because of the extent to which the fund has grown employees will not be permitted to re-invest the July dividend but will be limited to the usual one-third of their annual salary. Ford's annual payroll is $60,000,000, of which a maximum of $20,000,000 a year could be added to the investment fund under the rules. About one-third of the employees are availing themselves of limit investment. Thus it is estimated that the fund is growing at the rate of more than $5,000,000 a year. It totaled $7,000,000 at the end of last year, of which $2,000,000 came from branch employees. The present balance of investment certificates is understood to approximate $10,000,000.

American Bosch Magneto Corp. reports bookings in May as $860,000 or more than twice those of May, 1921. Comparison of the business done since the first of the year with the corresponding months a year ago follows: January, 1922, $502,000; January, 1921, $190,000; February, 1922, $476,000; February, 1921, $215,000; March, 1922, $558,000; March, 1921, $400,000; April, 1922, $667,000; April, 1921, $440,000; May, 1922, $860,000; May, 1921, $429,000. May also showed a substantial net profit, the first in a number of months. A statement of the corporation's financial condition as of March 31, 1922, shows cash and debts receivable, $1,831,101, as against $1,336,006 in 1921 and accounts and notes payable of $1,283,570 compared with $2,031,971 a year ago.

Watson Products Corp. of Canastota, manufacturer of wagons and motor trucks, made sales aggregating more than $100,000 during May. March sales were $73,000 and April sales $78,000. The plant is in the hands of Kirk B. Delano, receiver. The claims against the company by 102 creditors total $476,469. About 90 per cent of these creditors have agreed to accept 7 per cent cumulative first preferred stock in a new company the Watson Truck Corp., in full for their claims. Federal Judge Ray is expected to approve the transfer of assets of the old concern June 20.

Electric Storage Battery Co. has declared a quarterly dividend of 75 cents on the common and preferred stock, payable July 1 to stock of record June 14. Following the meeting of the board, the directors stated that while business of the company is excellent at this time they are not prepared to consider any increase in the dividend rate at the present time.

Pierce-Arrow Motor Car Co. shows a slight profit in current operations, indicating that an addition to the surplus may be reported for the second quarter, for the first time since September, 1920.

Duesenberg Automobile & Motors Co., Inc., has offered $3,000,000 of its 8 per cent cumulative preferred stock at $100 per unit, consisting of one share preferred and one half share common.

Firestone Tire & Rubber Co. is reported to be contemplating the issuance of $1,500,000 bonds as part of a plan to finance the new plant under construction at Hamilton, Ont.

Mack Trucks, Inc., has declared the regular quarterly dividends of $1.75 a share on both first and second preferred stock, payable July 1 to stock of record June 20.

Chandler Motor Car Co. has declared a quarterly dividend of $1.50 a share, payable July 1 to stock of record June 20.

Columbia Now Has Orders for 23,700 Light Sixes

DETROIT, June 14—Stockholders of the Columbia Motor Car Co. were informed at their annual meeting by President J. G. Bayerline that the company now has on hand orders for 23,700 light sixes for delivery up to Jan. 1, 1923. This makes a total of $25,000,000 worth of business pending for the remainder of the year. Directors were re-elected, and they subsequently re-elected the old officers, with the addition of George J. Martin as assistant secretary and treasurer.

The books of the company indicate that June will be its largest month, and officers declare that July will be 50 per cent better. Stockholders expressed their approval of the large production plans outlined. The financial position of the company was shown to be excellent. It was announced at the meeting that Columbia now has 102 distributors in the United States and Canada, exclusive of foreign connections, and 1015 dealers.

1,748 Vehicles Shipped by Packard During May

DETROIT, June 10—Packard Motor Car Co. shipments for May, 1922, were 1748 vehicles, a gain of more than 15 per cent over the previous high shipping record made in May, 1920, and an increase of 100 per cent over shipments in May, 1921. In cars shipped and orders booked, May was the most successful month the Packard company has had in twenty-three years of operation.

Sales in the retail field in the month amounted to $5,600,000. Orders on the books as of June 1, 1922, are reported to cover all single-six cars that can be produced in the next three and a half months. Twin-six deliveries are reported to be a month behind. The truck department is reported to be receiving more inquiries than for several years.

200 PER CENT GAIN BY GARDNER

ST. LOUIS, June 13—Gardner Motor Co. reports a gain of 200 per cent in shipments in the five months ended June 1, over the corresponding period in 1921. Unfilled orders on hand will require capacity production until Aug. 15. Distributors and dealers report a big gain in sales.

GEORGE E. McGINNESS BURIED

CLEVELAND, June 13—Funeral services for George E. McGinness, purchasing agent of the Chandler Motor Car Co., who died Sunday, were held to-day from the family residence, in Cleveland Heights. McGinness had been with the Chandler company since its organization.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Call money rates last week showed considerable ease. The range was from 3 per cent to 4¾ per cent as compared with 4 per cent to 5½ per cent the previous week. Toward the end of the week call money was reported to have been placed on the outside market at as low as 2¾ per cent. Time money rates also tended downward. At the close of the week loans for 60 days were quoted at 4 per cent 90 days, 4 and 5 months, at 4 per cent to 4¼ per cent and 6 months at 4¼ per cent, as against 4 per cent for 60 days and 4 per cent to 4¼ per cent for other maturities the week before. Federal Reserve discount rates remained unchanged. A uniform rate of 5 per cent for all classes of discounts prevailed at Minneapolis, Kansas City and Dallas, while 4½ per cent is the uniform rate for all other Federal Reserve Banks.

For the purpose of bringing the rate paid on deposits in line with that at which the banks can lend money, the New York Clearing House adopted, on June 13, a new schedule providing for a reduction in the average deposit interest rates paid by New York banks. The new ruling extends to all classes of deposits, the sliding scale based upon the Federal Reserve Bank commercial paper rate which formerly applied only to deposits by banks, trust companies and private bankers. Mutual savings banks, including all such institutions, and not merely those in the Second Federal Reserve District, are favored over corporations to the extent of ½ of 1 per cent, under existing conditions, by virtue of a differential which has been created.

The Federal Reserve Banks in their statement as of June 7 showed an increase of $2,451,000 in gold reserves.

Nearly all the European exchanges declined last week, probably in the main a result of the report of the Committee of Bankers in Paris stating that in their opinion an international loan to Germany is not feasible at the present time.

Exports from the United States in May, $308,000,000, were $10,000,000 less than exports in April.

Sale of Maibohm Motors Awaiting Confirmation

TOLEDO, June 14—Federal Judge Killits has not yet confirmed the sale of the Maibohm Motors Co. assets to a new corporation called the Arrow Motors Co., which was organized by a creditors' committee. He is expected to hear the appeal from the decision of a referee in bankruptcy confirming the sale when he returns to this city late this week.

Objections to the confirmation have been filed by H. C. Maibohm, president of the Maibohm company, and T. W. Cushing, vice-president. They are said to be backed by a firm of New York brokers, which stands ready to refinance the old Maibohm company.

Decision Followed by Bakelite Merger

Parties to It Will Continue to Make and Sell Products Separately

NEW YORK, June 14—The Bakelite Corp. has taken over the General Bakelite Co., the Condensite Co. of America and the Redmanol Chemical Products Co. The merger is the result of a suit for infringement of the Bakelite patents brought against the General Insulate Co. of Brooklyn, one of the customers of the Redmanol company.

This suit resulted in a victory for the Bakelite company when a decree in the United States district court broadly sustained the Bakelite patents covering the molding of phenolic condensation products by heat and pressure and the use of fibrous bodies in such products.

The decision made it impracticable for the Redmanol company to continue in business, and it was decided to consolidate its business, including the personnel, with that of the General Bakelite Co. The Redmanol company had purchased, in the meantime, a controlling interest in the Condensite company which made possible the inclusion of that company in the merger. In many respects the products of the three companies are not identical, and each of the three will continue separately to manufacture and market its products.

Dr. L. H. Baekeland is president of the new Bakelite corporation. The vice-presidents are Philip Schleussner, A. Karpen and Kirk Brown. Brown is general manager. The offices of the corporation are at 8 West 40th Street, New York.

300,000 Willys-Knight Engines, Plan for 1923

PONTIAC, June 14—The Wilson Foundry & Machine Co. has been directed by John N. Willys to prepare for production next year of 300,000 Willys-Knight engines. Willys made an inspection of the plant this week and declared the increased schedule should start in the fall to build up a reserve in preparation for enlarged operations at Toledo.

The increase will call for an expansion of the Pontiac plant, with additions to the test house and the assembly floors as well as larger machine departments. The schedule now is 178 daily, but that point has not yet been reached. It was only 25 a day in March.

"There is no prospect of a let-up in operations this summer," declared General Manager Wilson. "Mr. Willys is especially optimistic."

CADILLAC SETS HIGH MARK

DETROIT, June 13—A high mark for one day's output in the production record of the Cadillac Motor Car Co. was reached this past week when 150 of type 61 cars were made and shipped in 24 hours. More than half of this number were closed bodies.

The value of the day's output was over $700,000.

The total number of men now employed at the Cadillac plant is approximately 8000, and additional men are being taken on at the rate of 50 a day.

EMPLOYMENT GAINS

DETROIT, June 12—The Employers Association reports a further increase of 2900 in the total employment this week. The increase represents an addition of 145,000 payroll hours. The total association roster of 173,026 is approximately 60,000 greater than the corresponding week of last year and is only 16,000 less than the total for the corresponding week in 1920.

INDUSTRIAL NOTES

Martin-Parry Corp. will offer dealers in and surrounding Los Angeles, Minneapolis and Baltimore additional distributing and servicing facilities as soon as buildings now contracted for are prepared to handle the work. Recent negotiations have expanded the service of the corporation in Omaha, Salt Lake City and Denver. The corporation has broadened its manufacturing facilities through the acquisition of new interests in Lumberton, Miss. Additional mills secured there will eliminate much rehandling and excessive freight costs as formerly have been necessary. It is expected that before the end of the year there will be in operation more than fifty servicing and distributing plants throughout the country.

Simplex Rims Co. of Delaware, incorporated in that state for $1,000.000, has also been incorporated in Missouri with a capital stock of $100,000 and with headquarters at Kansas City. The company will manufacture and sell Simplex rims, as well as accessories, and under certain letter patents will convert other rims for automobile tires into Simplex. The company expects to establish agencies in Missouri and sell territorial rights to agents.

Van Wheel Corp., Syracuse, maker of cast metal hollow spoke automobile wheels, has moved its factory to Oneida, N. Y., where operations have been resumed on a larger scale. The offices of the company will remain in Syracuse for the time being. T. G. Meachem, former vice-president of the New Process Gear Co. and president of the Palmer-Moore Co., is president of the company.

Cleveland Duplex Machinery Co., Inc., Cleveland, has been appointed exclusive representative by the Diamant Tool & Manufacturing Co., Inc., Newark, N. J., in connection with the sale of punch and die sets for the northeastern section of Ohio.

H. L. Rackliff Co. of Cleveland and New York, automotive marketing counselor, has been retained by the Dayton Automotive Wheel Co. of Dayton to assist in the company's marketing plans.

METAL MARKETS

Once more the automotive consumer finds himself confronted with a steel market of decidedly dual character. In the sheet market the chief producing interest adheres to previous quotations while the independents are asking irregularly higher prices. The latter are apparently judging each inquiry upon its own merits, and the advance asked over the Corporation's prices depends upon the desirability of the account, the specifications, and the backlog of orders on the books of the individual producer. In one respect, however, there appears to be more or less unanimity. The Corporation has so far refrained from committing itself on sheet orders beyond July, and even at the higher pricee asked by the independents the latter appear not eager to encumber their order books with commitments for the second half of the third quarter.

At the same time the preponderance of opinion among independent sheet rollers inclines to the view that there is very little likelihood of any runaway market conditions developing during the year's second half. Producers are simply adopting the same methods which automotive consumers practiced in their buying earlier in the year. Producers do not want to have their hands tied any more than is absolutely unavoidable. The automotive industries continue short of sheets, and rollers are being constantly appealed to to speed up shipments. While the sheet industry as a whole has not yet reached 100 per cent of capacity in its operations, the capacity of the pickling and finishing departments is taxed to the utmost and the limit in output of full-finished automobile sheets has been reached long ago, so that here and there consumers have sought to make common black sheets do. This, however, usually proves a failure.

Most of the producers of full-finished automobile sheets are now quoting 4.75c. for 22-gauge body stock, an advance of $5 a ton over previous quotations. With the sheet bar market having apparently settled on a $35 basis, non-integrated rollers of full-finished sheets are in fairly comfortable position as regards the price of their principal raw material, although the supply of sheet bars is at times rather tight. Concurrent with the advance in sheets, there have been advances in the prices of virtually all automotive steel products, such as strip steel, cold-drawn steel bars, etc.

Pig Iron.—Although the foundry market is practically in abeyance, blast furnace interests continue very optimistic and prophesy a very heavy movement after July 1, when freight rates will be lowered.

Steel.—Makers of cold-drawn steel bars are working double turn full time to satisfy the automotive demand, orders ranging from 100 to 1,000 tons. Spring steel is moving in heavy tonnages to automotive plants. Most of the independents are now asking 4¢. base Pittsburgh, for cold-rolled strip steel; they expect that the chief interest will follow suit. Some makers of hot-rolled strip are quoting as high as 2.40¢. base Pittsburgh. Many orders are being turned down or accepted in part only because makers fear to commit themselves beyond the raw material they have in sight.

Aluminum.—Very little change is noted in the conditions surrounding the aluminum market. The whole future of the metal is wrapped up in the tariff developments.

Copper.—Automotive consumption is well maintained. On the whole the market is quiet and fairly steady.

Calendar

SHOWS

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiserdamm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

July 17 — Baltimore, meeting, representatives of highway departments of ten Eastern states.

June 19-20 — Detroit, Summer Convention of the Automobile Body Builders Association.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

Sept. 13, 14, 15—Annual credit meeting, Motor and Accessory Manufacturers Ass'n.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer Meeting of Society of Automotive Engineers.

Northwest Sales Off After Record Month

Spring Business, However, Showed Earlier Development This Year Than Usual

MINNEAPOLIS, June 12—Automobile dealers in the Northwest have been wondering where all the money came from that participated in the recent raid on stocks of motor cars. They have discovered that it has been dug out of socks, tin cans, kitchen stoves and other hiding places, where people who were afraid of banks, of the business future, of themselves and everything else have been keeping it. The sun of prosperity having risen and begun to dispel the clouds of gloom, these people have begun to come to themselves and are holding private resurrections of cash.

However, except where distributing agencies and factory corporations have been financing dealers, there is still a lack of money to pay for small car shipments from distributers. The bankers either have not the money or will not let loose of it.

This spring spurt in business, which has developed a shortage of cars with dealers and their distributors, has come earlier than usual, so that many report May as a record month. By the same token this business has receded about a month earlier than usual, and another spurt is not expected until the bumper crop on the way is assured and perhaps partially liquidated.

Sales in Texas Increase 10 Per Cent in Half Month

DALLAS, TEXAS, June 13—There was a considerable improvement in the automotive business in Texas during the past 15 days. Sales by retail merchants showed an increase of some 10 per cent over the preceding 15 days.

The real reason appeared to be the fact there is more money in the country. East Texas farmers are now marketing a $15,000,000 fruit and canteloupe crop, and they have already sold or contracted to sell $10,000,000 worth of berries and tomatoes. Northeast Texas and southwest Texas are marketing $10,000,000 worth of potatoes, and west Texas has sold a big wool crop. The people in these sections are in the market for automobiles, and the dealers have not overlooked the bet.

Goodyear Produces 45,000,000th Tire

AKRON, June 9—The Goodyear Tire & Rubber Co. has turned out its 45,000,000th tire.

Tire No. 45,000,000 was taken from the moulds at ten o'clock on the morning of June 8, marking the greatest number of tires produced by any company in the world.

The tire will be exhibited in the company's rubber museum in Akron. It was built with the assistance of Vice-President and Factory Manager Paul W. Litchfield, while President E. G. Wilmer, Vice-President George M. Stadleman and other Goodyear officials looked on, and when it was completed the Goodyear factory whistles were blown for 45 minutes.

ASK HICKS-PARRETT BANKRUPTCY

CHICAGO, June 9—A petition in bankruptcy was filed yesterday against the Hicks-Parrett Tractor Co. of Chicago Heights, Ill., by three creditors, whose claims aggregate $657. Officials of the company said they hoped the claims could be adjusted without going through the bankruptcy courts. The company has been operating only on a small scale for some time.

R. C. O'BRYAN SENTENCED

OMAHA, June 13—R. C. O'Bryan, executive head of the defunct Great Western Commercial Body Co., recently tried and found guilty in district court of conspiracy to defraud the public in the sale of that concern's stock, has been sentenced by Judge Goss to a year in the state penitentiary and to pay a fine of $1,000. His attorneys immediately gave notice of an appeal.

Signs Guide Dealers When Visiting Stutz

Catalog Is Also Used to Give Visitors Better Understanding of Factory

INDIANAPOLIS, June 10—At a two-day sales and service conference of the Stutz Motor Car Co. of America the first day was devoted to talks by department heads with a trip through the factory as the end of the formal sessions. In the factory visit a rather novel plan was followed. The entire factory was labeled with signs and legends for each department. It was numbered also to key with a brief catalog somewhat on the lines of a simple art catalog.

Along with each exhibit legend in the catalog the name of the foreman in charge appeared, and he formally met each visitor. While every factory introduces department heads, the foremen are often neglected for one reason or another.

"That is wrong," says Fred Wilson, general sales manager, who was responsible for the plan. "The way to do it is to introduce each foreman so that in the future that department will have a personal existence to the dealer and service man."

Another innovation introduced in the factory visit was a sheet upon which was listed the number of pieces in the Stutz, those purchased finished, the number of assemblies made in the plant, the number of holes drilled, reamed and tapped, the number of pieces of various sorts of metals and materials, etc.

This list gave the visitors an impression of the magnitude and multiplicity of operations and materials and parts handled and work done upon them. Also it gave them a quick view of the proportions of the car and assemblies made in the plant, so that they could form a conception of the factory before they reached the first department.

Besides the guides, one to every four visitors, each dealer was supplied with a miniature catalog that described the twenty-two main departments.

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New Problems of Engineer Shown at S. A. E. Meeting

President Bachman says automotive engineer must have part in solving questions of transport as well as design. New standards adopted. 500 members attend Summer meeting at White Sulphur Springs. Financial report read. Nomination Committee appointed.

WHITE SULPHUR SPRINGS, W. VA., June 20—Five hundred members and guests are attending the annual midsummer meeting of the Society of Automotive Engineers which began here to-day. The meeting will continue until the end of the week. Everyone is agreed that this is the most attractive place at which a summer meeting of the Society has ever been held.

Mild weather and invigorating mountain atmosphere are making the sports program specially attractive this year. Two golf courses, tennis courts, a swimming pool, horse back riding, trap shooting equipment and other facilities provide for a greater diversity of entertainment than ever before.

Special trains from the East and the Middle West brought the majority of the five hundred guests this morning, although a few golf enthusiasts arrived during Saturday and Sunday. More than 120 ladies are in attendance.

Golf, tennis and bathing are merely the diversions of the meeting, however, as was evidenced by the large attendance at the standards meeting which lasted most of the day and the business session which took place this evening. President Bachman addressed the membership at the evening meeting.

A large proportion of the active and prominent engineers of the industry are in attendance, so that the constructive work of this meeting is likely to be considerable. Five past-presidents of the Society are present, together with nearly all the "old standbys" of the organization.

Practically all of the recommendations of the Standards Committee were adopted without change, although a few minor alterations were made. A summary of the recommendations appeared in AUTOMOTIVE INDUSTRIES last week. Chairman E. A. Johnston of the Standards Committee had no difficulty in completing his lengthy report by 4 p. m.

WE should exercise all our ability and energy to proceed in a rational way to extend and continue the Standards work which was inaugurated about twelve years ago and has been carried on continually since.

I wish that we could find some way of still further impressing upon the automobile and allied industries the importance of this work; that we could find a successful method of definitely determining the degree to which the Standards are used and a more definite measure of the economies which their use brings about.—B. B. Bachman.

The automotive engineer must take an active part, not only in designing vehicles, but also in solving those problems of highway construction and transportation which involve the increasing profitable use of cars and trucks. The speed-wagon, the motor bus and the motor rail car are the three outstanding developments of recent months in the automotive field.

The problems of design and operation that they have brought with them call for serious attention from the automotive engineer. Research and standardization will play an important part in their solution.

These are the high spots of B. B. Bachman's presidential address delivered at the opening session of the summer meeting of the Society of Automotive Engineers. Bachman said in part:

AFTER this more or less hurried summary of the affairs of the society, I would direct your attention to a more general survey, with a view of determining along what lines our activities as engineers and as an engineering society should be directed in the immediate future.

The period of industrial depression through which we have gone should be productive of some lessons to which it would be well for us to give thought. Naturally, those which appeal to me most forcibly and which I feel most competent to discuss are those which have to do with the truck rather than the passenger vehicle. There have been three outstanding developments during recent months, the appearance of which may be due in part to conditions resulting from the depression. They are: the speed-wagon, the motorbus and the motor rail car. That there is a fertile field of usefulness for all three of these types can probably be accepted without question. That they each present features of design requirements which are distinctive and possibly not yet fairly appreciated in general is, I believe, also true.



President B. B. Bachman

We held in January and will hold at this meeting a session dealing in a degree with the problem of bus transportation. There have been sessions held by the Metropolitan and the Indiana Sections which had to do with the matter of the railway motor car. The problem of the speed-wagon may be more commercial than technical, but I believe that it deserves consideration. I am mentioning these points with the hope that our sections will find some suggestions for their development for meeting topics.

The question of highways is one which has been given considerable attention in the past in our discussions and should receive continuing attention. The ability and the efficiency of the vehicles which we manufacture are dependent in a large degree upon the character of the roads upon which they are operated. While it is true that the invention and development of the automobile has increased the demand for improved roads, it is also true that the growth of improved roads has increased the demand for and use of the motor vehicle, and future limitation in road construction will act as a limitation on the vehicle market.

It appears to me to be particularly unfortunate that there should be any controversy between the railroads and the users and manufacturers of motor vehicles, instead of complete harmony and co-operation. Except in the most isolated cases, competition between these two forms of transportation is most unlikely. I think this is almost universally true with regard to transportation of goods; and in the transportation of passengers it is almost equally true if we stretch our imagination to embrace what must be the development of the future. I recognize the fact that there is a large amount of capital invested in street railway transportation, but I am also impressed more and more daily with the fact that the streets of our cities are becoming less able to accommodate the burden of traffic which they are called upon to bear. It seems to me not at all improbable that this condition will make it imperative in the not very distant future to replace track vehicles with a more flexible form of vehicle for short hauls and where frequent stops are necessary.

This problem of highway capacity as evidenced by our city streets deserves the most careful study on the part of every automotive engineer, particularly as to what its probable effect will be on future design requirements as affecting the size of the vehicle, the control with respect to steering, turning-radius, acceleration and braking. In many of our cities very stringent regulations with regard to parking have been put into force. It is useless to spend our time in railing against these provisions, for in some measure at least they represent the legitimate effort to distribute the use of the streets in a fair way among all citizens. The problem presented is of the most complex nature and deserves careful study and analysis.

Another result of the increasing traffic-density is the lowering of the efficiency of motor vehicles as a means of saving time. As the cost of operation of motor vehicles has been reduced, and the possibility of use thereby increased, this new factor of limitation of speed, due to congestion, becomes increasingly important.

In the broader aspect of transportation in rural and suburban communities there should be practically no question of conflict between the railway and the motor vehicle. We have in this country a sufficiently close-up picture of the development of transportation facilities to be able to get a very comprehensive view of the relation between various means of transportation and the establishment of communities.

THE early settlements were along the seaboard and the more navigable streams, and this condition of affairs continued up to the time of the development of the railway, which resulted in the unlocking of the vast inland empire and the linking up of the Pacific Coast with the Atlantic, which would have been practically impossible without this new means of transportation. The development of electricity and its application to high-speed interurban lines was the next step in bringing high-speed transportation into closer contact with the small community and individual. It is obvious, however, that the operation of rail lines calls for a virtual monopoly of territory in the form of a franchise and limits the operation of vehicles over any given track to one centralized authority and calls for fixed schedules of operation.

The advent of the automobile has resulted in placing

into the hands of the individual a smaller and more flexible unit with practically the equivalent speed-capacity of the railway. This vehicle, capable of being operated over the road, can be made more truly competitive and infinitely more flexible and independent of fixed schedules. The growing use of the automobile and the truck, coincident with the development of and as an auxiliary to the railway system, has resulted in extensive suburban and rural development which would probably have been as impossible without the automobile as the development of the inland cities of this country would have been without the railroad.

While this development has resulted and the increase in realty value is recognized and acknowledged, the increasing traffic, particularly over main routes, will bring a reaction unless we are peculiarly alert to study and suppress in design all objectionable characteristics of our vehicles to the greatest possible degree. I appreciate that the control of all these features is not in the hands of the engineer or manufacturer, but he should be thoroughly posted as to what they are and be prepared to co-operate intelligently with regulatory bodies to assure that rational measures for the protection of the public are enforced which do not impose unreasonable restriction on road transportation.

Originally road construction was in the hands of individuals or corporations that operated them for profit in the collection of tolls. While we have rejected, as a nation, the idea of public ownership of railroads, so also have we rejected the idea of private ownership of highways. I believe both these ideas are proper. In the railroad we require concentration of authority and responsibility in operation over any one given line. This can be obtained most efficiently by private ownership and operation under reasonable government regulation. The highway, on the other hand, is primarily for the use of the individual according to his needs and desires, with as little restriction as possible consistent with public safety, which can be obtained best by public ownership and complete government control.

Much of the discussion on the question as to who should bear the burden of the cost of construction and maintenance of our highway systems, or whether the motor-vehicle operator is receiving a public subsidy which is not shared by the railroad, etc., appears to be beside the point. The cost of transportation of passengers and freight, by railroad, water or highway, is borne by the whole community and shared by every citizen in proportion to his requirements for transportation. I believe this to be so, whether the cost of transportation is included in the cost of the commodity or it appears partially in the form of taxes. The big fundamental problem is to determine the economic field for each medium of transportation and the relation each should bear to the other for maximum efficiency, and the most satisfactory means of proportioning the expense to the individual.

I have endeavored to the best of my ability to give you a brief and yet comprehensive view of the problems which are confronting us and should receive our active individual and collective attention. I hope the result may be to stimulate interest in the affairs of the society and enlargement of the horizon in our view of the future activity of, and the service which can be rendered by, each of us individually and as an organization.

Bachman also reviewed the general work of the society during the past year, discussing briefly the activities of the meetings committee, the restriction of membership, the society finances, the progress in standardization and the research work.

THE Standards Committee has done some excellent work during the past year. Among its accomplishments should be noted the following:

1. Mountings for car bumpers were standardized.
2. Ball studs for steering connections were adopted.
3. Adjustable yokes for brake rods and similar uses were adopted.
4. Serrated fittings for shaft ends from ⅛ to ⅜ inches diameter shafts and tapers were adopted.
5. Standards were adopted for tempers and toughness of lock washers.
6. Dimensions for five spindle sizes for motor truck axles were standardized.
7. Base shaft dimensions for small magneto mountings for isolated electric plants were standardized.
8. The two bolt flange dimension in four sizes of motorcycle carburetors were adopted.
9. Threaded ends for car top irons were standardized.

This list is a fine record of constructive achievement. The recommendations not accepted were of comparatively small importance. The proposed standard of three-quarter inch hole for crankcase draining was rejected, as not being sufficiently specific.

Three lighting bulb sizes were eliminated. These were bulb sizes G 10, G 12 and G 16½. 8-10 and 18-24 voltage ranges in bulbs were dropped as were four and nine battery cell arrangements. The proposed specifications for soft annealed copper wire were also rejected. Roll-



This is where the engineers are spending their afternoons during the Summer Meeting



Some of the S. A. E. council members and two of the permanent staff. Left to right—C. F. Clarkson, Lon K. Smith, O. W. Young, H. M. Crane, President B. B. Bachman, Past-President David Beecroft, L. C. Hill

ing tolerances for concave spring steel and for wire spring steel were adopted.

Standards for screw bolts and nuts were amplified by specifying length of thread and position of cotter pin. The present recommended practice for spring eye bushing and bolt tolerances were revised by eliminating bolt tolerances and changing the title to spring eye bushing. The present recommended practice for frame brackets for springs was canceled. Specifications of tests for headlamp lighting control devices were revised.

Specifications for non-ferrous alloys were modified to cover ingots as well as finished products for bearing metals. New specifications were adopted for phosphor bronze, spring strips, aluminum sheets and strips and brass wire for brazing. The screw thread report was accepted.

The committee will leave to the American Engineering standards committee the task of standardizing a series of plain washers used in all industries. The drawbar adjustment standard was elaborated to cover 2, 3 and 4 plows; where formerly there was one now there is a different one for each plow.

The supplementary report on general information regarding gages and gaging was referred back.

An informal proposal to standardize ten grades of lubricating oil provoked strong discussion by oil representatives and matter will be handled by lubricant division. Engine flywheel housing recommendations adopted.

A two-day production meeting of society will be held in Detroit in October and made annual affair to be held in different cities on successive years. The forenoon of each day may be given over to technical sessions and afternoon to factory visits, a program for the Detroit meeting will be announced soon.

The membership in general session voted in favor of council arranging to hold evening meetings in many cities, such as St. Louis, Milwaukee, Syracuse, Akron, Cincinnati, Peoria and Pittsburgh, where there are no sections in order to give members in such cities more service from the society.

Report of Lon Smith, chairman of the membership committee, showed a gain of 132 members during the first eight months of this year and a present total membership of 5530. The securing of new members and holding old ones was the major topic discussed at the business session; many members pledged to get two new members before the winter meeting.

THE financial report of the Society as of June 1, 1922, was presented at the business meeting on Tuesday morning. The report was as follows:

The Society's net loss for the first eight months of this fiscal year was $18,360.26 as compared with an unexpended income of $14,504.88 for the corresponding period of last year. This loss is due to a reduction in income of $27,439.30 as compared with the first eight months of the last fiscal year.

The advertising sales fell off $7,595.66 and the expense of selling advertising was increased $11,540.09, making a total decrease in net revenue from advertising of $19,135.75 as compared with the first eight months of the last fiscal year. The net revenue from advertising has averaged about $5,500 per month for the past eight months, but has increased steadily since January, the gross business for the month of June being about $15,000, with a net balance of approximately $10,000 for Society activities when cost of sales has been deducted.

Initiation fees from new members are $6,335 less than for the same eight months of last fiscal year.

By careful management on the part of the president, the treasurer, the council and the various committeemen the total operating expense has increased only $5,425.84, as compared with the first eight months of last fiscal year, in spite of added activities costing approximately $10,000.

The assets of the Society at April 30 were $180,127.63, offset by accounts payable of $9,159.29 and special reserves of $50,758.11, leaving net assets of $120,210.23; $89,998.49 of this is in the form of Railroad and U. S. Government bonds and accrued interest and the balance is the invested working capital.

THE nominating committee was also appointed at this session, and will make a report before the end of the meeting. This committee is composed of members elected by each of the sections, and three members elected at the summer meeting. The section members of this committee will be instrumental in determining the officers of the S. A. E. for next year.

Considerable interest is being evidenced in the section stunts, some of which are particularly attractive this year.



H. M. Swetland, chairman of the Finance Committee

S. A. E. Summer Meeting

How to Secure Effective Lubrication

Crankcase oil must be renewed frequently. Rate of oil pumping depends on oil thrown to cylinders, speed of revolution, piston drainage, viscosity and cylinder vacuum. Piston rings affect pumping. Oil grooves with return holes keep down oil consumption.

By G. A. Round*

GEORGE A. ROUND, Assistant Chief, Engineering Division, Automotive Department, Vacuum Oil Co., in his paper on "Oil Pumping," said that to secure good lubrication and offset the effects of dilution the crankcase oil must be renewed at frequent intervals. This can be done either by periodic draining of the entire supply or by the frequent addition of fresh oil to replace that used. Where the oil consumption is low the former method is the natural one. Unfortunately the draining of the oil is such a disagreeable task that many owners neglect it. In many engines the oil consumption increases to an undesirable extent after a comparatively short period of service, and it is this class that Mr. Round's paper was chiefly concerned with.

The rate of oil pumping depends upon the following principal factors: The amount of oil thrown to the cylinders; the speed of revolution; the efficiency of the means for piston drainage; the ring fit; the oil viscosity and character and the vacuum in the cylinder. Mr. Ricardo in his paper at the Winter Meeting stated that he had been unable to determine any effect of the vacuum in the cylinder on the oil pumping, but an engineer who was working out a device for preventing oil pumping and sealed the crankcase so that a vacuum equal to that in the intake pipe was maintained in it, found that the oil loss was reduced by one-half. There was no smoking when accelerating after prolonged idling.

As a general thing the oil consumption decreases with an increase in the viscosity of the oil, but in several cases of engines with cast iron pistons having no scraper rings on the skirt, but oil return holes through the piston wall at the bottom of the lowest ring groove, the reverse relationship was found to hold true. In one engine with force feed and one with splash lubrication the less viscous oil showed the higher economy. The first of these, a small six-cylinder engine, consumed 1.37 lb. of the lighter oil in 10 hrs. and 2.1 lb. of the heavier oil under similar operating conditions. In the case of the splash-lubricated engine, a single cylinder lighting unit, the consumption was 0.5 lb. of the lighter oil in 10 hrs. and 2.6 lb. of the heavier oil. The consumption figures in both cases were corrected for dilution.

The viscosities were 45 and 58 seconds Saybolt at 210 deg. Fahr. The conclusion is reached that the resistance to the flow of the lubricant behind the ring in the groove where the return holes were located was the controlling factor, as with a different form of oil return the behavior of the oils was quite normal. High fire test oils also show a reduced consumption, especially in tractor and heavy truck engines, but the use of such oils is not always to be recommended, because of the fact that they may not burn cleanly when running under small load.

It has been found that the piston rings have much to do with oil pumping. The important factors are the amount and uniformity of the ring pressure and the clearance of the ring in the groove, while the end clearance in the groove is of minor importance. That oil pumping is very much dependent upon the unit pressure of the ring against the cylinder wall was shown by an experiment with an aircraft engine in which the oil consumption was reduced 30 per cent by cutting down the bearing surface of the ring about one-third, increasing the pressure per unit area about 50 per cent.

The fit of the rings in their grooves is of prime importance, as experience has shown that where the amount of oil thrown onto the cylinder walls is constant, as with splash systems, the oil consumption increases rapidly with the wear of the groove. With cast iron pistons and rela-

the wear of the groove.

OIL grooves with return holes are a great help in keeping down the oil consumption.

The large increase in the use of pressure feed during the past few years is mentioned, and the observation made that the V-type engine requires this form of lubrication, for equal distribution to all cylinders. Its great disadvantage is that the amount of oil thrown to the cylinders increases with the wear of the bearings, whereas with splash lubrication it remains constant. With the pressure feed system there is danger that at light loads the amount of oil thrown onto the cylinder walls is excessive. Accurate fitting of bearings tends to minimize oil-pumping, but this is often nullified later by poor repair work. As regards connecting rod bearings, Mr. Round claims that the ideal design has no shims. Where these are used, either the lead-edged or plain brass shim is satisfactory only when properly fitted. If a bearing fails from lack of oil the lead edge will be destroyed and the repairman is likely to overlook this fact, with resultant trouble. For truck and tractor service this shim seems to be less satisfactory.

*Digest of paper presented at Summer Meeting of Society of Automotive Engineers.

S. A. E. Summer Meeting

What Constitutes a Perfect Motor Bus?

Controlling design factors are safety, comfort, and minimum operating cost. They can be obtained with low center of gravity, wide frame, track and spring centers, and effective braking. Short turning radius is necessary together with clear vision for driver.

By G. A. Green*

IN its broadest sense we believe the controlling design factors from the standpoint of the motorbus, in the order of their importance, are:

(1) Safety.
(2) Comfort and convenience of the public.
(3) Minimum operating cost.

Safety easily heads the list and a very large proportion of the engineering development work must be concentrated under this heading. It is generally agreed that a truck carrying freight should be in all respects safe, and that every reasonable precaution should be taken to render automobiles transporting from one to seven passengers safe; so how much more important is it that a vehicle carrying fifty or more passengers should be free from every sort of hazard! It must be remembered that much of the mileage of the bus is through congested thoroughfares. This is not the case with the average automobile or truck. Again, the average individual makes some effort to get out of the way of a truck or automobile, but the bus, with its acknowledged flexibility, is supposed to move out of the paths of both vehicles and pedestrians.

The design of a motorbus from a safety standpoint includes certain basic features which must be incorporated in the general constructional plan. There are also other detail features which must be included. The latter are dictated by humane considerations. Reference is now being made to providing the driver with reasonable comfort and convenience so that no undue hardship will be inflicted upon him as a result of the performance of his duties. First, let us consider the former. These are

(1) Low center of gravity.
(2) Wide frame, track and spring centers and general dimensions.
(3) Effective brakes.
(4) Short turning radius.

Beyond doubt, the future bus will be low hung. The inherent danger in connection with any other form of construction is the possibility of overturning.

We have found that a safe and practical height of the frame from the ground for a single-deck bus is 25 in. and for double-deck bus 18 in. The center of gravity of our type-L double-deck vehicles, with a full complement of passengers on both decks, is 52 in. from the ground. With our type-J single-deck bus, this dimension is 38 in. It is interesting to note that when rounding corners, even at a high rate

*General manager, Fifth Avenue Coach Co., New York. Excerpt from a paper read before the summer meeting of the Society of Automotive Engineers.

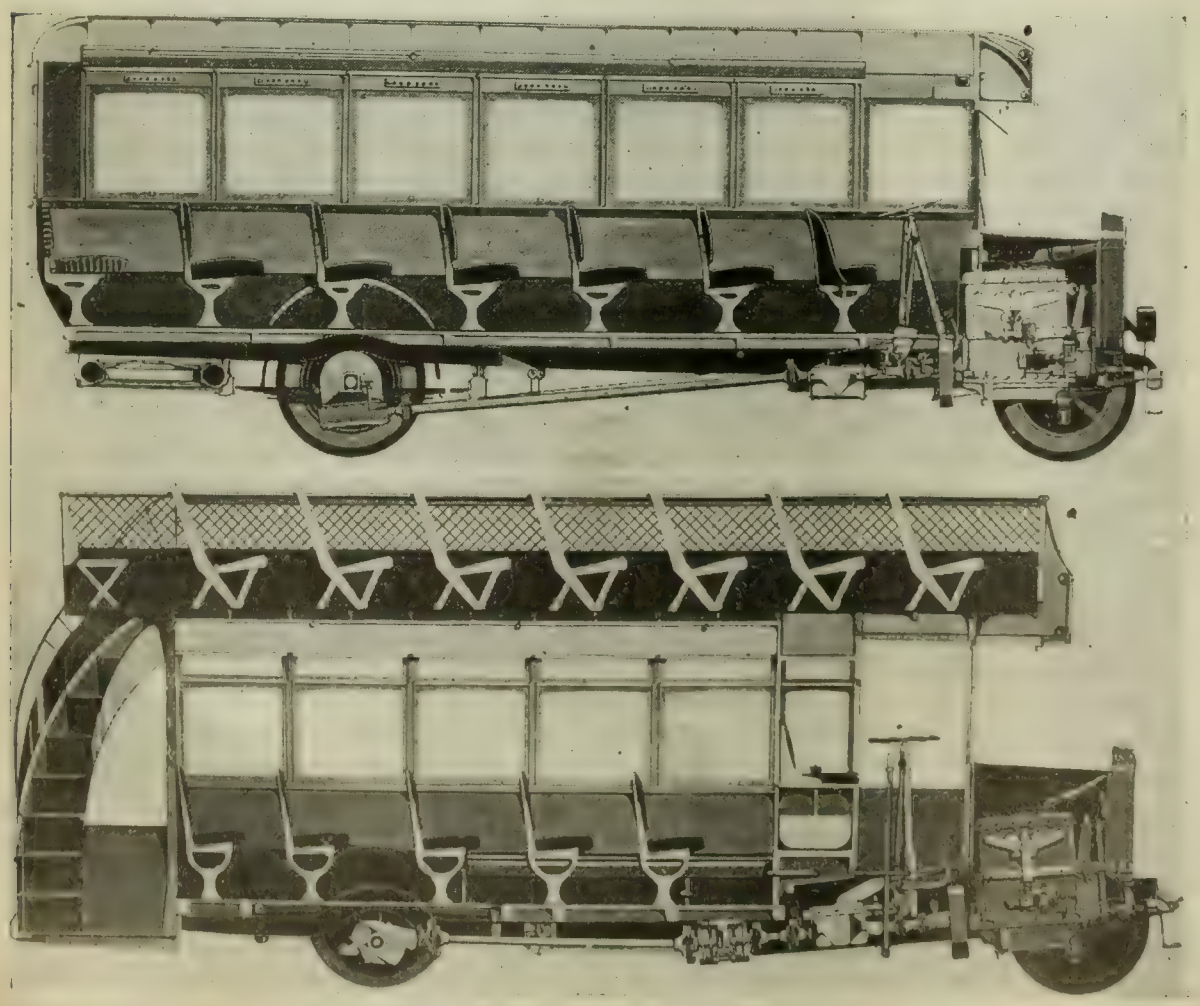


Fig. 1 (*above*)—*Sectional view of J-type single-deck bus.* *Fig.* 2 (*below*)—*Sectional view of L-type double-deck bus*

of speed, skidding will occur, due to centrifugal force and overturning is scarcely possible. Furthermore, rolling or sidesway is practically eliminated. The sectional views of our J and L-type buses, reproduced in Figs. 1 and 2, indicate clearly how this condition has been reached. With type L it will be seen that the frame and rear axle construction is somewhat unconventional. The rear axle is of the internal gear type. The spiral bevel gear and differential assembly is in unit form and can be entirely assembled and adjusted on the bench. The carrying member is a heat-treated forging.

From the sectional drawing shown in Fig. 3 the general construction of the type-L axle will be clear. It will be seen that the ends of the carrying member are cranked, the wheel spindles being above the drive shaft center line. It is in this manner that the low-level feature has been accomplished. The photograph showing the carrying member and driving gear assembly which is reproduced in Fig. 4 at once emphasizes the general simplicity and accessibility of construction. Due to the fact that the drive shaft pinions are in the vertical plane, a special form of tooth has been developed for the internal gear to provide adequate clearance and at the same time permit of maximum silence even after a certain amount of wear has occurred.

We do not employ this special form of axle construction for the type-J bus. This class of vehicle will have a much wider use; therefore the matter of road clearances must be taken into account. In many cases single-deck vehicles will be operated over very bad roads. The double-deck vehicle is essentially a city job where the streets are, generally speaking, in fair condition. Again, with the single-deck vehicle, the floor level requirements are not so exacting. There is no top deck to take care of, and the entrance can therefore be located at the front end of the bus; but with the double-deck vehicle, conventional practice is to have the passengers enter at the rear, so in passing to the interior they are obliged to cross the rear axle, which must be of special design to have the floor level within easy stepping distance of the ground. In the case of the single-deck bus it is not desirable to have a step 18 in. high. Therefore the best plan appears to be to employ an orthodox rear-axle design. Even assuming the use of our type-L rear axle, it would not be practical to produce a stepless vehicle. The appearance would be completely spoiled and, as explained above, the ground clearance would be cut to a point where the vehicle would be unsuitable for use in many localities. Of course, a stepless single-deck vehicle can be produced, but its practical value for general utility purposes is debatable.

THIS article presents in detail the views on bus design of a man who has had very extensive opportunity to build and operate motorbuses. In presenting his opinion as to what a motor bus should be, he has drawn upon his own experience. He has sought to establish principles for general use rather than to merely describe current practice.

The great interest in motorbus construction that has swept through the automotive industry in recent months makes this discussion one of vital interest both from a commercial and an engineering standpoint. Some bus designers will disagree with certain points raised by the writer, but they cannot fail to appreciate the constructive character of this comprehensive discussion.

Among the constructional difficulties in connection with the production of low level equipment, one of the problems is to obtain a flat floor. There is a natural tendency for the components to project above the frame and therefore through the floor. To avoid this, special design is required. The effect of a flat floor is very pleasing to the eye. Its structural strength is greater. It is less costly to keep in repair and there is less possibility of accidents due to the passengers' feet coming into contact with the obstructions during the boarding and alighting processes.

In construction, wide frame, track and spring centers are features which are necessary to provide for adequate vehicular stability and, in conjunction with a low center of gravity, make for maximum safety. The necessity of providing proper stability applies equally to single and double-deck vehicles. It may be said that the added risk due to the top deck load with the latter is more than equalled by the higher speed of the single-deck unit.

Apart from the matter of safety, a wide frame is necessary in connection with the body construction. Obviously it is desirable to support the body as far out as possible, for in all cases the seating arrangement is such that the passengers are grouped about the outer edges. Then, the wide frame admits of the lightest possible form of body under-frame. The wide frame also is a factor from the standpoint of the passengers' comfort. This point will be referred to later.

We believe that the overall length of a motorbus for city service should not exceed 26 ft.; the total width, 7 ft. 6 in., and the overall height for single-deck vehicle 9 ft. With the double-deck bus, the last-named dimension should be such that a person standing on the top deck can clear a 14-ft. structure. With these dimensions we have found it possible to accommodate comfortably 51 seated passengers with our double-deck and from 25 to 29 with our single-deck vehicle. Whether this practice is economically correct for all localities, we cannot say. We have, however, up to the present, found that this arrangement works out very well both in our own service and in the service of those who have purchased our equipment.

Next, there is the question of important dimensions other than those over-all, such as the wheelbase which naturally affects the axle load distribution, the turning

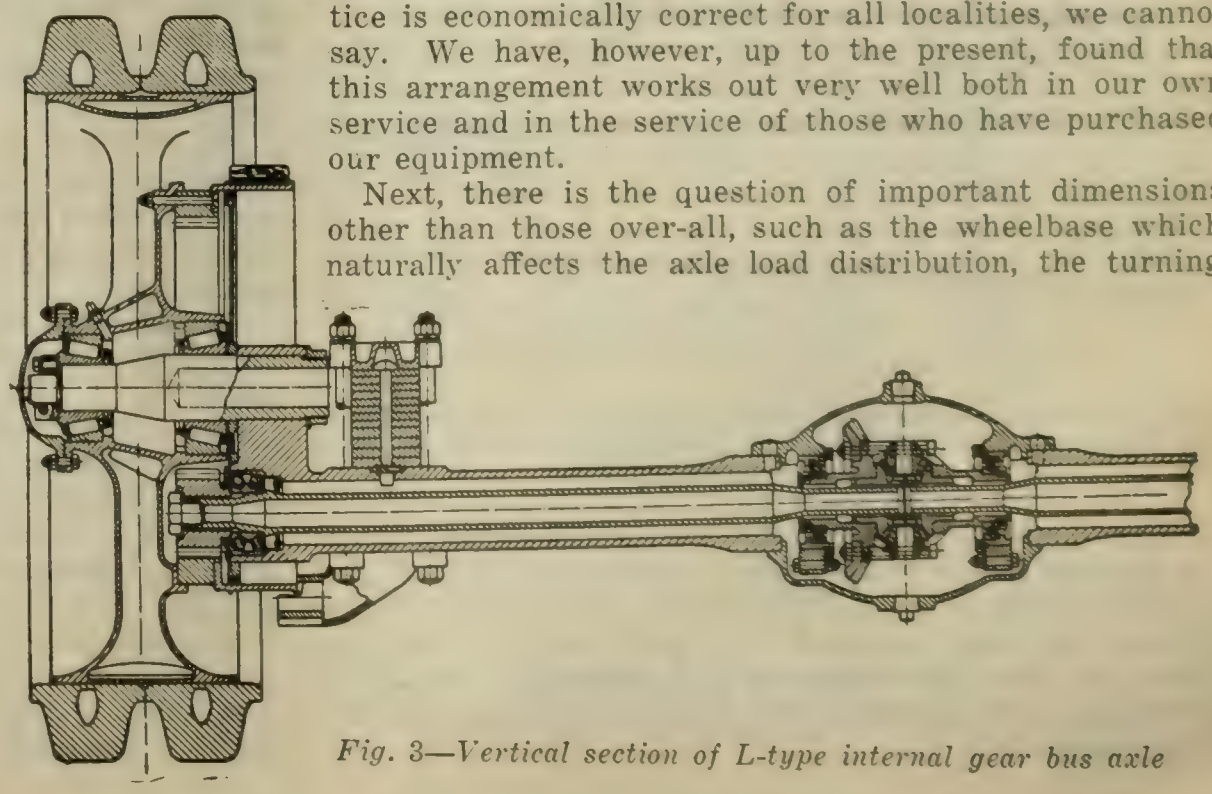


Fig. 3—Vertical section of L-type internal gear bus axle

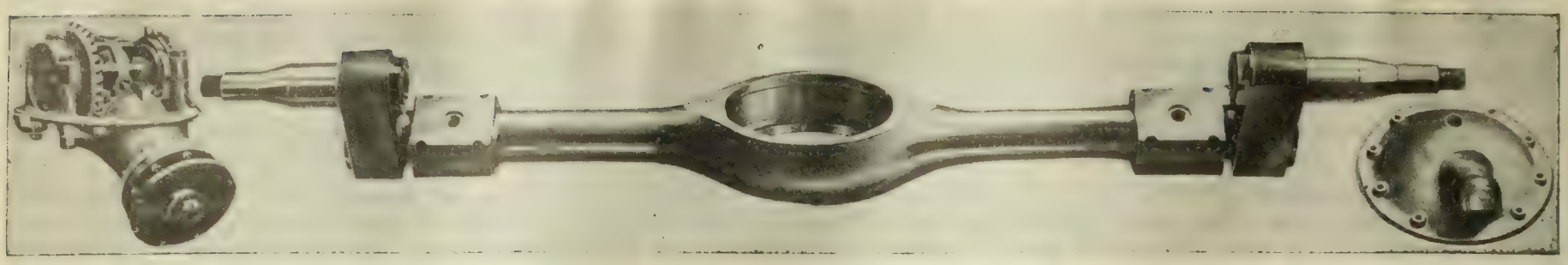


Fig. 4—Parts of the L-type axle, showing readily detachable driving gear assembly

radius and the general comfort and balance of the vehicle. For the class of vehicle now under discussion, we believe that the wheelbase should not be less than 168 nor more than 180 in.

The front track should be ample in width and not less than 67 in., for to turn a bus within the intersection of the average city street it is necessary to move the front wheels through an angle of not less than 35 deg. This determines the distance between the front-axle pivots and the springs. The spacing of the front springs should not be less than 36 in., since they are responsible to a large extent for the stabilization of the vehicle when turning a corner.

Regarding the rear track, we believe that the outer edge of the tires should closely correspond to the extreme over-all width of the body and that the rear springs should be as close to the tires as is practical. For buses as above described, the rear track should not be less than 72 in. This will bring the distance between the springs to approximately 52 in. Having decided the approximate distance between the vehicle springs, it naturally follows that the best design is to arrange the frame dimensions so that they connect with the springs in the closest and most practical manner. Our practices in regard to these matters may be readily followed from the diagrammatic sketch of the type-J chassis as shown in Fig. 5.

Perhaps the most difficult problem that engineers must face is the brake question. It has not as yet been solved entirely satisfactorily, at least in so far as our knowledge goes. With the bus, the number of applications is in excess of that of the average truck or automobile, and the brakes of a bus must be sufficiently powerful to lock the wheels at any moment. Yet the effort required for average application must not be such that a driver may become exhausted as a result of the work imposed upon him.

Particular attention must be paid to the location of

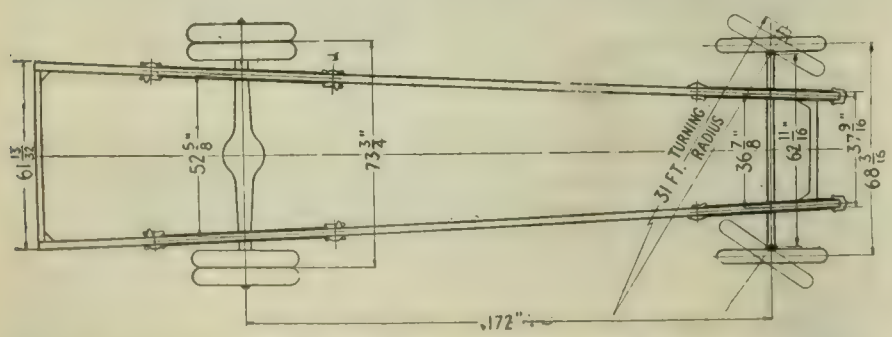


Fig. 5—Diagrammatic plan view of the type J chassis, showing major dimensions, relative position of frame, springs, wheels and axles

hand brake lever. It should be positioned so that it can be grasped firmly without moving the body out of the normal seated position. We believe the best practice is to have the lever arranged for a push and not a pull-on. Time can thus be saved, and a fraction of a second is often the determining factor from an accident prevention standpoint.

The brakes of a bus must be free from undue noises such as squeals or rattles. This involves, among other matters, the use of special brake drum material. The conventional soft pressed steel is practically useless. The best plan is to employ treated steel forgings or, failing in this, steel castings with a high carbon content.

The friction surfaces must have long life, and the adjustment be such that no tools or special skill are necessary. We attach considerable importance to the matter of foolproof adjustment. The J system employs two vise-like levers. The outside controls the hand, the inside the foot brake. One turn is usually sufficient. If by any chance the levers are not returned to the vertical they will automatically reach this position by force of gravity.

The braking action must not be too abrupt. It must be positive yet not sudden and violent, for such a condition is exceedingly severe on the driving members, tires and body. It is also a frequent source of accidents from which serious claims may result. Excessively efficient brakes have a most marked influence on tire wear. It may be said that tire wear is almost directly proportionate to the effectiveness of the brakes.

Maximum Speed

In bus operation it is desirable from every point of view to cover the route as quickly as safety will permit. In this manner the maximum number of passengers can be carried daily. With a fixed maximum speed, this means fast deceleration and acceleration. Expressed in another way, the problem is to move from a stop in one location to a stop in another in the least time. In our own service this must be done without exceeding a speed of 15 m.p.h., or accelerating or decelerating faster than 2 m.p.h. per sec. A still more rapid rate of deceleration is, of course, available for emergency, but it will be uncomfortable and unsafe, especially for standees.

The acceleration and deceleration graph as reproduced in Fig. 6 shows how closely the present type of equipment approaches this conception. But in connection with a study of this graph, the following points should be kept in mind:

(1) The bus was fully laden.

(2) The test was carried out where traffic is not heavy.

(3) Normal service conditions were followed, no attempt being made to obtain maximum acceleration or deceleration.

(4) The bus was selected at random. Apparently the vehicle was below standard from the viewpoint of pulling power.

One of the great advantages of a bus over any other form of transportation unit is its flexibility. A bus can be switched around at any point, and it is highly desirable that it should be able to make a complete turn in the average thoroughfare without backing, for the latter practice if followed in congested areas merely adds to both confusion and congestion. There is also a marked possibility of an increased number of accidents.

A short turning radius is dependent on the interference of the tires with the drag-link, front springs or

frame, when the wheels are turned at the maximum angle. The controlling elements are wheel-spring tracks and wheelbase. As the radius of the steering angle equals the wheelbase divided by the size of the front wheel lock angle, it can be seen that a wheelbase of reasonable length is important to secure a short turning radius.

From the viewpoint of safety, the design features dictated by humane considerations are:

(1) Easy steering.
(2) Clear vision for driver.
(3) Comfort and convenience for driver.

The steering of a bus should be at least as easy as that of the average automobile. To operate a stiff steering-gear is a hardship that certainly should not be inflicted upon the driver of a public service vehicle. A driver's energy and effort must be concentrated on his regular duties, and if he becomes fatigued through the expenditure of unnecessary effort, faulty operation is bound to result. This renders accidents more likely. Tests have convinced us that the actual physical labor imposed on the driver of a bus in connection with the manipulation of a steering wheel represents by far the greater proportion of the sum total of his work.

Easy Steering

Ease of steering is controlled by the total ratios between the hand and road wheels. Naturally frictional losses in the steering gear box and steering knuckles are of importance. Minimum losses in these respects are dependent upon the use of properly lubricated anti-friction bearings. Another very important matter is that the steering knuckle pins should lie in the vertical plane; otherwise there will always be a tendency to lift the front end of the bus when turning the steering wheel. An angle in either the longitudinal or transverse plane will cause lifting at the expense of effort on the part of the driver.

It is highly desirable that there should be an absence of shocks at the steering wheel. This is largely controlled by the total ratio, but also by the distance between the point of contact of the wheel with the road and the intersection of the knuckle center-line and the road. Every effort should be made to keep this distance small. With the J type the length of the lever arm is about 2¾ in.; and an increase of only 1 in. would decrease the total ratio some 36 per cent. This is the only point in the steering linkage where a change increasing the total reduction does not result in increased steering wheel travel for a given lock. A short drag link or the incorrect alignment of the drag link with the front springs will also result in shocks at the steering wheel when passing over rough roads.

TYPE	"A"	"L"	"J"
GEAR RATIO	9½ : 1	10 : 1	12 : 1
A	18	18	18
B	9	9	10
C	8 5/8	8 9/10	7
D	2 3/4	2 7/8	2 3/4
TOTAL RATIO	59.6:1	56.8:1	55:1

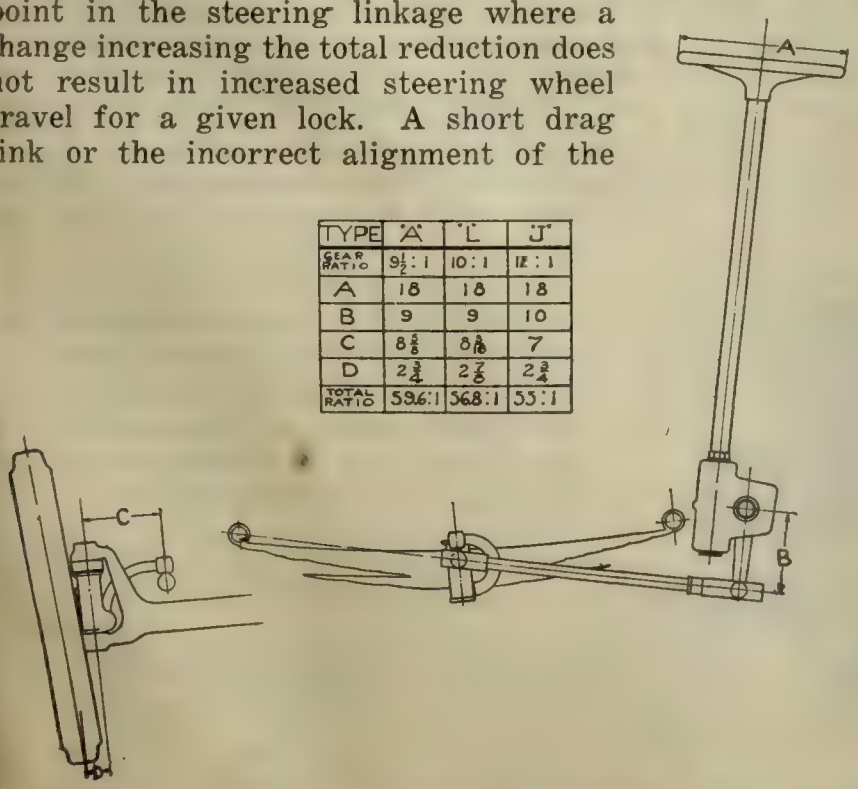


Fig. 7—Diagram showing important dimensions which affect ease of steering

Minimum steering wheel travel is important as it makes a change of hand position unnecessary for ordinary driving. It also decreases the apparent backlash, which is present in all steering mechanisms. The steering wheel travel is roughly inversely proportional to the total ratio, which is kept as low as possible for this reason. Our practice so far as the important dimensions referred to above are concerned may readily be followed from an examination of the diagram of steering leverages as illustrated in Fig. 7.

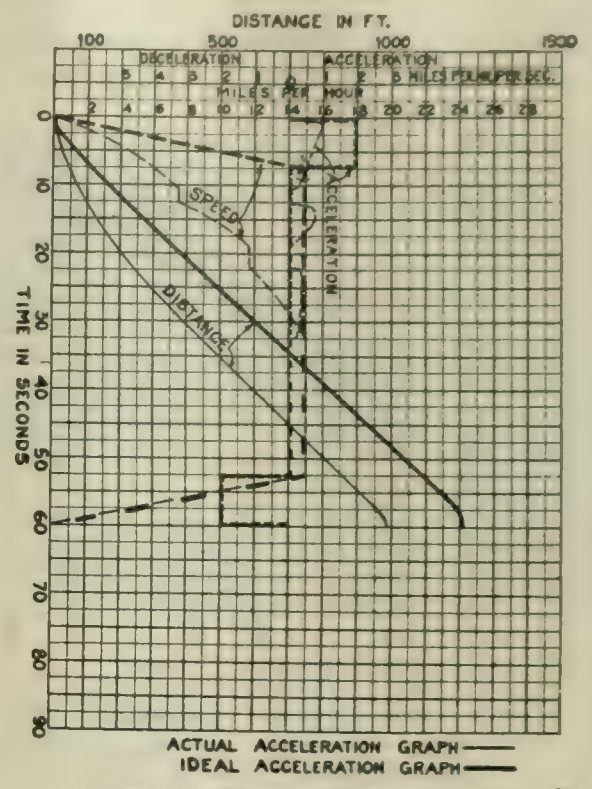


Fig. 6—Curves showing rate of acceleration and decelleration of L-type bus

The driver should be located close to the left side of the vehicle. This permits him to observe and also to signal his intentions to oncoming traffic. There should be absolutely nothing obstructing his view. He should face clear glass. It should also be mentioned that with single-deck vehicles the placing of the driver well over on the left side provides for the very necessary boarding and alighting space for passengers and adequate room for operation of door.

Briefly, a driver's vision should be such that when seated, even back of a closed windshield, he will have nothing on which he can readily concentrate his gaze, no vertical posts or obstructions of any kind. He should just naturally sense that he is in the open.

From the viewpoint of design, it is essential that consideration be paid to the attitude of the public as a

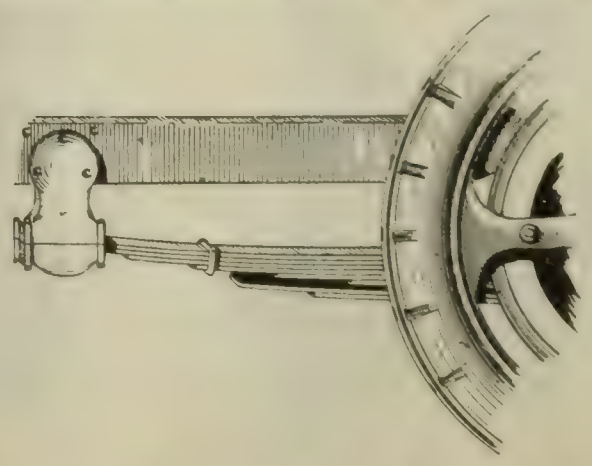


Fig. 8—Progressive type of spring intended to afford good riding qualities at both light and heavy loads

whole. It is not enough to consider only the attitude of the actual riders; regarding the matter of comfort from these somewhat different angles, it is necessary that attention be given to:

(1) Ridability.
(2) Reliability.
(3) Silence of operation.
(4) Smoothness of starting and stopping.

Broadly, ridability is a matter of proper spring-design. There are, however, other important influences; the wide

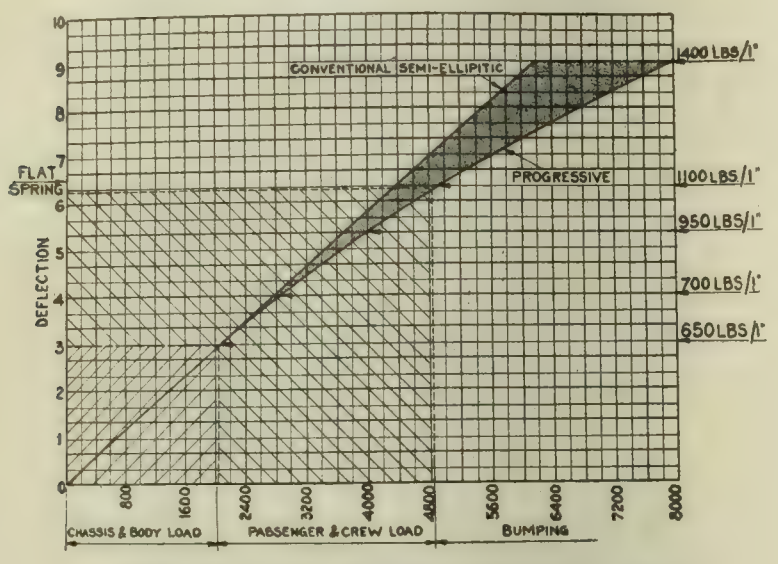


Fig. 9—Rear spring deflection curves for progressive and non-progressive or conventional types of spring

frame, track and spring centers bear materially upon this question, for the nearer the wheels are to the outer edge of the body, the less will be the movement to which passengers must be subject when obstacles are passed over. Again, with the wider track, many of the ruts and depressions created by vehicles of narrower gage, will be passed by. Incidentally, this is quite an important matter from the standpoint of road wear. The wide track also diminishes the wheel house projection inside of body. The modern tendency is to employ cross seats and with the narrow gage vehicle the wheel houses are a source of much discomfort to those seated upon the inside immediately over them. A rigid frame, correct axle load distribution and minimum overhang are all factors that make for better riding performance.

Apart from the points briefly touched upon above, the controlling factor from the standpoint of ridability is, of course, the design of the suspension itself. Obviously, the difficulty is to obtain good riding under all conditions of load. Spring design is always a compromise; a spring must be able to withstand maximum load, yet vehicles are expected to ride reasonably well when light. As a matter of fact, they seldom, if ever, do so. In general, more damage is done to vehicles when running light than heavy because the riding properties under these circumstances are at their worst and the speed too often is high. Under conditions of heavy load, springs function best, and at the same time there is less likelihood of excess speed.

We believe that the answer will be found largely in the employment of what we term the progressive spring as illustrated in Fig. 8. It will be seen that spring is split into two parts. The top half takes the weight of vehicle, body and a certain proportion of load. The bottom part or helper, comes into action progressively. The top part must make a rolling contact with the bottom. One of the great advantages of this system is the fact that for no additional cost or weight, a marked improvement in performance is possible. The theory behind our choice of the progressive spring and the advantages that may be derived from its employment can readily be seen from an examination of the rear-spring deflection curve for both the progressive and the conventional semi-elliptic designs reproduced in Fig. 9. No doubt it will be appreciated that to secure comfortable riding with a small number of passengers, it is necessary to have a spring of not over 670-lb. per in. deflection. But a spring having these characteristics is not a practical arrangement, for the result would be too great a difference in body and step height between the minimum and maximum number of passengers. This point is clearly shown in the graph where the proportion of the 51-passenger load equals 28,000 lb. per rear spring, from which the comparative figures given in Table 1 are deduced.

TABLE 1—DEFLECTION FOR PASSENGER LOAD

	Conventional Semi-elliptic Spring	Progressive Spring
Full passenger-load	4¼	3¼
Maximum bumping-load	8½	6¼

The deflection curve of a simple semi-elliptic spring is a straight line showing a constant load per inch. But as the progressive element comes into play gradually, a curve is apparent. The departure from a straight line which is shown shaded represents the load carried by the progressive element which can be designed to come into action at any desired point. It has been found most satisfactory to design this spring so that the stiffened action begins very gradually, that is to say, after a limited number of passengers have been taken on. Obviously, as the progressive element comes into action, there is a gain in the stability of the vehicle.

From the graph above referred to it is exceedingly interesting to note the change in rate of progression as a result of a variation in passenger load. The figures based on increments of 10 passengers given in Table 2 bring this point out in a striking manner.

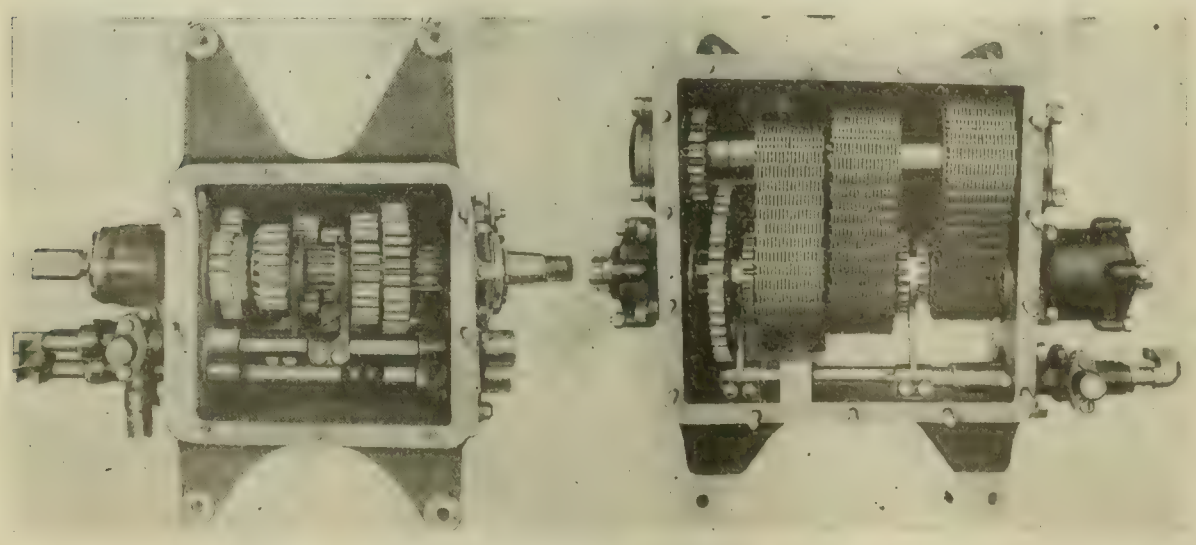


Fig. 10 (left)—Four-speed gearset, used on some chassis built by the Fifth Avenue Coach Co. Fig. 11 (right)—Three-speed chain transmission used on other chassis of same make

TABLE 2—CHANGE IN RATE OF PROGRESSION FOR VARIATIONS IN LOAD

No. of Passengers	Load per 1 in. Deflection, lb.	Increased Stiffness, per cent
0	670	0.0
10	780	16.4
20	810	20.9
30	850	26.9
40	900	34.4
50	1,080	61.3

For our single-deck equipment we have standardized the Mack type of rubber shock-insulator. We are experimenting with this device for our double-deck vehicle, but as yet are not prepared to state the results. This arrangement, in conjunction with our progressive system, markedly improves the riding conditions. It also avoids the necessity for lubrication and for replacement of shackles, shackle-pins and bushings; also, no spring-eyes are required. Experience up to the present shows that we may expect a very satisfactory life from rubber blocks.

Silence of Operation

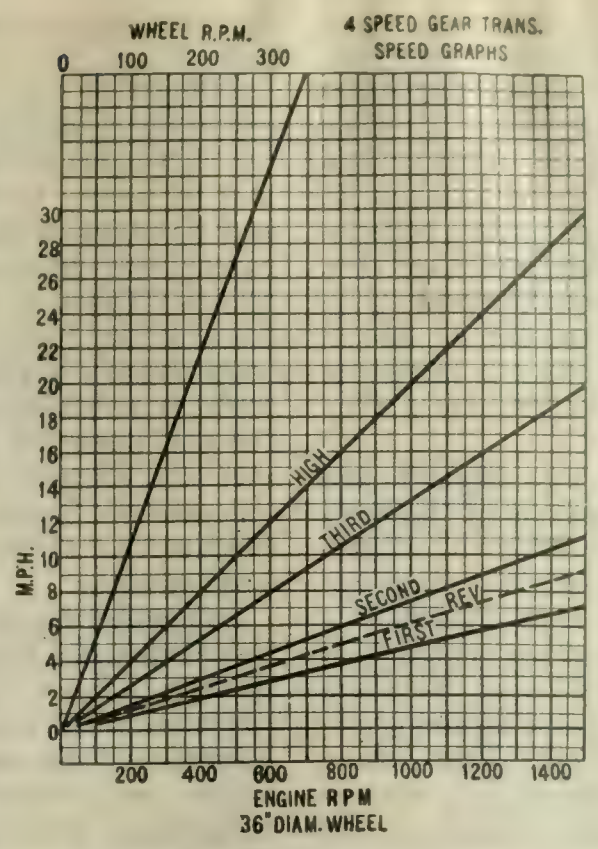
It is a problem to produce a silent vehicle. It is doubly difficult to retain this state throughout the life of the vehicle. Silence necessitates freedom from engine vibration, quiet transmission gears, evenly stepped gears, a quiet rear end, and generally the elimination of all rattles and squeaks from both body and chassis. To attain this, every detail of design must receive the most minute care. Silent operation is necessary in crowded thoroughfares, and certainly the people demand this condition in the residential areas, particularly at night when the streets are comparatively empty and noises become automatically emphasized. As a rule, noises are tolerated simply because such things are nearly always with us, but in the quiet of the evening sounds that ordinarily pass unnoticed become startlingly evident. In connection with the general question of noise it is interesting to consider for a moment conditions on Fifth Avenue, New York, in the rush period during which we operate 180 buses per hr. in each direction. If this vehicular volume were not reasonably quiet, we should soon be ordered off the streets as a public nuisance and a menace to health.

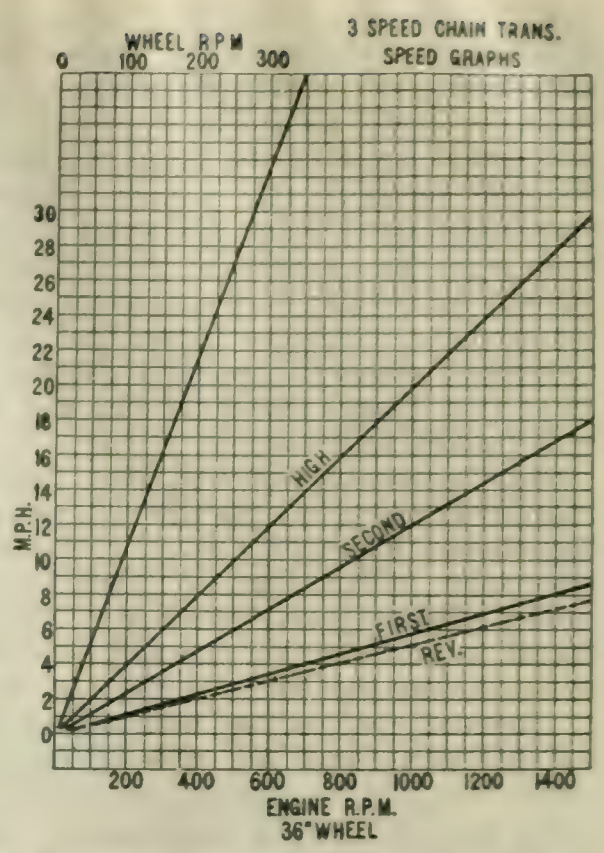
From the standpoint of silence, our greatest difficulty has been and still is the matter of transmission gears. We employ a four-speed gear and three-speed chain transmission, shown in Figs. 10 and 11 respectively, depending upon the class of service and general operating conditions.

The shift-rods, their bearings and the lock mechanism are of substantial proportions.

The curves in Figs. 12 and 13 show that the ratios of the four-speed transmission are almost exactly in geometrical progression. The three-speed transmission is not so satisfactory in this respect, but here a compromise is of course necessary. This remark applies to all three-speed jobs. Where grades are severe, four speeds are highly desirable, to cut down ability losses to the minimum. But where roads are practically flat, the advantages of a four-speed transmission are not nearly so marked.

The silent-chain transmission is particularly useful for city service where there are frequent stops and starts, and where the percentage of direct-gear operation is relatively small. Substantially it is similar to a constant-mesh gear transmission but chains are used in place of gears. The shift is extremely short and very easy to effect. Such transmissions remain quiet throughout their useful life, and from our observation one can expect at least a year's service from the chains, which are cheaper to replace than gears. Chain transmissions are standard practice for London bus service.





Figs. 12 *and* 13—*Curves showing relation between engine and vehicle speed on various gears in the four-speed* (*spur*) *gearset and the three-speed chain transmission*

The entire design of a bus must be predicated on ability to give uninterrupted service between clearly defined periods, preferably based on mileage. The ability of a bus to fulfill this requirement with particular reference to the duration of period will at once determine the utility of the design. The public will not long tolerate an unreliable service. Failures with an automobile cause confusion enough, but the number of persons involved as compared with a bus is relatively insignificant.

One point it is especially desired to bring home is that under average conditions, drivers cannot be expected to make any attempt whatever to spare their equipment. All

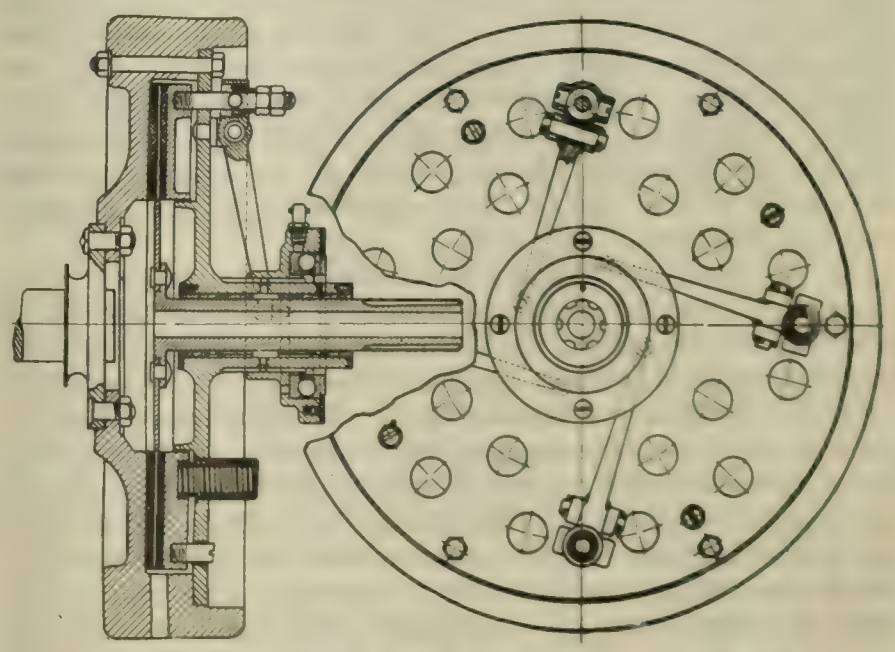


Fig. 14—*The single-plate clutch used in all Fifth Avenue Coach Co. chassis*

they are concerned with is stopping for passengers, avoiding accidents and keeping in their places on the road in accordance with their schedule. Everything must be subordinated to these three things, and in cases where vehicles cannot stand up under such conditions, either the required changes must be made to enable them to do so or they should be scrapped, for assuredly they have no place in the operation of a public utility.

Smoothness of starting is primarily a clutch function,

but of course the driver is a factor. Correct gear-ratios, a satisfactorily performing engine and proper axle-load distribution are contributing influences. Quick starts and stops are highly dangerous from the viewpoint of possible accidents. Some of the heaviest claims for injuries and damages result in this manner. Apart from injuries to passengers, quick starts and stops do more toward causing damage to the chassis and the bodies than anything else. All driving members are subject to abnormal stresses with the former. With the latter, the fore-and-aft or lateral movement, which of necessity results, causes a loosening up of post joints, panelling, etc., and consequently a very high rate of depreciation.

Of the various features that make for efficient and economical operation, the clutch is perhaps one of the most important. We employ exclusively a clutch of the single-plate type. From Fig. 14 it will be seen that there are several unconventional features. Particular attention is drawn to the fact that the spring pressure is evenly distributed over the entire surface of the friction members by 20 small springs, the levers are balanced against centrifugal force and the disk is exceedingly light, thus simplifying the changing of gears. Incidentally, a clutch-brake has been found unnecessary. The removal of the clutch body is an extremely simple operation, as is also the adjustment of the levers. Smoothness of stopping is discussed under the heading of Brakes.

Minimum operating cost demands:

(1) Maximum accessibility
(2) Minimum consumption of labor and material. This of course means excellence of both materials and workmanship
(3) Minimum consumption of fuel
(4) Minimum weight, particularly that which is unsprung
(5) Maximum safe speed. This naturally comprehends rapid acceleration
(6) Maximum tire-mileage

Maximum Accessibility

It is fundamentally necessary that the design of a motor-bus be such that inspection and repairs can be carried out quickly and economically. We believe it is imperative that separate unitary construction be followed. For instance, engines, carbureters, all electrical equipment, fans, clutch couplings, transmissions, control levers, axles, wheels and propeller shafts should all be entities so that the repair of any one of these assemblies will not necessitate the removal of any other.

As a practical illustration, take the orthodox unit powerplant and assume it is necessary to renew the clutch friction linings. The propeller-shaft, transmission and complete control system must first be taken down, possibly even the engine moved forward. In all probability the vehicle must lose a complete day's service. Compare this for a moment with the relatively simple operation where the separate-unit form of construction is employed, as with the J and L types. Here we need only remove a few bolts from the clutch coupling and housing. The clutch can then be taken out as a complete unit and the linings replaced within a period of 20 or 30 min.

The unitary system, if properly carried out, guarantees minimum loss of bus-hours, minimum operating cost, and minimum difficulties from the standpoint of training employees. Obviously, less skill is required on the part of mechanics where they are constantly performing the same operation; here it is simply a question of specialization. But where the construction is such that multi-repair operations are required, the situation is much more complicated. Summing up, to be obliged to remove several units before a faulty unit can be inspected, repaired or replaced, is a condition not to be considered for a moment. Such practice would be ruinous from a public utility standpoint.

It must be remembered that the general conditions surrounding repair work are seldom ideal. There is the matter of wet floors, dirt surrounding the various units, often lack of light. Garage repair forces must work Saturdays and Sundays, which is not particularly attractive. It is exceedingly difficult to find men who are willing to work nights. Taken as a whole, the conditions surrounding the work of the repair-men seldom bear favorable comparison with modern high-class factory practice. Here again we wish to emphasize the desirability of unit construction, for the theory is to remove the defective unit and take this to a central repair plant having all the advantages of the modern factory, so that the repairs can be promptly executed by skilled men working under the best possible surroundings.

In connection with the matter of accessibility, it should be remembered that repairs and adjustments must be occasionally carried out at night, sometimes under most unfavorable conditions. Again, assuming the use of low-level equipment, the design should be such that inspections, repairs and renewals can in practically all instances be undertaken from the sides or underneath the vehicles. This means the use of pits. The practice of providing trap-doors inside buses is not desirable. Trap-doors weaken the bodies, are a possible source of accidents, cannot be kept tight in place, permit exhaust gases to leak through, and create undue noise. Experience has shown that it is highly unsatisfactory to carry out chassis repairs from the inside of the body. If this practice is indulged in, claims are bound to result from passengers due to their clothes coming into contact with grease or dirt. Mechanics are sometimes careless and this results in unnecessary damage to the interior fittings, particularly the seat cushions.

Minimum Consumption of Labor and Material

From a financial viewpoint, the success or failure of a utility operating buses depends upon the cumulative additions or subtractions of small amounts expended on either labor or material. Sometimes the items may appear insignificant but, taken as a whole and over lengthy periods, the story is entirely different. When working, a bus is a heavy consumer of both labor and material. The consumption is perhaps much greater than is generally supposed. To afford a practical illustration, Table 3 representing the actual consumption by our company of some of the major elements for the year 1921, may be of interest. These figures are based on the average of all buses.

TABLE 3—FIFTH AVENUE COACH CO.'S COST PER BUS FOR 1921

Gasoline			$1,125.94
Lubrication			109.42
Tires			284.34
Repairs to Chassis	Labor	$676.97	1,436.78
	Material	759.81	
Repairs to Bodies	Labor	359.00	521.44
	Material	162.44	
Drivers			3,071.71
Conductors			2,692.48
Total			$9,242.11

From a casual study of these data it will be seen that a relatively small percentage of saving, if applied to any of the items and then multiplied by a large number of vehicles, must total a vast sum annually. If one assumes that the equipment in question is of good design and that its maintenance is economically undertaken, then how much more important does this issue become when the reverse is true.

Perhaps it will not be out of place here to point out that the profit of the average utility expressed percentage-

wise, usually does not run beyond one figure, and that there are a vast number of utilities where the figure is in red. To change the color and to exceed the single-figure basis, requires all that is best in design, material, workmanship and operating care.

Minimum Consumption of Fuel

Aside from the human elements which have been covered in a previous paper, Motor-Bus Transportation, presented at the 1920 Semi-Annual Meeting, the major issue, of course, is the engine. We employ exclusively the sleeve-valve type. From our viewpoint this type possesses certain basic advantages which make for economy of operation.

First, taking the question of fuel, high gasoline-economy is possible due to

(1) Absence of valve pockets and the spherically shaped combustion-chamber. Incidentally, this permits of high compression being employed.
(2) Positive action of valves at all speeds. With poppet-valve engines, valves at high speeds tend to float due to weak or broken springs
(3) Extraordinarily low friction-horsepower
(4) Ideal location of the spark-plug

Next, there is the question of service. In this respect we believe the sleeve valve engine has the following advantages:

(1) The performance remains reasonably constant throughout the useful life. It is not necessary to make adjustments constantly to permit of satisfactory and uniform behavior
(2) Throughout the useful life the performance tends to improve
(3) Practically no adjustments can be made since there is nothing to adjust. This alone represents a considerable saving in the garage force.
(4) Throughout useful life there is little, if any, increase of noise due to wear
(5) Cost of repairs in small since there are very few operations requiring skill
(6) Cylinders never require reboring. This obviates the necessity of carrying in stock second-standard pistons and rings

The performance of a correctly designed engine is largely a function of its carbureter; therefore a wide variety of results is always obtainable with varied settings. The points which are brought out in Table 4 are of special interest.

TABLE 4—HORSEPOWER AND TORQUE DATA FOR TYPE-J BUS

Power Developed at 1000 R.P.M., hp.	36.2
Power Developed per cu. in. of Displacement, hp.	0.12
Weight of Vehicle per Horsepower, lb.	301
Weight of Vehicle per cu. in. of Displacement, lb.	36.2
Maximum Torque, lb-ft.	194
Speed for Maximum Torque, R.P.M.	800
Decrease in Torque at 400 R.P.M., per cent.	5.1
Decrease in Torque at 1400 R.P.M., per cent.	11.9
Speed for Maximum Torque with a 5.4 to 1 Rear-Axle Ratio, m.p.h.	16.1

During 1921 our entire fleet of buses averaged 50.7 ton-miles per gal. The carbureter is of the Zenith type. There is no exterior adjustment. The throttle spindle is 7/16 in. in diameter, hardened and ground. There is a total of 4 in. spindle bearing-area. There is a gland with a suitable packing at the front end and a blank nut at the other. With the bus there is an abnormal amount of throttle movement, and unless this factor is taken into consideration from the standpoint of design, rapid spindle and bearing wear will take place. It will also be seen that the design is rugged throughout. All screws, nuts, plugs or unions are of ample size. The butterfly is exceedingly well fitted and provision is made for a simple throttle-stop adjustment.

In the earlier days of bus operation the tire question was one of our chief anxieties. To-day the situation is very different, for wonderful improvements have been made in tire manufacturing methods. Of course, there is no sense in decreasing tire expenditures at the cost of the equipment generally. Resilient tires are essential and too great a wear must not be permitted. It is our regular practice to remove a tire immediately the rubber has worn to within 7/8 in. of the hard base.

In looking back over our records, it is extremely interesting to note that in 1911 our cost per mile for tires was 4.93 cents. From that date on, a steady reduction has been effected. The figure for 1921 was 0.87 cent per mile, and this, of course, includes the use of six tires. From our viewpoint the various factors which have permitted this condition to be reached are, in the order of their importance, as follows:

(1) Better tire manufacturing methods
(2) Improved vehicle design. This includes decreased weight, particularly unsprung weight, the substitution of metal for wood wheels, etc.
(3) Closer supervision from an operating standpoint
(4) Closer supervision from a maintenance standpoint

As the result of long experience in connection with the design, construction and operation of buses, we are convinced more than ever that trucks or automobiles, modified or unmodified, are absolutely incapable of giving satisfactory and economical service if operated as buses. The tendency to-day is to employ trucks or automobile chassis as buses, or to attempt to modify their construction, then to re-christen them. This is a dangerous policy from the standpoint of both the builder and the user, and eventually it must surely result in dissatisfaction and disillusionment to all parties.

There is another and very important matter: We must not lose sight of the fact that the bus has not made good in some of the localities where it has been tried out. We are constantly confronted with failures such as those at Des Moines, Toledo, Kansas City and other cities. Such failures, when analyzed, invariably point to the fact that the combination of extemporized equipment, indiscriminate operation, overloading and lack of experience is responsible. But these failures can be avoided, and the automotive industry in its own interest should do all that is possible to guard against such occurrences.

Bus Standardization

It seems scarcely necessary here to comment upon the splendid achievements of the Society in connection with standardization work in general. Certainly, this has been a controlling influence in the development of the automotive industry. We believe much would be gained if it should now concentrate upon the motorbus. What we have in mind is the standardization of certain of the main dimensions; for example, front and rear-axle tracks, spring center-to-center distances, frame width, dimension between dash and wheel pocket, seat dimensions, aisle widths, etc., for the various classes of service.

The main object of this paper is to bring to the attention of interested parties in a clearcut, vigorous and interesting manner, the fact that to produce motorbus chassis that can be operated efficiently and economically, a very close study must be made of the entire situation. It is also desired to destroy as far as possible the illusion that a bus chassis is merely a modified truck. If in these things, even a moderate degree of success is achieved, we shall feel amply repaid for our efforts.

The matter of body design has not been touched upon since this is a subject that, because of its magnitude, must receive separate treatment.

S. A. E. Summer Meeting

Can Less Volatile Motor Fuels Be Used Successfully?

Proper fuel preparation prior to combustion involves formation of a continuously homogeneous mixture without liquid film or drops at lowest possible temperature. Advantages and disadvantages of present methods of heat application are herein discussed

By F. C. Mock and M. E. Chandler*

MANY 1922 model cars have operated satisfactorily with the motor fuels at present in use, both in summer and in winter, but many have not. We are convinced that it is possible to operate better a number of cars that are considered satisfactory to-day with kerosene, mixtures of gasoline and some heavier oils, combined with alcohol, benzol or other "anti-knock" components, than with gasoline. The sole requirement would be the proper preparation of the fuel in the manifold.

The requirements of proper fuel preparation are

(1) A thoroughly and continuously homogeneous mixture of fuel and air with no drops or liquid film wall flow to the valve ports
(2) The charge temperature should be the minimum possible while complying with requirement (1).
(3) The provision for a prompt change in the rate of action under changes of load and speed.

A cylinder charge of fuel is only a medium-sized drop. Any one who has observed through glass manifold sections, the storm of drops that is usually present, can easily appreciate the importance of this point. All the oil dilution in the crankcase is due, of course, to the introduction into the combustion-chamber of fuel that is not burned later. I believe that a large part of the rapid carbon formation, characteristic of engines having poor distribution, is due to the cracking, without burning, of the drops of excess fuel that occasionally enter the cylinders. It is evidently desirable to prevent liquid gasoline from reaching the cylinders after the use of a primer or choke means of starting.

If we consider as our objective a minimum temperature of the dry mixture, that is, a mixture of transparent fuel-vapor and air, it is immaterial, in theory, whether the heat is applied first to the fuel or to the air. If, however, we accept what our experiments have apparently demonstrated, that is, that a fog mixture of condensed vapor and air is satisfactory, provided the cylinder temperatures are such as to change this fog to a vapor before the end of the compression stroke, we shall find, both in theory and in practice, that the minimum temperature that can be used will vary with different methods of heat application. The theoretical considerations involved are, we hope, clearly shown by an analysis of the known and available methods of heat application. These have been classified as follows:

Case 1—The heat imparted to the mixture through the medium of the air, by the communication of heat from the manifold walls to the air and to such part of the fuel as has been deposited on the manifold walls. This is considered to involve only the production of a dry-vapor mixture. An interesting variation of this is shown as Case 1b, where part of the preheating of the air is accomplished by subtracting heat from the air and the vapor mixture already formed, thus giving a fog mixture.

Case 2—The application of heat first to the fuel alone, with the resulting condensation of the vapor when it joins the main air-column; this results in a fog mixture.

Case 2a—Heating the fuel and a part of the air to generate a rich dry-vapor mixture, which is then condensed as it enters the stream of the remaining air-supply. This also gives a fog mixture.

Case 3—Directing a spray of atomized fuel and air against a heated surface. One result obtained with this construction is the breaking up of the spray drops into even smaller drops in the so-called "spheroidal" condition; the mixture thus formed cannot be properly designated as a fog mixture.

This classification has been made on a functional rather than a structural basis. Most of the hot-spot constructions in actual use employ two, and sometimes three, of these heating methods, but for analysis the distinction we have made seemed necessary. Consideration of the direct application of heat to the fuel has been purposely limited to designs in which the fuel has been previously metered in a liquid state, as doing so after heating has not thus far been demonstrated as practicable.

THE computation of the mixture-temperatures is based upon the methods used and determinations made by Professor R. E. Wilson. The gasoline values used are those of the high end-point gasoline referred to in Professor Wilson's discussion.† This gasoline, by the way, is apparently quite similar to the "D" gasoline of the fuel research consumption test recently concluded.

*Members engineering staff, Stromberg Motor Devices Co. Condensed from a paper presented at semi-annual meeting of the S. A. E.

†See AUTOMOTIVE INDUSTRIES, June 8, 1922.

In Case 1 the air charge receives a heat supply such that after the latent heat of evaporation has been supplied to the fuel, the resulting mixture will have the minimum temperature of a dry vapor. A typical construction is shown in Fig. 1. Its practical equivalent, the application of heat to the air charge before it enters the carbureter, is shown in Fig. 2. With the complete evaporation of a 15 to 1 mixture of the high end point gasoline measured by Professor Wilson and, ignoring the heating of a small amount of fuel on the walls, this would involve air entering the carbureter at 154 deg. Fahr. with a resulting mixture temperature of 135 deg. Fahr. For the kerosene measured by Professor Wilson, the air would have to enter the carbureter at 287 deg. Fahr. with a final mixture temperature of 230 deg. Fahr.

In practice, however, dry mixtures are not realized at such low temperatures, for the reason that only part of the hot air comes into contact with the fuel. Within a short distance from the carbureter jet the tiny drops of fuel spray take up a velocity and direction identical with that of the air which bears them and thenceforth until they strike a wall, they generally are surrounded by a miniature atmosphere of vapor at the dew point. Fuel that travels along the walls comes into actual contact with only a thin film of air. We have endeavored by various means to create a turbulence that would accelerate and decelerate the spray droplets in the air medium that carries them, but every effort of this kind has resulted in increased deposition of fuel on the manifold wall and has made conditions worse than before. The temperatures actually existing in practice are more nearly those that would result if the fuel came into heat conducting contact with but one-half to one-third the air charge during the travel through the intake manifold. On such a basis the average temperature of the mixture is considerably higher, for instance, with a 15-to-1 dry mixture, and, as the fuel receives heat from one-half the air, the final average temperature will approximate 160 deg. Fahr. with gasoline and 273 deg. Fahr. with kerosense, as is brought out in Table 1.

On account of the high heat capacity of dry mixture charges formed in this way, there being no cooling from any further evaporation of the fuel during the compression stroke, the tendency toward detonation should be, and apparently is, greater with this method of fuel preparation than with most others. Due to the relatively slow heat transfer, more than the customary difficulty is experienced during changes of engine speed and load. The proper functioning of a device of this kind is contingent upon the maintenance of adequate temperatures; but in actual practice such temperature regulation is disturbed by a number of factors, depending upon seasonal and climatic conditions, as will be explained later. Since the mixture-temperature depends upon that of the air entering the carbureter, which in most cars depends in turn upon the temperature of the cooling water and of the whole mass of metal under the hood, there is a long duration of "warming-up" which can be taken care of only by elaborate thermostatic devices. A factor of safety, to provide for the occasional use of fuels heavier than the average, can be obtained only by raising still farther the temperature of the fuel charge of normal operation. More important is the fact that there is nothing to prevent raw gasoline entering the cylinders during the starting and warming up period and probably also during normal running.

In Case 1b, Fig. 3, the fuel vapor is formed as in Case 1, but a smaller exhaust air-heater is used. The air entering the intake system, before it reaches the exhaust heater, is used to cool and condense to a fog the dry mixture coming from the carbureter. The temperatures of the air entering the carbureter and of the mixture leaving the carbureter are the same as in Case No. 1, but the final mixture-temperature in the intake manifold, if a complete heat-transfer could be established, would be considerably lower than in Case 1; for instance, 122 deg. Fahr. with gasoline as against 160, and 188 deg. Fahr. with kerosene as against 273. But we do not believe that in practice the addition of this condensing device would be of value. If made elaborately enough to accomplish the desired heat transfer, it would probably increase the amount of fuel on the walls and require a still higher temperature of the air entering the carbureter. It would also increase the difficulties of acceleration and the "loading" in the intake manifold while the engine is cold.

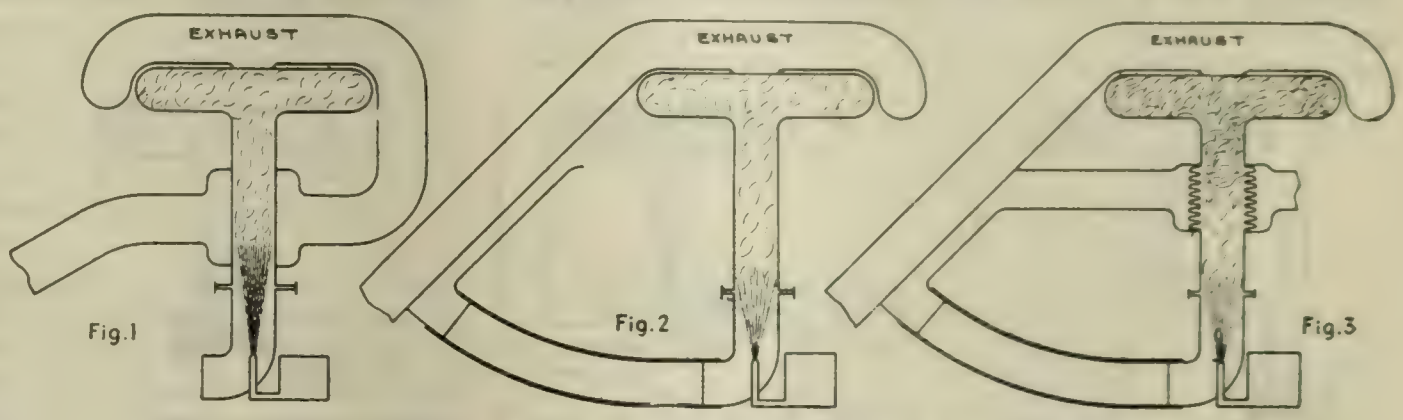


Fig. 1 (*Case* 1) *Heat applied directly to air through contact with manifold walls.*
Fig. 2 (*Case* 1-*a*) *Heat applied to air only before it enters carbureter*
Fig. 3 (*Case* 1-*b*) *Part of initial heat application obtained by cooling vapor mixture sufficiently to form a fog*

IN this method, which is shown in Fig. 4, the fuel, after being metered, is discharged into a heating chamber which the air charge does not enter; the vapor formed here is then mixed with the unheated air charge to form a true fog mixture. At first thought this system seems to be promising, but actually it has serious inherent disadvantages, for the reason that the delivery of vapor depends upon the temperature being kept above a certain minimum.

An open chamber will evaporate liquid below the boiling point much more quickly than a closed one, the difference being due solely to the more rapid escape of the vapor from the open chamber. In the design illustrated a normal flow of vapor from the heating chamber should take place only when the vapor temperature is raised to the final boiling point of the fuel; that is, the vapor must be between 400 and 500 deg. Fahr., which is much higher than the temperature needed with any other construction shown. The final temperature of the mixture may, however, be quite low because of the fact that very little more heat need be added to the system than is necessary to vaporize the fuel. Also, the "factor of safety" in heating capacity may be large without raising the final temperature of the mixture in proportion.

This arrangement might be hard to start and would possibly be slow on acceleration. With heavy fuels there would be a tendency for the heavy elements to collect in

the bottom of the heating chamber during idling, when the exhaust temperature is lower than the boiling point of the fuel. Upon a sudden increase of the exhaust temperature this pool of heavy elements is apt to coke. In fact, we have known of a number of instances where a pocket for the collection and heating of the fuel would fill with greasy tar or coke. This trouble was marked particularly in high end-point gasolines.

This construction has the additional advantage, when properly designed, of permitting no liquid fuel to reach the valve ports. On this account, as also with Case 2a, it will give a homogeneous fuel charge, or "good distribution," as we call it, with any shape of intake manifold and any convenient location of the carbureter.

Case 2a, Fig. 5, is a sort of compromise between Cases 1, 2 and 3, which seems to possess all the advantages of Case 3 and fewer disadvantages. The mixture spray from the carbureter is thrown against a deflecting surface, that may be heated, and fuel not vaporized is thrown down into a heating chamber as in Case 2. An opportunity is afforded for the fuel to evaporate in and mingle with the air, before the separation of the liquid and the vaporized portion. This reduces the fuel lag on acceleration and also reduces the amount of fuel that must be taken into the heating chamber. An air circulation is maintained through the heating chamber, which helps to carry the vapor away as fast as it is formed; the action in the heating chamber then can be **evaporation** rather than **boiling** as in Case No. 2. This distinction is important because **boiling** implies the maintenance of temperature above a certain point, at all engine speeds and at a constant pressure, while evaporation can take place at any temperature and, fortunately, under a change of engine speed, the decrease of the exhaust temperature being accompanied by a reduction of the fuel feed and the rate of evaporation.

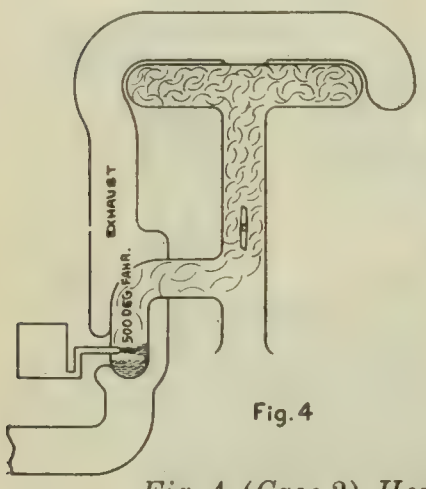


Fig. 4

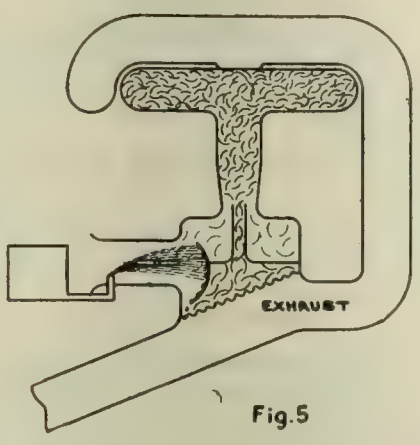


Fig. 5

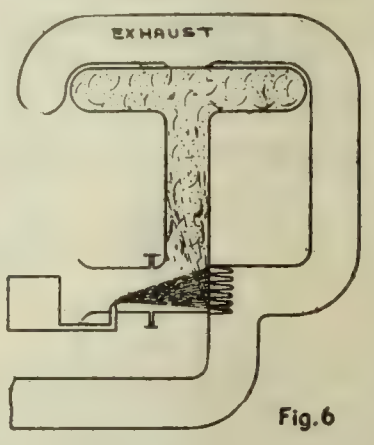


Fig. 6

Fig. 4 (Case 2) Heat applied direct to fuel of mixture charge
Fig. 5 (Case 2-a) Heat applied directly to main part of fuel and small part of air charge
Fig. 6 (Case 3) Fuel and air mixture sprayed against a hot surface

THE air taken through the heating chamber is, of course, highly heated, so that, as compared with Case 2, we have a small part of the fuel and of the air heated, to be cooled by the remainder of the air charge and a certain part of the fuel charge. The temperature balance would, of course, depend on the percentages of the fuel initially vaporized and of the air passed through the heating chamber.

This arrangement possesses the advantage of Case 2, in allowing a large reserve capacity for warming up without excessive heating of the mixture under normal operation, and also of preventing liquid fuel from going into the engine cylinders. A device of this sort, though of design entirely different from Fig. 5, has been used in the actual driving of a passenger car with a six-cylinder engine and gave as good a demonstration on kerosene, with a benzol component to avoid detonation, and alcohol at a mixture-temperature of 120 to 140 deg. Fahr., as with gasoline. It was also found possible to use heavier fuel combinations which resulted in considerably better operation than that shown by the average car in the hands of its owner. Starting on gasoline in very cold weather was not more difficult than with the ordinary carbureter and intake-manifold arrangement. In fact, no difficulty was ever experienced in starting; the starter was always strong enough to turn the engine over. Closing the choke would always effect a start. On gasoline the warming-up was very good. In weather 10 deg. Fahr. above zero, it was necessary only to use the dash mixture control device for about ½ min. or less after starting, after which it was possible to set all the controls in the normal driving position and drive away. This usually synchronized with the development of a mixture temperature of about 90 deg. Fahr. With gasoline the fuel consumption was but slightly lower than with a good carbureter on a conventional type of hot-spot intake manifold, but the engine would run smoothly on very lean mixtures and the weekly mileage, particularly in winter, was better. The smoothness and the absence of carbon, crankcase oil dilution and ignition trouble were marked. We found also improved operation at low speed on hills. The engine would pull smoothly and without apparent effort and maintain this smooth low speed pulling indefinitely.

As illustrated in Fig. 6, this includes a condition aimed at, and more or less realized, in many hot spots in use to-day. It is the general belief, perhaps, that the fuel spray strikes the heated surface, vaporizes, and then condenses in the airstream. More recent observations lead us to believe that very little of the fuel vaporizes on the heated surface. It seems rather that the sudden application of heat to one side of the drops of spray, as they strike the heated surface, relieves the surface tension that holds them in globular form and causes them to burst; meanwhile, if an air draft is present, the "spheroidal condition" keeps them from adhering to the heated surface. This belief was first suggested by the observation that large drops come off such a hot spot in a coarse spray, while small drops come off in a finer spray.

There is one interesting hypothesis of action under these conditions, the realization of which would give a fog mixture at very low temperatures that has a very simple structure. If the heating surface were of exactly the size and location to be wholly covered by the liquid of the fuel spray; if its heating capacity were such that it could vaporize all the fuel that strikes it; and if the scouring action of the air-draft across the heating surface were sufficient to carry away the vapor as fast as it was formed, it would be possible to produce the vapor at the relatively low temperature corresponding to a density of one-fifteenth to one-twelfth that of air; also, there should be little, if any, heat transmitted directly to the air from the heating surface. Under such conditions, which we believe can be realized only in theory, the mixture temperatures would be the minimum among all the

systems suggested for producing a fog mixture by external application of heat energy.

Fig. 7 is an effort to show the nature of such action, assuming complete evaporation at the surface. There is, first, near the surface, a film of liquid, or a layer of liquid drops. Just off the liquid film the greatest vapor-density occurs, but as the distance increases and the air begins to lower the temperature, the molecules will begin to gather in small drops, in the action that we term condensation. It is obvious that it would be impossible to bring **all the air** into such contact with the liquid film that the vapor would be swept away, and uniformly diffused, within a few molecule paths of the liquid film, and it is only under such a condition that the temperature balances of Fig. 6 could be obtained. But it also is clear that the more completely we can direct and diffuse the air charge on the heating surface in the conventional hot-spot design, the lower the temperature and density can be next the liquid film, the lower can be the temperature of the liquid film and the wall itself and the lower the final temperature of the charge.

REGARDLESS of the correctness of the theory of operation of this type of hot spot, there are several advantages and disadvantages in practice that should be pointed out. As already outlined, reserve capacity can be obtained only by making the surface larger. Also, there is no inherent characteristic of this arrangement that would prevent liquid fuel from going into the engine. The heat capacity of the wall of any structure that could be used would be sufficient to prevent any lag in acceleration, provided the carbureter were made to give a charge of slightly increased richness, with a fuel of graduated volatility.

In the quantitative computation of heat transfer, we first must take into account the very wide variations of temperature that the air charge and fuel supply undergo before they enter the intake manifold system. On account of the large range of variation of hood temperature, Fig. 8 is given as a rough indication of the various changes in temperature that a molecule of air undergoes in getting from the external atmosphere to the cylinder port, without purposeful application of heat to the intake charge, other than the commonly used hot air stove around the exhaust pipe. Starting from atmospheric temperature, the temperature of the air is raised between 30 and 60 deg. in passing through the radiator. It has been my observation that there is a greater difference between the motometer temperature and that of the external air in summer than in winter. There is sometimes an additional rise of temperature under the hood due to the radiation of heat from the engine. The rise of temperature from the hot air stove is presumably about the same in the summer and in the winter but on many cars an appreciable portion of the heat added by the stove in the winter is lost before it gets to the carbureter, because of the cooling effect of the fanblast of relatively cold air on a long length of flexible tubing. The temperature drop in the carbureter and the manifold due to vaporization is indeterminate, dependent upon the fuel, the temperature and the vacuum. In many cars the intake manifold is so close to the exhaust that under full load the temperature is raised considerably by the cross radiation. We have sometimes gained 3 to 4 hp. in a maximum of about 70, by cutting off this radiation with asbestos board.

Fig. 8 will give an idea of the range of natural temperature-variation with which our intake systems have had to deal. Between the temperature of the air entering the intake system just after starting in the winter and that during a long run in the summer, there easily may be a difference of 120 deg. Fahr. Very few current applications of heat to the intake charge, by either hot air or hot spots, affect the temperature one-half this amount. Any effort to attain minimum charge temperatures in actual practice must include means for dealing with the natural temperature variation under the hood.

With heating methods that approximate Fig. 1, the heating surface should perhaps be in two sections, one of which is in action at all times, and the other of which may be thrown open to the exhaust, either by a seasonally regulated valve, or by the dash mixture control of the carbureter.

Arrangements such as that shown in Fig. 2 can be controlled within certain limits of temperature by using a hot air stove on the exhaust line that has at least three times the heat capacity of those in common use to-day, with a valve adapted to cut off part of this hot air and admit cold air as the engine warms up. The regulation should preferably be automatic.

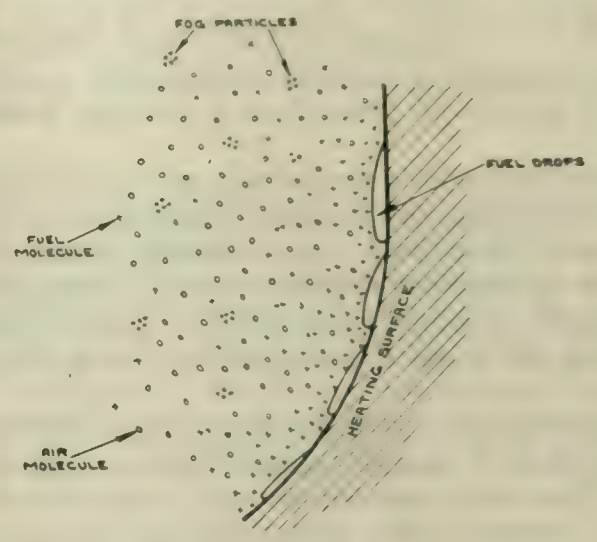


Fig. 7—Diagrammatic study of vaporization from a hot surface

In the methods of Case 2, Figs. 4 and 5, no particular regulation for variation of atmospheric temperature is necessary. The heating action is almost independent of the outside temperature. With this type of construction, I have always recommended making the heater large enough so that cool air from outside the hood will be taken into the carbureter in the summer time.

Fig. 6, like Fig. 1, would perhaps be taken care of best by a regulable variation in hot spot area. Difficulty is experienced in practice in confining the heat to the region where it is desired. In warm weather the heat from the warm hood atmosphere tends to conduct across the flange junctions and through the walls of the heating chamber.

Homogeneous Mixture Quality

AS has been brought out in the foregoing, a homogeneous mixture requires a fine spray from the carbureter issuing directly into the heating region. If the fuel is allowed to condense or gather on the walls, it will reach the hot surface in waves and irregularly timed splashes, under which conditions the carbureter setting must always be somewhat rich, and many details of engine operation will suffer. Acceleration is always more difficult when there is a fuel lag between the carbureter and the heating surface.

The arrangement, common in many heavy duty engines, of locating the governor between the carbureter and the hot spot, is very bad. Everything indicates that the carbon deposit will be reduced to the minimum and crankcase oil dilution eliminated only when this custom is discarded and the carbureter is placed close to the hot-spot.

Several 1922 engines that have the property of operating very smoothly on extremely lean mixtures, have in-

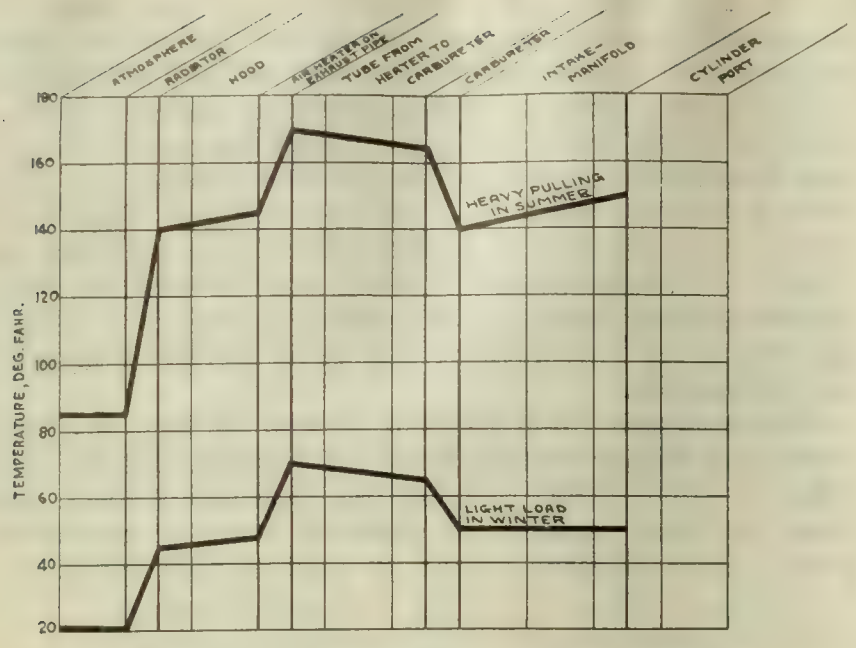


Fig. 8—Range of natural temperature variation of air charge from time of entering hood

take manifolds that are characterized by a hot-spot at the carbureter opening and have additional contact with the exhaust manifold a little farther along, usually at a point of division of the fore-and-aft reaches. Apparently the second "spot" catches some of the particles that elude the first one and gives a more complete and steady evaporation.

One important requirement of a successful fuel charge heater is that it should warm up and get underway quickly. The walls should be thin, and, if cast, should be lightly ribbed on the exhaust side. Aluminum combines low specific heat and rapid conduction and is a very suitable material for a cast hot spot heating surface, if there are no shielded parts that get so hot that they melt.

Preventing Liquid Fuel Reaching the Cylinder

IT is recognized generally that it is desirable to prevent liquid fuel from reaching the cylinder and it has been claimed for many designs that they have this action. We have tried models of a number of them and have found that few impede the travel of liquid fuel to the cylinders in even a slight degree. With transversely ribbed elbows, for instance, the fuel drops are caught off the tips of the ribs by the air eddies and snatched through the elbow as if no ribs were present. This, of course, is with air velocities above 70 ft. per sec., and part of the lively action naturally is due to the spheroidal condition already described.

We have used centrifugal force, surface tension and the force of gravity to separate the unvaporized drops. Careful combination of all seems to be required to achieve complete separation. A partial separation, which should be very effective at low engine speeds, can be obtained by abruptly increasing the manifold area above and beyond the hot spot. This would allow the heavy drops to settle down and again be hurled against the heating surface. The separation and recirculation would obviously be beneficial to the action of either Figs. 4 or 5, but **the heat supply must be adequate or the fuel will not reach the engine,** with an actually functioning liquid fuel separating device.

After watching the fuel, in an accumulation equal to many cylinder charges, bubbling, splashing, sometimes lying quiescent on the heating surface of glass-walled hot-spots, and sometimes swept through in a high-velocity spray, one fact stands out: the **rate of fuel-feed from the manifold to the cylinder** primarily governs the conditions of combustion, and the rate of fuel-feed to the manifold is an indirect rather than a direct controlling factor, as regards the mixture proportion of the charge actually used by the engine.

This point of view, we believe, is the proper one from which to consider the problem of the efficient use of fuel in our engines of to-day.

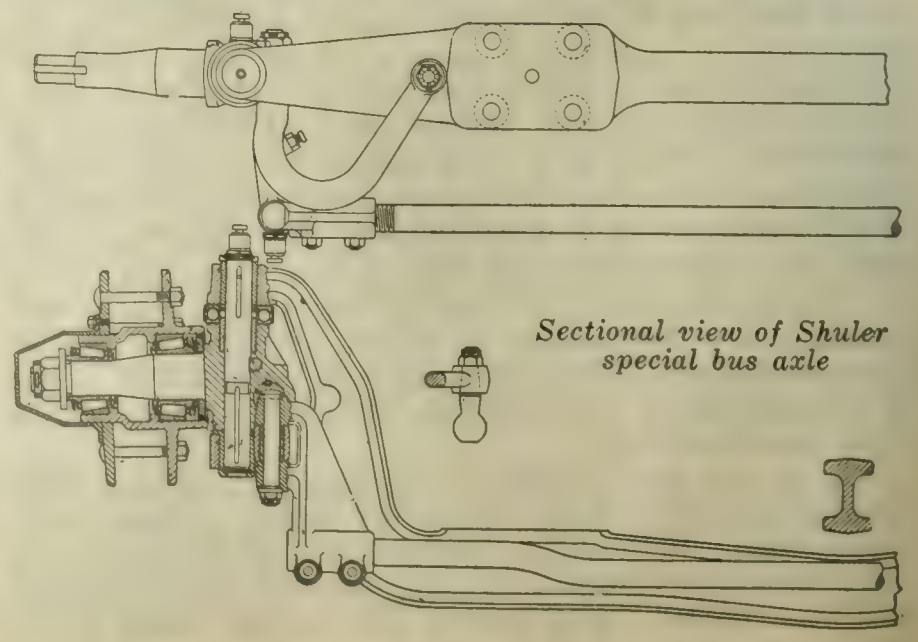
TABLE 1—FINAL AVERAGE MIXTURE TEMPERATURE WITH ENTERING AIR AND FUEL AT 75 DEG. FAHR.

Fuel	High End-Point Gasoline		Kerosene	
Air-fuel ratio	12 to 1	15 to 1	12 to 1	15 to 1
When heat is transferred from all the air to the fuel (Fig. 2).....	145	135	240	230
When heat is transferred from one-half the air to the fuel (Fig. 2).....	168	160	278	273
When heat is transferred from one-half the air to the fuel (Fig. 3).....	132	122	193	188
When heat is applied directly to the fuel (Fig. 4)	143	132	174	159
When the fuel only is heated to temperature of required vapor density (Fig. 6)	98	92	124	116

Shuler Producing Special Bus Axle

THE tendency toward the use of wider and lower frames in bus chassis is being reflected in the parts market by announcement of axles designed especially for this class of service. Among recent developments in this field is the front axle now being produced by the Shuler Axle Co., a cut of which is shown here.

It will be noted that the spring pads in this axle are 7 in. below the center line of the wheel axis, while the cross link is arranged for a corresponding drop. Spring centers can be varied from a minimum of 28 in. to a maximum of 42 in. with a 64½ in. track. The axle center is of I-section drop forged from 30-40 carbon steel, heat-treated, while steering knuckles and arms are of S.A.E. 3135 chrome nickel steel. The knuckle pin is 3½ per cent nickel steel, hardened and ground, and a ball thrust bearing is fitted between the knuckle and upper yoke. All yoke eyes are bushed with hardened steel bushings. The wheel spindles are fitted with Timken bearings.



Sectional view of Shuler special bus axle

S. A. E. Summer Meeting

Widespread Use of Motor Bus

Great variation in conditions under which buses operate. California vehicles make 45 m.p.h. Country bus must carry both passengers and freight. State regulations very numerous. Future effect uncertain, but supervision now makes for better buses.

By R. E. Plimpton*

ANY division of the types of vehicle used for buses must be arbitrary, but for convenience we can consider them as applied in city, inter-city and country service. The city bus is designed for use on good pavements. The seating capacity is high, 20 or more passengers, but high speed is not essential. A maximum of 15 m.p.h. is often considered ample. Ability to thread through traffic and to move passengers quickly, on and off, is required. Ordinarily, overload capacity should be provided, so that standees can be accommodated during the rush hours.

The double-decker, a dense-traffic vehicle, has been developed highly through years of service in London and New York. The L-type bus of the Fifth Avenue Coach Co. is distinguished by the low floor, the first step being at the curb and only one other being required to reach the floor of the bus. Increased seating capacity, without any increase of weight, has been secured in many recent double-deckers. A sample now operated in Chicago seats 69 passengers, with a total vehicle weight of only 157 lb. per seat. Previously, about 200 lb. per seat had been considered good practice.

Covered upper decks have been tried out in New York City and Chicago, but have proved popular only in bad weather. Double-deckers in London, England and Toronto, Canada, have been fitted with blankets for each top-deck seat, in the effort to build up the load factor. The so-called double-single-decker has been tried in England; the entire top deck of this vehicle can be detached for winter service, the stairs being removed and the hatchway closed by a trapdoor. One vehicle of this type has a capacity of 29 passengers as a single-decker, and of 54 passengers, half below and half above, when both decks are in use. However, the single-decker has by far the largest field as a city bus.

Long Wheel-base

Long wheel-base to give loading capacity, a wide rear gage and a narrower gage on the front to give stability, a small turning-circle, low frame-height to give quick passenger movements as well as stability, long springs and special devices for easy riding are the more important features of a design that will be used widely in and about our cities.

It is of interest to know that experts on city transportation favor three sizes, for 21, 25 and 29 passengers, with a maximum frame-height of 26 in. A smaller size, for 16 passengers, has also been proposed.

Most city buses have a central aisle, with cross-seats on each side. In a modified form the seats near the service door are of the longitudinal type, thus providing a space for standees or for those making short trips. This is being applied in short-haul work, while there is a tendency to use the unmodified cross-seat type in suburban work, and even for inter-city service.

The Inter-City Bus

The inter-city bus is smaller and faster than the city bus. From 12 to 20 seats are provided for the long runs of 20 miles and upward. These vehicles are known as stages in the West and particularly in California, probably because of familiarity with the term to designate a horse-drawn omnibus. The stage usually is built with three or four rows of seats running all the way across the body, each having its own side doors. It resembles an enlarged touring car and, of course, that is what it frequently is. Comfortable riding is desired, rather than the ability to handle crowds. The floor level is kept as low as possible without decreasing the road clearance below 7 in. The center of gravity is kept down to eliminate sway and undue wear on tires and wheel bearings.

The average speed in Western inter-city service is high. Orders to drivers on a large system in California are to make 32 m.p.h. on well-paved highways and 35 m.p.h. is the legal speed limit. However, there are stretches where it is hard to keep down to this speed. For example, on the desert floor west of El Centro, Cal., a broad concrete pavement stretches away for 30 miles. There are no cross-roads and no habitations are in sight; there is no obstruction to view and very little traffic. With a high-powered car, the driver who will keep down to 35 m.p.h. is unusual. The actual speed over such stretches is from 40 to 45 m.p.h. and, occasionally, 50 m.p.h. The chassis and body should be of the minimum weight, consistent with long life and durability. The improvements being made in highway systems will, it is believed, lead to the use of even lighter chassis.

The stage used in the West is, as a rule, a rebuilt product. A high-grade touring car is bought second-hand, the frame is lengthened 4 to 5 ft., and a heavier differential, heavier springs and heavier tires are installed. It is realized that these vehicles are expensive, in both first and maintenance costs, since they are always in the "special" class, but Western operators have used them because they could not buy a chassis that would

*Associate editor, *Bus Transportation*. Excerpt from paper read before summer meeting of Society of Automotive Engineers.

carry the long bodies under the heavy-duty, up steep grades and at high speeds demanded by Western operating conditions. One design at least, that is included in Table 1, is now on the market, and there are indications that others will be available soon for inter-city service, not only on the Pacific Coast, but also in many other parts of the country where the large rebuilt touring car has been used heretofore.

The Country Bus

The country bus may start nowhere and end nowhere, as is said of some of them, but usually it runs through rural districts to a trading center or a point where connections can be made with some other form of transportation. This service does not require particularly high speed, but the bus should be able to keep going over poor roads, even when they are covered with mud or snow. Travel is light in this service; so the vehicles used are small. Touring cars of five and seven-passenger capacity may be operated when the roads are particularly bad, giving way to larger buses, up to 18-passenger capacity, during the summer months. One trip a day is often the custom, to town in the morning and returning in the middle of the afternoon. Thus, the operator has the time to pick up light freight for delivery along his route; or he may be a star-route contractor for the Post Office Department, in which case he may carry passengers and freight so long as his contract is properly performed. Therefore, the country bus should be built to carry both passengers and freight. Most operators seem to use the standard passenger vehicle, car or bus, and carry the packages inside or outside, wherever there is vacant space. A space for packages is placed at the front of the vehicle in some designs, with the rear given over to seats.

THE automotive manufacturer is the logical maker of bus equipment. The market for vehicles of this kind is growing and in the future is likely to be very extensive. The type of vehicle exactly suited for bus work, however, is still a subject for discussion.

Many motor buses are already operating throughout the United States. They differ both as to design and performance. The tasks they have to perform are quite different in different localities. But they are showing the important place that the motor bus can play in economical transportation.

A convertible vehicle would be particularly useful in consolidated school service, where many buses are now operated only 3 or 4 hr. per day. The seats are removable in one design, so that the school bus can be changed quickly to a light delivery truck. Several combination bodies are on the market, designed to carry both passengers and express, but they have not been used to any extent by bus operators so far.

A transferable body has been suggested for school use, although it might be applied by the operator of country buses also. This would be mounted on a motor-vehicle chassis when the roads were good, but transferred to a horse-drawn vehicle, on wheels or runner, when they are impassable. The fact that this has been proposed seriously indicates the need for properly designed country buses. The field for them is enormous and it should be possible to provide operators with a light, sturdy, economical bus for use during the 12 months of the year. Some engineers contend that good roads must come first. Yet bus service is being given on thousands of miles of unimproved roads. The life of the vehicles used is short, and some operators believe it econmical to turn them in yearly for new ones. Here is a real problem waiting for automotive engineers to solve. The bus for city service is receiving attention from a large number of sources, but its country cousin is, as yet, almost entirely neglected.

Before taking up the details of chassis and body used for the standard gasoline bus, other types that have been applied will be noticed. The gasoline-electric bus is used commercially in England, some 175 of the Tilling-Stevens chassis being operated in London, and others in the smaller towns. This consists of a gasoline engine direct-connected to a dynamo. The latter is electrically connected to an electric motor, which drives a worm rear-axle through a propeller-shaft. The control is by a speed regulator of the multiple-contact type, operated by varying the resistance in the shunt field of the dynamo, and by shunting the series field of the electric motor.

Storage-battery buses are used in Chicago for carrying passengers between the railroad depots and the department stores. One street railway is now trying out a battery vehicle in short-haul feeder service. This bus is fitted with pneumatic tires and makes about 18 m.p.h. in ordinary operation. The limited speed and battery capacity have worked against the battery-driven vehicles, although they undoubtedly have a field for short runs on good pavements.

The trolley bus shown, a road vehicle using the overhead system of the electric railway, is making headway in this country, as shown by recent installations in Toronto, Canada; Minneapolis, Minn.; and Los Angeles, Cal. The system on Staten Island, N. Y., is to be extended by the use of 15 trolley buses now ordered for the New York City Department of Plant and Structures. Some of these will be used on the City Island line, in the Borough of the Bronx, New York.

Many of the trolley buses look like rail cars fitted with rubber tires. However, there has been a tendency of late to follow closely gasoline vehicle design, thus using standard parts and making it possible to change from one type to the other by installing a gasoline engine and transmission apparatus.

A front-drive design has been worked out for the buses used in Leeds, England. The electric motors are under the front, and can be removed for repairs. It is claimed that this construction improves adhesion and traction effort, reduces the consumption of electric energy and makes possible a 14-in. floor level.

Steam Buses

The steam-propelled bus is not in commercial operation at present, although several experimental vehicles are being developed for such service. The Clarkson steam buses, which were popular in London because of their speed, quietness and ease of control, stopped operation in 1919, mainly, it is said, because of the increase in fuel cost.

Laws and ordinances by the hundred, almost by the thousand, have been passed to "supervise and regulate" the bus. The safety and comfort of the traveling public are protected by a host of these regulations, many of which are more honored in the breach than in the observance. In common with other users of motor vehicles, the bus operator is limited as to weight, dimensions and

speeds. In addition, he often must pay special taxes that influence the type of equipment.

To assure safe operation, presumably, the carrying capacity of the bus is limited. In some States, in New Hampshire, for example, the manufacturer's rating is taken as the legal limit, and no standees are permitted. New Jersey allows 50 per cent of the seating capacity to be carried as standees. Connecticut allows two more than the number of seats provided. The District of Columbia permits one standing passenger for each 1.5 sq. ft. of floor area, this being calculated on the area remaining after deducting the space occupied by seats and 10-in. knee-room for longitudinal seats. In Maryland the maximum carrying capacity is the total length of seats divided by 16, except when the result exceeds the carrying capacity. This method, in effect, bars out standees.

An emergency door that can be opened from the inside in case of accident is required in a number of localities. Other equipment insisted upon, for safety reasons, includes speedometers, inside lights, extra tires, skid chains, warning device and a fire protection device.

The requirements for heating, lighting and ventilation are usually indefinite; when enforced they depend upon the interpretation of the authorities. Closed buses in the District of Columbia must have a minimum temperature of 40 deg. Fahr. between Nov. 1 and April 1. Interior lights, of 2 cp. or more, are demanded in Ohio and other States. In Maryland each bus must have two ventilators.

In many States the taxes are based upon seating capacity, and the larger vehicles pay more per seat than the smaller. Florida exacts from the buses used as common carriers a fee of $5 per seat for 7-passenger or less capacity, $7.50 per seat for 7 to 17-passenger capacity, and $10 per seat for more than 17-passenger capacity; in addition there is a tax of 75 cents per 100 lb. of gross weight of the vehicle and the load. Connecticut and Maryland also have systems whereby the fee shoots skyward for the larger buses.

The regulatory authorities may even supervise the purchase of equipment, approve drawings and specifications and compel the improvement of those already in service. It is too early yet to judge what the result of this supervision will be. At present it seems to make for better buses. With wise regulation, and with improved highways that will permit lighter vehicles and more economical operation, the bus, already with such a wonderful development, will have an even more wonderful future as an instrument of transportation.

Experiments with Sherardizing

SHERARDIZING is a method or process of providing steel parts with a rust-protecting coating of zinc without previously melting the latter. Zinc dust is brought in contact with the thoroughly cleaned surface of the part to be coated, under protection from the air, and the parts are then heated to a temperature below the melting point of zinc, when a highly protective coating of zinc is formed on the steel parts. The process was introduced into this country from England about 15 years ago and has come to be widely used for certain purposes.

A paper detailing Experiments with Sherardizing was presented to the American Institution of Mining and Metallurgical Engineers by Leon McCullogh, research engineer of the Westinghouse Electric & Mfg. Co., some time ago. Mr. McCullogh states that the coating imparted to steel parts by the sherardizing process is a brittle alloy of zinc and iron. The zinc particles are covered with oxide and cannot touch the iron, but an extremely small amount of zinc vaporizes and the vapor, reaching the iron, alloys with it.

Other zinc then vaporizes to replace that which has been removed from the atmosphere, and as the coating already formed permits zinc to diffuse through it, the process continues at a decreasing rate. By a certain experiment carried out by Mr. McCullogh it was shown that the growth is at the junction between the iron and the coating; that is, by interrupting the process for a while and then continuing it, it was found that the layer last formed was next to the iron.

As would be expected from the mode of growth, the composition of the sherardized coatings varies from the surface inward. The iron content increases slowly at first and then more rapidly, the minimum possible proportion of iron at the surface being 6 per cent.

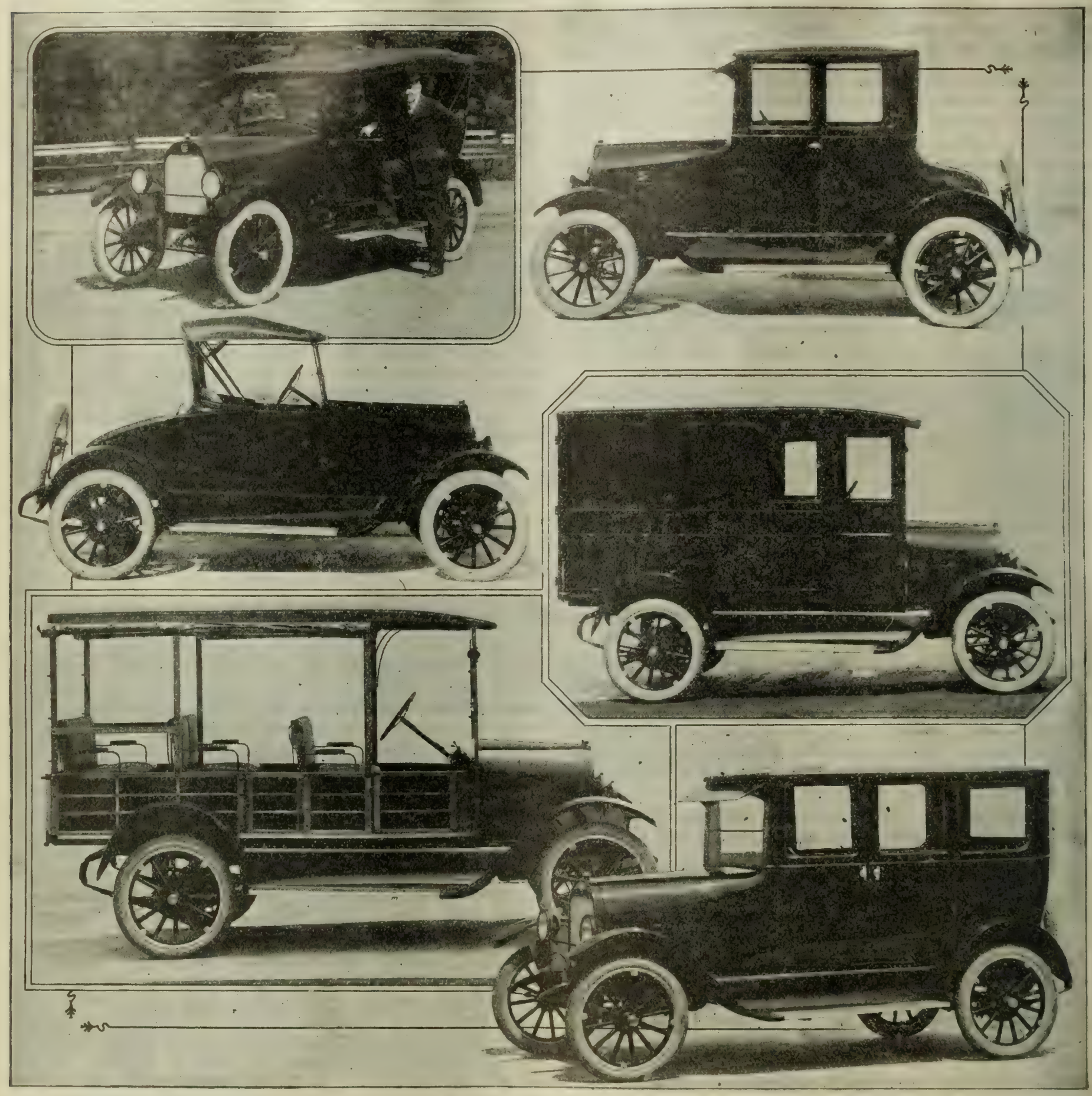
The constituents of the sherardized coating are believed to be as follows: The solid solution n, varying in composition between 6 and 10 per cent iron; the compound $FeZn_3$; and possibly a 20 per cent solution of zinc and iron. Next to the iron is the solid solution of zinc and iron, in amounts too small to be detected; then there is a very thin layer of the compound $FeZn_3$ and beyond this the relatively thick layer of solid solution n, on which the protection of the iron depends. $FeZn_3$ can have little protective value, for it readily rusts when placed in water.

Life tests show that a minimum weight of zinc per square inch is necessary for good coatings; to test the value of sherardizing, the weight of zinc should therefore be determined. There are various proposed methods for doing this. One approximate way is by the Preece or copper-sulfate test.

A new method depends on the fact that a boiling 10 per cent solution of ammonium chloride removes zinc from sherardized coatings rapidly, but does not dissolve iron until the zinc is practically gone. This test may be applied in two ways: The coating is completely removed and its amount determined by loss in weight; or the weight of the coating is found approximately by noting the time for iron to appear in the boiling solution. At each 5 min. interval a drop of the solution is removed upon a spot-plate and tested with potassium ferricyanide for the presence of iron. When the blue color appears, the coating is gone, and the time is a measure of the weight of zinc. A good coating should withstand this test for 10 or 15 min.

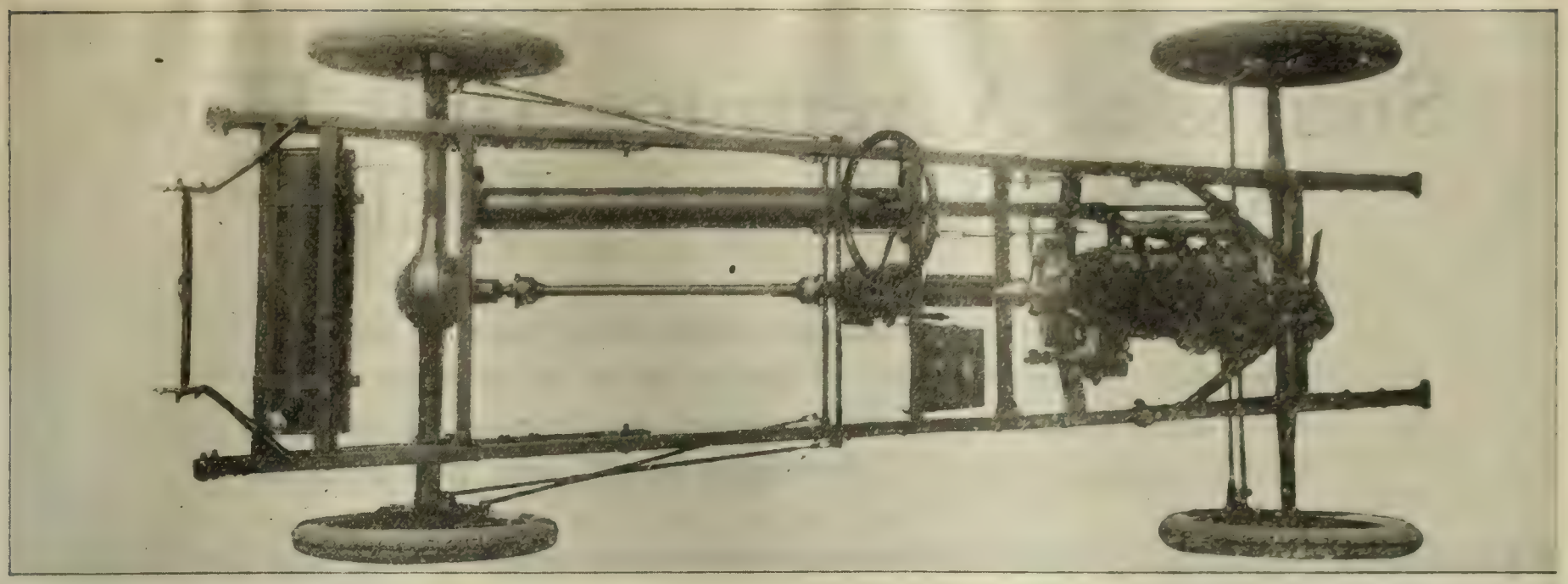
A comparison of short-time rusting tests, such as the salt spray, with tests in actual service, shows that rusting in the short-time tests does not necessarily mean a short life in service. The rapid rusting tests are, however, of value in judging the quality of a coating, when an actual determination of the weight of zinc is made at the same time. These two methods of testing should supplement each other.

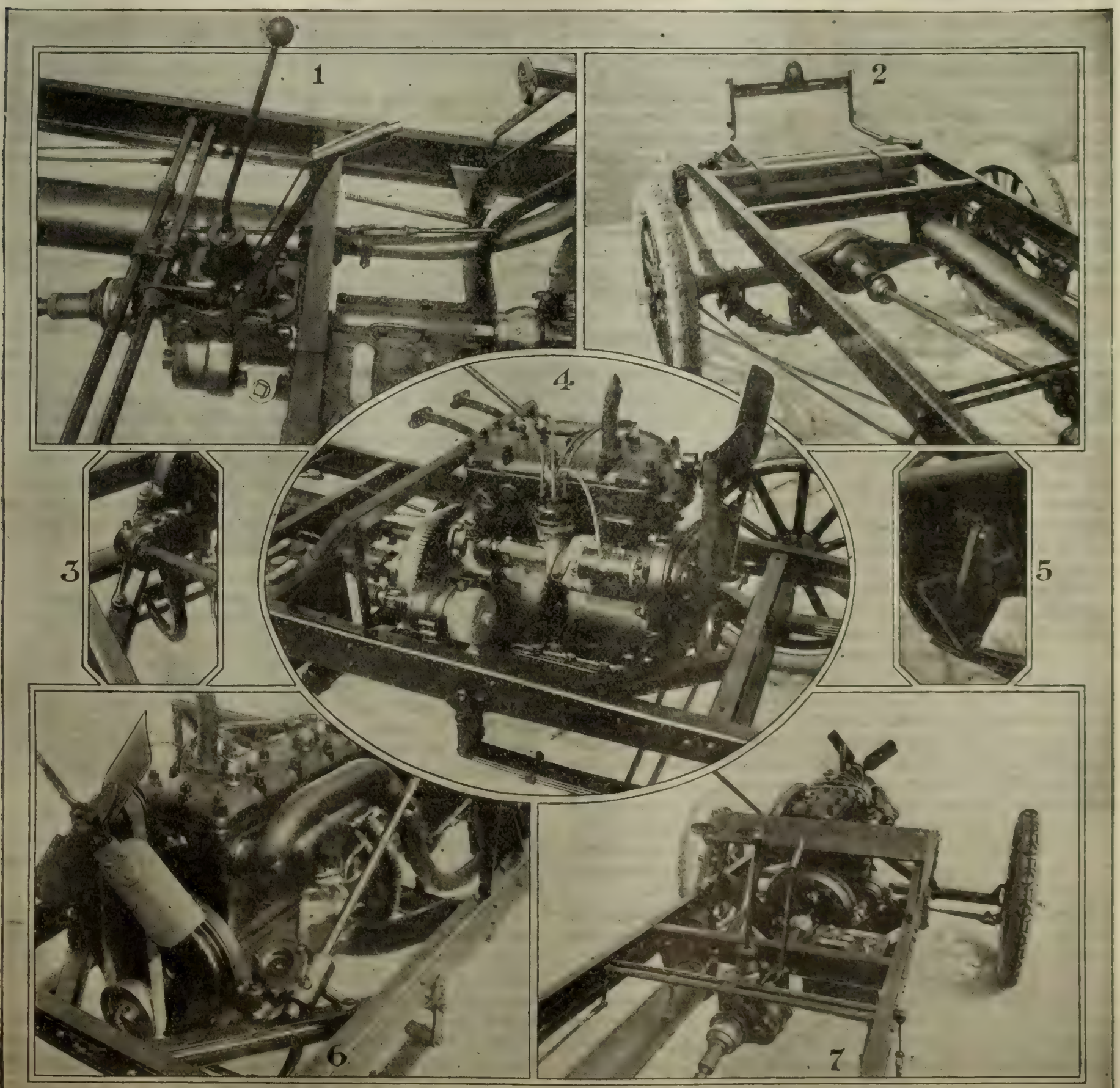
Star Body Models and Chassis Parts



The Star body models exhibited for the first time in New York last week and referred to in the news columns of AUTOMOTIVE INDUSTRIES *at that time are illustrated above. The first detail pictures of the chassis and its parts are shown on the opposite page.*

1—*Center portion of chassis showing gearset mounting with its rear end supported from the brake shafts and location of battery.* 2—*Rear end of chassis showing underslung spring, fuel tank mounting and the new combination tire carrier, license plate bracket and tail lamp which has been added since car was described in* AUTOMOTIVE INDUSTRIES *for March 16. Note the brake rods which are of thin flat stock with forged ends welded on.* 3—*The worm and worm wheel steering gear bolted to diagonal frame member. The worm shaft extension is bent forward at right angles to form an integral steering arm.* 4—*Right side of Continental engine showing mounting of electrical units, fan and pump. The chain is tightened by swinging the generator outward. The pump, mounted near rear of engine, is driven off the rear of the generator-ignition unit by a hose-type flexible connection.* 5—*Detail of bracket for front end of rear spring. It is stamped from flat stock.* 6—*Left side of engine showing hot spot manifold and method of mounting.* 7—*Front end of chassis.* 8—*Plan view of chassis showing the well constructed frame. The tubular member which also forms the muffler gives the frame an unusual degree of stiffness against torsion*




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Successful Advertising Must Have Active Backing by Dealers

N. A. C. C. advertising managers stress importance of dealer in automotive selling scheme. Superlatives in advertising ineffective. Parts makers spend $10 in advertising to every $6 spent by vehicle manufacturers. Advertising should seek new markets.

PRACTICALLY the entire morning session of the National Automobile Chamber of Commerce advertising managers meeting was given over to a discussion of the importance of the dealer in the present stage of the automotive vehicle business. Each of the three topics assigned to the morning session turned largely on the importance of the dealer in carrying out an advertising and sales program.

In the afternoon session the dealer was somewhat less prominent but was always appearing in the discussion under the topic of selling cars to women. Miss Bohn made the surprising statement that in a questionnaire sent to dealers no one had made any effort to sell cars to single women. Miss Bohn was also quite critical of both dealer and manufacturer for not recognizing the fact that women determine the purchase of about 75 per cent of the motor cars. The final discussion in the afternoon session was on motion pictures and in this discussion was shown the Paige-Detroit dealer picture.

This was the first of the revived advertising managers' meetings and was held in the University Club at Chicago. About 30 manufacturers were represented. Edward S. Jordan, chairman of the advertising committee, presided.

A. B. Batterson of the Buick was to have opened the discussion on the first subject, Relationship of the Advertising Department to the Dealer, but Batterson wired that he was unable to be present and Jordan asked Clyde Jennings, managing editor of *Motor Age*, to open this discussion. The speaker said that he knew nothing of the relations of the advertising department to the dealer but preferred to put the discussion on the relationship of the advertising and the dealer. He said that in his interviews with dealers he had found that many of them were not sold on the advertising policy of the company.

Especially were the dealers in small towns likely not to understand the advertising tests and its application and to entirely ignore it.

The speaker called attention to the necessity of having a connecting link between the prospect and the car if the advertising was to be made of assistance to the seller. The purpose of advertising is, of course, to assist in selling; that until the man responsible for the advertising had made publicity serve this purpose there was little object in discussing what the cost, or how it was done. The big idea at present is to get an organization that would cash in on advertising and the advertising that was placed where there was no connecting link between the maker and the prospective owner was of little direct value.

L. B. Dudley, of the Federal Motor Truck, led the discussion on the topic of Special Problems in Motor Truck Advertising. Dudley also brought dealers very strongly into his topic and said that in his opinion the advertising managers should be responsible for the kind of dealers that represented the manufacturer. The question of dealers and of their activities in behalf of the company seemed to Dudley to be of vital importance. He also presented the different point of view that governs truck advertising now from that of a few years ago. Formerly the question was where to spend the money, but now the question has become when and where to advertise.

The speaker was somewhat critical of some of the truck advertising, and pointed out some technical errors and some foolish superlative statements that could only do harm to the manufacturer. He closed his remarks with a plea for fair play on the part of all truck advertisers and invited any other truck advertiser to take up with him any criticisms they might have on Federal advertising. He said that the policy of the Federal advertising was to play fair with all competitors and to make their advertising constructive and for the upbuilding and use of all the truck industry.

Ezra Clark, advertising manager of the Clark Equipment Company and chairman of the advertising managers' committee of the M.A.M.A., was then invited to address the meeting.

In describing the activities of the M.A.M.A. advertising committee, which has now been revived, Clark said that their investigations had indicated that the parts manufacturers spent $10 for advertising to each $6 spent by the complete vehicle manufacturer. He also said that the M.A.M.A. advertising manager had found that too much of their advertising was competitive and their effort had been to turn their advertising men to find new markets

NED JORDAN presided at the meeting of the N. A. C. C. advertising managers. In addition to presiding he made some remarks upon his favorite topic—automobile merchandising.

* * *

An Omaha banker recently asked Jordan how many of the automotive manufacturing companies were going to survive. Jordan offered to answer his question if the banker would answer a question in turn. Jordan's question was "How many dealers are on your preferred list?"

* * *

The banker's reply was that 6 out of 48 dealers in Omaha were on his preferred list. Jordan's view is that dealer co-operation is going to decide which manufacturers have the largest measure of future success.

rather than attempt to take each other's trade. He believed that much of the promotion of the interest in bus transportation was due to this sort of advertising.

The speaker said that a year ago he went to Judge Gary of the Steel Corporation and asked him to serve as judge of the art contest the subject of which was to picture the automotive vehicle as transportation. He said that Judge Gary replied that he had not thought of the automotive vehicle as transportation and was much surprised that it was to be so presented. However, the Judge consented to act on this committee and has become a firm convert to the automotive vehicle to industrial transportation. Clark said that as long as important men so regarded this industry that there was a great field for industrial advertising for the presentation of the automotive industry as a transportation industry and that the advertising men should always keep in mind that they can promote an industrial conscious legislation, better relation with the railroads and otherwise help the major interests of the industry. The speaker closed with the expression of a hope that in the near future a joint meeting of the advertising managers of the firms connected with the N.A.C.C. and M.A.M.A. could be arranged for the purpose of bringing about a community of interest.

At this point the three talks so far made were thrown open to discussion and practically every man present participated at one time or another. Jordan said that the relations of the advertising managers to the progress of business had been well set out and that he believed that if the advertising manager was not appreciated by any concern that it was his own fault; that the layout of an advertising campaign was the most serious happening of the day that could take place in a motor vehicle factory. That an advertising campaign should mean sales and obtaining of sales meant the success or failure of the company.

JUDGE GARY of the U. S. Steel Corporation was asked to serve as judge in an art contest the subject of which was "The Automotive Vehicle as Transportation."

* * *

Gary replied that he had not thought of the automobile as transportation and was much surprised that it was to be so presented. He consented to act on the committee, however, and is now a firm believer in the automotive vehicle as a transportation unit.

* * *

The incident shows the possibilities for industrial advertising on the part of automotive firms. "Automotive advertising men can promote proper industrial legislation, better relationships between the automotive industry and the railroads, and otherwise further the major interests of the industry which they represent." This is what Ezra W. Clark told the N. A. C. C. advertising managers. The accompanying story relates other interesting details of this meeting.

An advertising campaign should be planned definitely for a long period and should not at any time be subject to serious alteration of method and that the money should be insured when the campaign was undertaken. He said that the Jordan policy was entirely settled at the factory and that the assistance given to the dealers in advertising did not permit that the dealers were to have any influence at bringing about a change of policy. Instead of that the policy was sold to the dealer.

S. R. Swiss of the Republic Truck reviewed briefly the dealer situation and presented the view that there was entirely too much turnover among dealers and that it was up to the advertising and sales department to bring about a more stable situation and that this could be done only by selling these dealers on the factory policy of advertising and sales and that the dealer situation would not remedy itself until more were planning on establishing dealerships that their sons might come into the business 20 or 40 years hence. His view was that the factory policy should seek to build up a respect and a value for the dealer franchise so that the dealer would see that it was much to his personal advantage and also to his profit to work in line with the factory policy at all times.

Cliff Knoble of Liberty brought out some interesting statistics by asking a series of questions on the financial basis of dealer advertising. His question brought out that Packard was the only company reporting that charged for catalogs and all other sales literature. Packard had been doing this for two years and has had no complaints. Even during the last few months when the dealer interests had been broadened and they had recruited dealers who had formerly handled other cars. These dealers had not complained about this practice. No other manufacturer charges for catalogs although Cadillac charges for some literature. The question was brought out that practically all manufacturers were going fifty-fifty with the distributor on territorial advertising and that some of the more important dealers had the same privilege. Subdealers apparently are restricted to advertising helps to one per cent in retail sales or a certain amount with each car that they sell.

On a series of questions asked about how billing of dealer advertising was arranged it was learned that four companies have the local advertising billed one-half to the distributor and one-half to the factory. Four others have the advertising billed to an agency which in turn bills one-half to the dealer. Two companies reported that they were paying for the billing entirely and then charging the dealer one-half of it on his parts account.

J. E. Baird of the General Motors Truck asked why a factory should assist the dealer in local advertising. W. E. Blodgett of the Autocar said that his company believed that through this policy they could bring about a greater concentration of advertising in localities favorable to sales. Several speakers said they believed that this policy was merely a relic of the days when no automotive vehicle was produced in such quantities as to jutisfy really national advertising. Several expressed the opinion that this was not good practice and would eventually be discontinued. Baird announced that his company was practically ready to discontinue this practice.

Jordan was next on the program to discuss The Next Big Selling Punch. He told that recently in Omaha a banker had asked him how many of the manufacturing companies were going to survive. He offered to answer this question if the banker would answer a question for him. This question was how many dealers in Omaha were on the banker's preferred list. The banker's reply was that 6 out of 48 dealers in Omaha were on this list. There are 88 manufacturing firms connected with the N.A.C.C. Jordan said that the answer was so obvious then that he did not repeat the question. Jordan's view is that dealer co-operation is going to decide which of the manufacturers will survive.

The big selling punch of the future will come in the selling of service, according to the speaker. That the manufacturer will find it necessary to build up a dealer organization so that he can give to the owners everywhere, all of the time, and service of transportation that he bought with his car. He put it in this way: "The survival

of the manufacturer depends on the survival of the dealer, which in turn depends on the survival of the owner as an owner of that kind of car. The future of car sales must be replacement." Jordan said that the present buying wave would continue for some little time and then at the fall season would come the wave of used car buying which should carry well into the winter. He suggested to the advertising men that they try to put across this idea.

The open car is a luxury car in the sense that it can be used with comfort only for a part of the year. Even then it is necessary to dodge rains, if the owner would be thoroughly comfortable and realize on his investment. The closed car is an investment because it is an all year car and the owner can get full service from such.

Women and the Automobile Market

Elizabeth Hallam Bohn presented an elaborate analysis of the motor car market from the viewpoint of a woman. She said that while men had created the car and made it a wonderful transportation vehicle the woman's influence had socialized the car and brought it to the point of comfort that marked it to-day. She expressed considerable surprise that car manufacturers had not written more copy directed to women. She said she believed that booklets on motor manners, on proper fitments for a car and on general social use of a car would be greatly appreciated by women.

G. U. Radoye of Haynes led the discussion on the subject of Advertising Used Cars. Radoye presented chiefly the policy put into practice by the Triangle Motors Company of Chicago, last winter. This company rebuilt cars and advertised them as Trianglized cars and made considerable number of sales during that period. Radoye, also, presented a series of advertisements that Haynes Company had prepared for the use of their dealers in the building character for rebuilt cars. He was of the opinion, however, that classified advertising was the best class for sales.

In speaking on this subject Jordan said that he believed the time would come when a new car dealer would have a complete line of cars in his sales room and he would describe them in this way. He would present the current models of cars and say that this car is "now in production at our factory." Then he would come to a car that had been traded in, which had been painted and dolled up and he would say of this car "this car was in production in our factory in 1920." Concerning these cars he would say to the buyers we guarantee all of these cars to be adjusted and in proper condition for use and we guarantee all of them against any difficulty with parts, etc. The guarantee we make to you is the same on the 1920 car as on the current model.

News Items Must Have Importance

The discussion on What Automotive Happenings Are News, was led by Walter A. Bermingham of the *Chicago Evening Post*. Bermingham presented rather a history of how the automotive news department had developed because the automobile was a new thing just as the radio is a new thing to-day. He said that he believed the day for promiscuous printing of publicity items had passed and that the automotive manufacturer who would now obtain publicity must send out news of really important happenings, or of important informative character.

Jordan, who was formerly a newspaper man, told of his own experiences in visiting newspaper offices and how eager he had found the newspaper men to get real articles and to take advantage of any information he could give them about the industry and about the helpful information he could give them at show time to assist them in the write-up of the show. Jordan asked Jennings to comment on this subject and he said that in his days, as an automobile editor of a daily paper that his time was charged to the business department rather than to the editorial department and that to his personal knowledge the automotive display rates were made to include the amount of space given to publicity, that the automotive manufacturers had never gotten anything free.

The subject of motion pictures in automotive advertising was introduced by K. W. Vance of Paige. Vance told of the discoveries of his company that their was no organized means of distribution. They had paid National News Weekly for showing a few feet of film and had found that the local theater owner had cut out this part of the picture. Then they had tried to deal with the local picture dealers and had found that each one was an individual problem. Later, however, they have organized a system of sending with the film a check payable to the local theater owner when he signed the statement that this picture had been displayed. The dealer, also, served as a check on the question of display. Vance expressed the opinion that perhaps motion picture advertising was better than in the small town papers.

G. U. Radoye of Haynes, told of the experience of his company in seeking to display a rather elaborate film. He said that owing to the un-organized state of the motion picture industry at present he did not believe that a film for presentation to the public was a good investment to-day.

Use of Technical Films

Several speakers told of excellent results of technical films designed to be displayed to technical organizations and among their own dealers. The sentiment seemed to be that the profitable use of films to-day was for educational work.

Vance then had displayed the Paige film, "Four Links of Success." This shows a dealer who had lost all interest and ambition in his business because he believed that cars would not sell. An example of business energy on the part of a factory representative brought him out of the dumps and started him on the road to prosperity. He told of how it had been of much benefit to the Paige dealers in general.

The following factory representatives were present:

Anderson Motor Company, R. G. Wine, Chicago branch mgr.; Apperson Bros. Automobile Co., C. J. Dwyer, adv. rep.; Autocar Company, W. E. Blodgett, adv. mgr.; Cadillac Motor Car Co., Verne E. Burnett, adv. mgr.; J. I. Case T. M. Co., R. S. Walker, adv. mgr.; Clark Equipment Company, Ezra Clark, adv. mgr.; Daniels Motor Co., H. E. Spoffard, asst. sales mgr.; Dort Motor Car Co., H. S. Daniels, adv. mgr.; Elgin Motor Car Corporation, A. L. Chambers, adv. mgr.; Federal Motor Truck Company, L. B. Dudley, adv. mgr.; The Gardner Motor Co., Inc., W. H. Yeldell, sales and adv. mgr.; General Motors Truck Co., J. E. Baird, adv. mgr.; The Handley Knight Company, D. B. Williams, asst. commercial mgr.; Hupp Motor Corporation, F. Dickinson, adv. and sales mgr.; International Motor Company, H. C. Baily, advertising mgr.; R. B. Anderson, H. K. McCann Co.; GMC Advisory Staff, H. G. Weaver; Kleiber Motor Truck Company, N. B. Burkness, asst. to pres.; Liberty Motor Car Co., Cliff Knoble, adv. mgr.; Lexington Motor Company, Emery Husten, adv. mgr.; Mercer Motors Co., W. A. Smith, sales mgr.; Moon Motor Car Company, N. E. McDarby, adv. mgr.; Nordyke & Marmon Company, H. H. Brooks, sales mgr.; Olds Motor Works, E. J. Shassberger, adv. mgr.; Packard Motor Car Company, T. E. Cathecart, adv. mgr.; Paige-Detroit Motor Car Co., K. W. Vance, adv. mgr.; The Pierce-Arrow Motor Car Co., W. M. Baldwin, publicity dept.; Reo Motor Car Company, Clarence E. Eldridge, branch mgr.; Republic Motor Truck Co., Inc., S. R. Swiss, adv. mgr.; Service Motor Trucks, Rolfe C. Spinning, adv. mgr.; Studebaker Corp. of America, W. E. Betts, adv. mgr.; Ward Motor Vehicle Company, Edgar Parker, adv. mgr.; The White Company, W. H. Newton, adv. mgr.

Can Factory Rebuilding of Trucks Be Made a Success?

Practical application of this policy by the Autocar Company proves that it can. Trading-in of used trucks limited to own product. Used truck sales placed on sound business basis. Plan may not be applicable under other conditions.

By Philip H. Smith

MANUFACTURERS and dealers both are against the practice of factory reconditioning of motor vehicles and the policy of trading in old trucks. This fact was brought out in the answers to the questionnaire sent to members of the industry by the N. A. C. C. and N. A. D. A. a few months ago.

Factory reconditioning has not been customary practice, hence there have been no difficulties attached to it. Trading in old trucks has been a bugbear for the industry and still is, consequently any time that these two problems have been tackled with even partial success, it awakens interest as to how it was done.

The Autocar Company of Ardmore, Pa., has, for over twelve years, employed the policy of factory rebuilding and has limited trading to its own product. The two problems have thus been handled.

In permitting trading in of its own product a maximum allowance has been set by the factory and the policy of selling almost entirely through its own branches enables this plan to be carried out strictly. If a truck can be put in first-class condition by a slight overhauling, the work is done at the branches and the vehicle is sold as a reconditioned truck. But if it needs more than a slight overhaul it is sent back to the factory, where a separate plant is maintained which does nothing but rebuilding.

On reaching the factory the truck is immediately torn down and each part is carefully inspected. Those parts which by their very nature are non-wearing, and are in good condition, are placed in a used-part stock room to be drawn on later. Other parts which do not pass inspection are scrapped. In rebuilding, no attempt is made to treat the trucks individually; they lose their identity when torn down and the process of rebuilding draws from the used-part stock room and from new stock wherever necessary.

After repainting, a rebuilt truck carries a new truck guarantee. Any new features or change in construction which has appeared since the truck was produced are incorporated in rebuilding so that it is strictly up to date. This is, of course, possible for the Autocar Co. to do, as they are manufacturers of the parts of their own product.

The deciding factors as to whether a truck shall be rebuilt at the factory or reconditioned at the branch is the mechanical condition of the truck.

The factory charges the branches a flat rate for rebuilding. A branch must sell a rebuilt truck for every truck that it turns in to the factory; in other words, the branches must sell their trade-ins just as if they had never been rebuilt. Rebuilt trucks are sold for very nearly as much as the new product.

Of particular interest is the fact that the number of rebuilt or reconditioned trucks (they must be one or the other for no truck is allowed to be sold "As Is") on hand at any branch is taken into account when selling the branch new trucks. As this would indicate, new and used trucks are not separated in sales, but are considered as one department. At the factory they are segregated. Branches have two departments—sales and service.

There are several vital advantages accruing from factory rebuilding and the policy of only trading in their own product. Some of these are:

1. Avoiding a large used-truck inventory of unknown realizable value.
2. Better used-truck sales through a knowledge of the market for their own product.
3. Reputation of the product not endangered by other makes of used trucks.
4. Ability to turn used trucks into a profit.

Undoubtedly the policy of refusing to trade in trucks of other than their own manufacture has a decided effect in limiting the volume of business which can be secured. It is doubtful whether this policy could be maintained unless there were a large number of owners to sell to.

The greatest benefit bestowed is that used trucks are handled on a sound business basis and are not an unknown quantity. It also shows a recognition of the inter-relation of new and used-truck sales. Instead of this end of the business serving as a continual leak for profits, it is transformed into a source of revenue.

MANUFACTURERS can render material assistance to their selling organizations, whether branches or distributors, by a complete understanding and recognition of the inter-relationship between the new and used product in the field of marketing.

The market for trucks cannot be divided; conditions which affect the market for new trucks likewise affect that for used trucks. This demands that the sale of used trucks proceed steadily lest any hindrance to this flow retard the sale of the new product.

This article shows how one manufacturer has met the problem of the used truck. No division is made in the market and due emphasis is placed on the necessity for considering the used trucks on hand in connection with new truck sales.

Potential Car Sales in South Africa Estimated at 60,000

Market expanding rapidly. Farmers becoming interested in automotive equipment. One car for every fifty white persons. High dealer discount made necessary by local conditions. Margin between American domestic and South African price is great.

By Perry J. Stevenson*

AMERICAN manufacturers will find an increasing number of prospective buyers of motor vehicles in South Africa for some years to come. Fears were often expressed during 1920, especially when imports were running into large figures, that the market was dangerously near the saturation point and that future sales would only be for replacements. Investigation shows that there is a wide margin between the present number of cars in use and the potential market for the latter.

The Union of South Africa, comprising the Transvaal, Orange Free State, Cape Colony and Natal, imported 24,265 motor vehicles during the last five years, 1917-1921 inclusive. Making allowances for cars re-exported and those held in bond, it appears that the automobile trade has, in the past five years, sold on the average of 4536 passenger cars, 375 chassis and 135 trucks, or a grand total of 5046 motor vehicles per year. Taking these figures and the census of 1920, when there were 25,084 motor vehicles in the Union, it is estimated that there are now approximately 32,000 in operation.

ON the basis of white population, South Africa is the largest car market per capita in the world with exception of the United States, Canada and New Zealand.

South African farms offer a vast potential market for automotive equipment which will be realized when information regarding operating costs is known more generally.

Lower prices will expand the market hence American manufacturers should assist in reducing South African prices, which vary from 200 to 320 per cent above the American equivalent.

On the basis of white population, South Africa is the largest car market per capita in the world with the exception of the United States, Canada and New Zealand. One in every 50 white persons owns a car in South Africa, as compared to one in 68 in Australia, one in 96 in Great Britain, one in 152 in France, one in 230 in Belgium and one in 1050 in Dutch East Indies.

Local farmers are becoming more and more progressive and are adopting labor saving devices of all kinds. As the cost of labor rises and the supply becomes less abundant, the tendency toward the use of cars and trucks will steadily increase. The Union comprises 81,014 farms averaging 1130 morgen each (a morgen equals 2260 acres).

If the South African ratio of cars on farms could be brought up to only one-third that in the United States, where one-third of the cars are on farms, or 58⅓ cars to every 100 farms, there would be 16,290 passenger cars used by farmers alone, not to mention motor trucks.

In addition to the potential buyers on farms there are in the cities some 42,500 possible purchasers of motor vehicles with salaries ranging from £400 to £1,000 per year. A large percentage of the 17,000 motorcycle owners may graduate into the car owning class. In addition, it is estimated that the increase in population, amounting to 11.5 per cent in the period of 1911-1921, will add in the next few years another 3500 to the present number of motorists, especially so, as according to reports from the High Commissioner for South Africa in London, most of the present immigrants are well supplied with capital. The Asiatic population of 164,000 also includes a number of passenger car owners.

Replacements will be a large factor in estimating the possible sales of the next five years. Allowing the liberal period of eight years as the life of the average car, it is estimated that the replacements will soon number over 4000 per year. At present, while most of the cars are still new, replacements will perhaps only number 2000 to 2500 per year.

Motor Transportation Needed

The use of motor vehicles for city and farm transportation offers by far the greatest possibilities. Although the imports of motor trucks have fallen far behind those of passenger cars, due to the lack of intelligent figuring on costs and unsatisfactory roads, motor transportation will in time come to take a more important position.

Lack of adequate transport facilities at reasonable rates has probably been the chief cause for the slow economic development of the Union. It is reported that at present the South African Railways are giving considerable thought to the problem of using motor transportation as feeders to the main traffic in place of expensive branch lines. In the event that private initiative does not get there first, it is highly probable that the railroads will do so.

It has been suggested that the South African Motor Traders' Association should appoint a committee to study

*U. S. Trade Commissioner, Johannesburg. Printed through the co-operation of Automotive Division, Bureau of Foreign and Domestic Commerce.

the problem of how to increase motor haulage and should report its findings to the Association for the benefit of all its members. The scientific study of this problem and the gathering of accurate data on the comparative costs of oxen, rail and motor transport, would be a valuable contribution which the Association could make.

At the present time there is too great a margin between car prices in South Africa and those in effect in the United States. The South African price is, in some cases, over 200 per cent, and even as high as 320 per cent above the American equivalent. At the present rate of exchange, American cars might reasonably be sold in South Africa at 100 per cent above the sterling equivalent of the retail price in the United States.

A car that sells in the United States for about £200, at the present rate of exchange can be landed at Johannesburg for £300 after paying duty and railway charges. The dealer should sell for £400 to make a fair profit.

A profit of 33⅓ per cent may seem high to American manufacturers, but local conditions demand it to keep a dealer from becoming insolvent. The capital investment is higher, due to high building costs, overhead and a higher interest rate in an undeveloped country. The great distance from the source of supplies necessitates larger stocks, and repair work is all done on a credit basis according to British custom. An important factor is the small turnover where business is so highly competitive.

Stocks of cars on hand have been radically reduced, business is once again satisfactory, and prospects are that imports from the United States will be normal in 1922.

Research Develops Electrical Equipment to Meet Variable Operating Conditions

By A. M. DUDLEY*

IT is fundamental that any passenger car or truck, to render the maximum service, must be capable of meeting a wide range of operating conditions. In addition to the actual working schedule of hours' time, load carried and miles covered, questions of climate, temperature, topography, road conditions and personal equation of drivers introduce an almost limitless number of variables.

The electrical equipment used for cranking the engine, igniting the charge and for lighting and signalling purposes shares with the complete job the difficulties in meeting this wide range of conditions. A third brush generator set for an output which covers a wide average of applications may overcharge in Texas and undercharge in Minnesota under what seem to be identical conditions.

The study of these divergent results and the experimental work with new combinations and new principles forms the basis of extensive research work which is being continually carried on by leading manufacturers of electrical equipment for automobiles.

Some of these problems of general interest are:

1. In the attempt to produce a universally durable and noiseless timing gear for motor car engines:

   a. The general timing gear problem. This covers the manufacture in quantity of a quiet, durable operating gear to a fine degree of accuracy and also holding the crank case or gear supports to a degree of accuracy which will prevent the necessity for selecting and matching up sets or trains of gears for a particular engine. It includes also a consideration of the entire engine design with a view to eliminating hollow or sounding board construction of parts adjacent to timing gears which will magnify the natural noise or carry it to other parts of the chassis where it is more plainly noticed. These results to be secured at minimum cost.

   b. The mechanical requirements of such a gear involve: Machining accuracy required in gears themselves; variations caused by inaccuracies of machining in engine parts; wearing qualities of gear material; sound deadening qualities of gear material; study of vibrations set up by engine operation; study of natural period of vibration in the gear itself; machining qualities of gear material such as taking accurate finish, reasonable wear on cutting tool, absence of brittleness tending to chipping; coefficient of expansion under heat of the gear material, must compensate for expansion of gear center distances on the engine so that gears run quietly, both cold and hot.

2. In the study of third brush current regulation of generators and their action coupled with storage batteries:

   a. Effect of brush contact on commutator of main and third brushes as affecting current regulation.

   b. Various elements entering into the shape of the current—R. P. M. regulation curve and the effect upon batteries of various shapes of this curve.

   c. Effect of commutator expansion on brush contact and current regulation.

   d. Instantaneous shape of magnetic field at different outputs and speeds, as shown by oscillograms. The effect of this shape upon performance and noise, and how it may be changed.

   e. Relative desirability of various methods of eliminating magnetic noise.

   f. Analysis of separate sources of losses in generator and effect upon heating and performance of redistributing these losses.

   g. Effect upon heating and regulation of short circuited currents under the main and third brushes.

   h. Requirements of different passenger car and truck applications as affected by climate and other conditions outside the vehicle design.

3. In study of special applications of battery ignition:

   a. Effect on combustion of using more than one spark plug.

   b. Degree of synchronizing necessary with more than one spark studied by oscillograms and indicator cards at different speeds and loads.

   c. Effect of variation of battery potential on ignition performance.

   d. Effect of battery performance on ignition when using batteries of different capacities under same car conditions.

   e. What is a "fat" spark and how best produced.

   f. New uses for oscillograph and indicator in studying comparative ignition performances.

4. In the study of electro static condensers:

   a. Relative advantages of different forms of condensers, *e. g.* stacked, rolled, molded, etc.

   b. Material studies, paper, wax, mica, foils, etc.

   c. Process studies, such as impregnation, molding, winding, soldering, connecting.

   d. "Shape" studies—cylindrical, rectangular, "Kidney," etc.

   e. Dielectric studies—materials, creepage distances, distribution of strain, etc.

The solution of problems as indicated above involves not alone the elements directly concerned, but invention of new tools or new applications of old tools and methods.

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*Mgr., Auto. Eng'ing Dept., Westinghouse Electric & Mfg. Co.



Why Navy Recommends Completion of ZR-1

FROM a design point of view ZR-1 does not resemble ZR-2, and the basis of design of ZR-1 has practically no relation to ZR-2. The basis of design of ZR-1 is taken from information obtained from German rigid airships thoroughly tested and successfully flown.

The National Advisory Committee for Aeronautics has appointed a special committee of engineers to make a complete study of the plans and specifications for the ZR-1. This action has been taken upon the request of the Chief of Bureau of Aeronautics and was done with the idea of getting a final check from the best engineering talent available in this country. This action was also taken as an answer to the criticism in the British press when the ZR-2 disaster was being discussed.

So far as the design and construction of the ZR-1 are concerned, the best information available has been obtained and due consideration has been given to the experience in Germany, Great Britain, France and Italy.

The British have temporarily ceased lighter-than-air construction, but negotiations are still under way to turn over all their equipment to a very powerful financial combination made up of Vickers & Co., Ltd., and the Shell Oil Company. If these negotiations go through, or if the major part of these negotiations are consummated, there is no doubt but that the lighter-than-air game in Great Britain will not only not be abandoned but will be developed as rapidly as practicable.

The statement of paragraph 4 with regard to German opinion is certainly based on misinformation. Commercial enterprises now being promoted for two overseas passenger services are based exclusively on rigid airships of greater sizes than were ever attempted during the war. This is on the ground that commercially only the very large ships are economical as carriers. As a matter of fact, the Germans possess at the present time designs of airships very much larger than the ZR-1. ZR-1 has a capacity of 2,000,000 cubic feet, while the Zeppelins L-70, 71, 72, L-57 and L-59 had a capacity of 2,420,000 and ZR-2 had a capacity of 2,750,000 cubic feet. It is definitely known that designs of airships of 4,000,000 cubic feet exist in Great Britain and in Germany. It is also pretty definitely known that designs of airships up to 10,000,000 cubic feet are in existence.

So far as the operations of lighter-than-air craft are concerned, it is believed that this matter will be satisfactorily solved by the time the ZR-1 is completed. Certain experience has already been gained by handling smaller ships. Some of our personnel have already received instructions in operating large rigids, and additional instructions will have been received by our personnel by the time that ZR-1 is finished. Arrangements are being made for the instruction of the American crew by some of the most experienced and expert rigid airship people in Europe.

The bureau thoroughly appreciates the fact that it is essential to insure safety of operation in handling rigid airships, but it is strongly of the opinion that the construction of ZR-1 should be proceeded with in order that proper development of the lighter-than-air art may go hand in hand with the development of the heavier-than-air art. It is the earnest desire of the bureau to take advantage of experience gained by other nations and by the United States, and each step in the development, design and construction of ZR-1 has been given careful and mature consideration in order that errors made heretofore may be avoided in the case of ZR-1.

Pioneering in any art or science involves the expenditure of brains and energy and a certain amount of risk, but the bureau is firmly of the opinion that the construction of ZR-1 should be continued and expedited in every practicable way. The fleet requires a long range scout and the rigid airship is the only answer.

The Bureau of Aeronautics, Navy Department, has requested that we publish the accompanying comments concerning our editorial in the issue of May 11, 1922, entitled "Can Airship Builders Walk Before They Creep?" We, of course, desire to give both sides of the argument and are therefore pleased to record the point of view taken by the Navy on this important subject.—Editor.

Grease vs. Oil as a Lubricant

Editor, AUTOMOTIVE INDUSTRIES:

With your permission I would like to discuss in a brief way Mr. J. Henly Frier, Jr.'s Forum letter on the relative merits of grease and oil as a chassis lubricant. This letter appeared in AUTOMOTIVE INDUSTRIES for Feb. 23, 1922.

The problem of chassis lubrication is a tremendously complicated one, involving all sorts of considerations of design, maintenance, manufacturing expense, owner's preference, and a hundred and one other things not apparent to the casual observer.

Chassis lubrication as now practiced is far from being perfectly satisfactory, regardless of whether either grease or oil is used as the lubricant. The average chassis as it is now built demands both oil and grease, if it is to approach a condition of proper lubrication. In other words, there are places on the chassis where oil is the proper lubricant, and others where grease is the proper lubricant.

If this is true, how idle it is to make the broad statement that grease is the best chassis lubricant, as is done in paragraph six of the article in question.

It is necessary to get down to details and consider each bearing or group of bearings by itself before any conclusion can be reached as to the proper lubricant, and then

a decision can only be reached on the particular bearing or group of bearings considered, and not on all the bearings in the chassis.

A good part of the discussion I have seen centers around the steering spindles, tie rod bolts and shackle bolts, probably because they are the worst bearings to lubricate properly. For the purposes of this article I will confine myself to consideration of this group of bearings.

This group of bearings has one peculiarity which has apparently completely escaped the attention of Mr. Frier, i. e. none of the bolts or pins ever make a complete revolution in their bearing.

I submit that it is a practical impossibility to completely coat the inside of a bearing of this character with any semi-solid lubricant introduced through a hole in the side of the bolt, unless at some time the bolt or pin makes a complete revolution in its bearing, remembering that the ends of the bearing are open for the escape of the lubricant.

The fact that the lubricant may be introduced at the point of load, as in the case of a shackle bolt, does not necessarily mean that all of the wearing surface is covered. The actual surface covered is likely to be merely a spot directly over the oil hole in the side of the bolt, or if the pressure in the gun is high enough, the surface covered is a streak reaching to the nearest point of relief. There is no reason to expect the grease to seek out all the wearing surface; in fact, it is quite apparent that nothing of the kind will happen.

The comparatively slight oscillation of the bolt in its bearing will, of course, help in some degree to distribute the grease. That anything but a complete job is done is amply testified to by the collection of worn grease bolts that can be found in any repair shop.

Suppose we admit, for the sake of argument, that each time a shackle bolt is lubricated by grease under pressure, that the wearing surface *is* completely covered, it certainly does not follow that the opposite or unloaded side of the bolt is completely covered. It must be remembered that the bearing is open at both ends to permit free escape of lubricant, and that the bolt oscillates through only a few degrees. These conditions operate to make the chances of complete distribution of lubricant on the slack or unloaded side of the bolt very remote.

If the unloaded side of the bolt is not covered, or only partially covered with lubricant, it is free to rust and collect road grit which eventually works up to the bearing surface and acts as an abrasive.

TURNING to the steering spindles, it is interesting to note that a good many manufacturers use some kind of an oil cup in this place, even though they may use grease on their shackle bolts. If grease is a perfect lubricant, why do they go to the trouble and expense of providing for the use of two kinds of lubricant on their chassis? I believe they have found out by experience that it is a practical impossibility to properly lubricate the long steering spindle bolt with grease, especially in cold weather. The stiff steering of a car with dry spindle bolts is very disagreeable, if not positively dangerous, and a way had to be found to keep the spindles lubricated.

Mr. Frier quotes from Mr. John Rome Battle's book on Industrial Oil Engineering. I find nothing to indicate that Mr. Battle is a recognized authority on lubrication in general, or on chassis lubrication in particular. I believe his book antedates the active period of chassis lubrication by several years. In fact, the very title of the book would indicate that Mr. Battle did not have chassis lubrication in mind when he wrote it.

I cannot see how this quotation has any particular bearing on the subject of modern chassis lubrication.

Whether Mr. Battle's seemingly rather extraordinary reasoning on the subject of grease lubrication agrees with that of the best modern authorities on the subject or not, I think it is almost certain that Mr. Battle had no idea of extending his theory to the oscillating bearings of an automobile chassis. It seems more likely he had in mind the heavy, slow, revolving journals of certain industrial machinery. If Mr. Battle had contended with the problem of forcing grease into one side of the bearing he had in mind, knowing that the shaft would never make a complete revolution, I am of the opinion that his choice of a lubricant would have been different. He would, I imagine, have been forced to use oil, probably not an excessively heavy oil either.

IF the exact service expected of a lubricant is left out, and all that went before or after is to be omitted, it would seem easy to select quotations from a number of authors to bear out nearly any statement one chose to make.

In the absence of the specific service which is expected from the lubricant, only the broadest treatment of the subject can be helpful, and any quotations should be chosen accordingly.

Mr. Charles E. Carpenter, president of the E. F. Houghton Co. and an authority recognized by all lubrication engineers, says: "That lubricant is the most economical which possesses the greatest fluidity consistent with the use to which it is to be put." This quotation means something; it applies to all lubricating problems, chassis lubrication among the rest. He also says: "The great difficulty with grease is when the bearing is subjected to shock, the grease does not cushion like an oil; the oil will resist, slide away gradually and then dart back to the point from which it has been squeezed."

This exactly describes the conditions present in the automobile shackle and shows why an oil must render better service in bearings of this character than grease can.

Mr. Frier mentions the dirty appearance of a chassis lubricated with oil. I think he meant over-lubricated, as it is entirely possible to so lubricate a chassis with oil that no objectionable amount of oil will appear outside the bearing, even with the common designs of shackles, in most cases not particularly designed for retaining oil.

It is, of course, a matter of personal choice as to whether one prefers to see a certain amount of oil outside the shackle and be sure of good lubrication of the bearing, or to see a certain amount of grease outside the shackle and not be sure of even partial lubrication of the bearing.

Mr. Frier speaks of the impossibility of dirt entering the bearing, if the grease is introduced through a fitting having a ball valve closure. I submit that it is extremely probable that dirt enters every time a bearing is lubricated by grease under pressure through such a fitting.

It is a practical commercial impossibility to construct a fitting of this description without its having a shallow groove around the ball where it projects through the end of the fitting. This groove remains full of road dirt, no matter how much wiping off is done, and must pass into the bearing with the grease. As far as the cap sometimes supplied with such fittings is concerned, no unattached cap stays around the chassis long enough to help much.

Mr. Frier also speaks of the pleasing appearance of these fittings. This is, of course, another matter of taste. I consider that they look well enough, if you can see them; they are so small and are generally so covered with mud or dust as not to be very conspicuous. Whatever one's taste may be on this point has no bearing on the choice of a chassis lubricant.

C. A. BACON,
Chief Engineer, Bowen Products Corp.

Employers Must Originate Improvements in Labor Situation

Unions too young to extend platform beyond immediate demands.
British co-operative societies and their possible counterpart here.
The character, habits and interests of labor must be studied.

By Harry Tipper

SOMETIME ago, in AUTOMOTIVE INDUSTRIES, reference was made to the work which has been done in Great Britain in the experiment of guild operations which, in effect, amount to copartnership among various organizations of workmen for the direct operation of business with their own capital and for themselves. These experiments are being continued and extended in Great Britain. Of course, the ground was prepared by the operations of the co-operative societies which were started as trading societies only, but which developed into manufacturing, shipping, warehousing, and other activities.

Co-operative societies, before the war, were doing a business of approximately $600,000,000 a year, and they had been built up entirely by the workers with their own capital and their own management. The operations of these co-operative societies did not differ very materially from the operations of the ordinary business except that a portion of the profits has turned over to the workers as a dividend on wages, the rest of the profits being divided between a dividend on purchases and a dividend upon the capital invested.

Another difference between these and other business institutions lies in the fact that the stock in these co-operative societies is owned by the customers and there is an active interest from the customer's standpoint in all the considerations of the co-operative society work. In other respects they are very much like the ordinary business. The volume of trade handled in proportion to the number of people employed is not startling and does not reflect any great increase in the efficiency of the work. The percentage of profit is not low—in fact, it averages probably somewhat higher than the percentage of other business concerns in the same field. Neither does the share reserved for the dividend on wages stand out as notably larger than the share offered in some of the profit sharing schemes adopted by other business concerns.

Probably the most advanced of all these producing associations of workers is the building guild in respect to which we published some few particulars some time ago. The London *Times* states that the capital invested in these producing associations is something over a million pounds and is turned over about three or four times a year with a net profit of 25 per cent. The growth of these organizations as they have flourished in Great Britain has not made any change in the general method of doing business. Their operations are similar to those of any other industrial concern. Their methods of payment are similar, and their reserve of profit is not less. The important feature lies in the ability shown by a homogeneous people, through the machinery of their associations, to engage in business co-operatively, to continue over a period of years, and to progress at least in as large a proportion as other concerns.

Co-operative societies have been started from time to time in this country. They have not attempted anything more than a trading control and they have not been either large or very successful.

The above illustrates very definitely the difference between the position and the interest of the workers in Great Britain and those in a similar position in this country. The workers in Great Britain have been accustomed to working in the same place and living in the same place for several generations. By position and long development of association, their machinery of organization is very complete and the individual takes a keen interest in all matters developed through the association. This long experience in association work has also placed the emphasis upon the practical side of association development.

Some business men and publicists in Great Britain are inclined to see in these co-operative associations a way out of the continual stoppages, disagreements and difficulties concerning the ordinary business institution in that country. The complexities of the labor union divisions and the difficulties of maintaining a reasonable peace with all the different unions at any one time lead in that country to a very serious discussion of the possibilities of co-operative producing associations similar to the guilds already formed.

These discussions have laid a great deal of emphasis upon the absence of strikes in the co-operative associations

UNION power in the United States is not strong enough to demand the consideration that the labor party receives in Great Britain. Any necessary changes in the character of industrial organization for the purpose of limiting or eliminating the difficulties and interruptions must come out of the manufacturer's larger consideration of the matter and his willingness to experiment for the purpose of improvement.

The machinery of the union organization is sufficiently weak and the number of unorganized workers sufficiently large to enable the manufacturer to bring into play the ideas of an organized industrial community, organized for the purpose of, and around the object of, the common production of those people who are engaged in that particular concern.

of business, the steadiness of the employment and the relief from the other hindrances continually disturbing the productive work of the ordinary business institutions.

In this country we have no homogeneous population of workers. The working population is composed of many races with different conditions and associations and with different habits of approach to any question. There is no common political viewpoint, and the average worker does not take much interest in the collective actions of the associations of which he may be a member. Any co-operative associations for production which might start in this country would be unlikely to have any success in the immediate future because of these differences in the conditions. However, the success of the guilds on the other side is likely to have some effect upon the thinking of the labor leaders in this country and the development of their active platforms. Something of this sort is indicated by the continuance of the propaganda by railroad unions in regard to the operation of railroads, and the more recent statements of the leaders of the mine workers in regard to the operations of the coal mines.

Aside from this reflex upon the platforms and ideas of the labor leaders in this country, the co-operative movements in Great Britain carry no especial significance in themselves. They are interesting from the indications they give as to the ideas of the workers when they are engaged in business for themselves as collective organizations. It is evident from an examination of their operations that workers in Great Britain are interested. . . .

1. In continuance of employment
2. In the maintenance of the union methods, and
3. In a voice in the affairs of the producing unit.

These demands are not excessive and they have been admitted by the organization of individual concerns in Great Britain and in the United States. In the United States, the different conditions make it necessary for the manufacturer to introduce many changes in the business organization, and it is not likely that the unions will be sufficiently powerful or the interest of the individual workers sufficiently keen to extend the platform of the union leaders much beyond the actual requirements in hand. It is obvious that union power is not yet sufficient in the United States to demand the consideration the labor party receives in Great Britain, and the present tendency makes it quite as obvious that any necessary changes in the character of industrial organization for the purpose of limiting or eliminating the difficulties and interruptions must come out of the manufacturer's larger consideration of the matter and his willingness to experiment for the purpose of improvement.

THE interest occasioned by the building trade guilds and other newly formed producing associations in Great Britain is largely due to the fact that trade union machinery has been sufficiently complete for so long that neither the manufacturer nor the laborer can consider the industrial organization without the presence of these elements.

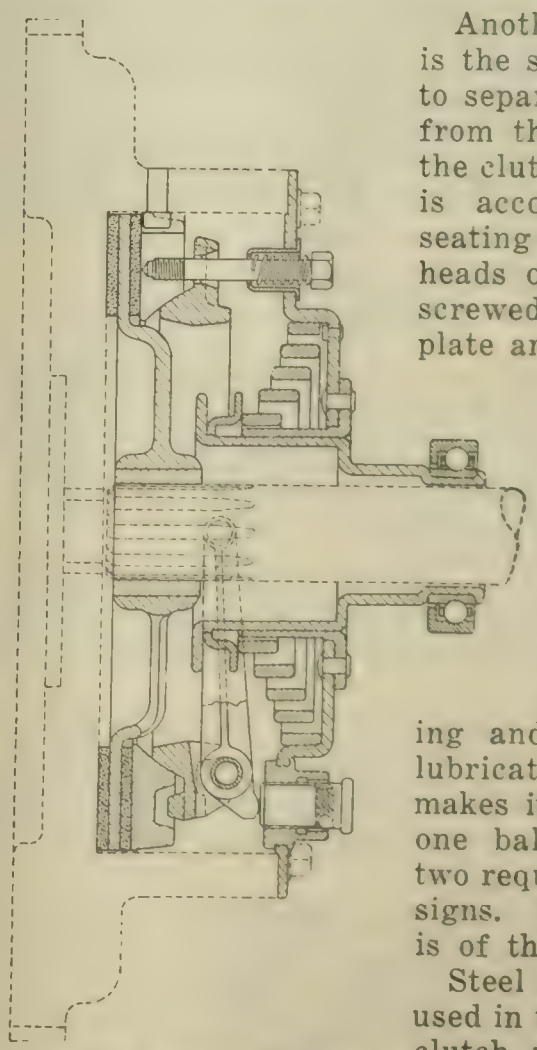
In the United States, on the other hand, the machinery of the union organization is sufficiently weak and the number of unorganized workers sufficiently large to enable the manufacturer to bring into play the ideas of an organized industrial community, organized for the purposes of, and around the object of, the common production of those people who are engaged in that particular concern.

A New Self-Aligning Single-Plate Clutch

A NEW single-plate clutch designed primarily with a view to securing a uniform pressure over the faces of the driven member is being placed on the market by Baker Brothers.

The design is attributed to Charles B. Rose, who states that, in his experience with some other single-plate clutches, he has found a lack of uniform pressure resulting in slipping and consequent rapid wear, and that this fault develops frequently due to a lack of sufficient accuracy in the machining of the parts which bear against the friction members or to uneven adjustment of the parts through which the thrust of the engaging springs is transmitted to the friction disks. Perfect alignment of driving and driven members is rendered more difficult due to the fact that the flywheel face, which is usually one of the bearing surfaces, and the face of other members, which should be precisely parallel to it, are frequently made by different manufacturers, so that proper alignment is not always secured.

In the new clutch, as shown in the accompanying cut, the pressure plate has a part-spherical surface against which bears a second member with a similar or mating surface, forming, in effect, a ball and socket joint, the purpose of which is to take care of any lack of alignment and thus give a uniform bearing on the friction surfaces. The male member of the ball joint carries multiplying levers through which the pressure of the single volute spring is transmitted. The outer end of these drop-forged levers bear against self-locking adjusting screws which, because of the ball joint, are said not to require close adjustment.



Sectional view of Baker single-plate clutch

Another feature of interest is the special means provided to separate the pressure plate from the friction disks when the clutch is disengaged. This is accomplished by springs seating in the cups under the heads of the bolts which are screwed into the pressure plate and project through the cover plate.

It is worthy of note that the disengaging sleeve has no bearing whatever upon the clutch shaft, with which it does not come in contact. This construction avoids the bushing and consequent need for lubrication at this point and makes it necessary to use but one ball bearing as against two required in some other designs. The throw-out bearing is of the radial thrust type.

Steel stampings are largely used in the construction of the clutch, which is carefully balanced and assembled.

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A Railroad Official Speaks

THE attitude of railway officials toward co-operation with highway transport is widely divergent, ranging all the way from direct opposition to active support. No attitude seems particularly characteristic of any part of the country.

Truck manufacturers will be interested in the statements of one railroad official who may be considered as one of those who favor co-operation. He believes that:

"The justifiable business for the motor truck is limited to a distance of fifty miles from a terminus. Longer runs in competition with the railroads are not profitable if costs are accurately figured and allowance made for depreciation.

The attitude of truck manufacturers and operators is one of taking away business from the railroad rather than co-operating with the latter to secure the business which is rightfully theirs.

Motor trucks cannot make long hauls of valuable merchandise at a lower cost than the railroads if they carry the requisite insurance.

In large cities much of the trucking is done by former teamsters who do not understand the necessity for depreciation allowance."

This official thinks that truck manufacturers should foster a spirit of sound business in making sales and should disseminate the principles of sound operating cost keeping.

In his opinion, economic laws will eventually work around to bring a more profitable arrangement between railroads and highway transport, but meanwhile manufacturers can do much to mitigate some of the existing evils.

S. A. E. Meeting Program

IN making up the program for the semi-annual meetings of the S. A. E., the Meetings Committee seems to have two objects in view, namely (1), to present something of special interest to all of the different branches of the industry, and (2) to cover particularly any recent trends and developments. Ever since the war, aircraft has occupied a prominent place in the deliberations of the society, and the program of the present meeting is no exception, containing as it does three papers on aeronautic subjects. In spite of the handicaps under which the aircraft industry is laboring, there is still much research work going on and much constructive thinking being done in this field, much of it in the Engineering Division of the Air Service. Some of the best research talent of the country is connected with aircraft development, and there are so many aspects to the problem of aerial transportation that material on this general subject seems never to be lacking.

There is a passenger car session and a commercial vehicle (motorbus) session, so that engineers in both of the great branches of motor vehicle engineering stand a good chance of learning something of practical value to them.

The two sessions which mark relatively new developments in the industry are the Motorbus Session and the Research Session. Two years ago the society began to pay attention to the motorbus at its general meetings, but some of the earlier papers dealt rather with the commercial and organization phases of the motorbus industry than with its technical aspects. Recently there has been a great extension of the use of motorbuses, especially in country and suburban districts, and many firms in the truck branch of the industry have begun to interest themselves in it, hence it is quite timely that the engineering requirements in motorbuses should have some light thrown upon them at an S. A. E. meeting.

Since the society has actively undertaken to promote research work and has made a sizable appropriation for the purpose, the membership naturally wants to know what has been accomplished so far and what are the plans for the future. A report of this phase of the society's activities is being made by Dr. Dickinson, who is in charge of this work. There are also being presented at this session two papers by members of the staff of the Bureau of Standards, and the titles of these papers as well as the outline

of Dr. Dickinson's report emphasize the fact that a very large proportion of the automotive research now under way has to do with the properties of engine fuels and methods of their use.

For the final session, devoted to fuels and engines, some of the best papers of the meeting are scheduled. The subjects of these papers, moreover, are of the most general interest of any presented at the meeting.

On the whole the program is one of diversified interests, and that high expectations are attached to it by the membership is shown by the number to which the registrations had attained just before the opening of the meeting, which, considering conditions in the industry during the past year and the distance to the meeting place from most of the large centers of the industry, is larger than might have been expected.

Experience in Bus Design and Operation

THOSE who are engaged in or contemplate entering the field of bus manufacture will do well to heed the sound advice given in the paper by G. A. Green, of the Fifth Avenue Coach Co., which appears on another page of this issue. Some engineers will not agree in all of the conclusions arrived at, but concerning fundamentals there will be little disagreement. Aside from the London General Omnibus Co., in whose service Green secured his early experience, and the company with which he is now connected, there are but few concerns of prominence which build as well as operate their own buses. The consequent close co-operation between user and producer has therefore seldom been attained elsewhere, and it is partly for this reason that the article in question is worthy of such close study.

A wholly suitable bus chassis must be designed for the purpose of carrying passengers safely and comfortably. The problem is not satisfactorily solved by simply applying a body with seats to existing chassis designed primarily for use as trucks, and those who follow this practice inevitably do so at the risk of securing dissatisfied customers. No sound business can be built upon such a basis.

Aside from the matter of safety, which should be the prime consideration in the design of any vehicle, that of dependability, or freedom from trouble and unnecessary delays for adjustments and repairs, is perhaps of greatest importance; but this characteristic is of small consequence if the vehicle remains so uncomfortable to ride in that possible patrons avoid rather than seek its use. In this connection, the comfort of the driver must not be forgotten, for aside from any humane reasons pertaining to the driver himself, the safety of the passengers is involved. A fatigued driver, as Green points out, is much more likely to make mistakes which result in accidents than one whose energies are conserved by providing a comfortable seat, easily operated controls and a responsive vehicle.

Ability to accelerate and decelerate smoothly as well as quickly are qualities which now depend too much in many cases upon the skill of the operator. There is room for considerable improvement in brake design, while the characteristics of even the best of conventional internal combustion engines are far from ideal. The steam engine, because of its high torque and smooth, steady pulling characteristics, and the fact that its use makes it possible to eliminate the conventional clutch and gearset, has still great promise for application in bus as well as in other vehicular work, especially where frequent starts and stops are involved. Highly successful steam buses have been operated for many years in London and their possible development here in the near future should not be overlooked.

Incomes and Automobiles

THE recent publication of 1921 income tax returns in the daily press may bring out another crop of "saturation point" discussions in connection with automobiles and trucks. 'Twas ever thus.

We hasten to reiterate our thoughts on the subject, in the hope that priority of expressions may bring added emphasis.

The total number of automobiles operated in the United States is related to the income tax returns only in a very indirect way. Automobiles and trucks are primarily a form of transportation. They will continue to be sold in increasing quantities until the transportation needs of the American people have been entirely met. Only when this point has been reached, will the car market become entirely a replacement market.

A good proportion of the passenger cars operated in this country to-day are used solely for business or utility purposes. They are not dependent upon the income tax returns of any individual. They are, in fact, responsible for producing income. Take them away and the income tax returns would fall.

In the class are all taxicabs, jitneys, omnibuses and other passenger cars for hire. Cars operated by salesmen, by industrial plants for the efficient transportation of executives, doctors' cars and others are used entirely for utility purposes, and consequently become a factor in providing income rather than in expending income.

Nearly every one of the 10,000,000 cars in the United States is used partly for business or utility purposes. Every car, therefore, is to some extent a provider of income—or a reducer of expense in time or money—which is much the same thing.

These facts appear clearly to the careful student of automobile production and operation. They show clearly the utter fallacy of discussing a mythical saturation point on the basis of income tax returns.

Automobile sales and operation depend upon many factors, each of which exerts a certain proportionate influence. No accurate estimate can be made of future automotive development by reasoning simply about one of these factors. All of them must be considered and correlated. Income tax returns probably do not affect automobile sales any more than automobile sales affect income tax returns. Saturation point discussions on this basis, therefore, are something like arguing in a circle.

Truck and Tractor Business Mounting

Passenger Car Plants Continue at Full Speed—Output May Exceed 200,000

By JAMES DALTON

NEW YORK, June 20—All passenger car plants still are operating at full speed and truck factories are steadily increasing their output. Many companies, especially those which might be placed in the middle class in volume of production, claim to have on hand sufficient orders to keep them going at the present pace from one to three months. Makers of several of the more popular lines are far behind on deliveries.

Reports from the South and from the centers of the great agricultural districts, are all to the effect that much automotive equipment will be purchased by planters and farmers as soon as the harvests are well under way. The South promises to be a particularly good market in the fall. Sales of tractors and other agricultural machinery also are steadily mounting. The leading interest in the low priced tractor field is unable to keep pace with orders.

The Northwest may be taken as typical of these sections. Sales of motor vehicles in May broke all records, but with the beginning of June there was something of a recession in demand. This is expected to continue until the harvests. There is every reason to believe that it then will revert to the level of May.

Output Not Likely to Equal May

Indications are that June will be another month in which production will pass the 200,000 mark but the total promises to be slightly less than in May when it was 252,000. It is improbable that volume of output can be continued.

Production still is handicapped somewhat by a shortage of the raw materials from which parts are made. This is the result of caution in ordering on the part of manufacturers who are reluctant to accumulate inventories in excess of the orders actually on their books. The industry as a whole still is proceeding cautiously.

Several more mergers, both of truck and passenger car makers, are in the air and formal announcement of some of them probably will be made in the near future. None of the more prominent companies is included in the merger reports.

Business in Brief

NEW YORK, June 19—No backward steps have been taken either by trade or industry, although the approach of midsummer usually brings some lessening of activities in certain primary lines.

Trade reports—retail, mail order and crops—are cheerful, especially in the North, West and East.

Building apparently is as active as ever, with scarcity of unskilled help and high wages for skilled mechanics.

The strength of manufactured textiles in primary lines has become more marked, with cotton goods showing most aggressiveness, but with another increase in worsted prices announced by the mills.

Shoe manufacturing is gaining in eastern centers with wage settlements being made, and leather is in better demand.

A notable feature in the iron and steel industry is a reduction of 50 cents a ton in iron ore prices, which are now at about the 1917 level. Steel mill deliveries are still falling behind, although plants are operating from 75 per cent to 80 per cent of full capacity.

Railroad traffic continues to gain in the West in spite of the coal strike.

Movement of wheat in the Southwest continues surprisingly large, and it is evident farmers had more than was generally supposed.

Stocks are active but weak, bonds irregular, money easier and foreign exchanges heavy.

Bank clearings for the week ending June 15 were $6,919,710,000, a loss of 5.2 per cent from the previous week, but a gain of 4.3 per cent over the same week last year.

The only menacing clouds on the horizon are those caused by labor difficulties. The coal strike has continued so long that it threatens next winter's supply, and a rail strike in protest against wage reductions appears to be a real menace. The two together would have a disastrous effect.

Numerous producers already are making plans for the introduction of new models in the early fall, but few of them propose radical departures. Most of the changes will be in the nature of refinements. Chief attention in this respect is being given to closed models. Demand for closed cars is expected to be stronger this fall than it ever has been before because of the sharp price reductions which have brought them more nearly into line with the cost to the consumer of phætons and roadsters.

Analyze Territories for Balance of Year

Distributors and Dealers Estimating Sales Possibilities at Request of Companies

NEW YORK, June 19—Most companies in the motor car field will follow a conservative policy for the remainder of the year. Several of them already have asked their distributors and dealers to make careful estimates of the sales possibilities in their territories for the last half, and tentative schedules will be based largely on these predictions.

The larger dealers have been requested to make careful analyses of the present and prospective general conditions in their territories with full allowance for the effect they probably will have on the sale of motor vehicles. They have been asked, however, to take into account the fact that the sales to farmers probably will be larger than they have been in the past two years, and that the general improvement in industrial and trade conditions has resulted in a sharp increase of purchasing power generally. Another factor which will be considered will be the probable market for closed cars the coming fall.

The last six months of the year never have been as good as the first six for the sale of automobiles, and it is the general expectation that the same situation will prevail in 1922. Most manufacturers expect a seasonal decline in sales in the cities beginning in July, but they believe this falling off will be balanced in part by the strong farm market.

Shipments Exceed May

When the production figures for May were announced, it was felt that there was little probability of June making so good a showing, but, contrary to expectations, shipments for the first week of June were larger than for the first week of May.

Almost without exception manufacturers will continue to buy supplies cautiously, and there is no disposition to make definite commitments for more than 60 days in advance of current needs, and the greater part of the business will be placed on a 30 day basis or even less.

Credit conditions generally are highly satisfactory, and most manufacturers are discounting their bills to parts makers.

STEVENS ASSETS SCALED DOWN

SPRINGFIELD, MASS., June 20—The investigation of Harry G. Fisk and Frank H. Shaw, receivers for Stevens-Duryea, Inc., is said to be nearing completion. Assets of the concern, which were estimated at more than $4,000,000 are said to have been scaled down somewhat, while the liabilities, given as exceeding $1,000,000, are said to have shown up as somewhat larger. Early developments in the proceedings are expected.

Court Confirms Sale of Elizabeth Plant

No Opposition to Purchase — Durant Takes Steps Preparatory to Occupying It

NEW YORK, June 20—Sale of the Elizabeth, N. J., plant of the Willys Corp. to Durant Motors, Inc., for $5,525,000 was confirmed by Judge Bodine in Federal Court at Trenton yesterday. There was no opposition.

Durant and his engineers made a thorough inspection of the factory to-day as a preliminary to the installation of the necessary machinery for assembling the new Star. When the plant is in full operation it will be possible to produce the Star at the rate of 550 a day, thereby bringing the total productive capacity of the Durant divisional plants up to 332,500 a year.

To Organize Subsidiary

Steps will be taken at once to incorporate the Durant Motor Co. of New Jersey, but the capitalization has not been determined. This subsidiary will operate the Elizabeth plant under the direction of F. W. Hohensee, chief engineer for the Durant plants at Long Island City, Lansing and Toronto. Production of the Star will begin at the earliest possible date and it is expected quantity production will be started within sixty days. Production of the Durant four will be continued at Long Island City.

A continuous flow of parts to the Star factory now is assured, but the supply will not be as large as could be desired for some time to come. Several freight carloads of materials now are on the factory sidings ready to be unloaded. The Continental Motors Corp. has given assurance that it will be able to deliver 6500 motors in June and from 7500 to 8500 in July. The output obviously will be governed by the supply by engines.

Skeleton Organization Exists

A skeleton organization to operate the plant was formed at Long Island City some time ago, and no skilled workers will be taken on at Elizabeth under any circumstances before next spring. Probably a year will elapse before any unskilled men will be required. The Durant organization now is such that it will not be necessary to engage any additional executives. This announcement is made by Durant Motors because of the large number of applications received.

Distribution plans for the Star have not been completed, but Durant has summoned to this city about twenty dealers who will be offered district managerships. The organization for the first year probably will not exceed twenty distributors who will be given large territories. They will appoint their own dealers. It is expected that under the Durant contract distribtors will be supplied with the Star car at cost, and that there will be division of net profits at the end of the year with an established minimum for each car.

Another provision of the contract, it is reported, will be that each distributor must organize a stock company with a substantial paid in capital, part of which will be turned into the treasury of Star Motors, Inc., the selling company.

Evidence of the interest manifested by the public in the Star is found in the fact that 59,303 persons inspected the various models in the three days they were on display in the showrooms of the Poertner Motor Car Co., Durant dealers, in this city last week.

Production of the Durant six at the Muncie, Ind., factory is steadily increasing. On May 31, the Durant Motor Car Co. of Indiana had turned out 1982 sixes, of which 1960 had been sold.

Efficiency and Economy of Operation, Chief Factor In Car Building

By F. L. KLINGENSMITH

President of the Gray Motor Corp.

DETROIT, June 19.

PRESENT automobile registration figures in the United States establish a market for at least two million cars a year. This is based on an average life of five to six years a car, and does not take into consideration normal increases occasioned by growth of population or other causes.

There will be fluctuations in this demand of say ten per cent a year at times, induced by poor business conditions and unexpected developments, but the depressions of one year will be made up in the next. We are witnessing now the catching up of the automobile with its normal market after two years' depression.

As registered now there are from five to six million cars in the lowest price field. This means that there will be an average yearly business of one million cars in this field, providing there is only normal deviation from one price field to another. Aside from this assured market, the low priced field undoubtedly will continue to be most favored by the ingress of new buyers.

For three years now the farmer has not bought a thing as compared to the buying formerly existing in this market. The latter part of this year and next he is going to buy the things he has been compelled to do without. Automobiles, trucks and power machinery are prime requisites to the farmer today and it is almost certain that the buying from this source, combined with normal buying in other fields, will make business in the fall and next year of major proportions.

To keep the automobile industry thriving it is incumbent on the manufacturer to improve his product and keep improving it. Aside from performing the work that has come to be relegated to the automobile, the manufacturer must plan to make it perform its tasks more efficiently and economically.

The banking situation as pertaining to the automobile market to-day is most satisfactory, due, in a large measure, to the fact that prices have been brought to a point where it is safe for the banker to advance money upon them. This is an important fact for car makers to remember, for the complete co-operation of the banks is imperative where volume business is sought.

There is a constantly widening field for American cars in foreign countries, but here, more than in our own country, the demand for efficiency and economy of operation is the first consideration. Rates of exchange make low prices important. With exchange becoming close to normal in many countries, the American car should enjoy a very wide popularity.

ASH DEMAND GREAT

ATLANTA, June 20—Most of the southeastern lumber mills manufacturing ash advise that the demand for this item from the automotive industry the past two months has increased so steadily that they are having some difficulty keeping up with their orders.

Says Gasoline Price Rise Is Inevitable

WASHINGTON, June 19—An increase in the price of gasoline is inevitable if the demand for the product this summer is to be met, according to John D. Reynolds, secretary and counsel of the Western Petroleum Refiners Association and chairman of a committee of that organization which will present statements relative to the price of gasoline to the Senate Manufacturing Committee.

In discussing the gasoline situation, Reynolds said that the present price is not high enough to afford the independent refiners "a living profit."

ENGLISH BRANCH IN CANADA

MONTREAL, June 20—A dispatch from London says that an English motor car company has decided to establish a branch in Canada, which will permit its product to compete with American cars. The company will turn out a small car in an assembling plant in the Dominion, and if it is successful will experiment with complete manufacturers there. It is hoped to sell the car in Canada for less than $1,000.

Lincoln to Be Sold Under Ford Contract

Dealers Will Be Expected to Handle Truck and Tractor as Well as Car

DETROIT, June 19—Under the reorganization of the Lincoln Motor Co. and the general policies as determined by Ford executives, the Lincoln car will be classed as a Ford product and as such will be subject to sale by all Ford dealers under Ford contracts. Lincoln contracts as formerly effective will pass out of existence and will be superseded by regular Ford contracts.

Under these the dealers and distributors who formerly handled Lincoln cars exclusively will be expected to handle other of the Ford products including the car, truck and tractor. Provision will be made in the contracts, it is understood, for the handling of Lincoln sales in the larger cities on a wholesale basis by the present distributors.

Aggressive Sales Policy Likely

The realignment is taken to indicate a very aggressive policy in the sales end of the Lincoln business. It is also taken to indicate that Ford has completed plans for the manufacture of the car on a large scale and that this will be accomplished largely by using several of the other Ford plants in manufacturing parts for the Lincoln.

Cancellation of the Lincoln contracts as formerly existing and the complete merging of its sale with the Ford products is said to have been a factor in bringing about the break between the Lelands and Fords. The Ford sales organization has been removed back to the Highland Park plant and all sales will be handled from there. The purchasing department of Lincoln was transferred to the Highland Park plant a month ago in the shift which took the Ford sales department to the Lincoln plant.

Engineering offices of both Lincoln and Ford will be moved to the Dearborn plant where Henry Ford has his private offices and experimental laboratories. The engineering office at Highland Park has already been moved and the Lincoln office will soon go. The entire office building at the Lincoln plant will be discontinued as such and if the original plan of Ford is followed out, it will be transformed into a body plant.

Says Lelands May Return

NEW YORK, June 19—The "Wall Street Journal" prints the following dispatch under a Detroit date line:—

"Henry and Wilfred Leland, released last Saturday from the management of the Lincoln Motor Co. by Henry Ford, may come back into the motor manufacturing world as competitors of the Lincoln. Banking interests in the East and friends of the Lelands have offered financial support and are urging a new start. Those interested believe that the Lelands can come back with a high grade car to be named the 'Leland'."

M.A.M.A. INAUGURATES BEST LETTER CONTEST

NEW YORK, June 19—Directors of the Motor and Accessory Manufacturers Association have decided to award a prize of $100 in gold to the employee or executive of any company belonging to the organization who writes the best 500 word letter, outlining to present members as well as prospective members the advantages and benefits of using all the departments of the association's service.

The prize will be presented and the winning letter read at the September credit convention. The real purpose of the contest is to educate all the members to the benefits of the association's activities. The letters will be judged by W. O. Rutherford, G. Brewer Griffin and Harry Horning. There is no limit to the number of letters from any one company.

Committee of Creditors for Templar Disbanded

CLEVELAND, June 19—Through the personal efforts of M. F. Bramley, the president and general manager, there has been a sharp improvement in the affairs of the Templar Motors Co. The committee of creditors, which took charge of its affairs some time ago, has been disbanded, and the plan of the Templar syndicate has been declared effective. Under this plan the creditors have agreed to accept 66 2/3 per cent of their claims in full settlement of all the company's obligations.

Production is steadily increasing, and in view of the fact that it is virtually starting again with a clean slate, there is every reason to believe that the company will be successful under the Bramley management.

Friend Realty Unsold; Equipment Goes in Lots

PONTIAC, MICH, June 17—No offer was made for the buildings and real estate of the Friend Motor Car Co. here June 14 when the property was offered for sale at auction by the Detroit Trust Co. as agents in Michigan for the Gotham National Bank, which purchased the property at the face value of its mortgage some weeks ago.

The sale was conducted by Samuel Winternitz & Co. of Chicago, with 50 to 100 persons present. When bids failed on the real estate, comprising about 17 acres of land and several factory buildings, the machinery, supplies, equipment, office furniture, parts and other property were put up in lots and knocked down to the highest bidder in rapid sequence.

Other Makers Scout Tire Surplus Report

Manufacturers Disagree with Firestone That Akron Plants Are Overproducing

AKRON, June 20—Akron tire manufacturers are inclined to take as unfounded the warning of President Harvey S. Firestone of the Firestone Tire & Rubber Co., regarding a possible overproduction in tires and have characterized the existence of any unbalanced tire surplus as a myth.

"Although the Akron district is now making close to 100,000 tires a day, and although the conditions obtaining in the industry closely resemble those of 1919 and 1920 as far as demand is concerned, it is becoming apparent that the industry as a whole will not make the mistakes which led to the problems of 1920 by overproducing or by the hiring of unskilled men and women when they are not absolutely needed in the factory," said one prominent Akron tire manufacturer.

When the unexpected sales spurt came for the tire industry a few weeks ago, necessitating the pushing of factories to their maximum production, and causing a shortage of skilled labor, it was feared that the industry might forget the lessons learned during the depression period when they were confronted by a huge tire surplus, and might repeat some of the things that helped to bring about the severe tire sales slump of 1920.

Only Skilled Men Hired

However, a survey of the industry in Akron shows that companies here are hiring only skilled men, and only when men are needed, and that they are not producing in excess of sales, keeping production in direct balance with sales. It is stated frankly by tire men that when orders slump, production will ebb accordingly and will be kept to correspond with sales in the future.

The outlook now is for a continued heavy demand for tires for the next two months, according to Vice-President and Factory Manager Paul W. Litchfield of the Goodyear Tire & Rubber Co., who says: "The seasonal tapering off of sales should start about the end of August and continue until October, when things probably will stabilize at a lower production level, perhaps 75 per cent of the present output."

Goodyear now is making 32,000 tires a day, including its Akron, California and Canadian plants. The Akron output is 26,000 casings daily.

TRUCK CREDITORS EXTEND TIME

LIMA, OHIO, June 19—Creditors of the Gramm-Bernstein Motor Truck Corp. have agreed to extend for five years the time for payment of their claims under a plan which has been worked out by a creditors committee.

A. A. A. Bolters Form Rival Organization

Delegates from Twelve States Help Launch National Motorists' Association

CHICAGO, June 19—The National Motorists Association was organized here to-day by about 200 delegates from automobile clubs representing the opposition to the American Automobile Association which developed at the national convention of the A. A. A. in St. Louis last month. The delegates came from about 12 states, including Ohio, Illinois, Michigan, Iowa, New York, Massachusetts, Indiana, Missouri, Texas, Nebraska, California and Washington.

Judge Walter D. Meals of Cleveland was elected president of the association, and a board of governors consisting of 30 members was named.

A constitution setting forth the name of the organization, its principles and purposes and the plan of organization and operation was adopted by unanimous vote of the delegates. The central offices are to be in Washington, D. C. The purposes include co-operation with state and local automobile associations, promotion of good roads, collection of data of interest to motorists, action on legislation affecting motorists, protection of motorists from excessive and unreasonable charges for materials and services used in connection with motoring, and the uniform marking of roads.

To Promote Racing

The constitution also provides for supervision over automobile exhibitions and contests, indicating a purpose to promote shows and races. The following classes of membership are provided for:

State associations, local clubs in states in which there is no state association affiliated with the national body, individual and sustaining. Individual membership dues are $10 annually; sustaining memberships, $100 annually and there is a scale of from 15 to 25 cents a member, according to number, for association and club memberships.

Fred H. Caley, president of the Ohio State Automobile Association, acted as temporary chairman. Among the speakers were Judge Walter D. Meals of Cleveland and Richard H. Lee of Chicago, both of whom have been active in the A. A. A. Both predicted that the new association would supersede the A. A. A. Caley announced that he was authorized to affiliate the Ohio association having about 50,000 members with the new organization. Many other delegates said they were not officially authorized to affiliate, but were confident their organizations would come in. Committees on credentials, resolutions and nominations were appointed.

VACUUM TANK SUIT SETTLED

CHICAGO, June 19—A suit instituted by the Stewart-Warner Speedometer Corp. against the Michigan Lubricator Co. of Detroit, alleging infringement of the Seager and Harrington patents covering vacuum tanks has been settled, and the lubricator company has sold its vacuum tank business to the Stewart-Warner corporation which has acquired several companies making vacuum tanks since it purchased outright the Seager and Harrington patents.

Three Companies Named in Another New Merger

NEW YORK, June 20—Official confirmation is lacking of reports of a prospective consolidation of the Apperson Brothers Motor Car Co. of Kokomo, Ind., with the Supreme Motors Corp. and the Colonial Motors Co., both of Warren, Ohio.

Supreme Motors, which is headed by A. W. Green, manufactures the Supreme Eagle Seal engine for cars, trucks and tractors. Colonial Motors was formed recently by Otis Friend, widely known in the automotive industry, who has proposed to build an assembled car.

It is reported that negotiations for the consolidation of the three companies have been in progress for some time.

Additions for Industrial Motors

NEW YORK, June 19—While no official announcement has been made in reference to additional companies which will be included in Industrial Motors, Inc., the combination of the Selden and Atlas Motor Truck Corp., it is understood that negotiations are pending with at least three more companies, including one in Detroit, one in Chicago and one on the Pacific coast.

The merger ultimately is expected to include a spring company and an axle company, as well as other parts makers.

Kemp Succeeds Eckhart as President of Auburn

AUBURN, IND., June 21—A. P. Kemp has been elected president and general manager of the Auburn Automobile Co. to succeed Morris Eckhart, effective July 1. Kemp has been vice-president and treasurer.

Eckhart has been connected with the company since its organization in 1900, being one of its founders. It is understood that he has retired from all active business and plans to travel extensively during the next two years in Europe and America.

Other officers elected are J. I. Farley, vice-president; E. A. Johnson, secretary; Z. B. Walling, assistant secretary and John Zimmerman, assistant treasurer.

FORD WANTS DAM PRIVILEGE

MINNEAPOLIS, June 19—Representatives of the Minneapolis and St. Paul Trades and Labor Assembly and Twin Cities business men have been invited by Henry Ford to confer with him at Detroit this week, regarding development of the government dam in the Mississippi here.

Electric Auto-Lite Is Now New Company

Sale to Miniger Confirmed—Fail to Adjust Willys and Overland Troubles

TOLEDO, June 19—The attempt of Federal Judge Killits to iron out the differences existing between the Willys Corp. and the Willys-Overland Co. have been unsuccessful thus far, and the matter has been put on the court calendar for hearing Aug. 1. Judge Killits said he was hopeful that the difficulties might be settled out of court before that time.

The motion was brought up in court to-day, and the court and all interests involved went out to the Overland administration building for a private conference on the claims.

Many Attend Meeting

There were in attendance at the conference session, Judge Killits, Thomas H. Tracy, Rathbun Fuller and Edward Marshall, representing the receivers; Frank P. Kennison and Col. Francis G. Caffey, New York receivers; J. P. Cotton, representing the first preferred stockholders' committee and the Willys Corp.; Forrest Jefferies, representing the corporation; Eldon Bisbee, for the bank creditors' committee; Paul G. Pennoyer, representing the merchandise and construction creditors' committee; Walter Earle, for the common stockholders, and George Hahn, counsel for the receivers.

Up to May 1 the claims filed against the Willys Corp. were $10,392,707.49, with possibility of some supplemental claims such as the claim preferred by the Overland company.

Assets of the Electric Auto-Lite division will be turned over to a new Ohio corporation known as the Electric Auto Lite Co., with 500 shares of no par value common stock by Clement O. Miniger, the purchaser. This announcement followed the confirmation of the sale in Federal Court here yesterday.

Farm Lighting Contract Made

Attorneys for Miniger announced that he had effected a farm lighting contract with the Willys-Overland Co., which would satisfy the terms of sale. He will receive a credit of $30,000 upon the purchase price from an advance of funds made from the jurisdiction of the Toledo court to New Jersey.

Miniger said after the sale that the officers of the new Auto Lite company had not been named, but that the same management would continue. It is assumed that he will be president and general manager and control more than 51 per cent of the stock.

Financial and operating statements filed by the receivers indicate that the business of the Electric Auto-Lite property has been increasing rapidly for the last few months. In March the profits were $224,795.13 and for the month of April increased to $343,507.81.

Ford Car Shipments To Mexico Increase

Many Go to New Dealers—General Conditions in Country Reported Better

DETROIT, June 17—Reports to the Ford Motor Co. from its Houston, Texas, branch, show a steady improvement in exports to Mexico. In May, 514 cars were shipped to Mexican dealers, all in car load lots. Many of these shipments went to new dealers in parts of Mexico that were without Ford representation up to six months ago.

General business conditions in Mexico are reported much better than for some time. With continued progress toward a normal condition in that country the branch is looking forward to the resumption of train load shipments which it was making until business became poor.

Production of the Ford foreign plants for April was at about the same rate reached in March, the Copenhagen plant being the only one to register an increase. Manchester built 3,013 cars and trucks; Buenos Aires, about 1,000; Copenhagen, 824; Sao Paulo, 154; Bordeaux, 609, and Cadiz, 305. Cork production of tractors fell off slightly.

Compared with business of the year before, April shows a considerable increase. Manchester production about equaled July of 1921. With the exception of one plant, business was approximately trebled in Buenos Aires, Copenhagen, Bordeaux, Sao Paulo and Cadiz, the latter plant showing the largest gain.

The improved foreign situation is arousing an optimistic viewpoint as to the automotive outlook in foreign countries.

Gray Plans to Build 250 Cars This Month

DETROIT, June 19—The Gray Motor Corp. will get into production next week and will build 250 cars this month. This production will be doubled in July and the company will enter upon a schedule of 1,000 cars monthly thereafter. President F. L. Klingensmith said it is expected to continue this schedule for the remainder of the year.

Engine production at the Gray plant is now 15 to 20 daily and will be increased. The company has been held up latterly by the non-delivery of jigs for its bodies but these have now been received and the company is assured of ample body supply from this time on. Delivery of other material has been ample and many chassis have been assembled pending the arrival of bodies.

SENATE ADOPTS ALUMINUM DUTY

WASHINGTON, June 19—The House duty of 5 cents a pound on aluminum scrap and alloys in which aluminum is the component of chief value in crude form was retained by the Senate in voting the metal schedule of the tariff bill. The Senate committee inserted "coils" in the paragraph relating to aluminum plate, sheets, etc., on which the House duty of 9 cents per pound was retained. The 30 per cent duty approved by the Senate committee on airplanes and motor boats, etc., was approved by the Senate.

Big Gain in Delco Sales Reported in Six Months

DAYTON, June 17—The sale of Delco Light, electric houselighting units, increased 25 to 40 per cent during the first six months of 1922, as compared with a corresponding period in 1921. January showed an increase of 15 per cent, and May over 50 per cent. The Delco Light plant is now operating at 60 per cent capacity.

President R. H. Grant is focusing sales efforts on questions removed from the competition of high tension electric lines in many parts of the country. The possibilities of lighting units have been found to be not as large as many manufacturers anticipated a few years ago, when a great many makers entered the field under the stimulus of war prices for agricultural products.

The Delco Light dealer as a general rule has given up the idea of a store in which to sell products, and now operates chiefly from his home or from headquarters established in a garage. The distributor still operates a store, but does not handle the broad line of electrical supplies he did a year or so ago. Delco Light export business, which was 25 per cent of total production, is now at 10 per cent.

Goodyear Increases Wages to Meet Akron Conditions

AKRON, June 17—Wage increases averaging between 5 and 6 per cent have been granted employees of the Goodyear Tire & Rubber Co., following a demand made upon officials of the company by the Goodyear industrial assembly, composed of employees, for wage increases commensurate to those given by other Akron tire companies.

Firestone's wage increase averaged 10 per cent. Other companies have adjusted wages and salaries. Goodyear announces that no horizontal increase in office employees' salaries will be made.

"Neither the profits of the industry nor a higher cost of living seems to justify any wage increase at this time, but they are being made specifically to meet Akron conditions," said Vice-President and Factory Manager Paul W. Litchfield, in announcing the wage revisions.

3478 ADDED TO PAYROLLS

DETROIT, June 19—Another upward swing in employment was reported last week by members of the Employers Association, who added 3478 men to their payrolls, bringing the total to 176,500, which is 60,000 more than for the corresponding week last year and within 10,000 of the total for the same week in 1920.

Indianapolis Plants Aiming at New Marks

Indications Are That Business with Them Will Keep Up Well Through July

INDIANAPOLIS, June 16—Marmon, National and Lafayette factories are aiming at new monthly records during June, with indications of business keeping up well through July.

Marmon went into June with 500 orders behind. May records in retail sales for the entire country are claimed to have been the highest ever reached by the company, although some production records of 1920 surpassed the May figures in factory shipments. Shipments this month exceed last month's figures, though slight material shortages may prevent the breaking of records.

National's recent price cut has resulted in placing this week's shipping records ahead of any week for some years. Factory production is being increased progressively. A greater force of men was put to work this week. Next week will see another increase, and if the orders continue to be received at anywhere near the present rate this process will go on week after week, until the plant reaches capacity.

Conservative in Increases

Although the price cut went into effect as of June 1, there was no time, when the decision was reached, to cover the country in the advertising announcements the first week. George M. Dickson, president of the company, will make haste conservatively in swinging into maximum production. By increasing the force slowly, there will be no wrench of factory systems, and the standards of the plant will be maintained at all times.

Lafayette Motors, recently reorganized, is now turning out more cars than at any time in its history. Six cars a day are being manufactured and shipped, and the inflow of orders seems to be steady. June will certainly be up to May, and July appears as good at the present time.

Cole is making steady progress, with May the best month of the year and with June running as well. H. C. S. keeps at a normal pace established about three months ago when its price cut went into effect.

Lafayette Policy Unchanged

INDIANAPOLIS, June 19—Lafayette distributors were told at a conference at the factory here that negotiations undertaken several weeks ago for a merger with the Pierce-Arrow Motor Car Co. had been definitely abandoned, and that Lafayette Motors now is fully prepared to proceed independently with plans which look far into the future. Assurance was given that no change would be made in the policy of turning out a quality car. Production at the Lafayette factory now is larger than at any time since the company was organized.

Will Trim Schedules When Sales Decline

Makers Do Not Plan Stocking Dealers with Cars or Acquiring Surplus

DETROIT, June 19—Any sales lull that may occur in the summer months will not lead to the stocking of cars by dealers or to the manufacture of a surplus by factories, according to leading executives in many plants. Should business fall off heavily, manufacturing schedules will be trimmed accordingly and both the factories and dealers will do business on a sales basis only.

Manufacturing schedules over the winter months have been given little thought as yet but on this point also the factory officials declare whatever stocking is done will be discretionary with the dealer. By adopting a sane manufacturing policy over the winter, manufacturers declare the delays in delivery of the present year can be eliminated without dealers being asked to take more cars than the normal early season would demand.

NEW YORK

NEW YORK, June 17—The first two weeks of June give no signs of a let-up in the demand for motor cars in the Metropolitan district. For most dealers handling the well established makes, the June problem is one of deliveries rather than sales. While the demand continues to be strongest in the medium price class, there is still a brisk business in the higher class and no signs of abatement before July 1 in the smaller car sales.

The New York market to-day seems to present, although in a much milder form, the situation that existed when the post-war boom was at its peak. Inability of several well known makes of cars to make deliveries has caused the public to go shopping for deliveries, and the suspicion has been expressed in some quarters that the demand is somewhat inflated through this "shopping" practice.

Those who looked for a decided decrease in the car sales for June in this district point to the fact that one of the things that is holding up June business is the inability of several dealers to meet May demands with deliveries.

With a few notable exceptions where reserve stocks were depleted or factory shipments curtailed to meet demands from other sections the sales in the New York district for May made substantial gains over the preceding month. This was especially noticeable in the higher price cars.

New York dealers are viewing with considerable interest the increasing popularity of the closed car even in the orders that called for delivery in the spring and summer months. In some instances the demand has advanced to better than fifty-fifty in favor of the closed jobs, especially in the higher price class.

Truck sales have made steady advancement through the early part of June and the month is expected to show a considerable increase over May. The demand for medium and heavier types of trucks on the whole seems to show more momentum than the lighter delivery lines.

NEW ORLEANS

NEW ORLEANS, June 17—Better conditions in New Orleans than have prevailed for two years, a practical absence of excess stocks of used cars, less halting of sales than was expected as a result of the floods from the Mississippi River, and expectation of heavy sales of trucks adapted to road building are the salient features of a review of the present and prospective market in Louisiana by Vice-President Ginder Abbott of the Abbott Automobile Co. of New Orleans.

Dun, Bradstreet and the government reports, as well as the long recorded observations of New Orleans business men, indicate that New Orleans is to some extent economically isolated from the rest of the country. Depressions reach here long after they are felt in the other large cities, and general revivals of business are likewise later in coming.

The semi-stagnation that followed the period of high prices in 1920 affected New Orleans less than the other cities, according to the government's employment reports. The prospect of excellent crops of cotton, sugar, rice and corn at fair prices has recently been offset only by the Mississippi floods, which affect a relatively small number of persons, but a considerable property value.

(*Continued on next page*)

ADOLPH PRICKEN DISCHARGED

NEW YORK, June 19 — Adolph Pricken, president of the Hamilton Motors Co. and of the Coastwise Warehouses, Inc., who was on trial before Judge Taylor in Brooklyn on a charge of grand larceny, was discharged when the court ruled that it had no jurisdiction. The charge against Pricken was based on statements that he had induced investors to put money into his warehouse enterprises on the promise of very large dividends. Pricken had returned all the money to dissatisfied investors.

DORT GAIN, 156 PER CENT

FLINT, MICH., June 19—Production of closed cars in May by the Dort Motor Car Co. showed a gain of 156 per cent over May of last year and 374 per cent over the same month in 1920. The company expects that June will show another gain in total production over May.

Rail Car Is Opening Big Field for Parts

Reports Made to Manufacturer of Growing Interest in Gasoline Driven Vehicles

DETROIT, June 17—Reports of an increasing interest shown by street railway car makers and railroad car makers in gasoline driven vehicles to run on rails, have been brought to Detroit by a sales manager for a leading unit parts manufacturer, who declares that there is promise of a large market in the near future for parts for such vehicles.

The parts will be practically identical with those used in automobile and truck construction, except that they will be of sturdier build and design, he said. Engineers in several of the larger rail car making plants have been carrying forward steadily their experiments with gasoline cars, and find that general construction along automobile lines will prove satisfactory for the heavier work.

Although ultimately it is planned by these companies to make all their own parts, there will be a considerable market for a number of years for parts made by independent unit makers, he said, and it will be business of the best sort because of the heavy character of the work and the strong financial position of the companies. Through an intimate acquaintance with the progress of the work, he predicts that an early start will be made in producing these vehicles.

The engines will be more of the marine type than the automobile, but the rest of the assembly will follow automobile design.

Oshkosh Tractor Stock Sales Under Scrutiny

MADISON, WIS., June 20—A hearing on alleged misrepresentation of stock sales of the Oshkosh Tractor Co. in connection with the purchase of the La Crosse Tractor Co. have been held here by the securities division of the state railroad commission. The Oshkosh company was dissolved last December, and its plans abandoned after $60,000 worth of stock had been paid in and $40,000 subscribed.

George F. Williams, Oshkosh, representing the stockholders of the Oshkosh company, is alleging three misrepresentations to the stockholders. First, in regard to the amount of stock actually subscribed when application for permit was made to the commission. Second, as to the amount of profits made by the La Crosse Tractor company prior to the filing of this application. Where profits are shown the stock is not classed as speculative. Third, that the stock issued in payment of salaries was sold for the benefit of individuals and misrepresentations made as to the value of the stock.

Widely Separated Sections Report Good Conditions

NEW ORLEANS

(*Continued from preceding page*)

Abbott says:

The conditions in the city of New Orleans are better than they have been for two years. Buyers have seemed to sense that the manufacturers are to-day marketing automobiles of superior quality at very low prices.

The used car situation has been pretty thoroughly cleared up, and there seems to be at the present time practically no excess stocks of used cars except in isolated cases. Therefore, there is not the usual bidding of one dealer against the other for used cars at excessive prices.

The demand in the territory surrounding New Orleans is somewhat affected by the flood and high water situation, but, while a considerable area has been inundated, an analysis will show that a comparatively small percentage of the population has been affected by these overflows, so that while it has had the effect of somewhat delaying purchases in those particular districts, the business as a whole cannot be considered as having been seriously affected thereby.

I should say that in so far as cars are concerned that the outlook is most promising. The truck business, on the other hand, is not in such good condition, for the reason that during the war period practically all users of trucks purchased in excess of their normal requirements, so that in most instances truck users are overequipped and will not be in the market except for special types of vehicles to meet special conditions until some of the equipment purchased during the war period has been junked. In the surrounding territory the demand for trucks, particularly of a type adaptable to road building, should show a healthy increase during the next six months, in view of the fact that the recently organized highway departments are rapidly rounding into shape for actual road construction.

ATLANTA

ATLANTA, June 16—Sales in the Atlanta territory continue to show some improvement from week to week, a majority of the dealers advise, though as a whole business is not at a point that could be termed satisfactory. The outlook, however, is steadily improving due to advancing cotton prices, and by the latter part of the year the trade is anticipating that sales again will be running along on about a normal basis as compared with the business of pre-war times.

Registrations in Atlanta alone for the week ending Saturday, June 10, were slightly in excess of 175, which indicates a very material improvement as compared with the same period last year when each week's average was around only 50. These registrations include new and used passenger cars and trucks, and inspection of them shows that a large majority of the sales being made are of medium and lower priced cars, Ford sales well in the lead. Ford business, in fact, the Atlanta dealers state, is considerably above normal and has been holding up well for the past three months.

Registration figures throughout the state show that in the counties where the larger cities are located, such as Savannah, Macon, Atlanta, Brunswick, etc., sales are proportionately greater than they are in the smaller communities. Business among the smaller dealers is at a very low ebb and there is little promise of improvement for some months due to the poor financial condition of the southeastern farmers.

MINNEAPOLIS

MINNEAPOLIS, June 19—The biggest general automobile demand in this territory seems to be for the lower priced cars and for coupes and sedans. One reason for this character of demand is that traveling salesmen find the closed cars give them more consistent protection against the weather, and that they are kept in better trim physically for their work, when they have this protection on the road. Wholesale houses are beginning to realize that the closed car is the most generally useful for their salesmen, and find that their men ask for these cars when the firm does not offer them. This is found true especially in Iowa, for some reason.

An illustration of local retail sales in motor cars by one firm will have the effect of a birdseye view of the general conditions in this line, and the variety of demand. In one day these sales were distributed as follows: Business men, 3; salesmen, 2; merchants, 2; public school teacher, physician, oil company, music teacher, farmer, chef and bookkeeper one each.

General business conditions are indicated in the demand for cars reported by the Ford assembling plant. June sales of cars, trucks and tractors in Minneapolis territory are expected to total $4,500,000 for 8,840 vehicles, of which 8,190 will be assembled at the local plant.

The force is now 750 men, as against 140 January 1. The capacity is 315 cars every day of eight hours, beginning June 1. The April distribution was 4,806 cars as against the best previous month, which was 4,573 in 1919. May's total was 6,240. The June record for Fordsons is expected to be 750, as against 433 in April. The company expects to sell in the Twin Cities 2,500 vehicles a month through the summer. In May it exceeded 2,000. Sales totaled 1,836 cars and trucks in April.

CALIFORNIA

SAN FRANCISCO, June 19—A record for automobile sales in California was set during the month of May just closed, with 14,088 new passenger cars registered in the state. This surpasses April, 1922, which, until now, had held the record, by 1,837 cars, and the record of May, 1921, by 4,719. This is a gain of virtually 50 per cent in automobile sales for May of this year over the same month last year. A list of the cars sold, compiled by the "Motor Registration News" of Oakland, Cal., indicates that the gain in sales is most noticeable in medium-priced cars, than in high-priced cars, and least in the low-priced cars.

Many dealers were surprised by the great increase in May sales over those of April, 1922, because the peak of the spring selling is reached usually between April 15 and 20. Some of the dealers believe that June and July will be as active as May, and are making preparations accordingly. Southern California led in sales, with 7,269 cars, compared with 6,819 in the northern half of the state. Sales in southern California in May, 1921, totaled 4,888 cars, but that section surpassed this by 49 per cent in May, 1922. In May, 1921, northern California sold 4,481 cars, and beat this record by 52 per cent with its 6,819 sales in May this year.

Truck Dealers Share in Increase

Motor truck dealers shared in the general increase in sales, disposing of 1,944 trucks in May of this year, as compared with 1,206 in May, 1921, a gain of 61 per cent in the year. May, 1922, was the largest and best month the truck dealers and distributors ever have had in this state.

Consistent with this increase in sales, and the prospects of even better business during June and July, dealers in both passenger cars and trucks are expanding their sales forces and increasing their advertising expenditures.

One of the most important recent events was the purchase by the Star Motor Co. of California of five acres adjacent to the Durant Motor Co.'s plant on East 14th Street, Oakland. The land is to be used for an office building and a U-shaped warehouse, surrounding the office building, with spur tracks running into the property.

TRUCK INTEREST INCREASING

PONTIAC, MICH., June 20—Increased buying interest in trucks was indicated at the fourth of the series of agents' and salesmen's conferences held by the General Motors Truck Co. at its plant here. The conference brought together men from the South and Southwest.

Men of the Industry and What They Are Doing

Stephenson Heads Indiana Truck

J. W. Stephenson, executive vice-president and general manager of the Indiana Truck Corp., has been unanimously elected president of the corporation as successor to Charles G. Barley, who died last week after an illness of more than two years. Stephenson has been connected with the Indiana Truck Corp. since 1915 as vice-president and general manager, and had complete charge of its affairs during the illness of Barley. Stephenson and Barley had been associated together in many business enterprises, including a partnership in the Rutenber Motor Co. Stephenson is an officer or director of several other corporations in Marion as well as other parts of the country.

L. J. Ollier Retires from Business

L. J. Ollier has resigned as vice-president in charge of export sales of the Studebaker Corp., effective July 1. He will retire from business and will make an extended European trip for rest and recreation. Ollier has been identified with the corporation for a number of years, rising successively from a salesman to the positions of branch manager at Los Angeles, sales manager at Detroit and vice-president in charge of sales. Harry A. Biggs, vice-president in charge of sales, hereafter will direct both domestic and export sales. Harold S. Vance, formerly assistant to the president, has been appointed manager of export sales, under the direction of Biggs.

Fraser Succeeds McGinness

R. M. Fraser has been appointed purchasing agent for the Chandler Motor Car Co., to succeed the late George E. McGinness. Fraser has been with Chandler for six years, the last two and one-half of which he served as service manager. J. W. Whiteherbe has been promoted to the head of the service department. He has been identified with Chandler for seven years, six of which have been spent in service work.

Goldie Managing Ruggles Truck

R. J. Goldie, for six years factory manager of the Columbia Axle Co., Cleveland, has resigned to become general manager of the Ruggles Motor Truck Co., Saginaw. F. H. Ragan, formerly with the Gemmer Manufacturing Co., has been appointed his successor.

Nash Advances Bliss and Smith

C. H. Bliss is assistant salesmanager of the Nash Motors Co., to succeed W. W. Smith, who has been awarded a direct factory distributing contract at Oklahoma City. Bliss has been identified with the Nash organization for the last five years, spending considerable time in the factory and working in a number of different departments until he was transferred to sales work. Smith has been associated with Nash ever since its organization. He entered the industry in 1910 when he organized the Speedwell Motor Car Co. Later he joined the Thomas B. Jeffery company and was in its sales department when the plant was bought by C. W. Nash and the Nash Motors Co. was formed. Three years ago he was appointed assistant sales manager.

Hibbard with Maxwell

John Lawrence Hibbard has been elected president and general manager of the Maxwell and Chalmers companies of Canada. Hibbard has had extensive experience in the automotive industry, having served as export manager of the Studebaker Corp. and, recently, as president and general manager of the Cleveland Tractor Co. of Canada, Ltd. M. O. Andrae has been appointed Toronto branch manager. Andrae comes to Toronto from the Sterling organization at Milwaukee, where for some time he was in the cost department and lately in charge of the Milwaukee city branch. R. Bagnall is in charge of service. Bagnall has been connected with the Sterling factory for many years.

Burckart Appointed by Dort

Louis F. Burckart, traffic manager of the Flint Chamber of Commerce, has been appointed traffic manger of the Dort Motor Car Co., succeeding Thomas Cole, who died recently.

Ross at Hagerstown

Herbert N. Ross of New York has taken charge of the Crawford Automobile Co.'s plant in Hagerstown, Md. Ross has been identified with the industry for fifteen years and is a pioneer in the motor truck field.

D. Kirke Moore Joins Dana

D. Kirke Moore has become associated with C. A. Dana as supervisor of sales for the Spicer Manufacturing Corp., Parish Manufacturing Co., Sheldon Axle & Spring Co. and the Salisbury Axle Co., which comprise the Dana group. Moore was one of the organizers of the American Distributing Co. until January, 1912, when he joined the Weston-Mott Co. as general sales manager. Nine years later he returned to the American Distributing Co. After severing his connection with the Weston-Mott Co. he became director of sales for Northway Motor & Manufacturing Co. and the Jackson, Church & Wilcox Co. Subsequently he was identified with Standard Parts as manager of the bearing and axle departments, resigning in 1920.

Clifford, New Jersey Distributor

John E. Clifford, manager of the wholesale department of Warren Nash Motor Corp., New York, since 1918, has resigned to become president and general manager of the Nash Sales Corp. of Jersey City, which he has organized with a capitalization of $125,000. Prior to beginning his association with the Nash distributor in New York, Clifford served for five years as manager of the Australasian division of the General Motors Export Co. and for two years merchandised and distributed Buick and Oakland cars direct through Australia and New Zealand, when C. W. Nash was successively president of the Buick Motor Co. and General Motors Corp. In 1917, when Nash left General Motors, Clifford resigned to take a position at the Nash factory in Kenosha. The Nash Sales Corp. will handle distribution in Hudson and Bergen counties.

Eustis, Service Body Manager

John R. Eustis will become secretary and general manager of the Automotive Service Association of New York July 1. Eustis is one of the pioneers in automobile activities in New York and has been connected with the trade in one way or another since 1903. Coincident with the change of management will be a removal of the business office and headquarters of the organization to 50 East Forty-Second Street. Eustis will take entire charge of the affairs of the association including the A. S. A. Bulletin, a monthly publication issued by the association.

Schaefer Associated with Brother

Robert H. Schaefer, for several years a member of the sales department of the Tuthill Spring Co., is severing his connection with that company July 1. His purpose is to move to New York and become associated in business with his brother, William H. Schaefer, at 79 Walker Street, who is representing the Tuthill company and several other manufacturers of automobile equipment.

Toland Sent to Coast

H. I. Toland, wholesale manager of the New York Mitchell organization, has been appointed Pacific Coast manager of the Mitchell Motors Co., Inc. At present Toland is at the plant in Racine, making an analysis of his territory. As soon as this is completed, he will leave for the coast with Los Angeles as his headquarters.

Kroneberger With Yellow Cab

W. L. Kroneberger, formerly sales manager for the Commonwealth Motors, has been appointed manager of the sales promotion department of the Yellow Cab Manufacturing Co., Chicago.

Diamond Cab Starts With Big Contract

1,000 Taxis for New York—Klingensmith, Beall and Hanover in Company

NEW YORK, June 20—The Diamond Taxicab Co. has been launched with Frank L. Klingensmith, Frank F. Beall and Harry T. Hanover, president of the Apex Motor Corp., among its backers. Announcement that these executives would manufacture a standard cab which would sell for approximately $1,200 was made in AUTOMOTIVE INDUSTRIES of March 2. The new company states that its first fleet of cabs for New York City will number 1000 and that the contract for the initial unit of 250 has been executed. It is expected that the first of them will be on the streets by July 1.

Associated in the venture with Klingensmith, Beall and Hanover are O. D. Havenrich, Fred Lewis and United States Senator Owen of Oklahoma.

The taxicab will be of the town body type with rather less glass than the conventional cab. The panels will be removable so that they can be easily replaced in case of accident. The units will be made very accessible, interchangeable and easy of replacement. One of the novelties of construction is the removable upholstery. When the cushions and backs are removed, the whole inside of the cab can be washed out with a hose without doing damage to anything remaining.

The company will maintain model garages in various parts of the city with club rooms, swimming pool, billiard room, etc., for the chauffeurs. The carbureter equipment is so fixed that no adjustments can be made except at the garages.

Sterling Enters Canada with Own Sales Force

TORONTO, ONT., June 20—The Sterling Motor Truck Co., Milwaukee, maker of Sterling motor trucks, is now entering Canada with its own sales organization and, if sales and business warrant it, will establish a factory here later on.

The head office for Canada will be at 510 King Street E., this city. It is also planned to cover Canada with a chain of factory branches or dealer service stations.

G. B. Wheeler, formerly factory sales manager for the Canadian Fairbanks Morse Co., Toronto, has been appointed Canadian sales manager. Wheeler has been identified with the Canadian Fairbanks Morse Co. for fifteen years, twelve of which were spent in building up an organization of dealers in eastern and western Canada.

PENN, BELMONT MAY MERGE

PHILADELPHIA, June 20—A new arrangement has been made whereby the Belmont Motor Co., Lewistown, Pa., will build the trucks for the Penn Motors Corp. of Philadelphia. Hilton W. Sofield, Penn president, has been made general manager of the Belmont plant, and a consolidation of the two concerns shortly is expected. The Belmont company, until it recently remodeled the North American tannery at Lewistown, had been without a location since its old plant at Riverton, N. J., was destroyed by fire in 1920.

Total Output in May Now Reaches 256,302

WASHINGTON, June 21—Output of Motor vehicles for May reported to the Census Bureau by 91 passenger car companies and 82 truck companies was 256,302. This is considerably in excess of the estimate of the National Automobile Chamber of Commerce for the month, which was 252,000. Passenger car output totaled 231,699 and truck production 24,603.

Revised production figures for April with approximately the same number of companies reporting showed 197,221 passenger cars and 22,227 trucks made in that month, a total of 219,448. No accurate data is obtainable, but it is estimated that the output in March, 1920, the best previous month in the history of the industry, was 220,000.

It will be noted that truck production continues to approximate 10 per cent of the total and that the commercial vehicle branch of the industry now is operating at the rate of 300,000 a year. The total for 1921 was 154,550. It was 322,039 in 1920 and 316,364 in 1919.

Guilty of Taking Bribe in Skid Chain Contract

WASHINGTON, June 16—Charles J. Ritzman, general manager of a firm of accessory dealers in Detroit, and formerly a captain in the Motor Transport Corp, yesterday was found guilty by the Federal grand jury of accepting a bribe of $800 for a government order for $100,000 worth of skid chains.

Ritzman was convicted on the testimony of R. W. Standley, president of the Standley Skid Chain Co. of Boone Iowa, who testified that he had paid the army captain $800 with marked bills to influence him in recommending the order, it being Ritzman's duty, the testimony showed, to recommend or reject automobile accessories to be bought by the motor transport corps.

Standley testified that in November, 1918, he, with a United States intelligence service operative, fitted up a dictaphone in a room in a local hotel, where the marked money was given to Ritzman while the dictaphone recorded the conversation.

Ritzman declared, in his testimony, that the tender of the money merely aroused his suspicions, and he accepted it in order to expose the party offering it. Two other charges of soliciting a bribe were dismissed against him.

National Will Join Associated Motors

Stockholders Accept Offer to Transfer Assets for $1,175,000, Part in Cash

NEW YORK, June 21—Stockholders of the National Motor Car & Vehicle Corp. decided at a special meeting here yesterday to accept the offer of Associated Motor Industries, Inc., for the assets of the company. Details of the merger will be worked out by the directors, and it will take some time to arrange for the actual transfer of the property.

In effect, the offer of Associated Motor Industries is to pay for the National assets $125,000 in cash and $1,050,000 in stocks and bonds of the newly organized corporation.

Creditors of the National company have been asked to accept 10 per cent in cash, 25 per cent in one year notes, 15 per cent in bonds of Associated Motors and 50 per cent in preferred stock of Associated Motors for their claims. Directors of the National company assert that none of the creditors have objected to the proposal, as was done in the case of the Kentucky Wagon Co., which also wants to enter the merger with six or eight other companies, including Jackson Motors and Traffic Truck.

Banking Syndicate Being Formed

Promoters of Associated Motors declare that a banking syndicate is being organized in Chicago to underwrite a bond issue of $4,500,000 and that these negotiations have been practically completed. The Union Trust Co. of Chicago will act as trustee for the sale of bonds. The combined assets of the companies which will be merged are estimated at slightly more than $21,000,000.

Before it is formally launched, the name of Associated Motors will be changed. It is probable the corporation will be headed by Will I. Ohmer of Dayton, Ohio.

The National Motor Car & Vehicle Corp. was incorporated in New York in 1916 to take over the assets of the National Motor Vehicle Co. incorporated in Indiana. Its plant at Indianapolis has a floor space of five and one-half acres with an annual capacity of 6000 cars. The company is controlled by New York bankers and brokers.

CONTINENTAL'S BEST MONTH

DETROIT, June 21—Continental Motors Corp. will reach the largest production in its history this month. The company reports the closing of contracts with a number of important truck manufacturers giving it a more extensive outlet for the heavy duty engines than it has enjoyed at any other point. Production of the single six engine is reaching the proportions necessary to meet the demand of its customers.

Booklet on Bodies for All Car Buyers

Association Plans to Distribute Publication Through Automobile Makers

DETROIT, June 21—Under the terms of a resolution adopted at the convention here of the Automobile Body Builders Association, a booklet will be prepared on the care and treatment of bodies, which will be submitted to car manufacturers with the request that it be passed along to persons buying cars as important in the continued service of the body.

This will be part of the general service plan of the association given through the car manufacturer.

The service committee of the association headed by Francis D. Willoughby of the Willoughby Co., Utica, N. Y., will prepare the booklet and will work with the service committee of the National Automobile Chamber of Commerce in compiling it.

The question of servicing bodies was discussed extensively at the meeting, the feeling being that much of the ill treatment to which bodies were subjected and which later entailed service, could be eliminated by the issuance of a publication setting forth essential facts on body care. As a further step looking to service, the committee will draft a set of proposals on what the association is prepared to do and will submit these to the automobile chamber committee, so that a working agreement may be reached.

Speaks on Ordering Timber

Speaking on the hardwood situation, John W. McClure of the National Lumber Association said considerable delay in the cutting of timber had been occasioned by floods in the South, and that it would be late in the year before the new timber would be ready for marketing. He spoke against the practice of specifying certain sections in ordering timber, saying this led to increased prices and to impositions, to some extent, in that lumber was shipped from section to section to meet the demand from the favored spots. This increased freight bills and added to costs without bringing any gain.

Wilson Foundry Prepares to Meet Engine Demand

PONTIAC, MICH., June 19—Work will be started the first week of July on necessary changes and additions at the Wilson Foundry & Machine Co. plant here to meet a demand for 300 Willys-Knight engines daily that has come from the Willys-Overland plant in Toledo.

The changes, according to D. R. Wilson, general manager, will be completed in time for the new schedule to be put into effect this fall, so that the plant can build up a reserve of engines to meet the demand.

MICHELIN TIRE MAN WILL BE "OLD 1895"

MILLTOWN, N. J., June 20—The judges in the contest instituted by the Michelin Tire Co. for a name and slogan for its product have awarded the first prize, $1,000 in cash, to L. J. Keller, a Kendallville, Ind., banker. The name he proposed for the Michelin tire man was "Old 1895," and the slogan, "Full of Life and Quality."

Michelin tires have been awarded to fifteen others whose suggestions were considered next best. Remarkable interest was aroused by the contest and several hundred thousand suggestions were received. They came from every state in the Union and many foreign countries. The tire man has been used in Michelin advertising since the early days of the industry. The idea was developed in the suggestion of a workman who saw in a pile of tires a crude resemblance to a man.

To provide for the larger output, the extensive plant built here for the Monroe Motors Co. will be brought into active manufacturing use for the first time. It was planned originally to make tractor parts in the building, but this purpose was abandoned and the upper floor of the structure has been used for a plant cafeteria.

S. A. E. Is Deadlocked on Choice for President

WHITE SULPHUR SPRINGS, June 2—The midsummer meeting of the Society of Automotive Engineers is proving a great success, although sport and outside attractions are interfering slightly with the technical program. So many members entered the golf tournament that it had to be divided into three sections.

The real sessions started to-day. The motor bus session, attended by about 150 members, and the aeronautic session, with 40 members, were held this morning. George Green of the Fifth Avenue Coach Co. presented a paper on motor bus design which was one of the most striking ever given before the society.

The nominating committee reached a virtual deadlock in its attempt to choose a president for next year. The arrival of some other members who have been delayed in coming is now being awaited, as there seems to be little hope of a choice being made until then.

NEW YORK CLOSED CAR SHOW

NEW YORK, June 22—The Automobile Merchants Association of New York, Inc., has arranged to hold a closed car show at the Grand Central Palace, Sept. 23 to 30. The show has been sanctioned by the N. A. C. C.

Detroit Has Enough Coal for 2 Months

Detroit Edison Co., Which Supplies Power to Plants, Slowly Increasing Reserve

DETROIT, June 20—The Detroit Edison Co., which supplies power to all automobile plants in the city with the exception of one or two, is building up its reserve of coal to a three months' supply, ample, in its estimate, to carry the district through the present coal strike without the necessity of reducing working schedules to any degree.

At present there is a two months' supply in its bunkers at the several power producing plants, and this is being steadily augmented. This week there are 280 cars of coal in transit from its various supply sources. Unless a railway strike interferes it will have its three months' supply safely in hand within a short time.

No Need of Reducing Power

Should a railway strike check deliveries of finished products by the automobile factories and other industries of the city, the company declares its coal supply will be spread over just that much longer period of time, and it dismisses any thought of being compelled to reduce its power production for this three months' period at least.

After a ten-day period of investigation in the coal fields, an officer of the company reports a continued state of stagnation in the strongly unionized districts in Illinois, Indiana, Ohio, Pennsylvania and West Virginia, but declares there is a gradual increase in production in the districts where the union foothold is of recent origin, or where it had not established a strong claim upon its members.

Ford Has Plenty of Coke

The Ford Motor Co. declared itself comfortably situated as to its coal supply and said that in addition to the stores on hand it is receiving daily shipments from its own mines. Aside from some congestion due to heavy traffic on its railroad there is no difficulty in obtaining coal. All coal being taken from the Ford mines is used in the Ford plants. Unlike other companies suffering from a shortage of coke, Ford has plenty of coke for its manufacturing requirements, and in addition is selling it to its employees for household use. Employees are being urged to buy now to guard against a possible shortage later on. The company is not considering the sale of coke to anyone except Ford employees.

SPANISH FIELD OPENED TO FRANCE

PARIS, June 22 (*By Cable*)—A commercial treaty between France and Spain has been concluded under which France will get a minimum duty under a most favored nation clause. French automobile manufacturers now will be able to compete in the Spanish market.

Would Put Bus Lines Under Rail Control

Short Lines in Georgia Also Alarmed by Inroads Made by Trucks

ATLANTA, June 20—Because of the tremendous inroads motor truck freight traffic and passenger bus transportation have made the past year or two in the business of the short line railroads of the Southeastern territory, thirty-nine of the lines operating in Georgia have organized what is known as the Georgia Short Lines Association, and will seek legislation immediately for the control of motor bus lines and truck freight traffic.

The primary effort of the association will be to bring about legislation making the motor bus lines common carriers subject to the rules and regulations governing the railroads. This would place bus lines under the direct supervision of the State Railroad Commission.

Score Taxation Policy

The present taxation policy which permits motor trucks to compete with the railroads, charging higher freight and passenger rates, using public highways in counties where the operators of the lines contribute nothing to the upkeep of these highways which the railroads pay taxes to preserve, was scored at a recent meeting in Atlanta, and efforts will be made to remedy this situation.

At a meeting of bus line operators held in Atlanta this month an organization was formed that will endeavor to defeat the aims of the short line railroads by combating such legislation as it seeks to enact and that, it is believed, would prove detrimental to the truck transportation business.

Laments Conditions

ATLANTIC CITY, June 20—The competition of highway transport was again bewailed by W. J. Tollerton of Chicago, chairman of the annual convention here of the American Railway Association.

Tollerton said:

> The railroads are confronted with a field of competition in the form of automobiles and auto trucks which is having a serious effect on local traffic, both passenger and freight.
>
> Insofar as automobile trucks are concerned they are in a position to operate at a very low cost, practically on a government subsidy, having no other expense than a small tax in investment or maintenance of roadway, terminal and other station requirements.

MIDWEST MAKES PROGRESS

INDIANAPOLIS, June 22—Receivers for the Midwest Engine Co. report that subscriptions have been received for $1,000,000 worth of refunding bonds insuring speedy reorganization and working capital to complete the transfer to the New Midwest Engine Corp. The property will be offered at public sale about July 11. All claims against the old company must be filed with the receivers or Judge Solon Carter in Marion County Superior Court by June 29. It is stated that 95 per cent of the creditors and stockholders have assented to the reorganization plan.

134,762 IN MAY MADE NEW RECORD FOR FORD

DETROIT, June 21—A new high monthly production record of 134,762 cars and trucks was established in May by the Ford Motor Co. Domestic output in all plants was 121,073, compared with the previous record of 109,187, which was established in June 1921. The six foreign plants produced 6170 cars and trucks and the Canadian plant 6519. The company estimates that the May record will be bettered this month. Production in American and foreign plants for the first five months of the year was 409,309 cars and trucks, compared with 329,813 for the same period last year.

Each Ford foreign plant, including Canada, showed a considerable increase in output in May over the previous month.

Eager Succeeds Armitage as Whitman & Barnes Head

AKRON, June 22—William H. Eager, who has been vice-president of the Whitman & Barnes Manufacturing Co. since 1918, has been elected president to succeed A. D. Armitage, who resigned two weeks ago to devote his entire time to the J. H. Williams Co. of Brooklyn, of which he is vice-president and general manager. Since the sale of the Whitman & Barnes factories at West Pullman & St. Catherines, Ont., to the Williams company, Armitage has served in a dual position as president of the Akron company and general manager of the other.

He will remain a member of the Whitman & Barnes directorate.

Eager, widely known as an engineer, has been with the Whitman & Barnes company for the last 16 years, having joined it as assistant superintendent of the Chicago factory. He was elected treasurer in 1908 and was transferred to Akron in 1909. Two years later he became sales manager.

Frank W. Oliver, widely known as a salesman in the twist drill and reamer field, has joined the Whitman & Barnes organization as eastern sales manager with headquarters in New York.

WORKS ON MERIDEN PLANT

MERIDEN, CONN., June 22—The New Departure Manufacturing Co. has recruited a staff of workmen to put the Meriden plant of the company in readiness for operation. The factory buildings were completed two years ago at a cost of about $2,000,000. The company has taken on 800 additional workers at its Bristol plant.

A. E. A. Jobbers Favor Extending Campaign

Merchandising Work Features Convention—Business Far Ahead of 1921

COLORADO SPRINGS, June 22—The merchandising campaign which has been under way for 10 months and which is to be supplemented by propaganda intended to foster shop profits and the sale of shop equipment along with accessory sales, was the feature of the Automobile Equipment Association's spring convention which convened to-day.

Jobber members showed strong support of the campaign which was to come before the full session of manufacturers and jobbers with a recommendation that $60,000 be provided for the second year's work. About $35,000 of a $40,000 appropriation for the first year has been spent to date. The plan is to continue the "Ask 'em to Buy" film and kindred activities along with the new film and literature suggesting to dealers methods of making money in maintenance work. One hundred and thirty-five manufacturing houses and 90 jobbers are represented at the convention with alternates and guests bringing the attendance up to 600.

Accessories Sell Strongly

Delegates report business far ahead of 1921 in nearly all parts of the country, and in Canada the revival has begun, though slowly. Shop equipment and utility accessories are selling strongly.

Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce, spoke before the manufacturers division for an hour, describing recent developments of the work of his division. Lee said that recent inquiries indicated that automotive equipment manufacturers would be put into the export business whether they wanted to go into it or not. In many countries, he said, dealers were calling for accessories in addition to standard equipment on American cars.

Per Capita Earnings Increase 3.9 Per Cent

WASHINGTON, June 19—Data compiled by the Bureau of Labor Statistics show that the per capita earnings in the automotive industry for May were 3.9 per cent higher than in April. Comparison of employment in 44 identical automobile factories in April and May for a period of one week shows that the amount of payroll increases averaged 14 per cent and the number on the payroll, 9.7 per cent.

These factories in the week covered by the survey employed 90,992 in April and 99,389 in May. The amount of the payroll in April was $2,961,591 as against $3,376,438 in May. The bureau reports that a wage increase of approximately 15 per cent was granted to 20 per cent of the employees in one factory. Two plants report a 14 per cent increase.

Lower Canadian Tax On Cars Over $1,200

Protests Bring Revision—Increase Made in General Sales Levy Remains Unchanged

OTTAWA, June 19—The Fielding budget has been passed as revised and presented by the Minister of Finance. The chief revisions affecting the automotive trade are: Cars valued at not more than $1,200 each, 5 per cent; cars valued at more than that amount, 5 per cent up to $1,200 and 10 per cent on the excess over $1,200. In the original budget the impost on cars selling over $1,200 was ten per cent throughout. Thus the impost on every car selling over $1,200 is reduced by $60.

To this extent the representations made by the Automotive Industries of Canada and the various trade associations bore fruit as they did also in the revision in the matter of imported cars for which bona fide orders were placed prior to midnight of May 23, the day the original budget was brought down.

A ruling was given some time ago that the tax would not apply on cars of domestic manufacture where affidavits from purchasers and dealers showed that orders had antedated midnight of May 23 but would apply on cars not then imported to fill orders.

To this the importers protested vigorously with the support of the general trade and industry. As a result the revision provides that the excise duty on automobiles shall not apply on cars purchased before May 24 and imported and entered for consumption on or before July 1. The 50 per cent increase in the general sales tax stands, in addition to the special tax. The sales tax now is 4 per cent and 6 per cent on passenger cars of domestic and foreign manufacture respectively.

New Oakland 2-Passenger Coupe Marketed at $1,285

PONTIAC, MICH., June 19—A two-passenger coupe of standard closed car construction and priced at $1,285 f. o. b. Pontiac, has just been put on the market by the Oakland Motor Car Co. It is mounted on the regular Oakland chassis. The body is built in accordance with regular coach making practice over a rigid frame work.

Genuine leather and automobile cloth are used in the interior and plate glass for the windows. A feature is the wide door opening on each side of the body. Lever operated windows are fitted for easy regulation of temperature in any weather. The doors have double latch catches with locks in the handles.

The seating arrangement permits the driver and passenger to sit side by side. The lower portion of the windshield is built stationary into the body to make it weather-proof, while the upper half is adjustable. A cowl ventilator is adjustable from the dash and there is a windshield visor. There is a large compartment under the rear deck for heavy luggage, with a deep, covered compartment back of the driver's seat to provide for smaller parcels.

The instrument board is of walnut, with all instruments silver faced and glass covered. The steering wheel is of corrugated walnut with a nickel plated steering column. The standard equipment includes snubbers, visor, rear view mirror, windshield wiper and non-skid cord tires. The tire size is 32 x 4 in.

REVOKING LICENSES CURTAILS ACCIDENTS

BOSTON, June 19—Drastic action taken by Frank R. Goodman, state registrar of motor vehicles, to keep down the number of accidents by revoking the licenses of careless drivers, is meeting with material success. Representatives of the department follow up all complaints, and in most cases the licenses of drivers against whom complaints are made are revoked. The revocations already number approximately 5000. They are for various periods from 30 days to one year.

New Kelly-Springfield Truck Model to Be Built

SPRINGFIELD, OHIO, June 20—Within the next six weeks the Kelly-Springfield Motor Truck Co. will make formal announcement of a new model of motor truck, according to announcement by Frank H. Peitsch, general manager.

Orders are gradually increasing, he said. An order was filled for railway motor buses Monday for a copper company in Nevada. An official test of one of the company's railway buses was made to-day on the Baltimore & Ohio Railroad in West Virginia. The Kelly company has booked a large order from the railroad.

The Springfield plant of the International Harvester Co. is keeping up its 50 trucks a day shipment, Superintendent C. H. Morton states. Inability to get parts is causing some delay in forwarding shipments.

Y. F. Stewart Acquires Coats Steam Car Co.

COLUMBUS, OHIO, June 22—The Coats Steam Car Co. has been taken over by the Y. F. Stewart Motor Car Manufacturing Co. with a capital of $2,500,000 and has purchased the former plant of the Immel Co. in this city, which was sold by the receivers several months ago.

The Stewart Corporation will have plants at Bowling Green and Louisville, Ky. The company will turn out a low priced steam car developed by G. A. Coats, who will be vice-president and general manager of the corporation.

Hoover Aids Graham "Anti-Dumping" Bill

Sends Letters to Finance Committee Senators on Sale of War Materials

WASHINGTON, June 20—Early passage of the Graham "anti-dumping" bill by Congress has been urged by the Department of Commerce, it has been learned. The measure, which would prevent the return to the United States of automobiles and other war supplies by imposing a 90 per cent ad valorem duty on them, is needed, the department believes, to stabilize the American market.

Passage of the bill is being urged by the department as a matter of fairness to American producers. Secretary Hoover, in a letter to certain members of the Senate Finance Committee, who are now holding up further consideration of the bill, has pointed out the fact that the government has sustained enormous losses on the sale of war supplies in Europe.

These losses by the government have resulted in profits by the speculators abroad, thus enabling them to take advantage of the government's prices and re-import millions of dollars' worth of motor vehicles into the United States, cutting prices and underbidding legitimate manufacturers. This, the department has notified members of the committee unofficially, is unfair to the American manufacturer.

No Organized Opposition

There appears to be no organized opposition to the passage of the measure, although it has been before Congress for 10 months. It was first reported to the House Aug. 10, 1921, from the House Military Affairs Committee, passed the House on Aug. 12 and was referred to the Senate Finance Committee.

Senator McCumber, chairman of that committee, has devoted practically his entire time to the tariff bill, and the committee has held no hearings on the measure. In a letter to the department, Chairman McCumber expressed doubt as to the necessity of the bill to protect the automobile market.

Figures were immediately secured by the department showing approximately 8000 cars available for re-import, which, it is stated, will be brought back and sold in the United States unless the anti-dumping measure is speedily passed.

These figures were furnished the committee by Secretary Hoover three weeks ago.

SALON DATES IN DECEMBER

NEW YORK, June 22—The 18th annual automobile salon will be held in the Commodore Hotel from Dec. 3 to 9 inclusive. It will be repeated in Chicago the latter part of January while the national automobile show is in progress. The entire ballroom floor of the Commodore will be used for the display.

FINANCIAL NOTES

Reynolds Spring Co., Jackson, Mich., has declared a dividend of 1¾ per cent on the preferred "A" stock payable June 30 to stockholders of record at the close of business June 27. A dividend of 14 per cent has also been declared, being all of the accumulated dividends on the preferred "B" stock and payable June 30 to stockholders of record at the close of business June 27. All dividends on both classes of preferred stock having now been paid in full in cash, the board of directors may at its discretion declare dividends on the common stock from time to time. Donald Ford of Goodbody & Co., New York, has been elected a director of the company to take the place of Rafe S. Craft, resigned.

Durant Motors, Inc., stockholders at a special meeting to be held June 27 will vote on a proposal to increase the capital stock to 2,000,000 common shares of no par value. The present authorized capitalization is 1,000,000 shares, of which about 700,000 are outstanding. The 300,000 shares of unissued stock are being held in the treasury for the use of converting stock of the subsidiary companies into stock of the parent company. Authorization of the new stock is being asked in order to provide additional shares for conversion purposes and to provide means of possible future expansion.

Firestone Tire & Rubber Co. of Canada, Ltd., is offering through Otis & Co., New York, at 99 and accrued interest to yield about 7.10 per cent, a new issue of $1,500,000 of fifteen year first mortgage 7 per cent sinking fund gold bonds. The bonds are dated June 15, 1922. The issue represents the only bonded indebtedness of either this subsidiary or the parent company.

Jordan Motor Car Co., Inc., has declared the regular 1¾ per cent quarterly dividend on preferred stock payable to stockholders of record June 15. President Edward S. Jordan states that the factory is running at capacity production and that the earnings during May were more than sufficient to take care of the preferred stock dividend require-

Hudson Motor Car Co. and Essex Motors consolidated balance sheet as of May 31, 1922, shows cash, $6,826,100; sight drafts for car shipments, $2,262,237; accounts receivable, $270,000; notes payable, $3,500,000; accounts payable, $4,218,000; accrued accounts and distributors' deposits, $954,900 and surplus, $12,284,000.

Barlow Steam Car Co. has been formed in Detroit with a capitalization of $300,000 made up of 30,000 shares at $10 a share. Paid in cash is $23,500 and paid in property $228,755. Principal stockholders are Lester Barlow, 9000 shares; Wayne R. Barlow, 650 shares and Byron Pierce, 650 shares.

General Motors Corp. directors at their meeting this week took no action on resuming dividends on the common stock. Only the regular dividends were declared on the 6 per cent preferred stock and the two classes of debentures, these being payable Aug. 1 to stock of record July 3.

Dearborn Tractor Appliance Co. has been formed with a capital of $25,000, 250 shares at $100; paid in cash, $5,000. Principal stockholders are John Miller, C. Ford and Clarence Spencer, all of Dearborn.

BRITISH EXPORTS GAIN

WASHINGTON, June 19—The automotive exports from Great Britain during April exceeded those of March by 9 per cent and amounted to £270,971, made up of 142 passenger cars, valued at £110,540; 50 trucks valued at £55,088; 45 chassis, valued at £36,783, and parts worth £68,560.

The United States was the leading market, taking 38 passenger cars valued at £46,411, and two chassis valued at £1,431. Sweden followed with 21 cars valued at £7,396.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Last week's local money market was characterized by general ease. Call loans covered a range of 2¾ per cent to 4 per cent, as compared with 3 per cent to 4¾ per cent in the previous week. On June 12 call funds went to 2¾ per cent, the lowest level touched since April 24, 1918. Under the influence of the heavy Government financing in connection with the retirement of Victory notes and Treasury certificates of indebtedness and notes, the rate advanced to 4 per cent on June 14, but the next day fell to 3½ per cent. In time money the situation was comparatively quiet, sixty days' maturities being quoted at 4 per cent, ninety days, four and five months at 4 per cent to 4¼ per cent, and six months at 4¼ per cent, the same as in the previous week.

The Bank of England announced on June 15 a reduction in the bank's official minimum discount rate to 3½ per cent from the 4 per cent level, which has ruled since April 13 last.

The Federal Reserve statement as of June 14, 1922, showed a decline of $2,278,000 in total gold holdings, while other cash reserves showed an increase of $4,690,000.

Further evidence of the continued improvement in the steel industry is to be found in the United States Steel Corp.'s report showing that unfilled orders on its books at the end of May amounted to 5,254,228 tons, the largest total for any month since May, 1921, when unfinished business amounted to 5,482,487 tons. The total for May, 1922, showed an increase of 157,311 tons over the total at the end of April.

Railroad earnings in April reflected to a considerable extent the effects of the coal strike. According to the complete reports filed by the Interstate Commerce Commission by 201 Class 1 railroads, the net operating income in April was somewhat over $50,000,000, or at the annual rate of return of 3.93 per cent on the tentative valuation. This compares with a net operating income for March of $83,500,000, or 5.83 per cent, and $29,856,000, or 2.33 per cent for April, 1921. For the first four months of 1922 the net operating income of Class 1 railroads was a little over $211,000,000, or at the annual rate of return of 4.36 per cent, as compared with a net operating income of $57,408,000 and a rate of 1.18 per cent for the first four months of 1921.

Aluminum Interest May Be Taken Over

Offer Made to Lease Property of Manufactures, Inc., Including Patents

NEW YORK, June 22—An offer to lease all the real estate, buildings, machinery and equipment of the Aluminum Manufactures, Inc., for 25 years from July 1 has been made by the Aluminum Co. of America, which, under this proposal, would obtain the right to use all patents, trade names and trade marks.

The Aluminum Co. of America also has offered to purchase the entire inventory at market value July 1 and to take over the capital stock of the Aluminum Die Casting Corp. and of the Aluminum Screw Machinery Products Co., which are owned by the Aluminum Manufactures, Inc., for $321,200.

Dividends Depend on Action

W. P. King, president of Aluminum Manufactures, has sent a letter to stockholders, in which he says that if this proposition is accepted, the company will be in a position to continue to pay the 7 per cent dividend on the preferred stock; to retire each year 2000 shares of preferred and to pay dividends on the common beginning in 1924 at $1 a share with $1.50 in 1925 and $2 a share thereafter.

"If the proposition of the Aluminum Co. of America is not accepted," King said, "dividends on the preferred stock of the Aluminum Manufactures, Inc., will have to be discontinued, and dividends on the common stock will be remote at best."

A meeting of the stockholders of Aluminum Manufactures has been called on June 29 to ratify the proposition.

Lower Rates for Milk Or Trucks Will Be Used

WASHINGTON, June 20—Organized milk producers of the country have issued an ultimatum to the railroads to reduce freight rates or compete against a national motor transport. A delegation of the National Milk Producers Federation and representatives of the American Farm Bureau asked the Interstate Commerce Commission for a hearing before final steps were taken for the establishment of a motorized system of distribution.

The commission has been asked to take the passenger rate from milk and make freight rates apply, in order that the 200,000 milk producers may receive the benefit of the recent 10 per cent freight reduction.

Unless the commission permits milk to be transported on the basis of freight rates, instead of the present passenger rates, the railroads will lose practically their entire short haul transportation of milk, which will be taken over and handled by motor transport, the commission was told.

Further Federal Aid Is Assured Highways

Appropriation of $200,000,000 for Three-Year Program Is Authorized

WASHINGTON, June 20—Federal aid in the construction of highways was definitely assured for three years more when President Harding signed a bill authorizing appropriations of $50,000,000, $65,000,000 and $75,000,000, respectively, for the fiscal years of 1923, 1924 and 1925. Further sums of $6,500,000 were voted for each of the fiscal years 1924 and 1925 for forest road construction, the funds for this work for 1923 having been cared for in earlier laws.

The authorization for 1923 carries with it definite authority to the Secretary of Agriculture to enter into contractual relations with state highway commissioners for road construction.

The appropriations will be made under the provisions of the Federal aid act of 1916 as amended in 1919 and 1921, which means that the expenditures must be made on those highways comprising the 7 per cent system of main roads. The states are required to maintain the highways once built.

Limits Aid Offered

The most important change in the organic act is an amendment which limits Federal aid participation to $16,250 per mile for 1923 and to $15,000 per mile thereafter. This contrasts with the $20,000 per mile maximum of 1919 and the $10,000 limit of 1916. The limitation will work no hardship in average conditions, but for special situations where traffic has become very heavy it is not improbable that some change will have to be made at a later session of Congress to prevent the waste resultant from too low a type of construction.

The government has now appropriated or authorized a total road fund of $587,000,000 since the passage of the Federal aid act in 1916. Figures of the Bureau of Public Roads show that construction has been proceeding for the last three years at the rate of approximately $80,000,000 annually in Federal funds and as state organizations have now become well stabilized, it is anticipated that this rate will be exceeded in 1923 and succeeding years.

Taxes Must Be Readjusted

WASHINGTON, June 19—A readjustment of taxes in the financing of future highways must be made before the state and Federal governments can be expected to foster a permanent and national highway transport system, according to Thomas H. MacDonald, chief of the Bureau of Public Roads.

The bureau estimates that of the amount spent for highways last year 33 per cent was obtained through Federal aid and motor vehicle tax. The remaining 67 per cent came either directly or will be paid eventually from state and local taxes.

Discussing the subject, MacDonald says:

Development and increase in numbers of motor vehicles and the coincident need and demand for good roads have come so rapidly that methods of raising funds have often been expedients for the time being. Consideration has been given not so much to the just distribution of the cost as to how the funds can be raised with the least controversy and the utmost ease.

This leads to the inevitable conclusion that the whole situation must be gone over very carefully, traffic studies made, and the cost distributed in proportion to the service rendered. There must undoubtedly be a readjustment of the sources of revenue so that a larger percentage will be paid by the road users and a lesser percentage from state or local taxes.

INDUSTRIAL NOTES

Machined Parts Corp. is nationalizing its new parts service to jobbers and dealers throughout the entire trade. The company is specializing in ignition equipment of all kinds. J. E. Hamilton is secretary and treasurer of the company with headquarters in Detroit, having taken that position after leaving the Puritan Machine Co.

Yellow Cab Manufacturing Co. reached its highest production in May, having shipped 425 cabs. Sales are still increasing and the schedule now calls for production of 20 cabs a day.

Excel Tire & Rubber Co. has been reorganized and the stockholders have elected the following officers: President, Mayor Fred Falk of Wadsworth, Ohio; vice-president, Robert Stephenson; secretary, W. I. Dague and treasurer, Z. N. Wallis. The board of directors is composed of Fred Falk, Earl Rickard, Z. N. Wallis, John Ewing, C. M. Wertz, Elton J. Brouse, R. E. Brown and Robert H. Stephenson. The company was recently lifted from a receivership and it is expected that the plant will soon be operating at full capacity.

Black & Decker Manufacturing Co. has established a new Detroit office in the General Motors Building. C. G. Odell, assistant to the president, will use this office as his base, in addition to which it will provide headquarters for the local Detroit representative.

Auto Metal Body Co., Springfield, Mass., is increasing its force and expanding its quarters for the production of Hupmobile bodies. New machinery is being installed. Part of the work is being done temporarily by the Wason Manufacturing Co. at its car shops.

Stewart-Warner Speedometer Corp. sales for the first ten days of June were slightly greater than for the corresponding periods last month and 135 per cent more than a year ago. Last month broke records with the company and the second quarter is expected to make new high marks.

Pennsylvania Pump & Compressor Co., Easton, Pa., has opened a direct district office at 105 West Monroe Street, Chicago, with H. M. Montgomery in charge.

WARD LA FRANCE SOLD

ELMIRA, N. Y., June 22—The property of the Ward LaFrance Truck Corp. has been sold by the receivers to Walker Motors, Inc., of New York. It is proposed to remove the plant to New York and manufacture for the market there a truck similar to the Ward LaFrance.

METAL MARKETS

PRESSURE for early shipments exerted upon steel mills by automotive consumers continues to be one of the outstanding market features. The somewhat more nervous feeling with reference to what the transportation situation will be at the beginning of July tends to intensify this condition. While the majority of automotive buyers of steel do not appear greatly perturbed by the spectre of a railroad strike, they recognize the fact that the shipment of numberless bulk commodities has been deferred until July 1 because of the then effective freight reduction, and the congestion of traffic which must thus be figured with as a possibility makes every one in need of steel for July operations anxious to expedite as much as possible shipments during the remainder of June.

In the sheet industry the situation is strikingly odd. Most of the independent rollers are working, in so far as concerns the bulk of their production, on orders booked at $2 to $5 a ton below the levels which they are now quoting for third quarter shipments. A considerable amount of this tonnage for which sheet mills are obligated to consumers will keep pickling and finishing departments fully occupied during the first half of July, so that the placing of third quarter sheet orders in the expectation of obtaining large shipments during the first half of July is fraught with much difficulty. On the other hand, information obtained in the trade as to the extent of August bookings tends to confirm the impression that the mills have relatively little business booked for shipment during that month either at the now obsolete low levels or at the recently promulgated advances.

In fact, in the last few weeks there has been considerable modification of the premiums asked by independent sheet producers over the levels of the chief interest. This is ascribed by many to the peculiar situation with reference to orders for August shipment.

Pig Iron.—Automotive foundries are sounding the market for July and third quarter shipments. Some blast furnace interests have advanced prices recently, and it remains to be seen whether reduced freight rates and lower iron ore prices will bring any appreciable advantages to pig iron melters.

Steel.—Quite a few transactions in full-finished automobile sheets and cold-finished steel bars in which premiums are reported to have been paid took place of late between dealers and consumers. Makers continue to quote cold-finished steel bars on a 2 cent basis for carload lots and the independents' price for full-finished automobile sheets appears to be 4.75 cents, or $5 a ton above the price of the American Sheet & Tin Plate Co., which remains at 4.50 cents. The independents' quotation for cold-rolled strips is 4 cents base, and there are expectations that on this commodity there will be early upward revision in the American Steel & Wire Co.'s price, which at the beginning of this week was still 3.75 cents, base.

Aluminum.—Recent decision by the Republican members of the Senate Finance Committee to stand pat on the proposed duty of 5 cents per lb. on aluminum has so far failed to affect the market, which is of a steady routine character.

Copper.—Speculative lots press on the market and offset the reserve of producers who are holding their metal at a pegged figure.

Calendar

SHOWS

Sept. 23-30—New York, Closed Car Show, Grand Central Palace.

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

Dec. 3-9—New York, Eighteenth Annual Automobile Salon, Commodore Hotel.

January—Chicago, Annual Automobile Salon.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiserdamm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show, British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

July 17 — Baltimore, meeting, representatives of highway departments of ten Eastern states.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

Sept. 13, 14, 15—Annual credit meeting, Motor and Accessory Manufacturers Ass'n.

S. A. E. MEETINGS

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer Meeting of Society of Automotive Engineers.

Wisconsin Expanding Motor Bus Facilities

Service Increases 100 Per Cent in Month—Aero Express Cuts Travel Time

MILWAUKEE, June 20—Simultaneously with the announcement of the railroad commission of Wisconsin that motor buses operating as bonded carriers have increased 100 per cent in the last month, bringing the total number of bus lines to 126, the T. M. E. R. & L. Co., of this city, owner of the Wisconsin Motor Bus Lines, announced the inauguration of motor bus service between Milwaukee and West Bend, operating daily over Highway 15; between Okauchee and Oconomowoc on Highway 19; between Buena Vista, Hartland, Burlington and Rochester, with bus connections for Union Grove and Eagles Lake and for Lake Geneva, Elkhorn and Delavan at Burlington.

Within the city limits of Milwaukee, motor buses may soon be operating, if the plans of the Lincoln Avenue and South Division Civic Associations are carried out. Signed petitions for the bus lines have been presented to the public utilities commission of the Milwaukee common council and will be acted upon at the committee's next meeting.

Eight in Madison

The Lake Shore Transportation Co. is seeking a franchise to operate its buses into Milwaukee on Sheridan Road and connect Waukegan with Kenosha, Racine and Milwaukee. To date Winthrop Harbor has given its consent and Zion City has taken the matter under consideration.

The number of Madison's bus lines has already been increased to eight, connecting that city with points as distant as Milwaukee, Fond du Lac, Beaver Dam and Stoughton.

These bus lines are operating largely in competition with interurban lines, and the railroads offering faster and more comfortable travel, but the completion of an aero express line at Milwaukee threatens to quicken the competition in the transportation fields of the state.

The first aero express line between Milwaukee and Chicago was recently placed into operation, enabling passengers to make the 90 mile hop in 45 minutes, according to T. F. Hamilton, president of the Hamilton Aero Products Co., who will pilot one of the two planes on the line. The trains will be closed three-passenger Lincoln runabouts with a double seat for two passengers in front of the pilot. They can make the trip in one-half the traveling time of the fastest limited train.

Birthday of First Sale of Franklin Celebrated

SYRACUSE, June 20—The employees of the Franklin Automobile Co. yesterday celebrated the twentieth anniversary of the sale of the first Franklin car, June 19, 1902, to S. G. Averell of New York. The car was on exhibition throughout the day beside a late model of the Franklin product.

The demonstration took place in the yard of the company and included music by the employees' band and addresses by Mayor John Walrath of Syracuse; S. G. Averell of New York and E. D. Winkworth, president of the Solvay Process Co., Syracuse, representing the Chamber of Commerce.

Dealer Loses All Equity in Car Sold Bootleggers

BIRMINGHAM, June 17 — A far-reaching decision which will result in the inauguration of radical changes in the methods of selling automobiles on credit in Alabama has been rendered by the Alabama Supreme Court. As a result, persons desiring to use motor cars for the illegal transportation of liquor will soon discover that their credit rating with automobile companies is negligible.

Under the decision dealers must use due diligence in ascertaining whether or not the purchaser of a car intends to use it for an illegal purpose.

Argentina Prepares for November Show

Early Start Indicates Efforts Officials Are Making to Insure Success

BUENOS AIRES, May 22 (*By Mail*) —The officers of the Argentina Automobile Club, desirous of holding the annual automobile exposition scheduled for next November on a larger scale than in previous years, have already begun working out preliminary plans toward this end. Circulars have been addressed to all firms engaged in the distribution of motor vehicles inquiring as to what extent they intend supporting the show.

The fact that the club has taken up the question of the annual show so early clearly indicates that its officers intend to do everything in their power to give the show all the prestige it deserves on account of the quality of the cars exhibited and also because of the demonstration it affords of the purchasing power and taste of the Argentine public.

New Features Planned

A great many new features for the coming show have been planned and it is confidently expected that the exhibition this year will be a real exponent of the progress made by motor vehicles in Argentina during the last twelve months. It is now stated that one company will install a model assembling plant on the grounds of the exposition in order to demonstrate the rapidity with which cars are assembled, and no doubt this innovation will attract much attention.

The success already achieved has exceeded the most optimistic hopes expressed by the authorities of the club some months ago. Special efforts will be made to show to the best advantage the latest models. This part illustrates how the automobile dealers here view the future and with what great efforts they are endeavoring to place the automobile upon a high plane of use in this country.

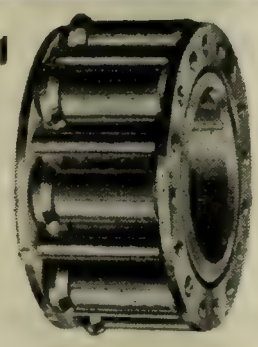
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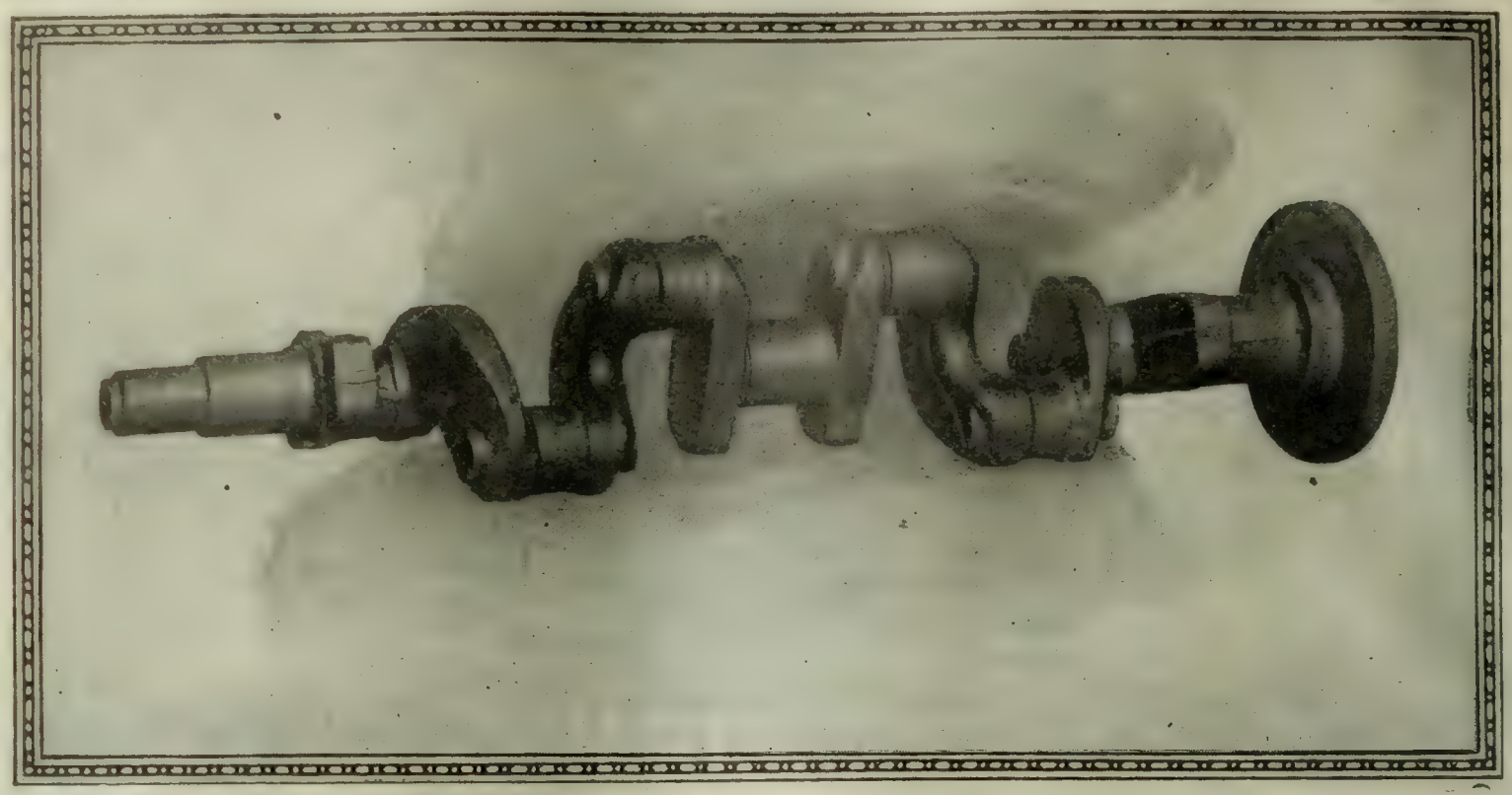
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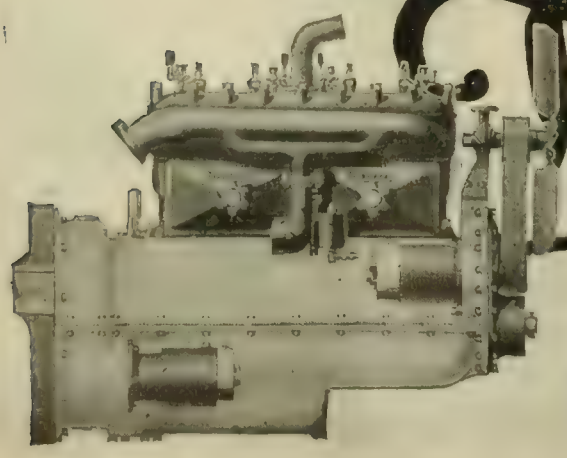
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Normal View *Deflected View*

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLVI NEW YORK—THURSDAY, JUNE 29, 1922 No. 26

S. A. E. Completes Successful Summer Session

General Motors announces new anti-knock fuel. Motor bus discussions lead in interest. Petroleum companies well represented. Herbert W. Alden nominated for S. A. E. presidency. Metropolitan Section wins sports championship. Attendance 560.

By David Beecroft

WHITE SULPHUR SPRINGS, June 24.

PRACTICALLY all of the 560 S. A. E. members and guests who have spent most of this week at this delightful resort in the lap of American colonial life are agreed that no finer place was ever selected for an S. A. E. summer meeting, and express the hope that future summer meetings will be held here.

From the S. A. E. convention viewpoint White Sulphur Springs is a fine combination of conveniences. Excellent hotel accommodations—at a quite high price, however—most pleasant weather, excellent grounds, an 18 and a 9-hole golf course, good tennis courts, an ideal swimming pool, fine trails for horseback riding and good facilities for general sports make it ideal for such meetings.

White Sulphur Springs, situated at 2000 ft. altitude, in a very pleasant valley of the Alleghenies, is an ideal recreation point; in fact, almost too good from this standpoint to insure adequate attendance at technical sessions. It has the disadvantage of being quite a distance from the East and almost as far from the West. It is by train nearly as far from New York City as from Chicago.

The attendance of 580, of whom 125 were women, was nearly 100 short of reservations, many cancellations being made just previous to the meeting. Undoubtedly the $10 deposit required on hotel bills made this somewhat easier than in former years where all hotel accommodations had to be paid for in advance. The industry was fairly generally represented, although the usual number of passenger car engineers were not present. The aeronautical session was poorly attended, beginning with a dozen and ending with 40. This indicates, perhaps, that New York City is the best place for an aviation meeting in these days of depression in matters relating to aerial transportation. The program had nothing specific on farm tractors and the attendance of farm tractor engineers was small, not over three or four being present.

More petroleum and lubricating engineers were on hand than ever before, at least ten of the large gasoline and oil producing concerns being represented. This is something of a compliment to the fuel research program that the S. A. E. has pioneered so constantly for four or five years, and a further indication that at last the petroleum producers have realized the necessity of research and the great desirability of their working hand in hand with the S. A. E. in solving the fuel problem. The S. A. E. research activities of the past year have been largely responsible for this.

S. A. E. Leaders

Present and Future



B. B. Bachman, President

Herbert W. Alden, Nominee for President



The motor bus business, perhaps, was the greatest magnet of the meeting, over 165 being present when Col. Green, of the Fifth Avenue Coach Company, gave a summary of his masterly paper and made one of the best presentations of a paper in S. A. E. history. It was an object lesson in how to present a paper without reading it.

As Green tersely expressed it, his paper was the consensus of opinions of his company on bus design and operation, rather than the ideas of one particular person. The paper provoked the widest discussion and indicated the great interest the industry is taking in the bus problem. The large attendance contrasted strongly with two years ago when Col. Green presented a paper on the motor bus at Ottawa Beach, when the attendance was very small. The bus has taken hold of the industry in the last year.

The oft-heard criticism of "not time enough for discussion" came up particularly with the final session this morning, which was cut off at 12.30, a half hour early because of the Detroit train leaving at 1.15. Post mortems are always easy, but it is a good rule to always give a little more time for discussion than may be thought necessary. As several engineers expressed it, the engineer who attends the meeting and who has read the paper previously attends largely to hear the discussion and at a summer meeting it would be a good plan to give 40 per cent of the time to presenting the papers and 60 per cent for discussion. The present rule of 50-50 scarcely gives enough time for members to discuss. A suggestion that evening sessions be held for discussion that could not be completed at forenoon sessions is well worth considering.

Lubricating oils created real interest as was first demonstrated in the Standards meeting when the suggestion was made to standardize ten grades of lubricating oil, and again when there was no time to discuss the two papers on oil pumping and oil consumption. This lack of time brought a strong protest from members. Some oil members were very positive that if engine cylinders were more accurately machined and piston rings and pistons better fitted, there would be much less oil pumping and a lower oil consumption.

The news that the General Motors Research Laboratories fuel "dope," tetra ethyl lead, would soon be on the market and would be sold through oil refineries, created special interest. This anti-knock liquid was demonstrated in a passenger car in which many members had demonstrations. Thos. Midgeley, Jr., General Motors Research Laboratory, advised that this "dope" will sell at approximately $50 per gallon and that gasoline blended with this would sell at 2 to 3 cents per gallon more than regular prices. The doped fuel will cost refineries about 1 cent per gallon. The volume necessary to use approximates 1 cubic centimeter per gallon. Production of this anti-knock, as it is generally designated, will be on a commercial scale this fall. For some months Mr. Midgeley has been perfecting equipment for its manufacture in quantity.

H. M. Crane's suggestions for improvement in rear spring suspension created considerable interest, his design being a semi-elliptic rear spring shackled at both ends and rigidly bolted to the axle. It is mounted so as to be higher at the rear end than at the front, and works with a radius rod from the frame side member well ahead of the axle to an arm extending downward from the axle housing. The shackles permit the axle of movement longitudinally with respect to the frame as well as vertically.

P. M. Heldt's analysis of engines with overhead camshafts developed the fact that this design is more accessible that generally considered and that in racing practice engines of this design have demonstrated that they can be quickly dismounted. This information, advanced by F. S. Duesenberg and Abell, did not convince all of the doubting Thomases. The task of servicing such engines in the garages of the country is a subject that admits of future analysis.



Daily S. A. E. Staff

That a production session of the S. A. E. is to be held during a couple of days in Detroit in October and made an annual affair is certain to have an influence on future summer meeting attendance. You heard the criticism this week that there were not enough of the factory department heads at the meeting, not so many attending as in former years. It is highly probable that sessions such as those at the contemplated production meeting in October will subtract from the summer meeting attendance and may demand some alterations in the summer meeting program.

Production sessions will afford opportunity for factory visits and will bring factory department heads together once a year at a much lower expenditure of time and money than is possible at summer meetings.

There can be no doubt but that the conflicting convention of the Automotive Equipment Association at Colorado Springs kept quite a few away who otherwise would have swelled the members at White Sulphur Springs. It is very difficult to prevent conflicting dates of this character.

Perhaps not in any previous year has the nominating of a slate of officers created greater interest than this year and the nomination for president of Herbert W. Alden, of the Timken-Detroit Axle Co., who in 1912 as vice-president, filled out an unexpired term of Henry F. Donaldson, deceased, met with unanimous approval. The selection of H. M. Crane as first vice-president was equally popular. The council is reinforced by several men who have played a strong part in S. A. E. affairs. Horace M. Swetland, president of the United Publishers Corporation and Class Journal Company, and who has been chairman of the Finance Committee for several years, is a council nominee, as are also W. A. Christ, chief engineer of the Delco Co.; Arthur J. Scaife, consulting engineer of the White Co., and F. W. Gurney of the Gurney Ball Bearing Co.

The Daily S. A. E. was a most creditable production, one of the best the society has had, and a standard worthy of emulating in the future, was set up.

The summer meeting is always a fertile spot for airing section activities, and no subject was more discussed than that of getting larger attendance at monthly meetings. Many sections have great difficulty in getting section members, so many members of the S. A. E. not joining sections. There was considerable comment to the effect that there should be no section dues. Suggestions were made that section officers should give more attention to proper staging of section meetings. It is certain that section work is in need of considerable attention.

The S. A. E. summer meeting is always a good thermometer of business conditions as a large percentage of the number in attendance represents the sales and business end. This year was no exception in this regard. Members from concerns manufacturing parts were all optimistic. Many are working at 100 per cent capacity and adding help daily. A drop of perhaps 10 per cent in production in July and as much as 15 per cent by August and perhaps 25 per cent in September is looked for with a gradual increase of business in the fall. Many parts makers have orders to keep them busy for two months and future commitments are increasing.



Meetings Committee—L. C. Hill, Orel A. Parker, M. P. Rumney, John R. Cautley, M. C. Horine

An improvement in tractor sales is looked for this fall, but little improvement in farm machinery sales is anticipated. The farmer is repairing his farm implements. A decided pickup in motor car sales with farmers is looked for with the progress of harvest. Sales so far this year have been very largely from cities and urban areas and the entry of the farmer into the market should have a stimulating effect.

Sports this year absorbed greater interest than in former years, golf in particular, running away with ma-



The Nominating Committee

jor interest. In fact, the Greenbriar corridor after breakfast resembled a golf tournament more than an engineering convention, so omnipresent were linen knickerbockers and every design of Scotch plaid stockings imaginable. Tennis did not have so many devotees as formerly. The evening of competition in the swimming pool was a great success. Trapshooting is gaining in popularity, but in general field day sports on Thursday afternoon were not so generally entered into as formerly.

The S. A. E. summer convention offers an ideal opportunity for men of the industry—engineers, factory executives, sales heads, etc., to get together. There can be no doubt but that this getting together and the general exchange of views is one of the great assets of such a convention, and a phase of it that must not be neglected or overlooked. The aim of future meetings is to increase these, but also to increase in still greater attendance the number of engineers. The engineer provides the technical program that makes the meeting possible and he must attend in increasing numbers.

Research Aimed at Solution of Fuel Problem

Automotive and petroleum industries are co-operating as never before.
New knock preventive announced by General Motors.
Lubricating problems also discussed.

By Herbert Chase

BOTH the automotive and the petroleum industries are rapidly wakening to the need for fuel research as an aid in conserving our fuel resources. Years of effort on the part of those who foresee a serious stringency in the fuel situation of the near future are beginning to bear fruit. The automobile industry, through the National Automobile Chamber of Commerce and the petroleum industry through the American Petroleum Institute are at last definitely co-operating to the end that the largest possible number of miles per barrel of crude oil be obtained by learning what character of gasoline can be obtained in a quality suited to give greatest mileage so far as a given amount of crude petroleum is concerned. This has been brought about largely through the persistent efforts of the Society of Automotive Engineers, whose members have shown their interest at many times, but never with more enthusiasm than at the present meeting.

The practical value of research is coming also to be more fully realized, and since the fuel problem is of paramount importance, it is natural that research effort should be turned in that direction. After several months spent in organizing and study of problems requiring early attack, the S.A.E. Research Department is coming through with a highly constructive program and is using its effort to see that this program is carried through as expeditiously as possible.

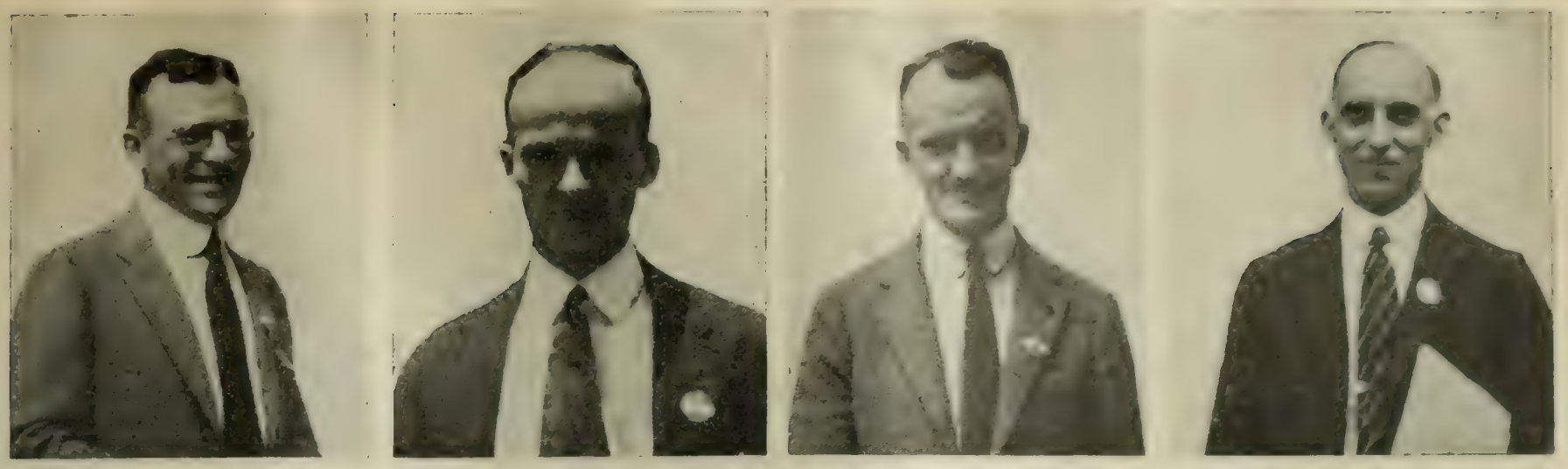


Thomas Midgley, Jr., foster father of tetra ethyl lead of the anti-knock family, is engineer of the Fuel Division, General Motors Research Corp.

Among the most interesting things which developed at the Research Session was the statement by Thomas Midgley, Jr., of the General Motors Research Laboratory to the effect that his organization has discovered and developed a process for making an anti-knock substance which can be added to gasoline and will thereby prevent detonation even when an engine of very high compression is employed. This substance known as tetra ethyl lead, unlike many of the other substances experimented with, is made from materials which are available in practically unlimited quantities and can therefore be very widely used. It is furthermore the most effective of numerous anti-knock substances with which the General Motors Research Laboratory has been experimenting for a number of years. It is made from alcohol and lead by a special process the nature of which has not been revealed. It has the chemical formula $(C_2H_5)_4Pb$. Midgley stated that one c.c. of this liquid added to a gallon of the average commercial gasoline now sold in this country will prevent knock in an engine of the average compression pressure used in this country today. For higher compressions the amount of tetra ethyl lead required to prevent detonation must be increased, but the greater economy obtainable at higher compressions is said to more than offset the added cost. It is understood that the most economical compression ratio which can be employed when this anti-knock substance is used, cost of the substance and fuel considered, is about 6½ to 1. With this compression ratio about five c.c. per gallon of "dope" is required. It is the plan of the General Motors Co. to market this product through petroleum refiners who will add it to gasoline before it is distributed. While the tetra ethyl lead is rather expensive to manufacture it is thought that it can be marketed at a price which will enable the refiners to retail gasoline thus treated at a price of about 2 cents per gallon advance over that charged for untreated gasoline.

The writer was given an opportunity to ride in a car which when pulling knocked badly on ordinary gasoline, but which ceased to knock entirely even on heavy pulls when the new dope was employed.

The subject of greatest interest discussed at the Fuel and Engine Session on Saturday morning was that of the special apparatus developed at the Bureau of Standards



Some prominent contributors to the Fuel and Research Session. Left to right—Frank C. Mock, Stromberg Motor Devices Co.; Wm. S. James and C. T. Coleman, Bureau of Standards; H. C. Dickinson, manager S. A. E. Research Department

for making accurate determinations of car performance on the road. A car equipped with this apparatus, driven to the meeting place from Washington and was exhibited and demonstrated to those interested and the apparatus itself, together with the reasons for its development were described by W. S. James, who is in charge of the testing work relating to fuels which is to be conducted at the Bureau of Standards in co-operation with the S. A. E. Research Committee. The apparatus will probably be described in detail in these columns at a later date, but a few particulars concerning it will be given here. It is designed for ready application to practically any passenger car or truck and is intended to give an autographic record from which instantaneous values of the various factors to be determined can be made, with an accuracy within about 5 per cent of the true value. To secure the desired information it is necessary to measure the rate of fuel input to the engine, the power output of the engine and to identify the conditions under which the engine is operated. This is done by determining instantaneous values of the rate of fuel flow, the rate of air consumed and by taking certain readings with an accelerometer developed especially for the purpose. The wind velocity and its direction as well as the speed of the car are determined. Other readings taken include engine speed, manifold depression, temperature of inlet and outlet cooling water, temperature of lubricating oil, temperature of air entering engine and spark position.

Practically all of these readings are recorded graphically on a single chart over which several pens are moved in the manner employed in conventional recording instruments.

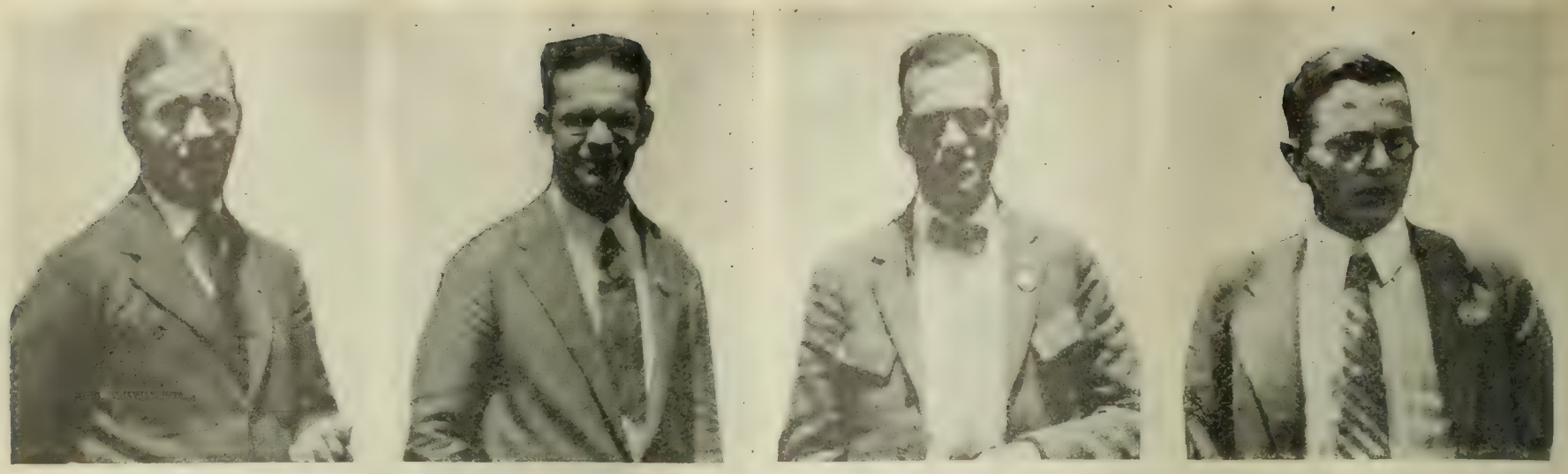
It is believed that the use of this apparatus will enable determinations of many factors concerning which little is now definitely known. O. C. Berry, who presided at the Saturday morning session, said that it is hoped the apparatus will eliminate much of the guesswork which is now prevalent in road testing because of the lack of satisfactory methods and apparatus.

These, in brief, are outstanding facts made clear by the Research and Fuel sessions of the semi-annual meeting. In addition much interest attaches to certain specific reports on particular phases of the problems presented in efforts to satisfactorily use fuels as we have them to-day and are likely to find them to-morrow. Midgley, Mock, James, Coleman and others have presented reports of value at this meeting and other reports of progress have been heard while much research, details of which have not yet been made public, is known to be in progress.

A change had to be made in the program for the session on Thursday morning for the reason that James, whose paper on Fuel Volatility Research at the Bureau of Standards was to have been presented, found that he could not complete his arrangements for the demonstrations with which this paper was to be accompanied, until Saturday. H. M. Crane, who presided at this session, said that sometime ago James conceived the idea of making a much more detailed study of the subject of fuel consumption of cars on the road than is



This is not a crap game, but a group of engineers observing the cremation of tetra ethyl lead, the new fuel "dope" which Midgley exhibited



Left to right—Prof. W. K. Hatt, author of the paper on Highways; G. A. Round, who presented the paper on Oil Pumping; M. A. Thorne of the Bureau of Standards, and A. A. Bull, author of the paper on Oil Consumption

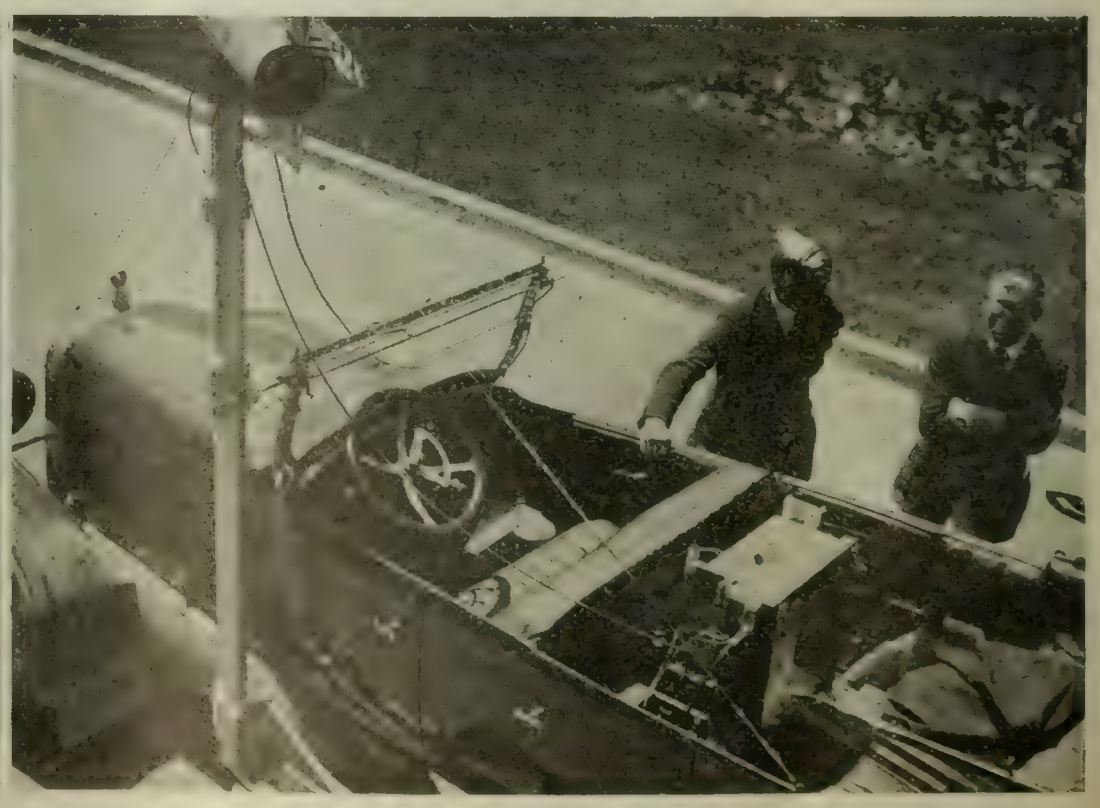
usual. He planned not merely to determine the number of miles that could be obtained per gallon but to study the variation in the rate of fuel consumption with variations in road and grade change in speed, etc., so that he would be able to plot alongside of or superimpose upon a road profile a curve of fuel consumption corresponding thereto. The value of this work appeared so plain to the Research Department of the Society that it decided to secure support for it. Funds as well as the co-operation of both the National Automobile Chamber of Commerce and the American Petroleum Institute were obtained through representations made to these organizations, which agreed also to support the undertaking by providing materials and the necessary personnel. When this work has been carried through to completion we shall have a much better picture of how gasoline is used in road service, said Crane.

C. T. Coleman of the Bureau of Standards, presented a preliminary report covering road tests made on fleets of trucks operated by the Post Office Department in Philadelphia and Pittsburgh, using four different grades of fuel, of different degrees of volatility. The first 20 per cent of these various fuels distilled over at substantially the same temperature, so that the starting characteristics of all four fuels were substantially the same. The fuels were designated by the letters A, B, C and D. Of these, grade B represents the average fuel which is being marketed for general automotive use today. Grade A is somewhat more volatile; Grade C less volatile and Grade D still less volatile. It was estimated by the refiners that if the production of grade B from one barrel of crude oil were set at 100, that of grade A would be 80.9, of grade C, 114.4 and that of grade D 124. The reason for selecting Philadelphia and Pittsburgh for making the tests is that they afford practically opposite extremes in conditions with respect to grades. The equipment used in the tests includes Ford, G.M.C., Packard, White and Riker trucks varying in load capacity from ¾ to 3 tons. Each truck is operated for one week on one fuel, and careful determinations of the mileage per gallon with the different grades of fuel are made. The amount of crank case dilution during each week is also determined, the following method being employed. A sample of the fresh oil is taken and its boiling point determined. At the end of the week the oil is drained from the crankcase and sent to the laboratory for the dilution test, which is made by distilling off the light ends until the oil has the same boiling point as originally. The amount of loss by distillation then represents the dilution.

The results obtained thus far show that a considerably greater mileage is obtained with the gasoline from



Apparatus used by Midgley and Boyd in measuring the relative detonating values of various fuels



Car equipped with the special apparatus, described by James of the Bureau of Standards, for measurements of performance in actual use

a barrel of crude if the heavier or less volatile grades of fuel are used, but at the same time there is considerably more dilution of the crankcase oil with these fuels.

In the discussion of this report, H. M. Crane, commenting on the tables and charts accompanying it, observed that in Philadelphia the best results were obtained with the normal fuel, grade B, and that this indicated the detrimental effect of any attempt to vary the volatility, a matter that had already been taken up with the Petroleum Institute.

Dilution of Crankcase Oil

P. S. Tice asked how the dilution of the crankcase oil was determined, saying that results varying almost 100 per cent could be obtained, according to the apparatus used. Coleman replied that the regular 100 cubic centimeter distillation flask was used. In reply to another question Coleman said that the lubricating oil used in the trucks in the two cities was of the same brand, but that two grades in respect to viscosity were employed. In some of the trucks the use of the heavy grade would have been impracticable. The specific gravities of the two grades used were 0.906 and 0.931 and their viscosities at 100 deg. Fahr. 316 and 408 sec. Saybolt, respectively.

P. J. Daisey said that in his own determinations of crankcase dilution, he made it a practice to first operate the engine on city gas and then make a test for light ends in the lubricating oil from the crankcase. This showed the effect of heat upon the decomposition of the oil, a factor which he concluded formed light fractors often attributed to fuel dilution. Next he operated the engine on liquid fuel for the same period of time and under the same load, and then made another determination of the crankcase dilution, which in this case would be greater. The difference between the results in the first and second cases represented the dilution from the heavy ends of the fuel. Under these circumstances it seems unfair to the oil men to charge all of the light ends in the crankcase oil after use to poor fuel.

Carlson of the staff of the Bureau of Standards gave a brief résumé of the work which had been done by the S. A. E. and the Bureau in further study of the fuel problem, using the James and other apparatus. He explained that they had arranged for a series of tests on passenger cars similar to those made on trucks as described by Coleman. Ten different automobile manufacturers are to furnish the cars for this purpose, and it is the plan to apply the tests as nearly as possible to average cars under average driving conditions. These tests will be made at the plants of the car builders. In connection with the tests at the Bureau automobile manufacturers and oil refiners have volunteered to send some of their research men down to Washington to assist in the work. A committee from the S. A. E. will also go to Washington in the near future to study the plans for the test. The cars will be run over a measured course and the instantaneous as well as the average rate of fuel consumption will be measured.

Hot Spot Not Mysterious

The paper by F. C. Mock and M. E. Chandler on the use of less volatile fuels (printed in these columns last week) which had been scheduled for presentation at the Saturday session, was read at Thursday's session to take the place of the paper by Mr. James deferred to the Saturday meeting.

In opening the discussion Chairman Crane said he was glad this paper had been presented as it showed there was nothing mysterious about the action of the hot spot, as some would make us believe. He referred to Mock's experiments on the vaporization of alcohol and his statement that under certain conditions an acetic acid odor was distinctly noticeable in the exhaust. Some years ago he used a fuel mixture known as Alcogas for a period of about a year, and as a result the bottom of his muffler, which was made of No. 16 gage sheet steel, had entirely rusted through. The muffler, he said, always had a tendency to act as a condenser and even when using gasoline he had often found water in it, but although water also has a corrosive action he had never observed anything like the destructive effect with gasoline as with the alcohol mixture in the case cited.

Thomas Midgley, Jr., gave a brief account of the latest development in the line of fuel "dopes" or anti-knock preparations upon which he has been working for several years. He showed a small bottle of tetra ethyl lead which he said had very strong anti-knock properties, one cubic centimeter being sufficient to counteract the knock producing tendency of 1 gal. of any fuel. In reply to a question by G. A. Green, Midgley said that the anti-knock preparation is not yet ready for the market, difficulty having been experienced in obtaining sufficient raw material. Present costs are such as to indicate a selling price of about $50 per gal.



P. S. Tice and O. C. Berry, two prominent contenders in the Fuel and Research Sessions

Dr. H. C. Dickinson, manager of the S. A. E. Research Department, outlined the history of the department since its organization, indicated why the universities are the principal bases of operation for pure research, described how the department functions as a clearing house with regard to research data and commented upon the bright prospects for the future. He enumerated also the facilities the Research Department has for the co-ordination of research problems.

The practical achievements of the department, he said, resulted from its recent concentration upon the two major projects of study with regard to the tractive resistance of roads, and to the fuel testing program. The Bureau of Standards and the Bureau of Mines have been enabled to continue their elaborate research programs through assistance rendered by the S. A. E. Research Committee.

Supplementary road tests now being conducted by nine different automotive vehicle companies were outlined, and the factors governing the selection of fuels for test purposes stated and commented upon.

Mr. Littell in discussing Dickinson's report said that he had attended a meeting of the Petroleum Institute at Chicago last fall, at which it was plainly intimated that we must prepare for the use of heavier fuel in the near future. In view of this fact he thought the efforts in the proposed research work on fuels should be concentrated on methods of using less volatile fuels. Crane expressed the view that there is more opportunity in changing the fuels than in changing the engines.

Also, we must not loose sight of the fact that there are now in use in the country a tremendous number of cars which cannot be radically changed to adapt them to new fuels. If the proposed tests resulted in an average increase in fuel economy of only 10 per cent, it would be equal to wiping out the effect of the addition of one whole year's production to the cars already in use.

Prof. E. P. Warner asked whether it was planned to cover also suubstitute fuels and fuel mixtures in the tests. In the vicinity of Boston a benzol mixture is sold in large quantities and there are those who swear by this fuel, especially owners of comparatively old cars which have engines with a high compression ratio. Dickinson said that it was not contemplated to extend the test to any but straight petroleum fuels for the present, and gave as one reason that it was not well to introduce too many variables. He considers that the grade D fuel selected for the tests, which has an endpoint of 586 deg. F., is about the heaviest fuel that it is practicable to use with present day equipment.

Dasey suggested designing all new engines so as to be capable of taking care of heavier fuel than regularly marketed at the present time, say with an end point of 550 deg. Fahr. On the other hand, such devices as are being developed by Tice and Mock, among others, will help, he believes, to take care of the older automotive vehicles, permitting of adapting them to the heavier fuels.

Littell said that we should not give the oil men the impression that we could properly handle the 550 deg. endpoint fuel. We must remember that there are 10,000,000 old cars in service and they would certainly be most troublesome if operated on such fuel. He did not believe that the oil people were giving us the best fuel they could. What he would like to see was more of the kerosene cracked and less mixed with the gasoline. The oil men should also be given to understand that the automobile industry is prepared to accept a slight increase in the cost of fuel if that made possible a material increase in the quality. What the automobile men are interested in is not so much the number of gallons per dollar as the number of miles per dollar.

Less Volatile Fuel in the Future

The discussion of James' remarks was limited owing to lack of time to a few questions concerning such items as the balance of the recording pens and their friction on the paper, and the effect of grade and spring friction on the accelerometer readings. James replied that the high paper speed and vibration would overcome frictional distance to pen motion and that the accelerometer takes into account grade over which the car is passing. He drew attention to the fact that the accelerometer used is dead heat and is so arranged as to be practically unaffected by temperature changes.

There was apparently considerable interest in the paper by Midgley and Boyd on the Detonation Characteristics of Some Blended Motor Fuels, which is printed on another page of this issue, but time prevented any extensive discussion of this paper. It was brought out that the important effect of spark position upon detonation had been taken care of in the tests reported by setting the spark to give approximately the maximum power in each test, but making certain that it was in precisely the same position for the particular fuels under comparison.

Oil Consumption and Pumping

The last two papers of the Saturday morning session dealt with the subject of oil pumping and oil consumption. Lack of time interfered with any extensive discussion of these papers, but it appeared to be the opinion of the few persons who spoke that trouble from oil pumping and high oil consumption can be minimized by making certain that the cylinder bore is perfectly true and that the piston and rings are well fitted.

A brief abstract of the paper on "Oil Pumping," by George A. Round was printed in last week's issue, but it may not come amiss to add a few more points here, particularly concerning the new device for preventing crankcase dilution.

Mr. Round referred to the influence of the ring pressure per unit of cylinder contact area on the oil consumption and said that by cutting down the bearing surface of the rings in an aircraft engine by one-third the oil consumption was decreased about 30 per cent.

All of the three methods of reducing the bearing surface of the ring, illustrated in Fig. 1, are equally effective in this respect. Of course, if the bearing surface is reduced very much, the unit pressure becomes so great as to squeeze out the oil, and this will result in rapid wear. Mr. Round thinks that a reasonable working limit is such that 2 lb. per inch of diameter are required to close up a ¼ in. ring. Much oil pumping has been traced to defective rings that bear only part way round the cylinder. The original cause may be either poor inspection of the rings or distortion in assembling them on the piston. From the standpoint of oil pumping there seems to be no difference between narrow and wide rings, as long as the unit pressure remains the same. However, the narrower rings wear the piston grooves less and are therefore preferable, especially in connection with aluminum pistons. Oil grooves with return holes are a great help in keeping down the oil consumption.

Three arrangements of the oil return holes on pistons are shown in Fig. 2. The one on the left has been extensively used, but the middle one has the advantage over it that the ring is supported over its whole depth on the lower side, and it will therefore not wear loose in its groove so rapidly. The arrangement illustrated at the



Fig. 1—Examples of piston-ring construction. The first three views beginning at the left show how the pressure of the piston-rings against the cylinder wall is increased by reducing the contact area, while the illustration at the extreme right shows a ring that is designed to remain tight in the groove

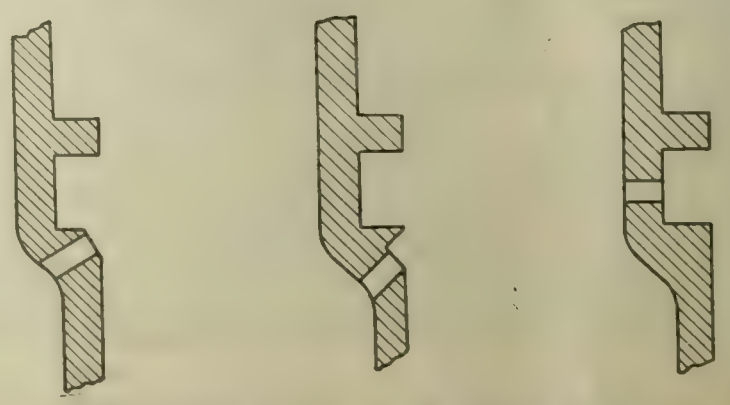


Fig. 2—Some forms of oil return grooves

right has been found the most effective with some engines. In V type engines the oil grooves should extend only half way around the piston and be on the lower side. As to size of oil holes, Mr. Round recommends 5/32 or ⅛ in. spaced 1½ in. The new type of constant clearance aluminum piston is self-draining and does not require oil return holes.

Considerable interest was evinced in the new method of preventing crankcase dilution, described in the paper.

Referring to Fig. 3, a connection, A, is made to the cylinder wall at a point that coincides with the lower limit of the travel of a groove " located on the piston below the ring next above the piston pin. A short vertical groove intersecting the circumferential groove and in line with the hole for the connection is also cut in the piston. The connection A leads to a heater C that is connected to the exhaust manifold by the pipe D and thence to the separator E. From the upper part of this device a connection, F, is made to the intake manifold G. The lower part of the separator is cut off from the upper by a valve and communicates with the crankcase. On the side of the piston opposite the connection a hole is drilled through the groove into the inside of the piston.

Factors Affecting Oil Pumping

In the operation of the device the suction in the manifold is communicated to the groove in the piston while the latter is near the bottom of its travel and during approximately 90 deg. of crank motion. The vacuum created draws into the heater any oil or oil and fuel mixture that collects in the groove and with it a small amount of air. In passing through the heater, the mixture is heated by the exhaust to a temperature of about 375 deg. Fahr. On reaching the separator, any fuel or water present in the oil is evaporated and carried into the manifold. The remaining oil is passed into the bottom of the separator from which it flows back to the crankcase.

In the discussion of this paper Mr. Kishline said that the amount of exhaust heat available at light loads was very small and he questioned whether this heat was sufficient to remove all of the light ends from the crankcase oil. Mr. Rounds replied that the tests referred to in his paper had been made in road service. Mr. Clayden asked whether the device had been used on engines fitted with constant clearance pistons, but Mr. Rounds said he did not believe it had been tried out on such engines as yet. Mr. Crane said he did not agree with the author's theory regarding the flooding of bearings. In his practice he gave the oil a free exit, using ⅛ in. shims not nearly touching the bearing, the rate of flow being dependent upon the size of the hole in the crank bearings. It was his practice to determine the best rate of flow experimentally, and he had used from 2½ to 25 lb. per square inch pressure on the oil. One had to remember that the pressure relief valve was the same for widely varying conditions of operation, from driving in the crowded thoroughfares of New York City to touring in European Countries. That this is possible is due to the fact that the centrifugal action on the oil leaving the crankshaft increases with the engine speed.

As regards pistons, he had found oil grooves and holes to be useless. It was his practice with cast iron pistons to allow 0.001 in clearance per inch of bore on the skirt or crosshead portion, and to place the piston pin substantially at the center of this portion. On top of this crosshead was the ring zone providing for three rings, and at the bottom of it was the scraper ring, this lower ring over-running the end of the bore.

The oil was trapped between the top and bottom rings, as shown by the fact that in an aircraft engine that had seen long use this portion of the piston wall was often quite

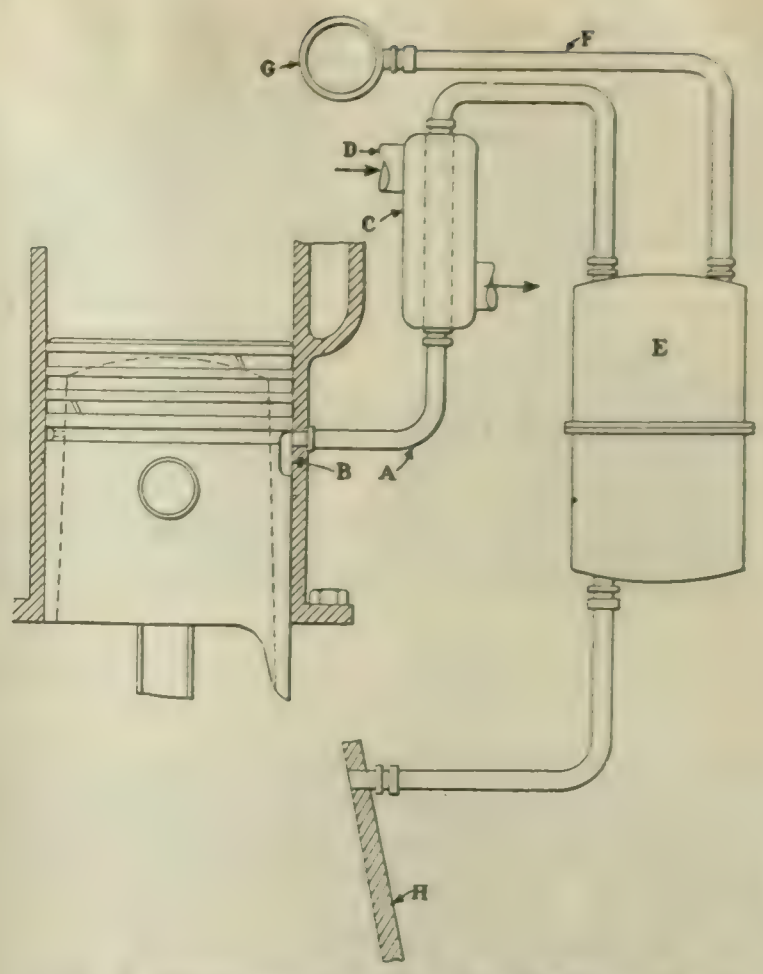


Fig. 3—Diagrammatic sketch of Skinner device for neutralizing the effect of oil pumping and fuel dilution by lubricant

black, showing that there had been no metallic contact. He claimed that the ordinary concentric ring performed every desirable function.

H. M. Crane, who was the principal speaker in the discussion, said that he advocated feeding plenty of oil through the engine bearings. The crankshaft, he said, acts as a centrifugal pump which tends to increase the rate of oil flow as the square of the speed, if the oil is fed to it with sufficient rapidity. This, he said, makes any special provision for varying the rate of feed with the speed unnecessary. Crane also advocated the use of a piston with a scraper ring at the bottom so arranged as to slightly overrun the cylinder bore. With this construction oil is trapped between the upper and lower rings and piston slap is thus prevented. It is important, he said, to have the sides of the ring parallel to the bore of the cylinder and to have the cylinder true in order to give the rings an opportunity to perform their function.

Crane and other speakers expressed the view that a plain slot in the ring is as good as any other type of joint providing that rings are well fitted to the piston and cylinder bore.

Crane Gives Test Results

Mr. Crane said that he had fitted aluminum pistons in an engine with 4⅜ by 5¾ in. cylinders, the skirt clearance being from 0.008 to 0.010 in. when the engine was cold, and had found that he could use 50 per cent more pressure on the oil when using a bottom scraper ring than when operating without it. With the scraper ring and rings of the ordinary concentric type he got low oil consumption and practically no carbonization. He then discussed some tests which he had made on an old engine.

In one case he ran some tests on an old engine in which the cylinder bore measured 0.009 in. more at the top than at the lower end, with very satisfactory results so far as oil consumption was concerned. This showed that the oil delivery could be controlled with the simplest means. A great deal of ingenuity had been expended on the elimi-

nation of the gap, and he asked his hearers to imagine what the gap between the ends of the ring must have been at the top end with the cylinder 0.009 in oversize.

A paper on Oil Consumption was presented by A. A. Bull, chief engineer of the Northway Motor & Mfg. Co. Mr. Bull raised the question as to what constitutes reasonable oil consumption and gave a table of the oil consumptions of a large number of truck and tractor engines a discussion of which will appear in a later number of AUTOMOTIVE INDUSTRIES.

Lack of time for sufficient discussion of the papers on pumping and oil consumption lead to the suggestion that these two papers be taken up again at some later session of the society or some of its sections.

Motor Bus Session Causes Widespread Interest

George A. Green outlines principles of bus design. Plimpton discusses suburban buses. Discussion spirited.

By Herbert Chase

THE great interest in the subject of bus design and transportation was reflected in an unusually large attendance at the session devoted to consideration of these subjects. This was in marked contrast to that at Ottawa Beach two years ago when G. A. Green also presented an interesting and valuable paper on bus transportation, but had only a small audience. Green, in summarizing his paper said that it had been written primarily for executives and therefore dealt more with fundamentals than with details, and could consequently serve as a guide to companies contemplating entering the bus building field. He stressed the importance of considerations of safety in design and of the need for a low center of gravity in attaining this objective. In reference to dependability he said that it is highly important to keep all units of a fleet in operation as much of the time as possible. Only seven days are allowed for the annual overhaul of vehicles in the fleets he operates while minor repairs are required not oftener than once a month. Buses must be kept in good repair throughout their life and are retired from use after five to seven years of service, not because they are worn out because of obsolescence.



G. A. Green of the Fifth Avenue Coach Co., whose paper on bus design and operation received much favorable comment

In the discussion, G. W. Cravens and T. V. Buckwalter drew attention to the fact that in the case of railway equipment it had been found that too low a center of gravity could be had and that this resulted in high side thrust when curves are taken at considerable speed. Green replied that the question of road clearance plays an important part in determining the center of gravity and establishes a certain low limit. The side stresses must be cared for by proper design in the way of thrust bearings and the like.

Replying to a question regarding the wear of sleeves used in the Knight engines of the Fifth Avenue Coach Co., Green said that they can be used for one year without replacement, and that regrinding of cylinders, necessary in other types, and the use of oversize pistons, is thus avoided.

M. C. Horine asked for Green's views in respect to body overhang, wheelhouse construction, use of clutch brakes and avoidance of clutch riding and the desirability of straight frame construction. Green replied that body overhang adds to the hazards of operation in traffic and is uncomfortable for passengers in the overhung portion of the body. The wheelhouse can be made to interfere but little with seating if a wide tread is employed and the housing is properly constructed. This is accomplished in the case of vehicles of his design, by the use of thin cast aluminum housings which conform as closely to the wheel and brake drum as it is feasible to make them. Clutch brakes are not used on the Fifth Avenue buses, because they are a detriment when changing from a higher to a lower gear. Clutch riding has not given trouble even though inclined toeboards are not used. It is considered that a flat floor is as comfortable for the driver as an inclined toeboard, since that is the natural position for the feet. Straight frame construction is employed on the single deck buses since they are a more general utility vehicle and must be capable of use on rougher roads. They consequently require greater road clearance and cannot be so low hung. On the double-deck jobs the frame has a kickup and the special rear axle is provided to help keep the center of gravity low and facilitate rapid loading and unloading.

Buckwalter expressed the belief that the bus will eventually replace the street railway because it is less of a hindrance to traffic, is more flexible, and can receive and discharge passengers at the curb.

Herbert Chase asked Green for an explanation of the low engine friction which is said to account in part for the good economy of the Knight engines used in the Fifth Avenue buses, saying that he could not understand why the Knight type should be superior to the poppet valve type in this respect. Green said he was unable to assign a precise reason for this low friction but gave the following figures and suggested that engineers interested compare them with those they may have on poppet valve engines: Friction hp. at 600 r.p.m. 2.2, at 800 3.1 and at 1000 4.5 hp.

E. W. Weaver commented upon the desirability of using the lowest possible engine speed for a given bus speed and said that he agreed with the statements in this regard in Green's paper. He expects, he said, to demonstrate the value of low engine speed in some experimental development upon which he is working.

Berry asked for an explanation of the claim made that the Knight engine is capable of using higher compression

SOME MEN WHO DISCUSSED THE PAPER ON BUSES



G. W. Cravens, Pres., Climax Eng. Co.



T. W. Buckwalter, Timken Roller Bearing Co.



C. T. Myers of Rahway, N. J.



A. J. Scaife, White Motor Co.

than poppet valve types, and stated that the plug location is not that which is generally supposed to be most advantageous since it is at a point where the mixture is lean rather than rich. Green replied that the central location of the plug had worked most satisfactorily even though it is not, according to some opinions, ideally placed. This appears to be borne out by the fact that the double-deck buses average about seven m.p.g. of fuel consumed or over fifty ton miles per gal., while the single deck models make 10 to 11 m.p.g.

Chase stated that he believed Green would be the first to agree that even the present day bus is far from perfection, and suggested that the advantages of the steam engine for bus propulsion should not be overlooked. He said the simplicity, high torque at low speed, steady pulling power, ability to give rapid acceleration and the fact that no gearset is required are all in its favor, though it possesses also certain disadvantages. He called attention to the successful operation of Clarkson steam buses in London.

Green replied that he fully appreciated the advantages of the steam engine but that he had chosen to develop the type using an internal combustion engine partly because of his greater familiarity with that type. He readily agreed, he said, that even the most advanced of present bus designs are scarcely in production before possible improvements are discovered, and that there is much development required before even an approach to perfection is realized. He favors intensive study of the subject and the development of steam as well as other promising types.

Plimpton on Present Day Buses

R. E. Plimpton, in presenting his paper entitled Some Fundamental Characteristics of Present Day Buses, dwelt to a considerable extent upon the country or suburban bus which is widely used in rural and semi-rural communities. The numerous problems involved in its operation were enumerated, these including highway upkeep, taxes and related matters. Taxes, cost of bond and other items of similar nature which must be paid before any income can be earned on bus equipment, amount in New York State to upward of one thousand dollars per vehicle, said Plimpton. Operators do not greatly object to taxes, he added, providing the authorities who collect them do their part in keeping the highways in repair and open for use in all weather. In reference to the city bus Plimpton called attention to the fact that Paris operators have recently added fifty more six-wheel buses seating 48 passengers. He mentioned also the possible development of a six-cylinder engine for bus service especially for long distance service in which high speeds are attained.

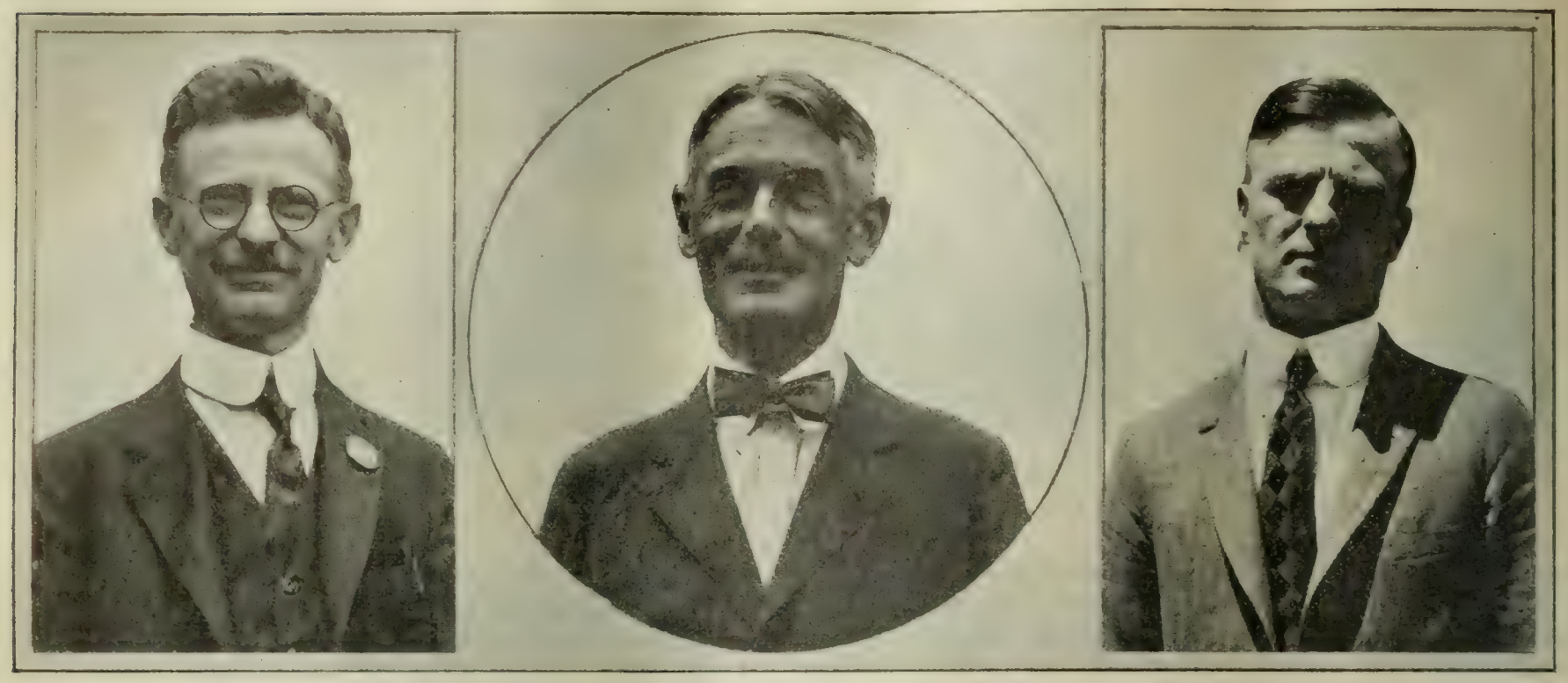
Green, in commenting upon the subject of six-wheel buses and six-cylinder engines for bus use, said that it is far better to reduce than to add to the number of parts employed. Suggestions for simplifying the construction of the Fifth Avenue Coach Co. are always given serious consideration as added parts increase first cost and maintenance expense. A four-cylinder engine of 300 cu. in. displacement or less Green considers adequate for all save very high speed bus transportation over very long distances. The addition of two extra wheels or two additional cylinders he considers folly. The six-wheel buses used in Paris, which Green said he had examined carefully, are, he believes dictated largely by the French temperament, although a more rapid loading and unloading is claimed for large single-deck buses of the six-wheel type as compared to the double-deckers of conventional type used in Paris.

Passenger Capacity of Buses

Cravens stated that he is interested in a company which is developing a steam bus, and that he believes there is much to be said in favor of this type. The type which gives lowest cost per passenger mile is, however, bound to be given serious consideration. He asked concerning the most desirable seating capacity for buses intended for a general sale throughout the country. To this Green replied that his concern considered that single-deck buses seating from 25 to 29 passengers and double-deck jobs seating 50 to 55 were most generally applicable. There may, he added, be some market for a 15 passenger bus, but since labor costs are such a large item in operating expense it is difficult to make so small a bus pay. In this connection it was pointed out that the London General Omnibus Co. had found it necessary to increase the seating capacity of its buses from 34 to 46 and then to 54 in order to make a profit in the face of increasing labor costs. Green stated that a company which at first starts with small single-deck buses often finds it desirable to purchase double-deckers later, but that the single-deck job is then still useful and economical, especially when traffic is light or in weather when an upper-deck cannot be used.

A. J. Scaife said that many street railways which had at first fought the introduction of competing bus lines had found it more expedient to go into the bus operating business themselves. He said that he had found in a recent trip to California that long distance bus operation there is three years ahead of this section of the country. There three large operators have bought up nearly all franchises. Their long distance lines operate at average speeds of 35 m.p.h. in some cases. The average wheelbase of the California bus is about 200 in, and the seating capacity from 32 to 35 in many cases; 36 x 6 in. pneumatic tires are largely used.

AUTHORS OF PAPERS IN THE PASSENGER CAR SESSION



P. M. Heldt, Engineering Editor Automotive Industries

H. M. Crane, Consulting Engineer and Nominee for First Vice-President

F. A. Bonham, Parts and Service Division, Durant Motors

Design Practice Discussed in Passenger Car Session

Overhead camshafts, spring suspension, and service are topics presented. F. E. Moskovics, J. G. Vincent, Henry M. Crane, and Rollin Abell are prominent in discussion.

By P. M. Heldt

AT the Friday morning session, presided over by J. V. Whitbeck, the first paper presented was that on Overhead Camshaft Passenger Car Engines by P. M. Heldt, which has been printed in full in AUTOMOTIVE INDUSTRIES. Discussion on this paper was opened by F. E. Moskovics, who said that the chief difficulty in connection with the direct actuation of the valves from the overhead camshaft was not due to the necessity for clearance adjustment but to the side thrust on the valve stems. He admitted that the overhead camshaft engine had certain advantages, but the service problem, he thought, was not stressed enough in the paper. In service the cylinders will become carbonized and the heads then have to be removed for scraping out the carbon, and if the camshaft is on top of the engine this is necessarily harder to do. It is, moreover, a difficult problem to keep an overhead camshaft engine silent, as the cylinder head seems to be a natural sounding board, whereas the crankcase acts more like a muffler.

Mr. Crane said that he had successively built three six-cylinder engines, all of about the same cylinder dimensions, of the three types, viz., L head, engine with tappet rods at the side and engine with overhead camshaft. The first two were 4 by 5 in. and the last was a 4¼ by 5 in. So far as he could ascertain the m.e.p. was substantially the same in all three engines. However, the L head engine had a much greater tendency to detonation, with the result that the driver would retard the spark and thus lose power. On the other hand, the turbulence was greater in the L head engine and it required never more than 25 deg. spark advance, whereas the valve-in-head engines required up to 35 deg. spark advance even when two simultaneous sparks were used. The valve-in-head engine with pushrods seemed to operate more quietly than the L head engine. The matter of handling the parts when making repairs came up here. With the L head and pushrod type valve-in-head engines the cylinder heads were cast in two sets of three each and were then of quite moderate weight. With the overhead camshaft the cylinder head had to be made in a single piece and complete with the valves, camshaft, etc., weighed so much that it could not be easily handled by one man. As regards the noise, this was due mostly to the hammer action of the valve on its seat. Not more than 0.010 in. variation in clearance need be allowed for in any of the engines, and by means of the so-called ramp on the cams this could be easily taken care of. He had used this on the exhaust valves. As far as passenger cars were concerned, the engines would be operated mainly below 2400 r.p.m., as above this speed it was practically impossible to get silent operation, hence the possibility of operation at higher speeds affored by the overhead camshaft engine could not be taken advantage of. Summing up, Mr. Crane said that if you add to the lack of accessibility of the combustion chamber the difficulty of keeping the engine quiet, it was obvious that there was no opening for the overhead camshaft engine in the passenger car

field. In the case of moderate speed engines where the bearings could be made large and everything more rigid the conditions might be more favorable.

J. G. Vincent said that he also had gone through with the development of L head, tappet rod and overhead camshaft engines. In his estimation the lack of accessibility was the most important objection to the overhead camshaft engine. All noise-producing parts were on top of the engine where you could hear them most distinctly. For the camshaft drive the same driving means could be used as in the case of an engine having the camshaft in the crankcase, and he thought that among the different drives available the chain had slightly the best of it, from the manufacturing standpoint.

Valve-in-head Advantages

He thought that for passenger car service the choice lay between the L head type and the tappet rod, valve-in-head engine. What he would like to know was what could be gained by placing the valves in the head. He had never been able to observe a difference of more than about 1 per cent and much greater gains were possible by equal efforts in other directions, as, for instance, in connection with the carbureter system. The valve-in-head engine weighed slightly more than the L head, and this balanced the small gain in power possible. Probably both would continue to be used.

Fred Duesenberg said that with his construction of overhead camshaft engine there was absolutely no chance of disturbing the timing when removing the cylinder head, as the drive was through a single jaw clutch which could not be inserted wrong. The gear noises had to be considered. He had been driving a Wills-Sainte Claire car and the engine gears were rather noisy at first, but after 10,000 miles of driving they operated silently. The accessibility he considered to be even better with the overhead camshaft engine than with the other types, because the sides of the crankcase were left free. At first they were considerably troubled by the variable thickness of the cylinder head gasket. Their cylinder head weighed 140 lb. with valves and all and could be readily handled. As an illustration of the ease of removing and replacing the cylinder head he mentioned that in a California race Murphy burned out one of his valves in the first lap and he and his assistant removed the cylinder head, replaced the valve and then put the cylinder head back in just 32 minutes, after which he established a world's record. To this Mr. Moskovics remarked that he saw Murphy and his assistants at work and he felt that they did just about as much work in the 32 minutes as the average repair shop crew would do in 32 hours.

Rollin Abell stated that it was important to have all adjustments in the drive very accessible. A. E. Nelson made the remark that while there might not be much difference between the results achieved with L head and valve-in-head engines under present operating conditions, if the introduction of doped fuel should permit of a compression ratio of, say, 7 to 1, it would be necessary to use valve-in-head engines, as the compression space could not be reduced sufficiently with the L head engine. Messrs. Kettering and Midgley, in trying out their doped fuels on various engines, had had much more difficulty with the L head than with valve-in-head engines in reducing the compression spaces to the necessary reduced volume.

H. M. Crane presented a paper on A New System of Spring Suspension for Automotive Vehicles. Mr. Crane outlined the development of vehicular suspension during the past, and then pointed out some of the shortcomings of present suspensions with different forms of axle linkage.

The Hotchkiss drive has some very manifest advantages. It is light in weight and has a minimum number of parts to wear and rattle. It gives a cushioned resistance to suddenly applied driving and braking loads. Moreover, if the springs are properly proportioned, it maintains the center-line of the pinion shaft substantially parallel throughout the range of axle movement. This latter feature is of an importance not often recognized.

The Hotchkiss drive has also some distinct disadvantages. When the rear springs are sufficiently flexible to give good riding, the resistance to torque reaction is too soft, with the result that, especially in lighter cars, the rear axle tends to jump when under heavy driving or braking loads and on soft or rough roads. From the point of view of good riding it leaves much to be desired. It furnishes a sufficient degree of flexibility in a substantially vertical direction, but is far too rigid otherwise.

The Crane Spring-Suspension

With the idea of combining the simplicity and other advantages of the Hotchkiss drive with the proper cushioning of the shocks, the device illustrated in Fig. 1 was conceived, which also appears in practice to remove two of the principal disadvantages of the Hotchkiss drive, by greatly increasing the resistance to torque reaction of any given set of springs without entirely removing the desirable cushioning effect to driving and braking shocks and, because of this fact, doing away almost completely with the jumping action of the rear axle on soft roads.



J. G. Vincent of the Packard Motor Car Co.



W. A. Chryst, nominee for Councilor.



John H. Hunt of General Motors Research Co.



B. S. Pfeiffer, member Meetings Committee



Alfred Reeves, General Manager N. A. C. C.



First Vice-President J. V. Whitbeck, who presided at Passenger Car Session

Fig. 1 shows a semi-elliptic spring, shackled at both ends, and rigidly bolted to the axle. It shows also distance-rod, the forward end of which is connected to the frame by a ball-and-socket joint and the rear end is connected to the axle by a similar joint, not at the center-line of the axle, but at a point substantially below the center-line, a bracket rigidly attached to the axle being provided for the purpose.

It is obvious that, with this arrangement, the axle is free to move longitudinally with respect to the frame as well as vertically, while at the same time it is constrained in both these movements by the resistance of the semi-elliptic spring. The vertical resistance need not be explained, being the normal spring action. The resistance to longitudinal movement is occasioned by the fact that, to translate longitudinally, the axle casing must rotate about the ball-and-socket joint located below the center of the axle. This rotation is resisted by a couple set up in the spring, tending to increase the load on one arm of the spring and decrease it on the other. The character of this resistance evidently can be varied by changing the distance of the point of attachment of the distance rod below the center of the axle. The spring shackles are made long enough not to interfere with this action. It is also necessary to provide for extra longitudinal come-and-go in the propeller-shaft connection.

As in the conventional Hotchkiss drive, the torque reactions due to driving and braking are resisted by couples set up in the springs, but in this case the couples are of considerably less magnitude due to the action of the lever-arms to which the distance-rods are attached. The reduced twisting of the axle is very evident in actual driving, as is also the improved action over soft rough roads when using heavy power. The latter improvement undoubtedly is caused by the better method of taking care of the torque reactions and by a different type of tire reaction with this suspension.

The new method of suspension is believed to provide a considerable improvement over conventional arrangements by reducing materially the maximum compression in the tire under any given set of operating conditions, and by giving an attachment between the axle and the frame that is cushioned in all directions except laterally.

W. C. Keyes wanted to know what type of universal joint and propeller shaft were used by Mr. Crane in connection with the springs described by him, and whether he had ever given a comparative test to the full elliptic spring. The universal joint used at the rear end of the propeller shaft, Mr. Crane said, was of the type in which steel blocks slide in slots in a dumbbell, the blocks having roller bearings. The full elliptic spring was excellent for taking up vertical shocks but poor for taking up torque reaction, as in that case only one-half the spring was active, as compared with the whole spring in the case of a half elliptic. H. W. Alden said that back in 1905 or 6 at the Columbia Motor Car Co. in Hartford they used a somewhat similar system to that described by Mr. Crane. It was a sort of pantagraph arrangement and was intended to keep the pinion shaft parallel with the frame. They found, however, that it was unsatisfactory and discarded it. Mr. Alden thought that in the spring arrangement described by Mr. Crane, if the body should roll, the side rods would exert an enormous torsional stress on the axle housing. Mr. Crane said that he also had tried the pantagraph arrangement described by Mr. Alden and had discarded it for the same reason that it was too rigid. In his present construction the semi-elliptic springs were shackled to the frame at both ends by long shackles. His objection to the torque arm drive was that it was too rigid. Some years ago he had an old Fiat four-cylinder car overhauled, which, as generally known, is fitted with a torque tube drive. All of the keys in the drive of that car were loose, evidently owing to the lack of flexibility in the drive, and it was a very expensive repair job. This also was his chief objection to the ordinary cantilever springs—you had to use a torque arm with them.

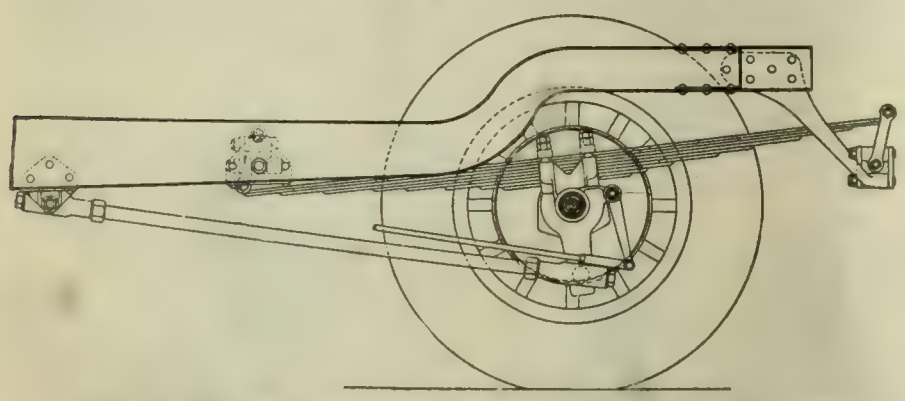


Fig. 1—Spring suspension suggested by H. M. Crane

Objections to Cantilever Springs

Another objection to cantilever springs was the difficulty of properly mounting the body. With two spare tires at the rear, a large gasoline tank and three full-grown passengers almost as far back as the fuel tank, there was too large an overhanging weight.

F. A. Bonham, of the National Automobile Chamber of Commerce, gave a talk on "The Automotive Engineer and Our Service Problems." He said that the service problems of to-day were the result of lack of understanding as to what constituted service. The basis of the service problem was carelessness, ignorance and incompetence. The pioneer dealers and repairmen naturally located in the large cities and they drew their mechanics largely from the factories. Later it was found impossible to get a sufficient number of good men from this source and training schools were then opened. Many of the older mechanics who had grown up with the industry were not content to remain in the grease and the dirt and secured other employment. Training schools had grown up galore and some actually had advertised that they would turn out finished automobile mechanics in three weeks. Instruction was also given by correspondence, and while all of this no doubt helped, it did not solve the problem of furnishing an ample supply of automobile mechanics. The repair shop crews at the present time consist largely of incompetents.

Additional to the service department problem of training competent mechanics is that of supplying repair parts. In this connection the speaker asked the engineers whether, when they changed their car designs, the changes were always made in fairness to the old owners and to the dealer. Often an owner suffering from recurring troubles of one kind or another was told that the difficulty had been overcome in a later model but that the change was not applicable to his model. The matter of accessibility for repairs was a most important one, as owners wanted the element of time loss reduced to the very minimum. In one case that had come under his observation it was necessary to remove fourteen parts before a certain wearing part could be taken out.

In the discussion of this paper T. J. Litle of the Lincoln Motors Co., said that a good way of overcoming the difficulties complained of was to have frequent conferences at the factory at which the service manager should sit in. They had found that one such a conference per week met the requirements very well. At these conferences everyone in attendance was told of troubles in connection with matters under his jurisdiction, and he was required to report back at the next meeting as to what steps he had taken to eliminate them.

Professor Hatt was scheduled to present a paper on highways, but owing to lack of time this had to be abstracted very briefly. He said that the highway transport problem must pass from the field of opinionated discussion to that of a branch of national transportation. One difficulty at the present time is that the forces behind the highway movement are too much scattered. There are no fewer than twenty-four different organizations taking an interest in highway development, including the S.A.E. Each of these organizations should have a member assigned to highway committee duty. Professor Hatt gave a brief summary of the experimental work now being done in connection with road design and construction. In Massachusetts determinations of road resistance with different types of surfaces are being made. In Kansas air resistance experiments are being carried on. Professor Lay, of Michigan University, is studying the effects of grades and in Iowa State College the problem of road location is being investigated. Other highway researches are being conducted elsewhere.



The Petroleum industry was well represented—C. W. Stratford, Associated Oil Co.; S. W. Bevin, Tidewater; E. W. Dean, Standard of N. J.; K. A. MacKenzie, Texas Co.; H. C. N. MacConnell, Texas Co.; H. C. Mougey, Gen. Motors; W. H. Herschel, Bureau of Standards; T. W. Steak, Standard of Indiana

Government Laboratories Aid Aircraft Growth

Aeronautic Session develops discussion on aircraft performance formulas, Government subsidies, and commercial flying. McCook Field work is shown in motion pictures.

By P. M. Heldt

THREE papers were scheduled to be presented at the Aeronautic Session on Tuesday morning, and, in addition moving pictures were shown of McCook Field and the work being done there, of scenes at the front in the late war and of American aircraft activities in France during the war. Col. V. E. Clark presided. The first paper to be read was that on Airplane Performance Formulas by Professor E. P. Warner of Massachusetts Institute of Technology. It was pointed out that the performance of airplanes can be predetermined by two methods, viz., by an airodynamic analysis and by model tests in a wind tunnel. The former is a very laborious method, as it involves the summation of a considerable number of elemental resistances and the making of many corrections for such factors as the slip stream, the inclination of the thrust axis, interference between parts of the structure, and the like. Wind tunnel tests on a model are far simpler, but less accurate, as the model is so small that many of the minor items, such as fittings and stranded wires, have to be omitted, and, besides, the scaling effect is so enormous as to introduce appreciable errors. Furthermore, the wind tunnel method does not allow of making a correction for the slip stream effect. In view of these various defects it is surprising that a reasonably close approximation to the performance of an airplane by a single test of the lift and drag of a complete model can be made in this way. The results for maximum speed are even better than those for climb, as the slip stream effect is of less importance at high speed.

Wind tunnel tests are very important and have been a great help in the development of aircraft, but such tests cannot be made in all cases. When a new type of airplane is to be designed it is often necessary to determine the approximate performance quickly, without great expense, and recourse must then be had to simplified performance formulas or graphs.

Professor Warner divides performance formulas into three groups, as follows:

1. Those based solely on experience with airplanes previously constructed.
2. Those based on rational considerations alone, or perhaps combined with data drawn from wind tunnel tests.
3. Those which depend on a combination of theory and practice.

Up to the present the first class of formula have been of the most value.

For the minimum speed of an airplane the author derives the formula

$$V_{min.} = K_1\sqrt{W/S}$$

where K_1 is a constant somewhere between 16.2 and 18.6,
W, the weight of the airplane and
S, the wing area.

In connection with this formula an average value of 17 may be used for the constant K_1, and the paper contains a graph of minimum speeds based on the relative wing loading. The author states that claims of landing speeds materially lower than shown by the graph should be looked upon with suspicion.

For the maximum speed the following formula is derived:

$$V_{max.} = \sqrt[3]{375\ \eta \div [D_c + R_c(s/S)]} \times \sqrt[3]{P_o/S} = K_2\sqrt[3]{P_o/S}$$

where η is the propeller efficiency; D_c the coefficient of wing drag, R_c the coefficient of parasite resistance, s the parasite resistance area, S the wing area. The rather surprising conclusion is thus reached that with a given fineness of design the maximum speed of an airplane is independent of its weight, provided it flies at its maximum speed very close to the angle of minimum drag of the wing. The few tests made under these conditions have verified this conclusion. The value of the constant K_2 is most readily determined by free flight experiments. By plotting the values of P/S and $V_{max.}$ on logarithmic paper, not only can the value of K_2 be found, but the deduction that the maximum speed varies as the cube root of the power-area ratio can at the same time be checked. In a graph accompanying the paper experimental data from 65 machines were plotted and it was found that the best average straight line corresponds to the equation

$$V_{max.} = 127\ (P/s)^{0.39}.$$

The maximum departures from the straight line were found to be 12 per cent high and 17 per cent low for land planes. The points for all sea planes lay below the line, which is due to the fact that their fineness is generally less than that of land planes. The average error for all land planes was 5.4 per cent. The reason the experimental data gives a higher exponent than one-third is undoubtedly that among the machines considered were a good many commercial planes, and these do not fly at the angle of minimum wing drag as assumed in deriving the formula.

Several other formulæ for maximum speed have been derived. Bairstow, for instance, has given the equation

$$(V_{max.} - 55)^2 = 1445\ [(40 \div (W/P) - 1)]$$

for a constant wing loading of 7 lb. per sq. ft., and the British Advisory Committee for Aircraft has presented a similar formula as follows:

$$V_{max.} = 196\ [(84.8 \div (W/P)\ \sqrt{W/S} - 1]$$

This, however, applies only to single engine land planes, values of the constants being changed for other types.

Both of the British formulas give from 7 to 10 per cent higher values than the Warner formula, as may be seen from the following table:

TABLE 1—COMPARISON OF AIRPLANE SPEEDS CALCULATED BY DIFFERENT FORMULAE

W/P	W/S	Bairstow	Committee	Warner
7	7	137	136	127
8	7	131	130	121
10	7	120	120	111
12	7	113	113	103
15	7	104	104	95
20	7	93	94	85
9	9	..	136	127
6	6	..	132	127

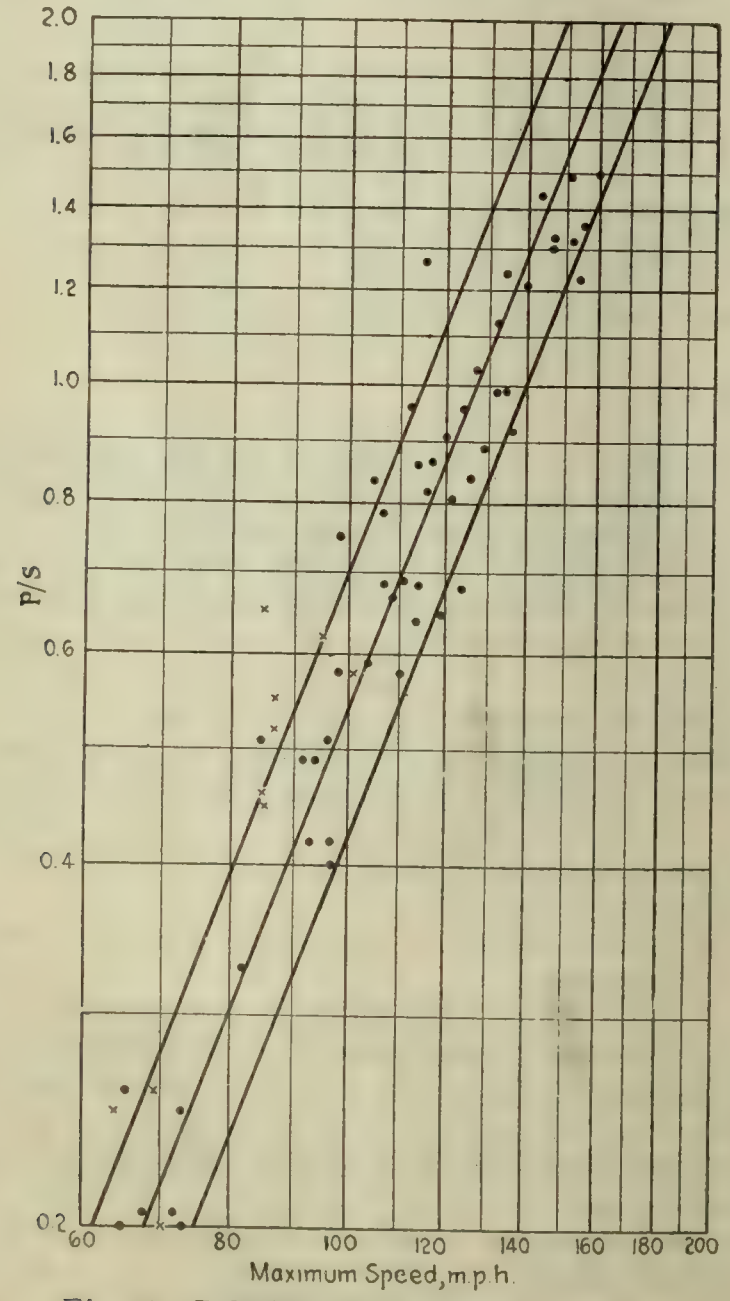


Fig. 1—Relation of maximum speed to weight surface ratio

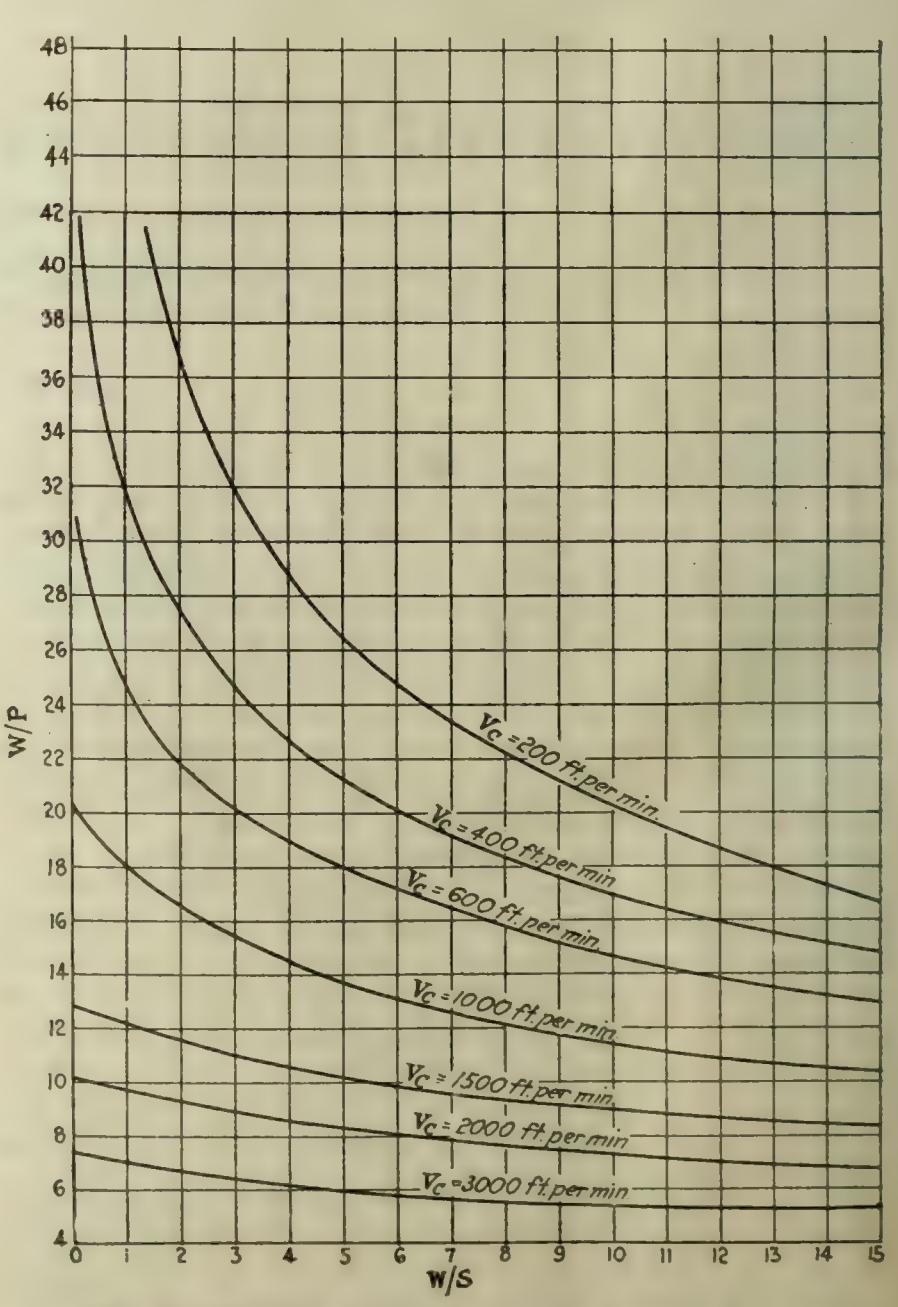


Fig. 2—Relation between velocity of climb, weight, surface ratio and weight power ratio

For the rate of climb from sea level the following formula is developed:

$$V_c = [271 \div (W/P)] \times [79 - (W/P) \times \sqrt{(W/S)}]$$

which shows that this factor is directly dependent upon the weight-power ratio and the weight-surface ratio.

Another performance factor, of value in connection with the problem of the minimum area of landing fields, is the angle of climb. This may be found from the equation as follows:

$$\sin \theta = 10.62 \div [(W/P)\sqrt{(W/S)}] - 0.135.$$

For the ceiling the following theoretical formula was developed:

Experimental values from 46 different planes were plotted on semi-logarithmic paper in order to obtain a straight line for the characteristic, and it was found that in order to most accurately express these values the constants in the formula should be slightly changed so as to make it read as follows:

$$H = 40{,}000 \log_{10} [87.6 \div (W/P)\sqrt{(W/S)}]$$

The average error of this formula for the 46 machines on which the constants are based is 12·6 per cent.

In conclusion the author gave two illustrations of the application of his formulas and the charts based thereon. Let it be required to design an airplane having a maximum speed of 100 m.p.h., capable of carrying 4000 lb. of useful load, including fuel, and to reach an absolute ceiling of at least 12,000 ft. The total weight, the power and the wing area are to be found. The requirement of a speed of 100 m.p.h. gives immediately the power-area ratio. By reference to the maximum speed chart (Fig. 1) it is found to be 0.54. A similar reference to the ceiling chart (Fig. 3) shows that an absolute ceiling of 12,000 ft. requires that the value of $(W/P)\sqrt{(W/S)}$ must not exceed 44. It is now possible to solve directly for the power loading and the wing loading, which are found to be 15.3 lb. p. hp. and 8.3 lb. p. sq. ft. Assuming the useful load to be 40 per cent of the total weight, the required quantities are found to be 10,000 lb., 665 hp. and 1210 sq. ft. The minimum speed would then be approximately 40 m.p.h.

As a second illustration the minimum wing area required to carry a total load of 4000 lb. to a height of 20,000 ft. with a 400-hp. engine may be found. The power loading is then 10 lb. p. hp. and the ceiling chart shows that $(W/P)\sqrt{(W/S)}$ must not exceed 27.7 if 20,000 ft. is to be reached. W/S, therefore, must be less than 7.7 lb. p. sq. ft. and the wing area must be at least 520 sq. ft. The maximum speed would be 115 m.p.h. and the minimum 47 m.p.h.

Prof. Warner's paper being of a mathematical character, there was very little discussion on it. It had been pointed out that the one machine whose performance was most at variance with the formulas and curves was the Fokker monoplane, which had a lower maximum speed and a higher ceiling than would be expected from its weight-surface ratio, and it was explained that this was due to its low parasitic resistance Mr. Mock wanted to know why a machine with a lower parasitic resistance should have a lower maximum speed than would be expected from calculations based on averages.

Prof. Warner in reply stated that this was due to the form of wing used, which had a much greater lift factor than the ordinary type of wing, hence the weight-surface ratio was virtually less than it should be in the case of such planes.

Col. Clark stated that in the formula for the rate of climb use was made of the expression $(W/P)\sqrt{(W/S)}$ and that with this formula involved an appreciable mean error. He asked Prof. Warner whether it was not possible to obtain

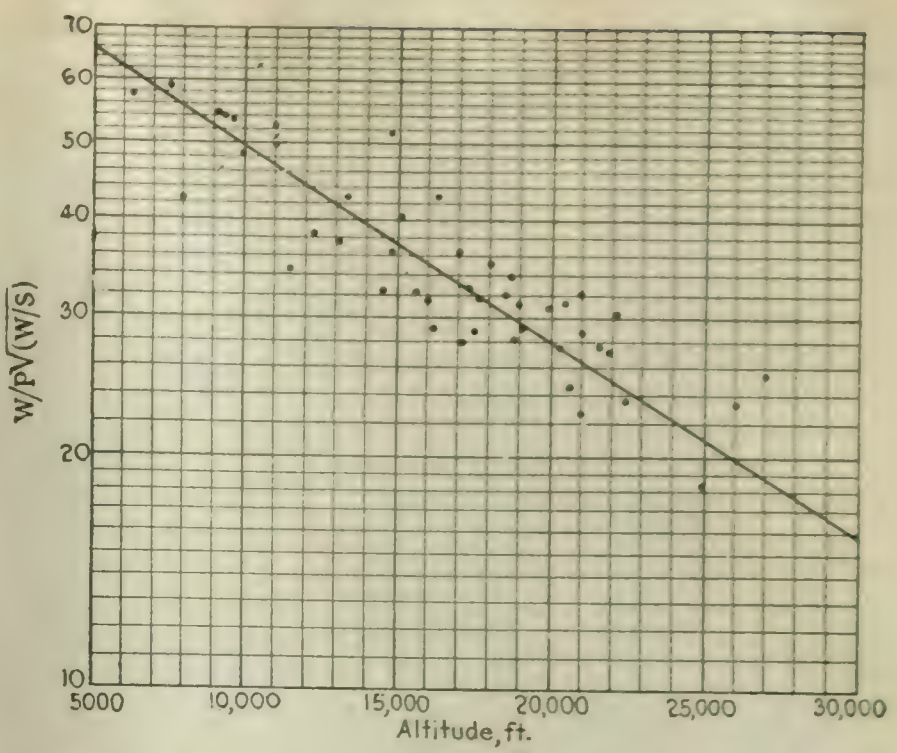


Fig. 3—Dependence of ceiling upon mechanical data

a better agreement of the formula with experimental results by introducing the factor $K_{y\ max.}$ in the denominator of the fraction under the radical sign. Prof. Warner admitted that with this modification there would be closer agreement but said that his aim had been to keep the formulas as simple as possible so they would be handy to use for first approximations. Mr. Crane said he wished to express his appreciation of the work which formed the basis for the paper. It was the simplest presentation of formulas for the determination of aircraft characteristics which he had yet seen, and they enabled the layman and the engineer in other fields of endeavor to quickly determine the performance characteristics of airplanes from their weight, wing area and engine power.

The second paper on the program was On a Method of Developing Aircraft Engines, by Capt. George E. A. Hallett of the Air Service, McCook Field. In the absence of Capt. Hallett, due to sickness, it was presented in abstract by his co-worker, Capt. Jones. The paper said that in general the steps in the development of engine types there have been as follows:

1. The design and layout are started in most cases by civilian contractors.



Left—Prof. E. P. Warner, nominee for Second Vice-President and author of paper on Airplane Performance Formula



Right — Second Vice - President V. E. Clark, Chairman, Aeronautic Session

2. The Engineering Division, upon receipt of these layouts, generally checks stress and weight calculations.

3. The engine is checked from a standardization and installation point of view; in other words, the gasoline, oil, water, throttle and electrical connections must be standard and located at points that will be accessible after the engine has been installed; provision must be made for mounting the standard electric starter, gun synchronizers, gasoline pump, tachometer drive and electric generator. Much serious trouble in airplane design and engine maintenance is thus avoided.

4. The layout is checked to see that it has embodied the latest experience of the Engineering Division and its contractors in design and constructional details.

If the cylinder construction of the engine is not of a well-proved type, a single cylinder is machined up first and tested on one of the universal test engines. These single-cylinder tests often show many troubles, but, fortunately, most of them can be remedied by modifying the design or methods of construction. Frequently changes in the design of the valves, valve guides or valve gear are found necessary. Sometimes the compression ratio proves too high or unnecessarily low, and the best location and number of spark plugs, as well as the proper spark timing and piston clearance, have to be ascertained. If the results with the single-cylinder prove too bad the entire project is held up pending the design and development of a more satisfactory cylinder, or perhaps it is entirely abandoned. The single-cylinder test is satisfactory in regard to everything except fuel consumption. In newly designed engines the fuel pumps, oil pumps, water pumps, ignition systems and carbureters can all be thoroughly tested in an accessories laboratory entirely independent of the engine, and at McCook Field a gear case assembly was tested in this way, by driving by an electric motor, to see whether the lubricating system was satisfactory.



Elmer Sperry and C. M. Manley discuss the aircraft situation

Captain Hallett then described the standard test of the completed engine, the teardown and inspection and the flight test as given new engines at McCook Field. Besides developing complete engines, the Engineering Division has done much work in perfecting accessories that are not really parts of the basic engine but are fairly general in their application, such as carbureters, spark plugs, piston rings, valves and pistons. The results of this work have been applied to whatever engines could be benefited and have produced considerable standardization as well as improved performance. Between January, 1919, and the present time development has been started on 23 engines. Of these, two which were failures have been abandoned. Sixteen have been successes, and five which are not yet complete give promise of being successful.

Commenting on this paper Prof. Warner said that there was a feeling in certain sections of the industry that Government appropriations for the maintenance of research laboratories were largely so much money wasted and that it would be a much better plan for the Government to turn the money over to private companies in the form of subsidies, so as to keep the aircraft industry alive.

This question as to the best method of obtaining results from Government funds for aircraft development was of the highest importance to every one interested in aircraft, as well as to the country at large. Each method—that is, development wholly by the Government and by private companies respectively—had its limitations.

If all the work was done by the Government the industry would disappear and there would be no possibility of quick expansion in case of another emergency. On the other hand, if the work was carried on solely by private companies there would not be that free and equitable distribution of experimental data which we had at present, with most of the experimental work carried on under Government auspices at McCook Field.

He was, therefore, a strong advocate of Government laboratories. At the same time he realized that the private aircraft companies had to be supported to a certain extent by the Government in order that in case of a national emergency they might turn out military aircraft.

Mr. Crane said that it was very desirable to have an educated personnel both in the Government departments and in the industry. When he first entered the aircraft engine business during the war, development did not mean anything. The first machine either had to make good or it was thrown out and the design started all over again. If one looked over the really successful aircraft engines of the present time, they were all models which originated from 1915 to 1918 and had had the benefit of several years development.

Elmer A. Sperry highly commended Col. Bain's organization at McCook Field and said that it did not have its like anywhere else in the world. They were enterprising and had established new records of various kinds; the older types of engine were constantly being developed and at the same time a fair chance was given the man with entirely new and perhaps radical ideas. The Society as an organization should uphold McCook Field and see that it got the appropriations necessary for carrying on its work; they had shown us a great many things that should not be done and this was almost as important as to tell us what to do.

Prof. Warner emphasized the necessity for sympathetic co-operation between the Government services and the manufacturers. Development work was absolutely necessary and he mentioned that some planes had to be rebuilt between 20 and 30 times before they were really serviceable. Messrs. Moscovics and Crane recalled some of the difficulties the Air Service labored under during the war when inventors appealed to Congress over the heads of the Service to accomplish certain things. Mr. Moscovics in particular mentioned a certain instance where an inventor presented a machine of radical construction for tests to McCook Field. The calculations showed that the machine was unsafe and the Air Service wanted to subject it to a sand test, to which the inventor objected. Through his Congressman he complained to Congress that the Department was about to wreck his machine, and orders were practically given from Washington that the machine be flown.

The unfortunate pilot who volunteered to make the test was dead in three minutes from the time he left the ground. Mr. Moscovics thought that if there were some safe and sure method of picking out concerns possessing the necessary engineering ability and balance it would be all right to grant Government subsidies, but in default of such a method the subsidizing of private concerns would not only entail waste but court disaster.

The third paper on the program, on Flighty Reflections, by C. L. Egtvedt, chief engineer of the Boeing Airplane Co., was read by title only and there was no discussion.

THE COMMITTEE WHICH RAN THE SPORTS



Best Attended Sessions Are Devoted to Recreation

John W. Watson Wins the Golf Tournament—C. A. Thompson, H. Chase and W. J. Buettner Are Tennis Champions. Metropolitan Section Scores Most Points

AS is usual at the summer meetings of the Society the afternoon and evening of most days were given over to sport and recreation, for which the meeting place selected this year was ideal. An excellent golf course and a half dozen well-kept tennis courts besides a baseball ground made it possible to run off a large number of athletic events during the five days of the meeting.

Golf was beyond question the most popular of all sports, and it attracted upward of 100 entrants in the men's events. The preliminary round was played on Tuesday afternoon and Wednesday morning, the 48 making the lowest score being arranged in three flights of 16 for play on succeeding days. The first flight was won by John Warren Watson, the second by Sanford Brown and the third by David L. Gallup.

Mrs. George Case won the women's golf championship and Mrs. C. H. Foster the women's putting championship. E. O. Jones won the men's putting championship and Jack Gray the men's driving championship.

Among the other sports which lasted throughout the greater part of the week, tennis attracted the largest number of entries. There were eighteen players in the men's singles and eight teams in the men's doubles. The men's singles was won by C. A. Thompson. He eliminated in successive rounds Herbert Chase and C. F. Clarkson, who have in past years held the tennis championship of the Society. The men's doubles championship was won by Herbert Chase and Walter J. Buettner, who defeated C. F. Clarkson and Henry M. Crane, champions of the last two years, in a close five set match.

The women's tennis championship in singles was won by Mrs. Snead and the mixed doubles by Miss Jessie MacKenzie and C. A. Thompson.

The intersectional baseball matches which have been a feature of several of the earlier meetings attracted only four entries this year, and one of the teams was made up of members of two sections, the Mid-West and Indiana. Detroit won from the Indiana-Mid-West team by the score of 5 to 3, while the Cleveland section defeated the Metropolitan section by a score of 18 to 3. In the final between Cleveland and Detroit teams, Cleveland won by the score of 10-8, thereby securing the cup held last year by the Metropolitan section.

A number of members entered the trap shooting contest. H. W. Miller won Tuesday. Wednesday's event was won by George Duck with a score of 23, while W. S. Harley was second with a score of 21. Thursday's shoot was won by R. M. Owen with a score of 47 out of 50 from scratch. The final in this event was decided on Friday in a match between W. H. Miller, George Duck, R. M. Owen and W. S. Harley. Harley, who had a handicap, won the event and the trap shooting championship of the Society.

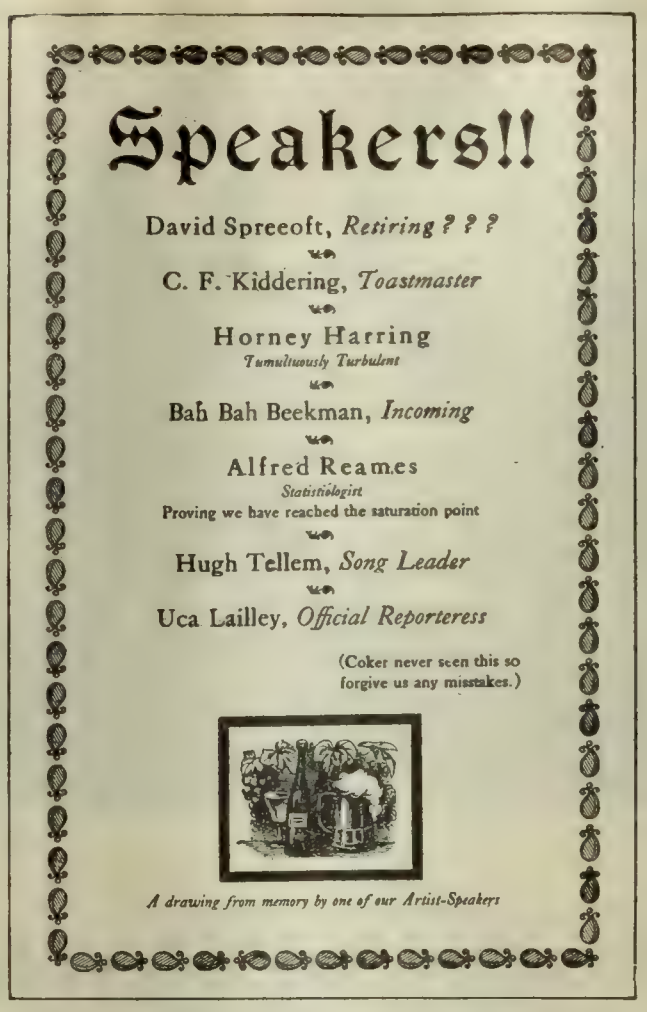
One of the most popular events of the entire meeting from the sporting standpoint was the aquatic sports in which a large number of men as well as several ladies took part. The events included 33 and 66-yard swims, plunge for distance for men and women, egg race for men, candle race for women, blindfold race, men and women, plate diving contest, balloon relay sectional event and sectional championship relay. Gordon Brown won several of the men's events and the inter-sectional events were won by members of the Metropolitan and Detroit sections.

The afternoon of Thursday was given over to an S. A. E. field day in which there were numerous events for both men and women. These included 50 and 100-yd. dashes, fat man's race, three-legged race, potato race, shot put, hop-step-jump, standing broad jump, high jump, baseball throwing for ladies and intersectional relay race. The intersectional relay race was won by Indiana, with the

Detroit section second and Metropolitan third.

A careful record of the point scores allotted in the various events was kept in order to determine what individual and what section won the greatest number of points. A total of 50 points was allowed for the winners in golf and 50 for the winners in men's tennis singles and doubles. In other events, such as the running contests and the aquatic sports, 5 points were allowed for first place, 3 for second and 1 for third. The highest individual score was made by Gordon Brown, who accumulated 24½ points total to the credit of the Metropolitan section. This high score resulted in part in the Metropolitan section winning the cup given for the greatest number of points scored by the different sections. The total for the Metropolitan section was 121½ points; for Cleveland, 118; for Detroit, 105.

Besides the events already mentioned there were a number of special events for the women, including clock golf, bridge and 500. There was also the usual dancing contest, which was won this year by Miss Cramer. This contest was held on Friday evening and was followed by a formal presentation of prizes to the winners of the sporting events and other contests of the week, after which the grand ball was held in the ballroom of the hotel.



One of the features of other summer meetings has been the stunts of various descriptions arranged by the different sections of the Society. This year there were only three sections which contributed entertainment of this character, this number including the Cleveland section, which arranged for a baritone soloist, who sang, following the luncheon and dinner hours, on several days. The Detroit section staged a fake radio stunt in which speeches and music, presumably broadcasted from Detroit, were received in the ballroom of the hotel. It soon developed, however, that phonograph records played on a machine hidden by a screen were being used in place of the genuine receiving paraphernalia exhibited.

What was undoubtedly the most interesting and elaborate stunt was that staged by the Metropolitan section. This consisted of a parody on the annual dinner of the Society. An idea as to the speakers can be gained by reference to the accompanying cut showing a part of the program given. In this stunt C. T. Myers took the part of Kiddering, the toastmaster, while H. W. Slauson impersonated Spreeoft, M. C. Horine took the part of Bah Bah Beekman and Azel Ames impersonated Alfred Reames. Herbert Chase, clad in abbreviated skirts and wearing a blonde wig, took the part of Miss Uca Lailley, the stenotype operator, whose recording instrument was a toy piano. This event was staged in the main dining room of the hotel and was preceded by a supposed flashlight picture in which Nathan Lazarnick used a kodak and discharged a starter's pistol in lieu of a flashlight. Immediately after taking this picture a drawing purporting to show the speakers' table was circulated among the diners as if resulting from the flashlight exposure. Others who took part in the Metropolitan stunt were A. D. T. Libby, P. M. Heldt, C. D. LeFevre, L. C. Hill and R. E. Plimpton.

Standards Meeting Provides Argument

THE general results of the Standards Committee meeting were briefly presented in a telegraphic report in our last week's issue, but it may be of interest to refer here to some points that led to discussion and differences of opinion. In the table of general information on motor truck front axle hubs a change in wording was made, eliminating the use of the phrase "Spindle Load Rating in Pounds," as it was feared that the adoption of such a rating at the present time might prove embarrassing in the development of a motor truck capacity rating formula which the Society has been requested to undertake.

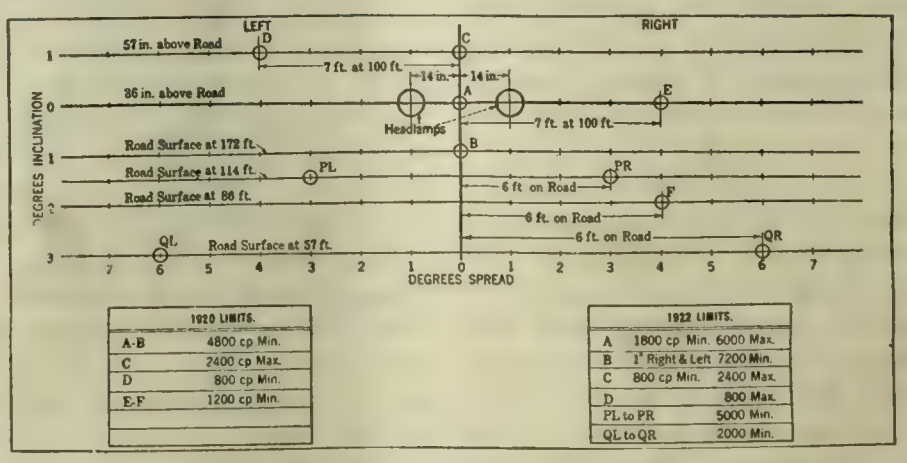
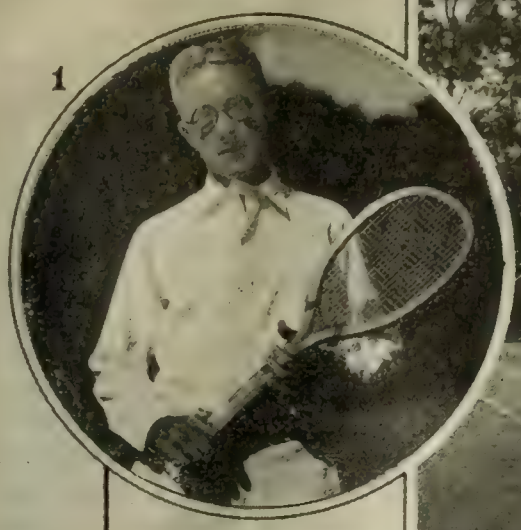


Diagram of headlamp test positions

H. M. Crane objected to the adoption of the proposal regarding crankcase drain plugs, which was to the effect that the drain opening should have a minimum diameter of ¾ in., be located at the lowest point of the oil pan and preferably be operable from under the engine hood. He asserted that the proposal was not in the interest of interchangeability, and that it represented standardization along a new line which merely hampered designers without accomplishing any useful purpose. He questioned whether it was worth while to go into this, and if it was entered upon would it be carried to its logical conclusion by the Society. One member expressed the opinion that the members of the Division probably had been actuated by their experience as automobile operators; that they knew the annoyance of having to drain the oil from a crankcase with too small a drain hole, and that the motoring public would be greatly benefited by the adoption of the proposal. After some further discussion the opposition to the proposal prevailed and it was referred back to the Committee.

Some difference of opinion arose over the question of the proper headings for specifications for materials for specific purposes. For instance one of the proposed headings read "Specification No. 77, Phosphor Bronze Strip for Flat

ATHLETIC CHAMPIONS


1


2


3


4


5

1—C. A. Thompson, singles tennis winner. **2—Field events.** *3—Golf finalists: C. H. Foster, runner-up; J. W. Watson, winner.* 4—*Tennis finalists: Herbert Chase and W. J. Buettner, champions; C. F. Clarkson and H. M. Crane, runners-up.* 5—*Golf spectators*



Left, H. L. Howell, research manager, National Railway Appliance Co.; center, the Smith brothers, and (right) P. J. Dasey, the latter three being connected with the Midwest Engine Co.

Springs." It was held that this was a materials specification pure and simple and that the heading should give only the name of the material, whereas the uses of this material might be stated in a footnote if desired. This, it was argued, was in accordance with the general practice followed in the specification sheets and was desirable for the sake of uniformity. There were those who maintained the opposite view, holding that the more specific heading facilitated reference, but a motion was carried that the Standards Department be instructed to follow the rule of stating uses of materials in footnotes in the publications of the Society.

A departure was made in connection with bearing metals in that a specification for ingots was proposed in addition to the present specifications which were considered satisfactory for castings. The necessity for different specifications for ingots and castings of certain bearing metals was explained as follows: These alloys have a very high tin content, and as tin is the most expensive element in the alloy, the manufacturer tries to keep the tin content as low as the specifications permit.

A supplementary report concerning headlamp illumination was made by the Lighting Division, and it was urged that action be taken on this at the meeting, as if such action were deferred till the January meeting it would lose its practical value.

At the meeting of the Lighting Division in November, 1921, it was felt that the existing S. A. E. Recommended Practice should be revised in view of the improvements which had been made in automobile headlamp equipment and lighting characteristics. A subdivision was therefore appointed to co-operate in conducting tests which were then being made at the National Lamp Works of the General Electric Co. in Cleveland, and to report to the Lighting Division. While this work was progressing the Committee on Motor Vehicle Lighting of the Illuminating Engineering Society prepared a report which was approved and published by that Society in February, 1922. The S. A. E. Subdivision upon receiving this report reviewed it carefully and subsequently reported its recommendations to the Lighting Division at its meeting on May 3, 1922. The Subdivision's report was the same as the published report of the I. E. S. except that it included recommendations for two major changes and a few minor changes as a result of the tests which had been run.

The report of the I. E. S. divided naturally into two parts, one dealing with laboratory tests of road lighting apparatus and the other with the administration of laws concerning the control of road illumination, the so-called anti-glare laws. There was a proposal offered from the floor of the Standards Committee Meeting to approve or endorse the entire report, except for a few changes in the administrative part. However, it was the consensus of the meeting that it would be very unwise for the S. A. E. to make recommendations to State Legislatures as to how laws should be enforced, and the Standards Committee refused to take any action on that portion of the I. E. S. report. The remainder of the I. E. S. report, dealing with laboratory tests, was approved as submitted by the Lighting Division. This report specifies the minimum requirements which must be met by lighting equipment in laboratory tests.

There was a second part to the supplementary report on road lighting which was original with the S. A. E. Standards Committee Division, and which specifies the desirable intensity of road lighting at various points relative to the vehicle. This part was in the form of a proposed revision recommended that the following proposal of the present S. A. E. Recommended Practice for operating requirements in head-lamp illumination:

Points on chart	C. P.	C. P.
A	2,000 min.	6,000 max.
B and intermediate points 1 deg. to right or left	25,000 min.	
C	800 min.	2,400 max.
D		800 max.
PL	10,000 min.	
PR	10,000 min.	
QL	4,000 min.	8,000 max.
QR	4,000 min.	8,000 max.
SL	500 min.	
SR	500 min.	

SL and SR—Four deg. of arc below the level of the lamps and 12 deg. of arc to the left and to the right respectively of the median plane.

This part of the report was also adopted.



Members of the engineering staff of the Fifth Avenue Coach Co., who collaborated with G. A. Green in the preparation of his excellent paper on bus design and operation. Green is the second from the right. On his right is R. E. Fielder, in charge of design and development, and W. D. Rees, research engineer

What the A. E. A. Means to the Car and Truck Manufacturers

Automotive Equipment Association convention, closed last week, shows possibilities of dealer education. "Ask 'em to buy" film to be supplemented next year with "Shop Profits" picture. A. E. A. brings order in No Man's Land of automotive industry.

By Clyde Jennings*

THE Automotive Equipment Association, in session at Colorado Springs last week, authorized an extension of its merchandising activities. Only a year ago this association established a fund of $40,000 for the promotion of merchandising of the products of the association members. The department was actually established 10 months ago and has enjoyed probably eight months of organized activity. In this brief period the department has proved quite conclusively that it was a great forward step.

The outcome of the action of a year ago was the "Ask 'Em to Buy" movement which has been widely promoted by word of mouth, printed word, but most effectively by a film showing how a dealer can make sales by asking car owners with whom he comes into contact to buy some of the more or less necessary accessories for his car.

"Crude" is the usual comment of the experienced salesman when he sees this picture or reads the appeal. Granted that it is crude or primary, such a criticism is made without a consideration of the target at which the work is directed. Results have proven that the cure was properly estimated for the disease. The faults of the merchandising system were apparently even more crude than the cure, as the following instance will indicate:

After this picture had been shown in a community an accessory dealer wrote to an automotive dealer paper about as follows:

"The 'Ask 'Em to Buy' is based on standing at the gas pump. I have no gas pump. How can I seek sales?"

Some car manufacturers' sales managers have rather turned up their noses at such crude propaganda, and yet one car manufacturer has done much good in his dealer organization with a film that is almost as elementary as the "Ask 'Em to Buy."

This year the A. E. A. has authorized another film campaign to promote the sale of shop equipment. This film is replete with pictures showing what an orderly conducted, properly equipped shop can do in the way of turning out good work and making money for the owner. This film has a much more serious background than its predecessor and will accomplish much more for the automotive industry. This film will be known as "Shop Profits" and strikes exactly at the weak point of the entire industry, maintenance of the owner's car. The members of the A. E. A. have assessed themselves $60,000 to promote the work the coming year.

The opportunity for this film is due largely to the neglect of the car manufacturers to see and correct the weak point in their own business.

Car manufacturers in many cases refused to sell parts to maintenance workers because they needed them for new cars; the car manufacturers did not attempt to point the way for the maintenance man to get proper equipment for his work; nor did the car manufacturer concern himself in the slightest about the added comfort the car owner might want to socialize or make more comfortable his car. The car manufacturer and his dealer have hardly touched the accessory field.

This neglect left a very wide field for an honest and worthy business. Into this void stepped a manufacturer of single items for which there was a great public demand. This new manufacturer was not often appreciated. Sometimes he was called a pirate and sometimes names that were even plainer in meaning. There is no question that some of these manufacturers deserved all the names they were called or that some were pirates in all that this word can be made to imply, but the fact that these men flourished was as much due to the neglect of the car manufacturer as to the enterprise of the "pirate." If there was anything to be gained, any pirate could easily show where many a car manufacturer practically got money under false pretenses by merely printing a parts list which implied service and that the prices quoted were an evidence of knavery. Long steps have been taken to enable the industry to sing as a chorus "Them days is gone forever."

Without suggesting further some of the darker days, it is well to consider why there is an A. E. A. It is because there exists in this middle ground of the automotive industry men with high ideals; men who believe their field of endeavor is legitimate and that as manufacturers of specialized automotive equipment and accessories they have a work that is creditable to them and to the industry. These men would like to have this field defined. The desire for definition is a basic reason for business organization. In this case the definition was more difficult because in no man's land there are always snipers as well as recognized sentries.

Another reason for business organization is the belief that in union there is strength. In seeking this union the A. E. A. members were much criticized by others who had sought strength in similar unions. Perhaps some of this criticism was just and much of it was not.

*Managing Editor, Motor Age

It is a fact that the A. E. A. has never fought back as strongly as it might have done, had it cared to use the tarred stick without discrimination.

In every industry there comes a time when it is necessary to separate the sheep from the goats and sometimes it is better business to educate some of the goats into the sheep class than to merely slaughter them. There is a fine line of discrimination here that can be entrusted to only a few persons and these persons will always make mistakes. As long as progress is being made business can afford to forget the mistakes.

It has been a criticism of the A. E. A. that it has worked selfishly rather than for the good of the industry. That probably is true, and in what case has it not been true? Especially is it true when an organization is forced to fight on the defensive much of the time. Only an offensive battle appeals strongly to imagination.

Recently the A. E. A. has disarmed most of its critics by its offensive battle. The belief of the leaders appears to be that the field is fairly well defined and the time has come to appear in the open. The Standards of Practice have been printed for years so that even those who run may read. The Association has been open in its fight on the co-operative club buyer swindle. The standardization of packing and cataloging has made for economy. These are just some high lights. There are other points to be cleared up, but time is needed.

The merchandising campaign is entirely in the open and it is educative. Some car manufacturers have sold more cars this year because their dealers saw this film and realized that he could sell more cars if he cleaned up his place and asked some of his neighbors to buy, instead of sitting behind a stained glass and waiting for the neighbor to come in and ask him if he would sell a car.

The "Shop Profits" campaign is going to do even more. It is going to make a good maintenance station out of many a poor one. It is going to be the means of making a satisfied owner out of many a knocker. It is going to equip shops all over the country so that they can take care of the million or more orphan cars which to-day constitute one of the great liabilities of the car manufacturer. This film and this campaign will probably appeal very strongly to the independent maintenance man, and he is legion, and will enable him to set a pace that will cause the car dealer who sells maintenance only for one make of car to look well into his own equipment.

The manufacturers in the A. E. A. make much of the equipment that is used in the specialized dealer shop. This specialized shop is selfish to the extent that the dealer seeks to service economically only the cars sold by him. The equipment manufacturer is selfish in that he wants to sell this equipment just as widely as he can and in this selfishness he is assisting the owner of an orphan car and putting him in the humor of buying a second car when his present vehicle is worn out.

And this is the reason for the A. E. A. It is making orderly the No Man's Land of the industry and it has had a difficult task. No one could look over the convention last week and not be impressed. The capital represented goes into very high figures. There were in the ranks many men who make standard equipment for many cars and who are in the replacement market. There were present men whose products are recommended by manufacturers to their maintenance shops. There were present men who have resisted bribes to make exclusive ideas and devices that were wanted exclusively by certain interests.

The officers and committee members worked hard all week and this industry was evidence of their earnestness of purpose. The Association is one step ahead of most industrial bodies in that it exacts attendance at all meetings by all members by a system of rewards and punishment. The list of applications for membership is evidence that the association is gaining in fame and respect. This social side of the meeting compares favorably with similar organizations. There is less encouragement of camp followers than in some other organizations.

At the meeting just closed the foundation was laid for a world-wide extension of the merchandising movement. Gordon Lee, chief of the automotive division of the Department of Commerce, was the guest of the Association and spoke at two sessions on export trade. Lee received an ovation seldom accorded an industrial speaker. At both sessions he aroused an enthusiasm that brought prolonged applause and both times he was accorded an enthusiastic rising vote of thanks with additional applause.

Lee made a strong appeal to the gathering when he told the audience that the members of this Association had paid roughly $39,000,000 in excise taxes during 1921 and that he was appearing before them to tell them how they could get some direct benefits from the government which they were helping so materially to support.

He outlined how his department could help a manufacturer to get into the export business, the kind of information and advice that was waiting for him if he cared to sell abroad and above all he urged manufacturers to feel entirely free to come to the Automotive Division and ask any and all questions they might have on their minds. He said that not only was his division there to assist in foreign trade, but it was the contact department for automotive manufacturers with all departments of the government. He asked that when any automotive manufacturer had trouble in getting what he wanted from any department of the government, that he write to the Automotive Division quite freely as to his troubles.

During the 24 hours following his first address, Lee received requests from 44 manufacturers for special information.

Lee also spoke freely on the new view the government is taking of the work of industrial associations. The Government's approval of an association and its co-operation with that association was based, he said, on the willingness of the association to supply information and statistics to the government for the use of business promotion.

The merchandising interest dominated last week's

THE Automotive Equipment Association has done constructive work for the industry. Its activities have benefited the maker of cars and trucks.

In this article, Clyde Jennings gives a critical analysis of what the A. E. A. means to the complete vehicle manufacturer.

* * *

After attending the convention held by this organization last week, Jennings says, among other things:

"The officers and committee members worked hard all week. Their industry was evidence of their earnestness of purpose. The social side of the meeting compared favorably with similar organizations. There is less encouragement of camp followers than in some other organizations."

meeting of the A. E. A. The dual nature of the Association membership threatened a clash on one point. The jobbers who belong to the Association believe that the show which is staged annually in the Chicago Coliseum in November should be open only to jobbers who belong to the Association. Heretofore this show has been open to practically all jobbers. Recently the directors decided that the show next November should be open only to the membership. The manufacturer did not take kindly to this suggestion and a motion was made on the floor that the show be open to others than members. An appeal for an experiment for one year of the closed show averted any continued controversy. A resolution suggesting that the 1923 show be held in the East resulted in a vote that Chicago be made the permanent show site.

Another merchandising experiment of the last year that met with the approval of the membership is the Universal Catalog. In this catalog the manufacturing members are permitted to list as many of their products as they care to. This catalog supplies for the jobber a survey of the field covered by the Association manufacturers in one volume. Lee told the Association that he had supplied this volume to American commercial attaches in foreign fields as a suggestion of American merchandise available. The catalog was only recently distributed but has been received with so much favor that it was decided that there should be annual editions.

British Investigate Endurance Limit of Automobile Steels

Dr. W. H. Hatfield, who is connected with the Brown-Firth Research Laboratories of England, in a recent paper before the Institution of Automobile Engineers, gave the results of extended endurance tests under reverse stresses on both carbon and alloy steels of the types which have been standardized in England. The machine employed in the tests was the Woehler rotary bend testing machine, which is very similar to machines used for the same purpose in this country. According to Dr. Hatfield, for motor car parts a good life would be represented by 200,000,000 revolutions, but he concludes that if comparisons of different materials are made of their behavior over 10,000,000 revolutions, it may be assumed that this will be indicative of their response over longer periods. One thing that should not be lost sight of by engineers in this connection is that the loads in the test are steady and consistent, and that when thinking of service conditions allowance must be made for occasional shocks and excessive loads.

The results are given in the form of tables containing the chemical analysis, the physical properties and the number of revolutions sustained under different loadings. For carbon steels with different carbon contents the results obtained are as follows:

CARBON STEELS (Figures in long tons)

Carbon Content	Tensile Strength	Elastic Limit	Safe range for 10,000,000 revs.
0.15	21.4	14.00	11.7
0.31	35.17	20.05	12.8
0.45	41.2	21.5	15.5
0.52	41.48	19.68	16.5
0.60	48.6	27.0	18.0
0.81	60.72	20.86	19.0
0.90	59.4	23.16	16.5

All steels normalized.

A carbon case-hardening steel containing 0.11 per cent of carbon and normalized at 900 deg. C. showed an elastic limit of 14.2 tons per square inch, a tensile strength of 26.3 tons and a safe range of 11.7 tons for 10,000,000 revs. The same steel normalized at 900 deg. C. and water-quenched at 760 deg. showed an elastic limit of 12.0 tons, a tensile strength of 30.1 tons and a safe range for 10,000,000 revs. of 17.5 tons. Five per cent nickel steel containing 0.14 per cent of carbon treated in the same way showed a tensile strength of 60.58 tons and a safe range of 26.5 tons.

The following results were obtained with air and oil-hardening alloy steels: Air-hardening nickel chromium steel containing 0.30 per cent carbon, 1.38 per cent chromium and 4.07 per cent of nickel, air-hardened at 820 deg. C., showed a tensile strength of 109.6 tons and a safe range of 32.0 tons; 3 per cent nickel chromium steel containing 0.32 per cent of carbon, 0.76 per cent of chromium and 3.41 per cent of nickel showed an elastic limit of 47.0 tons, a tensile strength of 62.0 tons and a safe range for 10,000,000 revs. of 28.0 tons; a chrome vanadium steel containing 0.46 per cent of carbon, 1.48 per cent of chromium, 0.19 per cent of nickel and 0.33 per cent of vanadium, oil-quenched at 850 deg. C., and air-cooled at 650 deg. C., showed an elastic limit of 38.6 tons, a tensile strength of 56.5 tons and a safe range for 10,000,000 revs.; a nickel steel containing 0.39 per cent of carbon, and 2.96 per cent of nickel, oil-quenched at 850 deg. C. and tempered at 600 deg. C. showed an elastic limit of 30.8 tons, a tensile strength of 49.51 tons and a safe range for 10,000,000 revs. of 21.5 tons.

The relation of the safe range under reversible stresses to the mechanical properties are given as follows:

PROPORTION OF SAFE RANGE FOR 10,000,000 REVS. TO OTHER PROPERTIES.

	Percentage of Limit of Proportionality.	Percentage of Yield.	Percentage of Maximum Stress.
Wrought iron	100.0	83.0	50.8
0.15 carbon steel	83.6	83.6	54.7
0.31 carbon steel	63.8	61.8	36.4
0.45 carbon steel	72.1	67.7	37.6
0.52 carbon steel	83.8	66.5	39.8
0.60 carbon steel	66.7	61.7	37.0
0.81 carbon steel	91.1	60.7	31.3
0.90 carbon steel	71.3	50.9	27.8
Carbon case-hardening steel (normalized)	82.4	70.5	44.5
Carbon case-hardening steel (hardened)	145.8	102.9	58.1
5 per cent. nickel case-hardening steel (hardened)	—	63.2	43.75
3 per cent. nickel chromium steel.	59.6	50.0	45.2
Chrome vanadium steel	71.25	56.6	48.7
3 per cent. nickel steel	69.8	51.6	43.4
Air hardening nickel chromium steel	—	35.4?	29.2

The outstanding fact established so far is that the high-tensile alloy steels (maximum stress in tons per sq. in. 50/65) have a materially higher fatigue range than carbon steels of the same hardness. This observation concerns the normalized condition of the carbon steels; the hardened and tempered condition of such steels has not been dealt with on account of the unsuitability of carbon steels for the hardening and tempering operations except in the thinnest sections.

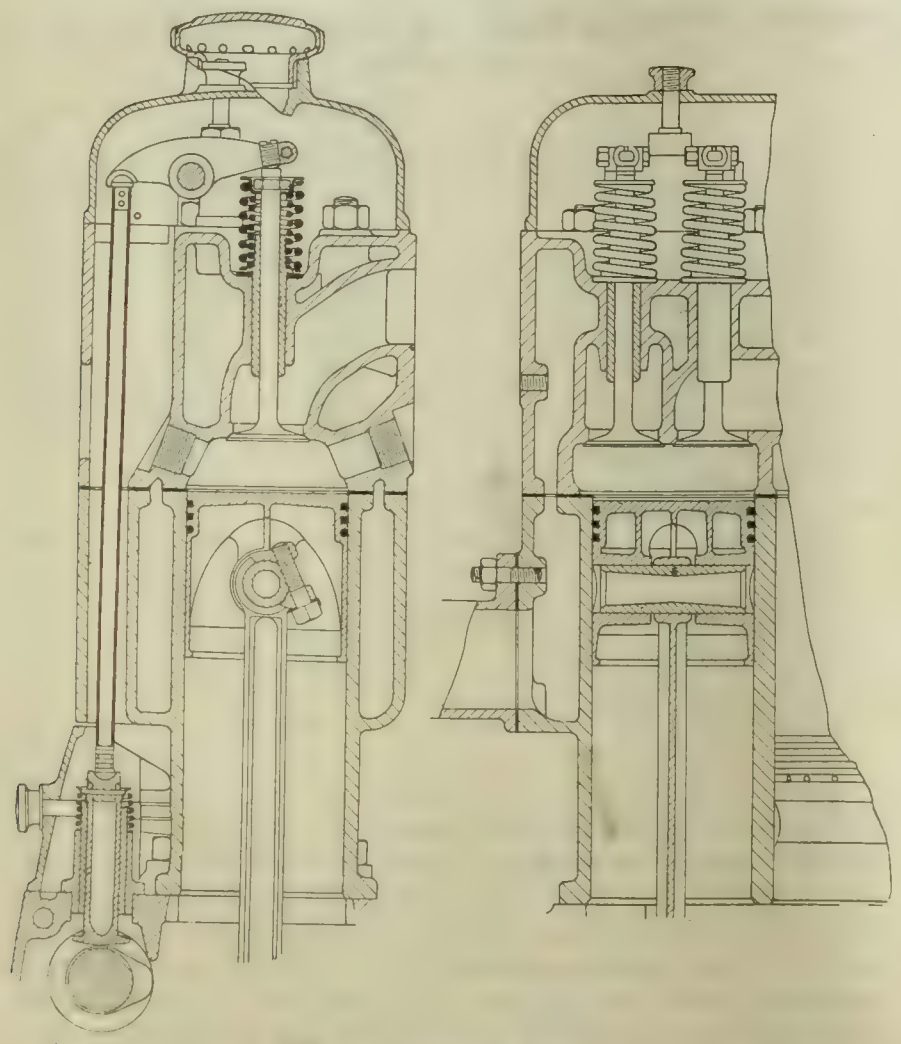
Citroen Which Lowered World's Fuel Consumption Record

New detachable head engine used in fuel trials. Total valve head diameter 1⅜ in. Reciprocating parts lightened. Compression from 65 to 68 lbs. Lubrication follows standard lines. I-section connecting rods. Rocker arms mounted on two separate shafts.

By W. F. Bradley

THE four-passenger car with which Citroen recently set up new world's fuel consumption records is equipped with an overhead valve type engine intended to be put on the market at an early date as a sporting model.

This engine will go in the same chassis as the normal type engine, and in order to keep down production costs, as many parts as possible are common to both the L head and the overhead valve engine. The aluminum crankcase is common to the two models and the same size main bearings are maintained. But as the valve-in-head engine is intended to run at a much higher speed and to develop considerably more power, the shaft has been stiffened.



Sectional view, Citroen engine, showing overhead valve construction

For the two main bearings the diameter is 1.415 in., the length of these bearings being respectively 3¼ and 2 7/16 in. The rest of the shaft has a diameter of 1.77 in.; the length of the connecting rod bearing being 1.65 in.

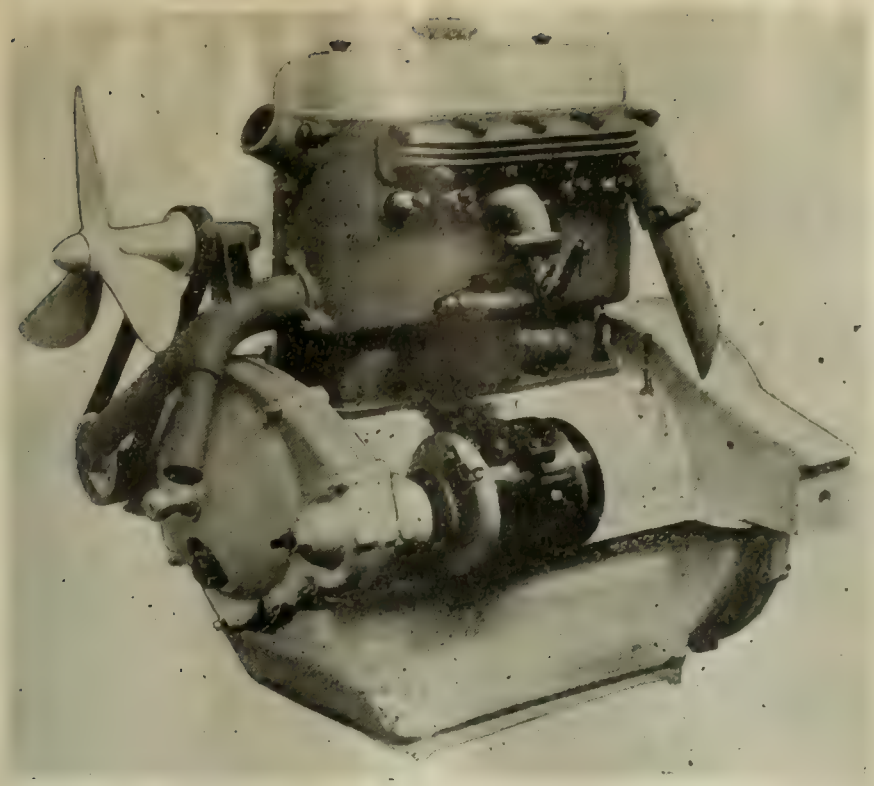
A detachable head is used, with the valves mounted directly in it, the total diameter of the valve heads being 1⅜ in. With a camshaft in the base chamber, valve operation is by means of tappets, hollow pushrods going through the cylinder block, and rocker arms. The rocker arms are mounted on two separate shafts, one being for the two forward and the other for the two latter cylinders. There is a central bearing between each pair of rockers. Adjustment between the rocker and the valve stem is obtained by means of a screw with a hardened and ground end mounted in the split end of the rocker arm and locked by means of a small bolt. Concentric valve springs are used.

Naturally all the reciprocating parts have been lightened. While the normal model has cast iron pistons, the sporting type is equipped with Ricardo cast aluminum pistons fitted with three compression rings. I-section connecting rods are used, and are machined all over. Two bolts are used for attachment to the shaft and there are detail changes in the connecting rod end, compared with the normal type, with a view to bringing about a reduction in weight.

Method of Lubrication

LUBRICATION follows standard lines, with all the oil in the base chamber, pressure supply to the two main bearings and a supply through the hollow shaft to the connecting rod bearings. At the present time the overhead valve gear is lubricated by the oily vapor from the base chamber passing through the push rod chest. The breather is in the aluminum cover enclosing the whole of the overhead valve gear, and the supply of oil in the base chamber is replenished from the top. It is intended, however, when putting this model into production, to change the oiling system so as to provide a direct oil supply to the rocker arm shaft.

Whether this engine will finally have Delco ignition with a double distributor or double magneto ignition does not appear to be quite certain. The design is so laid out that either one or the other can be used. The plugs are inclined in the head, on opposite sides, just below the valves. Cool-



Citroen engine unit complete

ing remains unchanged, with thermo-syphon flow with a double branched intake pipe from the two bottom corners of the radiator and a central outlet on the front end of the cylinder head. A three-blade cast aluminum fan is belt driven from the magneto shaft.

FOR the normal type engine, as delivered to the public, compression is from 65 to 68 lb. For the engines used in the fuel consumption trials at Le Mans the compression was carried up very much higher, being probably in the neighborhood of 86 lb. The engine timing also was special with a view to economy at the average speed of 25 m.p.h. imposed under the rules, and has not been made public. For the production job the exhaust has a lead of 50 deg. and closes on dead center, while the intake opens with a lead of 5 deg. and closes 40 deg. late. With this timing the power curve shows 35 hp. at 3600 r.p.m.; the engine runs up to 4200 r.p.m., but no reading appears to have been taken at this higher speed. The carbureter equipment is Solex, as on the normal model. Chassis features are identical on both the sporting and the normal passenger model.

French Method of Taxation Serious Obstacle to Sale of American Automobiles

THE French system of taxation of motor vehicles, according to a report to the Automotive Division of the Department of Commerce, was changed in 1920 from a direct tax based on ownership to an indirect tax based on actual usage. A car which is not operated does not pay taxes. The new system has extended taxation to motor vehicles used for the transportation of passengers and merchandise, motorcycles, side cars, and motor boats. It is based on four elements: (1) a tax on each automobile, ranging from 60 to 270 francs, according to the total population of the city in which the owner resides and the seating capacity of the car; (2) a progressive tax per horsepower, ranging from 15 to 45 francs; (3) a circulation tax from 100 to 500 francs, according to five grades of horsepower ratings; and (4) an additional tax for the benefit of the departments, representing 25 per cent of the tax on each car and the tax per horsepower.

Sharp increases occur between 12 and 13 hp., 25 and 26 hp., and 36 and 37 hp. Every effort is therefore being made by manufacturers to bring their motors down to the lower level of taxation in each case.

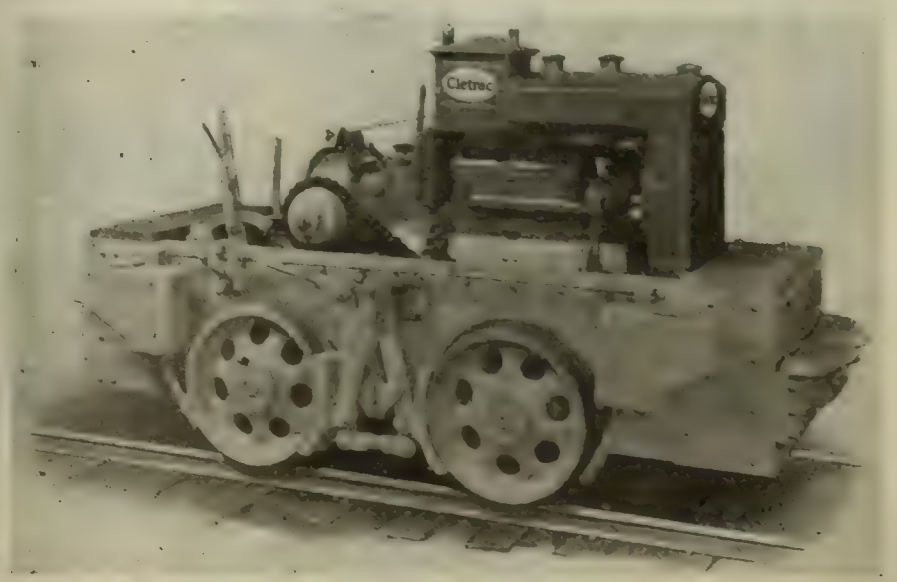
The entire French motor construction program is based on a comparatively narrow bore, long stroke, and high velocity, both because of the present system of taxation and for the purpose of low gasoline consumption. American motors are built on the opposite principle, which calls for a higher consumption of gasoline but gives more elasticity and has much more reserve power. French motors, therefore, generally turn at a speed of 50 to 67 revolutions per second in contrast to the average American motor, which turns at a speed of 20 to 25, although they can be pushed to 30 revolutions per second if required, but not without damaging the bearings and other parts of the motor.

Not considering this wide variation, French engineers at the Bureau of Mines, charged with establishing the various horsepowers of motor vehicles, have for fiscal purposes accepted 30 revolutions per second as the average speed and refuse to consider a lower figure. Thus, French motors are being taxed on the basis of average power, while American motors are being taxed on maximum power which cannot be maintained for ordinary running purposes.

The different bases may represent a variation of but a few horsepower resulting in a difference in taxes of 150 to 200 francs, which is sufficient to cause a real hindrance to the use of American cars. It is therefore necessary that American manufacturers make every possible effort to prove the comparatively low velocity of their motors.

Industrial Locomotive with Tractor Power Plant

A NEW use for tractor power plants is illustrated by the accompanying photograph of a new light industrial locomotive. The Model F Cletrac tractor, minus its side frames, tracks, seat and steering gear, is set bodily into the locomotive frame, making what is claimed to be an unusually light, inexpensive but powerful industrial locomotive. This Cletrac-Atlas industrial locomotive is recommended by the manufacturers, the Atlas Car & Mfg. Co., for road construction, industrial railways and general plant hauling.



The Cletrac-Atlas light industrial locomotive

Chinese Buy American Automotive Products

American cars predominate in Hongkong and Canton. Needed road construction will open up Chinese market. Political stability needed to aid commerce growth. All things American favored.

By Roy C. Bennett

IN one particular instance politics is playing an important part in keeping the automobile business of South China from expansion. The efforts of the British Government of Hongkong to have an automobile road constructed from Hongkong to Canton meets with continued opposition on the part of the Chinese Government in Canton. If such a road were built, as it undoubtedly will be some day, the market for cars in South China would be greatly augmented.

The automotive market in Hongkong is very limited at present and is even more so in Canton. In the latter city there are only 192 cars, practically all of American manufacture. These few cars find difficulty in keeping busy, because Canton has only 20 miles of streets open to automobile traffic, and there is much trouble in their operation because the people walk in the streets, most transportation being by the hand method.

Canton, the metropolis of South China, has seized on western ideas and is building modern streets from material which, until two years ago, was in the wall around the city. The 20 miles of road already built and the 25 to be constructed this year cannot as yet make a very strong bid for the use of automobiles, and it will be some years before the city has anything like a complete system of wide streets.

There is not a single road for cars outside the city of Canton. Six miles is as far as it is possible to travel in any one direction, and there is only one six-mile road. Magistrates in the interior districts of China are given official encouragement to build roads, and the idea is received with enthusiasm. In fact, road building associations are being formed for the purpose of covering the whole country with a network of highways, and if political disturbances do not hinder the plan, eventually South China will become a large market. At present opportunities are slight, but the market should be watched.

IN the central and northern part of China much good road activity is going on. The Shanghai-Minghong road is under construction and will be finished by June and the Shanghai-Cheling automobile road is to be extended to Haining, Chekiang. The Tungchow-Jukao road in Kiangsu is to be opened to traffic in the near future.

Automobile service companies are doing their part. Word has come that the Shanghai-Minghong-Nanhwai Automobile Service Co. has installed a telephone along its road and that the Shanghai-Taitsang Co. has recently completed its road to Lotien.

The Chinese authorities of Antung plan to build a six-mile motor road to Santaolangtou, the seaport of



The only street car service that Canton, China, a city of a million and a half people, has is that afforded by an omnibus line. The company operates ten buses under a street railway charter, but the city wants a municipally-owned system. Pending a decision the company is allowed to operate and earns large profits

Antung, for the purpose of bringing cargo up to the city without lighters. When this road is completed a small demand for motor trucks is certain to arise. There are no dealers in motor vehicles in the Antung district.

General Lu Yung-hsiang, Tuchun of Chekiang, proposes to use his soldiers to build roads from Hangchow to Szean, Huchowfu, and from Hangchow to Wenchow. The Chinese and Foreign Famine Relief Board in Yangchow plans to repair roads by means of the famine laborers.

It may be seen that roads are built by a variety of public and private enterprises and that there is no national program, or anything that approaches it, in operation as yet.

Hongkong is small, but it has 500 or 600 cars and, although it is a British colony, most of these cars are from American factories. The Island of Hongkong offers limited opportunity for the use of automobiles because of its extremely hilly nature. Many places, even select residential districts, are unapproachable except by foot and sedan chairs.

The government of Hongkong is anxious to open up to commerce as much of the territory of South China as possible, hence the idea, already mentioned, of constructing an automobile road to Canton. The officials of Canton fear that if such a road were constructed, Hongkong would draw commerce away from Canton, hence they are in favor of isolation as a means of opposing the growth of their rival city and trade center.

The authorities of Canton have under consideration the question of improving their port, believing that ocean-going steamers would stop there, rather than to unload at Hongkong and transfer cargo to trains and river steamers for Canton. It is generally understood that opposition to the Hongkong highway will cease when the Canton port is developed, because Canton would then benefit from the trade that such a road would bring. When the port will be developed is a matter of conjecture.

THE Chinese in Canton are most friendly toward America, Americans and American goods. They like American cars because of their quality, price and because they are American. If nothing happens to change this pro-American feeling, American cars will have an exceptional advantage when the market opens up.

South China is just awakening from centuries of sleep, and commerce should grow by leaps and bounds if anything approaching political stability could be realized. Just now there is every sign of local stability, and the effects are most wholesome. The national situation is such that investments are discouraged and the growth of markets which these developments would bring, is stifled.

Prospects for Increased Demand for Automotive Products in China

THE recent drop in the value of silver in China has resulted in automobiles selling for twice to three times what they sold for in 1920, and consequently has greatly curtailed the export business of automobile manufacturers in the United States and other countries.

A survey of the automotive industry in China, as seen from an American manufacturer's viewpoint, has just been made by the Automotive Division of the Department of Commerce. No automobiles are manufactured in the Tientsin, China District, which is covered by the survey, and so unstable has become the money market that none have been reported in this district during the past five months.

At the present time the American automobile predominates. There is no taxicab service in the whole of the Tientsin District, comprising more than 8,000,000 people. The bulk of demand is for low priced machines. No particular conditions exist, however, that exclude any kind, grade, or price of machine now being built in America.

Under the present condition of the money market in China each shipment of cars has its own price, depending upon the exchange rate at the time when payment was made or exchange was settled and it is not infrequent that the same dealer may sell the same type of car to two customers, one purchaser being forced to pay from $1 to $500 more than the other.

Due to bad roads the use of automobiles is greatly curtailed. The roads in Tientsin and surrounding country, excepting Peking, aggregate about thirty miles, and in Peking and environs about 130 miles, suitable for motor cars.

"The sale of automobiles and motor trucks and accessories is being vigorously pushed. Advertising, similar to that in America, is being employed. Native salesmen are employed, being paid chiefly on a commission basis. Generally speaking the market is well worked and there are prospects for an increasing demand of motor cars, but the trade is seriously hampered through lack of good roads," the survey concludes.

Japan Wants Cheap Cars

THE prospects for a successful import of British motor vehicles in Japan seem remote, judging from the remarks on the topic by Dr. Takuma Dan, head of the twenty-two Japanese trade delegates, while on a visit of inspection of British commercial means and methods.

British motor vehicles in Japan, he said, are only 5 per cent of the whole. The import motor business fell into American hands during the war and they seem likely to retain it because of such factors as initial price, facilities for replacement parts, ability to provide the sort of car best suited to local conditions and tastes and the promise of starting to manufacture locally. The import duty on cars in Japan is 50 per cent ad valorem and 35 per cent ad valorem on cars with certificates of origin. A British car at present British prices, plus this tariff and freight and incidental import charges, "is a very costly article," said Mr. Dan.

Business Books Discuss Automotive Problems

Survey shows works councils successful. Writer on automobile body building says future holds big opportunities for body engineer. Corporation procedure and commercial credits are discussed.

NEW business books are being published every day. Some are good. Some are mediocre. And some are not so good. Taken as a whole, however, the business literature that is being built up by American publishers is well worth the serious attention of the American executive.

That doesn't mean that you, as an executive of an automotive manufacturing concern, can find profit in perusing all the business books that are published. Not by a long sight! But current business books do comprise a summary of the best thoughts and the best methods of current business practice. They frequently enable you to get a good picture of a problem or a field in a few hours, which could be obtained through investigation or experience only in many months.

To help you save time, however, and at the same time keep you from missing anything of value, we are giving from time to time our opinion of some of the more important business books as they come out, together with an idea of what sort of information they contain.

CORPORATION procedure, commercial credits, experiences with works councils, production control charts, uniflow steam engines, automobile body building—quite a variety of subjects. Yet certain phases of every one have to do with problems and discussions of interest to the automotive industry.

Business books have recently been written on all of these subjects. This informal discussion gives you in brief form a clear idea of what bearing these new books have upon your work as an automotive executive.

We aren't going to review any books. We are just going to talk to you about them occasionally to let you know what connection each one has with the automotive industry or any of the practical every-day problems of the automotive executive.

WE received one book the other day that should be of great practical value to every automotive corporation, although we can't recommend it to executives for light summer reading. *Corporation Procedure* is the book. It is the work of three specialists and covers the fields of corporate law, finance and accounting. Some of the material has been published before, but in this volume it is collected and brought up to date. The authors are Thomas Conynton, R. J. Bennett and Paul W. Pinkerton. The Ronald Press Co. is the publisher.* * * * Special emphasis is given to industrial corporation procedure. * * * * The treatment of surplus and reserves and no-par-value stocks are specially complete and up to date. * * * * A good reference book for any automotive corporation. * * * * The library should have it.

THE National Industrial Conference Board has brought out an interesting report on the experience of various manufacturers with works councils. We commend it highly. It confirms our opinions. * * * * Under the uninspiring title of "General Summary" appears a thoroughly practical and constructive account of the things that have made for success or failure in works councils in this country.* * * * The spirit behind the works council is far more important than the mechanical form taken by the representation plan itself. The employer needs a real desire for fair-play and a real desire to hear what his employees have to say. Continued interest on the part of the management is essential to success. Works councils don't work while you sleep. * *

Detailed information about changes made in works council plans, how experience has shown the plans to operate, what subjects are usually discussed at meetings, etc., are included in the report. If you are a general executive you may not be interested in all of the details, but you ought to read the general summary. When you do so, bear in mind the fact that it is not an expression of opinion, but a digest of collected facts. * * * * There are 775 works councils in the United States as against 225 in 1919. * * * *

STEAM engines are a little out of our line, but for the benefit of those engineers who may have a rather broad interest in the various elements of their profession we make mention of *The Una-Flow Steam Engine* by J. Stumpf.

This is a second edition of a work by Prof. Stumpf who has been active in the development of una-flow or uni-flow steam engines for upward of twenty years. A una-flow steam engine, it may be explained, is an engine in which the steam flows through the cylinder without reversing its direction. In the ordinary engine the steam flows into the cylinder during that part of the power stroke preceding the cut-off, and after the steam has been fully expanded the exhaust valve is opened and the steam flows then back through the same port through which it entered, into the exhaust pipe. A una-flow engine bears considerable re-

semblance to the two-stroke gasoline engine. The steam enters at the head end of the cylinder, but after expansion it escapes through ports in the cylinder wall at the outer end of the stroke.

The author divides the losses in a steam engine into seven classes as follows: Losses due to cylinder condensation; clearance volume loss; throttling or wire-drawing loss; friction loss; leakage loss; heat radiation and convection loss and loss due to incomplete expansion. These various losses are analysed mathematically and otherwise, and means for their reduction are described. The una-flow engine was designed to reduce these losses, and how this is accomplished is fully explained in the book. Numerous types of these engines are described and illustrated in the book, ranging from large rolling mill engines down to automotive designs. The book, however, is more of an analytical than a descriptive character, all descriptions being held quite brief.

COMMERCIAL credits are becoming of greater interest to the automotive industry recently because of the pick up in foreign trade activities. American business men have sometimes hurt their chances for foreign business by commercial practices which were legally sound, but which foreign buyers did not consider to be morally correct. Usually the American exporter has been entirely innocent of any wrong intention in such cases. * * * *From this standpoint *American Commercial Credits,* another Ronald book, may be of interest to a few executives in the automotive field. This book covers fully the legal findings of the American Acceptance Council and analyzes the legal and financial nature of the letter of credit, shows the rights and responsibilities of the various parties concerned, and reproduces the various forms approved by the Conference. * * * *

PRODUCTION managers considering readjustments in control methods will probably be interested in *The Gantt Chart,* a book describing this chart and its use. * * * * Harry Tipper has something he wants to say about this book a bit later, however, so we pass it up for the time being. * * * *

A BOOK about automobile body design has just come in. To judge from recent discussion in and out of the S.A.E. the subject is timely. We are going to get a real body expert to tell you his opinion of this book sometime soon. Kingston Forbes is the author, and the title is *Principles of Automobile Body Design.* Ware Bros. Co. are the publishers. * * * * Another book on our list is *The Unconscious Mind* by Franklin Pierce. For some time we couldn't see what this had to do with the automotive industry * * * * we don't know that we do yet. But we gather from advertisements that it is applicable to salesmanship and merchandising, although you wouldn't guess it from a brief glance at the illustrations and the somewhat technical psychological terminology which greets the casual reader. * * * * McGraw Hill Book Co. sends us a list of books soon to be published among which are *Factory Storekeeping* and *Production Engineering and Cost Keeping for Machine Shops* which may interest our automotive readers. * * * * That seems to be about all for this time.

Thermal Conductivity of Cast Iron

THE thermal conductivity of cast iron is of considerable importance in connection with the problem of conveying the heat of the burning gases absorbed by the combustion chamber walls to the cooling water or the currents of air passing over the outside of the walls. Numerous observations on the thermal conductivity of iron and steel and its temperature coefficient have been made, but most of them do not cover wide temperature ranges. Jaeger and Dieselhorst observed a slight fall in the conductivity of pure iron, from 0.161 to 0.151, as the temperature rose from + 18 to 100 deg, C. Lees observed for wrought iron 0.152 at — 180 deg. C., and for steel a very slight rise with temperature, from 0.113 to 0.115 at — 180 and + 18 deg. C. Callender found a slight fall in the conductivity of cast iron between 54 deg. and 102 deg. C., from 0.114 to 0.112.

EXPERIMENTS on the conductivity of cast iron at high temperatures are described by Elmer E. Hall in *The Physical Review* of last March. He cast a cylindrical shell of 3 cm. wall thickness and 6 cm. internal diameter, fitted it with a hemispherical cap, charged it with parraffin or fused lead (kept liquid electrically) and measured the temperature differences between the inner and outer surfaces of the shells by means of thermo couples. The shell was placed inside a container of similar shape, the temperature of which was controlled. As the temperature of the inner surface rose from 197 deg. to 545.2 deg. C., that is, by about 350 deg., that of the outer surface rose from 194 deg. to 538.6 deg. C. and the thermal conductivity rose from 0.0718 to 0.2050. Two independent sets of observations by different experimenters agreed quite well. However, the thermo couple readings had to be continued for many hours before they became constant. The value at 197 deg. is very low and the change large.

Thermal Expansion of Metal

THE increasing use of nickel, monel metal, stellite, stainless steel and aluminum for spark plugs, steam valves, automobiles and in household and surgical appliances has created a considerable demand for the accurate determination of the thermal expansion of these metals and alloys. Scientific Paper No. 426 of the Bureau of Standards, for sale by the Government Printing Office, considers this subject fully. Ten samples of commercial nickel containing from 94 to 99 per cent nickel, five of which were heat rolled and five heat rolled and annealed: ten samples of monel metal, 60 to 69 per cent nickel, of which two samples were cast, three hot rolled and the remaining of various compositions and treatments; five samples of stellite of different grades, two samples of stainless steel and two samples of 99.4 per cent aluminum were used in carrying on this experimental work.

The conclusions should prove of assistance to engineers using these metals in applications in which the temperature varies considerably.

Service Expense Is a Part of Selling Cost

Accounting method should recognize reason for expense as well as department organization. Service is necessary to secure continued sales. Without it sales would drop off and finally cease.

By Harry Tipper

THE question has been raised as to the inclusion of the expense of the service organization in the marketing cost. This practice was advocated in my article in AUTOMOTIVE INDUSTRIES of June 15th. The question has arisen, undoubtedly, from the general practice of arranging costs in the accounting department in accordance with the departmental organization of the company and not necessarily in accordance with the functions which that department fulfills and the reason for the expense of those functions.

The general definition of marketing costs was given at the head of the previous article and it coincides with the definition of marketing, which was given about a year ago when these marketing articles were started in AUTOMOTIVE INDUSTRIES.

Marketing costs, as stated, include all those costs entering into the distribution and sale of the product.

In other words, manufacturing costs cease, when the product is finished and packed for shipment. General costs relate only to those costs required for the organization and maintenance of the corporation and which cannot be specifically laid either to the manufacturing necessities or the marketing necessities.

The service organization is required as an activity in marketing because of the nature of this business and the character of the products sold by it. The automobile is not useful in itself like soap or bread, to be consumed. It is a complicated piece of transportation equipment, simple to operate, almost fool-proof in the necessities of its travel, but requiring a definite maintenance service in order that it may continue to be useful through the period assigned as its life before the junk pile secures it.

The business grew so rapidly and was so entirely new in its demands upon retailing that there was no general maintenance system already existing by which the automobile could be kept in shape. From the very beginning of this business, therefore, the manufacturer was obliged to study the question of service along with the question of sale and to encourage the establishment of service facilities by retailers entering into the automotive business. The continued market for the automobile depends very largely upon the service which the owner secures from his present car.

The same thing is true of trucks and tractors. To maintain and enlarge the market, service must be available with a minimum of inconvenience to the user; with a maximum of efficiency in the service itself; and with a reasonable relation between the cost of the service and the value of the work to the user. The department created for the development of this service is not a necessary expense of the organization of the company or the operation of the company as a corporation. It is necessary for the purpose of enlarging and maintaining the market and offering the greatest encouragement to the continued and increased sale of the product.

The expense to which the manufacturer is put in maintaining a service organization within the company to supervise the character of the service rendered by the retailers; to encourage the improvement and extension of that service, is a cost of marketing related to sales and definitely a part of the marketing necessities of the business. One of the difficulties encountered in properly placing this service cost arises out of the general tendency to view this part of the marketing expense as necessary but not related to the actual production of sales.

This is unfortunate because all the direct expenses involved in sales or sales work of any kind, as listed in the article published on June 15th, are either productive in their effect upon the market or they are useless. They have no other reason for their existence. They are not required for the general operation of the company and they are not required for the completion of the manufacturing processes. They are required distinctly and solely for the purpose of enlarging and maintaining the market, increasing the sales, and devoloping the reputation of the product, and as such they are productive of sales value or they are useless to the business.

This is especially true of the maintenance of the automobile, truck or tractor in efficient working condition. The service organization maintained by the manufacturer is as necessary to the increase of sales as the sales force itself. Without a proper development of the maintenance service, conveniently located for the owners of the vehicles, the sales force can only maintain sales for a short time. The sales will begin to fall off and finally cease from lack of useful maintenance of the product. The sales, advertising, service, office organization, and administration of the marketing departments, are all a part of the job of enlarging and maintaining the sale and use of the product so that the future of the product can be successfully predicated.

AN automotive executive has objected to the statement made last week by Harry Tipper that service expense should be charged against marketing cost.

* * *

In this article Mr. Tipper maintains his position and emphasizes the fundamental character of service as related to continuing sales.

The accountant, in the usual work required of him, is not confronted particularly with the analysis of business costs from a functional standpoint. It is his business to record the expenses of the company, the expenses of the departments of the company, and to indicate the company's condition so that the executives may be able to determine the general efficiency or inefficiency of the work from the standpoint of cost. The various departments of the company are frequently divided off in the accounting, because of the way in which they have grown, and the general tradition of the organization. These divisions are not necessarily coincident with the functions and the reasons for their existence, and consequently, in the ordinary methods of accounting they are not correlated on that basis.

The writer has made many attempts in the last few years to arrive at some standards of practice in this respect by an examination of the operations of accounting in many different organizations. Individual methods vary, however, in the commercial and marketing costs of the business, so that it is impossible to lay out any general rules unless these rules are arranged theoretically from the functional requirements of the business.

In the manufacturing end of the business, the costs have been subject to discussion and consideration by production engineers and production executives for a good many years, so that there are definite and reasonable standards for the examination of such costs. It is comparatively easy to determine the cost of any operation in the factory, its relation to the total costs, and its comparative efficiency. In hardly any case is it possible to get the complete cost of marketing. Practically none of the present accounting details the cost of the different operations of marketing, their relation to the total cost of marketing in that concern, and their relative efficiency in connection with the actual market condition.

The importance of the cost of marketing, however, makes it very necessary for experimental work to be done along these lines. This experimental work will require the same concentrated study that has been given to manufacturing costs and the same functional analysis of the organization expenses.

When this has been done, the value of the different marketing operations will be determined more accurately and the development of marketing work will permit of a greater efficiency due to the keener analysis of its condition. Where the service organization required by the manufacturer is set up as a separate department on the books of the company, and is not included in the marketing expenses, it is obvious that the expense of sales does not indicate a total which can be relied upon as indicative of its proper position. Yet this method is adopted in a good many organizations so that any comparison of sales cost is based upon arbitrary and empirical method and cannot lead to any real advantage in comparison with what other concerns may do.

Engineers have been able to determine comparative manufacturing costs; to discuss these comparative costs; and to increase the efficiency because the functions have been defined and the elements of manufacturing costs established with a fair degree of common understanding. Until this is done in the marketing end of the business, sales will not bear comparison, and the manufacturer will have no means of knowing whether the sales costs, as exhibited on his books, are greater or less than the sales costs as indicated on the books of another concern, without knowing the detailed methods of classification and changing his own figures until a comparative cost can be established in the case of each detail. Thus comparative costs must be secured.

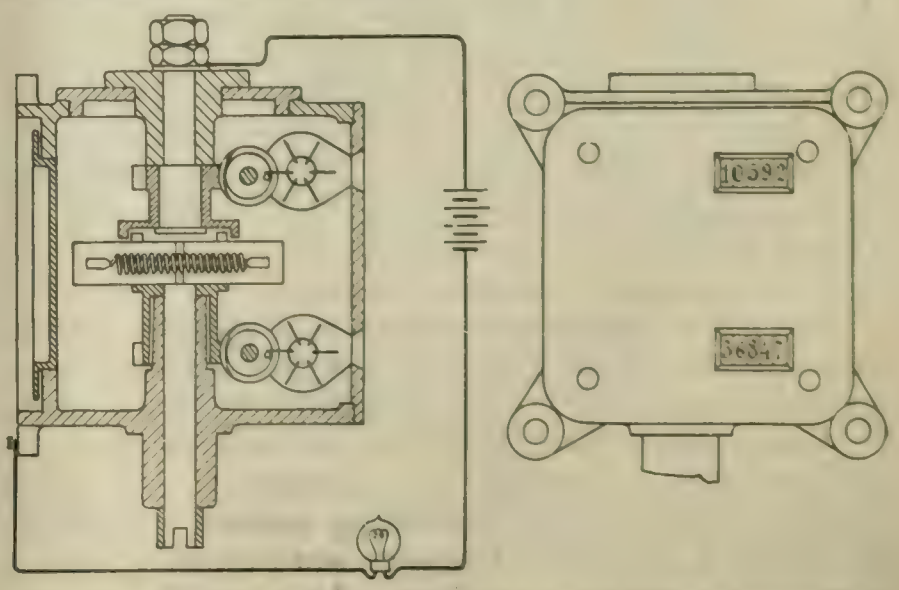
The purpose of the article of June 15th was to suggest the elements entering into the marketing costs in a general way so that their classification could be standardized to some extent and comparative figures could be secured which would be suggestive and advantageous to all manufacturers.

An Excess Speed Recording Odometer for Varied Application

AN odometer, which in addition to recording distance, also shows all mileage covered at any speed in excess of a maximum which may be set by the owner, is about to be put on the American market by Thomas W. Henderson of the Henderson Motor Cycle Co., who has purchased the world's rights for this French invention. He intends to enter into manufacturing arrangements.

This apparatus has two recorders, the one checking up total mileage, and the other only coming into operation when a certain maximum speed has been reached. Originally designed for a big European tire concern, which found that it could not maintain tire guarantees unless it had a check on the speed at which the vehicle was run, the Henderson odometer has a wide application for trucks and other vehicles handled by paid drivers.

This instrument is said to be simple and cheap to manufacture, to be proof against tampering, not likely to get out of order and to record with great accuracy. On the main shaft are a couple of spring controlled centrifugal weights, each one with a stud on its upper face. When the vertical shaft attains a certain speed of rotation the centrifugal weights are thrown out and engage with a notched disk on an upper shaft driving the excess speed recorder. Immediately the upper shaft is put into motion electric contact is made and an electric bell is rung, thus giving the driver warning that he is exceeding the speed limit set by the truck owner. This warning is given immediately the shaft begins to turn and before any figure has appeared on the excess speed recorder. As a consequence the owner can hold his drivers down to a strict observation of the limit he has imposed and would have grounds for discharging or fining any man who ran up more than a very small percentage of excess speed.



Sectional and front view of excess speed mileage recorder

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Afterthoughts of the S. A. E. Meeting

THE Summer Meeting of the Society of Automotive Engineers has passed into history, leaving many pleasant memories for those who were fortunate enough to attend. The facilities at White Sulphur Springs, so far as hotel accommodations, meeting rooms and recreation possibilities are concerned are ideal, but the location is none too central and the expense incident to traveling and hotel are rather too high to encourage a large attendance.

The professional sessions this year maintained the usual high standard, taken as a whole, and the more important ones were well attended. In some cases there was heard the rather common complaint of insufficient time allowance for discussion, this being especially true of the concluding session on Saturday, when four excellent papers were crowded into a time barely sufficient for two. As a result but few had an opportunity to express their views, while the authors had little or no time to close the discussion.

One suggestion which has come to us regarding future meetings is that a small room be provided in which members who so desire can meet in the evening with the author and chairman of the session for the purpose of asking questions and participating in further discussion. This will give all who wish to be heard an opportunity to give their views after time for study of the subject has elapsed. This seems to us an excellent suggestion which might well be given serious consideration by the Meetings Committee.

The paper by G. A. Green not only set an unusually high standard of excellence, but was presented in such an excellent manner as to enable those who had not had an opportunity to read it in advance to enter into the discussion. If all authors would prepare their subject matter in similar fashion, there is no doubt the interest which the sessions hold would be greatly increased, while the author would profit accordingly in the estimate of fellow members.

Errors in Export Figures

NOTICE has just been received from the Department of Commerce that many errors have been discovered in the statistics of exports published for the first four months of 1922. These figures were the first compiled under the new export classification which calls for many detailed subdivisions never before available.

Passenger cars, for instance, are now divided into three price groups and trucks into three weight groups, while previously only total figures were compiled.

It is not to be wondered that mistakes occurred in the first figures issued under this new system. To change a system of such magnitude is certain to be a difficult task, but the final results obtained in this case are so beneficial and desirable that the trouble is well worth while.

The mistakes have been due largely to inaccurate description in the export declarations presented by the shipper or his agent at the custom house for clearance. Frequently inquiries have to be made at a great loss of time through collectors at distant ports in order to reach the original shipper and obtain accurate information for correction of the original reports.

The Department of Commerce makes the following recommendation:

"Exporters are urged to insert in the column 'Class No. of schedule B' on the declaration the number of the statistical export classification of 1922 under which they think the goods should be classified. This practice will expedite clearance at the custom house and prevent return of the declaration for correction or inquiries about items of doubtful accuracy."

The errors in automotive figures may not be as large as in some other commodities, but it will be well for manufacturers to check their cumulative records carefully against the final figures issued at the end of the current year.

Looking Ahead

By James Dalton

THE midsummer season has arrived with nothing on the surface to indicate that a serious falling off in sales of motor vehicles is imminent. It is not to be expected, however, that the present volume will continue indefinitely, for factories are turning out cars and trucks at the rate of more than 2,500,000 a year.

Almost every year since the industry reached anything like its present proportions summer has brought a seasonal decline in business. There is no reason to expect that such a decline can be avoided this year.

Most of the great agricultural sections have reached the critical crop period of the year. Conditions will change from day to day and the weather will have much to do in determining whether crops will be good, fair or indifferent. Farmers are eager to buy motor vehicles, especially trucks, but they are still heavily in debt and the surplus they will have available for that purpose will be governed by the size of their harvest. Generally speaking, the prevailing prices for agricultural products are fairly satisfactory and there are no present indications of sharp declines.

Crop conditions are "spotty." Some sections have had floods and too much rain and others not enough. The Department of Agriculture predicts a wheat crop of 855,000,000 bushels, which will bring at least $1 a bushel and probably a few cents more than that. Market prices will be governed somewhat by foreign demand, and in most wheat growing countries except Russia, particularly in Argentina, prospects are good for more than an average crop. Corn in many districts is backward.

With demand keener and prices higher than for a long time, the outlook for a large cotton crop is not particularly encouraging. It has been delayed by bad weather and floods have forced the abandonment of large acreages. The boll weevil also is working serious damage. Some of the other Southern crops, such as Georgia peaches, are short.

The most menacing cloud on the industrial horizon is the coal strike. There are no signs of a settlement in the near future, however. While Detroit has a three months' supply, the strike has begun to slow up the iron and steel industry.

Railroad workers whose wages have been ordered reduced by the Railroad Labor Board are threatening a walkout, and a strike ballot is being taken, but this move is not taken seriously by the carriers. The unions involved are not strong, financially or otherwise, and their leadership is inexperienced. It is significant that the "Big Four" brotherhoods are holding aloof.

Industry generally has made long strides forward in the last month, continuing the improvement so pronounced in May. While almost all lines are recovering from the depression, as reserve stocks are exhausted and necessity demands new supplies, the greatest activity is manifested by iron and steel, building construction and automobiles.

Textiles are gaining steadily, although not sensationally. Labor troubles have delayed operations in New England, but they are being settled. Shoe factories there are increasing production, while those in the Middle West have been working steadily, practically at capacity. Wool is bringing higher prices and the huge reserve stocks built up during the depression have been practically absorbed. Cotton mills in the South have been operating steadily at high speed for several months and those in New England are coming back.

There is a tendency in several industries, including the automotive, to increase wages as the supply of idle men has become exhausted. Commodity prices are tending higher, and this naturally is raising production costs. The logical consequence will be higher prices at retail. This will be dangerous because it will indicate a secondary period of inflation and may bring on another "buyers' strike." It should not be forgotten that most people already have taken care of their immediate needs and can stay out of the market for some time if they think prices are mounting too high.

While there is nothing in particular to indicate a slowing up in the recovery of trade and industry, automotive manufacturers and dealers will be wise if they proceed cautiously for the next few months. This is no time to pile up surplus stocks of cars, to accumulate excessive inventories, indulge in unnecessary plant expansion, spend money recklessly or exhaust credit facilities.

The industry is doing extraordinarily well and this will be a year of fair profits if reasonable account is taken of the factors of safety.

Month's Shipments Keep at High Level

Prove Trifle Better Than in May —Output This Year Passes 1,000,000 Mark

By JAMES DALTON

NEW YORK, June 27.—With the approach of midsummer the automotive industry is watchfully waiting to determine what effect the national vacation season will have upon the sale of motor vehicles. Practically every year since the industry reached anything like its present proportions, except in 1921, the third quarter has brought a seasonal decline in business.

Conditions last year are considered abnormal. July and August were the best months, with production records, respectively, of 176,336 and 180,781. September showed 158,314.

Anything in the nature of a serious slump in the third quarter this year is highly improbable, but it would not be surprising if production and sales drop below 200,000 and approach the level of the best months of last year.

Production for 1922 already has passed the 1,000,000 mark. The first five months showed a total of 869,000 cars and trucks, and June will approximate at least 200,000. It had been expected generally that June would show a considerable falling off from the May figures, but shipments for the first half of the month were fully as good if not a trifle better.

Smaller Makers Share in Gain

The practically complete total for May was 256,302, once again exceeding the preliminary estimates by several thousand. This demonstrates that not only the big companies but the little ones as well are sharing in the phenomenal business. The belated reports have come from the small producers, and almost without exception they have exceeded the estimates.

Sales in July are likely to depend to a considerable degree upon the size of the harvests. This is the critical period in the agricultural sections and the weather in the next few days will have a great deal to do in determining how much surplus cash the farmer will have with which to buy the motor vehicles he needs and wants.

Dealers for companies which are far behind in deliveries now are having considerable trouble with cancellations from persons who want a motor car, but who will buy their second or third choice rather than go without an automobile in the best touring season of the year.

Business in Brief

NEW YORK, June 26—Additional improvement has been reported in the past week in industry, trade and crops. The general betterment in June was more marked than in May and conditions generally are the best in two years.

Best trade reports come from the West, with mail order houses making good showings.

Crops have held their own in the West and there has been a slight improvement in the South which, coupled with higher cotton prices, has tended towards optimism.

The trend in industry still is toward expansion in spite of the coal strike and threats of a rail strike. Strange apathy is manifested by the public in both these labor difficulties.

The railroads are getting more business than at any time since the coal strike began, and loadings have reached the peak of the year notwithstanding the fact that there are 180,000 idle coal cars.

Price strength is still notable in the textile industries. Cotton goods are stronger and wools have held their recent gains. The shoe and leather trades are more cheerful.

Increasing cost in fuel is credited with the strength of steel prices, although conservative mills are attempting to hold prices down. Additional car buying has been a feature of the week and automobile manufacturers are offering premiums for sheets.

Continued activity in building is keeping all related lines moving at top speed.

Stocks are advancing, bonds are active and firmer, exchange is irregular and money is relaxing.

Bank clearings for the week ending June 22 aggregated $7,381,787,000, a gain of 6.6 per cent over the previous week and of 19.7 per cent over the same week last year.

The parts branch of the industry still is operating practically at capacity and many factories are working day and night shifts. The commitments given them do not run far into the future, but they already have booked a substantial volume of business for July. The industry as a whole continues to proceed cautiously.

Tire production is reaching new levels and nearly all factories are working at capacity. There has been a very large increase this year in the sale of oversize pneumatics for motor buses which are rapidly increasing in number in all parts of the country. Building bus and rail car chassis has brought substantial profits to several truck makers.

No Let Up Expected in Wisconsin Plants

Car Makers Believe Factories Will Continue at Capacity Rest of Year

MILWAUKEE, June 26—Practically all shops in Milwaukee engaged in the manufacture of automotive parts and equipment are busy at full capacity, with some working night shifts to make deliveries according to contract specifications. While there has not been so marked an increase in demand for parts in the last two to three weeks as in March, April, May and the early part of June, nevertheless operations are keeping at or above the previous level.

There is a much more settled feeling in the industry, due to the greater definity of orders and the less hectic rush for materials and parts now that needs are better known and advance specifications more clearly defined.

Four Months' Capacity Sure

Passenger car manufacturers in Milwaukee, Racine, Kenosha, Hartford and other Wisconsin points are now operating at the greatest capacity reached since pre-war days, and orders from distributors everywhere are such that capacity will be required at least four months ahead. From then on, it is confidently believed, no difficulty will be encountered in getting business to keep plants in full operation to the close of the year.

In the last thirty days a gain of 5.1 per cent in number of employees at work in automotive industries in Milwaukee is shown by official joint state and Federal bureau figures.

"Business and Financial Comment," the monthly summary of local conditions issued by the First Wisconsin National, Milwaukee's largest bank, has this to say of the automotive situation:

Business in automobiles, parts, accessories and tires has been increasingly active. It is about time for the seasonal falling off in automobile sales and the trade is wondering whether to expect as lively business in the fall as last spring. Probably part of the sales made this spring would, under normal conditions, have been made last year. Automobile sales follow the fluctuations of business, so that the volume of business to be expected in the latter half of 1922 will depend upon how much improvement general business makes. Should farm crops turn out well and farm prices be well maintained, a good automobile business among the farm population will result.

Local Trade Active

The past week showed an increase in demand in Milwaukee for passenger cars over the previous fortnight, which in some respects was less active than the first week of June or the average week in May. The dip in the sales curve was not sharp, however, amounting to only a slight slackening. This did not disturb dealers to any extent, and the revival,

(*Continued on page* 1452)

Harroun, Long Idle, Now in Receivership

Guaranty Trust, Named by Court, Probably Will Sell Company's Assets

DETROIT, June 26—Harroun Motors Corp. has been placed in receivership by Judge Tuttle in Federal Court, the Guaranty Trust Co. being appointed to act pending further action on claims by creditors. An immediate appraisal of the plant and inventory will be made by the receiver to determine the assets, which are said to be less than half the liabilities.

William C. Butler, vice-president and secretary of the trust company, said that inasmuch as the plant has been idle for almost four years no attempt would be made by the receiver to operate it. The steps taken, he said, are merely to conserve the assets in the interest of creditors and stockholders. Indications are that these would be sold as soon as necessary preliminary work was concluded.

Nominal assets of the company are given as about $1,000,000 and the liabilities about $2,000,000. Buildings are valued at approximately $500,000 and material and equipment, consisting of automotive equipment and parts, $350,000. There is also a considerable stock of government owned property used in the making of ordnance during the war which will be removed.

Finances Held Company Back

When first organized, the company made the Harroun car, which was discontinued to make ordnance when the war began. Owing to lack of finances the company was unable to re-enter the automobile manufacturing field following the armistice, though efforts were made constantly by President John Guy Monaghan to enlist new support. Monaghan's efforts in this direction terminated just prior to the receivership.

The plant has been looked over a number of times during the present year by companies which were planning to expand or were planning to locate factories in the Detroit district. Negotiations were entered into several times by interested parties, but were abandoned because of inability to agree on terms.

The company was organized by Ray Harroun, racing driver, who served as first president. In the brief period between the time it was formed and the outbreak of the war, the company built a limited number of cars, but was hampered because of lack of capital.

FILMS CLUTCH ADJUSTMENT

CHICAGO, June 26—A motion picture showing how a clutch adjustment should be made and detailing the operations of removing, overhauling and setting up a clutch, has been prepared by the Borg & Beck Co. of Chicago. This film is available for exhibitions at trade association meetings, dealer conventions and service conferences.

The idea was conceived by William Mack, sales manager, who believes that many owners and service station managers consider the clutch somewhat of a mystery because it is entirely hidden from view.

When Sales Are Halted in One Section Shipments Should Be Diverted

By O. C. HUTCHINSON,
General Sales Manager of the Hupp Motor Car Corp.

DETROIT, June 24.

WITH the exception of four or five spots in the United States, business continues to be very steady and it is unlikely that there will be any dip in sales until late in the summer. As a general territory the South has not produced business as strongly as have other sections of the country and with warmer weather now setting in business there will decrease. Other sections of the country are good, many being sold far ahead of their shipping specifications.

There is room for much dealer development work in the South, owing to the mortality which swept many from business during the recent depression period. Small town dealers in that section were particularly hard hit, the large part of the business now being done in that section being in the larger cities. In other parts of the country the dealer situation is good, but there is a steady demand by dealers for franchises with companies producing standard makes.

Any overstocking of dealers with cars should be carefully avoided by the industry, and this should not be difficult with companies having national distribution. Where demand is temporarily halted in one section, the factory sales department should divert shipments from that section to others where business is better. This will not only keep dealers from being compelled to seek business on a disadvantageous basis, but will give poor sections a chance to recover their stride normally without getting several months ahead of true demand.

Closed car business at present is far ahead of factory production, a condition which was bound to assert itself as soon as owners became convinced of the superior comfort and convenience of the closed vehicles. I am confident that the industry is approaching the point where closed cars will total 85 per cent of all city sales, and that the open models will find practically all of their market in the smaller towns and country districts.

It is impossible now for factories to meet the closed car business developed and it will be several years before production can be brought up to the required point. Up to this year there has not been a sufficient volume of closed car business to make it especially desirable from the factory viewpoint, owing to the greater care required in the handling, but now it is coming through in quantities which make it very satisfactory.

There will be no revision in prices by the larger manufacturers this fall, and this stability, with the good business prospects for 1923, will induce dealers to buy cars for the spring trade much more liberally this winter than for several years past. The buying of the present year has disposed of the used car as a problem and dealers generally are in a better financial position than they have been since before the war.

New Metropolitan Agent for Maxwell and Chalmers

NEW YORK, June 26—The Colt-Stewart Co. has been formed here to take over on July 1 the business of the Maxwell-Chalmers Distributing Corp., which handles the Metropolitan distribution of the Maxwell and Chalmers lines.

The principals in the new company are W. L. Colt, eastern division manager for the Willys-Overland Co. and former member of the Colt-Stratton Co., Dodge Brothers dealer in this city, and W. D. Stewart, New York branch manager of the Willys-Overland Co.

Newly Formed Atlas Axle Takes Over Two Companies

WILMINGTON, DEL., June 26—The Atlas Axle Co. has been organized to take over the American Machine Co. of Newark, Delaware, and the Lobdell Car Wheel Co. of Wilmington. It has a capital of $500,000 in common stock, but none of the stock is available for sale.

Officers of the Atlas Axle Co. are: President and general manager, Joseph Stuart; vice-president and sales manager, Richard A. Whittingham; secretary and treasurer, H. Lobdell Seaman. The directorate is composed of the officers with J. Bayard Hearn, Richard A. and George H. Whittingham, and Charles R. Durling.

For the present, production will be confined to the various models of the special motor bus rear axle designated as the L C series. This design incorporates a one-piece cast housing of box girder section offset from the wheel spindles, and thus providing a very low spring mounting.

Double Durant Stock to Permit Exchange

Under Plan Divisional Shareholders May Get Securities of Parent Company

NEW YORK, June 27—Stockholders of Durant Motors, Inc., decided at a special meeting here to-day to increase the capital stock from 1,000,000 to 2,000,000 shares and thus provide for an exchange of stock of the several divisional corporations for the securities of the parent company. This exchange can be made at the option of the stockholders at any time between Aug. 1, 1924, and Aug. 1, 1926. The plan is designed to facilitate the acquisition by the corporation of large interests in its allied companies. For this purpose approximately 500,000 shares will be required. The balance of the stock will be available for such use as the directors may determine to be for the best interests of the corporation.

Sarver on Directorate

The stockholders decided also to increase the directorate from five to nine members. From the standpoint of the industry, the most interesting addition to the board was A. H. Sarver, who was president of the Scripps-Booth Corp., a subsidiary of the General Motors Corp. until it was liquidated recently. He is a widely known figure in the automotive field. The directors in addition to Sarver and W. C. Durant are:

T. W. Warner, Carroll Downes, who now is president of the Durant Motor Car Co. of Michigan; W. W. Murphy, who has been Durant's assistant since General Motors days; C. F. Daley, H. W. Alger, who is vice-president of the Michigan company; W. R. Willett, who is at the head of the Durant Motor Car Co. of Indiana, and F. W. Hohensee, chief engineer.

After their selection the directors organized by electing the following officers: President, Durant; vice-presidents, Warner and Downes; treasurer, Murphy, and secretary, H. F. Herbermann.

The Durant Motor Car Co. of New Jersey, which will have charge of the production of the Star in the recently acquired plant of the Willys Corp. at Elizabeth, now is being incorporated with a capital of $10,000,000. The stock will have a par value of $10 with the conversion privilege. It will be headed by Hohensee as president, but the other officers have not been determined.

A large force of men now is at work in the Elizabeth factory, getting it ready for production at the earliest possible moment.

PENN AND BELMONT MERGED

LEWISTOWN, PA., June 26—Hilton W. Soffeld, president of the Penn Motors Corp. of Philadelphia, announces the consolidation of the Penn Motors Co. and the Belmont Motor Co. The plant of the former company at Riverton, N. J., burned in June, 1921, and since then the concern has been without a location. The Belmont company has a large plant, the former North American Tannery remodeled. In addition to Penn motor trucks, the company will manufacture the Corey motor-driven cultivator, assemble metal windows, etc.

RAIL CAR EQUIPMENT LOWERS COST $14,000

NEW YORK, June 26—Substitution of motor rail car equipment for its steam locomotive and coaches will save the Union Transportation Co. of New Jersey nearly $14,000 a year.

The new equipment will be used on the line from Hightstown, N. J., where it connects with the Amboy division of the Pennsylvania Railroad, to Pemberton, the southern terminus, where connection is made with the main line of the Pennsylvania Railroad.

Midwest Engine Reports Steady Gain at Plants

INDIANAPOLIS, JUNE 26.—Receivers for the Midwest Engine Co. report that operations in the plants here and at Anderson have shown a steady increase. The Anderson plant has returned a substantial profit in the last five or six weeks. Progress is being made in the introduction of the heavy duty engine manufactured in the Indianapolis factory.

The reorganization plan under which the assets will be transferred to the new Midwest Engine Corp. will be cleaned up within two months. The reorganization committee consists of Lewis E. Pierson of New York, chairman; Charles F. Hills, Boston; C. Lasmann, Cincinnati; Elmer W. Stout and Homer McKee, Indianaoplis. The preferred stockholders committee consists of Thomas Taggart, Leo M. Rappaport and William N. Mooney of Indianapolis. The Midwest Engine Corp. is to have an authorized issue of $5,000,000 preferred stock and 125,000 shares of common stock of no par value.

FORM GOOD ROADS BODY

NEWARK, N. J., June 26—The Good Roads Association of New Jersey has been organized to stimulate interest in the $40,000,000 highway bond issue, which will come up for a referendum vote at the November election. The organization, which is incorporated, is composed of men prominently identified with other civic organizations throughout the state, including the state grange. Harry Meixell, secretary of the Motor Vehicle Conference committee, has been made secretary. The organization is non-political in character.

Women Told of Ways to Make Roads Safe

How Highways Benefit the Home Also Discussed Before Convention of Clubs

CHAUTAUQUA, N. Y., June 27—"Highways Benefit the Home" and "Highway Accidents Are Preventable" were the themes developed by Pyke Johnson and John C. Long of the National Automobile Chamber of Commerce, speaking before the biennial convention of the General Federation of Women's Clubs in session here.

Fresh food is made available for the city children, better schools and wider social opportunities are provided for the country boys and girls, as a result of improved highways and motor transportation, Johnson pointed out.

Guarding of danger points, prosecution of the careless driver, ample playgrounds and education in the schools will eliminate accidents, Long indicated.

"If every woman in America would enroll for the degree of Doctor of Safety, the accident question would soon be solved," said Long. "Twenty-eight cities reduced their motor fatalities last year. Massachusetts cut down the number of traffic injuries 50 per cent. The four main symptoms and their remedies are these:

Remedies Suggested

1. Danger spots, such as curves, blind corners, busy intersections. Sufficient guarding by patrolmen or by signs is an immediate remedy, with improvement of the physical design of the danger spot as an ideal remedy. That is, a sharp curve may be protected, but it should ultimately be eliminated.

2. Prosecuting the careless driver—Citizens Complaint Bureaus, like those in Detroit and Syracuse, are needed to facilitate complaint against and prosecution of the reckless minority who are making the entire community pay the price of their heedlessness.

3. Playgrounds — The school department should be consulted as to whether there is enough play space and whether there are enough play instructors to justify telling the children not to play in the streets. Pending the building of more playgrounds, if needed, certain streets should be roped off as play areas.

4. Education in the schools—Children are naturally irresponsible, but through traffic games, playlets and other instruction they can be trained habitually to conduct themselves properly in traffic.

WILLS DENIES FORD RUMOR

DETROIT, June 26—Emphatic denial is made by C. H. Wills that Henry Ford proposes to purchase the plant of C. H. Wills & Co. at Marysville. He declared the rumor was based upon a visit made to the plant by Henry and Edsel Ford. This visit was due, Wills declared, simply to the fact that friendship formed when he was in charge of production for Ford was being continued.

Parts Demand Keeps Plants at Capacity

June Will Equal May, Which Was 27 Per Cent Better Than Preceding Month

NEW YORK, June 26—Business in the entire parts and accessory field now is so good that filling orders has become much more difficult than getting them. Most plants are operating at capacity, and many of them are working both day and night shifts.

The volume of business done by members of the Motor and Accessory Manufacturers Association in May approximated $43,700,000. This was an increase of about $10,000,000 over April, or 30 per cent. It showed a gain of $26,000,000 over January when the total was $17,320,000. The biggest total for any month in 1921 was in May with $26,780,000, and the percentage of gain in May, 1922, was the largest since the close of March, 1921.

June Probably Will Exceed May

Indications are that the total for June will be fully as large as for May and probably larger. Commitments placed by passenger car and truck manufacturers for July are fully as heavy as they have been for any month since production approached present record proportions.

Numerous companies in the parts field have commitments running through September. Manufacturers expect something of a seasonal falling off in motor vehicle sales, but they are convinced that there will be no serious slump in the volume of their business before the last quarter of the year, and they do not look for the usual sharp drop at that time.

Credit conditions are highly satisfactory. Most vehicle manufacturers are discounting their bills, and the total of past due accounts has become practically negligible. Notes outstanding are being whittled down steadily.

Altogether the parts branch of the industry is highly enthusiastic over the volume of business thus far and the prospects for the remainder of the year.

TABLE SHOWING SALES OF M. A. M. A. MEMBERS FOR 1921 AND FIVE MONTHS IN 1922

NEW YORK, June 26—The following table shows the sales by members of the Motor and Accessory Manufacturers Association, the total of past due accounts and the total of notes held, for all the months of 1921 and first five months of 1922.

1921	Total Sales	Per Cent Change	Total Past Due	Per Cent Change	Total Notes Outstanding	Per Cent Change
January	$6,264,587	.....	$8,099,727	.....	$4,359,871	.....
February	10,408,962	66.15 Inc.	6,717,165	17.07 Dec.	6,063,118	39.08 Inc.
March	20,120,386	93.30 Inc.	5,603,992	16.57 Dec.	5,069,877	16.38 Dec.
April	26,746,580	32.93 Inc.	5,352,271	4.49 Dec.	5,371,086	5.94 Inc.
May	26,781,350	.13 Inc.	4,505,176	15.64 Dec.	4,460,355	16.77 Dec.
June	22,703,414	15.19 Dec.	4,720,973	4.79 Inc.	4,012,670	10.37 Dec.
July	23,096,214	1.68 Inc.	5,242,046	10.79 Inc.	3,690,154	7.90 Dec.
August	23,397,640	1.31 Inc.	4,348,790	17.06 Dec.	3,494,510	5.30 Dec.
September	23,141,891	1.09 Inc.	4,358,545	.22 Inc.	3,677,500	5.24 Inc.
October	22,053,327	4.70 Dec.	4,512,680	3.54 Inc.	3,463,500	5.82 Dec.
November	18,998,490	13.85 Dec.	4,352,000	3.56 Dec.	3,661,900	5.73 Inc.
December	14,349,750	24.47 Dec.	4,220,450	3.02 Dec.	3,384,250	7.58 Dec.
1922						
January	17,320,000	20.61 Inc.	4,450,000	5.45 Inc.	3,146,000	7.02 Dec.
February	22,720,000	31.17 Inc.	4,070,000	8.57 Dec.	3,483,000	10.74 Inc.
March	28,670,000	26.14 Inc.	2,890,000	28.86 Dec.	2,657,000	23.69 Dec.
April	33,830,000	18.07 Inc.	3,000,000	2.00 Inc.	2,500,000	1.5 Dec.
May	43,700,000	28.06 Inc.	2,900,000	2.75 Dec.	2,450,000	6.5 Dec.

Export Views Exchanged by Managers at Luncheon

NEW YORK, June 29—Export managers for automotive companies are holding here to-day the first of a series of monthly informal luncheons at which business in the foreign fields will be discussed. The meetings are being held under the auspices of the export departments of the National Automobile Chamber of Commerce and the Motor and Accessory Manufacturers Association. There will be no formal speaking, but anyone who has fresh information about export conditions will be expected to share it with the others.

The next meeting of the directors of the N. A. C. C. will be held at Buffalo, July 12. It is the custom of the directors to hold one meeting each year in Buffalo, the home of Colonel Charles Clifton, president of the organization, and another in Detroit, the center of the industry.

Old Associates Surround Miniger in New Auto-Lite

TOLEDO, June 26—C. O. Miniger, who has acquired all the property and assets of the Electric Auto-Lite Corp., has surrounded himself with men who have worked with him for years in developing the business. The new Electric Auto-Lite Co., incorporated in Ohio, will have the following officers: President, C. O. Miniger; vice-president, D. H. Kelly and A. E. Buchenberg; secretary, F. H. Landwehr, and treasurer, J. H. Householder.

It is stated that the plants at Toledo, Fostoria and Poughkeepsie will continue with practically the same lines of business as heretofore. Production now is at the rate of between 500,000 and 600,000 complete units a year.

An issue of $3,000,000 of 7½ per cent first mortgage sinking fund gold bonds of the Electric Auto-Lite Co. due July 1, 1932, has been issued through a syndicate. The bonds are to finance the purchase of the property by Miniger. Tangible assets are said to be $7,940,000 of which approximately $3,590,000 constitutes current assets. A sinking fund of $25,000 a month plus one-half the annual net earnings is to be used to redeem at 105 in the first three years, 107½ during the next four years and 105 thereafter.

NEW MARTIN-PARRY PLANT

YORK, PA., June 28—The Martin-Parry Corp. announces that it will duplicate in Los Angeles an assembling and service plant recently opened in a new building in San Francisco. Assembling and service plants also have been opened in Omaha, Denver and Salt Lake City.

Base for Chevrolet Flat Rates Is Time

DETROIT, June 26—The Chevrolet Motor Co.'s flat rate system on service will be mailed to all dealers and independent garages giving service on Chevrolet cars next week. The principal feature of the system is that it sets up a time for all major and minor operations necessary in servicing, and permits the service man to fix his labor charges on this basis.

The original plan of fixing the charge on a flat rate basis was abandoned in favor of the plan fixing the time, so that it would meet differing labor conditions and wage schedules in all parts of the United States and foreign countries where Chevrolet service is given. In setting up the time, the use of certain tools listed under the plan is counted upon.

The primary purpose of the plan is to help dealers and service men fix a charge for service previous to the performance of the work. To do this they will consult the flat rate schedule to ascertain the time required, and then add the cost of new material or parts they are required to install. Fixed material and parts costs have been effective previous to this time.

Although the employment of the flat rate in fixing charges is left largely to the discretion of the service shop, the company is setting up the advisability of its general use in maintaining the customer's good-will. The effect of the flat rate will be carefully followed and any revisions will be made.

AUTOMOBILE CARS ORDERED

CHICAGO, June 26—The Wabash Railroad has placed an order for 1500 automobile cars to be manufactured by the Pullman Co. and the American Car & Foundry Co.

Dirigible Company Working Out Plans

General Air Service Now Preparing for Terminals and Research Laboratories

NEW YORK, June 27—The General Air Service which proposes to operate dirigibles of the Schuette-Lanz type between New York and Chicago, is making preparations to provide terminal facilities along the proposed route, establish research and experimental laboratories for perfecting apparatus to handle helium gas and the production of new alloys for metal parts.

To Have Producing Branch

Inasmuch as the General Air Service is an operating company only, it is expected to organize in the near future a company to build the airships, of which three will be required in order to have a 10 hour service daily between New York and Chicago. The company is proceeding on comprehensive and conservative lines. The subscribers include many of the best known financiers and manufacturers in the country. In the list are:

S. Reading Bertron, Edward H. Clark, Lewis L. Dunham, William D. Joyce, J. R. Lovejoy, Samuel McRoberts, Franklin Remington, Franklin D. Roosevelt and O. D. Young of New York.

Taylor Allderice, George W. Crawford, Arthur V. Davis, E. M. Hur, W. H. R. Hilliard, James H. Lockhart, J. R. McCune, H. C. McEldoney, R. B. Mellon, W. L. Mellon, E. W. Mudge, Benjamin Shaw and Wilson A. Shaw of Pittsburgh.

Marshall Field, C. Bai Lihme and Philip N. Wrigley of Chicago; Chester C. Bolton, Benedict Crowell and L. C. Hanna, Jr., of Cleveland; Robert Cassat and Samuel F. Houston of Philadelphia; Lawrence V. Venet of Paris; W. E. Boeing of Seattle; John H. Kirby of Houston, Texas; E. W. Marland of Ponca City, Okla., and Lewis G. Stevenson of Bloomington, Ill.

Year Book Describes Ships

On the route between New York and Chicago, according to the Aircraft Year Book of the Aeronautical Chamber of Commerce, the ships of the General Air Service will be of about 3,350,000 cu. ft. capacity, contained in 20 or more ballonettes. This will make a ship 750 ft. long and 97 ft. in diameter, constructed of cold-riveted tubes. Such a ship would have 10 standard 300 hp. engines, and the net carrying capacity utilizing helium as the lifting gas will be sufficient to transport between New York and Chicago 100 passengers and baggage and 60,000 lbs. freight. Ships for transoceanic service would necessarily require an increase in size to 5,000,000 and 7,000,000 cu. ft. This would be necessary in order to carry greater paying loads and increase fuel capacity for cross-ocean flights.

Designs now completed for the type that the General Air Service will put into commission for trans-Atlantic service will be ships 900 ft. long and 114 ft. in diameter, with a gas capacity of 5,297,490 cu. ft. and a passenger capacity of 100, while ships for South American traffic will be 977 ft. long and 126 ft. in diameter with a gas capacity of 7,240,600 cu. ft. to accommodate 100 passengers. The horsepower of the Atlantic cruiser will be 3900 and of the South American ship 5400. The cruising speeds of all ships of this company will be 75 m.p.h. with a maximum speed of 100 m.p.h.

144,469, TOTAL FORD PRODUCTION FOR MAY

DETROIT, June 26—Total production of the Ford Motor Co. for May was 144,469 cars, trucks and tractors, divided as follows:

Cars, American, 121,073; foreign, 7170; Canadian, 6579.

Tractors, American, 8950; foreign, 155.

Lincoln cars, 602.

Grand total, 144,469.

Chapin Expects Pontiac to Become Parts Center

PONTIAC, MICH., June 27—The expected favorable decision of the Grand Trunk railway with regard to proceeding at once with building the proposed belt line around this city, thus opening several miles of frontage for factory sites, is regarded as furnishing a stimulus for the removal to the Detroit field of a number of plants now making automobile parts in other parts of the country.

Roy D. Chapin, president of Hudson-Essex Motor Car Co., expressed his conviction that a concentration of automobile parts plants in the Detroit district is a necessity for the continued economic manufacture of motor vehicles.

"It is getting out of the question to send large parts half way across the continent to the manufacturer of cars," he said. "These plants will some day establish themselves closer to their market, and I expect to see many of them locate in Pontiac."

LAFAYETTE PLAN APPROVED

NEW YORK, June 26—Stockholders of the Lafayette Motors Co. have approved the reorganization plan under which the company will be provided with $2,000,000 additional working capital. The factory personnel will remain unchanged. The present design of the Lafayette will be continued.

1921 TIRE SALES SURPASSED

NEW YORK, June 26—The Kelly-Springfield Tire Co. announces that in the first six months of this year it has sold more tires than during the entire year of 1921. The plants at Cumberland, Md., and Akron are working at capacity.

Helium Use Changes Design of New Ships

Dirigibles Goodyear Contracts to Build for Army Will Have Larger Envelopes

AKRON, June 26—The first dirigibles to be designed in this country to use non-explosive helium gas in the place of hydrogen gas will be built for the army under contracts awarded the Goodyear Tire & Rubber Co.

Owing to the fact that helium gas has not the same lifting power as hydrogen gas, the new ships will be of a rather radical design with considerably larger envelopes in proportion to the crew, cars and weight carried. Following the Roma disaster several months ago the air service of the Government ordered that no further dirigible flights be negotiated with hydrogen gas and that helium be substituted for hydrogen in all Government blimps then in commission.

The first of these ships to be changed over was the new Army Ship No. 221, of 178,000 cu. ft. capacity, built by Goodyear and now being re-assembled at Langley Field, Va., to replace the Roma. About 1500 pounds of weight had to be removed from the crew car of this ship, in order to give the envelope sufficient lifting capacity when filled with helium.

Ships of Non-Rigid Type

The new army ships will have a gas capacity of 250,000 cu. ft. each. They will be of the non-rigid type, each carrying a crew of from seven to eleven men, and will have wide cruising radii. They will be used by the army for experimental work, training of pilots and in patrol work.

Goodyear will open its aviation hangars near Akron on July 1 to begin assemblage of three similar ships for the navy, and will assemble the three army ships as soon as the navy blimps are commissioned.

Goodyear also expects to make shipment some time this summer to Lakehurst, N. J., of the eighteen large ballonets being made as gas containers for a sister ship of the ZR-2 which exploded over Hull, England, last year. This will be the first rigid dirigible to be built in America, and it will also be the largest rigid dirigible flown in this country. The ballonets range in capacity from 18,000 to 180,000 cu. ft. of gas, and are made of rubberized balloon cloth or fabric.

TRASK STEAMER IN CANADA

DETROIT, June 26—The Detroit Steam Motors Corp., manufacturing the Trask Detroit steamer, will open a plant at Windsor, Ontario, under the name of the Windsor Steam Motors according to A. B. Muir of this city. The company intends to enter not only the Canadian domestic market but to avail itself of the Canadian British tariff preference in seeking export sales, Muir said.

New Hartford Parts Has Spicer Backing

Charles A. Dana Elected President of Reorganized Company

HARTFORD, CONN., June 27—From the defunct Hartford Automotive Parts Co. has emerged the Hartford Auto Parts Corp., which has the backing of the Spicer Manufacturing Co. of Plainfield, N. J. Charles A. Dana, directing head of the Spicer organization, is president of the new local concern. Other officers of the new corporation are: Vice-president, John S. Berry, and treasurer and secretary, Paul D. Hawkins, both of Plainfield; directors, Charles A. Dana, Ezra P. Prentice of New York, and Lenore Carbaugh of Colonia, N. J.

The authorized capital stock is $430,000, with $100,000 paid in. The stock is held as follows: A. E. Brion, L. W. R. Campbell and R. N. Benham, comprising the creditors' committee of the Hartford Automotive Parts Co., 23,000 shares preferred; Spicer Manufacturing Co., Richmond, Va., 10,000 shares of preferred and 990 shares of common; Lucius F. Robinson, eight; Lucius F. Robinson, Jr., one, and Francis E. Jones, one.

There are 33,000 shares of preferred stock at a par value of $10 and 1000 shares of common at a par value of $100 each. The reorganization assures the operation of the Hartford plant.

Power Farming Bureau Reorganized by Fuller

CHICAGO, June 26—The Power Farming Bureau, with offices at 1456 Monadnock Building, has been reorganized and incorporated by George E. Fuller, its former secretary. Last March a number of tractor manufacturers comprising the membership of the bureau organized the National Institute of Progressive Farming, which was intended to serve as a successor. Guy H. Hall of Kansas City was employed as secretary and manager.

Fuller said there was a demand on the part of some tractor builders and gas engine manufacturers for the continuance of the Power Farming Bureau and so undertook the work of reorganization. Fred Tubbs of the Alamo Farm Light Co. is chairman of the executive committee. The publication of a monthly bulletin is proposed.

FORD COMPLETING TROY PLANT

TROY, N. Y., June 26—The Green Island plant of the Ford Motor Co., which will be used for the manufacture of ball and roller bearings for Ford cars, trucks and tractors soon will be in operation. A large one-story building, 1100 ft. long and 120 ft. wide, will be commenced in July, and as expansion becomes necessary duplicates will be erected in parallel rows. The hydroelectric equipment will generate 8000 horsepower.

MONITOR URGES TRUCK AND RAIL COORDINATE

BOSTON, June 26—An editorial in the Christian Science Monitor, under the caption "Railroads and Motor Trucks," says:

"Now that the motor truck has come to stay, and since its activities are so closely allied with those of the railroads, it would seem expedient for the railroads either to go into the motor-truck transportation business themselves, or so to coordinate their transportation business with that of the truck concerns that it would be helpful alike to the railroads, the truck companies, the shippers and, most important of all, the consuming public.

"The motor trucks could be made feeders of the railroads instead of competitors. In these days of giant motor trucks there is no reason why they should not become valuable accessories to the railroads. If it is not yet feasible for a freight-car body to be made demountable and used interchangeably with a motor truck body, it is not beyond the bounds of reason to believe that some day it will be."

M. A. M. A. Will Widen Scope of Convention

NEW YORK, June 26—Past, present and future conditions in the automotive industry will be considered at the annual convention of the Motor and Accessory Manufacturers Association which will be held Sept. 13, 14 and 15. The meeting place has not been determined. Credit has been the main theme of these meetings in previous years, but it has been decided to widen the scope so that there will be general sessions devoted to current problems of the industry with specialized departmental meetings for advertising, traffic and export managers.

This convention of the M. A. M. A. is regarded as one of the most important of the year. Speakers of national reputation will share the program with industrial leaders and executives of the companies which are members of the association. All branches of the trade will be represented, and banking, transportation and government departments will have their spokesmen.

Ad Council to Meet

NEW YORK, June 26—The executive committee of the advertising council of the Motor and Accessory Manufacturers Association will meet in New York July 7, to map out a program for the meeting which will be held in connection with the annual September convention of the association.

Parenti Plant Sold to Small Car Maker

Hanover Motors' Offer Accepted When Plans to Redeem Property Fail

BUFFALO, June 27.—The Marine Trust Co., which has been acting as trustee for the benefit of creditors of the Parenti Motors Corp., has reported to the creditors that the committee appointed some time ago to raise money for the redemption of the property was unable to obtain sufficient funds for that purpose.

The trust company, therefore, called the creditors' committee together to consider various bids which had been submitted for the property. A number of attorneys representing attaching creditors and the attorney for the parties who hold the mortgage on the property were also present at the meeting.

Number of Bids Received

At this meeting the trustee reported a number of bids ranging from $85,000 to $225,000. A resolution was passed authorizing the trustee to accept an offer made by the Hanover Motor Car Co. of Hanover, Pa., who claim to be the manufacturers, heretofore on a royalty basis, of a small automobile, built around a two cylinder, air cooled engine, the car being intended to take the place of motorcycles and motorcycle cars, at a cost to the consumer of about $250. A number of these cars have been recently on the streets of Buffalo.

It is reported that the Hanover company will move its jigs, machinery and equipment into the Parenti plant about July 1. It is also understood that an effort will be made to use the materials on hand at the Parenti plant to make completed cars, under an arrangement with a number of former stockholders of the Parenti company.

Price Exceeds Estimates

The trustee reported to the creditors that the demand for factory property has been dull and that the price obtained greatly exceeds the estimates heretofore made by competent authorities. It is believed that the price obtained will give the creditors a much better dividend than was expected. The liabilities filed with the trustees by the various creditors aggregate about $480,000, including the mortgage. However, a large number of the claims submitted are disputed, and a considerable reduction in the liabilities is expected when the claims are readjusted.

The Marine Trust Co. is not a creditor of the Parenti concern, having consented to act as a liquidating trustee for the purpose of saving the creditors the loss and expense usually involved in court proceedings. The matter has been handled by the trust department of the Marine bank.

Men of the Industry and What They Are Doing

Sloan to Sail for Europe

Alfred P. Sloan, Jr., vice-president of General Motors Corp. in charge of production, will sail for Europe next Tuesday to be absent until Aug. 15. He will be accompanied by Mrs. Sloan, and they will visit England, France and Switzerland. The trip will be principally a vacation for Sloan, who has worked under high pressure ever since he assumed his present duties.

Hannum Completes Year

A year as president and manager of the Oakland division of the General Motors Corp. closed during the past week for George H. Hannum, and the occasion was celebrated with a dinner given him at the Brooklands Golf Club, near Pontiac, by employees of the division. About 150 office men, foremen, superintendents and heads of departments were present with Hannum and Ernest M. Orr, assistant general manager, as guests of honor.

C. J. Nephler, sales manager, acted as toastmaster, and William R. Tracy, assistant sales manager, spoke. Hannum and Orr were presented with a number of humorous gifts and then with engrossed testimonials of loyalty, in the form of the Oakland 15,000 mile guarantee. Telegrams received from dealers in practically every state were read at the dinner, and all had an enthusiastic outlook.

Haynes Speaks at Commencement

Elwood Haynes, president of the Haynes Automobile Co., was the principal speaker at the Commencement exercises at the Babson Institute, at Wellesley, Mass. Haynes' son was one of the graduates this year. A few days previously Haynes was honored with a degree by the Worcester Polytechnic Institute at Worcester, Mass., from which he was graduated a number of years ago.

University Honors Chapin

The honorary degree of Master of Arts was conferred upon Roy D. Chapin, president of the Hudson Motor Car Co., at the annual commencement of the University of Michigan. He was at one time a student of the University but left to enter the automobile business, then in its pioneer stage. Although he has been the active head of the Hudson company practically since its organization in 1909, Chapin is one of the youngest presidents in the industry as he is only 42 years old.

Causer Resigns from Marmon

E. T. Causer, general superintendent in charge of automobile manufacturing of the Nordyke & Marmon Co., has resigned, effective July 1. Causer is well known in the manufacturing field, being identified formerly with the Mitchell Automobile Co., the Westinghouse Co. and the Driggs Seabury Ordnance Corp. He has made no announcement of his future plans.

Ruthenburg Leaves General Motors

Louis Ruthenburg has resigned from the General Motors organization and will retire July 1 as superintendent of the Dayton Engineering Laboratories Co.

Fredrickson Goes with Auburn

Walter S. Fredrickson has resigned as general sales manager of the Hart-Parr Co., Charles City, Iowa, to accept the position of sales manager of the Auburn Motor Co., Auburn, Ind.

L. H. Bloom Promoted

L. H. Bloom, assistant sales manager of the Hart-Parr Co. has been promoted to the position of general sales manager with offices at the plant in Charles City, Iowa.

Goodyear Promotes Sherlock

H. W. Sherlock, of the factory accounting department of the Goodyear Tire & Rubber Co., has been named manager of sales accounting. He succeeds Fred Nash, one of Goodyear's oldest executives in point of service, who has been granted a two months' leave of absence and who will take up other work when he returns to Goodyear.

Smith Leaves Doss Rubber

W. F. Smith, president and general manager of the Doss Rubber & Tube Co. of Atlanta since the latter part of 1920, has resigned his position, and the appointment of Charles Harper, of Rome, Ga., to succeed him is announced by the company. Under Smith's management the Doss company the past two years, in spite of business depression, has increased its output of cord tires more than 400 per cent.

Dickey Managing Equipment Sales

H. L. Dickey has been appointed sales manager for the automotive division of the Anderson Co., manufacturer of automotive equipment, at South Bend, Ind. Previously he served as eastern manager for the Beneke & Kropf Manufacturing Co., Chicago; sales manager for the Moto Meter Co., Long Island City, and later as central district manager for the Splitdorf Electrical Co., Newark, N. J.

Drouillard Now Dealer

Frank Drouillard, formerly assistant superintendent of Maxwell in Detroit, is now a Maxwell dealer in the Pontiac territory.

Promoting Sales for Goodrich

J. Louis Kelley of Beloit, Wis., widely known in the tire merchandising and advertising field of the Middle West, has joined the Chicago division of the B. F. Goodrich Rubber Co. in charge of a special sales promotion campaign in the northwestern states. His first activity will be to pilot a "Goodrich Special" through the vast Wisconsin lake and resort territory, to stimulate interest in Wisconsin as "the playground of the Middle West," later traveling through neighboring states for similar promotion. This is one of a number of new promotional activities which the Goodrich company is undertaking as a resumption of notable signboarding and tour chart work engaged in before the war.

H. H. Brenner in Own Company

H. H. Brenner, well known in automotive equipment circles for many years as general sales manager of the I. J. Cooper Rubber Co., has retired from that office and is succeeded by R. B. Crane, director of sales of the Cooper Corp. Brenner retains his interest in the Cooper organization, but is giving his personal attention to his own company, the Brenner Automobile Supply Co., with stores in St. Louis and Kansas City.

Keegan Traveling for Perfection

W. J. Keegan will go on the road this month for the Perfection Spring Co. He has spent five years in the Perfection factory, principally on the jobbing sales end, and also has spent considerable time in the production department. Keegan will travel chiefly in the Southern territory.

Gardner with Chevrolet

Kenneth W. Gardner, who was associated with the Dunbar-Sanders Co. of Boston for a year and with the Albee Corp. for a similar time, is leaving the Franklin-Jacobs Co. of Pontiac to become assistant advertising manager for the Chevrolet organization in Detroit.

Mott Joins Rackliff

O. H. Mott, formerly director of sales of the Jordan Tire & Rubber Co. and previously associated with the Ideal Tire & Rubber Co., has joined the H. L. Rackliff Co., automotive marketing counselors of Cleveland and New York. He will be located in the Cleveland office as sales and advertising counselor.

A. B. Acker Honored

A. B. Acker of the Packard Motor Car Co. of New York has been elected president of the Purchasing Agents Association of New York, which counts among its members the purchasing agents of 400 leading companies.

PERSONAL NOTES

Mott and MacLaughlin on Vacation

C. S. Mott, vice-president of General Motors Corp. and chairman of the advisory staff, with R. S. MacLaughlin, president of General Motors of Canada, Ltd., are on a ten day fishing trip in Canada, the first vacation Mott has taken in fourteen months. They will return to Detroit and Oshawa, Ont., respectively, after the July Fourth holiday.

Davis Touring Coast

George W. Davis, president of the George W. Davis Motor Car Co., Richmond, Ind., is making an extended trip through the Pacific Coast territory in the interest of Davis cars. He left Chicago on June 16 and will spend considerable time in San Francisco, Los Angeles, Oakland and other Western points.

Frank Espenhain Promoted

Frank K. Espenhain, formerly of New York, export manager for the Goodyear Tire & Rubber Co., of Akron, has been named special assistant to President E. G. Wilmer of the company. He succeeds H. H. Springford, who resigned several days ago to become president of the Steel & Tube Co. of America, at Chicago. A. G. Cameron will succeed Espenhain.

Cameron has been with Goodyear just a little less than ten years. He has had wide experience with the domestic company, for which he served as manager of its Dallas and St. Louis branches. Later he entered the export field, serving as manager of the Australian division for several years, and finally became export sales manager, a position he held until his present appointment as manager of the Export Co. of Goodyear.

Butterfield Resigns from Apex

C. W. Butterfield, assistant general manager in charge of sales of the Apex Motor Corp., Ypsilanti, Mich., manufacturer of Ace automobiles, has resigned, effective July 10. Before joining the Apex corporation, Butterfield was sales manager of the Herschell-Spillman Motor Co., North Tonawanda, N. Y. No announcement has been made as to his future plans.

Smith to Join Simms Magneto

Floyd H. Smith, formerly associated with the Pierce Arrow Motor Car Co., Buffalo, as director of purchases, will become identified with the Simms Magneto Co., East Orange, N. J., on July 1, as assistant general manager.

Stuyvesant Leaves Motor Company

Frank E. Stuyvesant, for years prominent in the automobile industry in this city, has retired from the active management of the Stuyvesant Motor Co., Cleveland, Hudson and Essex distributor, remaining, however, as chairman of the board of directors. Harry L. Lance, formerly manager of the Avenue Motor Co., Maxwell and Chalmers distributor, succeeds him.

Paige Associated With Jig

Emmett Paige, who was plant superintendent for the Oakland Motor Car Co., is now associated with the Jig Bushing Co., Pontiac, as one of the owners, though not taking an active part in its operation at present.

Boynton on Hawkins' Staff

Walter C. Boynton, formerly service manager of the Campbell-Ewald Co., has become a member of Norval A. Hawkins' sales, service and advertising section of the General Motors advisory staff. Frank G. Eastman is now devoting his attention exclusively to the advertising features of the staff work.

Drumpleman Expecting Steady Flow of Trade

DETROIT, June 28—After a trip which included nineteen cities in Eastern states, William J. Drumpleman, sales manager of the Rickenbacker Motor Car Co., said he expected a steady conservative flow of business for the remainder of the year, but without the heavy buying experienced in the spring which would have been abnormal at any other season.

Factory production in July will be absorbed by orders already on hand, Drumpleman said, but August probably will show a seasonal falling off. Baltimore was the only city he visited in which there has been a decline in sales. In Washington there has been a decided increase. Eastern demand is running steadily to closed cars, he declared, although open models are readily absorbed.

In consideration of the increase in closed car demand, the Rickenbacker company has made arrangements to extend its factory facilities for production of cars of this class.

U. S. Cigar Stores Now Handle Red Inner Tubes

NEW YORK, June 27—The United States Cigar Stores Co. has gone into the tire business, specializing in red inner tubes.

In the windows of several of the stores of the company in this city are displayed an assortment of these tubes which, cards announce, are made specially for the United States Cigar Stores Co. by the Dixon Rubber Co.

Eight or nine sizes are included in the price list from which the figures for some of the more popular sizes are given below:

Size	Price
30 x 3	$1.59
30 x 3½	1.79
32 x 4	2.50
33 x 4	2.60
34 x 4	2.75
35 x 5	4.25

G. M. C. Will Build New Service Station

New York Structure for Buick and Oakland Divisions Will Cost Almost $750,000

NEW YORK, June 27—Alfred P. Sloan, Jr., vice-president of the General Motors Corp. in charge of operations, announces that arrangements have been completed with the Argonaut Service Corp. for the erection of a thoroughly modern and complete service building in the heart of the automobile district in New York, for the joint use of the Buick and Oakland organizations.

The building will be located on the east side of West End or Eleventh Avenue, occupying the block between Fifty-fifth and Fifty-sixth streets, extending back 100 feet in depth. It will be of reinforced concrete, six stories high, with a total floor space of 140,000 sq. ft., and will represent an investment in land and building of almost $750,000.

To Rush Work

The work will be rushed to completion by early fall. When finished the building will house the entire service, parts and new car delivery departments of the Oakland Motor Car Co., and also the parts department and machine shops of the New York branch of the Buick Motor Co., which will move from the present quarters. This will not affect the score of sub-service stations of the Buick company which are located at convenient points over greater New York City. The building will be equally divided between these two divisions of the General Motors Corp. and will be so constructed that the two organizations will be entirely separate.

Oakland owners in New York City have heretofore been compelled to take their cars to Long Island City for service and parts.

The inconvenience of the two present locations to both owners and dealers of Buick and Oakland cars has been recognized by the General Motors Corp. for a long while and this new modern, up-to-date plant will be an important unit in line with the broad service policy of the corporation.

LINCOLN SALESROOM MOVED

DETROIT, June 28—The Detroit city salesroom of the Lincoln Motor Co. has been removed to the Ford sales and service headquarters at Highland Park. Each of the 22 Ford dealers in Detroit has become a Lincoln agent and service station.

PEERLESS EXCEEDING MAY

CLEVELAND, June 26—The Peerless Motor Car Co. reports that its sales records for the first half of June were better than for the same period in May. Cities reporting exceptionally good June business include Chicago, Philadelphia, San Francisco, Cleveland and Boston.

Durant's Line May Include Locomobile

Probably Will Be Bidder When Plant Is Offered at Public Sale

NEW YORK, June 29—There is substantial reason for believing that the Locomobile, or a modification of it, will be added in the near future to the line of cars controlled by Durant Motors, Inc.

Bids for the property have been asked by the receivers of the Locomobile company, and when the day of the sale arrives one of the bidders undoubtedly will be Durant Motors. The situation is similar to that which resulted in the purchase of the Elizabeth plant from the Willys Corp. when it was auctioned off by the receivers under the direction of the Federal courts.

If Durant obtains the Locomobile plant and the right to manufacture the car, drastic reductions will be made in manufacturing costs so that the price can be reduced to a figure where it can compete with Cadillac and Lincoln.

Locomobile now has a six-cylinder engine, while the power plants of Cadillac and Lincoln are eight cylinders, but it would not be difficult to change the engine.

Rest of Line Competes

The Durant four and six will compete with the Chevrolet and the Buick, the most popular of the lower priced General Motors lines. The Star will compete with Ford with the prices exactly the same.

The present price of the Locomobile open models is $7,600, and if Durant brought it into the Cadillac price class he would have to make a reduction of more than 50 per cent.

While Locomobile has had an enviable record as an automobile, the company has been in almost constant financial difficulties, and it has been found impossible to reorganize on a satisfactory basis since it was thrown into a receivership several months ago.

Exports, Imports and Reimports of Automotive Products for May, 1922, and for Eleven Months That Preceded

	Month of May				Eleven Months Ending May			
	1921		1922		1921		1922	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles including chassis	2,941	$3,768,033	8,027	$5,763,539	99,646	$130,710,201	43,358	$36,246,651
Electric trucks and passenger cars	....	....	26	27,235	....	....	121	174,861
Motor trucks and buses, except electric	462	794,699	....	....	17,180	28,980,721	2,727	2,851,223
Up to 1 ton	....	....	735	317,539	....	....	2,500	1,075,450
Over 1 and up to 2½ ton	....	....	182	272,577	....	....	822	1,177,254
Over 2½ ton	....	....	86	222,054	....	....	259	633,011
Total Motor trucks and buses, except electric	462	794,699	1,203	812,170	17,180	28,980,721	6,308	5,736,938
PASSENGER CARS								
Passenger cars, except electric	2,479	2,973,334	....	....	82,466	101,729,480	13,708	12,164,579
Value up to $800	....	....	4,529	2,098,907	....	....	14,346	6,846,361
Value over $800 and up to $2,000	....	....	2,096	2,311,407	....	....	8,139	9,002,775
Value over $2,000	....	....	173	513,820	....	....	736	2,321,137
Total passenger cars, except electric	2,479	2,973,334	6,798	4,924,134	82,466	101,729,480	36,929	30,334,852
PARTS, ETC.								
Parts, except engines and tires	....	3,204,723	*13,294,265	3,160,448	....	65,198,042	....	29,831,965
Accessories, parts of Station and warehouse motor trucks	....	9,386	42	29,970	522	300,831	141	150,846
Trailers	....	....	34	6,149	....	....	233	104,035
Airplanes	7	29,500	1	2,230	63	446,455	44	151,245
Parts of airplanes, except engines and tires	....	37,673	*15,228	11,202	....	186,603	....	83,948
BICYCLES, ETC.								
Bicycles and tricycles	....	117,531	812	14,334	....	3,423,029	....	468,978
Motorcycles	564	178,686	1,695	453,495	24,157	7,631,945	9,359	2,574,511
Parts, except tires	....	....	*336,016	197,951	....	....	*1,400,038	758,725
Gas engines	55	17,795	296	58,390	2,912	578,371	2,933	430,481
Traction engines (steam) except agricultural	14	27,126	7	9,323	271	478,419	21	51,064
Automobile engines	1,202	248,637	5,590	616,128	13,631	2,536,811	24,750	3,124,168
Aircraft engines	....	....	29	8,229	....	....	64	29,346
Complete tractors, except agricultural	19	35,344	1	2,435	19,961	19,673,608	150	257,280
Other internal combustion engines	476	136,119	453	38,502	13,876	2,416,622	4,110	529,591
IMPORTS								
Automobiles	22	55,023	34	79,105	1,017	1,201,079	4,017	717,613
Parts, except tires	....	97,942	....	74,204	....	1,256,000	....	600,593
All other	....	23,983	....	6,403	....	400,737	....	218,007
REIMPORTS								
Automobiles (free of duty)	433	774,289	172	357,140	3,104	4,877,378	2,641	4,154,032

*Pounds

No Let Up Expected in Wisconsin Plants

(*Continued from page* 1444)

if such it may be called, was expected and has not caused unusual comment. Most dealers are still behind on deliveries, even of roadsters and phaetons, while unfilled orders for coupe and sedan types have increased further.

One of the features of retail trade in Milwaukee is the steadily improving demand for trucks, which have been making rather slow headway all year. Sales are largely in the range from ¾ ton to 1½ ton, and the heavier capacity models are moving slowly. On the other hand, distributors have been making some fair fleet sales to such quantity buyers as concrete road construction contractors, builders, etc. These run into the 3-ton to 5-ton capacity class and usually call for special body equipment, which take the sales out of the standard truck class.

Georgia Reports Outlook Good for Rest of Summer

ATLANTA, June 27—That the automotive industry throughout Georgia has experienced steady, even rapid, improvement the past two months, and that conditions right now are better than they have been at any time within the past two years, with the outlook for the remainder of the summer months exceptionally bright, was the consensus of opinion among the leading dealers of the state, who attended the semi-annual convention of the Georgia Automotive Dealers Association, held at Macon. Dealers were in attendance from every section of Georgia.

May Exports Increased 5.5 Percent Over April

WASHINGTON, June 27—Passenger automotive exports for May increased 5.5 per cent in number and 2.1 per cent in value over those of the preceding month. The May, 1921, passenger car exports were 2479 cars, valued at $2,973,334, compared with May, 1922, exports of 6798 cars, valued at $4,924,134, and against exports in April, 1922, of 6438, valued at $4,822,737.

Exports of motor trucks during May shows an increase of 36 per cent in number and 20 per cent in value. The May, 1922, truck exports were 1203, valued at $812,170, compared with May, 1921, of 462 trucks, valued at $794,699, and 879 trucks valued at $674,747 in April of this year. The May exports of parts show a decrease of 19.2 per cent in value over the preceding month.

Old Scripps Plant Occupied by Buick

Company Expects to Meet Closed Car Demand with Immediate Deliveries

DETROIT, June 28—The taking over of the former Scripps-Booth plant by the Buick Motor Co. marks the preparation of this unit of General Motors to meet the demand for closed cars on an immediate delivery basis. Capacity for 400 closed cars a day is provided for, 10,000 monthly, or a total equal to the production of all models in the former plants of the company.

There is 350,000 sq. ft. of floor space in the former Scripps-Booth plant, including two large pent-houses now under construction in which will be located the enameling equipment. The plant will hereafter be known as plant No. 75 of the Buick factory and will be fitted throughout with modern assembling equipment, conveyors and other aids to large production.

All closed cars will be assembled there and shipments to dealers will be made direct from Detroit. The chassis will be built at the Flint plants and shipped to Detroit, where they will be assembled and the bodies set up. Enameling and upholstery work will be specialties of the new plant, attention having been given to place this on a highly efficient basis.

Production Efficiency Retarded

Formerly the bodies were shipped to Flint by a truck fleet from the body factories in Detroit, and fitted to the bodies in connection with the regular assembly work on all models. In addition to the traffic delays and the repeated handling of the bodies, the joint assembly of closed and open models prevented highest production efficiency.

The Scripps-Booth plant was built by the Saxon Motor Car Co. It was later taken over by Scripps-Booth, but during the war was occupied by the quartermaster's department. At the close of the war it was occupied for the manufacture of Scripps-Booth cars by that unit of General Motors, which was discontinued early this year. Scripps-Booth service is now being handled in one of the buildings of the Northway engine unit of the corporation.

New $400 Air-Cooled Car Operates on Little Fuel

CLEVELAND, June 26—F. F. Cameron, an engineer of 30 years' experience, partly in the automobile and allied industries, has developed a new 4-cylinder car for which he claims a fuel economy of 30 miles to the gallon.

Light weight, air cooled, and holding four passengers, the car will sell for approximately $400. The first model has been built at the plant of the F. H. Bultman Co. in this city. Just when production will be commenced has not been decided, but it is stated that the car will be manufactured in this city.

The complete car weighs only 1000 lb. The chassis has a standard transmission with constant mesh spiral herringbone gears to insure quiet running, three speeds forward and a reverse speed, with cane shift lever. Wheels are disk type, for 30 x 3½ tires. There is a full electric equipment, including a starter. The wheelbase is 104 in.

The entire car has been designed to adapt itself to quantity production at very low cost.

A company will be formed, backed by Eastern capital, to manufacture the car. It is proposed to have a plant in England as well as in Cleveland.

Menominee Producing "Hurryton" Speed Truck

CLINTONVILLE, WIS., June 26—The Menominee Motor Truck Co. has completed a new model of commercial car which will be marketed under the trade name of "Hurryton." It is of 1-ton capacity and is designed for duty where speed is an important consideration. The truck has been on the road for eight or ten months.

It is powered with a Wisconsin heavy-duty truck type, 4-cylinder engine, and has a 132-in. wheelbase, being equipped with 34 x 5 in. pneumatic tires. The turning radius is 22 ft. The truck will travel at a normal speed of 35 to 38 m.p.h. The equipment is especially complete, embracing electric starter, windshield and cab.

Stearns Starts Making First 6-Cylinder Cars

CLEVELAND, June 27—After having been for seven years exclusively in the four cylinder field, the F. B. Stearns Co. is now producing a six which will be marketed along with the four. Both cars are equipped with Knight sleeve valve engines. Following are the prices for the new six:

2-passenger roadster	$2,700
5-passenger phaeton	2,700
7-passenger phaeton	2,850
Coupe	3,500
Coupe-brougham	3,500
Sedan	3,700

The prices of the four cylinder models remain as before, the roadster and 5 passenger phaeton being priced at $2,250.

BIFLEX ADDS TO PLANT

CHICAGO, June 26—The Biflex Products Co. has increased its capacity 150 per cent by the purchase of additional buildings and land from the Chicago Hardware Foundry Co. adjoining the Biflex plant. The additional floor space obtained will be used in the production of Biflex bumpers. This is the second expansion in a year, as the Biflex company did not remove its offices and foundry from Waukegan to its larger home in this city until May 1, 1921.

Closed Models Lead in Unfilled Orders

Difficulty Experienced in Getting Bodies—Type Shows Increasing Popularity

DETROIT, June 26—Largely increased buying in closed cars during the present selling season has been very profitable for the manufacturer. Indications that the preference for this type promises to become permanent may lead to a scaling down of prices for closed cars, but it is felt that such a revision might have the effect of unstabilizing all prices, and open models now are at an irreducible minimum. There is every sign, however, that the next national shows will find the price differential between open and closed models considerably reduced.

Manufacturers declare that the difference in prices between the two has been due largely to manufacturing causes, in which the comparatively small number of closed models put through has made it necessary to keep the price up to make the business reasonably profitable. Now that closed car demand has reached a point where it approximates open car business, it has been found possible to handle it on a much more economic basis.

So heavy has the demand for closed cars been that despite hasty revisions in manufacturing schedules, effective since early in the season, many factories are from four to eight weeks behind on deliveries.

Body Plants at Top Speed

Closed cars constitute the bulk of the back orders, factories being unable to confine themselves more largely to their production because of inability to get bodies in quantities required. All of the body plants of the district are working at top speed, and many additional buildings have been taken over for body works, but there is slight possibility of the body section of the industry catching up with the rest of it for at least two months.

In view of the large buying in closed vehicles throughout the year, manufacturers do not expect that the demand for this type will run especially heavy in the fall, though the holding of closed car shows by dealers will probably keep a steady flow of orders coming. The farmer buying of the fall is expected to be mostly in open vehicles, for reasons of economy and of the greater utility of the open car in the country districts.

NEW OAKLAND COUPE APPEARS

PONTIAC, MICH., June 26—The new two passenger coupe model of the Oakland Motor Car Co. is being put into production, the first jobs coming through the plant during the past week. The model is one-seated and is designed especially for sale to business and professional men.

France Moving Up, Says Zenith Chief

M. Boulade Looks Over Detroit Plant — Industry Affected Most by Tourist Trade

DETROIT, June 26—While real quantity production is not as yet in sight in France as compared with automobile manufacture in the United States, the industry in that country is having a steady march of progress, according to Antonin Boulade, director general of the Zenith Carbureter organization. The Zenith company has factories at Paris, Lyons, London, Turin, Berlin and Detroit, and M. Boulade has been in this country for the past week for the purpose of visiting the Detroit factory.

Move Toward Higher Speed Engines

"Improving conditions in the United States," said M. Boulade, "are reflected also in Europe generally. Because of the smaller distances in France, and because of the higher cost of automobiles, fuel and a great many other conditions, the automobile has not become the utility device that it has in the United States. The bulk of the passenger automobile business is largely concerned with the touring trade, and when it is considered that the sea coast or the mountains are both within a few hours' drive of Paris, this is not surprising."

In speaking of the trend in France, M. Boulade had this to say:

The tendency toward higher speed engines is very marked in France at the present time. Our engine speeds are creeping up to 4000 r.p.m., and although there are no radical engineering changes which are tending to produce these higher speeds, yet the detail refinements are having this result. There has been no great inclination toward the adoption of the battery ignition system as compared with the magneto. The reputation for reliability which the magneto has established is largely responsible for this, particularly with the tourist business, which depends on the automobile for transportation through a country which is not as thickly supplied with automobile service stations as the United States.

Four-Wheel Brakes Popular

The use of four-wheel brakes is coming in rapidly on all automobiles which are capable of developing a speed in excess of 50 miles per hour. The Servo type of brake, such as adopted by the Hispano-Suiza, is becoming quite popular and it would not be surprising to see a wider adoption of this principle. No hydraulic or pneumatic four-wheel brakes are as yet applied, all of the four-wheel breaking systems utilized being mechanical.

Because of the smaller wheels used on our cars, I do not believe that the clincher tire will ever be supplanted by the straight side. We like the structural strength imparted by the clincher type of bead and will probably continue its use. Motorists generally, particularly the experienced tourists in France, are running their tires with inflation pressures much less than those recommended by the tire maker. While they admit that this is somewhat destructive to the tire, at the same time what is lost on the tire, it is felt, is generally made up by decreased wear and tear on the vehicle. The cost of one is about equalized by the saving of the other and the additional comfort might be regarded as pure profit.

M. Boulade stated that the Zenith factory in Germany was sold by the German government during the war. Negotiations have recently been completed whereby the Zenith company has again secured control of its Berlin plant and is resuming manufacture. During the war and immediately after, the German Zenith plant was used to manufacture the German Pallas carbureter, and a suit is now impending because of the alleged illegal use of the Zenith name in connection with merchandising the Pallas carbureter, both in Germany and for export during the time that the factory was out of the Zenith possession.

In commenting on the difference in conditions between dealing with manufacturers in the United States and in Europe, M. Boulade stated that it was not unusual on the continent for the purchaser of an automobile to specify the equipment, such as carbureter, ignition, etc., while in this country, of course, it was practically unheard of, except in rare instances among the very highest priced cars of a semi-custom nature. He stated that because of the almost universal employment of the car as a machine for tourists, the owner selected his units very largely as a matter of personal preference.

National Action Clears Way to Complete Merger

CHICAGO, June 26—The approval by the stockholders of the National Motor Car & Vehicle Corp. in New York of the offer of the Associated Motor Industries to take over that company in a merger with a number of others, clears up one of the difficulties which have been holding off the completion of the merger, according to Will I. Ohmer, chairman of the board of the Associated Motors.

Industrial Motors Progressing

NEW YORK, June 28—Completion of the merger of the Selden and Atlas truck companies under the name of the Industrial Motors Corp. has been assured by the depositing for exchange certificates of more than 80 per cent of the Atlas stock and 70 per cent of both classes of Selden stock. It is stated that negotiations are progressing for the acquisition of other truck and parts companies and that announcement of the completion of these negotiations may be made soon.

REO CLOSES FOR VACATION

DETROIT, June 27—The Reo Motor Car Co. has posted notices throughout its departments that the plant will close July 1 for the annual vacation period and will remain closed until July 17. The receiving and shipping offices of the company will not be closed, nor the general offices, but the rest of the plant will be shut down for the two weeks. In addition, the company will take an inventory during the closing.

Senate Retains Roe in Gasoline Probe

Committee to Mail Questionnaires to Get Data on Stocks and Prices

WASHINGTON, June 26—Plans for the Senate investigation into gasoline price increases moved forward a step with the employment by the manufacturers' committee of Gilbert E. Roe of Madison, Wis., as counsel, and decision by the committee to submit questionnaires to all interests in gasoline and oil holdings. Roe is a former law partner of Senator LaFollette, Republican, of Wisconsin, chairman of the committee.

The questionnaire is understood to ask specifically for data on the stocks of gasoline, crude oil and other petroleum products held by the various interests on different dates during the last three years and information as to prices on various dates of the products mentioned.

Hearings to Begin July 15

The questionnaires are made returnable by July 15, and it is deemed unlikely that further action of importance by the committee will be taken before that date. Hearings will start then.

Chairman LaFollette later issued a formal statement in which he said that public hearings might be held by the committee on "less technical portions" of the inquiry, while the information sought in the questionnaire was being assembled.

The present work of the committee, LaFollette said, consists largely of assembling records and data from government and other hearings on the same question in previous years. Until that is complete, he explained, the committee will be unable to determine what other data and information are necessary to present a proper picture of the situation. The Federal Trade Commission, the Bureau of Mines and the Geological Survey are co-operating with the committee, the Senator said.

Mason Tire Acquires Owen Bedford Factory

CLEVELAND, June 29—Under an order approved to-day by referee in bankruptcy, Carl D. Friebolin, the Mason Tire & Rubber Co. became the owners of the plant of the Owen Tire & Rubber Co. at Bedford. The Mason company paid $275,000 for the 14-acre Owen tract, which is located at Bedford, Ohio, a suburb of this city.

The Owen company has been through bankruptcy after petitions filed in the court of common pleas here charged that officers of the company profited through the misuse of funds received from the sale of stock in the corporation.

O. M. Mason, president of the Mason Tire & Rubber Co., says that the acquisition of the plant will enable his corporation to increase its production 1500 tires a day.

New Motorists' Body Plans Wide Service

President Meals Says Association Will Prove of Great Value to Industry

CHICAGO, June 26—The scope of activities to be undertaken by the new National Motorists' Association, organized by bolters from the American Automobile Association convention, was broadly sketched by a number of speakers at a banquet given for the delegates at the Congress Hotel.

Judge Walter D. Meals of Cleveland, who was elected president, presided as toastmaster and indicated that the keynote of the new association will be service to the automobile owners of such a nature as to be of great value to the entire automotive industry. He said that in order to live and grow the organization must perform a public service on a broad scale and must not fail to look after the interests of its members.

Lee Speaks on Taxation

Richard H. Lee, general manager of Lord & Thomas of Chicago, who was elected first vice-president, declared that automobile owners would be protected against excessive taxation only when thoroughly organized and able to stand together as a unit. Lee was formerly a member of the executive committee of the A. A. A.

Other officers besides Meals and Lee are: Second vice-president, B. H. Hagerman, Kansas City; third vice-president, C. H. Verschoyle, Dallas, Tex.; fourth vice-president, Eugene Stuart, Louisville, Ky.; fifth vice-president, J. Barton Weeks, Philadelphia; and treasurer, H. M. Lucius, Baltimore. A board of governors composed of thirty members was elected as follows:

To serve one year—H. F. Cohen, Houston, Texas; W. B. Wigginton, Kalamazoo, Mich; F. H. Cromwell, Kansas City; G. E. McInnich, St. Joseph, Mo.; E. B. Hague, Utica, N. Y.; E. S. Moseley, Dallas; James B. Fortesque, Boston; Fred H. Caley, Cleveland; Harry Burnhams, Denver and Oscar A. Ahlgren, Whiting, Ind.

To serve two years—W. N. Kenney, Decatur, Ill.' Charles C. Janes, Columbus; A. G. Lupton, Hartford City, Ind.; Henry L. Jost, Kansas City; A. J. Deer, Cornell, N. Y.; George Bird, Chicago; Geo. H. Kile, Akron; Fred Pantling, Grand Rapids; A. B. Waugh, Omaha and Richard Schafer, Merced, Cal.

To serve three years—L. B. Strothman, Waterloo, Iowa; L. A. Hoskins, Houston; H. R. Kettig, Louisville; A. A. Ledermann, Utica; I' A. Shelor, Seattle; Henry Paulman, Chicago; M. E. Noblet, Indianapolis; Richard Kennerdall, Franklin, Pa.; F. E. Gillespie, Lincoln and Alex E. Johnson, Louisville.

Caley Executive Secretary

The board elected Caley executive secretary and F. E. Ertsman of Chicago assistant secretary. Caley is president of the Ohio State Automobile Association, and Ertsman is secretary of the Illinois State Automobile Association. Executive offices for the new organization will be opened in Washington within a week.

A. A. A. Directors Meet

NEW YORK, June 29—Directors of the American Automobile Association are meeting here to-day to discuss business of vital importance to the organization. The bolt of the organizations now included in the newly organized National Motorists Association will be taken up and its probable effect discussed. Action may be taken on the selection of an executive secretary.

Car Thefts Keep Pace with Increased Output

ST. LOUIS, June 29—Statistics compiled by the National Automobile Dealers Association show that automobile thefts in the 28 "index" cities have kept pace with increased production. These 28 cities show that 27,554 motor vehicles were stolen in 1921 and 21,273 recovered The number unrecovered was the largest noted in four years

The summary of the figures for the last four years in the 28 cities follows:

1918,	stolen 27,445,	recovered	21,673;
1919,	stolen 33,508,	recovered	24,740;
1920,	stolen 30,046,	recovered	21,273;
1921,	stolen 37,554,	recovered	26,517.

38,699 Cars in Europe Await Reshipment Here

WASHINGTON, June 28—Additional figures on the number of automobiles in Europe, which it is feared will be resold in America unless prevented by the Graham "anti-dumping" bill, have been submitted by the Department of Commerce to the Senate Finance Committee.

In response to a request from the Committee, Secretary Hoover secured telegraphic information that a total of 8699 automobiles were available in France, England and Italy for immediate re-export to the United States. This cable advice has been supplemented by a more complete survey made by W. C. Huntington, Commercial Attache of the Department in Paris, which shows that in addition to the 8699 reconditioned cars there are more than 30,000 automobiles which could be reconditioned and resold in America.

There are 30,000 cars which are conditioned as being "bad to fair" which the Department has been informed could be repaired after a fashion and shipped back to the United States unless the Graham bill, imposing a 90 per cent ad valorem duty on each reimported car, is passed.

OFFER FORD WATER POWER

DETROIT, June 28—Announcement was made after a visit to Henry Ford by a delegation of Minnesota business men that he would build additions costing several million dollars to his factories near the high dam at Minneapolis and St. Paul. Ford was offered the water power now going to waste, provided he would build a plant employing between 4000 and 5000 men.

Huffman Bankruptcy Proceeding Dropped

Creditors Ask for Dismissal—Company to Go Ahead with Operations

ELKHART, IND., June 29—Bankruptcy proceedings instituted last October against the Huffman Brothers Motor Co., manufacturer of passenger cars and trucks, have been dismissed upon motion of the creditors who filed the petition for the appointment of a trustee.

L. R. Huffman, treasurer and general manager of the company, states that it has on hand approximately $500,000 worth of materials which will be turned into finished products as rapidly as possible. The organization was continued during the months of comparative inactivity, and the company is ready to proceed with manufacturing. Production will continue to be under the direction of R. E. Chiddester. W. L. Huffman, president of the company, will remain actively connected with the business.

Larger Truck to Be Made

While the plant has been in the hands of a trustee, the company has been designing new models and is now prepared to manufacture a larger truck than heretofore. It will have a capacity of 2½-3 tons. It is understood also that an original design in closed cars has been worked out.

The price lists of the company's products follow:

		Old Price	New Price
TRUCKS			
Model B	1½-2-ton	$1,995	$1,795
Model C	1½-2-ton	1,795	1,695
Model D	2-3-ton		2,895
PASSENGER CARS			
Touring		$1,795	$1,395
Sedan			2,295

NEW WINTON DISTRIBUTOR

CLEVELAND, June 28—The Winton Co. announced to-day that the Garland Automobile Co. of New York has taken over the Winton car sales in the Metropolitan district. The Winton building at Broadway and 70th Street has been sold to the Studebaker Corp.

REYNOLDS BUSINESS DOUBLED

JACKSON, MICH., June 26—The Reynolds Spring Co. has received several new contracts from motor companies, and the volume of its spring business is double that of a year ago. It is making enough profit to pay common dividends.

PACKARD INCREASES OUTPUT

DETROIT, June 29—Announcement is made by Alvan Macauley that a production schedule of 2000 Packard single six cars a month has been determined upon, in addition to the twin six and truck output. This schedule would make the production exactly twice the volume decided upon when the new single six was announced in April.

Federal Tests Show Saving of Gasoline

Through Adjustment of Carbureter Consumption Is Lowered 25 Per Cent

WASHINGTON, June 27—Preliminary reports on efficiency tests, now being conducted by the Government Bureau of Mines, show, after a course of experiments in the adjustment of carbureters on government operated automobiles, a saving of 25 per cent in the consumption of gasoline.

The tests now being conducted are made on motor trucks used for hauling coal from the government fuel yard, the cars being in operation for eight hours a day, under ordinary city use. The tests, under the supervision of G. W. Jones, assistant explosive chemist, disclose the fact that practically all the forty vehicles tested were using a mixture too rich in gasoline.

Before the adjustments, the exhaust gas was found to run 5.8 to 12.3 per cent carbon dioxide. All machines were adjusted to give 11 to 12 per cent carbon dioxide at a speed of five miles per hour, the usual speed for the trucks. On level grades the carbon dioxide dropped about 1 per cent under that on up-grade.

A complete record of the test is being kept by the government on each of the forty 5 and 7½-ton trucks, and the results and recommendations of the department will be made the basis of a brochure to the automobile industry, with the result, it is expected, that the government will be able to point the way for a very material saving in gasoline consumption.

The volume of gasoline consumption is considered to have been affected by three factors, 33 per cent due to the machine, 33 per cent to the carbureter adjustment, and 33 per cent to the driver.

Paige-Detroit to Resume Paying Common Dividends

DETROIT, June 27—With the payment of a cash dividend of 6 per cent on its common stock on July 10, the Paige-Detroit Motor Car Co. will resume payments on this stock which have been suspended since Dec. 10, 1920, when a 1 per cent dividend was distributed. Of the $4,000,000 common stock authorized, $2,000,000 is outstanding, the par value of which is $10.

In connection with the resumption of payments, the company notes that since 1914 it has distributed to its holders of common stock payments of 227 per cent in cash and 263 1/3 per cent in stock. The year 1915 was the largest cash dividend period when 59 per cent was paid, and 1916, the largest stock dividend year when 130 per cent was distributed.

President H. M. Jewett said the present production of the company is at the rate of 200 cars daily, this including the two Paige models and the new Jewett. The company's bank loans have been cleared away, Jewett said.

"Our only obligations are those of a current nature," he added. "Liberal allowance has been made for depreciation. Inventories have been written down to cost, and we are turning over our inventories now every 30 days or at an even shorter interval. Conditions seem to justify the dividend for the common stock."

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

The notable development in last week's money market, aside from a generally easier trend of rates, was the reduction of the rediscount rate by the New York and Boston Federal Reserve Bank. The New York institution reduced its rate on all classes of paper from 4½ to 4 per cent, effective June 22, and the Boston institution made a similar reduction, effective June 23. The 4½ per cent rate in both cases had been in effect since November last. The Minneapolis, Kansas City and Dallas banks still maintain a 5 per cent rate on all classes; the seven others have a 4½ per cent rate.

Last week, rates for call loans ranged from 2¾ per cent to 5 per cent, as compared with 2¾ per cent to 4 per cent in the preceding week. On the first three days of last week, call money was renewed at 3 per cent. On Thursday the renewal rate declined to 2¾ per cent, the lowest recorded since Oct. 11, 1917. On Friday there was a sudden advance, however, to 5 per cent. In time money the situation remained practically unchanged, sixty days' maturities being quoted at 4 per cent, ninety days', 4, and five months' at 4 per cent to 4½ per cent, with six months' at 4¼ per cent, the same as in the preceding week.

Freight car loadings during the week ended June 10 totaled 846,002 cars, as compared with 750,645 in the preceding week, which was an increase of 95,357 cars. The total for the week ended June 10 was within 33 cars of the largest loading for any week preceding the coal strike this year, and marked an increase of 58,719 over the corresponding week of 1921, but a decrease of 84,974 from the corresponding week of 1920.

EXPECT TOWNSEND REFINANCING

JANESVILLE, WIS., June 26—Creditors of the Townsend Manufacturing Co., maker of kerosene tractors, tractor engines, etc., after long consideration of its affairs, have permitted the institution of bankruptcy proceedings by which it is hoped to reorganize and refinance the enterprise and maintain it as a going concern.

The liabilities are given as approximately $75,000 and assets of $188,000 are claimed. The concern has some good orders on its books and considerable business in sight which it is believed possible to undertake if adequate working capital can be provided.

FINANCIAL NOTES

American Bosch Magneto Corp. shows a good sized profit for May, satisfactory net returns being probable also for June. It is likely, however, that there will be a slight operating loss for the first six months of this year. Volume of sales has been increasing steadily, reaching now close to $900,000.

Mullins Body Corp. reports gross shipments in May approximating $275,000, from which profits were between $45,000 and $50,000. It is estimated that June shipments will be between $350,000 and $375,000, on which net profits should approximate $60,000. According to officials, the plants of the corporation are operating at substantial capacity and it is anticipated that the present schedule will be maintained for some time. A seasonal lull is not unlikely during the late summer months, but forward business on the books is sufficient to assure active operations over an extended period.

Moon Motor Car Co. has declared a quarterly dividend of 25 cents a share on the common stock, of which there are 154,213 shares of no par value outstanding. The twentieth consecutive quarterly dividend of 1¾ per cent also has been declared on the preferred stock, payable July 1 to stockholders of record June 26. There are 3114 shares of preferred outstanding. The company states that for the first six months of 1922, June partially estimated, net earnings totaled $225,648,76, which are considerably more than sufficient to pay the full year's dividends on the preferred and common stocks. January and February showed a net deficit of $400. In May the output was 515 cars and shipments in June are expected to exceed 750 cars. July and August schedules call for a production of about 1000 cars each month.

Hayes Wheel Co. common stock to the amount of 30,000 shares, which was offered at $27.50 a share by a syndicate headed by McClure, Jones & Reed, John Burnham & Co., Chicago, and Otis & Co. of Cleveland, has been heavily over-subscribed. The capitalization of the company consists of 200,000 shares, authorized and outstanding of common stock, and $771,000 of first mortgage 10-year 7 per cent gold bonds. The original bond issue was $1,000,000, but is being retired gradually through the sinking fund provisions. A financial statement issued by the company as of May 31, 1922, shows cash on hand, $530,421; total current assets $3,682,227; current liabilities, $1,272,124; net current assets, $2,410,103, and total net assets after providing for all liabilities and reserves, $4,946,355.

Saxon Motor Car Corp. proposes an increase in the capital stock from 200,000 to 400,000 shares.

Studebaker Corp. is reported to be considering a plan for the retirement of the preferred stock by issuing common stock in exchange for the senior security, share for share. There is $9,800,000 of the preferred stock outstanding and its retirement through an exchange for common would remove everything ahead of the common stock. The immediate dividend return would be the same, 7 per cent.

L. H. Gilmer Co. has declared a dividend of 1¾ per cent on preferred stock, payable July 1.

Federal Motor Truck Co. has declared a dividend of 2 per cent in cash, payable June 30 to stock of record June 24.

Nash Motors Co. has declared a dividend of $6 a share on the common stock, payable Aug. 1 to stock of record July 20.

INDUSTRIAL NOTES

Cleveland Tractor Co.'s plant at Cleveland will have additions aggregating $1,250,000 made immediately so that it can produce 50 Zeder cars and 50 tractors a day and also provide for the building in the near future of a new 1-ton truck, embodying new ideas in design, which is being engineered under the personal direction of Rollin H. White. F. N. Zeder, designer of the Zeder car, is now at the plant to hasten the completion of preliminary work for production of the car.

C. G. Spring Co. has purchased the machine equipment and plating plant of the Shakespeare Products Co. and is now running that branch full capacity in an effort to keep up with orders booked for bumpers. The C. G. Spring Co. operates two plating plants in Kalamazoo, with branch plants in Detroit, Chicago and Cleveland, and has also been forced to let out large quantities of work. Both bumper shops at Kalamazoo and Chelsea are running full capacity.

Sundby Battery Co. has purchased and is now occupying the plant in Milwaukee built by the A. C. Holtz Chemical Co., but never placed in actual operation. The plant is of daylight construction, having been designed for chemical products manufacture, and lends itself admirably to storage battery production processes. The Sundby company is installing equipment so that production may be started by July 1.

Western Reserve Cotton Mills of Millen, Ga., began operations in mid-June with 300 operatives, manufacturing exclusively square woven tire fabric. Several thousand dollars worth of new machinery has been lately added to the plant, which will operate steadily from now on, both day and night. The plant is a subsidiary organization of the Mason Tire & Rubber Co.

Pennsylvania Rubber Co., Jeannette, Pa., during semi-annual inventory taking starting July 1, will rush to completion important extensions to equipment, which will increase curing facilities and place the company in a position to turn out 5000 tires and 7000 tubes daily. This schedule is expected to begin the early part of August.

Standley Manufacturing Co., Boone, Iowa, has opened up a branch house under the same name at Nelson Avenue and Manley Street, Long Island City, N. Y. A complete stock of the Standley line will be carried, quoted f.o.b. New York City.

Dura Co., manufacturer of mechanical window regulators for closed automobiles, has negotiated a five-year lease for one of the plants of the Toledo Cooker Co, Toledo. The Dura Co. has outgrown its present quarters. Officials of the company are closely allied with the Milburn Wagon Co.

Stewart-Warner Speedometer Corp. reports unfilled orders for June totaling $1,500,000. Sales so far this month are more than double those for the corresponding period last year. Officials believe that this month's business will be the largest in the company's history.

Gary Motor Corp., Gary, Ind., manufacturer of the Gary truck, has opened two new factory branches, one in Chicago at 1503-05 South Michigan Avenue in charge of Charles Statter and the other at 1722-28 Cherry Street, Kansas City.

Ruggles Motor Truck Co. has acquired a site at Bad Axe, Mich., on which it plans a new plant building, 50 x 175 ft.

EMPLOYMENT 1,970 BETTER

DETROIT, June 26—Members of the Employers Association report that the number of workers on their payrolls was increased by 1970 last week. This brings the total to a new high mark of 178,474, which is 68,000 more than for the same week in 1921 and only 10,000 less than the same week of 1920.

Rubber Association of America has removed its general offices from 52 Vanderbilt Avenue to the Fisk Building, at 250 West 57th Street, New York.

Automotive Structure Planned for New York

NEW YORK, June 26—The estate of J. Wertheim will erect a three story building adapted to the automotive trade in the block bounded by 57th and 58th Streets, Broadway and Eighth Avenue. Showrooms for passenger cars will occupy the Broadway frontage and truck salesrooms will face Eighth Avenue. In the center of the building will be a large court, permitting the movement of cars into the various showrooms without disturbing the store fronts.

A building was started by Wertheim on this site two years ago, but after the foundation was built Wertheim died and the property has been idle since then.

New Case 12-20 Tractor Will Pull Three Plows

RACINE, WIS., June 27—While not differing radically in appearance from previous Case models, the new Case 12-20 tractor is practically of a two-plow size for all conditions and will pull three plows under ordinary conditions. It will handle a 22 x 36 thresher with all attachments, will operate a 12 or 14 in. silo filler and will pull a 9 ft. double disk in high gear or a 12 ft. grain drill.

The frame is in one piece and this holds all bearings, shafts and gears. The engine is a vertical four-cylinder type, 4⅛ x 5 in., with valves in the head. The cylinder barrels are renewable. The belt pulley is mounted directly on an extension of the crankshaft.

FOUR COMPANIES ENJOINED

PHILADELPHIA, June 29—Upon petition of the Hudson Motor Specialties Co., the Federal court for the northern district of Ohio has granted it a perpetual injunction restraining the Simmons Manufacturing Co., the Lake Erie Accessories Co., the M & M Co. and the American Signal Co. from using or selling lugs for power plant support for motor vehicles embodying the inventions described in patent No. 1,263 899, as well as from using in conjunction with the manufacture or sale of any motor support or lugs for power plant support the name "Crankcase Repair Arm."

METAL MARKETS

Although both steel producers and consumers are more or less in a quiver over the developments which the next few days will bring forth with reference to the coal strike and the transportation situation, the market is not likely to undergo any incisive changes during the next few weeks. These developments, however, will exert considerable influence on the shaping of the market in August when the extent of the demand should determine whether buyers or producers will have the upper hand during the latter part of the year. Except for filling in, July buying is practically over, and, taking into consideration the limitations imposed upon production by the difficulties which some mills encounter in obtaining sufficient supplies of fuel and in the case of some non-integrated mills by the tightness in the supply of semi-finished steel, such as sheet bars, as well as the somewhat greater scarcity of efficient labor, orders for July shipment on the books of mills are on parity with capacity production.

The future course of the market will largely depend upon whether August will turn out to be a month of more active buying than that month usually is. Meanwhile, however, every development that tends to increase the cost of steel production, such as continuance of the coal strike, will furnish a prop for continued control of the market by sellers. The fact that the chief producing interest is booking orders for third quarter sheet shipments at old prices exerts a restraining influence upon the market at one of its most critical post-war periods when fundamental conditions would seem to favor a repetition of the 1920 runaway period of prices and a duplication, although on a somewhat smaller scale, of the disastrous aftermath of that flurry.

Apparently the lesson of those days has not been lost. It is a mistake to picture the sheet market of the present time as one in which the leading interest has one price and all of the independents another. There are several representative independents who are adhering closely to the corporation's price schedule.

Pig Iron.—Automotive foundries continue to buy in a conservative way. The Ford furnace at River Rouge figures these days as one of the largest buying factors in the iron ore market.

Steel.—Somewhat of a firmer tendency is noted in the market for automotive alloy steels. So much is certain that the price cutting on nickel steel that was in evidence for a long time has subsided. Strip steel makers continue to receive the bulk of their orders from the automotive industries. Producers are holding down commitments so as to have a free hand if continuance of the coal strike should bring about higher production costs. The hot-rolled market is at 2.40c., base, Pittsburgh, as a minimum, while the cold-rolled rules generally at 4. Sales of automobile sheet seconds at 4.25c., Pittsburgh, have been noted recently. The sheet bar situation continues tight as tight can be. These mills which are quoting $35, Pittsburgh, confine sales to regular customers. Others have been quoting $37.50 for third quarter.

Aluminum.—A waiting attitude characterizes the market which remains nominally unchanged.

Copper.—On the whole the market is fairly steady with a continuing good demand for copper and brass products from the automotive industries.

Calendar

SHOWS

Sept. 23-30—New York, Closed Car Show, Grand Central Palace.

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

Dec. 3-9—New York, Eighteenth Annual Automobile Salon, Commodore Hotel.

January—Chicago, Annual Automobile Salon.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

July 1-24—London (Olympia), Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile Exhibits in Connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague, Automobile Show.

Sept. 25-Oct. 3—Berlin, Automobile Show at the Kaiser-Damm Hall under the auspices of the German Automobile Manufacturers Association.

September — Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 4-15 — Paris, Automobile Show, Grand Palais.

Nov. 3-11 — London (Olympia), Automobile Show.

Nov. 10 - Dec. 19 — Brussels, Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

RACES

July 15 — Strasbourg, French Grand Prix.

CONVENTIONS

July 17 — Baltimore, meeting, representatives of highway departments of ten Eastern states.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28-Sept. 2 — Detroit National Safety Congress.

Sept. 18-23, 1922 — Rome, Italy. Second Annual Meeting of the International Chamber of Commerce.

Sept. 13, 14, 15—Annual credit meeting, Motor and Accessory Manufacturers Ass'n.

July 15, Date Fixed for Release of Film

Copies of "Story of Automobile" May Be Obtained by Manufacturers

WASHINGTON, June 27—History of the American automobile industry, depicted in a five-reel motion picture, made under the supervision of the automotive division of the Department of Commerce, will be ready for release on July 15, the department has announced.

The film, known as "The Story of an Automobile," was made under the personal direction of M. F. Leopold, engineer of the Bureau of Mines, and was taken in the Studebaker Corp. plant at South Bend. The purpose of the film is to advertise the entire automobile industry rather than any particular make of car. Copies will be loaned by the division to any manufacturer in the industry.

The picture shows in a graphic way the complete manufacture of an automobile and the many hundreds of mechanical operations employed. A first night "party" will be given to members of Congress, the Cabinet and diplomats, at an initial showing early next week.

The department has announced that the film will be copied with translations into more than half a dozen languages in order that the story of the American automobile may have wide distribution abroad. Attaches and American consuls abroad will be instructed to offer the loan of the film at any and all appropriate occasions, such as conventions or meetings of prospective consumers.

STANDARD PARTS' PROFITS

CLEVELAND, June 26—Business at the Standard Parts Co. has developed to such an extent that operations in April and May resulted in blank ink returns. Profits were not large, but the company has not operated in red ink figures since March.

The company has broadened its scope of late by closing contracts for several million feet of tubing which goes into beds. The tubing will be made at the Standard Welding plant. The company's automobile parts business is reported holding up well, while new contracts have just been closed for axles with some of the smaller companies.

Sharp Price Reductions Made on Dorris Models

ST. LOUIS, June 26—The Dorris Motor Car Co. announces sharp price reductions effective July 1. The list follows:

		Old Price	New Price
7-passenger	Phaeton..	$4,785	$3,950
4-passenger	Phaeton..	4,785	3,950
4-passenger	Coupe....	5,800	4,985
7-passenger	Sedan....	7,190	5,750

SHIPS 822 CARS ONE DAY

DETROIT, June 26—Buick Motor Car Co. shipped 822 cars on June 23, the largest single day's shipment in the company's history. The company has been operating on a part time schedule for the past month, pending changes in its manufacturing policy, which include the operation of the Scripps-Booth plant.

Orders on sport models run several months ahead, dealers taking orders on a delivery basis of eight weeks. The factory is likewise far behind on closed car deliveries.

ARGENTINA TRACTOR TESTS

BUENOS AIRES, ARGENTINA, June 8 (*By Mail*)—The National Bureau of Roads and Bridges will hold tractor demonstrations on July 17 for the purpose of trying out the different types of tractors imported into the Republic. All particulars may be referred to the Secretaria Departamento de Caminos y Puentes, Reconuista 575, Buenos Aires.

Five Tool Companies Form Consolidation

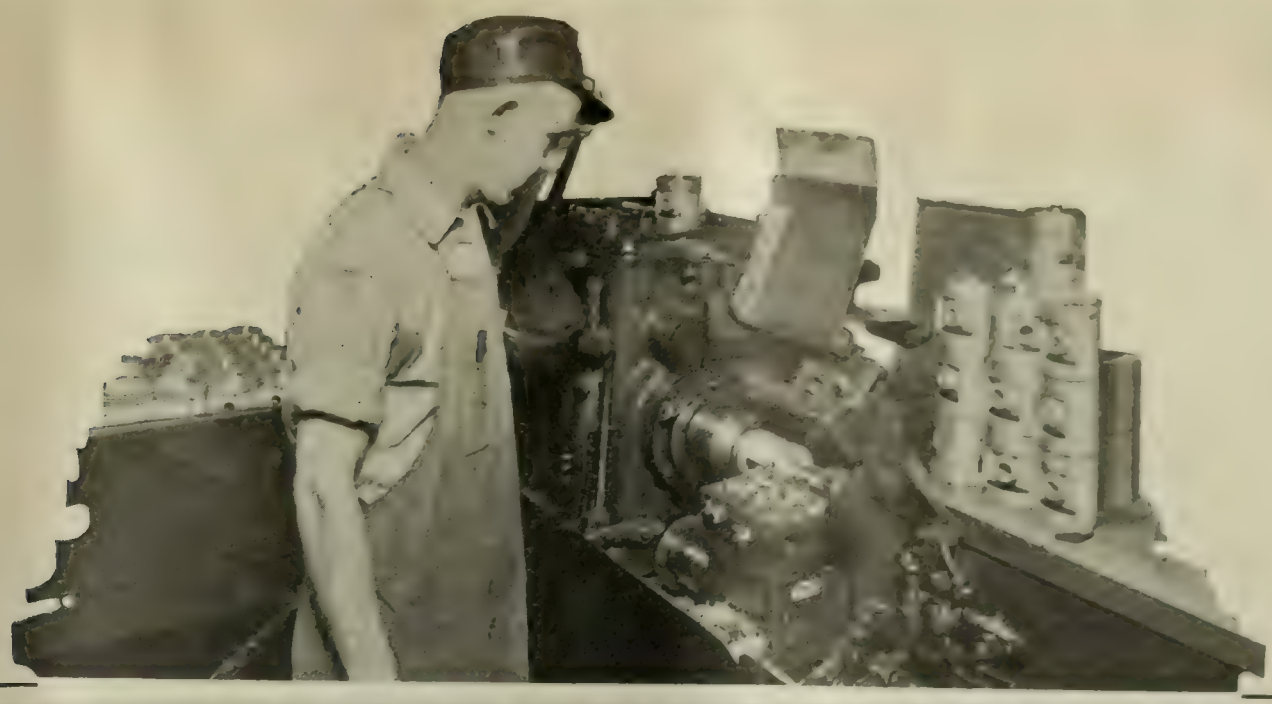
Former Head of American Locomotive Co. Will Be Chairman of Board

NEW YORK, June 26—Articles of incorporation have been filed in Delaware for the Consolidated Machine Tool Corp. of America, which will acquire the Betts Machine Co., whose plant is located in Rochester; Colburn Machine Tool Co. of Cleveland; Hilles & Jones Co. of Wilmington, Del.; Modern Tool Co. of Philadelphia, and the Newton Machine Tool Works, Inc., of Newton, Pa.

Permanent organization will be perfected by the election of officers and directors in a few weeks. It is stated that W. H. Marshall, formerly head of the American Locomotive Co., will be chairman of the board of directors, and C. K. Lassiter, who has been vice-president of the American Locomotive Co. in charge of manufacture, will be president. Besides these men the board will include R. H. Ingle, W. H. Breckenridge, H. J. Bailey, C. W. Tayne and H. W. Champion, all of whom have been active in companies that go to make up the combine.

The capital stock of the consolidated company is made up of 200,000 shares of no par value and $10,000,000 7 per cent non-cumulative preferred stock. The headquarters of the new enterprise will be at 17 East Forty-second Street, New York.

The new combination will handle heavy duty lathes, boring mills, shapers, slotters, planers, heavy duty drilling machines, internal and external cylindrical grinding machines, horizontal and vertical punches, shears of various types, cold saws, automatic die heads, miscellaneous small tools and a complete line of shop equipment.



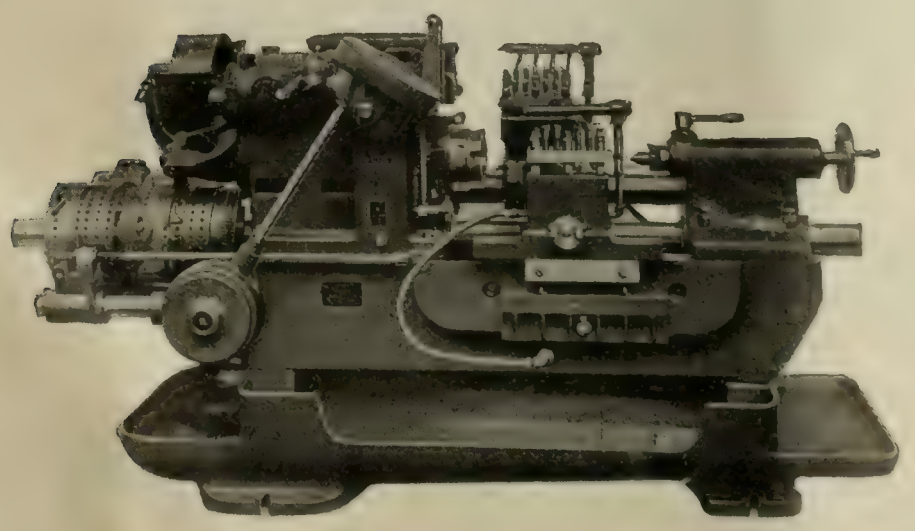
Precision Machine Work in the Production of Aluminum Pistons

THE vital role played by Fay Automatics in machining to close tolerances the aluminum pistons recently adapted by the builders of the Essex engine, is another reason why prominent automotive manufacturers continue to equip with this unusual Lathe.

The Fay Automatic shown above turns the outside diameter, faces the end and also rough cuts and finish cuts the ring grooves.

The floor to floor time on this operation is about 20 seconds.

Where will a Fay Automatic do the most good in your shop?



JONES & LAMSON MACHINE CO.

Also Makers of the Hartness Flat Turret Lathe

SPRINGFIELD, VERMONT

503 Market St., San Francisco, Cal.
9-10 Water Lane, Queen Victoria St. LONDON, Eng.

AGENTS: France, Spain and Belgium—F. Auberty & Co., 91 Rue de Maubeuge, Paris; Holland—Spliethoff, Beeuwkes & Co., Rotterdam; Japan, Korea, etc.—Mitsui & Co., Ltd., Tokio; Australasia—McPherson's Pty., Ltd., 554 Collins St., Melbourne. Stockholm, Sweden—A. Bol Oscar Lindbom, Postbox 420.

FAY AUTOMATIC LATHE

Future Costs Underestimated

EARLY in February we told you Warner & Swasey prices could only go one way and that up. Sales increased because people liked our frank price policy, which we said was based upon our analysis of the economic future.

In the three months that have passed, American business has come back strong, and raw materials, sold last winter at liquidation prices, have started back where producers can profit. The better mechanics have had jobs, but the "near" mechanics have drifted back to the farms or other occupations. Do you know that competent experts say there are already well defined shortages of certain classes of labor in the big industrial centers?

That means the real men in metal-working lines whom we need to build Warner & Swasey quality into machines are not going to be willing to give their best at as low cost as we figured when we set our prices in February.

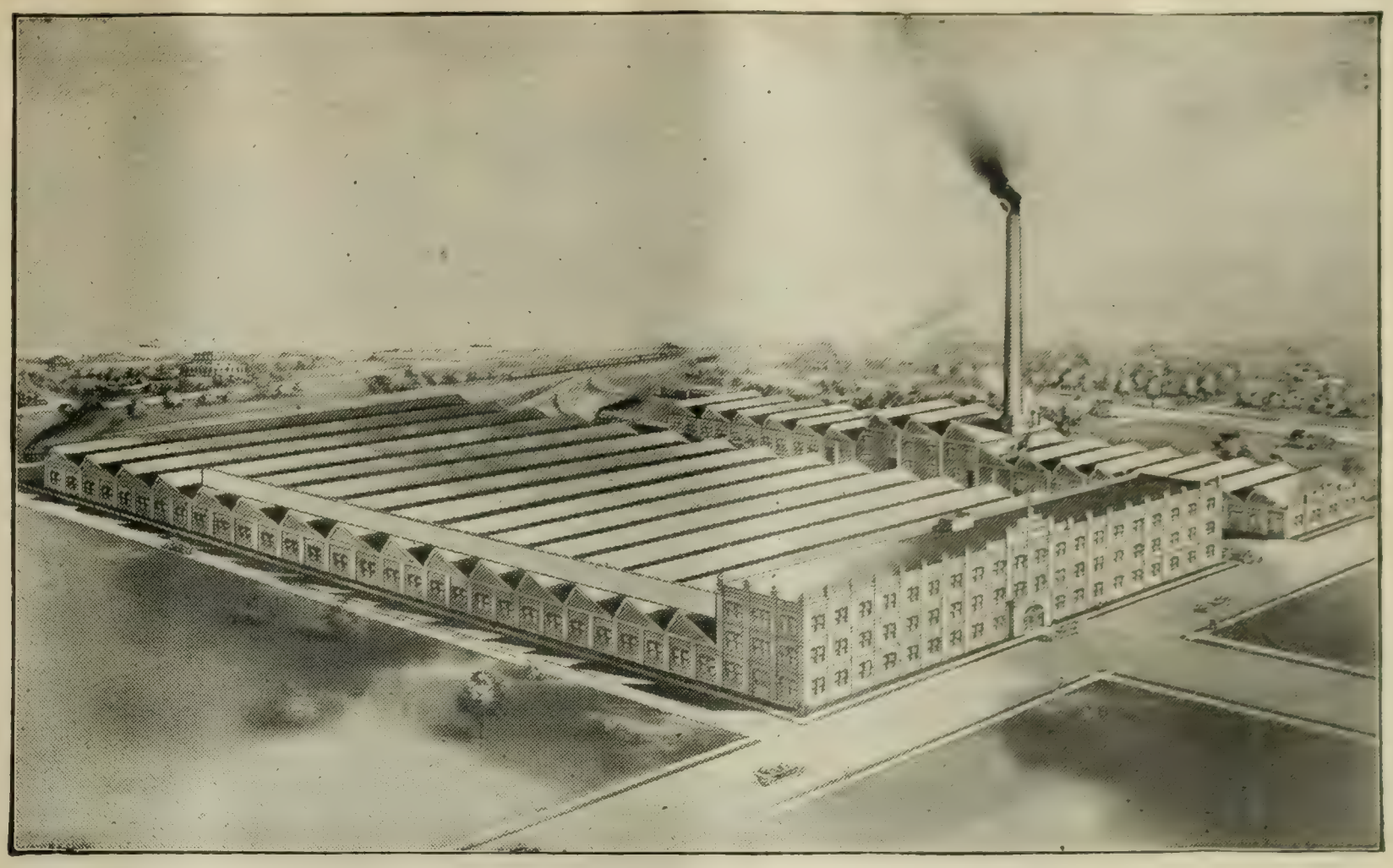
It has always been our policy to give you our product at the lowest possible price until we are compelled by costs, beyond our control, to increase. We don't know when this time will come, but if you haven't followed the trend of affairs as we have, you may well anticipate now what seems a certainty to us. Of course you can always buy cheaper turret lathes, but if you buy on the basis of cost per piece produced and long life of the machine you will find a W & S Turret Lathe means you have bought the real bargain in the turret lathe field.

Buy now—You can do so wisely and safely if you select W & S Turret Lathes

The Warner & Swasey Company

Cleveland, U. S. A.

NEW YORK: Singer Building
CHICAGO: 618-622 Washington Boulevard
MILWAUKEE: 209 Sycamore Building
BOSTON: Oliver Building
INDIANAPOLIS: 940 Lemcke Annex
BUFFALO: Iroquois Building
DETROIT: 5928 Second Boulevard
DAYTON: 518 Mutual Home Building



PLANT FOR SALE

DESIRABLE PROPERTY AVAILABLE AT A SACRIFICE. EXCELLENTLY ADAPTED FOR AUTOMOTIVE MANUFACTURING.

LOCATION—Cleveland, Ohio. In the heart of the automotive industry. On N. Y. C. R.R., 2 miles from center of city.

LAND AREA—4.12 acres. Two sidings from N. Y. Central Railroad.

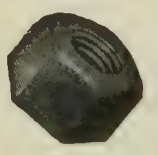
BUILDINGS—3 story brick and 1 story brick, saw tooth construction. Floor space, 133,000 square feet. Well lighted and ventilated; in good repair. Automatic sprinkler system. Power Plant, 2-250 H.P. B. & W. Boilers.

For further information inquire of

P. A. CONNOLLY

1406 Williamson Building, Cleveland, Ohio. (Phone Hemlok 2300)







The Labor Phase of "Scrap"

"Well, that's that!"

It is easy to take the philosophical view of scrap—of the daily pile of discarded bolts and nuts that failed to go in place and make good—when you think of them as so many pieces of metal that cost so much per pound or per thousand. You expect it.

But they don't cost so much per pound, or per thousand. *They cost so much per hour of labor.*

No bolt or nut is scrapped in assembly until it has been tried and found wanting—it can't say, "I'm bad, don't use me." Its tale of stripped threads or fracture or poor fit is told only after the wrench has done its work.

The Misleading Time Schedule

Every plant executive knows that lost motion cannot be entirely abolished, but it can be reduced to an acceptable minimum. The lower the minimum of waste, the higher the maximum of production. That is the guiding principle of every operating schedule.

There is unavoidable waste—and many executives fall into the error of including under this head a more or less fixed average of time lost in the handling of faulty bolts and nuts. This mistake has its source in the belief that in any large quantity of bolts and nuts a certain percentage of defective pieces must be expected. It leads to a wrong conclusion about standard time schedules—it ends in a schedule that fails to reap the benefit of the workman's full capacity.

How Defects Spring Up

Where nuts flow in an endless current from one machine to another there is always some chance for error in set-up or in some other detail. A nut, which is but one of hundreds of thousands produced in a day, cannot be watched over like some delicately balanced instrument — it must rely for its precision upon the integrity of the mechanical means of producing it.

Thus it is evident that if such mechanical means can be simplified, and the number of changes from one machine to another reduced, a proportionate reduction in error will be attained.

The makers of EMPIRE Bolts and Nuts, the originators of the cold punching process for the production of steel nuts, are the first, and so far the only manufacturers to produce a type of machine designed to perform all five of the major operations at one time.

The R. B. & W. Automatics

The Automatic Nut Machines are *production machines* of an unique and startling character. Taking in at one end the raw bars of open hearth steel, they discharge at the other a stream of cold punched nuts all ready for tapping and semi-finishing—the cutting, cold punching, chamfering, trimming and burnishing all completed. With no handling and no set-ups between operations there is no chance for variations in tolerance.

A staff of inspectors on every floor, trained to their tasks by an expert tool maker, erect the final barrier against defective workmanship. No faulty bolts or nuts can pass them.

A Comprehensive Guarantee

Every Empire Bolt and Nut is guaranteed against thread stripping, fractures and inaccuracies. Threads are gauged to within .003".

This is your protection against labor wasted in assembling — against "scrap" and its costly consequences.

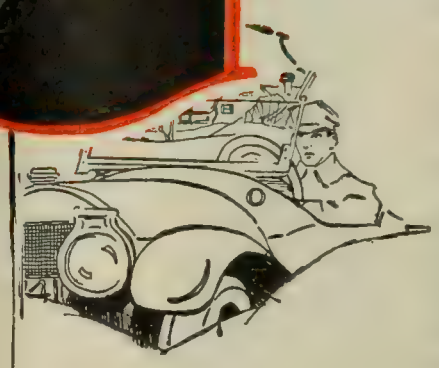
R. B. & W. engineers will gladly confer with you on your bolt and nut requirements, pointing to a saving in production costs far outweighing any other consideration.

BOLTS EMPIRE NUTS-RIVETS

RUSSELL, BURDSALL & WARD
BOLT & NUT COMPANY
PORT CHESTER, N.Y.
PEMBERWICK, CONN. • CHICAGO • SAN FRANCISCO • ROCK FALLS, ILL.
Makers of Bolts, Nuts and Rivets Since 1845

Set Wheel Play to Suit Every Driver







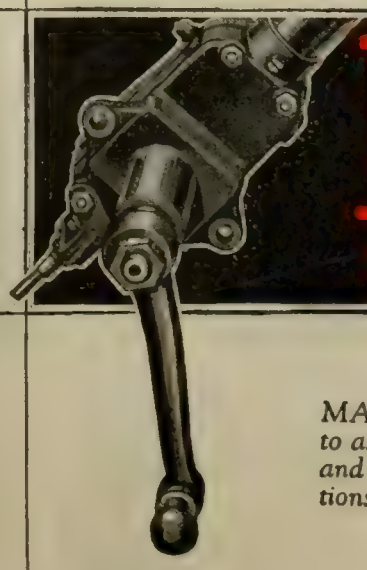
ANOTHER Lavine "PILOT" feature that is appealing to makers of America's fine cars is its simple and quick adjustment for any desired amount of wheel play—from zero to an inch and one-half.

Manufacturers appreciate what an important sales point this is. For many drivers want *no* wheel play whatever—while many others want the customary inch. To be able to please them all is an advantage.

In the Lavine "PILOT"—*the new standard of steering gear value*—the base of the worm shaft is supported by a small ball-thrust bearing and adjusting nut. This permits rapid and precise adjustment to suit the most critical driver.

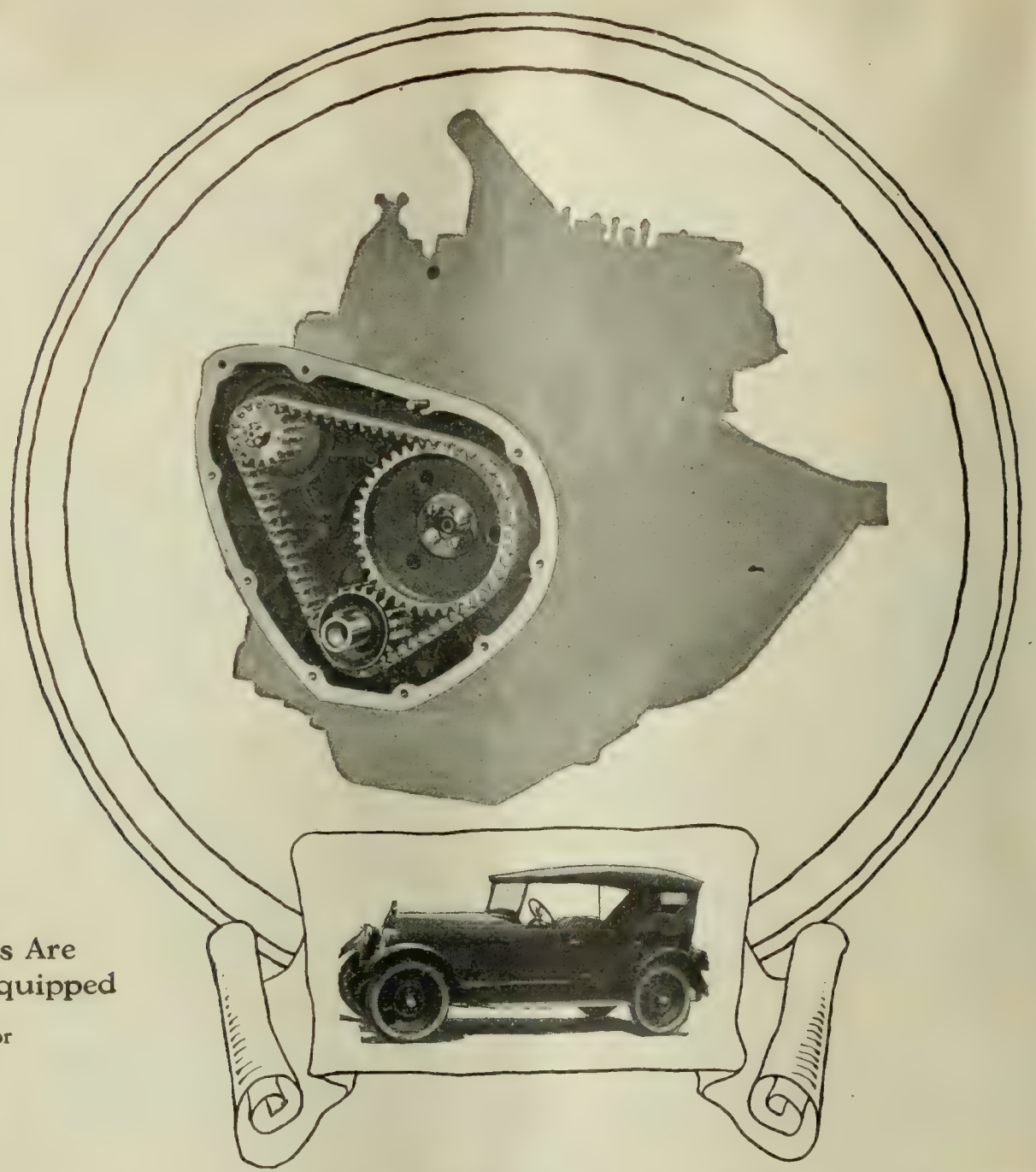
Throughout the "PILOT", you will find many other niceties of construction and design that distinguish this gear from the commonplace. In fact, the "PILOT's" superior durability, safety, simplicity, smoothness of action and freedom from rattle are points far-sighted car manufacturers can capitalize on during the keenly competitive years now at hand.

LAVINE GEAR COMPANY
MILWAUKEE, WIS.



LAVINE "PILOT" STEERING GEAR

MANUFACTURERS: Why wait for your sales departments to ask you about the "PILOT"? You should know this gear and how reasonably it is priced. Let us exchange specifications. Send us your blue prints—no obligation, of course.



These Cars Are Also Morse Equipped

Ambassador
Cadillac
Chalmers
Cleveland
Columbia
Davis
Fox
Hanson
Hudson
Hupmobile
Jordan
Lafayette
Lincoln
Moon
National
Oakland
Packard
Rickenbacker
Saxon
Stearns
Sterling-Knight
Studebaker
Templar
Winton

ANOTHER—The Davis Six

To meet the exacting demands of present-day discriminating automobile buyers, the George W. Davis Motor Car Company adds Morse Silent Chain as standard cam and accessory drive.

To the developments of 12 years devoted to building fine motor cars, this firmly-established company adds the final touch of engineering refinement. It ends the troublesome factors of front end drive by securing silence, smoothness, and durability.

Morse equipment is now standard on twenty-four dominant American cars. Follow their lead in perfecting the motor you build.

MORSE CHAIN COMPANY

Main Office and Works
ITHACA, NEW YORK

Sales and Engineering Office
DETROIT, MICHIGAN

MORSE

GENUINE SILENT CHAINS

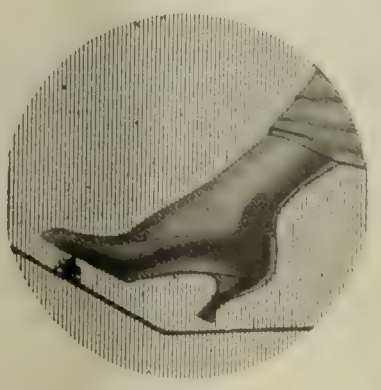
Auto-Lite

Starting, Lighting & Ignition

Only one thing proves to an engineer the unquestioned superiority of a product! That is, its success in the hands of the user.

All over the world more than two million car owners have learned from satisfactory experience to have implicit faith in the reliability of the Auto-Lite System, under all driving conditions.

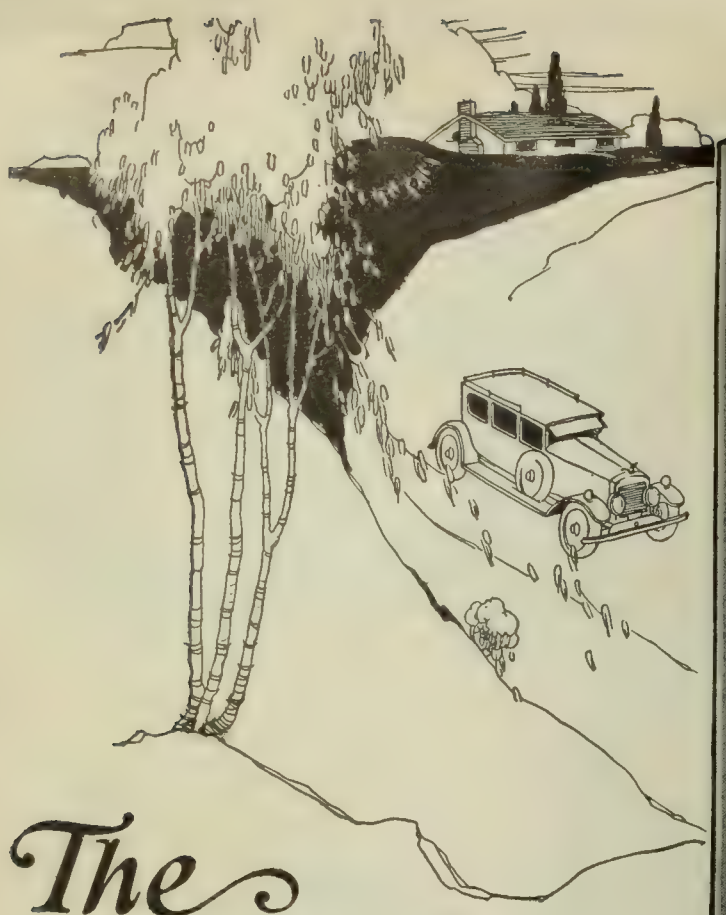
There are many reasons for the ruggedness, simplicity and long life of the Auto-Lite System. May we have an opportunity to go into these with you?



ELECTRIC AUTO-LITE COMPANY

Offices and Works, Toledo, Ohio **Detroit Sales Office, 1309 Kresge Bldg.**

WILLYS LIGHT DIVISION
of Electric Auto-Lite Company
Manufacturers of Electric Light and Power Plants for Farms, Etc.



The Six Factors in Raulang TRADE MARK Responsibility

The Fifth Factor—Our Cooperation and Counsel

Having, in the past, manufactured complete motor-cars, we are uniquely placed by first-hand knowledge to counsel helpfully on matters ranging from the mounting and finishing of bodies even to problems of sales demand.

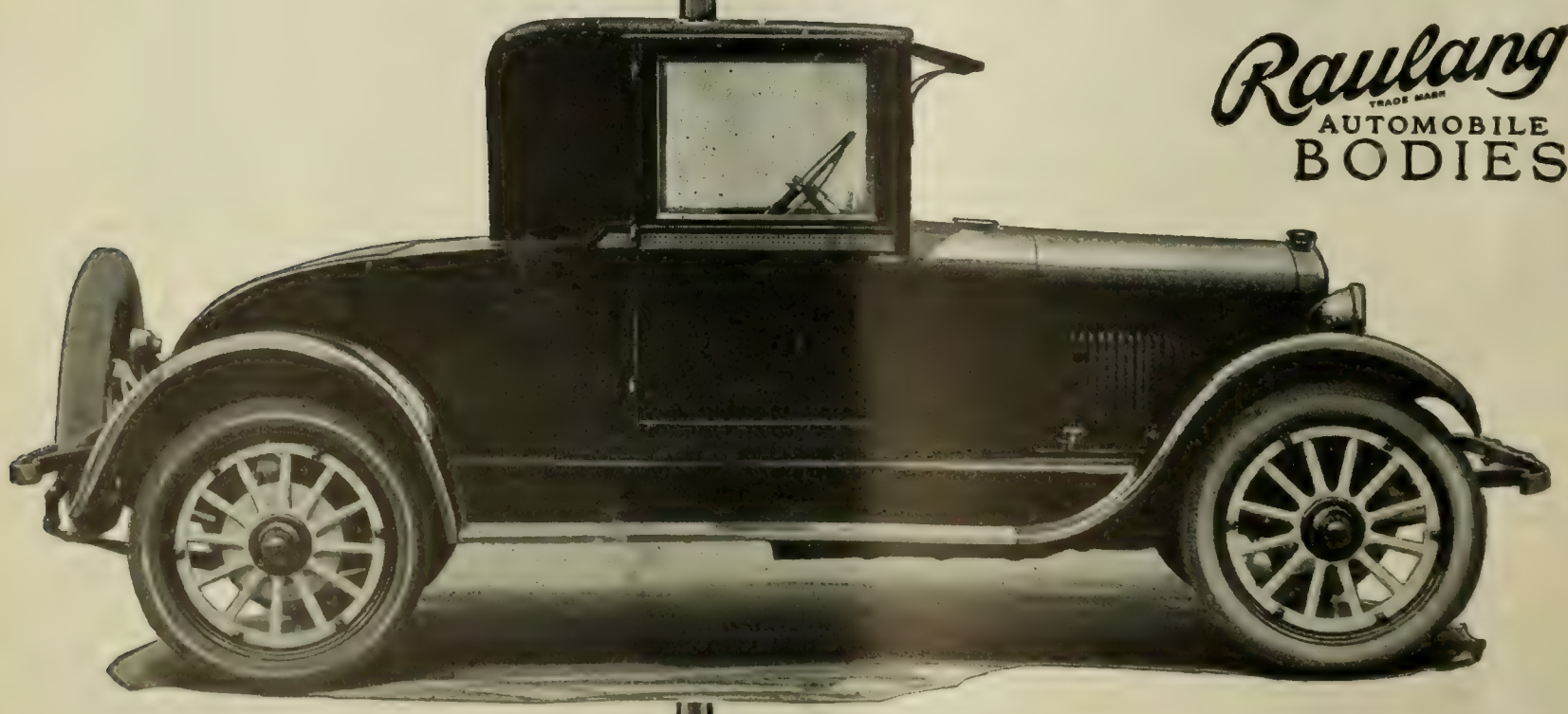
Engineering problems or sales problems—on either, or both, our counsel and help is yours, gladly—not thrown in as an extra but as a component part of our regular service.

For example, we are prepared to show you by established experience how you and your dealers can measurably increase sales in your closed models by a special handling and presentation of the Raulang exclusive features to the customer.

The use of RAULANG bodies means added sales momentum.

RAULANG BODY DIVISION
The Baker R & L Co.
CLEVELAND, OHIO. U.S.A

Raulang TRADE MARK
AUTOMOBILE
BODIES









This Shape

In Gier Tuarc Steel Wheels this original shape, embodying all of the disc and felloe, is a single jointless stamping.

The *one-piece* construction secures the advantages of matchless steel wheel resiliency, permanent quiet, true running, and a smooth contour.

It was the creation of this ingenious design which made possible the direct outside valve stem pioneered by Tuarcs. For the same reason largely, Tuarc wheels, with the acknowledged conveniences of the standard demountable rim, are lighter in peripheral weight—"weight at the rim"—than old types of wheels.

This epochal achievement indicates why Gier Tuarc wheels are looked to for the highest developments in steel wheels.

MOTOR WHEEL CORPORATION, LANSING, MICHIGAN

Motor Vehicle Wheels Complete—Metal Stampings—Steel Products

509 Fisk Bldg., B'dw'y at 57, New York
584 Commonwealth Ave., Boston
10 South 18th St., Philadelphia
Bigelow Blvd. & Craig, Pittsburgh
601 Capitol Theatre Bldg.
120 Madison Ave., Detroit
913 Phelan Bldg., San Francisco
1341 So. Hope St., Los Angeles
915 Keele St., Toronto, Canada

Gier Tuarc STEEL WHEELS
Motor Wheel PRODUCTS



UNDER

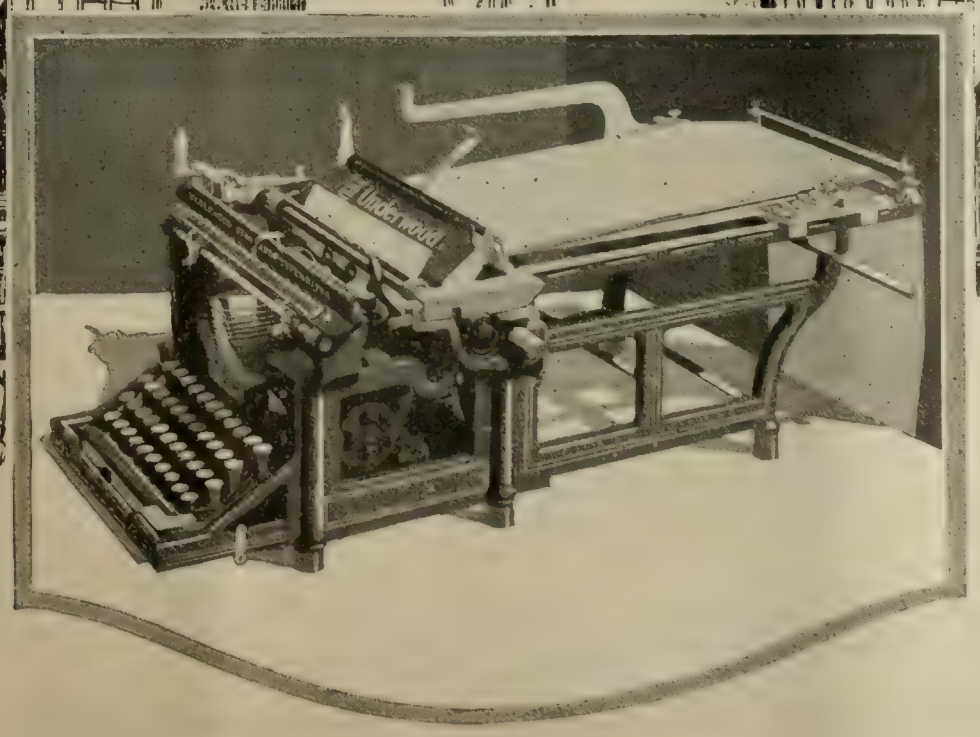
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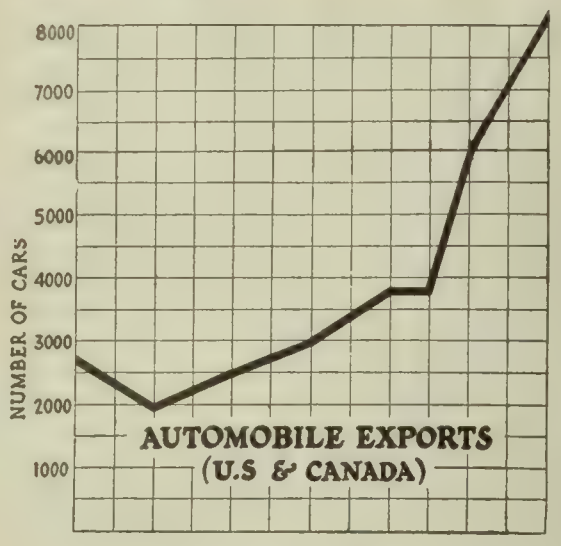


WOOD

World's Business



BenRimo



From April, 1921, to May, 1922
To all countries

Now Is the Time to Make Your Export Sales Plans

Overseas sales act as a balance to production. Most overseas business comes from the southern hemisphere and seasons there are the reverse of ours.

Here is a fundamental reason for developing overseas markets—the buying naturally takes place when domestic business is slack.

The automotive industry is most assuredly going to use foresight. Present export sales show that it has turned its attention to overseas markets.

But only a few firms in the industry are acting. They are the ones who are getting the increased business shown in the accompanying chart.

Why don't you, too, get busy with your export plans? It's time to do so now.

El Automóvil Americano
Automoviles · Camiones · Moto-Cicletas · Aeroplanos · Tractores
Published by
The Class Journal Company
No. 239 West 39th St., New York City

Away to a Good Start

at the Sign of the Orange Disc



GULF
DEALERS
GET THE BUSINESS

GULF REFINING COMPANY
FRICK BUILDING ANNEX **PITTSBURGH, PA.**

ADVERTISING IS MASS SELLING

ANY method that is good for individual selling is valuable for mass selling.

The first principle of selling is to call on your prospective customer and your present customer regularly and frequently.

The first principle of mass selling is to reach your customer and prospective customer regularly and frequently with the advertising message.

In selling—even to call—is better than nothing. Out of calling and showing his wares a dumb man can make sales. This is the minimum value of selling.

In mass selling—a card is better than nothing. A list of names, products and ad-

dresses will bring inquirers. This is the minimum effective value of advertising.

The second principle of selling is to know something about the products, the customers problems and the applications—and to present these things effectively, clearly and convincingly.

The second principle of mass selling is to use your advertising message to the customer so that it talks about how your product, service and organization meets his problems—and does this clearly, effectively and convincingly.

In selling and advertising keeping at it intelligently counts—advertising is mass selling.

THE CLASS JOURNAL COMPANY

New York, U. P. C. Bldg.; *Chicago*, Mallers Bldg.; *Boston*, 185 Devonshire St.; *Philadelphia*, Widener Bldg.; *Cleveland*, Guardian Bldg.; *Buffalo*, 18 Woodward Ave.; *Detroit*, 317 Fort St., West; *Milwaukee*, 516 Colby-Abbott Bldg.; *Indianapolis*, 1212 Merchants' Bank Bldg.

Publishers of AUTOMOTIVE INDUSTRIES, MOTOR WORLD, MOTOR AGE, COMMERCIAL VEHICLE, EL AUTOMOVIL AMERICANO, MOTOR BOAT. DISTRIBUTION & WAREHOUSING, THE TIRE RATE BOOK

DO YOUR JOINTS THROW GREASE?

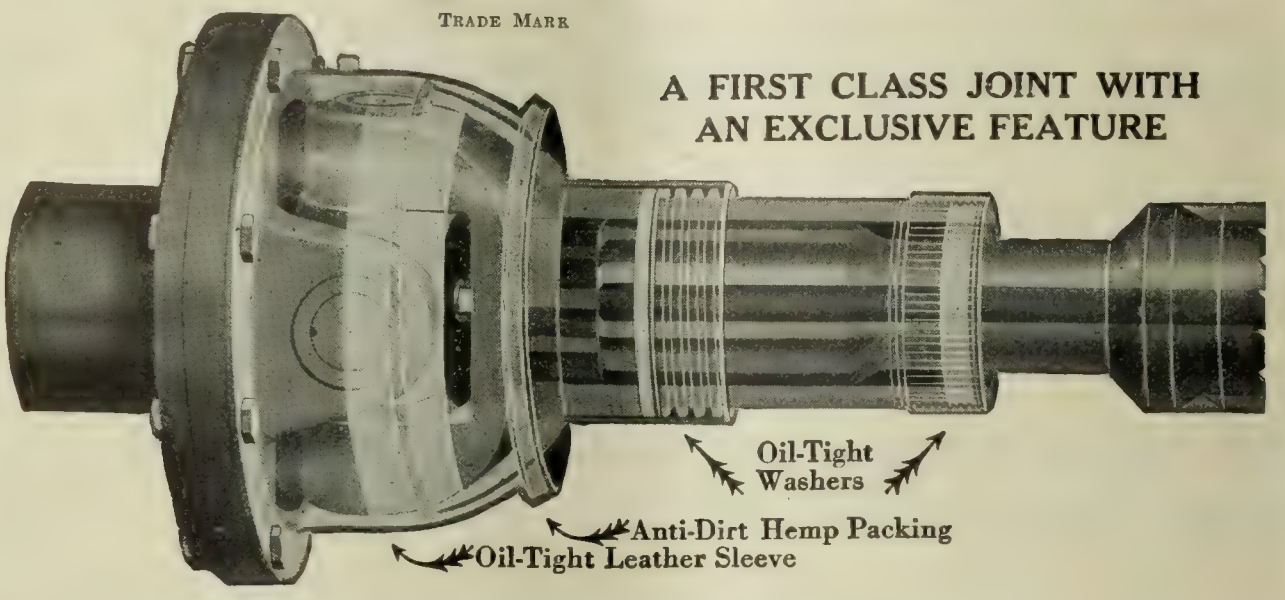
Do the bushings squeak, overheat and work loose in the Yokes?

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The leather sleeve (shown as light colored band) retains oil in the same way that the cup leather in a tire pump retains air. Standard Equipment on a Number of Well Known Motor Vehicles.

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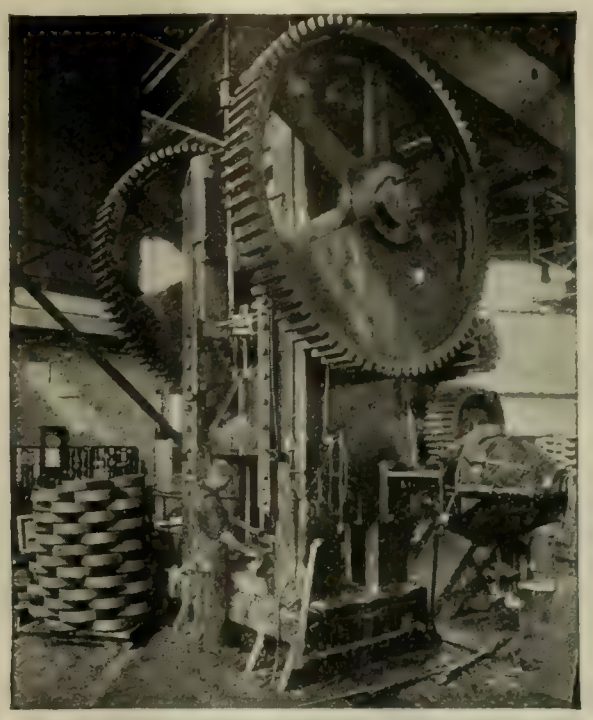
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This type Bliss Press is built in a great number of sizes and with many modifications to suit special requirements. Weight 1500 to 450,000 lbs.

They are built as flywheel presses, single geared. double geared and triple geared presses and arranged for single or twin drive. Frames may be either cut back or straight side as shown in the illustration. Slides are of unusual width and length.

The line of work for which this type press is adapted is indeed very wide. They are largely used in the manufacture of automobile parts, heavy hardware, agricultural implements, tractors, electrical instruments, cutlery, etc., etc. They are also used for light embossing work and the trimming of hot or cold forgings.

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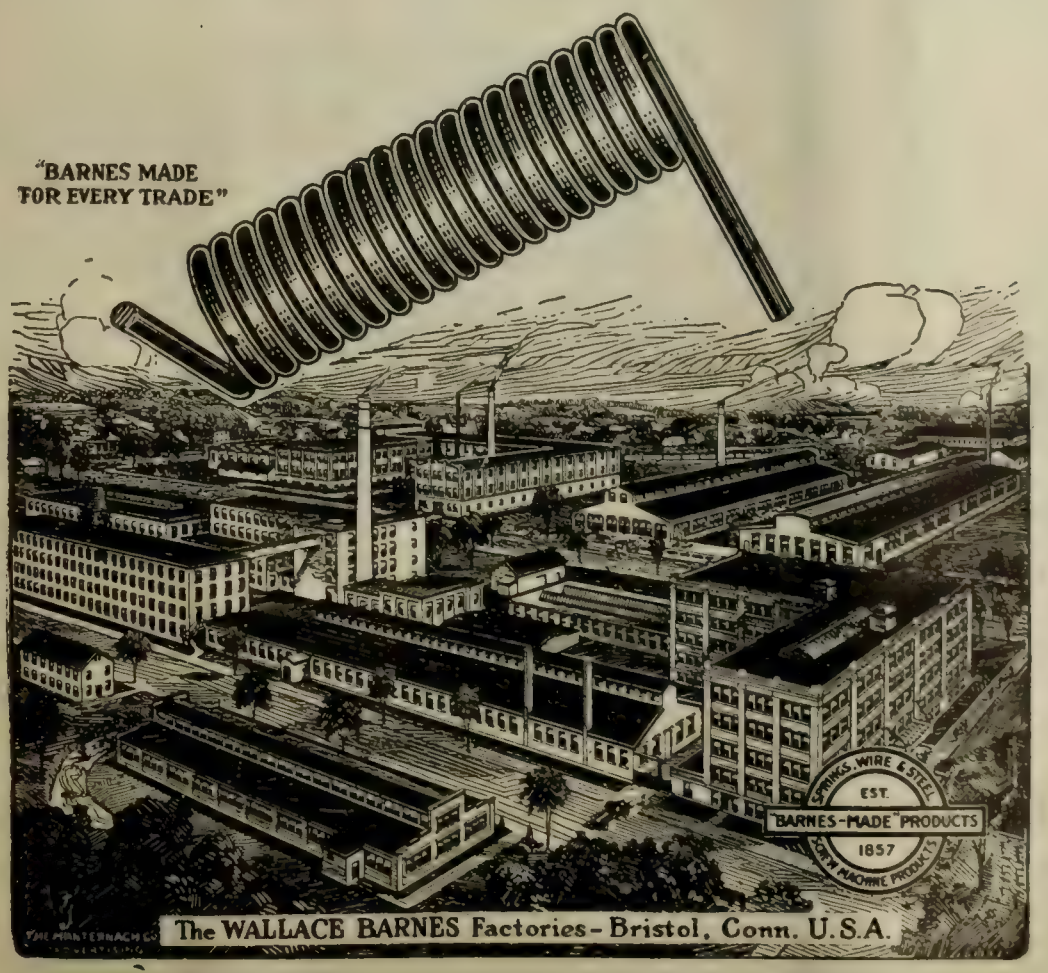
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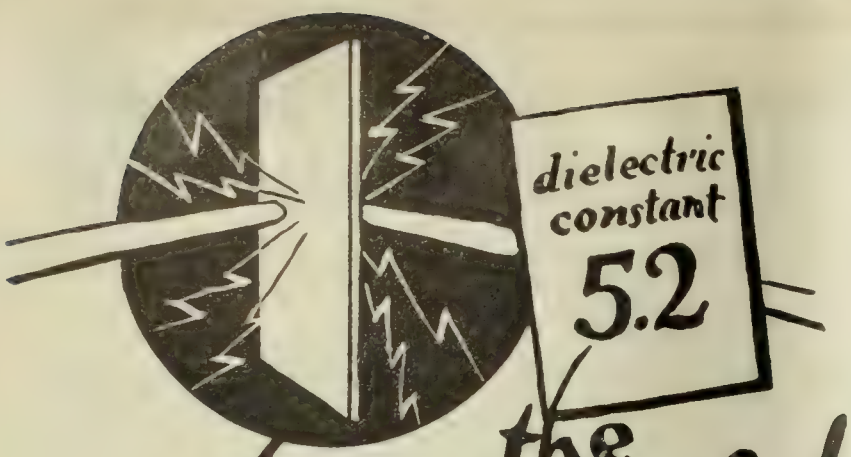
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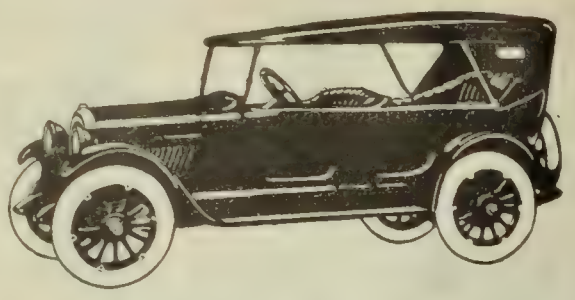
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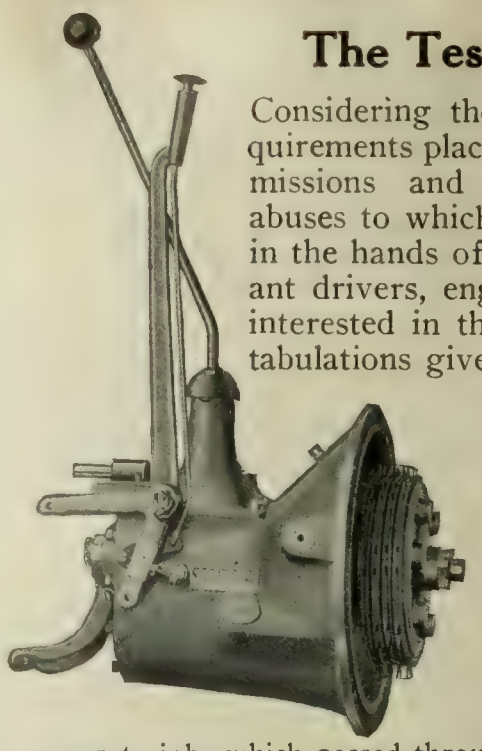
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Do not confuse the *original* Robert Bosch Products with others bearing names somewhat similar.



The Test of Service

Considering the heavy service requirements placed upon truck transmissions and clutches, and the abuses to which they are subjected in the hands of careless and ignorant drivers, engineers will then be interested in the repair percentage tabulations given below.

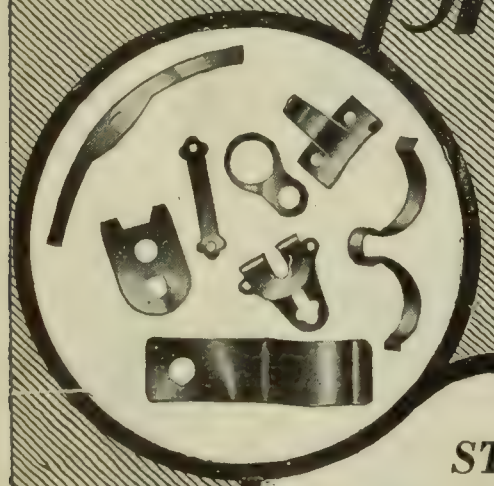
Read the Story

The following table is an actual record of the repairs on REPUBLIC trucks made by the Roberts Motor Car Company, REPUBLIC distributors, at Portland, Oregon. There were 317 separate jobs which passed through their shops and the following table shows the percentage of repairs from the different parts of the trucks:

Transmission (FULLER)	1.26%
Clutch (FULLER)	5.66%
Springs of all kinds	1.26%
Frame, all kinds	1.56%
Shift spring, rear axle, all causes	2.50%
Shift spring, front axle, all causes	2.52%
Rear axle, except brake	6.00%
Steering gear, repairs all kinds	6.00%
Propeller shaft and Universal joints	8.20%
Brakes	11.34%
Engine repairs, all kinds	53.70%
TOTAL	100.00%

FULLER & SONS MFG. CO., Kalamazoo, Mich.

Mattatuck Products



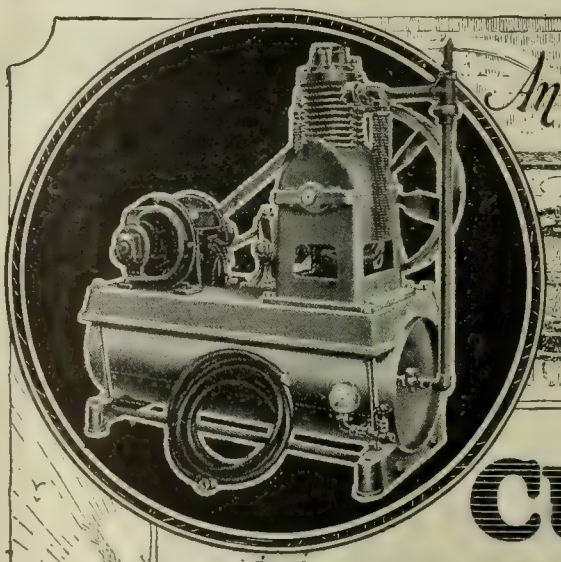
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Complete copper and nickel plating plant. Large shipping department, Toledo scale. Drafting department with vaults and blue print machine. Detached garages for 20 cars.

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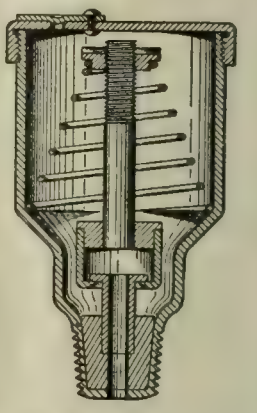
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easily adjusted to oscillate to any degree of vibration.

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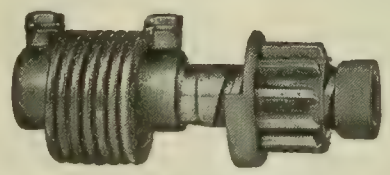
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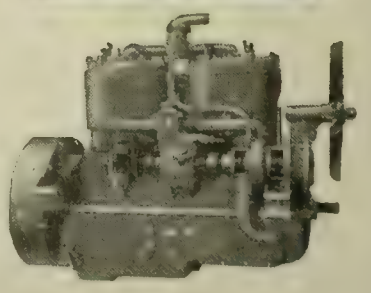
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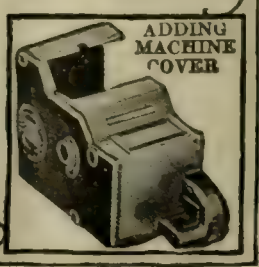


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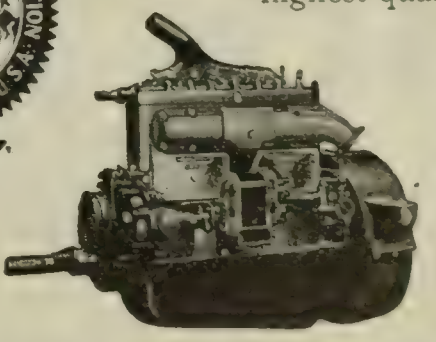
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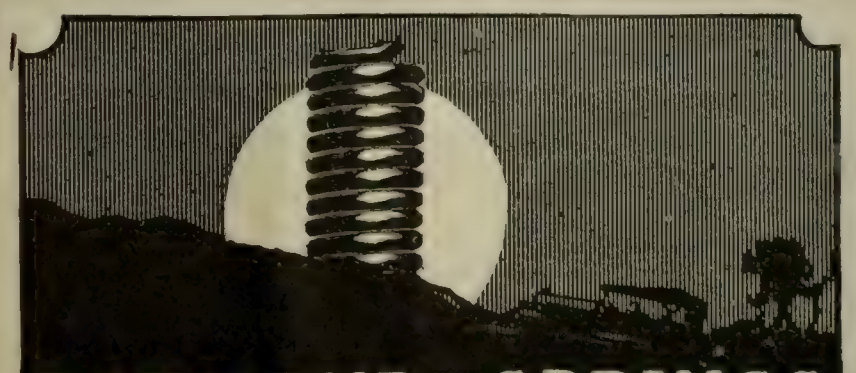
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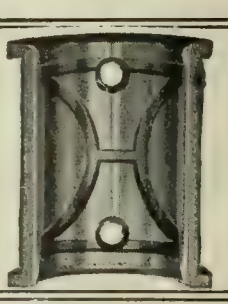


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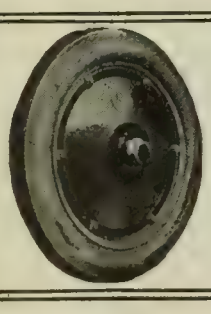
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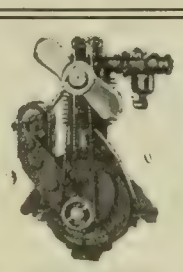
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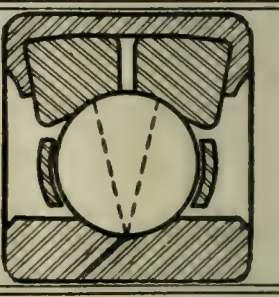


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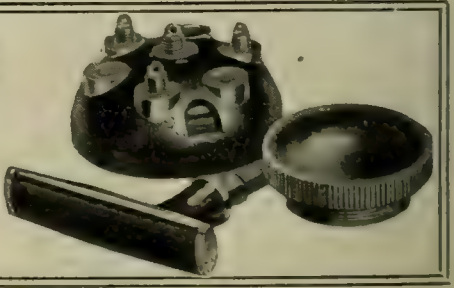
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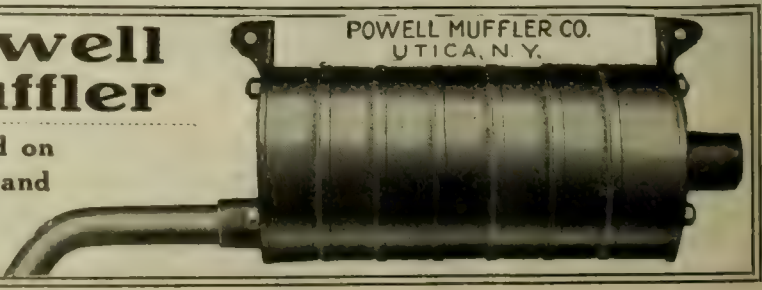
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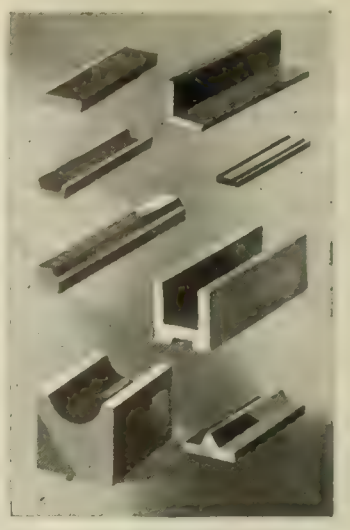


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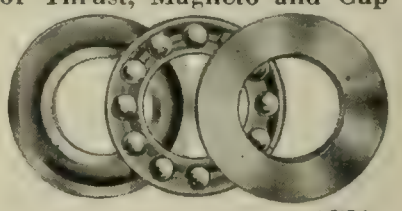
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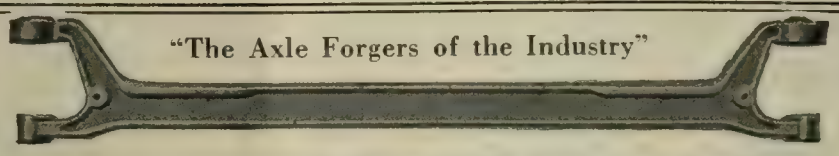
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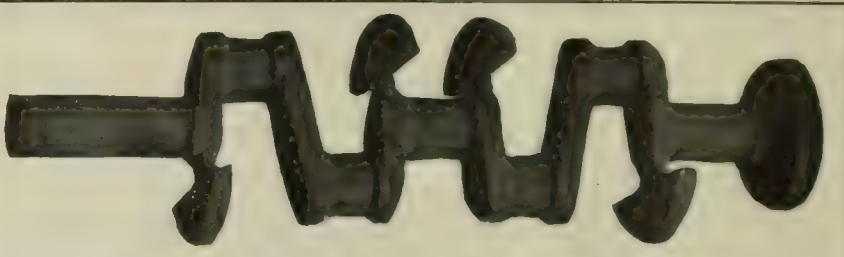


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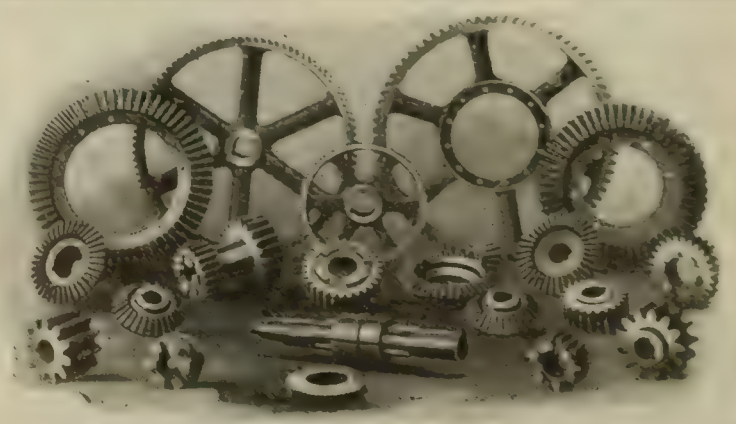
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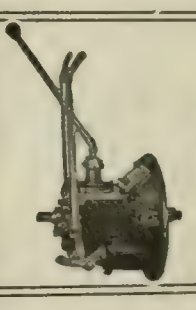
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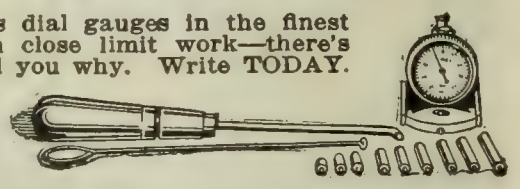
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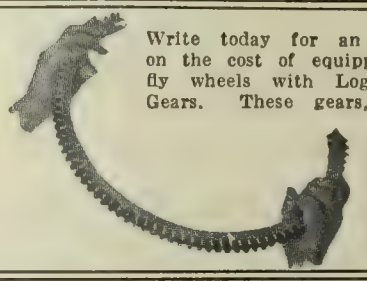
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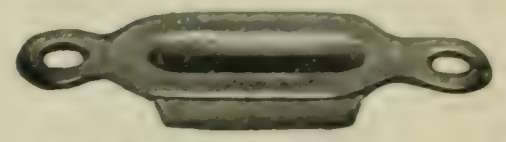
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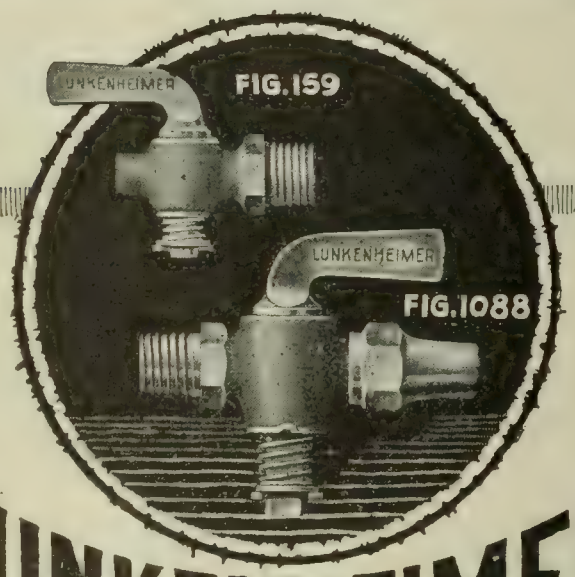
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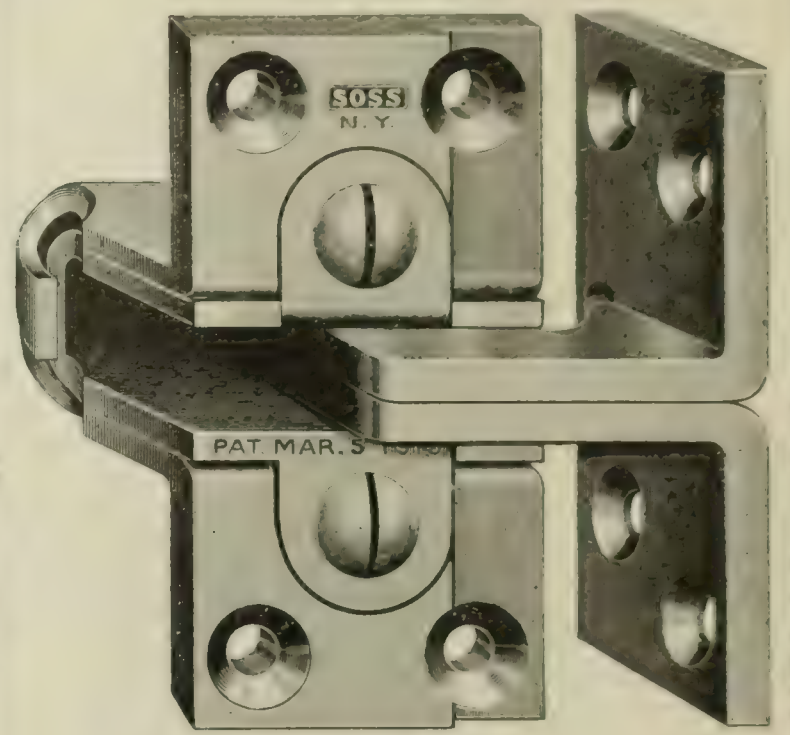
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How 183 Car Manufacturers are Making Use of 86 Service Stations—and Profiting

Car Manufacturers fully appreciate how difficult it would be to sell cars not backed up by reliable service.

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Realizing this, the successful car builder is striving to obtain perfect "service distribution"; a chain of service stations of which he can be justly proud. A tremendous task.

We are doing everything possible to lighten the burden. In 53 large cities in the United States we have established a Stewart-Warner Service Station. Stations in Canada and other countries bring the total number up to 86.

When a manufacturer equips his cars with any Stewart Product he can forget about ever having to give service on that product. In every Stewart-Warner Products Service Station there are expert mechanics who know Stewart equipment thoroughly. No guess-work there.

Briefly—the more Stewart equipment a manufacturer has on his car, the less trouble his own stations will have to contend with. This is where the real saving results.

The car maker whom Stewart equips is getting in addition to reliable equipment 86 Service Stations which are at the disposal of every buyer of his car.

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